Order Number 9402478

The effect of planned exercise as a disinhibitor of dietary restraint: An investigation of perceived control and resultant affect

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The University of North Carolina at Greensboro, 1993

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THE EFFECT OF PLANNED EXERCISE AS A DISINHIBITOR OF DIETARY RESTRAINT: AN INVESTIGATION OF PERCEIVED CONTROL AND RESULTANT AFFECT

by

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A Dissertation Submitted to
the faculty of The Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Greensboro
1993

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3/31/93

Date of Final Oral Examination

Elizabeth Ann Hart, Ph.D. The Effect of Planned Exercise as a Disinhibitor of Dietary Restraint: An Investigation of Perceived Control and Resultant Affect. (1993). Directed by Drs. Debra J. Crews and Diane L. Gill. 225 pp.

Recently, Polivy (1992) expressed the need for experimental studies addressing risk factors responsible for unhealthy eating and exercise behaviors. The purpose of the present study was to experimentally manipulate the relationship between exercise and eating behavior to examine if cognitions related to future exercise behavior are associated with caloric indulgence. The psychological set of eaters defined as restrained is theorized to motivate eating when natural physiological hunger cues are controlled, thereby justifying dietary consumption (Herman & Mack, 1975). Therefore, it was of specific interest in this study to examine whether plans for future exercise would lead to increased caloric consumption or "disinhibition" of dietary restraint. In addition, perceptions of control and resultant affect (anxiety and depression) were examined, as these factors have been found to be associated with dysfunctional eating and exercise behavior (Carmack & Martens, 1979; Crossman, et al., 1987; Crowther, et al., 1984; Giles et al., 1985; Gregory, 1981; Hawkins & Clement, 1980; Herman & Polivy, 1975; Morris et al., 1990).

The ice cream consumption of female (n=60) college undergraduates, defined as restrained eaters (Herman & Mack, 1975) who evidenced a high commitment to physical activity (Corbin et al., 1987), following assignment to either an exercise (n=40) or no exercise (n=20) group was examined. Temporal changes in perceived control and resultant affect (anxiety,

depression) were assessed throughout the experimental manipulation. Of particular interest was examination of these measures related to the removal of plans for future exercise. Therefore, perceived control and resultant affect were assessed in a third group, expected exercise (n=20), that was formed following ice cream consumption and was composed of half of the original exercise group.

A one-way ANOVA exploring ice cream consumption by group revealed that women with plans for future exercise did not disinhibit (eat more) than women without plans for future exercise. Furthermore, a 3 X 4 (Group X Time) MANOVA with planned univariate contrasts revealed a time main effect for anxiety, with all groups evidencing greater cognitive and somatic anxiety at the beginning of the experimental manipulation compared to the end. Analysis of the thematic frequency of thoughts revealed that the expected exercise group exhibited slight trends in increased control throughout the course of the investigation, as well as decreased positive affect upon being informed that they would be unable to participate in future exercise. Suggestions for future research exploring the relationship between eating and exercise behavior are discussed.

ACKNOWLEDGEMENTS

My thanks are first extended to Dr. Debbie Crews, my advisor and friend. I'm grateful to have found in Debbie, not only an outstanding academic mentor, but an insightful teacher in the crazy game of life. Debbie's never-ending patience, unconditional support, and encouragement are gifts for which I'll be forever thankful. She reinforced the meaning of the phrase, "the surest way to honor is to really be what you appear to be."

Thanks also to Dr. Diane Gill, who was always available to discuss ideas and troubleshoot along the way. Diane also accepted and supported my somewhat "unconventional" research ideas. Likewise, thanks to Dr. Regina Hopewell. Regina's expertise in nutrition and interest in this investigation were greatly appreciated. In addition, thanks to Dr. Jackie White for her insightful critiques and for contributing to my professional development.

Appreciation is also extended to the Department of Exercise and Sport Science at The University of North Carolina at Greensboro who deemed this investigation worthy of a 1993 Susan Stout Graduate Research Fellowship.

Additional thanks are extended to my fellow graduate students and Greensboro "family" who cheered me on, yet kept me grounded, both personally and professionally.

Finally, thank you mom, dad, Bret and grandpa . . . FOR EVERYTHING . . . I'm lucky to have you in my life.

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CHAPTER I

INTRODUCTION AND REVIEW OF THE LITERATURE

Increased physical activity and dietary modification can lead to many physiological benefits including enhanced cardiovascular function, increased aerobic capacity and maintenance of lean body mass (Rippe, 1987a). As a result of these numerous positive outcomes, many Americans have increased their exercise participation and have changed their eating behavior (Grodner, 1991). In fact, in 1988, it was estimated that 8.5 million Americans ran or jogged frequently (American Sports Data Survey, 1989), and 74 billion dollars was spent on diet foods (Time, July 25, 1988). In addition, many physicians are beginning to recommend exercise and diet regimens for their patients in lieu of traditional pharmacological interventions (Rippe, 1987b).

Unfortunately, exercise and diet behavior can be taken to extremes, resulting in unhealthy states, as witnessed by the epidemic proportion of eating disorders in young women (Szmulker, 1985) and by the proposal (De Coverley Veale, 1987) to include "exercise dependence" as a dependence syndrome in the development of the fourth edition of the American Psychiatric Association's Diagnostic and Statistic Manual of Mental Disorders (APA: DSM).

Approximately 7 million American women suffer from eating disorders (Krizmaniac, 1992). Often times, eating disordered individuals begin as well-intentioned dieters, using self-imposed dietary restraint to achieve an

initial weight loss goal, and then continue to control their intake to an extreme, resulting in dangerously low body weights. Alternatively, they may adopt behavioral strategies (e.g., purging and/or exercising) to accomodate excessive food intake while controlling against resultant weight gain.

Similarly, exercise-dependent individuals often commence upon an exercise program with admirable goals such as increasing endurance, weight loss or reducing stress. Exercisers can become "dependent," however, when exercise participation controls their life and becomes their central focus, thus, "incurring serious personal, vocational or social difficulties stemming from the 'need' to exercise" (Yates, 1991, p. 28).

Recently, similarities between eating disordered and exercise-dependent individuals have been drawn (Yates, Leehey, & Shisslak, 1983). Interestingly, research suggests that exercise behavior may lead to the development of eating disorders (Katz, 1986; Kron, Katz, Gorzynski & Weiner, 1978; Smith, 1980) and eating disordered individuals may include exercise participation as a means of controlling caloric expenditure, therefore, as another method of achieving weight loss (Feighner, Robins, Guze, Woodruff, Winokur & Munoz, 1972; Garfinkel & Goldbloom, 1988; Garner, Rockert, Olmstead, Johnson & Coscina, 1985).

Empirical data substantiating the proposed relationship between exercise and eating behavior are lacking and, at the present time, support comes primarily from anecdotal reports (Yates, 1991; Waldstreicher, 1985) and limited diagnostic criteria (APA: DSM-III-R [third edition revised]). Controlled research addressing the exercise-eating relationship may lead to a greater understanding of factors that lead some individuals to be at risk

for developing unhealthy exercise and eating behaviors. It is possible that certain factors (e.g., cognitions) can be identified that lead some individuals to engage in exercise behavior as a means of "allowing" caloric indulgences not normally granted themselves. Arguably, a caloric "trade-off" may be beneficial for some people, allowing increased consumption of preferred foods without excessive weight gain, while never reaching a point of concern. For others, however, chronic cognitions of calorie control in an effort to balance caloric consumption and caloric expenditure may be detrimental, potentially leading some individuals to be more "at risk" of developing future dysfunctional exercise and eating behaviors. Therefore, the primary purpose of the present investigation was to examine the role of exercise as a disinhibitor of dietary restraint. A secondary purpose of this study was to examine the relationship of a specific cognition, namely perceived control, on eating behavior as related to plans for future exercise. In addition, resultant affective states (anxiety and depression) were explored.

This review will address the various areas of research that are pertinent toward an understanding of dysfunctional diet and exercise behavior. First, diet theories and eating disorder literature will be examined. Then, exercise dependence and the proposed relationships between exercise and eating disorders will be reviewed. Finally, control theories and the role of perceived control in both eating and exercise behavior will be discussed.

Dietary Theories

A variety of theories have been posited regarding eating behavior. Early diet research focused primarily on the diet pattern differences between obese and normal weight people, specifically responses to environmental cues (Schachter, 1968; 1971). In time, research interest shifted to proposed physiological mechanisms responsible for differences in metabolic rate and resultant eating patterns (Nisbett, 1972). These early theories, although conceptually sound, were found difficult to empirically test. In addition, variability in the eating behavior of normal weight people obviously existed. Currently, many diet researchers have adopted a cognitive explanation known as "restraint theory" (Herman & Mack, 1975) to explain individual eating behaviors. Restraint theory not only allows for empirical investigation, but also explains differential eating patterns among people of normal weight.

Internal-External Theory of Obesity

Schachter's internal-external theory of obesity (1968, 1971) was one of the first widely held beliefs regarding the differences between the eating patterns of obese and normal weight people. Schachter proposed that the eating behavior of normal weight individuals was controlled by internal physiological cues (e.g., gastric contractions), whereas the eating behavior of obese individuals was triggered by external cues (e.g., sight of food). Additionally, when environmental cues are salient and compelling, Schachter (1971) further proposed that obese people are more responsive than their normal weight counterparts. Although much research was generated from Schachter's theory, the findings are mixed. It has been

difficult to account for the inconsistencies in the findings due to a number of methodological problems present in studying internality and externality (Ruderman, 1986). Reviewers addressing the research generated from Schachter's theory have generally concluded that there is lack of clear differences between obese and normal weight people in eating patterns (Spitzer & Rodin, 1981) and that the internal-external dichotomy is too simplistic to account for the processes underlying eating behavior (Rodin, 1981).

Set-Point Theory of Obesity

Nisbett's (1972) "set point" theory of obesity was another attempt to explain differences between obese and normal people in external responsiveness. According to Nisbett, each person has a "set point" or an individually determined, homeostatically defended ideal weight, and the set points of obese people are higher than normal weight people. Nisbett hypothesized that people are stimulated to eat in order to bring their weight into line with this biologically determined set point. He argued that when obese people are subject to social pressures to lose weight, subsequent dieting behavior places their body into a state of biological deprivation, as their weight is suppressed below their natural set point. According to set point theory, this state of physical deprivation leads to a number of behavioral consequences such as external responsiveness. Unfortunately, Nisbett's theory, like Schachter's, has been difficult to test due to the problems involved in measuring set point. At present, no data indicate that overweight people are further below their biological set point than normal weight people (Ruderman, 1986) and no changes have been

witnessed in external responsiveness with weight loss (Rodin, Slochower & Fleming, 1977).

Although the early focus of diet research on the differences between the obese and normal weight individuals in eating behavior was inconclusive, Schachter's and Nisbett's work was integral in stimulating a myriad of subsequent diet research.

Dietary Restraint Theory

Based on equivocal findings in the diet research relative to obese and normal weight differences and considering the obvious variability in concern with weight and eating behavior witnessed within the population of normal weight individuals, Herman and Mack (1975) developed the construct of "restraint." Restraint research addressed the belief that relative deprivation, rather than obesity, may be the critical determinant of individual differences in eating behavior. Incorporating both Schachter's notion of internal and external cues and Nisbett's set point phenomenon, restraint research addresses the eating behaviors of all individuals, regardless of body weight.

Herman and Mack (1975) state that many normal weight eaters are probably at or near their set points, eating in an internally controlled manner. Interestingly, however, they also point out that a large portion of normal weight eaters may be biologically "underweight" as their weight reflects conformity to cultural and social demands, rather than set point control. Motivated by the prevailing sociocultural norm of slimness, these individuals are motivated to exert strict self-control over their urges to eat (Tomarken & Kirschenbaum, 1984). Herman and Mack (1975) referred to

these "deprived" individuals as restrained eaters, "characterized by normal body weight levels, restraint in their eating habits, and a form of 'latent' externality which would be manifested strongly in the event that chronic restraints could be eliminated or overcome" (p. 649).

Herman and Mack (1975) hypothesized that restrained and unrestrained eaters differ in their reaction to the experimental removal of restraint. The authors proposed that restrained eaters would eat more when external food cues were salient and chronic restraint was experimentally manipulated. Unrestrained eaters, on the other hand, would be unaffected by the experimental manipulation of situational restraint and would continue to exhibit internal regulation. It must be emphasized, according to the authors, that these findings would not offer definite proof that restrained eaters are below their biological set points and chronically hungry. Instead, they believed that such findings would lend support for the notion that behavioral differences within normal weight individuals do exist and are related to chronic eating patterns. These chronic eating patterns, in turn, should affect individuals' positions relative to their set points as the restrained eaters are engaged in a cognitively mediated effort to combat the urge to eat (Herman & Mack, 1975). Additionally, Herman and Mack (1975) stated that individual eating patterns, rather than degree of overweight, were potentially better predictors of behavior (p. 649). Finally, the authors believed that this experimental manipulation would also tap "the nature of circumstances under which individuals indulge in what at least appears to be 'pathological' overeating" (p. 650).

Restraint and Preload Manipulations

To test their restraint hypotheses, under the guise of a "taste perception test" experiment, Herman and Mack (1975) utilized a "preload" manipulation. Subjects defined as restrained and unrestrained were instructed to consume a standard amount of a high calorie food ("preload" or "preliminary taste") in addition to their daily quota of calories, and were then asked to sample as much of an additional high calorie food ("final taste") as desired to complete a "taste test". The "preliminary taste" served as a "preload" or the experimentally manipulated removal of restraint across all subjects. The "final taste test" served as the dependent measure with total grams consumed measured. Due to the high caloric content of the preload (milkshakes), it was thought that restrained eaters would feel as though they had exceeded their self-imposed restrictive caloric limit and would be more likely to abandon their rigorous self-control, due to feelings of hopelessness. With the perception of having "blown it" (i.e, "the day is lost") the restrained eaters may then succumb to temptation (i.e.,"I might as well eat"), leading to increased consumption in the "final taste test" (ice cream). Thus, the disinhibitory effect of the preload upon self-imposed control of the restrained eaters (i.e., grams of ice cream consumed) was proposed to be positively related to the quantity of preload consumed (i.e., 0, 1, or 2 milkshakes). Because the unrestrained eaters were hypothesized to be unaffected by the removal of restraint, responding more "internally" to feelings of satiety than to external factors, the amount of ice cream consumed in the final taste test was proposed to be negatively related to the quantity of preload consumed, as the preload was thought to inhibit further consumption.

The results of Herman and Mack's (1975) investigation confirmed dietary restraint predictions. A significant restraint by preload interaction resulted. High restraint subjects consumed more ice cream after the milkshake preload than after no preload and low restraint subjects consumed decreasing amounts of ice cream relative to the size of the preload. Interestingly, the restrained eaters did not discriminate between 1 and 2 milkshake preloads and ate more ice cream following both of these preloads compared to the 0 milkshake preload. Therefore, the preload manipulation was basically dichotomous with the 1 milkshake preload appearing to be as sufficient as the 2 milkshake preload in disinhibiting restraint. The restrained eaters' responses to the disinhibiting effects of preloads, which resulted in increased consumption, were labeled "counterregulatory" (Herman & Polivy, 1980). On the contrary, after consuming a preload, unrestrained eaters respond by "regulating" or showing a reasonable degree of subsequent caloric compensation in response to prior consumption.

Herman and Mack's study of dietary restraint utilizing preload manipulations profoundly influenced diet research as it offered evidence of individual differences in eating behavior independent of body weight, and integrated applicable concepts from Schachter's (1968;1971) and Nisbett's (1972) research. The eating behavior of low restraint subjects seemed to conform fairly well with the pattern Schachter formerly ascribed to normal weight individuals, that is, "internal" regulation of intake. High restraint subjects, although of normal weight, behaved in a manner formerly thought to characterize overweight individuals, that is, "external" regulation. When forced to abandon self-imposed restraint, the presence of attractive food

cues triggered additional eating.

It is possible that high restraint subjects defy Nisbett's biological set point and are able to maintain body weights below their biological set point via their self-imposed restraint. When this restraint is disinhibited, however, their biological "demand" may be responsible for the excessive intake (Herman & Mack, 1975). The authors conclude that relative deprivation, rather than simply degree of obesity, may be the critical determinant of individual differences in eating behavior.

Thus, the eating behavior of restrained eaters appears to involve a balance of forces--pressures to eat and a self-imposed resistance to these pressures. Although all individuals exhibit these conflicting urges from time to time, the restrained eaters are able to exert extraordinary will, despite internal and external demands, unless disinhibited by salient forces. Therefore, the restrained eaters' ability to resist, in the absence of the disinhibiting effects of a forced milkshake preload, accounts for the restrained eaters consuming considerably less than the unrestrained eaters.

Herman and Mack explained their restrained eaters' post-preload eating behaviors as evidence of motivational collapse. In other words, by forcing the restrained eater to consume the preload, the preload interfered with their successful (short-term) dieting, "without a realistic hope of staying within the caloric confines imposed for herself, the dieter was left without a sufficient reason for dieting" (Herman & Polivy, 1980, p. 215).

Herman and Mack's (1975) findings regarding the elimination of restraint and counterregulatory eating patterns in preloaded restrained eaters have been consistently replicated (Hibscher & Herman, 1977; Kirschenbaum & Tomarken, 1982; Polivy, 1976; Polivy & Herman, 1976a;

Polivy & Herman, 1976b; Ruderman & Christensen, 1983; Spencer & Fremouw, 1979; Tomarken and Kirschenbaum, 1984), lending substantial support to their construct.

Restraint and Cognitions

Herman and Polivy (1980) have elaborated on and further developed the construct of restraint and its relations with food intake patterns with a particular emphasis on rejecting the notion that our behavior is determined solely by physiological and sensory cues. In addressing the factors responsible for sustaining weight suppression, and based on the findings of preload research, they increasingly support the influence of cognitive mechanisms in the regulation of food consumption.

> Resistance to the demands posed by hypothalmic urgings, gastric complaints, and the siren's call of haute cuisine, of course, is never entirely self-sustained. Our powers of resistance, clearly, can be strengthened by a (largely unexplored) variety of factors ranging from personality dispositions through induced self-consciousness to explicit exhortations. But such resistance -- whatever factors may contribute to it or interfere with it -- is a critically important aspect of consumption (and abstinence), without which we cannot account fully for the complexities of eating and dieting. (p. 211)

Cognitions may play a larger role in the differential effects of preloads on restrained and unrestrained eaters than previously thought. Polivy (1976) demonstrated the effect of cognitions on eating behavior by manipulating restrained eaters' perceptions of the caloric content of food. To compare the physiological mechanisms with cognitions, Polivy served subjects either a pudding preload high in calories or an

equivalent-tasting low calorie pudding preload and explored the effect of these on subsequent sandwich consumption. Within each group, she told half of the subjects that the pudding was high in calories and half that it was low in calories, creating four comparison groups; actual high-perceived high, actual high-perceived low, actual low-perceived high, actual low-perceived low. Interestingly, both physiological and cognitive factors influenced the restrained eaters' consumption. Restrained eaters who received the high calorie preload ate 20% more sandwiches than restrained eaters who received the low calorie preload, supporting a physiological interpretation. The high calorie preload may have served as an "appetizer," possibly stimulating hunger in the restrained eaters (Herman & Polivy, 1980). In addition, a cognitive interpretation was also supported as the restrained eaters who perceived the pudding as high in calories appeared to disinhibit and ate 61% more sandwiches than those who perceived the pudding as low in calories.

Other researchers have replicated Polivy's finding, showing restrained eaters to eat more and unrestrained eaters to eat less following preloads described as high calorie compared to preloads described as low calorie (Spencer & Fremouw, 1979; Woody, Constanzo, Liefer, & Conger, 1981). Therefore, taken together, these findings suggest that the restrained eaters' beliefs about the caloric value of the preload, in addition to the perception of having already overeaten via a forced preload, determine subsequent consumption.

In light of the consistent findings indicative of the disinhibition observed in preloaded restrained eaters, only inferences could be made

regarding this effect. To determine whether overeating by restrained eaters is triggered by the proposed disinhibitory effects of preloads, other known disinhibitors needed to be compared in both restrained and unrestrained eaters. Polivy and Herman (1976a; 1976b) designed a series of experiments using a known disinhibitor--alcohol. The authors hypothesized that restrained eaters would eat more after consuming alcohol compared to unrestrained eaters. Once again, the disinhibition effect upon restrained eaters emerged, as they elevated their ice cream consumption following the intake of alcohol, whereas the unrestrained eaters decreased their consumption. A cognitive component once again emerged in these studies, as only in a condition of "known" alcohol consumption did the disinhibitory effect surface for restrained eaters. Restrained eaters who consumed alcohol but were led to believe it was another beverage did not display disinhibition. The authors argued that restrained eaters may have cognitively rationalized the expression of ordinarily forbidden behavior. Therefore, a cognitive awareness of alcohol consumption, rather than simply the "pharmacological" effects of alcohol ingestion, seemed to contribute to the release of restraint in restrained eaters.

Anticipated overeating, yet another cognitive mediator of restraint, has also been proposed to lead to dietary disinhibition and subsequent counterregulation in restrained eaters (Ruderman & Wilson, 1979). These researchers reasoned that, given the effect of preloads (the perception of having <u>already</u> overeaten) on the dietary behavior of restrained eaters, the <u>anticipation</u> of overeating in the future should lead to similar disinhibition and counterregulation in this population.

Ruderman, Belzer and Halperin (1985) investigated this hypothesis by measuring cracker consumption in an intital taste test after leading subjects to believe that they would be consuming either a milkshake, a salad or nothing before participating in a second taste test. A control group did not expect a second taste test. Results supported the initial hypothesis regarding anticipated dietary violations, as restrained eaters expecting a milkshake ate more and unrestrained eaters less than their counterparts in the control condition.

Tomarken and Kirschenbaum (1984) conducted a pair of similar studies which examined the influence of future meal plans on present consumption in both restrained and unrestrained eaters. Surprisingly, in the first study, both restrained and unrestrained eaters ate more nuts following a milk shake preload when anticipating a high calorie dinner versus a low calorie dinner. In the second study when ice cream rather than nuts was used as the "taste test", the restrained eaters exhibited greater disinhibitory eating following a milkshake preload compared to the unrestrained eaters.

Tomarken and Kirschenbaum (1984) offered some interesting post hoc explanations of their findings. First, because the expectation of a future meal led both restrained and unrestrained eaters to eat more during the initial taste test, the researchers suggested that unrestrained eaters may possess a higher disinhibitory threshold compared to restrained eaters, therefore requiring a strong stimulation to elicit overeating. Therefore, Tomarken and Kirschenbaum (1984) posed the idea that the restraint dimension may be more continuous than dichotomous; "at least under certain experimental and sampling

conditions, restrained and unrestrained eaters differ more in degree than in kind" (p. 470). Obviously, this hypothesis counters Herman and Polivy's (1980) notion that unrestrained eaters are uninhibited and therefore not capable of disinhibition. However, in light of these findings, it has been stressed that the regulatory patterns of unrestrained eaters are still largely unexplored. Although physiological factors are thought to play an influential role in dietary regulation, the contribution of cognitive processes in all eaters must not be ignored (Ruderman, 1986).

Based on the findings of their second study, Tomarken and Kirschenbaum (1984) offered an additional "palatibility" hypothesis that suggests that restrained eaters may be more susceptible to disinhibition via sweet tasting foods. In fact, they suggested that very sweet foods may override the ability of certain cognitive factors to affect counterregulatory eating. Commenting on Tomarken and Kirschenbaum's (1984) findings, Ruderman (1986) added an additional interpretation regarding the perception of ice cream as a "taboo" food as playing a role in the restrained eaters' counterregulatory pattern. In conclusion, although somewhat at odds with traditional restraint research findings, Tomarken and Kirschenbaum's (1984) investigations did support restrained and unrestrained eaters' differences. Restrained eaters appeared to be more easily disinhibited than unrestrained eaters. Is it possible that the anticipation of caloric burning activity (i.e, exercise) may also lead to similar disinhibition and counterregulation in restrained eaters?

Other cognitive factors such as self-monitoring (Kirschenbaum &

Tomarken, 1982), social influences (Herman, Polivy & Silver, 1979), and situational demands (Polivy, Herman, Younger, & Erskine, 1979) have also been thought to be related to the restraint phenomenon. Although the findings do not support loss of restraint in restrained eaters alone, they address a variety of potential underlying processes influencing dietary restraint. In addition, the effect of emotions upon dietary restraint has yielded some interesting findings.

Restraint and Emotionality

Specific emotional states have been found to result in a disinhibitory effect on restrained eaters. Both anxiety (Herman & Polivy, 1975) and depression (Polivy & Herman, 1976c; Baucom & Aiken, 1981; Ruderman, 1985) have been shown to lead restrained eaters to temporarily cease their self-imposed control, resulting in increased consumption. It appears that for restrained eaters strong emotions may have the power to temporarily overcome cognitively mediated self-control, leading to an increase in normally inhibited behavior. In contrast, unrestrained eaters, whose eating behavior is characteristically uninhibited, have not consistently displayed disinhibition effects. In fact, restraint research has not explicitly addressed the impact of emotional states on amounts eaten by unrestrained eaters (Ruderman, 1985). During times of emotional stress, these eaters are thought to respond to internal sympathomimetic cues, normally leading to a suppression of appetite (Herman & Polivy, 1980).

Ruderman (1986) offers an important methodological insight regarding restraint theory's prediction that emotion differentially

affects restrained and unrestrained eaters. She suggests that it may be important to distinguish between studies that compare strong and weak affect with studies that compare positive and negative affect. Positive affect may actually increase restrained eaters' self-control, as evidenced by the facilitating effect of positive affect on self-regulatory behavior among children (Fry, 1977; Masters & Santrock, 1976) and adults (Kirschenbaum, Tomarken, & Humphrey, 1985).

Similar to the disinhibitory effects of preloads and known alcohol consumption on restrained eaters, the demands of negative emotions may temporarily overpower self-imposed restraints, "justifying" overindulgence (Ruderman, 1986). The immediate demands of a particular stressor, such as how to cope, may become a more urgent concern than adhering to one's dieting goals (Herman & Polivy, 1984). Additionally, Ruderman (1986) suggests that eating may serve as a distraction from distress for restrained eaters, as the comfort of food may represent indulgence in a pleasure usually denied themselves. It could be argued that caloric overindulgence may also be "justifed" when planning future activities known to be caloric burning, such as exercise participation.

The Boundary Model for the Regulation of Eating

In light of the increasing evidence of the role of cognitive factors as major determinants of eating behavior, researchers have not abandoned the contribution of physiological factors. In fact, it has been argued that as a result of the cognitive research findings, two major "schools of thought" regarding eating research have emerged -- physiological

versus nonphysiological (Herman & Polivy, 1984). In an effort to integrate both schools and provide a comprehensive interpretation of the regulation of eating behavior, Herman and Polivy (1984) expanded restraint theory to include a boundary model. According to their model, dietary consumption is regulated within boundaries, rather than at a specific point. One end of the boundary represents "hunger," while the other end represents "satiety." The researchers make the assumption that as long as consumption occurs within this biological range physiological needs are satisfied, thus, they refer to this zone as "the range of biological indifference." If consumption is either inadequate or overly indulgent, one falls out of this optimal zone into the proposed "adversive zones" of physiological hunger and satiety (specifically--overeating). These zones are referred to as adversive because they often lead to physiological discomfort. Herman and Polivy (1984) express that although the aversive nature of hunger often provokes eating, this is no guarantee that eating will occur. Also, they state that the simple anticipation of transgressing the hunger boundary may occur, leading people to eat more than is necessary in the present as an effort to eliminate the aversive experience of hunger in the future. Conversely, people may learn how not to eat the absolute maximum their stomach can hold in an effort to prevent the aversive experience of overeating.

When the boundary model is applied to restrained and unrestrained eaters, it is suggested that restrained eaters have a wider range of biological indifference compared to unrestrained eaters. Therefore, restrained eaters would be expected to have lower hunger and higher

satiety boundaries than unrestrained eaters. The lower hunger boundary most likely reflects cognitive control via self-imposed restrictions, while the higher satiety boundary may serve a compensatory function aimed at restoring caloric needs related to the chronic physiological deprivation resulting from dietary restraint. Additionally, Herman and Polivy (1984) suggest that restrained eaters have a self-imposed "diet boundary," located between their hunger and satiety boundaries which reflects their maximum desired consumption or "allowed" caloric quota.

Interestingly, the boundary model does not suggest that the dietary patterns of restrained eaters are unregulated or totally unresponsive to control. Rather, Herman and Polivy (1984) propose that they are regulated in terms of a series of boundaries. Although recognizing that diet boundaries are highly individual, Polivy admits that, to date, precise measurement of this point remains a methodological mystery (personal communication: August 12, 1992). The diet boundary is hypothesized to fall well short of the satiety boundary. Thus, applying previous findings to this model, disinhibitors such as preloads, cognitions and emotions temporarily undermine the restrained eater's diet boundary. As long as the restrained eater falls to the left of the diet boundary, the self-imposed dietary restraint remains in effect. Once disinhibited, the counterregulatory eating behavior of the restrained eaters is thought to represent complete transgression of the self-imposed diet boundary to the satiety boundary.

Because the restrained eater's diet boundary falls within the range of biological indifference, it is here that cognitive factors are suspected

to exert their greatest influence. Therefore, whether the restrained eater has actually consumed a high calorie preload, or simply has been led to believe so, motivation to continue to restrict appears temporarily undermined. Herman and Polivy (1984) have labeled this interrupted motivation the "what the hell effect" or the subjective state of caloric abandon. Could exercise participation influence the location of the restrained eater's diet boundary, shifting it toward the satiety boundary "allowing" greater caloric intake?

With the decline in interest in traditional theoretical approaches to eating behavior, such as Schachter's internal-external theory of obesity and Nisbett's set point model, diet research continued to proceed without a major theoretical guide. Herman and Mack's (1975) restraint theory, which incorporates the disinhibition hypothesis and the recently developed boundary model (Herman & Polivy, 1984), appears to have supplied a much needed heuristic framework as it has been enthusiastically adopted by many diet researchers.

In addition to lending an increased understanding of the eating patterns of restrained eaters, Herman and Polivy's (1984) boundary model also provides a useful model for understanding clinically disordered eating patterns such as bulimia and anorexia nervosa. The application of their model to these eating disorders will be addressed in the subsequent section.

Eating Disorders

It is probable that many individuals have engaged in dietary restraint practices from time to time in an effort to lose a few pounds. Conversely, dietary disinhibitions (i.e., overindulgences) are likely to occur in times of culinary temptation such as holidays and social gatherings. For some individuals, however, extreme methods of weight control such as chronic restrictive dieting or frequent episodes of uncontrollable eating followed by forced elimination can lead to life threatening clinical eating disorders such as anorexia nervosa and bulimia.

Anorexia Nervosa

Anorexia nervosa is a form of self-induced starvation characterized by weight loss leading to a maintenance of body weight 15% below that expected (American Psychiatric Association, Diagnostic and Statistic Manual of Mental Disorders - third edition, revised [APA: DSM-III-R], 1987). People classified as anorexic display an intense fear of gaining weight, evidence perceptual distortions involving their body shape and engage in chronic restrictive dieting (APA: DSM-III-R, 1987). Due to their distorted body images, anorexics do not "see" themselves as underweight but continue to restrict their food intakes often in a ritualistic manner (Grodner, 1991). The anorexic may engage in compulsive behaviors in other areas besides food intake such as intensive work behaviors, ritualized personal hygiene habits and excessive exercise.

Bulimia

Bulimia is another clinical disordered eating pattern characterized by recurrent episodes of "binge" eating (APA: DSM-III-R, 1987). Binge eating refers to the rapid uncontrollable consumption of a large amount of food in a discrete period of time. Often, the bulimic attempts to fast or severely limit food intake in an effort to lose weight, only to binge when hunger or the desire for certain foods becomes overpowering (Abraham & Beumont, 1982; Johnson, Stuckey, Lewis, & Schwartz, 1982). People classified as bulimic display overconcern with body shape and weight, experience a lack of control over eating behavior during the eating binges and regularly engage "purging" or forced elimination techniques in order to prevent weight gain (APA: DSM-III-R, 1987). A bulimic purge may include self-induced vomiting, use of laxatives or diuretics, strict dieting or fasting, or vigorous exercise. The binge/purge cycle can become repetitive to the point where it seems they can no longer be controlled or stopped. Unlike the anorexic, the bulimic oftens appears of normal weight but may fluctuate 10 or more pounds as a result of her binge/purge patterns.

Eating Disorders and the Boundary Model of Eating

Herman and Polivy's (1984) boundary model of eating can be extended to incorporate the abnormal eating behaviors of the anorexic and bulimic. As addressed earlier, unrestrained eaters are motivated to eat within their range of biological indifference or their physiological boundaries of hunger and satiety. The restrained eater, on the other hand, is proposed to have a lower hunger and a higher satiety boundary, as well as a self-imposed diet boundary. In addition, the satiety and hunger boundaries of the restrained

eater appear to be largely controlled by cognitive rather than physiological factors.

When the boundary model of eating is applied to the anorexic, the satiety boundary is proposed to be slightly lower than that of the restrained eater, yet is fairly irrelevant, as the self-imposed diet boundary serves as the marker of the upper limits of the caloric quota. The diet boundary of the anorexic is lower than that of the restrained eater and like the restrained eater, the anorexic is driven to stay below the diet boundary. The anorexic rarely eats enough to surpass the diet boundary which represents the upper caloric quota or "indulgence". This eating disorder is characterized by an apparent decreased awareness of physiological hunger and willingness to tolerate the discomforts of the lower aversive zone (hunger).

As applied to the bulimic, or "binge-eater," Herman and Polivy's (1984) boundary model suggests that, like the restrained eater, the bulimic has a lower hunger boundary. Although the restrained eater and the bulimic appear to be similar in their tendencies to restrict and counterregulate or "binge," Herman and Polivy (1984) note an important difference--even in times of caloric abandon, restrained eaters are still constrained by the pressures of satiety. Therefore, the restrained eater regulates at the satiety boundary, as they experience the unpleasant consequences of overindulgence, preventing a major transgression of the satiety boundary. Bulimics, however, are thought to binge to "capacity", surpassing satiety and eating until physiologically impossible rather than simply physiologically unpleasant. Thus, the bulimic is characterized by an apparent willingness to temporarily tolerate the discomfort of the upper

aversive zone (satiety) which, in time, commonly results in vomiting to relieve the bulimic from the physiological discomfort.

Returning to the eating patterns of normal or unrestrained eaters, it is important to point out that these eaters do not normally enter the aversive zones, as physiological hunger and satiety operate as motivators of eating behavior. The abnormal eating patterns of restrained eaters, however, become more cognitively controlled and strong disinhibitors (e.g., forced preloads, dysphoric emotion) have been shown to result in counterregulation or "overindulgence". The abnormal eating patterns of clinically eating disordered individuals, such as the anorexic and bulimic, appear entirely under the control of cognitive and emotional factors. Although outside the scope of this review, their insensitivity to physiological cues may be indicative of underlying psychological problems.

The boundary model offers a coherent framework within which normal and abnormal eating patterns can be compared and contrasted. Additionally, it incorporates specific physiological and cognitive factors hypothesized to play integral roles in the various eating behaviors. Given the application of the boundary model to a variety of eating patterns, it is of interest to explore whether or not the abnormal eating patterns of restrained eaters have the potential to become more dysfunctional, leading to the development of clinical eating disorders such as anorexia nervosa or bulimia.

Dietary Restraint and Eating Disorders

Herman and Polivy (1984) state that ". . . one of our major goals (via the boundary model) is to provide a bridge from normal to abnormal eating so that they are no longer treated as two separate disciplines obeying separate rules of their own" (p. 155). Given their proposed intent, they are quick to caution that the boundary model is still a skeleton and "the sorts of interpretations that it permits and the sorts of research that it suggests remain a task for us to undertake in the future" (p. 155). Nonetheless, researchers have presented evidence supporting transitions that may occur between specific disordered eating patterns. For example, a large number of anorexics develop the symptoms of bingeing and purging as their condition progresses (Garfinkle & Garner, 1984; Holmgren, Humble, Norring, Roos, Rosemark, & Sohlberg, 1983) and bulimics have reported frequent restrictive dieting prior to adopting their binge behavior (Fairburn & Cooper, 1984; Pyle, Mitchell, & Eckert, 1981). Evidence supporting a close association between the bingeing symptom of bulimia and counterregulatory eating behavior in restrained eaters is also available (Agras & Kirkley, 1986; Garner, Rockert, Olmsted, Johnson, & Coscina, 1985; Polivy & Herman, 1985). Given these relationships, it seems possible that chronic restraint behavior could be an underlying factor responsible for the development and perpetuation of these abnormal eating behaviors.

The most obvious motivators of all of the disordered eating patterns are weight loss and an obsession with body shape (APA: DSM-III-R, 1987). In an attempt to control weight gain, individuals may sporadically go on diets that may lead to more positive perceptions of body shape and of being "in control" of eating habits. As mentioned previously, however, chronic

dieting behavior can precede the development of more serious eating disorders. Given these relationships, is it possible that other behaviors related to body shape perception and weight control may also become disordered? In addition, is it possible that such behaviors may lead to perceptions of "being in control"? Exercise involvement is one such behavior often chosen as a method of weight control and related to body shape perception. Although the relationship between exercise and perceptions of "being in control" is largely unexplored, excessive exercise has been recognized as a dimension of both anorexia nervosa and bulimia (APA: DSM-III-R, 1987). However, the role of excessive exercise as a precursor to, or the result of, disturbed eating behavior is unknown. Literature specific to excessive exercise behavior is relatively new and often confusing, as a clear distinction between normal and disordered involvement has not been delineated.

Exercise Research

Researchers have documented the positive benefits of exercise involvement (Dishman, 1988; Rippe, 1987a). In fact, the majority of exercise psychology research addresses positive outcomes related to exercise such as enhanced mood (Williams, Krahenbuhl, & Morgan, 1991), decreased anxiety (Petruzzello, Landers, & Hatfield, 1991) and depression (North, McCullagh, & Tran, 1990), and improved self-esteem (Sonstroem & Morgan, 1989). Similar to the distinction between healthy and disordered eating, available evidence suggests that exercise participation can fall along a continuum from reasonable efforts to maintain fitness to dysfunctional overinvolvement. Dysfunctional exercise involvement has been described

as preoccupation with fitness that is out of proportion with the expected benefits of exercise (Nudelman, Rosen, & Leitenberg, 1988) and is referred to in the literature as "exercise addiction," "exercise compulsion," "obligatory exercise," and "exercise dependence." This darker side of exercise involvement, which will be referred to as exercise dependence in the majority of this review, has gained increased attention in recent years. Sacks and Sachs (1981) offer the following justification of exercise to become an addiction or dependence,

> It is not an all-or-nothing state of being, unambiguously present or absent. Addiction is an extension of ordinary behavior, a pathological habit, dependence, or compulsion. It is not characteristic of drugs or activities per se, but of the involvement a person forms with these substances or events. When involvement eliminates choice in all areas of life, then addiction has been formed. Given this view, it is reasonable to assume that addiction may become characteristic of participation in physical activity, including running, swimming, and playing tennis. (p. 117)

Interestingly, some researchers suggest that dependent exercisers and disordered eaters may share some underlying predisposing characteristics (De Coverley Veale, 1991; Yates et al., 1983). In addition, some have proposed that chronic exercise involvement may trigger the development of disordered eating (Katz, 1986; Kron et al., 1978). Conversely, because disordered eaters often include excessive exercise behavior as a supplemental weight control strategy (Garner et al., 1985) this practice may trigger the development of exercise dependence. Before specifically addressing these issues, literature pertinent to an understanding of exercise dependence will be reviewed. To begin, a

brief history of the notion of "positive addiction" is warranted as research on the negative aspects of running and other exercise dependencies largely resulted in response to this perspective.

Positive Addiction

Early literature suggested chronic involvement in physical activity such as running represented "positive addiction." Glasser (1976) promoted running and meditation as possible adjuncts to therapy for traditional programs (e.g., alcohol and drug) as he believed they represented healthy substitutes for these substances. Specifically, he viewed running and meditation as "positive" because he believed they were psychologically and physiologically supportive. This perspective on addiction represented a strong contrast to traditional interpretations of addiction (i.e., "negative"), such as cocaine and alcohol addiction, which are detrimental to psychological and physiological health. In time, however, it was noted that addiction to physical activity could have negative consequences (Morgan, 1979b).

Running Addiction

Although commitment to exercise can be manifested within a variety of physical activities, past literature focused primarily on running (Carmack & Martens, 1979; Chapman & DeCastro, 1990; Morgan, 1979b; Sachs & Pargman, 1979; Thaxton, 1982). These researchers examined the psychological characteristics of runners described as "addicted." Sachs and Pargman (1979) studied addicted runners, exploring their reasons for beginning to run and comparing those to

reasons for their current running participation. The addicted runners began running for a variety of reasons, notably physiological such as body weight reduction, improved cardiovascular fitness and concerns with general health. Although these reasons continued to motivate runners, additional psychological reasons surfaced regarding their current motives, including the need to relax, get away and feel better. The authors surmised that running had developed into a significant part of the runners' lives.

Similarly, Carmack and Martens (1979) explored running addiction and developed a "Commitment to Running" scale to measure this phenomenon. Highly committed runners were characterized by experiencing greater discomfort when a run is missed, perceiving a higher level of addiction, and running for longer periods of time compared to runners evidencing low commitment. Sachs (1981) notes that both the Sachs and Pargman (1979) and the Carmack and Martens (1979) study support psychological reasons as highly influential in motivating the continuing involvement of addicted runners.

Paradoxically, the negative aspect of running that occurs in some individuals is hypothesized to develop from an initial positive relationship (Sachs, 1981). In other words, dependence cannot be established until one is sufficiently motivated to begin and then continue to adhere to an exercise program. Admittedly, the exact conditions under which this shift from positive to negative occurs is far from clear. In fact, it has been suggested that one may be "committed" yet not "addicted" to running. For example, Morrow and Harvey (1990) state that an individual could run 70 miles a week and still not be

addicted, while someone who compulsively runs far fewer miles might irrationally believe his or her health is endangered by missing two days of running. According to Chapman and DeCastro (1990), addiction to running may be viewed as a process which compels an individual to run in spite of obstacles, whereas commitment is an intention to continue running and results in feelings of satisfaction, enjoyment and accomplishment. Sachs (1981) states that the addictive impact of physical activity, such as running, can be identified when participation moves from "an important, but considered aspect of one's life, to a controlling factor, eliminating other choices in life" (p. 121). He further expands,

> There are many reasons for starting to run. A fair percentage of individuals soon find that running is not for them and revert to states of inactivity or try other sports. But runners who do continue are buoyed by positively and negatively reinforcing contingencies. There are the inevitable positive comments of how well one looks, how much weight has been lost, the interactions with running friends and social atmosphere at races and track club meetings, and the feeling of being in better shape. Negatively reinforcing consequences arise from fear of what might happen if one should miss a day, or if one doesn't run as much as one is supposed to on a given day. Whatever the reasons, participation becomes a habit, a regular part of daily activity. At this stage the runner is hooked. Other aspects of life begin to be shaped around the daily run, with changes in eating and sleeping schedules, as well as in time spent with family members. These are in addition to changes in diet and leisure time activities, the latter frequently encompassing races or long runs on Saturday mornings, and voracious reading of books and magazines on running. Running has become a compulsion, a habit, an addiction. When days are missed, withdrawal symptoms become immediately apparent and generally powerful.

> Running has becomes much more than a means to an end of getting in shape; it has become the end itself. The need to run becomes omnipresent. (Sachs, 1981, p. 121)

Morgan (1979b) witnessed this negative addiction with running, citing a number of case studies of runners who continue to run even when seriously injured, who alter daily schedules to revolve around their running regimen and who neglect work, home and family responsibilities when they interfere with training.

Exercise Dependence

Exercise dependence is a relatively new area of study. Similar to characteristics of running addiction, exercise dependence has been defined as feeling compelled to exercise daily and feeling unable to live without it. Baekeland (1970) is often given credit for inadvertently discovering this obsession as he was unable to recruit heavy exercisers to temporarily stop their exercise to participate in a sleep study. Even when a monetary incentive was offered, habitual exercisers asserted that no amount of money would persuade them to discontinue their exercise regimen for a month.

Supported by the pioneering work on running addiction, exercise dependence has gained increased recognition as a mental health concern (Biddle & Fox, 1989; De Coverley Veale, 1987; Morrow & Harvey, 1990). As mentioned earlier, past literature referred to this phenomenon in runners as "addiction," most likely in response to Glasser's notion of running as a form of positive addiction (Morgan, 1979b). "Dependence" is currently the descriptor of choice by the majority of researchers and

clinicians investigating this behavior (De Coverley Veale, 1991; Sacks & Sachs, 1981; Thompson & Blanton, 1987). Interestingly, the World Health Organization has adopted this descriptor when describing similar negative behaviors (e.g., drugs, alcohol) due to confusion associated with the term "addiction".

Kagan and Squires (1985) used a measure that assesses a general tendency toward addiction to see if individuals who participate in a regular schedule of aerobic exercise share certain personality characteristics with other kinds of addicts. Their findings suggest that the more subjects exercised, the more they they tended to reflect an addictive profile. Negative mood states and withdrawal symptoms in the absence of a drug, object or activity are critical features of any dependence syndrome (De Coverley Veale, 1991). Fatigue, inability to concentrate, listlessness, feelings of guilt, anxiety, depression, tension and irritability have been associated with withdrawal from exercise (Carmack & Martens, 1979; Crossman, Jamieson & Henderson, 1987; Sachs & Pargman, 1979). One study suggests temporal differences in exercise withdrawal symptoms, with stress and physical symptoms (i.e., somatic symptoms, acute anxiety and insomia) appearing right away and emotional disturbance (i.e., chronic depression and anxiety) appearing after a longer period of deprivation (Morris, Steinberg, Sykes, & Salmon, 1990).

In light of these findings, because degrees of dependence exist with many gradations, it is often difficult to clearly "diagnose" unhealthy exercise behaviors. De Coverley Veale (1987) suggests the following criteria for identifying exercise dependence:

1. Narrowing of repertoire to a stereotyped pattern of exercise with regular schedule once or more daily.

2. Salience with the individual giving increasing priority over other activities to maintaining the pattern of exercise.

3. Increased tolerance to the amount of exercise performed over the years.

4. Withdrawal symptoms related to a disorder of mood following cessation of the exercise schedule.

5. Relief or avoidance of withdrawal symptoms by further exercise.

6. Subjective awareness of a compulsion to exercise.

7. Rapid reinstatement of the previous pattern of exercise and withdrawal symptoms after a period of abstinence.

Associated features

8. Either the individual continues to exercise despite a serious physical disorder known to be caused, aggravated, or prolonged by exercise, and is advised as such by a health professional, or the individual has arguments or difficulties with his partner, family, friends, or employer.

9. Self-inflicted loss of weight by dieting as a means of improving performance. (p. 736)

De Coverley Veale (1991) acknowledges that in some cases it may be difficult to differentiate exercise dependence from elite sport training. For example, athletes have been shown to experience similar "withdrawal" symptoms such as depressed mood, anxiety, irritability, fatigue and sleep disturbances in the absence of physical training

(Morris et al., 1990; Thaxton, 1982).

Although longitudinal data correlating performance with the features of dependence are not available, De Coverley Veale (1991) has reexamined the original criteria to clarify differences between elite sport training and exercise dependence and recommends that criteria 1, 2, and 4 may need to be more specifically defined and criteria 3 may need to be abandoned. Perhaps most importantly, De Coverley Veale (1991) suggests that the behaviors of exercise dependent individuals, as compared to athletes in training, would make it unlikely for them to reach maximum performance.

Physiological mechanisms have been proposed to contribute to exercise dependence. For example, endogenous opioids and sympathetic arousal adaptation have been suggested to play a role in creating a physiological dependence to exercise (Appenzeller, 1981; Thompson & Blanton, 1987). A thorough review of these physiological hypotheses is, however, beyond the scope of this review.

Disordered Eating and Exercise Research

The literature reviewed to this point suggests that both eating and exercise behaviors can become dysfunctional. It is of interest to explore the relationship between eating and exercise behaviors as both have been found to lead to negative addictions. Many questions related to this relationship arise. For example, are certain populations at a greater risk for developing disordered eating and/or exercise patterns? Are there common factors underlying these patterns? Can the development of one disorder lead to the development of the other?

To address these questions, this section will first explore one population that has received a great deal of attention regarding eating disorders -- athletic populations. To follow, Yates et al.'s (1983) controversial proposal that obligatory running may represent an analogue of anorexia nervosa will be discussed. Finally, proposed models linking excessive exercise and disordered eating will be examined.

Eating Disorders in Athletes

Interestingly, 24% of anorexic women are intensely athletic (Crisp, Hsu, Harding, & Hartshorn, 1980) and come from families in which the parents have strong athletic interests (Bruch, 1973). Also, pressures to reduce body fat to optimize sport performance may contribute to the development of eating disorders in some athletes (De Coverley Veale, 1987; Smith, 1980).

Specific physical activities may be related to greater incidences of eating disorders than others. Sports emphasizing body weight and leanness may lead some athletes to become preoccupied with their body weight and develop other tendencies toward eating disorders (Rosen, McKeag, Hough, & Curley, 1986; Welch, Zager, Endres, & Poon, 1987; Werblow, Fox, & Henneman, 1978). For example, gymnasts have been shown to experience pressures to maintain low body weights and low percentages of body fat and to exhibit pathogenic weight control behaviors (Loosli, Benson, Gillien, & Bourdet, 1986; Rosen & Hough, 1988). Also, symptoms of anorexia and bulimia have been found in a number of ballet dancers (Brooks-Gunn, Warren, & Hamilton, 1987; Garfinkel, 1981; Garner & Garfinkel, 1980), and body builders have been shown to score higher than student controls on a drive for thinness measure (Walberg & Johnson, 1991). In the Walberg and

Johnson (1991) study, 67% of the body builders reported being terrified of fat and 58% were obsessed with food.

Borgen and Corbin (1987) compared athletes in sports that do or do not emphasize leanness with nonathletes to explore weight concerns and eating disorder potential. No differences in degree of preoccupation with weight or other eating disorder tendencies were discovered between nonathletes and athletes as a whole. However, when athletes in sports that emphasize leanness were separated from athletes whose sports did not focus on body size, significant differences between nonathlete and "lean sport" athletes were found. Once again, lean sport athletes evidenced greater weight preoccupation and potential eating disorder pathology. In support of this, female ice skaters have been found to have higher dieting, bulimia, oral control and perfectionism scores compared to swimmers and nonathletes (Brooks-Gunn et al., 1987), and runners may overestimate their body size more than weight lifters (Pasman & Thompson, 1988).

Weight and Noakes (1987), however, found opposite findings when comparing elite runners with student controls on measures of eating disorder pathology. Although the scores were highest for the elite marathon subgroup, the difference between the athletes and controls was not statistically significant. Similarly, Harris and Greco (1990) did not find competitive female gymnasts' degree of concern regarding body weight to differ significantly from the "normative discontent" experienced by a large number of women (p. 432). In fact, one study reported high school athletes to be better adjusted than both their eating disordered and nonathletic peers (Mallick, Whipple, & Huerta, 1987).

It has been cautioned that some athletes may engage in weight and fat

loss strategies to improve performance, but that this does not automatically indicate the presence of an eating disorder (Smith, 1980). For example, an investigation of actual weight control techniques used by competitive female athletes representing a variety of sports found the majority of the women to partake in these practices to enhance athletic performance, rather than to improve appearance (Rosen et al., 1986). Also, it is important to note that not all women whose chosen activity exposes them to pressures to be thin (e.g., ice skating, gymnastics, running, ballet) develop eating disorders (Polivy, 1992). Conversely, eating disorders can be found in sports when pressure to be thin are less prevalent, as evidenced by weight concerns found in female swimmers (Drummer, Rosen, Heusner, Roberts, & Counsilman, 1987).

Running: An Eating Disorder Analogue?

Direct comparisons between compulsive exercisers and eating disordered individuals have been conducted. Yates et al. (1983) presented a controversial proposal that the personality characteristics of addicted or "obligatory" runners and anorexics closely resemble each other. Based on questionnaire surveys and case reports many parallels were drawn. Although obligatory runners tended to be male and anorexics tended to be female, they resembled each other in terms of family background, socio-economic class and concerns about weight, percent fat and adherence to strictly defined diets. Sours (1981) compares the fear of fat in runners to eating disordered individuals, "the fear of fat is constantly with them. They can only freely eat if they first run long distances, the reverse of

bulimic vomiters who eat first and then rid themselves of food. And like the anorexic, these athletes keep a record of calories, as well as miles. They make into a metaphysic the cliche': 'You are what you eat.' They know that running dulls the appetite and decreases hunger. They look forward to carbohydrate loading before a marathon, but still fear weight gain" (p. 87).

Both runners and anorexics have reported experiencing subjective "highs"-- the runner reporting sensations of effortless running and the anorexics reporting no perceptions of fatigue (Folkins & Sime, 1981; Halmi, 1974). Another similarity between obligatory runners and anorexic women was an incredible tolerance of physical discomfort and denial of potentially serious debility -- runners running in spite of injury or illness and anorexics subsisting on little to no food; "both the obligatory runner and the anorexic woman negate physiological needs in their single-minded quest for an elusive ideal" (Yates et al., 1983, p. 253).

Yates et al. (1983) cite information that supports that both groups share specific personality characteristics such as inhibition of anger, extraordinary high self-expectations, and a tendency toward depression. They expand that while runners as group do not appear depressed, they may become depressed when unable to run. Available research has shown that exercise may be an effective treatment for depression (Doyne, Ossip-Klein, Bowman, Osborn, McDougall-Wilson, & Neimeyer, 1987; McCaan & Holmes, 1984; Petruzzello et al., 1991). Based on this information and literature suggesting that fast running is an effective means of releasing anger (Sacks, 1979), stress and hostility (Kagan & Squires, 1985), the presence of depression among in-patient anorexics (where physical activity is controlled) may be, in part, be due to a lack of physical release (Yates et

al., 1983). In addition, when anorexic patients gain weight and obligatory runners are unable to run, both experience comparable feelings of anxiety and guilt (Pillay & Crisp, 1977; Sacks & Pargman, 1979). Sours (1981) compares the two this way, ". . . the runners must strive for a better time before their pleasure begins to pall, just as the abstaining anorexic must repeatedly attempt to reduce calories. If these runners are forced to give up running, a sense of loss ensues with increasing tension and dissatisfaction with themselves, like the anorexic who must relinquish starvation and return to everyday eating and the threat of a fat body out of control" (pp. 87-88). The onset for both anorexic and obligatory running patterns often appear in reponse to personal stressors, thus their behaviors may serve as coping mechanisms. In conclusion, Yates et al., (1983) state that these two groups may "represent a single mode of behavior, characterized by grim asceticism and an assiduous avoidance of passive, receptive pleasures" (p. 253). In fact, physiological similarities between obligatory runners and anorexics, such as blood profile, bradycardia, and increased blood urea nitrogen, have also been described (Liberman & Palek, 1984; Patel, Andrews, & Bowman, 1983).

Yates et al.'s (1983) proposal prompted numerous responses, most of which were critical of the methodology employed (Krelstein, 1983; Larsen, 1983; Stewart, 1983; Wells, 1983). While Yates (1983) admitted that much more controlled research was needed to clearly address the similarities, this preliminary study did prompt further investigation.

Contrary to Yates et al. (1983), subsequent questionnaire studies using objective psychological measures have found no resemblance between runners and anorexics (Blumenthal, O'Toole, & Chang, 1984; Blumenthal,

Rose, & Chang, 1985). Blumenthal et al. (1984) found anorexics, compared to runners, to score higher on 8 out of 10 clinical subscales and lower in ego-strength on the Minnesota Multiphasic Inventory (MMPI). Additionally, the runners generally had normal profiles, whereas only a few anorexics had normal profiles.

Although employing more controlled research than Yates et al.'s (1983) original work, Blumenthal et al. (1984) admitted possible selection bias, as the anorexic sample represented hospitalized psychiatric patients who were compared with a runner sample who were healthy well-functioning individuals. This selection bias may have contributed to the greater level of psychopathology seen in the anorexic group. In an attempt to equate the groups, a follow-up analysis (Blumenthal et al., 1985) was performed, in which only the most dedicated runners were selected, and again, no evidence of psychopathology was revealed in these runners.

The assumption that dedicated runners would automatically evidence "addictive" or dependent qualities may be a major fault of Blumenthal et al.'s (1984; 1985) studies. Just as not all dieters become anorexic, not all runners become addicted to running; therefore, perhaps the anorexic patients should have been compared to addicted runners (Polivy, 1992). Further support for the role of addiction is offered by Davis (1990) who found a general measure of addictiveness to correlate with weight and diet variables, as well as perfectionism, among exercisers compared to nonexercisers.

Gender differences may also account for the lack of similarities between runners and anorexics. The majority of these comparison studies have used male runners and female anorexics. While not all runners are men, nor all

anorexics women, the prevalence of disordered eating in women may reflect the cultural emphasis on physical appearance for women, whereas increased running activity in men may reflect a similar cultural emphasis on physical effectiveness for men (Yates et al., 1983). Nudelman (1988) conducted the traditional runner and eating disordered comparison design, comparing male runners, normal male weight non-eating disordered controls and eating disordered females on a variety of measures. This study concluded that the male runners were better adjusted and did not resemble the eating disordered women. Once again, because they did not control for gender effects, a female running comparison group, normal female weight non-eating disordered controls and eating disorderd men may have provided more appropriate comparison groups and possibly led to increased similarities.

Another major difference lies within the coping characteristics of the behaviors. Anorexia is thought to represent maladaptive coping, whereas running, if not in excess, may represent adaptive coping (Polivy, 1992). Nudelman (1988) concluded that running may serve as a coping technique for males, resulting in their higher adjustment scores. Although he tried to create a "stop running" group, similar to Baekeland's (1970) early work, no runners would agree to discontinue their running for the study. If a "stop running" group had been formed, this group might have compared more closely to the eating disordered females.

Motivational issues may account for these differences, as for anorexic patients exercise is a means to the end of weight control, whereas for runners exercise appears to be an end in itself (Polivy, 1992) as well as a means of weight control. Thus, different motivations for self-improvement

may exist between men and women. Striegel-Moore, Silberstein, & Rodin (1986) state that in the development of self-concept, physical attractiveness and body image are much more influential for females than males. Consequently, women who are dissatisfied with their appearance score lower in self-esteem. The self-concept of men is related to physical effectiveness as opposed to physical attractiveness (Lerner, Orlos, & Knapp, 1976). Thus athletic involvement by men, even in excess, may be perceived as achievement. In addition, because exercise and physical fitness are valued by society, the excessive exercising male may sense respect for his habit, whereas the eating disordered women may feel a sense of self-disgust for her behaviors (e.g., bingeing and purging).

The majority of literature focusing on abnormal eating and exercise behavior has primarily addressed individual differences specific to each behavior (i.e., obese vs. normals; athletes vs. non-athletes; men vs. women). Recently, however, researchers have begun to develop models in an effort to explain the dysfunctional eating-exercise relationship.

Excessive Exercise/Eating Disorders: Proposed Models

Abnormal eating and excessive exercise patterns have been found to exist simultaneously within individuals (Katz, 1986; Kron et al., 1978, Smith, 1980). Some evidence is available that suggests that fear of gaining weight can motivate excessive exercising simulating anorexia nervosa (Waldstreicher, 1985). In fact, increased physical activity has been considered a fundamental clinical feature of anorexia nervosa and may, in some cases, occupy a central role in its development (Kron et al., 1978). In the Kron et al. (1978) study, 25 of 33 anorexics engaged in excessive

physical activity prior to hospitalization and 21 of the 25 were extremely active well before they had ever dieted or lost weight. This data is not surprising, as an increase in activity is often a conscious effort to supplement weight loss (Garner et al., 1985), and temporally, increased activity often follows initial diet strategies (Beumont, Booth, Abraham, Griffiths, & Turner, 1983). De Coverley Veale (1987) has distinguished between primary exercise dependence and that which is secondary to a pre-existing eating disorder. Kron et al. (1978) found temporal differences in the physical activity of anorexics at various stages of their weight loss. Prior to their weight loss, physical activity was often goal-directed, organized and planned, whereas during active weight loss their physical activity continued to be intense and driven, but more disorganized and aimless. These authors hypothesized that starvation produces the later erratic motor behavior. Excessive exercise can also be the presenting behavior leading to the diagnosis of anorexia (Chalmers, Catalan, Day, & Fairburn, 1985).

In light of the diagnostic criteria and obvious linkages between excessive exercise and eating disorders, empirical research specifically addressing this relationship is lacking and the available research has been criticized for methodological weaknesses. General literature regarding this relationship largely consists of ambiguous anecdotal comments and case study reports. In an attempt to integrate current empirical findings and to lend guidance and strengthen future research efforts, models have been proposed to explain the excessive exercise and eating disorder relationship.

Eisler and le Grange (1990) propose four models which are discussed in the following section. They note that these models, although they imply

different causal or etiological mechanisms and have different implications for practice, are not mutually exclusive.

Model 1:

Anorexia nervosa and excessive exercise form distinct diagnostic groups

This model suggests that while both excessive exercisers and anorexics participate in high levels of physical activity, the anorexic clearly participates as a means of achieving a lower body weight. The anorexic's preoccupation with weight and body shape fuels their participation. Eisler and le Grange (1990) specifically refer to the condition by which some anorexics implement exercise as a means of further weight loss as "exercise anorexia nervosa." Excessive exercisers, on the other hand, may recognize the benefits of low body weight for performance but weight loss is not the primary motivator for their participation. Because the desire to be thin is secondary to the desire to improve performance, weight loss that impedes performance will be readily regained. Unfortunately, because of the superficial similarities between these two groups, the presence of a clinical eating disorder may go unnoticed in some exercisers.

Model 2:

Anorexia nervosa and excessive exercise are overlapping groups and excessive exercise can lead to the development of anorexia nervosa

According to this model, anorexia may be precipitated by physical activity. This proposal is supported by others (Katz, 1986; Rowley, 1987). Katz (1986) presents two case studies of long distance runners who became anorexic. When unable to run, these individuals exhibited depression and

bulimic behaviors. It appears that weight loss from exercising can trigger anorexia as can weight loss from dieting (Polivy, 1992). Eisler and le Grange (1990) address two mechanisms that may trigger the development of eating disorders, thus model 2 adds proposed causal links to the excessive exercise-eating disorder relationship. First, a "starvation addiction" has been thought to exist in anorexics (Szmulker & Tantam, 1984). Therefore, dieting initially started for performance may lead to a starvation dependence in exercisers as well. Second, high levels of physical activity have been found to reduce food intake in humans (Johnson, Mastropalo, & Wharton, 1972) which may lead to the development of eating disorders. These mechanisms could account for the prediction that 38-75% of all cases of anorexia nervosa may be activity induced (Epling, Pierce, & Stefan, 1983).

Model 3:

Anorexia nervosa as well as excessive exercise are both related to some other underlying disorder

This model states that anorexics and excessive exercisers both suffer from a common underlying disorder such as obsessive-compulsive or affective disorder. Thus, according to Eisler and le Grange (1990), many of the descriptive similarities between the two groups may be the expression of the underlying disorder. It has also been suggested that another illness might predispose individuals to become anorexic or excessive exercisers.

Model 4:

Excessive exercise is a variant of eating disorder

Eisler and le Grange's (1990) final model posits that a specific etiological process underlies both anorexia nervosa and excessive exercise. For example, genetic, personality, familial, and social factors that normally may lead to the development of anorexia may lead to a similar disorder with different manifestations (e.g., excessive exercise). This model seems to best explain Yates et al.'s (1983) contention that obligatory running may be an analogue of anorexia.

Eisler and le Grange (1990) also critique the research performed to date, specifically noting weaknesses in the comparison groups used and methodologies employed. Regarding lack of equivalent comparison groups, comparing active exercisers to eating disordered individuals assumes the same degree of pathology among exercisers as in eating disordered individuals. Methodologically, they point out an overreliance on self-report questionnaire data and relatively small sample sizes.

Polivy (1992) notes that the models proposed to account for the symptoms of eating disorder pathology in excessive exercisers or similarities between eating disorder and excessive exercising have yet to be tested. In addition, she acknowledges that the literature needs to be directed and unified with an explanatory theory as it tends to be spread around a number of questions. She stresses the need for further research to identify contributing factors,

> What is not known at this time is the etiological mechanism which converts some persons from "normal" exercisers into

> addicted, compulsive ones, or eating disordered (and compulsive) individuals. Some have argued that this is to some degree inherent in the activity, and, with time and degree of exertion, most will fall prey to the pathology. The causal mechanism is far from clear, however; those studies which have attempted to blame the activity have been correlational, not experimental or even quasi-experimental. At this time, we do not even have accurate figures on the prevalence of pathological compulsive exercising. We have thus identified the existence of problematic excessive exercising or exercise addiction, which affects some physically active individuals. Now we must discover who these susceptible people are, how they develop the problem, and how to prevent it. (p. 34)

One possible mechanism contributing to the development of both eating disorders and excessive exercise is perceived control. Interestingly, although the issue of control has been implicated as a factor related to eating disordered behavior, only one study could be located that empirically explores control and disordered eating (Rezek & Leary, 1991). Perceived control may also play a role in excessive exercise behavior, as evidenced by sporadic commentaries in the literature, although no empirical research could be located that addresses this relationship.

Polivy (1992) has noted that "case studies indicate that both eating disorders and excessive exercising tend to be found in individuals under stress, often with low self-esteem, who use these means to cope with distress and attempt to bring a measure of personal control into their lives" (p. 33). For individuals that exhibit both disordered eating and excessive exercise behaviors, perceived lack of control in one behavior may stimulate abnormal behavior in the other. For example, perceived caloric indulgence via eating may lead to compensatory calorie

expenditure via excessive exercise. In some ways, an investigation of perceived control as a contributing factor to the disordered eating-excessive exercise relationship may partially answer some of the questions posed by Eisler and le Grange's (1990) models 2 and 3. Before specifically addressing perceived control in eating and exercise, literature pertinent to the construct of control will be briefly reviewed.

Control Research

People are often motivated to achieve a sense of equilibrium in their lives and therefore may actively implement strategies aimed at gaining control. As has been discussed previously, control of eating and exercise behaviors may serve as examples of strategies some people may adopt to "gain control." Behavioral and cognitive theorists have explored the issue of self-control, offering a variey of explanations in an attempt to discover individual motivations for gaining control. Notably, Rotter's conceptualization of locus of control (1966), Burger's desire of control research (Burger & Cooper, 1979; Burger, 1986) and the benefits and detriments of perceived control (Langer, 1983), appear to apply to control concerns related to exercise and eating behavior and will be discussed below.

Locus of Control

Rotter's (1966) internal-external locus of control concept is considered to be a significant contribution to behavioral control research. This conceptualization of control developed out of Rotter's social learning theory which applies traditional learning concepts to an understanding of the

individual in a social learning environment. Rotter's social learning theory is basically "a theory of how choices are made by individuals from the variety of potential behaviors available" in social settings (Phares, 1976, p. 14). Rotter's theory places equal emphasis on both reinforcement and expectancy, "the occurence of a behavior of a person is determined not only by the nature or importance of goals or reinforcements but also by the person's anticipation or expectancy that these goals will occur" (Rotter, 1954, p. 102).

Specifically, the internal-external control construct is defined as a generalized expectancy to perceive reinforcement as either contingent upon one's own behaviors or as the result of forces beyond one's control and due to chance, fate, or powerful others (Levenson, 1981). Rotter hypothesized that people who are more "internal" and view reinforcements as contingent on their own behavior are better adjusted than those who are "external" and see reinforcement as determined by fate, chance or powerful others. The locus of control construct has been applied to exercise and weight loss behaviors.

For example, Dishman, Ickes, and Morgan (1980) reported that individuals who adhered to a 20-week exercise program were more "internal" than program dropouts based on their scores on a health locus of control scale. Although this differentiation in locus was not statistically significant, these two groups did differ significantly on degree of self-motivation. Unfortunately, the authors did not explore a possible interaction between self-motivation and locus of control, however, it has been suggested that a highly self-motivated internal would be most likely to stay with a physical activity program (Wallston & Wallston, 1981).

Saltzer (1979) studied the internality and externality of 115 women who began a voluntary, clinic-based medical weight reduction program. Upon examination of the locus of control scores on a weight specific measure, she found the 79 women who completed the program to be more internal than the noncompleters. In summarizing her findings she stated, "weight locus of control internals with high values on physical appearance or health were significantly more likely to translate their behavioral intentions to lose weight into successful actions" (Saltzer, 1979, p. xiv).

Wallston, Wallston, Kaplan and Maides (1976) report the results of a master's thesis that explored the interaction of locus of control beliefs and weight management treatment program characteristics. They found that "internals" (as measured by a specific health locus of control scale) expressed greater satisfaction with a self-managed program whereas "externals" were more satisfied with a therapist-directed program.

Interestingly, although an internal locus of control has traditionallly been thought to be related to "healthy" adjustment, whereas an external locus related to maladjustment, research on alcohol addiction has paradoxically shown alcoholics to be more internal than nonalcoholics (Goss & Morosko, 1970; Gozali & Sloan, 1971). Goss and Morosko (1970) suggest that internality is engendered by the functional value of alcohol in providing alcoholics with a means of regulating the way they feel at any given moment.

This effect appears to be true for other addictive behaviors, such as drug abuse, where the addict's strong belief in personal control is based on drug effects (Berzins & Ross, 1973). It is thought that each administration of the drug enables the addict "to sense control over anxieties, conflicts,

impulses, moods, and bodily states" (Worrell & Tumilty, 1981, p. 322). On the surface these results appear to contradict Rotter's (1966) original hypotheses. However, he has acknowledged a possible curvilinear relationship between adjustment and the internal-external dimension, such that people on either extreme of the continuum might be more maladjusted than those in the middle range.

Therefore, among addictive populations, it appears that the drug or behavior leads the addict to perceive control over the immediate situation and therefore reflect a high internal locus of control. Obviously, this internality does not reflect true adjustment, rather temporary perceptions of control. Langer (1983) suggested that the "subjective reality may be far more consequential in determining how the world impinges on us than most people assume" (p. 13). Thus, if one has a strong need for control and is led to believe that control has been gained in a particular situation, these perceptions may substitute facing the reality of the underlying issues and exercising direct responses to address those issues. Individual differences in desire for control have been hypothesized and may also be related to perceived control.

Desire for Control

A motive to control the events in one's environment appears to exist to some degree in all individuals. Burger and Cooper (1979) acknowledge that not all subjects react identically to issues of personal control and "if a desire for control over events is an important psychological dimension, then individual differences in the motivation for control should help account for variation in human behavior" (p. 382). Additionally, although level of

control motivation also varies from situation to situation, Burger and Cooper (1979) assert that a general level of this motive can be measured. In fact, they have developed "The Desirability of Control Scale" to measure people's general level of control motivation. Burger and Cooper (1979) hypothesized that differential responses covarying with desire for control are most likely in situations where the ability to control events is moderately advantageous. Consequently, people both high and low in desire for control will display similar behaviors in situations that indicate that personal manipulation would be highly advantageous. Similarly, no personal desire for control should be found for either highs or lows in unimportant situations that provide little or no payoff for control. Assessing one's general need for control may provide valuable insight regarding individual's reactions to threatening situations, as a lack of perceived control has been related to decreased performance and increased frustration (Glass & Singer, 1972),

Perceived Control

Research suggests many beneficial effects associated with perceptions of control (Langer, 1975; Seligman, 1975). For example, Langer and Rodin (1976) reported that nursing home patients, when given choices that allowed them to perceive more control became more active and felt happier than a comparison group of residents who were led to believe the staff was in control of them as patients. This example illustrates how low perceived control is increased by restoring the specific need in question (e.g., choices led to increased control). This phenomenon of restoring control is known as reactance (Brehm & Brehm, 1981).

Unfortunately, when unable to directly restore a specific loss or threat, individuals may react in a dysfunctional manner. Consequently, the increases in perceived control may not always be beneficial (Langer, 1983, p. 117). Thus, in the alcoholic example addressed above, alcoholics may perceive greater control by drinking, yet this behavior may simply be a substitution for losses of control in other areas of their life. Unfortunately, the dysfunctional reactant behavior (e.g., alcohol, drug use, excessive exercise), although leading to short-term perceptions of control, may be detrimental, and even life threatening in the long run. Creating a sense of control elsewhere that substitutes for the original source of lack of control has been labeled "displaced reactance" (Rezek & Leary, 1990).

Although most individuals need control in various aspects of their life, some exhibit a greater desire for control than others. Possibly this high need for control is fueled by underlying issues, leading to an increased likelihood of displaced reactant behaviors. More importantly, when the desire for control is high, yet the perception of control is low, the resultant feelings of frustration lead to potentially destructive reactive behaviors. As mentioned previously, several authors have suggested that eating disordered individuals display a high need for control that is motivated by perceptions of low control in one's life. Therefore, the eating disordered individual reacts to this loss in a displaced manner by controlling her eating.

Control in Eating and Exercise

Perceived Control in Eating

As mentioned earlier, only one study could be located that empirically examined perceived control and eating behavior (Rezek & Leary, 1990). This study focused on women defined as having "pure" anorexic tendencies and therefore predicted that perceived loss of control would lead to reduced consumption. Although on the surface, the authors' hypothesis appears to contradict theory and research on restrained eaters, they contend that restrained eaters do not necessarily have anorexic tendencies. This stance obviously conflicts with previously cited literature that suggests that extreme dieting is an integral underlying factor responsible for the development and perpetuation of abnormal eating behaviors (Davis et al., 1988). Interestingly, although Rezek and Leary's (1990) subjects were identified as having "anorexic tendencies," as defined by elevated scores on a "drive for thinness" measure (EDI-2; Garner, 1991), because the authors did not measure the subjects' dietary restraint, their assertion regarding the differences between restrained eaters and their sample is questionable. Nonetheless, this study did show that perceived loss of control influenced dietary behavior.

Perceived Control in Exercise

No research could be located addressing the role of exercise involvement as a means of gaining control. However, many of the motivators ascribed to the manipulation of eating behavior as a means of "gaining control" can logically be applied to exercise. For example, the restricted food intake of persons with a tendency toward anorexia may be a

reaction to a sense of low control that represents a means of exerting secondary control (Rezek & Leary, 1990). It could also be that increased exercise behavior is a reaction to actual loss of dietary control (i.e., surpassing one's calorie "quota"), therefore representing a means of exerting secondary control to regain a sense of caloric balance. Also, the anticipation of future exercise behavior may "justify" the loss of present dietary control, as future caloric expenditure via activity is perceived to maintain one's "calorie control".

Purpose of the Present Study

The intent of this investigation was to explore the relationship between eating and exercise behaviors. As addressed earlier, disordered eating and exercise behavior patterns have been speculated to exist simultaneously in some people, such that disordered eating can lead to excessive exercise or excessive exercise can lead to disordered eating. Because support for this relationship has primarily surfaced in the form of diagnostic criteria and literary commentary, this study was designed to empirically test the proposed relationship between eating and exercise behavior.

As addressed earlier, future meal plans (Tomarken & Kirschenbaum, 1984) have been found to lead to dietary disinhibition. Plans of future large meals appear to lead to self-defeating cognitions related to future caloric consumption, "justifying" current indulgence (e.g., "I'm going to blow it later, I might as well 'blow it' now too"). In the current investigation, it was suggested that cognitions related to future caloric expenditure may also "justify" current indulgence (e.g., "I'm going to exercise later, I'll 'allow' myself to 'blow it' now"). It was hypothesized that individuals high in

dietary restraint, who display a high commitment to physical activity, may exhibit such cognitions in an attempt to control caloric balance. Consequently, if these individuals exhibit chronic caloric consumption and expenditure cognitions they may be at risk for developing disordered eating and/or exercise behaviors.

Individuals concerned with balancing caloric consumption with caloric expenditure may justify decreasing self-imposed limitations in one of these behaviors (e.g., increasing consumption) when control is perceived to be gained by the other behavior (e.g., future exercise plans). In addition, because affective states of anxiety and depression have been shown to be related to losses in perceived control, the individual who disinhibits dietary restraint due to future exercise plans may experience anxiety and depression when unable to exercise.

Therefore, the primary purpose of this investigation was to experimentally manipulate the relationship between exercise and eating behavior. Specifically, the following question was asked, does a plan for future exercise act as a disinhibitor of dietary restraint? The secondary purpose of this investigation was to determine the role perceived control plays in this relationship. Do future plans to exercise increase perceived control by "justifying" dietary disinhibition? In the absence of future plans to exercise, do subjects inhibit their eating to increase perceived control? When expecting to exercise, but then being unable to, does initial perceived control decrease? Finally, is there a relationship between level of perceived control and affective states of anxiety and depression?

Specific Hypotheses of the Present Study

The present study was designed to examine the relationship between eating and exercise behaviors. The primary purpose was to explore the role of future plans to exercise as disinhibitors of dietary restraint. Secondary purposes included investigating the role of perceived control in dietary disinhibition and resultant affective states of anxiety and depression associated with plans for future exercise.

Women identified as restrained eaters and committed to exercise were initially assigned to an "exercise" or a "no exercise" condition. Following this two-condition assignment, they were asked to taste as much ice cream as they wanted as part of a sham "taste test". After consuming the ice cream, one half of the initial "exercise" subjects were told that they would be unable to participate in the exercise condition, forming a third condition ("expected exercise"). Throughout the investigation, perceived control and affective states (anxiety and depression) were assessed.

Thus, based on the primary purpose of the study, the following hypothesis was posited:

(1) Women with plans for future exercise would disinhibit dietary restaint (eat more) than women without future exercise plans.

Based on the secondary purposes of the study, the following hypotheses were posited:

(2) Women with future exercise plans would report greater perceived control than women without exercise plans.

(3) Women with future exercise plans would report less anxiety, depression than women without exercise plans.

(4) Women who expected future exercise but were later told they would be unable to exercise, would report less perceived control than individuals with future exercise plans who do later exercise.

(5) Women who expect future exercise but were later told they would be unable to exercise, would report greater anxiety and depression than individuals with future exercise plans who did later exercise.

CHAPTER II

METHODOLOGY

Subjects

The final sample consisted of 60 female college students selected from Exercise and Sport Science and Public Health Education classes at the University of North Carolina at Greensboro. Initially, however, 305 women were screened by completing a screening battery that included the Revised Restraint Scale (Herman, 1978; see Appendix A) and the Commitment to Physical Activity Scale (Corbin, Nielsen, Borsdorf, & Laurie, 1987; see Appendix B). Because the primary purpose of this investigation was to examine the effect of exercise as a disinhibitor of dietary restraint, subjects defined as highly committed to physical activity and high in dietary restraint were thought to represent the most appropriate sample. Women whose scores fell in the upper half on both the Restraint (score greater than 17) and the Commitment to Physical Activity (score greater than 36) scales were invited to participate in the study (see Figure 1).

Women who agreed to participate in the study were asked to complete a Health History Inventory (see Appendix C) and a Weight and Diet History Questionnaire (see Appendix D) and were measured for height and weight. Subjects whose weight did not fall within 20% of ideal weight based on the Metropolitan Life Insurance Company height and weight tables (1979) were excluded from participating ($n = 1$) because previous research has indicated that the use of the Restraint Scale is questionable in an

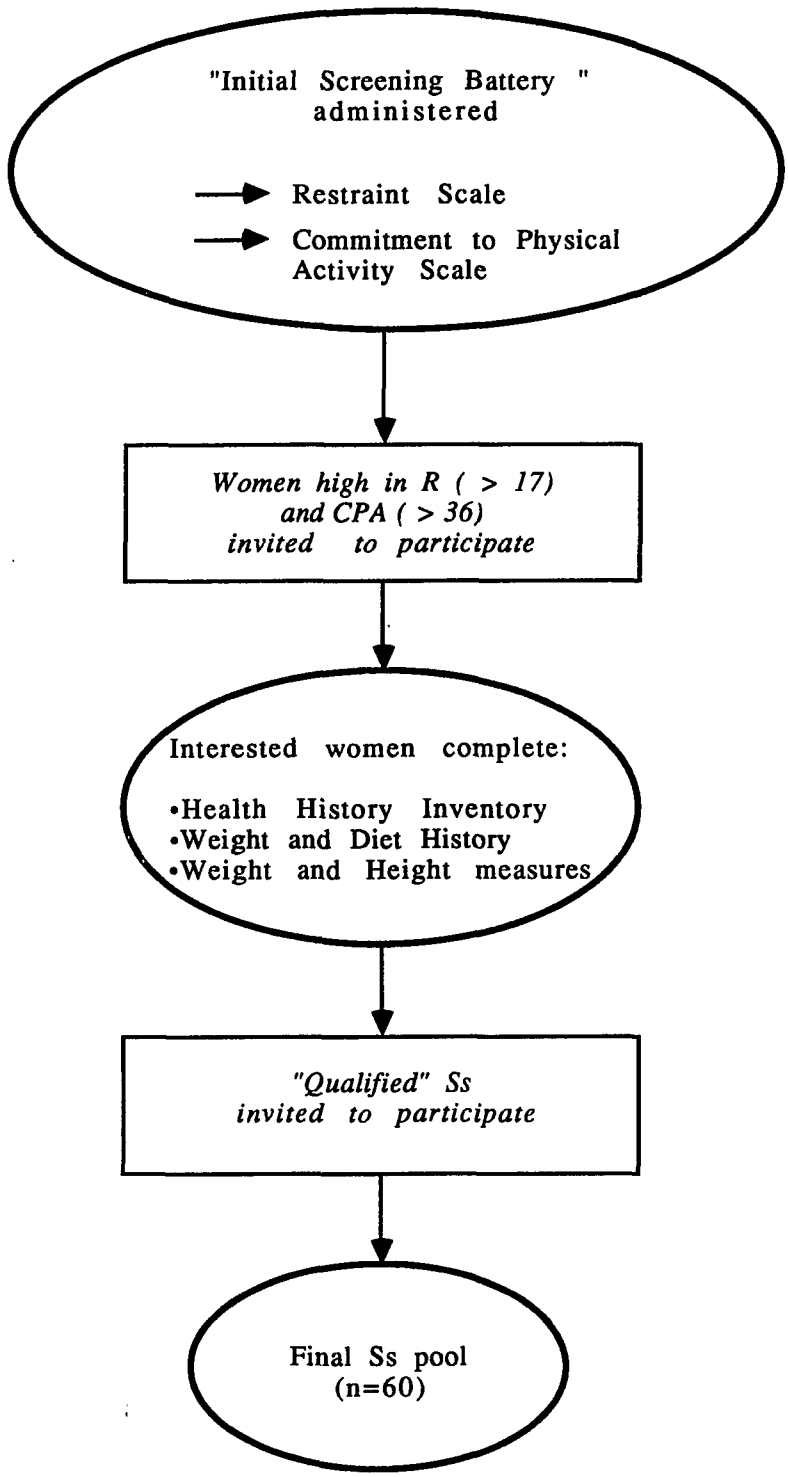

Figure 1. Subject screening procedures

overweight population (Ruderman, 1983; Ruderman & Christensen, 1983). Subjects who weighed 20% below their ideal weight were also excluded (n = 0) as this exceeds the diagnostic criteria for anorexia (APA: DSM-III-R) and should have adequately eliminated women with probable pre-existing severe eating disorders (i.e., anorexics). The Weight and Diet History Questionnaire also enabled the investigator to detect and eliminate related distorted eating behaviors (n = 2), as it included the Bulimia and Drive for Thinness subscales (Garner, 1991). It was thought that women who manifested severe bulimic and anorexic behaviors would confound the investigation. The focus of this investigation was on women who demonstrated a tendency toward disordered eating (i.e., restrained eaters), rather than on those who currently exhibited severely dysfunctional eating patterns. Also, the researcher believed it was unethical to place severely eating disordered women in an experimental manipulation that may have exaccerbated a pre-existing condition. Finally, the Health History Inventory helped to elimninate women who reported physical problems (n=2) for which exercise would have been contraindicated, as well as those who had relevant food allergies (n=1) that would have prohibited them from participating in the experimental manipulation (i.e., dairy products).

College-age women enrolled in Exercise and Sport Science and Public Health Education classes were chosen for two reasons: (1) it was suspected that women who enrolled these classes would be more likely to exhibit a high commitment to physical activity compared to women selected from general lecture classes, and (2) college-age women have been found to demonstrate increased concerns regarding diet and body weight (Miller, Linke, & Linke, 1980).

Instrumentation

Revised Restraint Scale : Herman's Revised Restraint Scale (R; Herman, 1978) was included in the initial screening battery to identify potential subjects who were high in dietary restraint. This scale has been found to evidence good test-retest reliability (r=.93) and adequate internal reliability with item-total correlations ranging from .41 to .77 for female subjects (Polivy, Herman, & Howard, 1988). The restraint scale has been utilized by a number of researchers studying the restraint construct (Herman & Polivy, 1980; Lowe, Whitlow, & Bellwoar, 1990; Ruderman, 1985; Spencer & Fremouw, 1979; Tomarken & Kirschenbaum, 1984).

Commitment to Physical Activity : Corbin et al.'s (1987) Commitment to Physical Activity (CPA) was also included in the initial screening battery to identify potential subjects who demonstrated a high degree of commitment to physical activity. This scale was developed as a modification of Carmack and Martens' (1979) specific Commitment to Running scale in an attempt to measure the more global construct of physical activity. Corbin et al. (1987) have established acceptable reliability and validity for the CPA scale. The Cronbach's alpha value of .88 found for this scale closely parallels the alpha values obtained for the original Commitment to Running scale (Corbin et al., 1987).

Health History : A standard Health History Inventory was administered to identify health problems that might have interfered with participation in the experimental manipulations (i.e., dietary and/or physical limitations). Questions specific to cardio-respiratory, muscular, bone-joint,

and general health history, as well as current medications, food allergies and exercise history were included.

Weight and Diet History : A Weight and Diet History Questionnaire was administered to assess eating behaviors and weight loss patterns indicative of severe eating disorders (i.e., anorexia nervosa or bulimia). Pertinent subscales (Drive for Thinness and Bulimia) from Garner's (1991) Eating Disorder Inventory, second edition (EDI-2), were also included in this questionnaire. This information helped to eliminate, as potential subjects, women who were suspected of manifesting pre-existing eating disorders. Both the Drive for Thinness (DT) and Bulimia (BUL) subscales exhibit internal consistency reliability coefficients ranging from .81 to .91 and .69 to .83, respectively (Garner & Olmsted, 1984; Raciti & Norcross, 1987; Shore & Porter, 1990; Vanderheyden, Fekken, & Boland, 1988). In addition, test-retest reliability ranged from .72 to .92 for the DT subscale and .44 to .90 for the BUL subscale. Garner (1991) offers a comprehensive review of the substantial content, criterion-related, concurrent, and construct validity data specific to the EDI-2 subscales in the EDI-2 Professional Manual.

Pre-session Activity & Food Log : Pre-Session Activity & Food Logs (see Appendix E) were distributed to all women who qualified to participate in the study. The purpose of this log was to track the activity and food intake during the 24 hours prior to each subject's scheduled laboratory appointment in an effort to increase experimental control and to verify the subject's activity and eating as "typical." The logs were divided into time

segments and the women were asked to record the type, duration, and intensity of all their daily activities (e.g., studying, sleeping, walking across campus, in class, running to the bus). In addition, they were asked to record all food eaten during the 24 hours prior to their laboratory appointment. These logs also included direct questions as to how typical the recorded activity and eating was of the subject's "normal" activity and eating. These logs were employed not only to record pre-session activity and food intake, but also to enhance the women's awareness of their pre-session exercise restriction. The awareness of pre-session restriction in committed exercisers was thought to increase the importance of having an opportunity to exercise during the laboratory session.

Informed Consent : A standard "Consent to Act as a Human Subject" form was provided to every subject who participated in this investigation (see Appendix F). This form had been accepted by the University of North Carolina at Greensboro Human Subjects' Committee for use in this investigation. Included in the form was the proposed rationale supporting the experimental manipulations, participation information, risks involved, benefits to be gained, time involvement and confidentiality information. This form also included contact information for follow-up purposes (i.e., address, telephone number), as well as subject information for descriptive and coding purposes (i.e., age, DOB, SSN).

Resultant Affect and Perceived Control : The Resultant Affect and Perceived Control scale consisted of the revised Worry-Emotionality Scale (WES-r; Morris, Davis & Hutchings, 1981), and single item measures of

depression and control (see Appendix G). Morris et al.'s (1981) WES-r is a 10-item scale representing a revised version of the original 47-item Worry-Emotionality Scale that was compiled from pre-existing anxiety questionnaires. The WES-r consists of two 5-question subscales; one measuring cognitive anxiety ("worry") and the other measuring somatic anxiety ("emotionality"). The WES-r has been found to correlate moderately with the original WES and the discriminant validity of the subscales has been found to be greater than the original scale (Morris et al., 1981). Women were asked to respond to the 10 WES-r questions by rating their current state on a 5-point Likert scale ranging from, "the statement does not describe my present condition" to " the condition is very strong; the statement describes my present condition very well."

Depression was assessed via a single depression question taken directly from the Incredibly Short Profile of Mood States (ISP). Developed by Dean, Whelan, and Meyers (1990), the ISP allows for quick and efficient assessment of mood states. The ISP also includes the the items of tension, confusion, vigor, fatigue, and anger. Participants were asked to respond to the single item of depression by rating their current state of depression on a 5-point scale. Dean et al., (1990) reported that the ISP correlated highly with the six subscales of the original Profile of Mood States developed by McNair, Loor, and Droppleman, (1971; range: $\underline{r} = .67$, to $\underline{r} = .82$).

A question assessing subjects' perceptions of control was the final measure included. At the present time, a standardized state measure of perceived control is not available, therefore, researchers addressing perceived control in sport and exercise contexts have developed situationally specific self-report measures that allow the subjects to report

their perception of the degree of control they feel they possess over certain situations/behaviors (Kimiecik, 1990; Kavussanu, 1992). Therefore, similar to the assessment of anxiety and depression, subjects were asked to respond to the single item of control, "I feel I am in control at this time," by rating their current state of perceived control on a 5-point scale.

Hunger Scale : A three-question analog Hunger Scale (see Appendix H) was used to determine the subjects' current level of hunger, fullness, and desire to eat. Three 100 mm analog scale questions were recommended to measure hunger, satiety, and desire to eat, as these represent separate dimensions of eating behavior (Lowe, personal communication, October 21, 1992). In addition, subjects were directly asked to report whether or not they had eaten within the last two hours. Women had been instructed to eat within two hours of their scheduled laboratory appointment to ensure that they were relatively satiated, yet not uncomfortably full, at the time of their appointment. The analog scale and the direct question allowed the researcher to assess the two hour pre-session eating requirement to eliminate those women who may have been physiologically hungry due to non-compliance. As will be discussed later in this chapter, resultant consumption was designed to be stimulated psychologically, rather than physiologically.

Thought-Listing : Thought-listing (Cacioppo & Petty, 1981) was used to assess the thematic content of subjects' thoughts at specified time frames throughout the experimental session (see Appendix I). This procedure involved listing immediate thoughts concerning the upcoming task or any

other thoughts subjects might have had, relevant or not, to the investigation. At specified time intervals, subjects were given a blank piece of paper with 12 rectangular boxes numbered for responses and were asked to list their current thoughts. The thoughts were to be brief and subjects could list as many as 12 thoughts at each of the three thought listing administrations.

Because it was of interest to assess the relevance of their cognitions to the intended focus of the investigation (i.e., resultant affect and perceived control related to food and exercise), each thought was thematically coded four ways. Specifically, each thought was coded as to whether or not it contained affect, food, exercise and control themes. The affect theme represented the existence of one of Tomkins' (1962) eight standard affects, which included the positive affects of interest, surprise, and joy, and the negative affects of anguish, fear, shame, disgust and rage. In addition, the categories of guilt, confusion, and relief were added to the affect theme, as pilot data revelaed these were appropriate for inclusion. Listed thoughts that did not contain any affect information were coded as "none." Each thought, therefore, was categorized as one of 12 possible codes for an affect theme. The food, exercise, and control codes represented simple dichotomous (yes/no) categorizations indicating whether or not the content of the thought reflected either of these three themes.

To ensure reliability of the thought coding process, all thoughts were independently coded by two individuals. Although the raters came to consensus on the 26 thoughts for which they disagreed, inter-rater reliabilities (see Appendix J) were determined for each theme prior to consensus using the following equation, [1 - (# of Thoughts of

Disagreement / Total # of Thoughts)]. The codes subsequently entered into the final analysis represented the post-consensus codes.

Taste Preference Rating Sheet : A "sham" taste preference rating sheet was used during the taste test to increase the subject's belief in the validity of the apparent "taste test" (see Appendix K). After tasting each sample, subjects were asked to rate the sweetness, creaminess, smoothness, and saltiness on a 3-point Likert scale and to rate the overall "tastiness" of each sample on a 6-point Likert scale.

Post-session Activity & Food Log : Post-Session Activity & Food Logs were distributed to all women at the conclusion of their laboratory appointment (see Appendix L). Similar to the pre-session log, the purpose of this log was to track the subject's activity and food intake during the 24 hours following their scheduled laboratory appointment in an effort to increase experimental control and to verify the subject's activity and eating as "typical." The logs were identical in design to the Pre-session Activity and Food Logs Similar to the pre-session logs, these logs were not only employed to record for post-session activity and food intake, but also to enhance the women's awareness of their post-session exercise restriction. The awareness of post-session restriction, in committed exercisers was thought to further affect the response of committed exercisers to the opportunity to exercise during the laboratory session. The women were instructed to return these logs within 24 to 48 hours of their scheduled laboratory appointment.

Post-session Questionnaire : The Post-Session Questionnaire (see Appendix M) was administered to subjects when they returned their Post-Session Activity and Food log. This questionnaire included questions regarding actual exercise and eating behavior since the experimental session, as well as post-session responses to the exercise and eating manipulations experienced during the experimental session.

The purpose of the Post-Session Questionnaire was two-fold. First, the expectation of a follow-up obligation to the researcher may have strengthened compliance to the 24 hour post-session exercise restriction that admittedly is difficult to enforce after leaving the controlled experimental setting. Secondly, this questionnaire allowed the researcher to collect post-session behaviors and cognitions that may have been related to the experience of forced inactivity and caloric intake outside of the laboratory session time frame.

Procedure

Qualified subjects were contacted and invited to participate in a "taste preference, activity and mood" experiment and were informed that the experimenter was investigating "the influence of taste preference and exercise on mood." Specifically, subjects were led to believe that recent research suggests that certain food preferences are related to mood. For example, subjects were told that salty foods have been associated with energetic moods, whereas sour foods have been associated with irritable moods. In addition, they were informed that exercise has been found to affect mood state. Therefore, subjects were informed that both food and activity had been found to affect mood, yet the effect of the combination of

these two factors on mood had yet to be determined. They were subsequently told that in the current investigation, it was of interest to examine the effect of sweet foods and exercise on mood, as physically active people often eat sweet foods prior to and following activity. Explaining this "modified" purpose was an attempt to discourage the women from determining the true intent of the investigation and to increase their belief in this "sham" motive.

Each subject was scheduled for 1.5 hour appointments and was instructed to eat a meal (breakfast, lunch or dinner) that was typical of her normal eating within two hours of the scheduled testing session. In addition, each subject was informed to abstain from exercising 24 hours prior to- and following her scheduled testing session.

As alluded to earlier, the 24 hour pre- and post-session exercise restriction was designed to enhance the importance of having an opportunity to exercise during the experimental session. Because commitment to running research has demonstrated that highly committed runnners experience great discomfort when unable to run (Carmack & Martens, 1979), it was thought that highly committed exercisers would experience similar discomfort when restricted from exercise. Committed exercisers are often defined as adherers to a specific number of weekly exercise sessions. The restrictions placed on the women who participated in this study were designed to interrupt their typical weekly exercise pattern. Also, these exercise restrictions were efforts to discourage post-session "compensatory" exercise behavior. For example, subjects who may have "indulged" during the taste test when anticipating participation in the "exercise condition," may have experienced low perceptions of

control when the opportunity to exercise was removed (i.e., that was, if they were assigned to the "expected exercise" condition). Furthermore, if they believed their post- session exercise behavior was going to be checked by the investigator, they may have been less likely to "compensate" for the lack of opportunity during the experimental session by exercising on their own after the session (i.e., noncomplying to the post-session guidelines).

Each subject was given a Pre-Session Activity and Food Log and was instructed to record her daily activity and food intake 24 hours prior to her scheduled laboratory visit and, furthermore, was asked to return the log to the investigator at the time of her appointment. Finally, each subject was informed that she may or may not be assigned to an exercise condition, therefore, proper dress for activity should be worn to the laboratory.

The experimental procedures used in this study closely followed the traditional forced preload paradigm used by Herman and Mack (1975). Upon arrival, each subject was seated alone in a quiet room and asked to read and sign the Consent to Act as a Human Subject Form which supplied the rationale for the experiment and explained the details of the procedure. After signing this form, the investigator verbally reiterated the experimental procedures and the subject was asked whether she had any questions. At this time, each subject completed baseline affect and control measures and completed the three-question analog Hunger Scale.

To begin the experimental manipulation, the subject was given the following instructions to read as the experimenter left the room to prepare the milkshake pre-load. The milkshake pre-load was referred to as a

"sensitizing product" to the subject.

Directions for Consuming the "Sensitizing" Product

Please consume the entire "sensitizing" product as this will serve to "prepare" your tastebuds for tasting a similar product during the "taste test." We have chosen a "sensitizing" product that is similar in temperature and texture to the "taste test" product to prepare you to make the most accurate taste ratings possible. For example, we would not "sensitize" you with a salty product in preparation for tasting a sweet product, as the salty taste most likely would interfere with your taste rating of the sweet product.

We ask all of the participants to consume this product as it is important that all of the individuals who are participating in this project are at relatively the same "hunger" levels when performing the taste test. Please feel free to take as much time as is necessary to consume the entire "sensitizing" product. The "sensitizing" product consists of one cup of whole milk, one cup of rich frozen yogurt* and 3 tablespoons of chocolate syrup.

If you are assigned to the exercise group, you will be given adequate "digestion" time between tasting and exercise. In addition, you will be riding a stationary bicycle, so your

stomach will not be affected by body movement as it might be if we asked you to run. These measures have been taken to ensure your comfort.

*Although the actual pre-load and the taste test samples consisted of ice cream, subjects were led to believe that they were consuming frozen yogurt. Pilot study information led the investigator to believe that subjects were more likely to "allow" themselves to consume frozen yogurt, compared to ice cream, regardless, of the actual fat and/or caloric content of the frozen yogurt. It appears that frozen yogurt is more easily "justified" as a binge food than is ice cream.

In approximately five minutes, the researcher returned to the room with the milkshake preload. The milkshake preload was prepared as described by Tomarken and Kirschenbaum (1984), consisting of one cup of whole milk, one cup of vanilla ice cream, and three tablespoons of chocolate syrup. The researcher reminded the subjects to drink the entire "sensitizing product" as this was required to prepare them for the subsequent "taste test." The researcher then left the room and instructed the subject to inform the researcher when she had consumed the entire "sensitizing product."

The actual purpose of including the forced pre-load, however, was to adequately satiate all subjects to eliminate the potential confound of physiological hunger differences. The two-hour eating requirement, in addition to the milkshake pre-load further controlled for baseline hunger levels across all subjects prior to participation in the taste test. Both of these "requirements" also increased perceptions of "excessive" daily calorie consumption and possible cognitions of "having blown it" similar to Herman and Mack's (1975) procedure.

After the subject had informed the researcher that she had consumed

the entire "sensitizing product," the researcher returned to the room with a box containing slips marked "E" and "NE" and asked the subject to close her eyes and reach into the box and select a single piece of paper. The box initially contained 40 slips labeled "E" (exercise group; E) and 20 slips labeled "NE" (no exercise group; NE) indicating to the subject the exercise condition to which they were to be assigned. Because the experimental design would later entail 20 of the E subjects being assigned to an "expected exercise" (EE) condition, 20 of the E slips were printed on pink paper, indicating that these subjects would later be informed they would be unable to exercise. The remaining 20 E slips were printed on blue paper indicating that these subjects would actually be exercising. The researcher made note of which color slip the E subjects randomly selected. The color coding of the E slips in conjunction with the 20 slips labeled NE ensured random assigment of the 60 subjects to one of the final three conditions (see Figure 2).

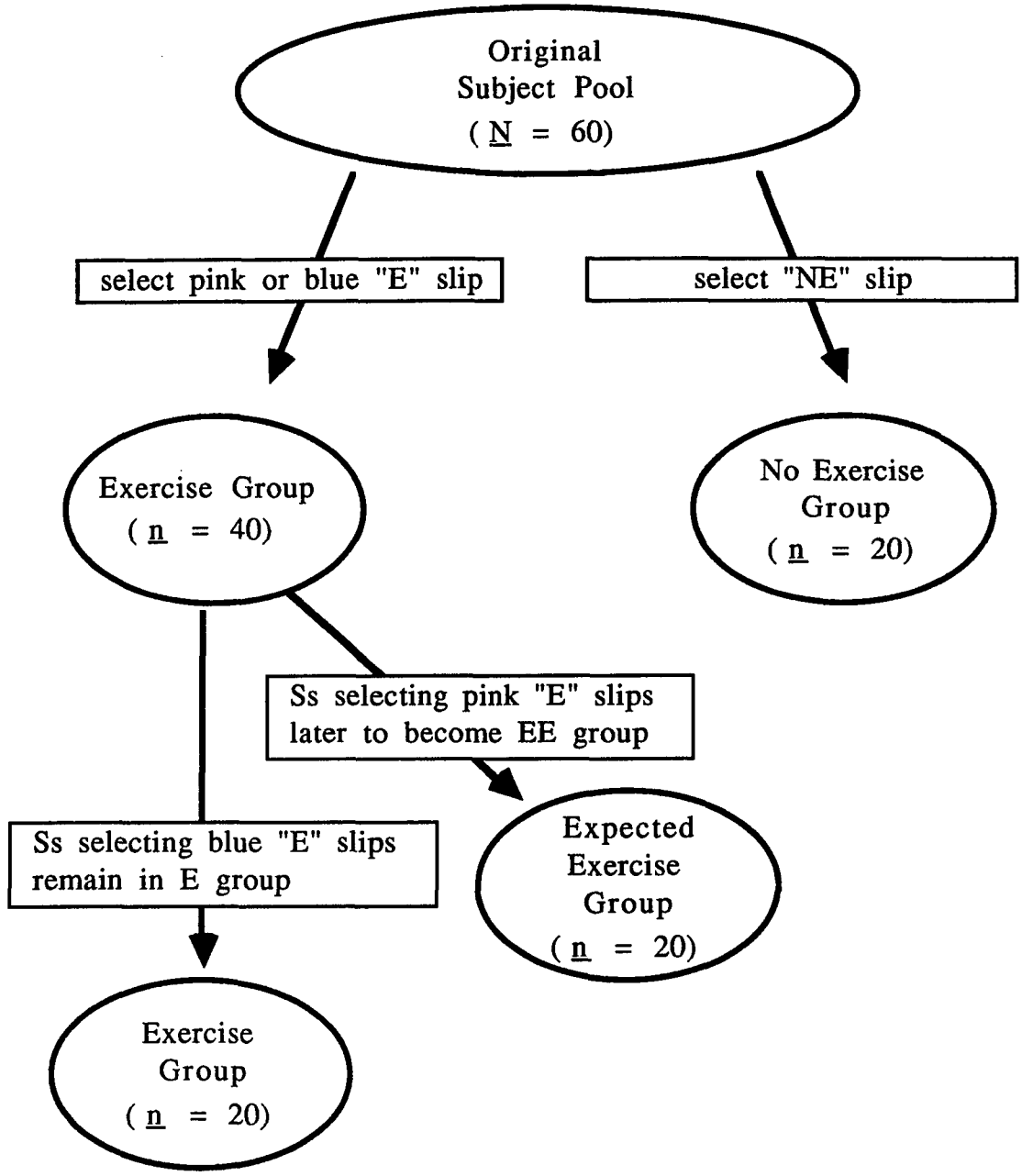

Figure 2 . Subject group assignment

After randomly selecting the exercise condition, affect and control measures were administered for the second time. These measures represented the "post-preload" administration. In addition, the subject was given the following instructions to read and completed the first in a series of three thought-listing administrations.

Directions for Thought-Listing

> We would like for you to list your current thoughts, relevant or not, to this project. For example, perhaps you are thinking that you do not feel like studying tonight . . . if this is a current thought, you might write, "I do not feel like studying tonight." Or, maybe you are having thoughts about this project, if so, you might jot down something like this, "the milkshake was cold." The important thing is that you write down your genuine thoughts, please do not just make thoughts up. Use as many boxes as you's like, if you only have two predominate thoughts, that's O.K., just use two boxes. If you have 12 thoughts, that's O.K. too, use all 12 boxes. All we ask is that you limit yourself to 12 thoughts. Please place only one thought in a box.

When the subject indicated that she had completed the affect/control and the thought-listing measures, the researcher returned to the room gave the subject the "sham" Taste Preference Rating Sheet so she could become familiar with the questions she would be answering during the taste test and instructed the subject to read the following "taste test directions" while the researcher left to prepare the taste test.

Taste Test Directions

In a few minutes you will begin the taste test. Please begin by tasting product A only. After you have consumed enough of product A to rate the product, answer questions 1-4 under column "A." Continue on by tasting product B. After you have consumed enough of product B to rate the product, answer questions 1-4 under column "B." Complete the taste test by tasting product C. After you have consumed enough of product C to rate the product, answer questions 1-4 under column "C."

It is very important that you completely rate one flavor before continuing to the next--this ensures that one flavor will not influence your taste rating of another flavor. After completing your ratings for product C, answer questions 5-7. At this point, when you have finished your taste ratings, do not go back and change your ratings.

Feel free to eat as much of the "leftovers" as you would like, obviously we will not be saving your "leftovers"--they will simply be thrown away. Please do not stack your bowls, leave them on the table and the assistant will return when you are finished to pick them up.

Remember, if you have been assigned to the exercise group you will have more than adequate "digestion time" before exercising.

The researcher returned with a spoon, a napkin and three bowls of ice cream, one bowl contained chocolate ("A"), one vanilla ("B"), and one strawberry ("C"). Each bowl of ice cream had been weighed on a Polder

(model #8025) Digital Recipe, Diet and Letter Scale and the pre-test weight of each bowl was recorded in grams. The bowls were placed on the table in front of the subject near corresponding index cards labeled A, B, C. The subject was reminded to taste the three flavors in the specified order and to taste as much of each flavor as necessary to ensure accurate taste ratings. The subject was also reminded that she could help herself to any remaining ice cream after completing her ratings, as "leftovers" would simply be disposed of, but she should not change any of her initial ratings. Finally, the investigator reminded the subject that a 30 minute "wait" period would preceed the exercise bout to assure that adequate digestion had occured resulting in a comfortable exercise bout. The digestion information was given to allow potential disinhibitory consumption that may have otherwise been confounded if subjects feared physical discomfort during exercise on a full stomach. In addition, the subject was reassured that stomach movement would be limited as stationary cycling was purposely chosen as the exercise mode because of the limited body movement it involved.

As discussed previously, immediately preceding the "taste test," each subject randomly selected her assigned exercise condition (i.e., E versus NE). The timing of this selection was an attempt to influence subsequent ice cream consumption during the taste test, as well as related affect, control, and cognition measures. In addition, to purposely increase the perception of the exercise activity as a highly effective calorie burner, the researcher told the subjects that the hand weight exercises would be performed simultaneously with stationary cycling and this had been found to be a highly effective calorie burning activity.

After 10 minutes had elapsed, the researcher returned, removed the bowls of ice cream, spoon, napkin and rating sheet and escorted the subject from the testing room to an adjacent video room where she was seated in a comfortable chair and viewed a 30-minute video, entitled "Sports Technology," that was unrelated to the study. As described previously, the video was included to allow perceived digestion time between the taste test and the subject's exercise condition.

While the subject viewed the video, the researcher weighed each of the three bowls of ice cream and recorded the post-weight in grams. The total grams consumed by each subject was determined by subtracting the final bowl weight from the initial bowl weight for each flavor, and then adding the three final bowl weights together. The total grams of ice cream consumed served as the dependent variable of interest for the primary analysis that addressed whether differences in ice cream consumption existed between groups based on their respective exercise conditions.

After viewing the 30 minute "wait" video, subjects were escorted from the video room back to the testing room. The actual exercisers (E; n=20) and the NE group were instructed that they would begin their respective conditions (cycling/weight training or quiet reading) in a few minutes, but were first asked to complete affect, control and thought-listing measures. Twenty of the 40 initial "exercise" subjects, who had been previously identified as the subjects who would become the EE group were informed that the exercise bicycle was malfunctioning and they would be unable to exercise. Instead, they would be asked to participate in the 20-minute quiet reading session, similar to the NE. To increase the subject's perception that the bicycle was not working properly, the tension belt had

been removed from the flywheel and a confederate was seated near the bicycle with a wrench in hand. The confederate acted as if he was trying to repair the bike. Upon entering the testing room, the confederate announced, "looks like we need to tighten the tension belt again, it'll be a least a few hours before I can get to it." The newly formed EE group were also asked to complete affect, control and thought-listing measures at this time. At this point, the final three exercise groups existed; E, NE, and EE, each consisting of 20 subjects. The measures that had been collected at this time represented the "post three-condition assignment."

After completing the post three-condition measures, the EE and NE subjects were seated in a reclining chair and were asked to read quietly for 20 minutes. Reading material that was unrelated to the investigation (i.e.,"Readers' Digest") was supplied to subjects. The E group was informed as to the organization of their upcoming exercise sesson and the investigator adjusted the seat height of the bicycle for each subject. Exercise heart rate ranges had been pre-determined for the 20 E subjects. The exercise session entailed a 20 minute ride on a Monarch ergometer at a workload that represented 80% of the subject's age-predicted maximum heart rate (HRmax). A 70-85% heart rate range had been determined to monitor the physiological state of the exercisers during the warm-up, work-out and cool-down, controlling for exercise intensity and ensuring exerciser safety. The subject was also shown the proper form for the hand weight exercises and was instructed as to the workout circuit she would be simultaneously performing while cycling (i.e., two sets of five repetitions of shoulder presses followed by five repetitions of biceps curls, followed by five repetitions of triceps extensions). To begin the exercise session,

each subject performed a bicycle warm-up which consisted of cycling at an intensity that represented 70-75% HRmax for five minutes. The purpose of this warm-up was to adequately prepare the body for more intense activity and to monitor the subject's heart rate as the workload was slowly increased until a final workload was reached at which the subject reached 80% HRmax. After the five minute warm-up, subjects maintained the final workload for another two minutes and then were led through two sets of the hand weight exercises (time=three minutes) as they simultaneously cycled. At this point subjects had been exercising for a total of ten minutes (warm-up=five minutes, workout=five minutes). Heart rate was measured at this point to ensure that the additional exercise had not led subjects to exceed 85% HRmax. If subjects exceeded 85% HRmax, the exercise workload was slightly decreased. After completing their first hand weight circuit, subjects continued to cycle another two minutes, followed once again by two sets of hand weight exercises (time=three minutes). After this second circuit, heart rate was once again assessed. At this point subjects had been exercising for a total of 15 minutes (warm-up=five minutes, workout=10 minutes). A final 5 minute cool-down at 70% HRmax was included that was similar to the inital warm-up, resulting in a 20 minute exercise session. The purpose of the cool-down was to allow the body to recover from the more intense activity it had previously performed. Subject's heart rates were monitored at the end of the cool-down to ensure adequate recovery had taken place. Following all conditions, final affect, control and thought listing measures were administered. This administration represented the "post-session" administration.

Before the subjects left the laboratory, body weight was measured to ensure that significant weight changes have not occurred since the initial screening. In addition, the investigator recorded whether or not subjects were currently menstruating. All subjects were reminded that they were to abstain from exercise for the next 24 hours and were given a Post-Session Activity and Food Log to log their activity and food intake for the next 24 hours. They were instructed to return the Post-Session Activity and Food Log to the investigator within 24 to 48 hours at which time they would be asked to complete the Post-Session Questionnaire. Figure 3 diagramatically illustrates the experimental design as described above.

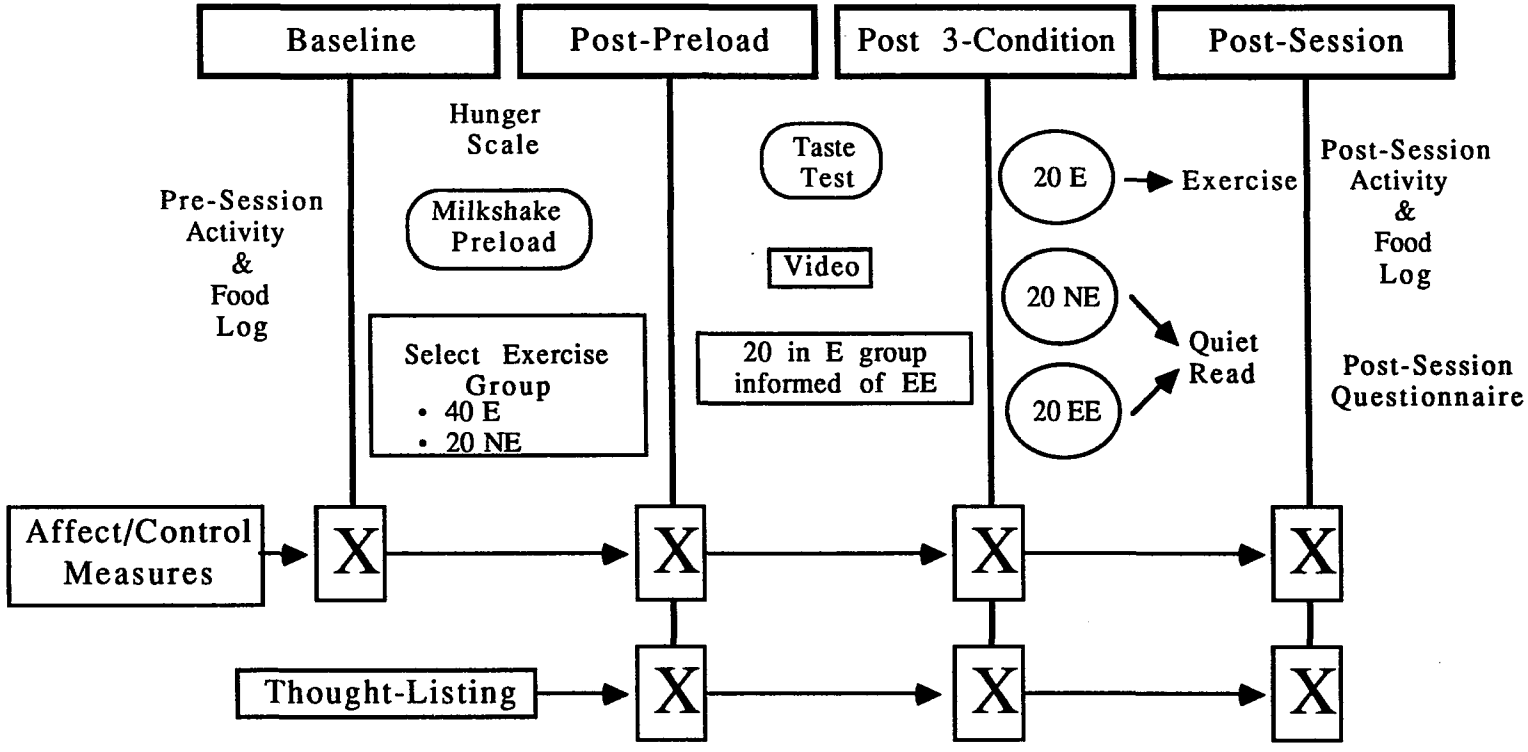

Figure 3. Experimental Design

Finally, subjects were generally debriefed regarding the purpose of the study and were informed that the results of the investigation would be sent directly to them when the investigator completed the research project.

Statistical Design/Analysis

Primary Analysis : A one-way analysis of variance (ANOVA) comparing exercise groups (E, NE, EE) on total grams of ice cream consumed represented the analysis of primary interest. The dependent variable of total grams of ice cream consumed was compared to determine if significant differences existed between the three exercise groups.

Secondary Analysis : A 3 x 4 Group (E, NE, and EE) by Time (Baseline, Post-Preload, Post Three-Condition Assignment, Post-Session) repeated measures multivariate analysis of variance (MANOVA) represented the analysis of secondary interest. The multivariate statistical application performed on the dependent measures of somatic anxiety, cognitive anxiety, depression, and control allowed for the determination of group and time differences. Planned univariate contrasts were employed to ascertain the exact nature of significant differences. Descriptive information regarding the frequency of thoughts specific to each theme (affect, food, exercise, control) was also of interest and was tabulated for both time and group.

CHAPTER III

RESULTS

The main analysis of this study was a one-way analysis of variance (ANOVA) comparing exercise groups (E, NE, and EE) on total grams of ice cream consumed. In addition, temporal changes in measures of affect (somatic anxiety, cognitive anxiety, depression) and control were analyzed using a 3 x 4 Group (E, NE, and EE) by Time (Baseline, Post-Preload, Post Three-Condition Assignment, and Post-Session) repeated measures MANOVA with planned univariate contrasts. Finally, specific affect, control, food and exercise cognitions were categorized and analyzed descriptively for both time and group.

Descriptive Profile of Subjects

Means and standard deviations of descriptive measures pertinent to the dietary and exercise manipulations performed in this study are presented for all subjects in Table 1. ANOVA results showed no significant differences among groups for any of the descriptive variables, indicating that the E, NE and EE groups were composed of subjects with similar characteristics. The mean age of all participants was 21.5 years old, indicating that the women were of average college age. All of the exercise groups had a mean height of 5 feet 4.43 inches, therefore they represented women of average height.

Descriptive analysis of the exercise behaviors of the groups revealed that all groups exercised between 3-4 days a week for 44 to 61 minutes

per session and had been participating in a committed exercise program for 20 to 28 months.

Assessment of pre-existing anorexia nervosa and bulimia symptoms showed no group differences on the Drive for Thinness (DT) or Bulimia (BUL) subscales. The NE group had a mean DT score of 10.00, whereas the E and EE averaged 8.90 and 6.60 respectively. The same pattern emerged for the BUL scores, as the NE group scored the highest (1.55), followed by the E (1.45) and EE (.65) groups.

Finally, descriptive data for Restraint (R) and Commitment to Physical Activity (CPA) measures were also analyzed for the final three groups. Dietary restraint scores for the three groups were closely related, with means ranging from 18.5 to 20.00. Mean scores on the CPA, however, were somewhat higher than the screening cut-off score of 36. The E group had a mean score of 48, followed by the NE and EE groups who averaged 45 and 44, respectively.

Table 1

Group Means, Standard Deviations, and F-ratios for Descriptive Measures Pertinent to Eating and Exercise Manipulations

	EXERCISE		NO EXERCISE		EXPECTED EXERCISE		
	M	SD	M	SD	M	SD	F
Age (yrs)	21.05	2.81	21.45	.36	22.25	5.23	.30
Height (in.)	64.65	2.30	64.40	2.90	64.25	2.07	1.36
Weight (lbs)	145.40	24.89	135.65	19.05	139.00	16.29	1.18
Ex. Freq.[a]	4.00	2.75	3.95	3.39	3.30	2.40	.36
Ex. Dur. [b]	61.65	35.64	46.30	29.59	44.42	24.18	1.97
Ex. History[c]	21.66	24.47	20.30	18.06	28.22	32.85	.50
DT	8.90	6.71	10.00	5.01	6.60	6.06	1.68
BUL	1.45	2.28	1.55	2.48	.65	1.18	.14
R	20.00	3.64	19.90	2.98	18.50	1.93	1.62
CPA	48.30	7.19	45.35	5.07	44.15	4.66	2.75

[a] Ex. Freq. = Exercise frequency (days/week)
[b] Ex. Dur. = Exercise duration (minutes/session)
[c] Ex. History = Exercise history(months)

Adherence to Pre-Test Guidelines

To verify that groups did not differ in adherence to pre-test guidelines, chi-square analyses were performed on dichotomous (yes/no) responses to questions directly addressing the guidelines. According to self-report, groups did not differ on the "normalcy" of either their 24 hour pre-test daily activities, $x^2(2) = .61$, $p = .73$, or their 24 hour pre-test eating, $x^2(2) = 2.13$, $p = .34$. Specifically, all groups reported that their daily activity and eating were normal throughout the 24 hours preceeding their laboratory appointment. Frequency data specific to these questions are located in Table 2. In both the E and EE groups, 13 of 20 indicated normal activity, whereas slightly more women in the NE group (15 of 20) reported normal activity. Interestingly, of all the women in the E and EE groups who indicated that their pre-test activity was not normal, reported that it was less than normal in a follow-up question. Similarly, the majority of the NE subjects who reported that their pre-test activity was not normal, reported that it was less than normal in the follow-up question (4 of 5), as only one NE subject indicated greater than normal activity.

In regards to pre-test eating, about the same number of NE and EE subjects, 16 of 20 and 15 of 20, respectively, reported normal eating, whereas only 12 of 20 in the E group reported normal pre-test eating. Equal numbers of NE and EE women (3 of 4) indicated in the follow-up question that their eating was greater than normal, whereas only one subject in each of these conditions stated that her eating was less than normal. Interestingly, however, the majority of the E subjects who responded to the follow-up question (5 of 6) indicated that their eating was less than normal with only one E woman stating her eating as greater

than normal. Finally, groups did not differ in their compliance to the pre-test guideline to eat within two hours of their scheduled laboratory appointment, $x^2(2) = 3.15$, $p = 20$.

These results suggest exercise groups did not evidence modifications in their pre-session eating and activity behaviors in ways that might have directly influenced the experimental manipulations. In addition, because the groups did not differ in their compliance to the two-hour pre-test eating requirement, between group physiological hunger differences were minimized.

Table 2

Group Frequency Count of Adherence to Pre-test Guidelines

	EXERCISE		NO EXERCISE		EXPECTED EXERCISE	
	Yes	No	Yes	No	Yes	No
Have you eaten within the last 2 hours ?	17	3	14	6	12	8
Was your activity in the last 24 hours normal ?	13	7	15	5	13	7
If "No," greater than (gt) or less than (lt)?	gt=0/lt=6*		gt=1/lt=4		gt=0/lt=6*	
Was your eating in the last 24 hours normal ?	12	8	16	4	15	5
If "No," greater than (gt) or less than (lt)?	gt=1/lt=5*		gt=3/lt=1		gt=3/lt=1*	

*Missing data, therefore, does not total to corresponding "No" response.

Adherence to the pre-test eating guidelines was additionally checked by a one-way ANOVA of subjects' responses to the baseline analog (0-100) hunger scale. No significant group differences were found at baseline on self-reported hunger level, $F(2,57) = .07$, $p = 92$; desire to eat, $F(2.57)=.06$, $p=.93$; or level of fullness, $F(2,57) = 1.35$, $p = .26$. Means and standard deviations for the hunger analog responses by group are located in Table 3. As Table 3 shows, the groups were similar in their estimation of their baseline hunger level with the groups reporting their "present hunger" to be low at approximately 23 to 26 on the 0-100 analog Hunger Scale. Additionally groups were similar in their estimation of their baseline "desire to eat" with the groups reporting a low desire to eat (23 to 25). Groups also indicated that they were relatively "full" at baseline, estimating between 49 and 61 on the 0-100 analog Hunger Scale. Taken together, the Hunger Scale responses supported no group differences in baseline hunger between groups. Therefore, physiological hunger differences did not exist between groups at baseline.

Table 3

Group Means, Standard Deviations, and F-ratios for Hunger Analog Responses

	EXERCISE		NO EXERCISE		EXPECTED EXERCISE		
	M	SD	M	SD	M	SD	F
How hungry are you at the present time ?	24.85	19.89	23.75	15.20	26.05	20.68	.07
How strong is your desire to eat something at the present time ?	23.25	21.04	25.60	19.99	24.30	19.01	.06
How full are you at the present time ?	61.00	25.13	51.60	20.30	49.75	23.70	1.35

Total Ice Cream Consumption by Exercise Group

A one-way ANOVA was performed to determine if group differences existed for total grams of ice cream consumed during the taste test. The total grams of chocolate, vanilla and strawberry that were consumed were added together to determine total grams of ice cream consumed per subject. No significant differences were found among groups for total grams of ice cream consumed, $F(2,57) = .40$, $p = .66$. A trend emerged, however, as both the E and EE groups consumed more ice cream than the NE group.

Because groups may have preferred different flavors, a 3 X 3 (Flavor by Group) ANOVA was conducted to determine if group differences existed in total grams consumed based on ice cream flavor. Results indicated no Group by Flavor interaction, $F(4,114) = 1.15$, $p = .33$. A Flavor main effect emerged, however, $F(2,114) = 5.31$, $p < .01$, as chocolate was the preferred flavor across groups. Specific to the chocolate flavor, once again the trend for the E and EE groups to eat more than the NE group was evidenced. Means and standard deviation values for ice cream consumption are located in Table 4. Although a Flavor main effect emerged, analysis of ice cream consumption by individual flavors did not evidence a Group by Flavor interaction that may have displayed selective dietary disinhibition by group relative to specific ice cream flavors.

Table 4

Group Means, Standard Deviations, and F-ratios for Ice Cream Consumption

	EXERCISE		NO EXERCISE		EXPECTED EXERCISE	
	M	SD	M	SD	M	SD
Chocolate (gms)	30.80	25.57	24.20	21.74	27.35	15.85
Vanilla (gms)	19.60	20.70	19.85	20.15	28.60	20.17
Strawberry (gms)	18.20	15.99	18.75	15.63	19.65	12.90
Total Gms Ice Cream Consumed (C+V+S)	68.60	53.63	62.80	40.52	75.60	39.74

Furthermore, one of the "sham" taste test questions asked subjects to rate the overall flavor ("tastiness") of each ice cream flavor. A 3 X 3 (Flavor by Group) ANOVA was conducted to determine if group differences existed in flavor ratings given to each ice cream flavor. Results indicated no Group main effect, $F(2,57) = .13$, $p = .87$, and no Flavor by Group interaction, $F(4,114) = 1.17$, $p = .15$. A Flavor main effect emerged, however, $F(2,114) = 5.31$, $p < .01$, with chocolate receiving the highest flavor rating. Therefore, as would be expected, subjects consumed the most of the flavor they found to be "tastiest." Means and standard deviation values for ice cream flavor ratings are located in Table 5. Overall, chocolate had the most favorable flavor rating ($M = 2.16$) followed by vanilla ($M = 2.36$), while strawberry had the least favorable flavor rating ($M = 2.71$).

Table 5

Group Means, Standard Deviations, and F-ratios for Ice Cream Flavor Ratings

	EXERCISE		NO EXERCISE		EXPECTED EXERCISE	
	M	SD	M	SD	M	SD
Chocolate Rating	1.90	1.07	2.25	.91	2.35	1.08
Vanilla Rating	2.35	.93	2.60	1.18	2.15	.81
Strawberry Rating	2.80	1.15	2.45	.94	2.85	.81

Note. Lower score indicates more favorable flavor rating.

Temporal Changes in Anxiety, Depression and Control

Affect measures of somatic anxiety, cognitive anxiety and depression, as well as a control measure, were taken four times throughout the experimental session; baseline (B), post-preload (PP), post three-condition assignment (P3C) and post-session (PS). Means and standard deviations for the affect and control measures are presented in Table 6.

Table 6

Group Means and Standard Deviations for Affect and Control Measures Over Time

	B		PP		P3C		PS	
	M	SD	M	SD	M	SD	M	SD
Somatic Anxiey								
E	4.84	1.25	4.78	1.08	4.42	.69	4.36	.95
NE	6.00	2.20	4.90	1.58	4.30	.92	4.20	.69
EE	4.89	1.10	4.57	.76	4.36	.95	4.15	.68
Cognitive Anxiety								
E	6.73	2.99	6.21	2.04	5.89	1.59	5.47	1.12
NE	7.00	1.83	5.90	1.07	5.20	.52	5.30	.80
EE	6.36	1.38	5.89	1.24	5.47	.96	5.36	.76
Depression								
E	1.15	.68	1.10	.56	1.00	.33	1.15	.76
NE	1.50	1.10	1.45	.88	1.20	.41	1.15	.36
EE	1.21	.63	1.15	.50	1.10	.45	1.05	.52
Control								
E	3.78	1.13	3.78	1.31	3.84	1.21	4.05	1.17
NE	3.70	1.03	3.75	.96	4.00	1.07	3.70	1.34
EE	3.42	1.42	3.52	1.46	3.36	1.38	3.47	1.42

Group X Time (3 X 4) multivariate procedures for repeated measures ANOVAs were conducted to examine whether temporal and exercise groups differed on the measures of affect and control. The first item on the WES-r was eliminated from the somatic anxiety score in final analyses, as exercise participation, rather than anxiety, appeared to be responsible for the elevated heart rate responses at PS in the E group.

Results revealed no significant Group main effects or Group by Time interactions. Significant Time main effects did exist for somatic anxiety, $F(3,53) = 7.36$, $p < .01$; and cognitive anxiety, $F(3,53) = 8.70$, $p < .01$. Helmert planned contrasts were used to examine the exact time intervals that resulted in significant cognitive and somatic anxiety differences. These contrasts showed that somatic anxiety at P3C was significantly different from PP, $F(1,55) = 11.09$, $p < .01$. As Figure 4 shows, somatic anxiety decreased continually over time, with the P3C level lower than PP. Planned contrasts applied to cognitive anxiety revealed that PP levels were significantly different from B, $F(1,55) = 17.49$, $p < .01$, and the P3C level was significantly different from the PP level, $F(1,55) = 10.92$, $p < .01$. Figure 4 also shows, cognitive anxiety, like somatic anxiety, decreased continually over time, with the PP level lower than B and the P3C level lower than PP.

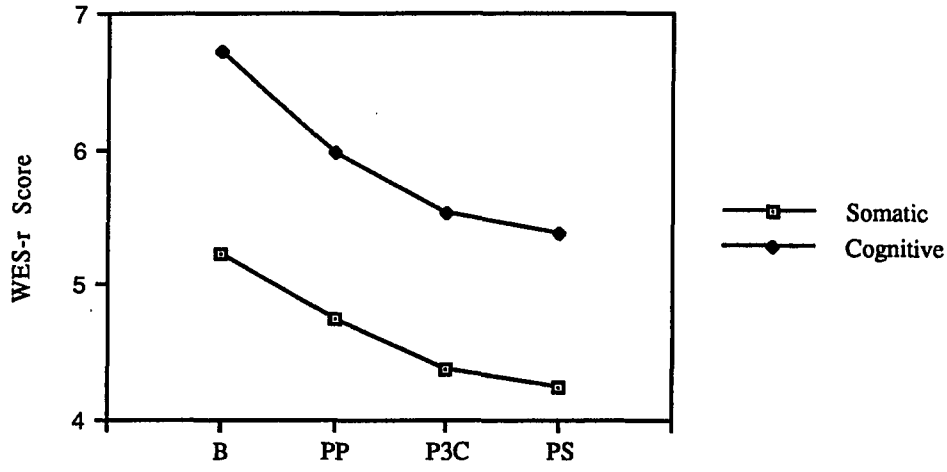

Figure 4. Overall Group Time Effect for Somatic and Cognitive Anxiety

Adherence to Post-Test Guidelines

To verify that groups did not differ in adherence to post-test guidelines, chi-square analyses were performed on dichotomous (yes/no) responses to questions directly addressing the guidelines. Frequency data specific to these questions are located in Table 7. According to self-report, groups differed on the "normalcy" of their 24 hour post-test daily activities, $x^2(2) = 6.11$, $p < .05$. As Table 7 shows, in both E and EE, 13 of 16 indicated normal activity, but in the NE group responses were about equally divided between "yes" (8) and "no" (9). Responses to the follow-up question revealed that all of the E and EE who said "no" also indicated less than normal activity, but in the NE group, responses were split with four women indicating greater and three indicating less than normal activity. The groups did not differ on their 24 hour post-test eating, $x^2(2) = 4.91$, $p = .08$. The majority of the subjects indicated that their post-test eating was normal. However, for those who indicated that it was not normal, responses were about equally divided between "greater than" and "less than" for each group. Four of the 6 subjects in the E group who indicated their eating was not normal responded to the follow-up question. Two of these subjects stated their eating was less than normal and two indicated greater than normal. Similarly, two of the three subjects in the NE group who indicated their eating was not normal responded to the follow-up question. One of these subjects stated her eating was less than normal and one indicated greater than normal. Only one EE subject indicated her post-test eating was not normal, and in response to the follow-up question she indicated she ate more than normal.

These results suggest exercise groups did evidence modifications in

their post-session behaviors in ways that might have been directly influenced by the experimental manipulations. Specifically, post-test activity differed among groups. Although the post-test activity guideline was primarily included to influence affect and cognition within the experimental session, it is not surprising that post-test activity could have been affected by the experimental manipulation. For example, women who were unable to exercise during the laboratory session, may have increased their activity after the session, regardless of the guideline.

Table 7

Group Frequency Count of Adherence to Post-test Guidelines

	EXERCISE		NO EXERCISE		EXPECTED EXERCISE	
	Yes	No	Yes	No	Yes	No
Was your activity in the last 24 hours normal ?	13	3	8	9	13	3
If "No," greater than (gt) or less than (lt)?	gt=0/lt=2*		gt=4/lt=3*		gt=0/lt=3	
Was your eating in the last 24 hours normal ?	11	6	13	3	17	1
If "No," greater than (gt) or less than (lt)?	gt=2/lt=2*		gt=1/lt=1*		gt=1/lt=0	

* Missing data, therefore, does not total to corresponding "No" response.

Thematic Coding of Thoughts

Frequency data were tabulated for thought content themes that a priori were deemed pertinent to the investigation. Thoughts were coded for the four themes of affect, food, exercise and control, therefore, some thoughts could receive as many as four codes. The inter-rater reliability for thematic coding, as coded by two independent raters, exceeded 98% (see Appendix J).

Frequency data will first be presented that reflects the emergence of the four independent themes across all subjects and by individual exercise groups. To follow, temporal changes in the frequency of thoughts across the three thought-listing administrations will be discussed. Finally, pertinent cross-themes within individual thoughts (i.e., affect/food, affect/exercise, affect/control, control/food, control/exercise, and food/exercise) will be discussed as related to exercise group and time.

Thematic Frequency of Independent Themes

Thematic frequency specific to the emergence of affect, control, food, and exercise thoughts by group at PP, P3C, and PS are located in Tables 8, 9, and 10. Many of the thoughts listed by subjects represented simple statements, void of affect, and therefore were coded as "none" under the affect theme. The calculated positive, negative and miscellaneous affect percentages, therefore, are relative to the total number of thoughts at each administration that contained an affective component. The affect content of the thoughts were classified as either positive or negative based on Tomkins' (1962) classification of affects. The negative affects included anguish, fear, shame, disgust and rage. Guilt was added as an additional

negative affect. According to Izard and Buechler (1980), guilt refers to a sense of being accountable for violating internal standards (p. 168). Therefore, it is highly likely that feelings of guilt may result from violating one's own eating and exercising standards, which may, in turn, be related to negative feelings such as shame, disgust, anguish and rage. The positive affects included surprise, joy, and interest. Codes for the miscellaneous items of relief and confusion were added, as pilot data suggested that subjects experienced these states as well. The state of confusion could have represented positive feedback regarding the experimental methodology, as reports of confusion may have supported subjects' inability to determine the true intent of the investigation. Similarly, the state of relief was added, as pilot data showed that thoughts often contained this component, particularly following key experimental procedures (i.e., choosing initial exercise groups, P3C, PS).

For thoughts coded as containing control, food and exercise themes, the calculated thematic percentages are relative to the total number of thoughts at each administration.

Table 8 presents a thematic frequency count at PP for all three exercise groups, which represented the first administration of the thought-listing measure. As a whole, subjects listed a total of 376 thoughts, averaging 6.26 thoughts per subject. Of these 376 thoughts, 278 were classifed as containing no affect, therefore, the calculated affect percentages are based on the 98 thoughts that contained an affective component. According to Tomkins' (1962) classification of affects, all groups evidenced more negative affects compared to positive affects. The negative affects of anguish, fear, shame, disgust, rage, and guilt represented 57.1% (56/98) of

the thoughts that could be classifed as containing affective content, compared to 34.7% (34/98) of the thoughts that could be classified as containing the positive affects of surprise, joy and interest. The miscellaneous items of relief (7/98) and confusion (1/98) represented the remaining 8.2% of the affect theme. As a group, the subjects thoughts also contained 9.0% control themes (34/376), 20.7% food themes (78/376), and 9.8% exercise themes (37/376).

Independently, the E group reported 55.6% negative affects (20/36), 38.9% positive affects (14/36), and 5.6% of the miscellaneous affects (2/36), accounting for an overall 28.3% of the total thoughts containing an affect theme (36/127). Control themes accounted for 13.4% (17/127) of the E group's total thoughts. Food and exercise themes, respectively, represented 28.3% (36/127) and 7.1% (9/127) of the E group's total thoughts.

The NE group was quite similar to the E group, reporting 57.1% negative affects (20/35), 34.3% positive affects (12/35), and 8.6% of the miscellaneous affects (3/35), for an overall 28.5% of total thoughts containing an affect theme (35/123). Control themes represented 8.1% (10/123) of the NE group's total thoughts. The NE group's food and exercise themes accounted for 15.4% (19/123) and 8.1% (10/123), respectively.

Finally, the EE group displayed 59.3% negative affects (16/27), 29.6% positive affects (8/27), and 11.1% of the miscellaneous affects (3/27), accounting for an overall 21.4% of the total thoughts containing an affect

theme (27/126). A control theme emerged 5.6% (7/126) of the time, whereas a food theme surfaced 18.3% (23/126), and an exercise theme accounted for 14.3% (18/126) of the affect theme.

Table 8

Group Thematic Frequency Count at Post-Preload

	EXERCISE	NO EXERCISE	EXPECTED EXERCISE	
	# Thoughts	# Thoughts	# Thoughts	Total
Negative Affect				
Anguish	10	11	12	33
Fear	3	3	1	7
Shame	4	1	1	6
Disgust	1	5	1	7
Rage	0	0	1	1
Guilt	2	0	0	2
Positive Affect				
Surprise	0	1	0	1
Joy	1	3	2	6
Interest	13	8	6	27
Miscellaneous Affect				
Relief	2	2	3	7
Confusion	0	1	0	1
Control	17	10	7	34
Food	36	19	23	78
Exercise	9	10	18	37

Table 9 presents a thematic frequency count at P3C for all three exercise groups, which represented the second administration of the thought-listing measure. As a whole, subjects listed a total of 272 thoughts, averaging 4.53 thoughts per subject. Of these 272 thoughts, 197 were classifed as containing no affect, therefore, the calculated affect percentages are based on the 75 thoughts that contained an affective component. Only the E group evidenced more negative affects compared to positive affects. The NE and EE groups both reported more positive affects compared to negative affects. For the entire subject pool, however, the negative affects of anguish, fear, shame, disgust, rage, and guilt represented 37.3% (28/75) of the thoughts that could be classifed as containing affective content, compared to 41.3% (31/75) of the thoughts that could be classified as containing the positive affects of surprise, joy and interest. The miscellaneous items of relief (12/75) and confusion (4/75) represented the remaining 21.3% of the affect theme. As a group, the subjects thoughts also contained 5.5% control themes (15/272), 13.6% food themes (37/272), and 9.2% exercise themes (25/272) at P3C.

As an independent group, the E group reported 46.7% negative affects (14/30), 36.7% positive affects (11/30), and 16.7% of the miscellaneous affects (5/30), accounting for an overall 29.7% of the total thoughts containing an affect theme (30/101). Control themes accounted for 6.9% (7/101), whereas food and exercise themes represented 18.8% (19/101) and 10.9% (11/101), respectively.

The NE group reported fewer negative affects (31.3%; 5/16), relative to the positive affects (56.3%; 9/16). The miscellaneous affects represented the remaining 12.5% (2/16). Overall, 19.8% of the NE group's total

thoughts contained affect themes (16/81). For this group, control themes represented 1.2% (1/81), whereas food and exercise themes accounted for 8.6% (7/81) and 3.7% (8/81) of total thoughts, respectively.

Finally, the EE group also displayed fewer negative affects (31.0%; 9/29) compared to positive affects (37.9%; 11/29). Miscellaneous affects (9/29) accounted for the additional 31.0%, resulting in an overall 32.2% of the total thoughts containing an affect theme (29/90). For the EE group, a control theme emerged 7.8% (7/90) of the time, whereas food and exercise themes equally surfaced 12.2% (11/90) of the time.

Table 9

Group Thematic Frequency Count at Post Three-Condition

	EXERCISE	NO EXERCISE	EXPECTED EXERCISE	
	# Thoughts	# Thoughts	# Thoughts	Total
Negative Affect				
Anguish	7	1	5	13
Fear	2	2	1	5
Shame	4	0	0	4
Disgust	1	2	0	3
Rage	0	0	0	0
Guilt	0	0	3	3
Positive Affect				
Surprise	0	0	1	1
Joy	4	1	0	5
Interest	7	8	10	25
Miscellaneous Affect				
Relief	4	1	7	12
Confusion	1	1	2	3
Control	7	1	7	15
Food	19	7	11	37
Exercise	11	3	11	25

Table 10 presents a thematic frequency count at PS, which represented the third and final administration of the thought-listing measure. Taken together, subjects listed a total of 243 thoughts, averaging 4.05 thoughts per subject. Of these 243 thoughts, 180 were classifed as containing no affect, therefore the calculated affect percentages are based on the 63 thoughts that contained an affective component. Only the EE group evidenced more negative affects compared to positive affects. The E and NE groups both reported more positive affects compared to negative affects. For the entire subject pool, however, the negative affects of anguish, fear, shame, disgust, rage, and guilt and the positive affects of surprise, joy and interest equally represented 36.5% (23/63) of the thoughts that could be classifed as containing affective content. The miscellaneous items of relief (16/63) and confusion (1/63) represented the remaining 27.0% of the affect theme. As a group, the subjects thoughts also contained 8.2% control themes (20/243), 11.5% food themes (28/243), and 16.9% exercise themes (41/243).

Independently, the E group reported 38.2% negative affects (13/34), 41.2% positive affects (14/34), and 20.6% of the miscellaneous affects (7/34), accounting for an overall 34.0% of the total thoughts containing an affect theme (34/100). Control themes accounted for 7.0% (7/100), whereas food and exercise themes represented 11.0% (11/100) and 36.0% (36/100), respectively.

The NE group also reported fewer negative affects (30.8%; 4/13), relative to positive affects (61.5%; 8/13). The miscellaneous affects represented the remaining 7.7% (1/13). Overall, 16.3% of the NE group's total thoughts contained affect themes (13/80). For this group, control

themes represented 10.0% (8/80), whereas food and exercise themes equally accounted for 6.25% (5/80).

Lastly, the EE group displayed greater negative affects (37.50%; 6/16) compared to positive affects (6.25%; 1/16). The miscellaneous affects of confusion and relief (9/16) accounted for the majority of affect themes (56.3%; 9/16), resulting in an overall 25.4% of the total thoughts containing an affect theme (16/63). For the EE group, a control theme emerged 7.9% (5/63) of the time, whereas the food theme equally surfaced 19.0% (12/63) of the time, and the exercise theme was not represented at all (0/63).

Table 10

Group Thematic Frequency Count at Post-Session

	EXERCISE	NO EXERCISE	EXPECTED EXERCISE	
	# Thoughts	# Thoughts	# Thoughts	Total
Negative Affect				
Anguish	4	2	2	8
Fear	0	0	0	0
Shame	7	2	4	13
Disgust	1	0	0	1
Rage	0	0	0	0
Guilt	1	0	0	1
Positive Affect				
Surprise	0	0	0	0
Joy	8	1	0	9
Interest	6	7	1	14
Miscellaneous Affect				
Relief	7	1	8	16
Confusion	0	0	1	1
Control	7	8	5	20
Food	11	5	12	28
Exercise	36	5	0	41

Temporal Changes in Thought Frequency

Changes in thought frequency across the three thought-listing administrations were also analyzed descriptively. Frequencies are graphed as percentages of total affect thoughts for the positive and negative affect themes and as percentages of total thoughts for control, food, and exercise themes.

Temporal Changes in Positive/Negative Affect Thought Frequency

As Figure 5 shows, as a group, the subjects decreased in negative affect over time and showed a slight increase and leveling off in positive affect. Independent inspection of group data (see Figures 6, 7, and 8) echoed this finding in the E and NE groups for negative affect and in the NE for positive affect. Differing patterns emerged over time, however, in negative affect for the EE group and in positive affect for the E and EE groups. Figure 8 illustrates that the EE group initially decreased in negative affect from PP to P3C and then showed a slight increase from P3C to PS. Figure 6 shows that the E group initially decreased in positive affect from PP to P3C, but then slightly increased from P3C to PS. Compared to the E group, the EE group presented an opposite response in positive affect, initially increasing from PP to P3C, but then decreasing from P3C to PS.

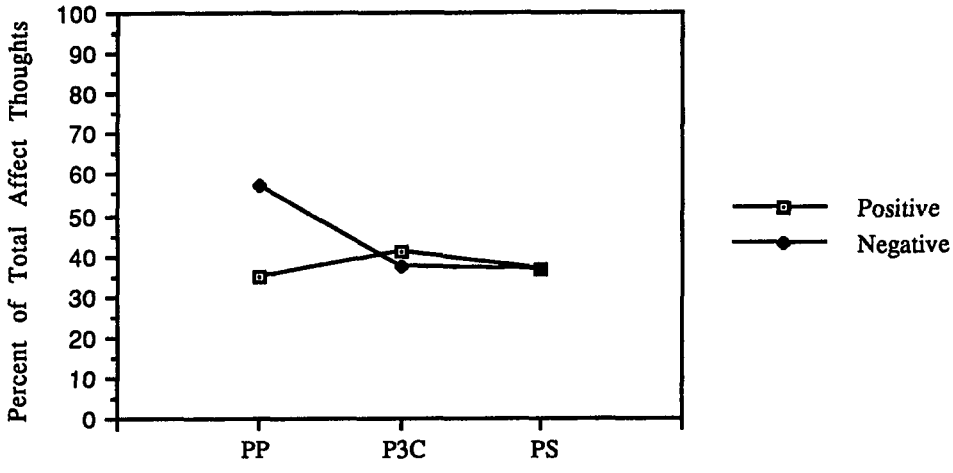

Figure 5. Overall Group Percent Affect Over Time

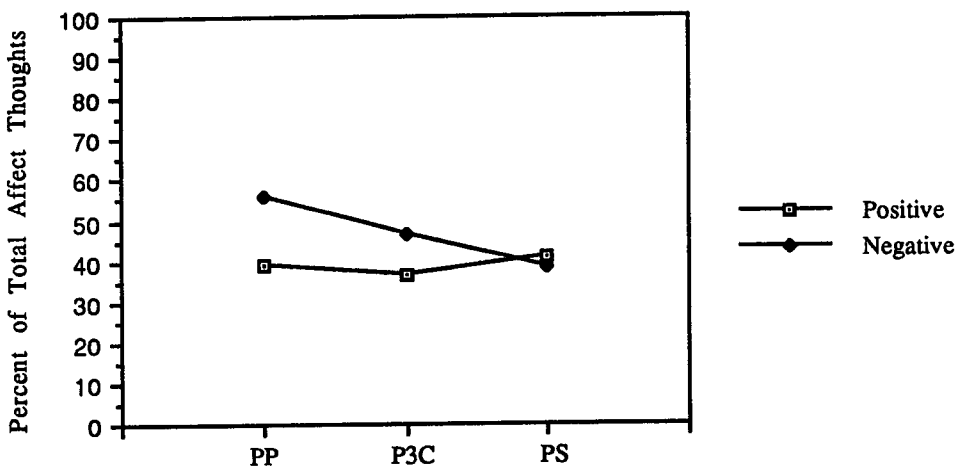

Figure 6. E Percent Affect Over Time

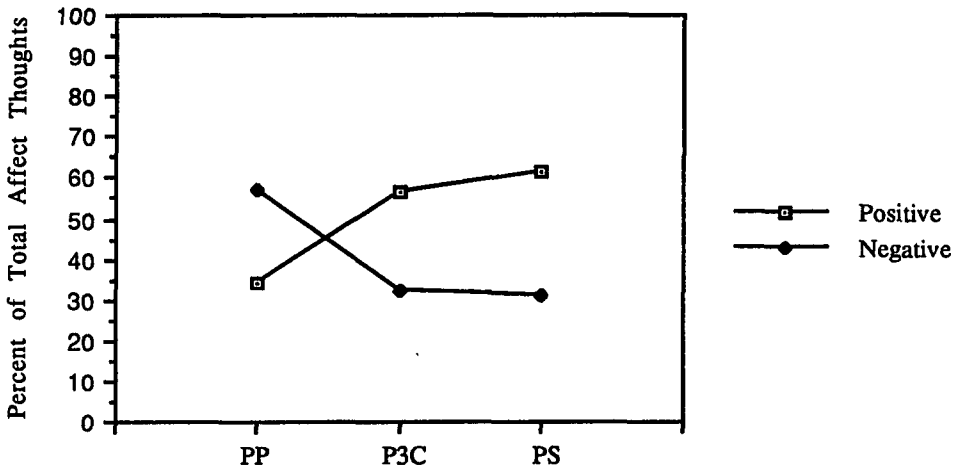

Figure 7. NE Percent Affect Over Time

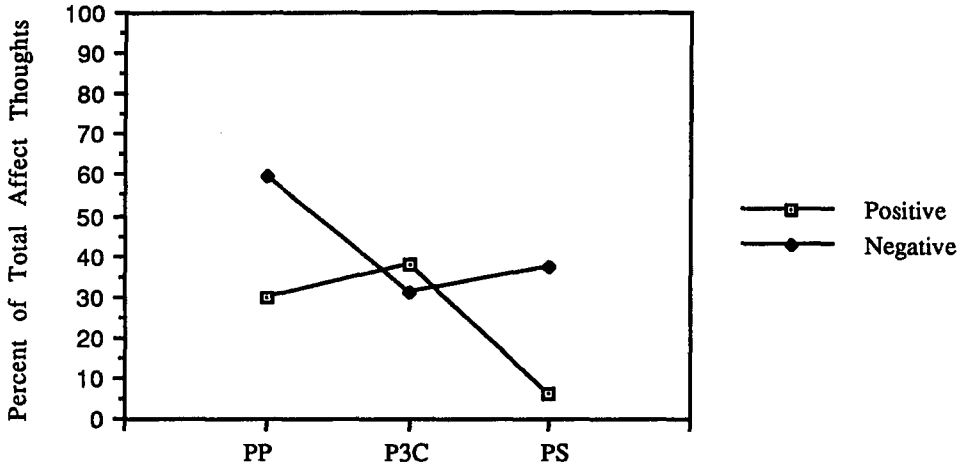

Figure 8. EE Percent Affect Over Time

Temporal Changes in Control Thought Frequency

The percentage of control thoughts initially decreased for the entire group as a whole from PP to P3C and then increased from P3C to PS (see Figure 9). Independently, however, only the E and NE groups shared this same temporal pattern (see Figure 10). The EE group responded differently, as their control thoughts slightly increased from PP to P3C and then remained the same to PS.

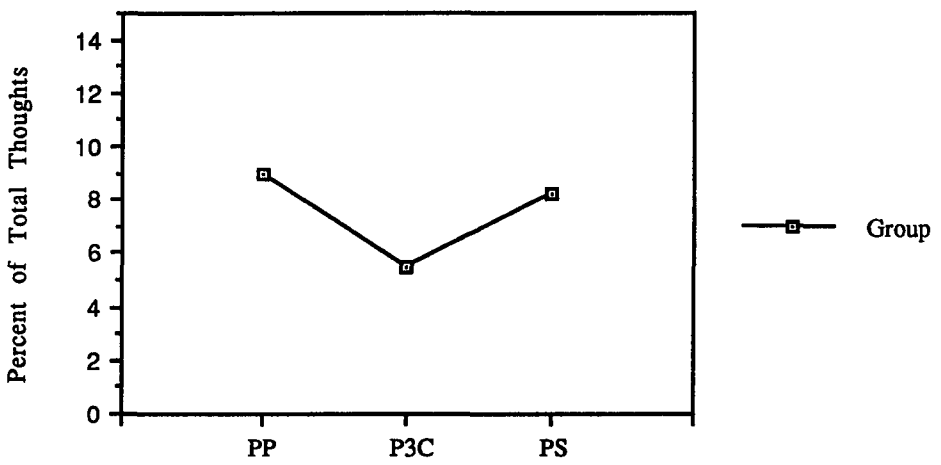

Figure 9. Overall Group Percent Control Over Time

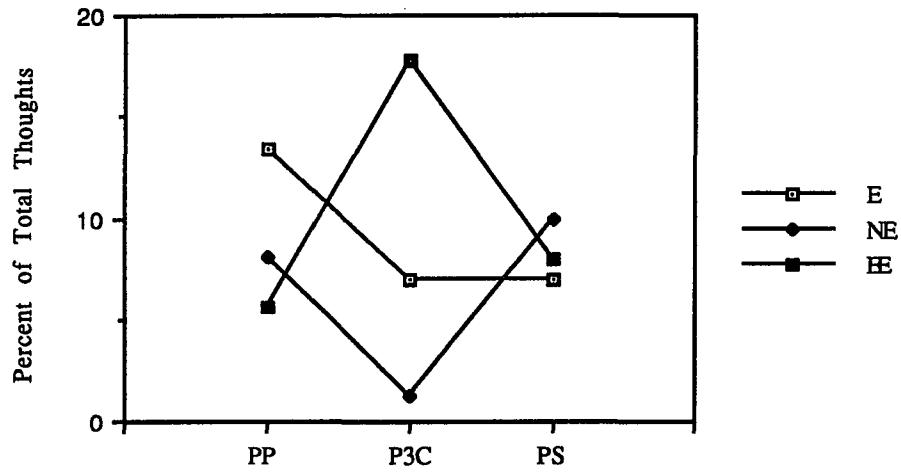

Figure 10. Percent Control Over Time by Group

Temporal Changes in Food/Exercise Thought Frequency

Finally, food thoughts decreased over time for the entire group, whereas the number of exercise thoughts slightly decreased from PP to P3C and then increased from P3C to PS (see Figure 11). As an independent group, however, only the EE group showed a differing food pattern, decreasing food thoughts from PP to P3C and then increasing from P3C to PS (see Figure 14).

As Figure 12 shows, the E group's exercise thoughts increased over time, while Figure 13 shows that the exercise thoughts of the NE group were similar to the overall group, as they decreased from PP to P3C and then slightly increased from P3C to PS. The EE group also mimicked the overall group's decrease in exercise thoughts from PP to P3C (see Figure 14). Interestingly, however, the exercise thoughts of this group showed a noticeable decrease from P3C to PS.

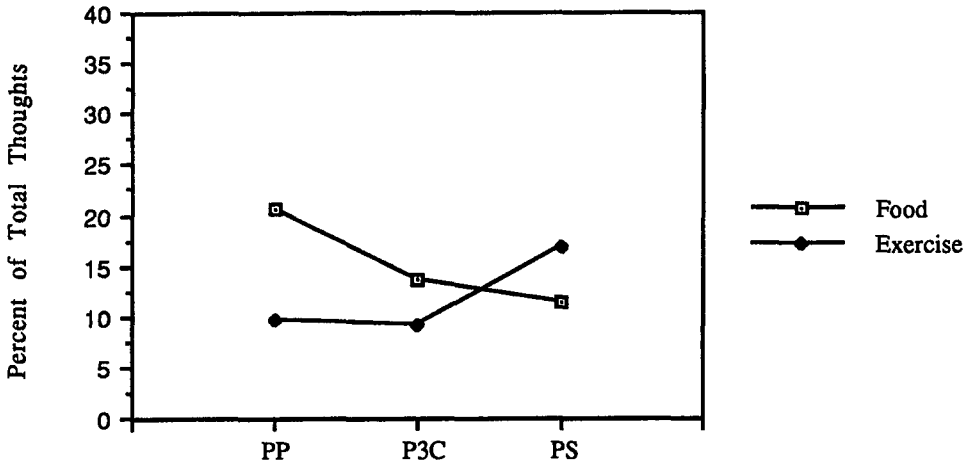

Figure 11. Overall Group Percent Food/Exercise Over Time

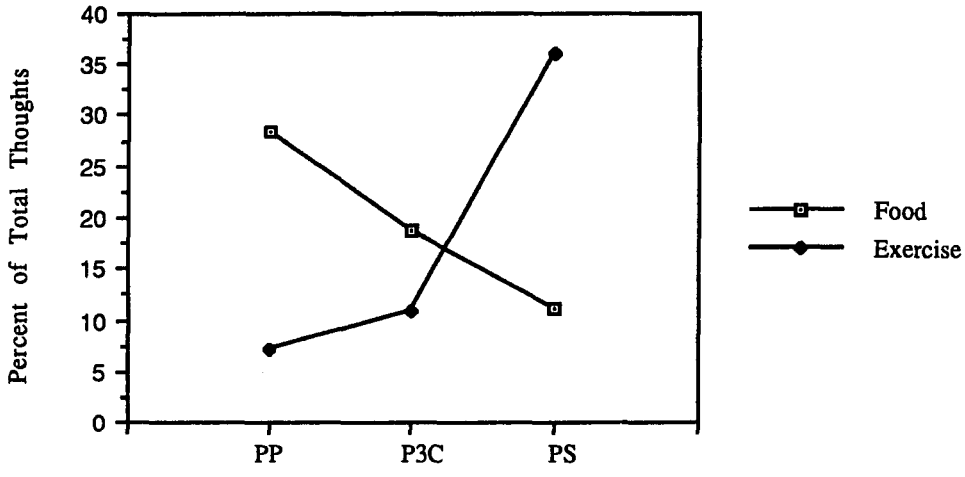

Figure 12. E Percent Food/Exercise Over Time

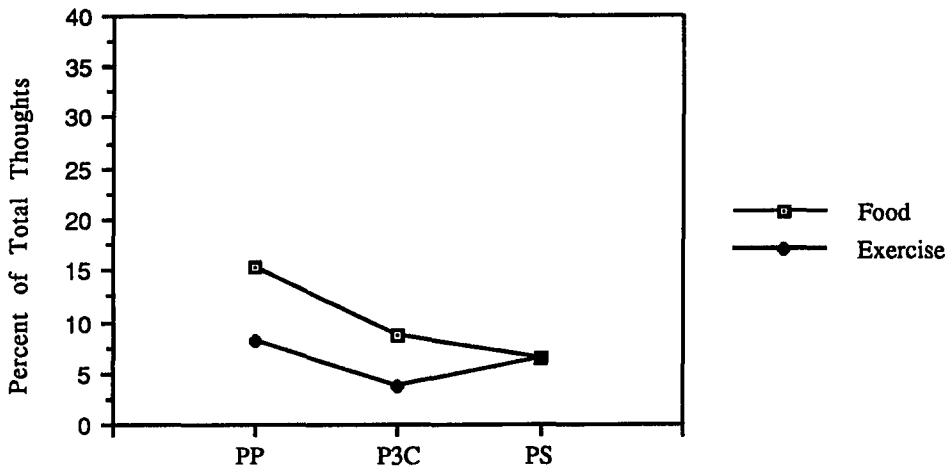

Figure 13. NE Percent Food/Exercise Over Time

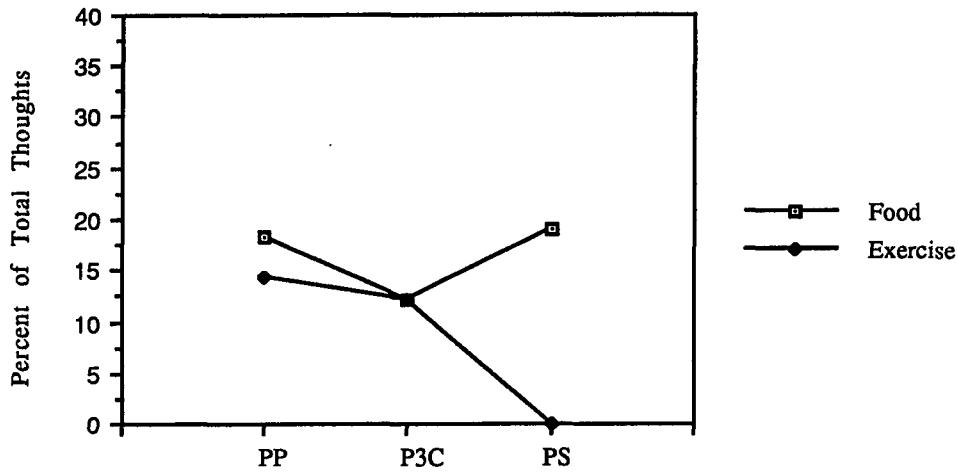

Figure 14. EE Percent Food/Exercise Over Time

Cross-Thematic Analysis of Thoughts

In addition to single thematic frequency counts, a cross-theme analysis was performed for each group at the three thought-listing administrations to determine if single thoughts represented two or more of the themes deemed pertinent to the investigation. The following cross-theme categories were investigated; food/affect, exercise/affect, control/affect, food/control, exercise/ control, and food/exercise. Due to the numerous possible combinations of negative and positive affect themes with food, exercise and control themes and the limited subject pools (n=20), the frequencies of similar cross-theme pairings that emerged within the specific exercise groups and at specified time frames were obviously low. In addition, it was unlikely that the same cross-theme pairings would surface across all exercise groups in magnitudes deserving of comparative analysis. For these reasons cross-theme analyses were limited to occurrences within the individual exercise groups.

Exercise Group Cross-Theme Analyses

Cross-thematic frequency data specific to the E group are located in Table 11. In regard to the negative affect/food cross-theme, the E group experienced the most cases of shame/food, followed equally by disgust/food and guilt/food combinations. Interestingly, incidences of guilt only surfaced at PP, whereas shame occurred the most at PP followed by a single occurrence at P3C. Single occurrences of disgust appeared at PP and P3C and were not present at PS. This group also reported the positive affect/food cross-themes of interest/food and joy/food at about equal occurrence. Interest was limited only to PP, whereas single cases of joy

did not emerge until P3C and PS. The miscellaneous affect/food combination of relief/food occurred only at PS for the E group.

The negative affect/exercise cross-theme for the E group revealed the most occurrences of shame/exercise, followed by fear/exercise, and lastly, single occurrences of both anguish/exercise and guilt/exercise. Shame was most frequent at PS, followed by P3C and PP for the E group, while fear emerged twice at P3C, dropping off to a single occurrence at PP. The single occurrences of anguish and guilt surfaced at PS. The E group experienced the most positive affect/exercise cross-themes in the form of joy/exercise, followed by single occurrences of surprise/exercise and interest/exercise. Joy was seen most at PS, followed by two occurrences at P3C and none at PP. Single occurrences of interest and surprise emerged only at PS. The miscellaneous affect/exercise combination of relief/exercise occurred twice at PS and once at PP for the E group.

Cross-theme analysis of negative affect/control surfaced equally for the E group as anguish/control and shame/control, followed by a single occurrence of guilt/control. Anguish was present at both PP and PS, but not at P3C, whereas shame only occurred at PP and P3C. The single occurrence of guilt appeared at PP. The single miscellaneous cross-theme of relief/control only surfaced at PS for the E group.

Interestingly, food/control and exercise/control cross-themes emerged 15 and eight times, respectively. Both of these occurred the most frequently at PP, followed by about equal occurrences food/control at P3C and PS and equal occurrences of exercise/control at P3C and PS. Thoughts containing both food and exercise content were limited, emerging singularly at all time frames for the E group.

Table 11

Cross-Thematic Frequency Count of Exercise Group at Post-Preload, Post 3-Condition Assignment, and Post-Session

	PP	P3C	PS	
	#Crosses	#Crosses	#Crosses	Total
Food/Negative Affect				
Anguish	0	0	0	0
Fear	0	0	0	0
Shame	3	1	0	4
Disgust	1	1	0	2
Rage	0	0	0	0
Guilt	2	0	0	2
Food/Positive Affect				
Surprise	0	0	0	0
Joy	0	1	1	2
Interest	3	0	0	3
Food/Miscellaneous Affect				
Relief	0	0	2	2
Confusion	0	0	0	0
Exercise/Negative Affect				
Anguish	0	0	1	1
Fear	1	2	0	3
Shame	1	3	7	11
Disgust	0	0	1	1
Rage	0	0	0	0
Guilt	0	0	1	1
Exercise/Positive Affect				
Surprise	0	0	1	1
Joy	0	2	6	8

Table 11 (cont.)

Exercise/Positive Affect (cont.)				
Interest	0	0	1	1
Exercise/Miscellaneous Affect				
Relief	1	0	2	3
Confusion	0	0	0	0
Control/Negative Affect				
Anguish	1	0	1	2
Fear	0	0	0	0
Shame	1	1	0	2
Disgust	0	0	0	0
Rage	0	0	0	0
Guilt	1	0	0	1
Control/Positive Affect				
Surprise	0	0	0	0
Joy	0	1	1	2
Interest	0	0	0	0
Control/Miscellaneous Affect				
Relief	0	0	2	2
Confusion	0	0	0	0
Food/Control	8	4	3	15
Exercise/Control	4	2	2	8
Food/Exercise	1	1	1	3

No Exercise Group Cross-Theme Analyses

Cross-thematic frequency data specific to the NE group are located in Table 12. Regarding the negative affect/food cross-theme, the NE group only experienced the shame/food combination. This cross-theme singularly appeared at PP, did not appear at P3C, and occurred twice at PS. The positive affect/food cross-themes of interest/food and joy/food both singularly appeared for the NE group. In addition, both of these cross-themes occurred only at PP. A single miscellaneous affect/food combination of relief/food also occurred only at PP for the NE group.

The negative affect/exercise cross-theme for the E group revealed singular occurrences of disgust/exercise and guilt/exercise. Both of these single occurrences surfaced at PP. The NE group only experienced the positive affect/exercise cross-theme of interest/exercise which occurred at P3C. The miscellaneous affect/exercise combination of relief/exercise occurred once at PP for this group.

Cross-theme analysis of negative affect/control revealed by a single occurrence of guilt/control at PP for the NE group. The NE group did not demonstrate any positive affect/control or miscellaneous affect/control cross-themes.

Food/control cross-themes only appeared at PP and were limited to just two cases, while exercise/control cross-themes emerged seven times. The majority of the exercise/control cross-themes were present in PP, none appeared at P3C, and a few occurred at PS. Thoughts containing both food and exercise content were not present for the NE group.

Table 12

Cross-Thematic Frequency Count of No Exercise Group at Post-Preload, Post 3-Condition Assignment, and Post-Session

	PP	P3C	PS	
	#Crosses	#Crosses	#Crosses	Total
Food/Negative Affect				
Anguish	0	0	0	0
Fear	0	0	0	0
Shame	1	0	2	3
Disgust	0	0	0	0
Rage	0	0	0	0
Guilt	0	0	0	0
Food/Positive Affect				
Surprise	0	0	0	0
Joy	1	0	0	1
Interest	1	0	0	1
Food/Miscellaneous Affect				
Relief	1	0	0	1
Confusion	0	0	0	0
Exercise/Negative Affect				
Anguish	0	0	0	0
Fear	0	0	0	0
Shame	0	0	0	0
Disgust	1	0	0	1
Rage	0	0	0	0
Guilt	1	0	0	1
Exercise/Positive Affect				
Surprise	0	0	0	0
Joy	0	0	0	0

Table 12 (cont.)

Exercise/Positive Affect (cont.)				
Interest	0	2	0	2
Exercise/Miscellaneous Affect				
Relief	1	0	0	1
Confusion	0	0	0	0
Control/Negative Affect				
Anguish	0	0	0	0
Fear	0	0	0	0
Shame	0	0	0	0
Disgust	0	0	0	0
Rage	0	0	0	0
Guilt	1	0	0	1
Control/Positive Affect				
Surprise	0	0	0	0
Joy	0	0	0	0
Interest	0	0	0	0
Control/Miscellaneous Affect				
Relief	0	0	0	0
Confusion	0	0	0	0
Food/Control	2	0	0	2
Exercise/Control	5	0	2	7
Food/Exercise	0	0	0	0

Expected Exercise Group Cross-Theme Analyses

Cross-thematic frequency data specific to the EE group are located in Table 13. The negative affect/food cross-theme appeared most frequently for the EE group as shame/food, followed by anguish/food. Shame appeared only at PS and anguish only at P3C. The positive affect/food cross-themes of interest/food emerged singularly at all three time frames and the single miscellaneous affect/food combination of relief/food occurred only at PS for the EE group.

The negative affect/exercise cross-theme resulted in the most frequent occurrences of anguish/exercise, followed by singular occurrences of fear/exercise, shame/exercise, and disgust/exercise. Anguish was seen most frequently at PP for this group, with only one occurrence at P3C and none at PS. The single occurrence of fear appeared at P3C, whereas, the single occurrences of shame and disgust appeared at PP. The EE group experienced the positive affect/exercise cross-themes of joy/exercise and interest/exercise, both of which only occurred at PP. The miscellaneous affect/exercise combination of relief/exercise occurred once at PP and P3C for this group.

Cross-theme analysis of negative affect/control revealed a single anguish/control combination at P3C and a single shame/control at PS for the EE group. The EE group did not demonstrate any positive affect/control and only the one miscellaneous affect/control cross-theme of confusion/control which appeared at PS.

Food/control cross-themes appeared five times, emerging most frequently at PS, with single occurrences at PP and P3C. Exercise/control cross-themes emerged eight times. The majority of the exercise/control

cross-themes were present in P3C, while the remaining appeared at PP. Only one EE thought contained both food and exercise content and this appeared at P3C.

Table 13

Cross-Thematic Frequency Count of Expected Exercise Group at Post-Preload, Post 3-Condition Assignment, and Post-Session

	PP	P3C	PS	
	#Crosses	#Crosses	#Crosses	Total
Food/Negative Affect				
Anguish	0	2	0	2
Fear	0	0	0	0
Shame	0	0	4	4
Disgust	0	0	0	0
Rage	0	0	0	0
Guilt	0	0	0	0
Food/Positive Affect				
Surprise	0	0	0	0
Joy	0	0	0	0
Interest	1	1	1	3
Food/Miscellaneous Affect				
Relief	0	0	1	1
Confusion	0	0	0	0
Exercise/Negative Affect				
Anguish	3	1	0	4
Fear	0	1	0	1
Shame	1	0	0	1
Disgust	1	0	0	1
Rage	0	0	0	0
Guilt	0	0	0	0
Exercise/Positive Affect				
Surprise	0	0	0	0
Joy	2	0	0	2

Table 13 (cont.)

Exercise/Positive Affect (cont.)				
Interest	1	0	0	1
Exercise/Miscellaneous Affect				
Relief	1	1	0	2
Confusion	0	0	0	0
Control/Negative Affect				
Anguish	0	1	0	1
Fear	0	0	0	0
Shame	0	0	1	1
Disgust	0	0	0	0
Rage	0	0	0	0
Guilt	0	0	0	0
Control/Positive Affect				
Surprise	0	0	0	0
Joy	0	0	0	0
Interest	0	0	0	0
Control/Miscellaneous Affect				
Relief	0	0	0	0
Confusion	0	0	1	1
Food/Control	1	1	3	5
Exercise/Control	3	5	0	8
Food/Exercise	0	1	0	1

24 Hour Post-Session Questionnaire Responses

Chi-square analyses were performed on subjects' responses to the 24 hour post-session questionnaire which assessed their cognitions and behaviors following their laboratory session. Frequency data for dichotomous (yes/no) responses are presented in Table 14. Groups did not differ significantly in their 24 hour post-session responses. Related frequency data for descriptive information (categorical) related to dichotomous responses are presented in Table 15.

As Table 14 shows, most of the women in the NE (19 of 20) and EE (18 of 20) did not exercise within the 24 hours following their laboratory session, while slightly less E women abstained from exercise (16 of 20). All of the women except for one EE subject indicated they had particular reasons for exercising. Table 16 shows that the majority of the E group ran (3 of 4) and the remaining one E, one NE and two EE subjects, who indicated that they exercised, participated in either a racquet sport, walking or a combination of activities.

It is of interest to note that the majority of the subjects in all groups who indicated that they did not actually exercise reported that they "felt like" exercising within the 24 hours following their laboratory session (see Table 14: E=15 of 16; NE=13 of 19; and EE=11 of 18). As Table 16 displays, a variety of exercise activities were desired, most of these being aerobic in nature (i.e., running, cycling, walking, stairclimbing, or a combination of these activities). The majority of women who "felt like" exercising indicated particular reasons for wanting to do so (see Table14: EE=13 of 15; NE=9 of 13; EE=9 of 11). The reasons given included for desiring to exercise were related to food, routine, energy, emotion or a combination of

these (see Table 16).

Post-questionnaire responses regarding the subjects feelings about consuming additional calories during the laboratory session revealed 14 E, 13 NE, and 12 EE had negative feelings. Only one woman in the E group and one woman in the EE group indicated positive feelings in response to consuming additional calories (see Table 15).

According to Table 14, about equal numbers of women in each exercise group indicated that their caloric consumption during the laboratory session affected their eating patterns following the session (E =11 of 20; NE = 12 of 20; EE = 13 of 20). As Table 15 shows, the majority of the women in all exercise groups responded they ate less than usual following the session (E =7 of 11; NE = 10 of 12; EE = 10 of 13).

Surprisingly, the majority of the women in each exercise group reported that their caloric consumption during the laboratory session did not affect their exercise patterns following the 24 hour restriction (see Table 14: E =16 of 20; NE = 14 of 20; EE = 16 of 20). As Table 16 shows, for those women whose exercise patterns were affected, the majority indicated that they exercised more than usual (E =4 of 4; NE = 5 of 6; EE = 4 of 4).

Table 14

Group Frequency Count of Dichotomous Responses to Post-Session Questionnaire

	EXERCISE		NO EXERCISE		EXPECTED EXERCISE	
	Yes	No	Yes	No	Yes	No
Did you exercise at all in the 24 hours following your laboratory session ?	4	16	1	19	2	18
If "Yes", did you have a particular reason for exercising?	4	0	1	0	1	1
If "No", did you "feel like" exercising at all in the 24 hours following your laboratory session ?	15	5	13	7	11	9
If "Yes", did you have a particular reason for desiring to exercise ?	13	2	9	4	9	2

Table 14 (cont.)

Did your caloric consumption during the laboratory session affect your eating patterns following the session ?	11	9	12	8	13	7
Did your caloric consumption during the laboratory session affect your exercise patterns following the session (after the 24 hour restriction) ?	4	16	6	14	4	16

Table 15

Exercise Group Frequency Count of Categorical Responses to Post-Session Questionnaire

	EXERCISE			NO EXERCISE			EXPECTED EXERCISE		
	Pos[a]	Neg[b]	NC[c]	Pos[a]	Neg[b]	NC[c]	Pos[a]	Neg[b]	NC[c]
Response to consuming additional calories ?	1	14	5	0	13	7	1	12	7
		More	Less		More	Less		More	Less
If eating affected, did you eat more or less than usual ?		2	7*		2	10		3	10
If exercise affected, did you exercise more or less than usual ?		4	0		5	1		4	0

[a] Pos = Positive
[b] Neg = Negative
[c] NC = No Change

*Missing data, therefore, does not total to "No" response from Table 14.

Table 16

Group Frequency Count of Categorical Responses to Post-Session Questionnaire

	EXERCISE	NO EXERCISE	EXPECTED EXERCISE
	activity ?	activity ?	activity ?
If you exercised, what did you do ?	Run=3 RS[b]=1	Combo[a]=1	Walk=1 RS[b] =1
Reason for exercising?	Other[c]=4	Other[c]=1	Other[c]=1
If "felt like" exercising, what would you have done* ?	AD[d]=1 Wts[e]=2 Bike=1 Run=1 Walk=1 Other[c]=1 Combo[a] =7	AD[d]=1 Stair[f]=2 Run=1 Walk=2 Other[c]=2 Combo[a]=5	AD[d]=4 Bike=1 Walk=2 Combo[a]=4
If "felt like" exercising, what was reason ?	Food[g]=2 Routine[h]=3 Energy[i]=2 Emot[j]=1 Other[k]=4 Combo[l]=1	Food[g]=3 Routine[h]=1 Energy[i]=2 Emot[j]=1 Other[k]=1 Combo[l]=1	Food[g]=1 Routine[h]=2 Energy[i]=2 Emot[j]=1 Other[k]=1 Combo[l]=2

[a]Combo refers to a combination of activties (e.g., walk + weight training)
[b]RS refers to Racquet Sports (e.g., tennis, racquetball)
[c]Other refers to miscellaneous activities (e.g., basketball, volleyball)
[d]AD refers to Aerobic Dance

Table 16 (cont.)

[e]Wts refers to Weight Training
[f]Stair refers to Stair Climbing
[g]Food refers to food reasons (e.g., "felt full," "ate too many calories")
[h]Routine refers to routine reasons (e.g., "to adhere to my schedule")
[i]Energy refers to energy reasons (e.g., "felt sluggish")
[j]Emot refers to emotional reasons (e.g., "felt stressed")
[k]Other refers to miscellaneous reasons (e.g., "friend wanted to walk")
[l]Combo refers to a combination of reasons (e.g., "tired and upset")

*Missing E data, therefore, number of responses does not equal Table 14.

CHAPTER IV

DISCUSSION

The primary focus of this study was to experimentally manipulate the relationship between exercise and eating behaviors. Recently, Polivy (1992) expressed the need for experimental studies addressing risk factors responsible for unhealthy eating and exercise. At the present time, support for a relationship between disordered eating and excessive exercise comes primarily from anecdotal reports (Waldstreicher, 1985; Yates, 1991) and limited diagnostic criteria (APA: DSM-III-R). For example, both exercise and diet behavior can be taken to extremes, resulting in unhealthy states, and similarities between the eating disordered and exercise-dependent individuals have been drawn (Yates et al., 1983). In addition, eating-disordered individuals often include exercise participation as a method to help control caloric expenditure (Feighner et al., 1972; Garfinkle & Goldbloom, 1988; Garner et al., 1985). Furthermore, it has been suggested that exercise behavior may lead to the development of eating disorders (Katz, 1986; Kron et al., 1978; Smith, 1980).

To empirically examine this relationship, in the present study, the eating behavior of women defined as "restrained eaters" (Herman and Mack, 1975) who evidenced a high "commitment to physical activity" (Corbin et al., 1987) were studied in the presence or absence of planned exercise behavior.

The commitment to physical activity construct (Corbin et al., 1987) was employed as a measure to assess exercise behavior. It was thought that inherent to excessive exercise tendencies would be an elevated commitment to general physical activity. The Commitment to Physical Activity scale (Corbin, et al., 1987) used to measure this construct was adopted from the Commitment to Running scale (Carmack and Martens, 1979). According to Carmack and Martens (1979), committed runners experienced great discomfort when a run was missed, perceived a higher level of addiction and ran for longer periods of time than runners with low commitment. Committed exercisers similarly demonstrate a high degree of commitment to general physical activity.

The restraint construct (Herman & Mack, 1975) was used to identify women who exhibit the tendency to think about and control their weight by curtailing intake. Developed by Herman and Mack (1975), restraint theory was one of the first explanations for differential eating patterns among people of normal weight. Early diet research (Schachter, 1968; 1971; Nisbett, 1972) focused on differences in eating behavior between obese and normal people. Dietary restraint, however, applies to a variety of populations. Also, unlike the traditional dietary theories, such as Schachter's (1968; 1971) internal-external theory of obesity and Nisbett's (1972) setpoint theory which are difficult to test, the restraint construct is amenable to empirical investigation.

Herman and Polivy (1980) believe that eating patterns are influenced by the balance between physiological factors prompting the desire for food and efforts to resist that desire. Restraint refers to the cognitively mediated effort to combat the urge to eat. Highly restrained eaters

constantly worry about what they eat and struggle to diet and resist food. Herman and Polivy (1980) hypothesize that restrained eaters develop irregular eating patterns characterized by dieting and periodic overindulgence. Interestingly, the restrained eater's self-control can be temporarily abandoned by certain factors known as "disinhibitors."

Past research examining dietary restraint has focused on the influence of cognitions, emotions and pharmacological agents (i.e., alcohol) as disinhibitors that lead restrained eaters to release their caloric control. The common theoretical thread among these studies is the proposed psychological "set" of the restrained eater that motivates eating when natural physiological hunger cues are controlled. For example, cognitive disinhibitors may include "all-or-none" perceptions, such as the belief that one has already overeaten, thereby justifying continued dietary violation (Herman & Mack, 1975; Hibscher & Herman, 1977; Ruderman & Christensen, 1983). Emotional disinhibitors, such as states of depression or anxiety, seemingly "justify" removal of self-imposed restraint, as these strong affective states may temporarily take precedence over one's dietary control (Herman & Polivy, 1975; Polivy & Herman, 1976c). Finally, knowingly consumed pharmacological disinhibitors, such as alcohol, appear to permit to the expression of the ordinarily forbidden behavior of dietary indulgence (Polivy & Herman, 1976b).

Exercise as a Disinhibitor: A Justification

Although plans for future exercise behavior would appear to offer an obvious justification for caloric indulgence, the influence of anticipated exercise as a potential disinhibitor of dietary restraint has not been

investigated to date. Anticipated overeating and plans for future meals, however, have been found to lead to dietary disinhibition (Ruderman, et al., 1985; Tomarken & Kirschenbaum, 1984). Apparently, cognitions related to future caloric consumption "justify" current indulgence (e.g., "I'm going to 'blow it' later, I might as well 'blow it' now too"). In the current investigation, it was suggested that cognitions related to future exercise behavior may also "justify" current caloric indulgence, as future behavior may be perceived as a means to restore caloric control (e.g., "I'm going to exercise later, I'll 'allow' myself to indulge now"). Therefore, it was hypothesized that individuals high in dietary restraint, who also display a high commitment to physical activity, may exhibit such cognitions in an attempt to control caloric balance. Chronic cognitions related to control of caloric consumption and expenditure may represent a potential factor leading some individuals to be "at risk" for developing dysfunctional eating and exercise behavior.

Additionally, the impact of exercise-eating cognitions on perceived control and affective states was of interest, as control, anxiety and depression have been linked to both eating disorders and excessive exercise (Herman & Polivy, 1975; Polivy & Herman, 1976c; Rezek & Leary, 1990; Yates, 1991). Therefore, a secondary purpose of this investigation was to examine perceived control and resultant affect associated with eating behavior in the presence and absence of anticipated exercise.

Verification of Exercise and Eating Behaviors

In order to empirically test the hypothesis that women defined as restrained eaters and committed to physical activity would disinhibit dietary restraint when anticipating future exercise participation, resultant consumption upon the anticipation of future exercise plans was studied. Initially, the women were not aware of whether they would be exercising during their laboratory session and all were instructed to prepare for activity. In an effort to create a sense of exercise urgency in these committed exercisers, they were asked to refrain from exercise participation 24 hours prior to and following their laboratory session. This restriction was intended to increase the women's desire to exercise during the experimental session.

Verification of pre- and post-session guidelines was required to ensure that eating and exercise behaviors outside of the session would not affect the experimental manipulation. For example, if a woman had known she was going to be in the NE group during the experimental session, she might have performed additional exercise the day prior to her appointment to compensate for the upcoming restriction. In addition, to ensure the women's dietary behavior before their laboratory appointment would not be influenced, they were asked to "eat normally" and to log all food eaten within the 24 hour time period preceeding their appointment. The majority of women in each exercise group adhered to both the pre-test and post-test guidelines, thus verifying that their eating and exercise behaviors outside of the session did not affect the experimental manipulation.

Dietary Disinhibition via Planned Exercise?

The primary results of this study indicated that women anticipating future exercise did not disinhibit dietary restraint (eat more ice cream) compared to women without future exercise plans. This finding was not consistent with previous studies that reported counterregulation (increased consumption) in restrained eaters when their self-imposed resistance to eat was overcome by cognitively mediated factors such as perceptions of having overeaten (Hibscher & Herman, 1977; Ruderman & Christensen, 1983; Spencer & Fremouw, 1979), strong affect (Herman & Polivy, 1975; Polivy & Herman, 1976c), perceptions of caloric content of food (Polivy, 1976), and anticipated overeating (Ruderman et al., 1985). Therefore, based on the findings of this study, planned exercise does not appear to act as a disinhibitor of dietary restraint.

Displaced Reactance and Dietary Disinhibition

Rezek and Leary's (1991) concept of "displaced reactance" may offer a plausible explanation for the lack of dietary disinhibition found in the present study. "Displaced reactance" is based on reactance theory (Brehm & Brehm, 1981), which proposes that when freedom is threatened or lost, people will behave in ways to protect or restore the specific freedom in question. Rezek and Leary (1991) contend that certain behaviors may create a sense of control that substitute for lack of control in other areas. They give the example of the anorexic who seemingly attempts to regain a sense of control which is missing in one aspect of her life (e.g., autonomy) through restricted eating. In the present study, it is possible that the forced consumption of the milkshake preload, although designed

to control for baseline hunger differences, may have been interpreted by the subjects as a forced loss of control. Subsequently, when the women were in control of their caloric intake (i.e., during the taste test), they may have limited their intake to just an amount necessary to respond to the taste test questions. Limited intake during the taste test may have been interpreted as a form of secondary control. Therefore, although one may argue that the opportunity to exercise may have offered yet another form of secondary (or perhaps tertiary) control, temporally, control during the taste test may have offered more immediate relief to feelings of loss of control during the preload. In addition, the subject had more direct control of her caloric consumption during the taste test than she had of her caloric expenditure during the supervised exercise session.

Planned Exercise as a Disinhibitor: A Continuous Variable?

In addition, although the women in this study who anticipated future exercise did not demonstrate the proposed dietary disinhibition found in previous studies (Herman & Polivy, 1975; Hibscher & Herman, 1977; Polivy & Herman, 1976b), the findings of the present study are not entirely unique. For example, not all of the previous restraint research has resulted in clear cut findings consistent with original hypotheses (Tomarken and Kirschenbaum, 1984). It is important to note that the Tomarken and Kirschenbaum (1984) study utilized unrestrained eaters, in addition to restrained eaters, and therefore is not entirely similar in design to the present study. The point, however, of discussing this study, is the promise the authors' surprising conclusions may hold for a link between disinhibitory eating behavior and exercise.

In a pair of studies by Tomarken and Kirschenbaum (1984) investigating the influence of future meal plans on present consumption, disinhibition was not isolated to restrained eaters. The anticipation of a high-calorie dinner compared to a low-calorie meal led both restrained and unrestrained eaters to eat more when anticipating a high-calorie meal. Results were somewhat consistent with restraint hypotheses, however, as restrained eaters ate more, on the whole, than unrestrained eaters. The unique finding was the apparent continuous dimension of the restraint construct versus the traditional dichotomous interpretation. The authors suggested that unrestrained eaters may possess a higher disinhibitory threshold compared to restrained eaters, yet are capable of disinhibition in the presence of a strong disinhibitor. According to Tomarken and Kirschenbaum (1984), under certain experimental and sampling conditions, the eating behavior of all individuals may differ more in degree than in kind. Therefore, the findings of the present study may be indicative of a similar continuous interpretation. Perhaps the amount of anticipated exercise in the present study was not strong enough to overcome the disinhibitory threshold of the women represented in this sample.

Dietary Disinhibition, Exercise and Restraint Score

Although it is possible that the anticipated exercise behavior may not have been a disinhibitor, it is also possible that the women defined as "restrained" in this investigation may not have been representative of a "highly" restrained sample, as the average restraint score for the subjects participating in this study was 19.46, which falls in the middle of the

potential range of 0 to 35. Also, although it was recommended to use 17 as a cut-off score for inclusion, the mean of the sample represented was somewhat lower than the mean restraint scores reported in previous studies (Ferguson, Brink, Wood, & Koop, 1992: R = > 29; Tomarken & Kirschenbaum, 1982: R = 22.95; Tomarken & Kirschenbaum, 1984: Exp. 1, R = 23.33, Exp 2, R = 23.52). Perhaps a sample of women with higher restraint scores would have represented a group more susceptible to disinhibition via planned exercise.

Disinhibition and Body Weight/Food Thought Frequency

Another possible explanation for the inability of exercise to disinhibit restrained eaters may be found in the physiological make-up and thought-listing frequency data. The initial E group (n = 40) group had a mean body weight that was 7 lbs heavier (142.2 lbs) compared to the mean body weight of the NE group (135 lbs). Although the body weights of these groups did not statistically differ, given that these two groups were of similar height (E = 64.45 in.; NE = 64.40 in.), the E group could have had a higher percent body fat, and thus, may have been more conscious of their dietary intake in general. Langston (1979) has reported attitudes towards body weight are significantly related to overall percent body fat. Specifically, women high in percent body fat were more dissatisified with weight-related items than women lower in percent body fat. Unfortunately, in the present study, body fat measures were not taken.

Furthermore, additional support for increased weight consciousness in the E and EE groups can be found in the frequency of their food thoughts

compared to the NE group. The E and EE groups reported more food theme thoughts at each of the three thought-listing administrations, reporting 29.5 (36+23=59/2), 15 (19+11=30/2) and 11.5 (11+12=23/2) food thoughts compared to the NE group who reported 19, 7, and 5. In addition, a similar pattern was found in the food/control cross-theme frequency. Once again, the initial E group reported ten food/control cross-themes (15+5=20/2), compared to the NE, who reported only two of these cross-themes. The lack of disinhibitory strength of the exercise program, combined with increased weight consciousness of the exercise group may offer an additional explanation regarding the failure of planned exercise to act as a disinhibitor of dietary restraint in the present study.

Disinhibition and Exercise Frequency and Duration

Lastly, the women in this sample appeared to be highly committed to physical activity, as evidenced by their mean CPA score of 45.93. In establishing the discriminant validity of the CPA scale, Corbin, et al. (1987) found the scale to be a reliable discriminator of actual activity level (i.e., those who were more active possessed higher CPA scores than those who were less active). Corbin et al. (1987) reported a mean CPA score of 46.98 to be a significant discriminator between high moderate (228.01 minutes per week) and low moderate activity (125.69 minutes per week) levels. The mean CPA score of women in the present investigation closely approximated this level. Because CPA scores have been found to discriminate between individuals of varying actual activity levels, the exercisers in the present investigation may not have perceived

the experimental exercise session to be of sufficient intensity to justify caloric indulgence. The initial exercisers (E + EE) in this study reported that they exercised on average of 53.03 minutes per session 3.97 times per week (210.79 minutes per week) approximating Corbin et al.'s (1987) high moderate activity level, thus, the 20-minute bicycle protocol may not have been interpreted by these subjects as being of adequate intensity to "justify" caloric indulgence.

A paradoxical explanation can also be offered, however, as these subjects indicated that they exercised on average of three to four days a week. It is possible that the 24 hour pre- and post-session exercise restriction did not affect their normal exercise routine. The opportunity to exercise within the experimental session may simply have been regarded as one of the subject's exercise days rather than as "additional" activity for which they could "allow" caloric indulgence. A study design that could control for pre- and post-session exercise behavior, yet at the same time create the belief that the exercise within the laboratory session was "additional" might lead restrained eaters to disinhibit dietary restraint. In addition, the women who did not exercise during the experimental session could feasibly organize their three to four day a week exercise schedule around the two day restriction. Because data regarding the subjects' perceptions of the exercise protocol were not collected in this study, these conclusions remain speculative.

Dietary Disinhibition and CPA: Conceptual Concerns

At the present time a standardized measure of negative addiction to exercise does not exist, therefore, it was thought that inherent to

dysfunctional exercise tendencies would be an elevated commitment to general physical activity. Although the subjects in this study had elevated levels of commitment to physical activity, it is possible that their perceived commitment is not reflective of dysfunctional tendencies. For example, Corbin et al. (1987) remind us that,

> " . . . it should be noted that commitment is defined as a pledge or promise to be active. As such, it will never be totally predictive of physical activity behaviors, no matter how specific the commitment instrument or the activity involvement. It has been said pledges and promises are made to be broken. Whereas, a commitment score from a questionnaire should be related to the specific commitment behavior, because commitment is also a tendency to action, commitment is a temporal concept which can never be expected to be acted upon with 100% certainty." (pp. 220-221)

Perhaps the subjects in this study represent women who are committed to being active, yet do not exhibit the negative aspects of excessive exercise. As Chapman and DeCastro (1990) have suggested, addiction may be viewed as a process which compels an individual to continue in spite of obstacles, whereas commitment is an intention to continue due to feelings of satisfaction, enjoyment and accomplishment. If this is the case, the CPA may not have identified women with dysfunctional exercise potential, but rather women who simply enjoyed activity.

The inability of planned exercise to act as a disinhibitor of dietary restraint appears to be best explained by displaced reactance, the sample's restraint score, and the duration of the laboratory exercise program. Eating behavior did not differ between exercise groups, therefore, it is

reasonable that the women could have exhibited displaced reactance--exerting secondary control, by limiting their taste test consumption following forced consumption of the milkshake preload. Furthermore, the moderate restraint score of this sample, combined with the limited intensity of the exercise program, may not have supplied sufficient strength to stimulate dietary disinhibition.

Perceived Control

A secondary purpose of this investigation was to explore perceptions of control associated with eating behavior and exercise anticipation. Control research suggests that people are motivated to achieve a sense of equilibrium in their lives and, therefore, implement strategies aimed at gaining control (Lefcourt, 1973). In the present study, it was thought that the experimental manipulation of eating and exercise may result in differences in perceived control between exercise groups. Specifically, when asked to participate in an ice cream taste test, women with plans for future exercise were hypothesized to report a greater sense of control relative to their caloric intake compared to women without plans for future exercise. In addition, although the exercise group was proposed to exhibit the greatest control throughout the experimental session, both the E and NE groups were hypothesized to exhibit more control throughout the investigation compared to the EE group, as the former groups' exercise plans were not altered during the course of the experiment. In contrast, the EE group was thought to initially demonstrate a high level of perceived control when led to believe that they would be exercising, yet evidence low perceived control when subsequently informed that they would be

unable to exercise.

Control was assessed two ways and was measured at various times throughout the experimental session. One of the control measures entailed subjects responding to a single control question on four separate occasions throughout the experimental manipulation. At baseline, post-preload, post three-condition assignment and post-session, subjects were asked to respond to the question, "I feel I am in control at this time" by selecting from a 5-point Likert scale the response that best represented their current feeling. Responses ranged from 1, "the statement does not describe my present condition," to 5 "the condition is very strong; the statement describes my present conditon very well." Control was also assessed by thematic coding of thoughts listed by subjects on three separate occasions during the experimental session (post-preload, post three-condition assignment, and post-session). Individual thoughts were coded as to whether or not they contained a control theme. Relative to the total thoughts listed by each group, percentages were calculated that represented the frequency of the control theme at each of the three thought-listing administrations.

The three exercise groups did not statistically differ in perceived control across the four administrations as measured by the single control question. Therefore, the control hypotheses proposed for this investigation were not supported with this measure. Because the question designed for use for this study was to be answered on a 5-point Likert scale (responses ranging from 1 to 5), a possible ceiling effect may have resulted that would have limited the ability to measure control, as illustrated in the moderately high

mean scores across time of 3.86, 3.78, and 3.44 for the E, NE, and EE groups, respectively.

Perceived Control as a State Measure: Psychometric Concerns

No studies directly addressing perceived control and exercise/eating behavior appear to have been conducted at this time. The few exercise studies that have included a state measure of perceived control (Kimiecik, 1990; Kavussanu, 1992), have asked subjects to report their perception of the degree of control they felt they possessed over certain situations/behaviors. In the absence of a standardized perceived control questionnaire, Kavussanu (1992) developed a 3-item perceived control inventory, yet found no significant differences in perceived control in her specific question of interest. She concluded that it was possible that the inventory specifically developed for her study might not have been sensitive enough to detect changes in perceived control. Furthermore, the psychometric properties of her scale are admittedly unknown. Similary, in addition to validity and reliability concerns, the single-item measure of control used in the present study may not have been an adequate measure of perceived control specific to the experimental design. Although Kimiecik (1990) used specific state measures in his research and found perceived control differences in exercise behavior, he was also faced with the validity and reliability limitations of using an unstandardized measure of perceived control. In the present study, pilot data revealed that specific questions regarding the subject's perceived control of caloric consumption and expenditure led to an increased probability of subjects becoming sensitized to the underlying intent of the investigation. As a result, it was

decided to use a more general measure of control. Unfortunately, this general measure may not have reflected specific exercise or eating control concerns. The development of behaviorally specific measures might strengthen the probability of detecting perceived control differences in a variety of contexts.

Conceptualization Problems and Perceived Control

Given the fact that existing general control measures conceptualize high control as representative of positive adaptation (Burger & Cooper, 1979; Rotter, 1966), it is possible that the single control question designed for use in the present study did not adequately measure potentially dysfunctional control. For example an eating- and/or exercise-specific control measure that taps upon dysfunctional needs may be a more pertinent measure. Perhaps a measure specific to the newly defined concept of "reactive control" (Brehm & Brehm, 1981), would allow for assessment of potentially negative adaptations in eating and exercise behavior. Negative control adaptations have been discussed as potential factors contributing to common addictive behaviors such as drug and alcohol abuse (Berzins & Ross, 1973; Worrell & Tumilty, 1981).

Insights on Perceived Control Via Thought-Listing

The analysis of control via the thematic coding of thoughts partially supported the initial hypotheses of this investigation. It is important to note that higher percentages of control content thoughts were operationalized as reflecting low perceived control. For example, the E group exhibited their highest percentage of control thoughts at PP (13.4%),

thus representing the time of greatest control concerns, whereas, at P3C the percentage dropped to 6.9%, representing the point of least control concerns.

Information gathered from the thought-listing offered limited support for the initial hypotheses regarding group differences in perceived control relative to eating and exercise manipulations. The original hypotheses predicted that the E and the NE groups would exhibit greater perceived control throughout the experimental session because the groups' exercise plans were not altered during the course of the experiment. Surprisingly, elevated control concern was evident at post-preload in all of the groups and this may reflect their response to the forced consumption. Regardless of their known exercise destiny within the experimental session, the forced consumption of the milkshake preload may have led to the decreased perceived control at this point for all subjects, as they were not in complete control of their behavior at this time.

The resultant decrease control concern that followed at P3C for both the E and NE groups was consistent with the original hypotheses, possibly reflective of perceptions of increased control gained during the taste test. Furthermore, the E group, had an opportunity to regain even more control during the exercise session. The unpredicted increase in control concern in the NE group at PS, might represent this group's awareness of both their lack of activity during the experimental session and their 24 hour exercise restriction following the laboratory session.

The EE group evidenced a slight increase in control concerns across the experimental session. Although percent change control between any two of the thought-listing administrations were not as great for this group

compared to changes seen in the other two groups, the slight trend exhibited was consistent with the original hypotheses for this group. Upon being informed that they would be unable to exercise, the control concerns for the EE group increased slightly and remained at this level for the remainder of the experimental session. The women who expected to exercise, perceived less control upon being informed that they would be unable to exercise. Decreased control perceptions were sustained throughout the experimental session for this group.

As mentioned previously, only one study could be located that directly examined control and eating behavior (Rezek & Leary, 1991). In support of the present study, the Rezek and Leary (1991) study found women who were high in drive for thinness ate less when perceiving a loss of control compared to women low in this measure. It must be cautioned that loss of control served as an independent variable in the Rezek and Leary (1991) study, whereas, perceived control served as a dependent measure in the present study. Also, the authors did not measure restraint levels, yet defined their subjects as exhibiting "pure" anorexic tendencies based soley on their drive for thinness scores. Although differing in design and sample, the Rezek and Leary (1991) findings support the relationship between the perceived loss of control (that may have resulted for all women after consuming the milkshake preload) and the resultant lack of dietary disinhibition that occurred in the present study.

Resultant Affect

A related secondary purpose of this investigation was to determine the resultant affect associated with eating behavior and exercise anticipation. Diet and exercise research both indicate that negative affective states such as anxiety and depression can result from dysfunctional behaviors such as dietary disinhibition (Crowther, Lingswiler, & Stephens, 1984; Giles, Young and Young, 1985; Hawkins and Clement, 1980; Herman & Polivy 1980) and exercise restriction (Carmack & Martens, 1979; Crossman, et al., 1987; Morris et al., 1990; Sachs and Pargman, 1979). In addition, these affective states have also been found to be related to losses in perceived control (Gregory, 1981).

In the present study, it was thought that the experimental manipulation of eating and exercise may result in differences in resultant affect between exercise groups. Specifically, when asked to participate in an ice cream taste test, women with plans for future exercise were hypothesized to report less anxiety and depression relative to their caloric intake compared to women without plans for future exercise. In addition, although the E group was proposed to exhibit the least amount of anxiety and depression throughout the experimental session, both the E and NE groups were hypothesized to exhibit less anxiety and depression throughout the investigation compared to the EE group, as the presence or absence of exercise plans were known from the start. In contrast, the EE group was thought to initially demonstrate low levels of anxiety and depression when led to believe that they would be exercising, yet to evidence increased anxiety and depression when subsequently informed that they would be unable to exercise.

Resultant affect, similar to perceived control, was also assessed two ways and was measured at various times throughout the experimental session. The revised Worry-Emotionality scale (WES-r: Morris. et al., 1981) was employed to measure both somatic and cognitive anxiety. Included with this scale was the single question measure of depression adapted from the Incredibly Short Profile of Mood States (ISP: Dean et al., 1990). Together, these measures of anxiety and depression were taken at 4 points throughout the experimental session; baseline, post-preload, post three-condition assignment, and post-session.

Affect was also assessed by thematic coding of thoughts listed by subjects on three separate occasions during the experimental session (post-preload, post 3-condition assignment and post-session). Individual thoughts were coded as to whether or not they contained an affect theme. Relative to the total thoughts containing affect listed by each group, percentages were calculated which represented the degree to which positive and negative affects surfaced at each of the three thought-listing administrations.

Although the three exercise groups did not differ from each other in overall affect (anxiety and depression) throughout the experimental session as measured by the WES-r and the ISP depression question, levels of both cognitive and somatic anxiety differed at specific times. Therefore, some of the proposed anxiety hypotheses were partially supported by the anxiety measure. As a group, the women's cognitive and somatic anxiety decreased over time. The E and NE groups did decrease in anxiety as predicted by the experimental manipulation. Because of the presence or absence of "known" exercise plans, these groups may have

experienced less cognitive and somatic anxiety throughout the experimental session relative to their eating behavior.

The EE group also evidenced decreased somatic and cognitive anxiety over time. This finding was contrary to the original hypothesis that predicted this group to experience increased anxiety upon being informed that they would be unable to exercise. It was thought that women who planned to exercise might justify eating more during the taste test in anticipation of regaining caloric balance later in the session. These proposed cognitions were thought to result in decreased anxiety prior to being informed that they would not be able to exercise. Because the EE group did not evidence dietary disinhibition during the taste test, it is possible that they never experienced eating related changes in affect, regardless of their plans for future exercise. Although, the decrease in both cognitive and somatic anxiety have been interpreted as offering limited support for the affect hypotheses specific to the E and NE groups, the lack of dietary disinhibition in the groups may have been responsible for the absence of affective changes.

Understandably, as a group, the women experienced the greatest somatic and cognitive anxiety at the beginning of experimental session. This elevated anxiety may have been related to general testing apprehension regarding participation an experimental project. Test anxiety has been reported a common form of situationally-specific anxiety (Leary, 1983). Specifically, the decreases in cognitive anxiety witnessed between baseline and post-preload and between post-preload and post three-condition assignment may have reflected lessened worry about the experimental procedures in general, as subjects became more comfortable,

rather than decreased worry regarding specific food and exercise manipulations. Therefore, overall test apprehension may have masked specific worry cognitions related to eating and exercise behavior for this particular measure. The significant drop in somatic anxiety between post-preload and the post three-condition assignment may reflect a general physiological response to the milkshake preload which may have dampened initial somatic cues. Perhaps consumption of the ice cream product led subjects to experience decreased somatic symptoms related to anxiety that may have been more salient prior to consuming the product. Unfortunately, responses specific to physiological reactions to the milkshake preload were not collected in this study.

The analysis of affective changes (positive and negative) via the thematic coding of thoughts partially supported the initial hypotheses of this investigation. To begin, the NE group had the highest percentage of positive affect on average across the experimental session, followed by the E group and finally, the EE group which evidenced the lowest percentage of positive affect. Therefore, as predicted, the two groups whose actual exercise behavior was consistent with anticipated plans appeared to experience increased positive affect as the experimental session progressed.

Also consistent with predictions, the EE group experienced a decrease in positive affect between the post three-condition assignment and post-session. These findings suggest that towards the end of experimental session, the group whose actual exercise behavior was inconsistent with anticipated plans experienced decreased positive affect. The decrease in positive affect seen in the EE group at post-session may also have been

exaccerbated by the knowledge that they would be unable to exercise for another 24 hours. It is important to note, however, that the EE group showed an increase in positive affect from post-preload to post three-condition assignment. Therefore, regardless of the eventual decrease, this group reported the highest positive affect at the specific time that was thought to lead to the lowest positive affect--immediately after being told they would be unable to exercise (i.e., post three-condition assignment). A possible explanation for this response may be related to feelings of relief resulting from general apprehension regarding their efficacy to perform the exercise program. This explanation seems plausible, as the E group evidenced a slight decrease in positive affect from post-preload to post three-condition assignment, therefore, they too may have had reservations regarding their competencies to perform the exercise program.

The E group was able confront their apprehension by actually participating in the exercise session which may have resolved any performance doubts, resulting in increased positive affect at post-session compared to the EE group. This is not surprising as exercise has consistently been shown to lead to increased vigor (Morgan, 1974). The NE group never had to experience apprehension regarding their ability to perform the exercise program, as they knew from the start that they did not have to exercise, thus possibly accounting for their progressive increase in positive affect throughout the experimental session

Because the negative affect changes witnessed in the groups represented the majority of the remaining percentage of affect for most of the exercise groups, reverse interpretations regarding the effect of the

experimental session can be drawn as expressed in negative affect for the exercise groups. Thus, in cases where situations were suggested to lead to increased positive affect, a concomitant decrease in negative affect was seen. For example, if 40% of the total affect thoughts were positive, in most cases, the majority of the resultant 60% were negative (the miscellaneous affect themes were rarely representative of the majority the affect theme). One notable exception was witnessed at post-session for the EE group, where the miscellaneous affect items accounted for the majority of the affect themes. It is not surprising, that the EE group reported confusion and relief as predominant affect themes at post-session. Increased confusion may have resulted fom the change in the EE group's exercise expectations. Increased relief may have resulted from not having to perform the exercise program if exercise efficacy concerns were present.

Experimental Manipulation and Post-test Behavior

Further support for the effect of the experimental manipulation on eating and exercise was evidenced in responses to the post-session questionnaire. The overwhelming majority of women reported a negative response to consuming the additional calories during the laboratory session. In addition, the majority of the women in each exercise group reported that their caloric consumption during the laboratory session affected their eating patterns following the session. For those women whose patterns were affected, the majority indicated that they ate less than usual. Post-session questionnaire responses also indicated that, for those women who reported that their caloric consumption during the laboratory session affected their exercise patterns following the 24 hour

restriction, the majority indicated that they exercised more than usual. Interestingly, even though the majority of women adhered to the post-test 24 hour exercise restriction, the majority indicated they "felt like" exercising during that time, noting food-, routine- and energy-related reasons.

Limitations of the Study

The interdisciplinary approach of the current investigation has warranted several limitations that need to be identified. The first limitation includes the sample population. Women who participated in this research investigation were undergraduates screened from intact university classes. Unfortunately, these women were not as representative of the "at risk" population most likely to exhibit dysfunctional eating and exercise behavior. Random selection of subjects referred for clinical assessment of eating or exercise disorders would have been more likely "at risk" populations.

Although theoretically sound, the milkshake preload design, as implemented in this study may have confounded the disinhibitory effect of planned exercise. In the present study, it was used to control for baseline physiological hunger differences. Because it should have affected all of the restrained eaters in this sample in a similar manner, differences in disinhibitory eating behavior were hypothesized to be related to differing exercise plans. Controlling for baseline hunger levels, however, may have unexpectedly exerted a stronger influence on eating behavior than did the plans for future exercise.

Another limitation of this study was the exercise program design. An

exercise protocol of longer duration might have led to a greater probability for disinhibition of dietary restraint. In addition, creating the perception of the exercise during the session as additional to a normal routine may facilitate disinhibition of dietary restraint. Also, because the investigator was not blind to the exercise group assignment, this too presented a methodological limitation (i.e., Rosenthal effect of investigator influence).

Psychometric limitations were also present in this study. Namely, the use of a general control measure may not have been sensitive enough to detect changes in perceived control specific to eating and exercise. A general question was used to protect the true intent of the study; however, it did not provide discriminating data between groups.

Another psychometric limitation was seen with the use of the CPA as a measure of risk for dysfunctional exercise. The ability of the CPA scale to discriminate between positive (commitment, pledge, promise) and negative (addiction, compulsion, dependence) reasons for exercise participation is questionnable.

Conclusions

The following conclusions were reached in the present investigation:

1. Plans for future exercise did not lead to disinhibition of dietary restraint. Displaced reactance, magnitude of restraint score, and exercise frequency/duration appear to offer the strongest explanations why exercise may not have acted as a disinhibitor.

2. In general, participation in the experimental session affected post-session eating and exercise thoughts and behaviors. The consumption of calories within the experimental session led to negative responses by all subjects. In addition, subjects reported they ate less than usual and indicated they "felt like exercising" during the 24 hours following the session.

3. Because subjects in this study did not disinhibit dietary restraint, the determination of direct relationships between disinhibition and perceived control/affect were not possible.

Trends seen in perceived control and affect for exercise groups and across time are summarized below.

4. Perceived control hypotheses, as measured by a single question, did not result in findings consistent with the original hypotheses. Perceived control, as assessed by thought-listing, partially supported the initial hypotheses of this investigation. E and NE groups exhibited decreased control concerns at post-three condition assignment. Also consistent with the original hypotheses, the EE group exhibited a slight trend in increased control concern throughout the course of the investigation.

5. Affect hypotheses resulted in mixed findings. Depression hypotheses were not supported. Limited support for resultant anxiety (cognitive and somatic) was found for the E and NE groups who evidenced a decrease in these measures throughout the investigation. Thought-listing partially supported the original affect hypotheses as the E and NE groups reported the highest percentage of positive affect across the experimental manipulation. Also, the EE experienced a decrease in positive affect after being informed that they would not be able to exercise.

Future Research

This research represents an interdisciplinary study attempting to experimentally manipulate the relationship between eating and exercise behaviors. Promising trends regarding the effect of eating and exercise behavior on perceived control and resultant affect were discovered. The following recommendations are made for future research exploring the exercise-eating relationship:

1. Populations at higher risk for dysfunctional behavior, such as anorexics, bulimics, or the obese should be studied.

2. Financial incentives to attract "at risk" populations for experimental manipulation of exercise and eating behaviors are recommended. Those who are likely to evidence the greatest potential for

dysfunction are often reluctant to voluntarily alter their behaviors (e.g., addicted exercisers).

3. The development of psychometrically sound measures to explore state-specific perceived control and to discriminate between the positive and negative motivations for exercise is encouraged.

4. Exercise protocols that are perceived as "additional" to subjects' standard exercise behavior are suggested.

5. Continued interdisciplinary approaches, including exercise physiology, nutrition, and psychology, will not only provide advancements within each field, but will also offer valuable information to clinicians treating dysfunctional eating and exercise behavior.

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APPENDIX A

REVISED RESTRAINT SCALE

Directions: Respond as accurately as possible to the following statements by placing the number that corresponds to your answer on the blank to the left of each question.

____ A. How often are you dieting?
0. Never **1.** Rarely **2.** Sometimes **3.** Often **4.** Always

____ B. What is the maximum amount of weight that you have ever lost in a week (lbs.)?
0. 0-4 **1.** 5-9 **2.** 10-14 **3.** 15-19 **4.** 20+

____ C. What is your maximum weight gain within a week (lbs.)?
0. 0-1 **1.** 1.1-2 **2.** 2.1-3 **3.** 3.1-5 **4.** 5.1+

____ D. In a typical week, how much does your weight fluctuate (lbs.)?
0. 0-1 **1.** 1.1-2 **2.** 2.1-3 **3.** 3.1-5 **4.** 5.1+

____ E. Would a weight fluctuation of 5 lb. affect the way you live your life?
0. Not at all **1.** Slightly **2.** Moderately **3.** Very Much

____ F. Do you eat sensibly in front of others and splurge alone?
0. Never **1.** Rarely **2.** Often **3.** Always

____ G. Do you give too much time and thought to food?
0. Never **1.** Rarely **2.** Often **3.** Always

____ H. Do you have feelings of guilt after overeating?
0. Never **1.** Rarely **2.** Often **3.** Always

____ I. How conscious are you of what you are eating?
0. Not at all **1.** Slightly **2.** Moderately **3.** Extremely

____ J. How many pounds over your desired weight were you at your maximum weight?
0. 0-1 **1.** 1-5 **2.** 6-10 **3.** 11-20 **4.** 21+

APPENDIX B

COMMITMENT TO PHYSICAL ACTIVITY SCALE

Directions: The following statements may or may not describe your feelings about physical activity. Read each statement and then place the number that corresponds to your YOUR FEELINGS MOST OF THE TIME on the blank to the left of the question (* = reverse score).

1 = Strongly Disagree
2 = Disagree
3 = Uncertain
4 = Agree
5 = Strongly Agree

_____ 1. I look forward to physical activity.

_____ 2. I wish there were a more enjoyable way to stay fit than vigorous physical activity.*

_____ 3. Physical activity is drudgery.*

_____ 4. I do not enjoy physical activity.*

_____ 5. Physical activity is vitally important to me.

_____ 6. Life is so much richer as a result of physical activity.

_____ 7. Physical activity is pleasant.

_____ 8. I dislike the thought of doing regular physical activity.*

_____ 9. I would arrange or change my schedule to participate in physical activity.

_____ 10. I have to force myself to participate in physical activity.*

_____ 11. To miss a day of physical activity is sheer relief.*

_____ 12. Physical activity is the high point in my day.

APPENDIX C

HEALTH HISTORY INVENTORY

HEALTH HISTORY INVENTORY

Please complete this form as accurately and completely as possible.
ID: _____
Date: _____

1. GENERAL MEDICAL HISTORY

CIRCLE ONE

Any medical complaints? (Please specify) YES NO

_____

_____

Are you on any medication? (Please specify) YES NO

_____

2. EXERCISE HISTORY

Do you exercise regularly? YES NO

If YES, please answer a. through d.

a. what kind(s) of exercise do you perform?

_____

b. how many times a week do you perform each type of exercise?

_____

c. how long is each exercise session? _____

d. how long have you participated in each type of exercise? _____

3. CARDIO-RESPIRATORY HISTORY

Any heart disease now?	YES NO
Any heart disease in the past?	YES NO
Heart murmurs?	YES NO
Occasional chest pain?	YES NO
Fainting?	YES NO
Asthma or allergies?	YES NO
Family history of heart disease?	YES NO
High blood pressure?	YES NO
Shortness of breath after 2 flights of stairs?	YES NO

Explain any YES responses _____

4. MUSCULAR HISTORY

Any muscle injuries now?	YES NO
Muscle injuries in the past?	YES NO
Muscle pains during exercise?	YES NO

Explain any YES responses _____

5. BONE-JOINT HISTORY

Any bone or joint injuries now?	YES NO
Any in the past?	YES NO
Ever had swollen joints?	YES NO

Explain any YES responses _____

6. GENERAL HEALTH HISTORY

Adrenal disease?	YES NO
Fainting spells?	YES NO
Hypoglycemia (low blood sugar)?	YES NO
Seizures?	YES NO
Diabetes?	YES NO
Kidney problems?	YES NO
Stomach ulcers?	YES NO

Explain any YES responses _____

7. FOOD ALLERGIES? YES NO

If yes, please describe _____

Height and Weight Data

Screening Weight: _____ lbs. Height: _____ ft. _____ in.

Testing Weight: _____ lbs. Menstrual Cycle?: YES NO

APPENDIX D

WEIGHT AND DIET HISTORY QUESTIONNAIRE

WEIGHT AND DIET HISTORY QUESTIONNAIRE

ID: _____
Date: _____

1. Highest past weight (excluding pregnancy): _____ pounds
   How long ago did you first reach this weight? _____ months
   How long ago did you weigh this weight? _____ months

2. Lowest past weight as an adult: _____ pounds
   How long ago did you first reach this weight? _____ months
   How long ago did you weigh this weight? _____ months

3. What weight have you been at for the longest period of time?
   _____ pounds

   At what age did you first reach this weight? _____ years old

4. If your weight has changed a lot over the years, is there a weight that you keep coming back to when you are not dieting?
   ___ Yes ___ No

   If yes, what is this weight? _____ pounds
   At what age did you first reach this weight? _____ years old

5. What is the most weight you have ever lost? _____ pounds
   Did you lose this weight on purpose? ___Yes ___ No

   What weight did you lose to? _____ pounds
   At what age did you reach this weight? _____ years old

6. What do you think your weight would be if you did not consciously try to control your weight? _____ pounds

7. How much would you like to weigh? _____ pounds

8. Age at which weight problems began (if any): _____ years old

9. How many diets would you estimate you have been on? _____

10. How old were you when you first became weight conscious?
_____ years old

11. How old were you when you first started dieting? _____ years old

12. Aside from holiday feasts, have you ever eaten a large amount of food rapidly and felt afterward that this eating incident was excessive and out of control? ___ Yes ___ No

    If yes to the previous question, how often have you engaged in this behavior during the last year?

    ___ Less than once a month
    ___ A few times a month
    ___ About three a week
    ___ About once a month
    ___ About once a week
    ___ Daily

13. Have you ever purged (used laxatives, diuretics or induced vomiting) to control your weight? ___ Yes ___ No

    If yes to the previous question, how often have you engaged in this behavior during the last year?

    ___ Less than once a month
    ___ A few times a month
    ___ About three a week
    ___ About once a month
    ___ About once a week
    ___ Daily

14. What is the maximum amount of weight (excluding normal menstrual cycle fluctuations) that you have ever GAINED in a week (lbs.)? _____ pounds

15. What is the maximum amount of weight (excluding normal menstrual cycle fluctuations) that you have ever LOST in a week (lbs.)? _____ pounds

Directions: Please refer to the following key for questions 16-29, placing the letter that represents your response on the line to the left of each question:

A = Always	**B** = Usually	**C** = Often
D = Sometimes	**E** = Rarely	**F** = Never

___ 16. I eat sweets and carbohydrates without feeling nervous.

___ 17. I eat when I am upset.

___ 18. I think about dieting.

___ 19. I stuff myself with food.

___ 20. I feel extremely guilty after overeating.

___ 21. I have gone on eating binges where I felt that I could not stop.

___ 22. I am terrified of gaining weight.

___ 23. I think about bingeing (overeating).

___ 24. I exaggerate or magnify the importance of weight.

___ 25. I eat moderately in front of others and stuff myself when they're gone.

___ 26. I am preoccupied with the desire to be thinner.

___ 27. I have the thought of trying to vomit in order to lose weight.

___ 28. If I gain a pound, I worry that I will keep gaining.

___ 29. I eat or drink in secrecy.

APPENDIX E

PRE-SESSION ACTIVITY & FOOD LOG

Directions: Use this form to log your daily activity (e.g., reading, sleeping, walking to class) and food intake in detail.

Date: _____

	ACTIVITIES (what?)	***DURATION*** (minutes)	***INTENSITY*** (lt.-mod.-heavy?)	+	***FOOD*** (what?)
6:00 am to 9:00 am				+	
9:00 am to 11:00 am				+	
11:00 am to 1:00 pm				+	
1:00 pm to 4:00 pm				+	
4:00 pm to 6:00 pm				+	
6:00 pm to 9:00 pm				+	
9:00 pm to 6:00 am				+	

Was today's activity typical of your normal activity? YES NO (> or <)

Was today's eating typical of your normal eating? YES NO (> or <)

APPENDIX F

CONSENT TO ACT AS A HUMAN SUBJECT FORM

UNIVERSITY OF NORTH CAROLINA AT GREENSBORO
Consent to Act as a Human Subject

I, _____, agree to participate in a research project to be conducted at the Exercise and Sport Psychology Laboratory at the University of North Carolina at Greensboro. I have been informed that the purpose of this research is to examine the relationships between taste preferences, exercise and mood.

My participation in this project has been described to me as follows: I will taste and rate various food flavors and will participate in an "exercise" (cycling and simultaneous hand weight exercises) or a "no exercise" session (quiet reading). Additionally, I will complete questionnaires during the investigation.

I understand that the following experimental procedures will be used in this investigation: during the taste test, I will first consume a drink in preparation for the subsequent taste test. I have been informed that the initial drink (milkshake) serves to sensitize my taste perception to a similar food that I will be taste testing. If involved in the exercise session, I will be asked to perform a 20 minute protocol that is thought to be a very high calorie burning activity at a submaximal intensity (85% of my age-predicted maximum heart rate). If involved in the "no exercise" session, I will read quietly for 20 minutes. I will be asked to observe a video in between my tasting and assigned exercise session to allow adequate digestion time.

I understand that a potential benefit of this project is gaining a greater understanding of the relationship between taste preferences, exercise and mood.

I understand that if involved in the "exercise" session I may experience the following risks and discomforts: local muscular fatigue, shortness of breath, nausea and dizziness. These conditions, however, are not often experienced by exercising at a submaximal intensity. Less probable are cardiovascular complications that can be induced by exercise in an extremely small proportion of the normal population involved in maximum exercise intensities (i.e., less than 2 out of 10,000 participants involved in maximal aerobic power or VO2max tests).

I understand that my exercise session will be supervised and

monitored by a certified exercise leader.

I have been informed that my expected laboratory involvement in this project will be approximately 1.5 hours in length. Also, I am aware that I will be asked to refrain from exercise for 24 hours preceding and following my laboratory appointment and I will be asked to record both my general activity and food intake on log forms for this period. In addition, I have been informed to consume a "typical" meal within 2 hours of my laboratory appointment. I have also been informed that I will be asked to return my post-session activity and food log to the investigator approximately 24 hours following my laboratory appointment at which time I will be asked to complete a final questionnaire.

I understand that as a participant, my personal rights and privacy will be maintained. There are no procedures used in this study which will invade my privacy. In addition, I will not be identified by name when the data are reported. To maintain confidentiality of my records, Elizabeth Hart will code results by number rather than by name. Only Elizabeth Hart, Dr. Crews and research assistants will have access to this information. Following the study, I will be able to see the data collected on me.

I have been informed that I can contact Elizabeth Hart (334-3275) or Dr. Debra Crews (334-3030), Department of Exercise and Sport Science, if I have any questions about this research.

I have been informed that I will not be compensated for my participation in this project, but I may receive credit for participation from my ESS or PHE instructor.

I am also aware that in the event of physical injury or illness, facilities and professional care which are available will not be provided free of charge and that monetary compensation for such injuries will not be made.

CONSENT: I have been satisfactorily informed about the procedures described above and the possible risks and benefits of the project, and I agree to participate in this project. Any questions that I have about the procedures have been answered. I understand that this project and this consent form have been approved by the University Institutional Review Board which ensures that research projects involving human subjects follow federal regulations. If I have any questions about this, I will call the Office of Research Services at (919)

334-5878.

I understand that I am free to withdraw my consent to participate in the project at any time without penalty or prejudice. In addition, I will not be identified by name as a participant in this project.

Any new information that might develop during the project will be provided to me if that information might affect my willingness to participate in the project. I have been informed that the general results of the project will be sent to me at the address I list below as soon as the investigator completes the project and I can contact the investigator at any time if I have any specific questions about the project.

_____	_____
Subject's Signature	Witness to Signature
_____	_____
Printed Name	Social Security #

_____

Today's Date

General Information

Date of Birth: _____ Age: _____

Mailing Address: _____

Telephone Number: _____

Best Times to Call: _____

ESS or PHE Class Time: _____

ESS or PHE Instructor: _____

APPENDIX G

RESULTANT AFFECT AND PERCEIVED CONTROL

Directions: In response to each of the following statements, indicate your feelings, attitudes, or thoughts as they are RIGHT NOW in relation to the upcoming task. Use the following numerical scale:

1. The statement does not describe my present condition.
2. The condition is barely noticeable
3. The condition is moderate
4. The condition is strong
5. The condition is very strong; the statement describes my present condition very well.

____ 1. I feel my heart beating fast.

____ 2. I feel regretful.

____ 3. I am so tense that my stomach is upset.

____ 4. I am afraid that I might do poorly on this task.

____ 5. I have an uneasy, upset feeling.

____ 6. I feel that others will be disappointed in me.

____ 7. I am nervous.

____ 8. I feel I may not do as well on this task as I could.

____ 9. I feel panicky.

____ 10. I do not feel very confident about the potential results of this task.

____ 11. I feel depressed.

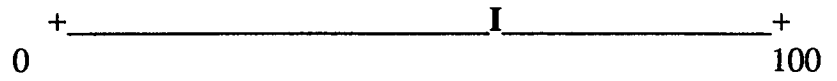
____ 12. I feel I am in control at this time.

APPENDIX H

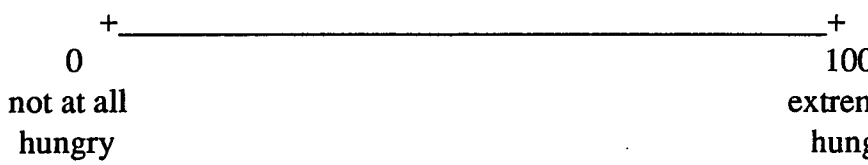
HUNGER SCALE

Directions: Please place a mark at any point on the continuum that bests represents HOW YOU FEEL AT THIS TIME.

Example: The mark below ("I") represents a response of approximately 60



1. How hungry are you at the present time?



2. How strong is your desire to eat something at the present time?

3. How full are you at the present time?

4. Have you eaten within the last 2 hours? YES NO
   If NO, how long ago did you eat? _____ hrs.

APPENDIX I

THOUGHT-LISTING

Directions: List one thought as concisely as possible in each box below.

APPENDIX J

THOUGHT-LISTING INTER-RATER RELIABILITY

THOUGHT-LISTING INTER-RATER RELIABILITY

Reliability Formula:

1 - (# of Thoughts of Disagreement/Total # of Thoughts)

Affect Theme:
1 - (14/900)
1 - .0155
.9844
=98%

Food Theme:
1 - (1/900)
1 - .0011
.9988
=99%

Exercise Theme:
1 - (3/900)
1 - .0033
.9966
=99%

Control Theme:
1 - (8/900)
1 - .0088
.9911
=99%

APPENDIX K

TASTE PREFERENCE RATING SHEET

TASTE PREFERENCE RATING SHEET

Using the following scale, rate each sample:

5 = extremely

3 = moderately

1 = slightly

	"A"	"B"	"C"
1. How sweet is the product ?	___	___	___
2. How creamy is the product ?	___	___	___
3. How smooth is the product's texture ?	___	___	___
4. How salty is the product ?	___	___	___
5. **Check** which sample(s) you would buy if price was not a concern.	___	___	___
6. On the following scale, rate the overall "tastiness" of each sample:	___	___	___

1 = extremely tasty

2 = very tasty

3 = moderately tasty

4 = moderately untasty

5 = very untasty

6 = extremely untasty

	YES	NO
7. Compared to similar products you have tasted, is this product "tastier" ?		

APPENDIX L

POST-SESSION ACTIVITY & FOOD LOG

Directions: Use this form to log your daily activity (e.g., reading, sleeping, walking to class) and food intake in detail.

Date: _____

ACTIVITIES (what?)	***DURATION*** (minutes)	***INTENSITY*** (lt.-mod.-heavy?)	+	***FOOD*** (what?)
6:00 am to 9:00 am				
9:00 am to 11:00 am				
11:00 am to 1:00 pm				
1:00 pm to 4:00 pm				
4:00 pm to 6:00 pm				
6:00 pm to 9:00 pm				
9:00 pm to 6:00 am				

Was today's activity typical of your normal activity? YES NO (> or <)

Was today's eating typical of your normal eating? YES NO (> or <)

APPENDIX M

POST-SESSION QUESTIONNAIRE

I. Did you exercise at all in the 24 hours following your laboratory session? YES NO

A. If YES, what did you do?

_____

1) Did you have a particular reason for exercising? YES NO

a) If YES, what was your reason?

_____

B. If NO to "I", did you feel like exercising in the 24 hours following your laboratory session? YES NO

1) If you felt like exercising in the 24 hours following your laboratory session what would you have done?

_____

2) If you felt like exercising in the 24 hours following your laboratory session did you have a particular reason for desiring to exercise? YES NO

a) If YES, what is your reason?

_____

II. How did you feel about consuming 1000 calories during the laboratory session?

_____

III. Did your caloric consumption during the laboratory session affect your eating patterns following the session? YES NO

A) If YES, how did it affect your eating patterns?

_____

IV. Did your caloric consumption during the laboratory session affect your exercise patterns following the session? YES NO

A) If YES, how did it affect your exercise patterns?

_____

APPENDIX N

GLOSSARY OF TERMS

"Blow It": To fail.

(Ex: "I'll probably blow it," similar to "I'll probably fail.")

Counter-regulation: Showing an unreasonable degree of subsequent caloric consumption (binge) in response to prior consumption. Theorized to result from dietary disinhibition.

Disinhibition: Increase in normally inhibited behavior--abandonment of rigorous self-control; overindulgence; a temporary overpowering of self-imposed restraint; motivational collapse; elevated consumption.

Displaced Reactance: Creating a sense of control elsewhere ("secondary control") that substitutes for the original source of lack of control.

Restraint: A cognitively mediated effort to combat the urge to eat. Motivation to exert strict self-control in response to pressures to eat.

"Sham": A trick that deludes; to act intentionally as to give a false impression; to pretend to be.

"What the Hell Effect": Justified interruption of motivation; Subjective state of caloric abandon.