FOOD CONSUMPTION, RESTRAINT, AND STRESS

1989

TALMADGE

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Abstract

It is important to examine the relationship between stress and food consumption because of the pervasiveness of stress in today's society and the health and social consequences of over and/or undereating. Literature addressing the food consumption and stress relationship does not completely clarify the role of stress in eating behavior. Recent studies have found that restraint, sex, and food type affect the results of studies. However, these studies left some important questions unanswered. The present study compared restrained and unrestrained women's eating during both stress and control. The previously proposed reduction in restraint during stress was also tested, and the effect of food availability on stress levels of restrained and unrestrained women was tested. The relationship between distraction and food consumption was examined.

Sixty-four women participated in the experiment. A repeated measures, counterbalanced design was used. Stress was manipulated by having subjects give a speech that was videotaped. As a control, subjects prepared but did not give another speech. One condition afforded high and low restrainers the opportunity to eat snacks from three different taste groups during both stress and control, while the other condition was similar but no food was available. Psychophysiological, mood, restraint, and distraction measures were obtained during both manipulations.

Restrained women ate less than unrestrained women. Under stress, restrained women did not change food consumption, but unrestrained women ate more. Distraction was not significantly related to eating in high restrainers but was significantly and positively related to eating in low restrainers during a nonstressful situation. Opportunity to eat stressed high restrainers, and high restrainers ate similarly during stress and control. Also, high restrainers' restraint increased during stress.

Therapeutic approaches toward weight loss should consider the restraint category of the individual. Weight loss therapies for low restrainers should probably include relaxation because low restrainers ate more during stress. The opportunity to eat stressed the high restrainer, but they ate similarly during stress and control. These findings suggest that presenting food to the high restrainer on a diet may assist her not to eat because it increases her restraint.

FOOD CONSUMPTION, RESTRAINT, AND STRESS

by

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Dissertation submitted to the Faculty of the Department of Medical Psychology Graduate Program of the Uniformed Services University of the Health Sciences in partial fulfillment of the requirements for the degree of Doctor of Philosophy

1989

DEDICATED TO BRANDON LEWIS TALMADGE

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The fact that stress alters typical eating behavior in both humans and animals has been recognized; stress can lead to either overeating or undereating (Willenbring, Levine, & Morley, 1986). Anecdotal reports suggest that some individuals eat more when under stress, while others eat less under stress. In addition, some individuals report that they eat differently because their food preferences change during stress. Almost all of us are acquainted with the "sugarholic" responding to stressful times.

It is important to examine the relationship between stress and food consumption in light of the pervasiveness of stress in today's society and the health and social consequences of over and/or undereating. For instance, obesity is a highly prevalent and chronic medical condition that is directly or indirectly responsible for several medical problems such as diabetes, arthritis, gall bladder disease, hypertension, coronary disease, and certain cancers (Downes, 1953; Kaplan & Kaplan, 1957; Powers, 1980; Osserman & Dolger, 1951; U. S. Public Health Service, 1966). It is clear that being overweight is a socially stigmatized condition. Stunkard (1979) noted that more people are receiving treatment for obesity than for all other conditions combined. Many people want to lose weight, either for health reasons, social reasons, or a combination of both. Greater understanding of stress-induced changes in food consumption could lead to more efficacious treatment of obesity and other eating-related health problems such as anorexia nervosa and bulimia. For instance, Keck and Fiebert (1986), in their comparison of inpatients and outpatients having bulimia or anorexia with normal dieters, reported that the degree of overreaction to specific life contingencies such as death, fate, guilt, emptiness, etc. was predictive of the degree of severity of eating disorder. They suggest that a main concern for recovery of the anorectic or bulimic is to accept life's contingencies and to learn problem solving. An understanding of the relationship of stress and food consumption could lead to better treatment of weight and nutritionally related health problems that affect many individuals.

Laboratory studies of stress and food consumption have been performed but have not clarified the contributory role of stress in eating disorders significantly more than case reports or personal experience. Some studies report an increase in eating behavior during stress (Leon & Chamberlain, 1973; McKenna, 1972; Slochower & Kaplan, 1980; Slochower, Kaplan, & Mann, 1981; Stunkard, Grace, & Wolff, 1955), while others report decrease or no change in food consumption during stress (Abramson & Wunderlich, 1972; Reznick & Balch, 1977; Schachter, Goldman, & Gordon, 1968). More recent studies have concluded that individual differences may determine whether stress leads to increased or decreased food consumption (Baucom & Aiken, 1981; Frost, Goolkasian, Ely, & Blanchard, 1982; Herman & Polivy, 1975;

Herman, Polivy, Lank, & Heatherton, 1987; Meyer & Pudel, 1977; Polivy & Herman, 1976; Willenbring et al., 1986).

A review of the stress and eating literature follows divided into sections based on findings of either increases, decreases, or both increases and decreases in food consumption during stress. The review divides into these sections for purposes of logical clarity rather than any theoretical reason. The first section briefly reviews some animal models of stress-induced eating. Animal models are included in the review because they provide additional evidence that stress affects consummatory behavior. A discussion of human studies of stress and eating behavior then follows. This review is arranged so that those studies which demonstrate increased food consumption under stress are presented first, followed by those studies which show a decrease in food consumption during stress, and followed by those studies which demonstrate mixed results of the effects of stress on food consumption.

Animal Models of Stress-Induced Eating

The animal literature consists of both naturalistic and experimental studies which pertain to stress and food consumption. The ethology literature is briefly reviewed, followed by experimental studies.

Naturalistic

The ethology literature contains many examples of stress-induced eating and consummatory behavior. Kruijt (1966) found that during fights between male jungle fowl, pecking at the ground was more than four times as common in winners than losers, and that the converse ratio was found for preening. McFarland (1965) reported that barbary doves that were inhibited in drinking or courtship behavior pecked at small objects on the ground. Cichlid fish have been reported to bite at sand and stone during intervals between fighting (Immelman, 1980), and stickle-back given electric shocks engage in hurried feeding similar to that following food deprivation (Tugendhat, 1980). Direction of causality cannot be inferred in naturalistic studies, and much of the behavior appears to be instinctual, making it difficult to draw parallels to the relationship between psychological stress in humans and food consumption. These studies suggest that stress leads to consummatory type behaviors in several species of animals in their natural habitat.

Experimental studies

In this section, animal research which experimentally manipulates stress and examines eating behavior is discussed. Much of this research utilizes rats or mice, although other species such as guinea pigs, rabbits, and cats have demonstrated findings similar to that of the rat (Kupferman, 1964; Morley, Levine, & Rowland, 1983). Only those studies using the rat are discussed because of the similarity of findings in other species and the preponderance of studies using rats.

Levine and Morley (1981) reported that a mild tail pinch on rats induced comsummatory behavior. Male rats were placed in a box with two pellets of rat chow and tail pinch was applied. Food consumption was quantified by weighing the pellets before and after the experimental period. Chewing was quantified by weighing the remainder of the pellets left behind after the food had been passed through a grid with $2mm^2$ pores. The authors concluded that this stress-induction technique serves as an excellent model of eating because it correlates well with starvation-induced eating and it precludes the necessary deprivation of food and water to adrenalectomized animals.

Other animal studies (Antelman & Caggiula, 1977; Levine, Morley, Wilcox, Brown, & Handwerger, 1982; Rowland & Antelman, 1976; Antelman, Rowland, & Fisher, 1976) have used tail pinch as a model of stress-induced feeding. Sustained mild tail-pinch in their animals induced a variety of oral behaviors including gnawing, eating, and licking. Physical stressors such as the tail pinch are limited in their utility of providing good models of stress-induced food consumption in the human because humans most often experience psychological stressors, and because in animals, physical stressors often lead to gnawing, biting, and consumption of nonfoods, behaviors not usually associated with human stress and food consumption (Morley, Levine, and Rowland, 1983).

The variety of species and situations in which stress-induced feeding or consummatory behavior is observed in animals provides some support for stress-induced increases in food consumption. However, the problems inherent in generalizing from animal to human studies limits the strength of the statements that can be made on the basis of animal studies alone.

Human Studies in which Stress Increased Food Consumption in Obese Individuals

The literature consisting of human studies in which stress increased food consumption is both correlational and experimental. Correlational studies are reviewed first, followed by experimental studies. The correlational studies provide weak evidence that stress induces eating. The experimental studies provide stronger support, but have methodological limitations which compromise their conclusions. The methodological limitations are discussed after each study, and the basic findings are summarized at the conclusion of the section.

Field studies

Three correlational field studies found a relationship between stress and total food consumption.

Stunkard et al. (1955) observed 23 female and 2 male obese patients at a special study clinic in a hospital and determined that their eating pattern formed a distinctive syndrome characterized by nocturnal hyperphagia, insomnia, and morning anorexia. This pattern was not found in 38 subjects studied who had no history of eating disorder. The authors noted that in the obese subjects, the "night eating syndrome" was particularly prominent during periods of weight gain and increased life stress. However, these conclusions are limited because of the reliance on patient self-report of life stress. Additionally, the subjects were considerably more obese than subjects in many other studies, having been referred from other departments at the hospital because of the severity of their obesity. This correlational study suggests that extremely obese females are likely to retrospectively report weight gain during periods of life stress.

In another correlational field study, Leon and Chamberlain (1973) contacted members of a weight reduction club one year after they had successfully reached their goal weight. They classified these individuals as either weight-regainers or weight-maintainers. The subjects were asked to fill out a history questionnaire which included items about food, family mealtimes, and the eating habits of other members of the family. Information was also gained about whether the subjects reported an association between eating and emotional states, and the life events occurring when the individual recognized that overeating was a problem. A control group of normal weight individuals was also given the questionnaire. The individuals who regained lost weight reported that they ate more during emotional arousal, while the predominate response of the control group (normal weight) was reported as eating when hungry rather than when emotionally aroused. Individuals who had lost weight and maintained the loss reported eating primarily in response to loneliness and boredom. The study also demonstrated the important role that taste probably has in food studies. Weight-regainers (30 females and 4 males) ranked pastries as their most preferred foods and diary products as their least preferred food. Weight-maintainers (19 females and 3 males) ranked pastry and meats equally as their most preferred foods, and starches as their least preferred foods. Control individuals (28 females and 11 males) ranked meats as their most preferred foods and dairy products as their least preferred foods. It is interesting to note that three other food consumption studies (Herman & Mack, 1975; Herman & Polivy, 1975; Herman et al., 1987) used ice-cream as the "test food" in their experiments, possibly limiting consummatory behavior in those studies because dairy products may be the least favorite food of many subjects.

The Leon and Chamberlain (1973) study is limited in its conclusions because of the possibility of self-reporting errors by the subjects, and because 95% of the subjects were female. Because of the correlational nature of the study, other interpretations of the results are possible. For instance, it could be that eating was the basis for emotional arousal in the obese subjects rather than that emotional arousal caused eating in these subjects. The study does suggest that females who have had weight problems retrospectively report that emotional arousal increases food consumption, while those who have never had a weight problem do not report this relationship. It also points to differences in food preferences between obese and normal weight subjects; obese subjects rank pastries as their most preferred foods while normal weight subjects rank meats as their most preferred food.

Slochower et al. (1981) assessed the effects of the stress of final examinations on food consumption in 23 moderately overweight and 14 nonobese female undergraduates by obtaining pre and post final exam questionnaires containing 13 mood scales which focused on current emotional states. Food consumption (MM candy) was measured in the laboratory under the guise of a "thinking task" designed to present eating as one of several equally appropriate activities in which to engage. They found that during examination week, as compared with post-exam measures obtained three weeks later, obese students ate considerably more candy (21.71 grams vs. 8.19 grams), while normals showed only a non-significant decrease in MMs consumed during examination week (3.05 grams vs. 7.01 grams). Only during exam week did obese eat more MMs than normal weight subjects.

Correlations between the questionnaire measures of anxiety and eating in the laboratory for the obese students was significantly and positively related to the degree of anxiety which they experienced. In contrast, normal weight students decreased their eating somewhat when they felt more anxious. The study was correlational and is, therefore, open to explanations other than that stress induced eating in the obese women. It could have been that during exams the obese ate in an uncontrolled manner which therefore produced eating in the laboratory situation and heightened anxiety. The study does provide some support for increases in sweet food consumption in obese females during a stressful life event.

These three studies demonstrate that obese females who either never lose weight, regain lost weight, or maintain weight loss are more likely to retrospectively report increased eating and to eat more sweets in the laboratory during emotional arousal than are individuals who have never had a weight problem. It also suggests that there may be differences in food preferences among those who lose weight and maintain the loss, those who regain lost weight, and those who have never had weight problems. Normal weight females are likely to eat in response to hunger rather than emotional upset or boredom. Because of the limited number of males included in these three studies, no conclusions are made about males' consummatory response to stress.

Human Laboratory Studies

This section includes three experiments in which stress or emotional arousal was experimentally manipulated. Each is discussed and critiqued and the findings are summarized. McKenna (1972) used obese or normal weight male subjects and varied the "valence" (taste and appearance) of the test food (cookies) "that would be marketed in about six months." He manipulated anxiety by making subjects feel comfortable in the low anxiety condition but fearful of embarrassing and painful medical procedures in the high anxiety condition. Subjects in this condition were led to believe that they would have to provide a blood sample, a urine specimen, and a rectal stool sample, although these procedures did not actually occur. McKenna hypothesized that the difference between the amount of test food eaten by overweight and normal weight subjects should depend on whether external cues or internal cues exert primary control of eating among the obese. This hypothesis was based on Schachter's (1971) findings that overweight persons pay more attention to external eating cues (appearance of food, habit, social stimuli) than internal eating cues (gastric contractions, blood sugar level). McKenna (1972) found that obese subjects ate considerably more (33%) under high anxiety than low anxiety. This finding was more pronounced for high valence food than low valence food. However, the interaction of weight and food-cue valence was not statistically significant. Normals and obese did not eat significantly different amounts in the low anxiety condition. Questionnaires that included manipulation checks were administered to all subjects to determine the effectiveness of the anxiety variable. There was a significant correlation between the amount eaten in the high anxiety condition and the deviation from ideal weight standard in the obese subjects, suggesting that eating in response to anxiety is a function of obesity level. The author noted that, based on results of the questionnaires, the eating habits of obese subjects resembled the "night eating syndrome" described by Stunkard (1955). The reader will recall that this syndrome is characterized by nocturnal hyperphagia, insomnia, and morning anorexia.

McKenna's study may be methodologically limited because all subjects were preloaded in order to bolster the cover story of the experiment. Each subject consumed two caramels, a cup of hot bouillon soup, two dried apricots, an ounce of quinine water, and roast beef sandwiches prior to being given the cookies. The effects of a preload on subsequent eating is probably different for obese and normal weight individuals (Herman & Mack, 1975; Herman & Polivy, 1975). The study found that anxiety increased consumption of sweet foods in preloaded obese males, but decreased consumption of sweet foods in preloaded normal weight males. Thus, among subjects who were not hungry, it seems that anxiety led to increased consumption of sweets in the obese but less consumption of sweets in normal weight individuals.

Slochower, Kaplan, and Mann (1981) recruited obese and normal weight male undergraduates for a study of "cognitive processes." Sixty-two moderately obese subjects and 67 normal weight subjects participated. Arousal was manipulated by presenting bogus audio feedback of the subjects' heart-rate during a "baseline measurement"; those in the high anxiety condition heard a rate of 88 beats per minute while those in the low anxiety condition heard a rate of 70 beats per minute. After this manipulation, subjects in one condition were told that the unusual noise level produced by wearing earphones in the laboratory probably accounted for their heart rate (label condition). Subjects in the no-label condition were given no explanation for their heart rate. The authors were testing the hypothesis that a diffuse, unlabeled source of anxiety as opposed to anxiety that has a clear source leads to the obese individual's idiosyncratic eating response. The dependent measure was the number of cashews eaten during a "thinking task" in which the subject viewed several objects (including the nuts) and were asked to think about and feel free to touch, feel, or doodle with the toys, or eat the cashews. As predicted by the authors, obese subjects' eating increased significantly in the anxious condition, and normal weight subjects' eating was unaffected by the experimental manipulation of anxiety. However, when subjects' self-reports of anxiety immediately after the experimental manipulation of anxiety were correlated with eating salty nuts, a significant negative correlation was revealed for normal weight subjects and a significant positive correlation was found for the obese subjects.

The results of this study are inconclusive because it is unclear whether the manipulation of anxiety was sufficient. The check on the anxiety manipulation consisted of subjects rating themselves on two nine point scales immediately following the heart rate manipulation. The two questions were: "how fast do you think your heart is beating?" and "how anxious do you feel?" As compared with low anxiety subjects, participants who heard the more rapid heart rate feedback reported that their heart was beating faster and reported feeling more anxious. Yet, when asked in an open-ended question what they believed had affected their heart rate during the baseline measurement, those subjects in the label condition were more likely to give attributions to "the earphones" or "being tested," while most subjects in the no-label condition left this question blank. It is questionable whether hearing a faster heart rate without any reason to attribute it to anxiety is sufficient to induce anxiety. It may also be the case that the heartbeat sounds produced an internal focus which differentially affected obese and normal weight subjects. The study supports increased consumption of salty foods in obese males who are anxious, but the effect of anxiety on normal weight males is less clear. Their eating was unaffected by the experimental manipulation of anxiety, although the correlation between their self-ratings of anxiety and food consumption was negative and significant.

These correlational and experimental studies appear to support stress-induced increases in food consumption in the obese. However, this conclusion is limited by interpretive problems of the correlational studies and methodological problems of the experiments. Of the studies reviewed, Stunkard (1955) and Leon and Chamberlain (1973) relied heavily upon self-report of life stress and food consumption rather than experimental manipulation of stress and actual measurement of food consumption. Additionally, both studies used female subjects almost exclusively. Slochower et al. (1981) used all female subjects and sweet foods as the test food. Because of the correlational nature of this study the results are open to other interpretations. McKenna (1972) may not be comparable to these two studies because he used all male subjects, the type of food available was limited to cookies, and preloading of obese and normal subjects may have had differential effects on the two groups. Slochower et al.(1980) also used male subjects, limited the test food to salty nuts, and may have created heightened awareness of internal sensations rather than anxiety. Therefore, the evidence suggesting that stress induces increases in food consumption is not conclusive.

Human studies in which stress decreases or does not affect food consumption

In contrast to studies demonstrating increased eating under stress, there are four studies that demonstrate diminished food intake under stress. In addition, clinical reports of depressed individuals and cancer patients typically report decreases in eating; diminished appetite is often used as part of the diagnostic criteria for depression (American Psychiatric Association, 1980; Burish, Levy, & Meyerowitz, 1985; Beck, Ward, Mendelson, Mock, & Erbaugh 1961). Only laboratory studies that find decreases in eating during stress are discussed in this section because no field studies were found which supported decreased eating during stress.

Human Laboratory studies

There are three laboratory studies reviewed in this section. Schachter, Goldman, and Gordon (1968) manipulated fear by telling male subjects that they would receive mild or painful electric stimulation as "part of the experimental test of the effect of tactile stimulation on taste." They also manipulated hunger level by directly manipulating whether or not a subject entered the experimental setting with an empty or full stomach. The number of crackers consumed during the "taste test" was the dependent variable. Overall, the amount eaten was similar between obese and normal weight subjects. However, fear markedly decreased the number of crackers eaten by normal weight subjects (34%) but had no effect on the amount eaten by the obese subjects. The study suggests that obese males do not eat more crackers when making taste ratings when they are anxious than when they are calm, while anxiety significantly reduces the number of crackers consumed by normal weight men who are making taste ratings. The results are limited because all subjects were male college students, the only food available was crackers, and it is possible that anxiety causes normal weight males to be less certain in their judgements, but has little effect on obese males' confidence in decision making.

Abramson and Wunderlich (1972) extended Schachter et al.'s (1968) finding that obese individuals eat approximately the same amount of food when they are calm as when they are anxious. Thirty-three obese and 33 normal weight college males were in either control, interpersonal anxiety, or objective fear conditions. The interpersonal anxiety condition was included to create neurotic anxiety (i.e., anxiety resulting from emotional conflict). The study was conducted within the framework of an experiment dealing with taste discrimination. There was no significant difference between amount of crackers eaten by anxious and nonanxious obese subjects. The results are limited because manipulation checks of anxiety levels indicated that only the obese subjects became anxious after the fear manipulations so that comparisons between obese and normal weight subjects were not possible. The study suggests that slightly to moderately obese males do not eat more crackers when making taste ratings when anxious than when calm. Because the anxiety manipulation was not effective for normal weight subjects, no conclusion as to the effects of stress on their food consumption can be made.

Reznick and Balch (1977) randomly assigned 46 male and 18 female subjects to either a control condition or a stress condition. In the stress condition, subjects were led to believe that the concept formation task they would participate in was equivalent to an intelligence test, and that incorrect answers would result in painful electric shock. Subjects in the low anxiety condition received relaxation instructions. Response cost was manipulated by presenting some subjects with unwrapped candies while others were presented with wrapped candies. The candy was made available as remuneration for participation in the experiment. The results are discussed by dividing them into number of subjects eating and amount (number) of candies eaten. Considering subjects who ate at least one candy, a greater number of obese subjects ate candies in the low-anxiety than in the high-anxiety conditions (11 vs. 6), while a roughly equal number of normal weight subjects ate candies in the low-anxiety and in the high-anxiety conditions (8 vs. 7). Regarding amount eaten, for the obese subjects who ate at least one candy, the mean number of chocolates eaten in the high anxiety-high response cost condition was significantly greater than the mean number eaten in the low anxiety-low response cost condition (10.5 vs. 2.86).[1] This study suggests that anxiety has an inhibitory effect on eating in obese subjects because fewer obese ate when anxious than when calm. However, if they did eat, they ate more than normal weight subjects during anxiety. Anxiety had a negligible effect upon the number of normal weight subjects eating candies in this study.

The studies in this section provide limited support that experimentally manipulated stress leads to a decrease or no change in food consumption in obese individuals. Of the studies specifically designed to examine the effects of stress on food consumption, two used all male subjects and one used 71.8% male subjects. In these three studies, fear of electric shock or some combination of social anxiety and fear of electric shock was employed as the stressor. Fear of electric shock is not a common stressor, possibly limiting the generalizeability of these studies. Two of these studies used crackers and one used candy as the test food, possibly confounding the comparability of their results. The Reznick and Balch (1977) study is confusing because it suggests that the obese may be less prone to eat when anxious than when

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1 The authors report that for obese subjects eating at least one candy, the mean number of chocolates eaten in the high-anxiety high-response cost condition was significantly <u>less</u> than the mean number eaten in the low-anxiety low-response cost condition. However, examination of their data shows that two obese subjects in the high-anxiety high-response cost condition ate a total of 21 candies (mean = 10.5), while 7 obese subjects in the low-anxiety low-response cost condition ate a total of 20 candies (mean = 2.86).

calm, but if they do eat, they may be prone to eat more than normal weight individuals who are anxious.

While this section suggests that stress leads to a decrease or no change in food consumption, it should be remembered that studies reviewed in the first section supported stress-induced increases in food consumption. However, that conclusion was limited by interpretive problems of the correlational studies and methodological problems of the experiments. Studies relied heavily upon self-report of life stress and food consumption rather than experimental manipulation of stress and actual measurement of food consumption. Also, use of either males or females and the availability of only one food limited the findings of these studies.

Human studies which show both increased and decreased food consumption

This section will discuss those field studies and experiments in which anxiety or stress led to bi-directional results within the same study, i.e., increased food consumption in some subjects and decreased food consumption in other subjects. These findings appear to be influenced by the personality variable of restraint (Herman & Mack, 1975). This individual difference taps eating history and dieting habits as well as weight history. Most of the studies which show increased and decreased food consumption during stressful conditions explain the discrepancy in terms of the personality variable of restraint. Prior to reviewing the studies and experiments, the development of the Restraint scale is discussed.

The concept of restraint was refined by Herman and Mack (1975) from attempts by Schachter and colleagues (Schachter, 1971; Schachter & Rodin, 1974) to ascertain the determinants of eating behavior in obese and normal weight individuals. Several studies conducted by Schachter's laboratory had suggested that the eating behavior of normal weight subjects is primarily determined by internal, physiological cues, while the obese's eating behavior is controlled primarily by external, social, and environmental factors. Nisbett (1972) hypothesized that both normal weight and obese individuals eat to bring their weight into line with a biologically determined setpoint. Herman and Mack (1975) reasoned that two individuals who are exactly identical in weight might differ with respect to the extent to which their current weight corresponds to their hypothalamically protected setpoint. So one obese eater might still be "underweight" with respect to his setpoint and consequently behave in an externally controlled manner, a pattern which shows many parallels with the normal weight eater who has been deprived of food and is thus below their setpoint. Another obese eater, in contrast, may be at his setpoint and therefore exhibit less external control of his eating behavior. Herman and Mack (1975) suggested that the biological setpoint discrepancies might underlie a population of normal weight persons. They assumed that many normal weight eaters are at their setpoints and therefore eat in the internally controlled manner suggested by Schachter. In addition, they hypothesized that there are probably many normal weight eaters who are "biologically underweight," but who do not overeat because of cultural and social demands to restrain their eating in order to remain at an "ideal" weight.

Herman and Mack (1975) tested their hypothesis by preloading normal weight college female subjects with either zero, one, or two milkshakes in an experiment in which subjects thought the purpose was to examine the effects of one "sensory experience" upon another subsequent experience in the same sensory modality. The purpose of the preload was to remove the chronic restraint of those individuals below their biological setpoint. It was hypothesized that the experimental manipulation of situational restraint ought to have little effect on subjects not chronically restrained. All subjects were preloaded and then provided with three 3-pint containers of chocolate, vanilla, and strawberry ice-cream and were asked to rate the taste of each flavor on various dimensions. After the taste ratings had been made, the subject was told to feel free to help herself to any ice-cream remaining. The dependent measure was the amount of ice-cream eaten. After the ten minute rating period, the subject filled out an eating habits questionnaire composed of 38 items related to eating and dieting habits and weight history. Ten of these items were selected on the basis of face validity prior to the study; statistical refinement with respect to reliability resulted in five items on which the restraint score analyses were based (see Appendix A). High restraint subjects (on the basis of a median split) consumed more ice-cream after the milkshake preload than after no preload at all. Low restraint subjects consumed decreasing amounts of ice-cream as a function of the size of the preload. The main effects of preload and restraint were not statistically significant, but their interaction was significant.

Herman and Mack (1975) concluded that Schachter's internality-externality hypothesis as the basis of differences in the pattern of eating behaviors of the obese and normal weight individuals could be better reconceptualized as differences in restraint. This reconceptualization was based on the results of their study which suggested, that within normal weight subjects, sizeable differences exist with respect to concern with weight and eating behavior (restraint), and corresponding to these individual differences in restraint are strong differences in eating behavior.

Field studies

There are two field studies in which the individual difference of "restraint" demonstrated that some individuals eat more and others less when experiencing stress. Polivy and Herman (1976) conducted a study of clinical depression and eating habits using 9 female and 3 male nonobese patient volunteers from an adult outpatient psychiatry unit. These moderately depressed outpatients filled out a questionnaire which assessed their depression and related weight changes, the Herman Restraint questionnaire, and an additional question about the effects of their depression on eating behavior. There were no significant differences between restrained and unrestrained individuals with respect to degree of depression, duration of depression, or number of symptoms. The hypothesis that restrained depressed patients would differ from unrestrained depressed patients in that the former would report a weight gain and the latter a weight loss in conjunction with their depression was confirmed. However, the results may be limited because weight gain or loss was by patient self-report using onset of depression as the baseline. It is not clear whether there were differences in the amount of exercise that restrained and unrestrained engaged in, or whether differences in accuracy of recall or willingness to report weight gain or loss between restrained and unrestrained individuals might account for the differences. Because only depressed individuals were included in this study, it cannot be determined for sure whether high-restraint persons report more weight gain than low-restraint persons regardless of levels of depression. The study is also limited due to the number of subjects, especially males. It does suggest that emotions may disrupt the chronic self-control of the restrained eater, increasing food consumption; and in unrestrained eaters, for whom self-control is not such an issue, the physiological correlates of emotional experience may inhibit hunger or food consumption and determine eating behavior.

In a field study that did not measure individual differences in restraint, Willenbring et al. (1986) recruited both obese and normal weight subjects from three groups: obese subjects from a medicine clinic, people in an organization for individuals wanting to lose weight, and normal and overweight workers from a V. A. hospital. They used 20 male and 60 female subjects, ranging in age from 20 - 71 years. Each subject completed an eating habits questionnaire and the Symptom Checklist-90, a self-report rating of the degree of being bothered by various symptoms in the previous week. Subjects were also given four diet bars and asked to rate them in terms of texture and overall likability on a scale of one to ten. The bars were designed to be similar in terms of appearance and calories, but differed on the crunchy-chewy dimension. Responses to the eating questionnaire indicated that 44% of the subjects increased eating when stressed, 48% decreased eating when stressed, and 8% did not change eating when stressed. Sweets were preferred over salty foods by 46%, salty foods were preferred by 29%, and 21% expressed no preference.[2] Seventy-three percent of the subjects reported that they were currently dieting. The authors suggest that their results indicate that the self-perception of being a stress eater and current stress level is associated with food preference. A lower preference for one of the four test foods bars (chewier texture) was predicted by both being a stress eater and high stress in a multiple regression analysis. Preference for sweet over salty foods was not predicted by stress eating or current stress level. This finding is in keeping with animal studies suggesting that stress-induced eating is associated with a preference for crunchy textures (Levine & Morley, 1982). The results of this study are weakened because stress was not manipulated and food consumption data were correlational and based upon self-report. It is also unclear what proportion of those who decreased food consumption when under stress were obese and what proportion were normal weight. The same criticism is true for the reports of those who increased food consumption during stress.

The Polivy and Herman (1976) study suggests that individual differences in restraint may interact with depression to predict self-report of weight gain. The Willenbring et al. (1986) study indicates self-reported differences in food preferences dependent upon self-

2 The authors do not report results for the remaining 4% of the subjects.

perception of being a stress eater and current levels of stress. Both studies may involve self-reporting errors and biases, limiting their findings.

Human Laboratory Studies of Restraint and Food Consumption

There are five experiments in which restraint may explain the discrepant findings within an experiment that some subjects eat more and some subjects eat less when stress is manipulated. Herman and Polivy (1975) assigned 42 female subjects to a high or low anxiety condition using shock to manipulate fear. Subjects were led to believe that they were participating in a study of the influence of tactile stimulation on taste. They filled out a mood scale and then tasted three flavors of ice-cream for the "initial rating." Subjects were instructed to be sure of their ratings and were allowed to eat as much as they wanted. Immediately after the taste test was completed, subjects were administered another mood scale and the Restraint questionnaire. A median split of the Restraint scale scores based on the Herman and Polivy (1975) Restraint scale (Appendix B) was used to divide the subjects into restrained and unrestrained groups. Unrestrained eaters ate significantly less when anxious, while restrained eaters ate slightly more, although the increase was not significant. Neither anxiety nor restraint alone affected consumption. There were four obese subjects in the study. Analysis were performed in which the obese (all of whom were restrained) were eliminated. The results were the same: restrained normal weight subjects ate 24% more when anxious and unrestrained normals ate 39% less when anxious. These results were consistent with Schachter et al. (1968) if his obese-normal distinction is reconceptualized as a distinction between restrained and unrestrained eaters. Thus, it appears that restraint might lead to differences in consumption of sweet foods in females who have been preloaded with a sweet food and who are experiencing an acute laboratory stressor. However, it might also be true that restrained individuals are less certain of their judgements and thus ate more ice cream to be sure of their ratings. This criticism can be made of any study in which taste ratings form the guise for the measurement of eating.

Meyer and Pudel (1977) used a food dispenser so that the subject was less likely to know the amount of food ingested. Subjects took their meals consecutively from the food dispenser and stress was induced in the subjects before, during, or after the last three meals. Stress was induced by noise conditions, flicker light, or a task induced stress. Results were:

CHANGES IN FOOD INTAKE
(% of subjects)

	standard conditions	noise	flicker light	task induced
appetite increase	2%	13%	26%	30%
appetite decrease	1%	7%	3%	10%

Subjects who were older, female, and obese reacted more often with increased eating. Children reacted to stress with a decrease in appetite and an increase in the time they took to eat. Subjects over 65 years of age displayed a fixed food intake that was not influenced by stress. These results suggest that stress may increase food intake after childhood and that these effects may decline in old age. Restraint was not measured in this study.

Baucom and Aiken (1981) manipulated mood (depression) by administering a concept formation task and allowing half of their subjects to receive veridical feedback about their performance, while the other subjects received predetermined bogus feedback so that no correct answer was possible. Manipulation checks indicated that this was successful in creating a depressed mood in the bogus feedback condition. Subjects were 18 males and 38 female college students. The test food was three commercial brands of crackers. Restrained subjects ate more crackers when depressed mood was induced, and nondieters (unrestrained) ate less when depressed mood was induced. Additionally, among depressed subjects, dieters (restrained) ate more than nondieters (unrestrained); among nondepressed subjects, dieters ate less than nondieters. These results were found for both obese and nonobese subjects, indicating that dieting (restraint) was a more salient variable than obesity. The authors did not measure restraint in exactly the same way as Herman and Mack did originally; they defined restraint as current dieting habits rather than typical eating habits. The study supports Polivy and Herman's (1976) findings of the interactive effects of depression and restraint in a nonclinically depressed subject population.

Frost et al. (1982) experimentally induced either depressed, elated, or neutral mood in 55 female undergraduate students. During the mood-induction procedure the subjects were given the opportunity to eat MM candies. The subjects were classified as high or low in restraint immediately postexperimentally based upon a median split of the Restraint scale scores of all the subjects. Results were that depressed mood led to higher food intake among high-restraint subjects as opposed to either neutral or elated mood, and that depressed mood led to higher food intake among high-restraint individuals than low-restraint individuals. The eating behavior of low-restraint depressed individuals did not significantly differ from that of low-restraint neutral or elated subjects. This finding that depressed moods resulted in greater food intake among high-restraint female subjects parallels the outcome of previous research concerning the effects of anxiety on eating behavior.

Herman et al. (1987) used female subjects in a study which manipulated anxiety and state of hunger. Subjects in the high anxiety condition believed that they would be videotaped while giving an advertising jingle that they made up, while subjects in the low anxiety condition were told to think about aspects of the product which they had just tasted which should be highlighted in an advertising campaign. In the preload condition, subjects were asked to drink a milkshake; the deprived condition involved no preload and no food consumption for four hours prior to the experiment. The authors found that their anxiety manipulation was not particularly strong, so they reclassified subjects by self-report of anxiety regardless of experimental condition. Subjects were also classified as dieters or nondieters on the basis of the Revised Restraint scale (Herman & Polivy, 1980) (see Appendix C). The results were that hungry dieters (restrained) ate more when anxious than when calm, while hungry nondieters (unrestrained) ate slightly less when anxious than when calm. For those subjects who had been preloaded and were not hungry, neither dieters nor nondieters were affected by anxiety. The food available to subjects to consume was three flavors of ice-cream. It is unclear what effect a milkshake preload might have had on subsequent ice-cream consumption and what the availability of other types of food might have had upon consumption. Additionally, males were not used as subjects so it is unclear whether the results can be generalized beyond females. The fact that the anxiety manipulation was not sufficient and subjects were reclassified post hoc by self-report of anxiety are criticisms of the study. The study suggests that restrained females eat more sweets during stress than unrestrained females do.

Ruderman (1985) induced dysphoric or nondysphoric mood in 105 normal weight female college students who had previously filled out the Restraint scale (Herman & Mack, 1975; Herman & Polivy, 1975). Under the guise of a taste test, she measured the number of crackers consumed by the subject. The results were that restrained eaters ate significantly more after dysphoria had been induced than when in a nondysphoric mood. However, the unrestrained eaters ate similar amounts in both mood conditions. The study is limited because all subjects were female and a taste test was used to measure food consumption. It is possible that restrained females become less certain of their judgements when they experience dysphoria while unrestrained females do not. This could account for the fact that the restrained subjects ate more; they were trying to be more certain of their decision.

These experiments generally support the utility of Herman and Mack's (1975) concept of restraint in predicting differences in food consumption in stressed or depressed individuals. Two experiments provided support independent from the Herman and Mack and Herman and Polivy labs for the concept. Therefore, there is fairly strong evidence that restrained individuals eat more when they are stressed or depressed than when calm or nondepressed, while unrestrained persons eat less when anxious than when calm. These conclusions held for both sweet foods and crackers. Additionally, one study (Meyer & Pudel, 1977) supports age and sex differences involved in stress induced eating; subjects who were older, female, and obese reacted more often with increased eating, while children reacted to stress with a decrease in appetite. Taste test ratings were used in four of the five studies, thus allowing the alternative interpretation that differences in certainty of judgements between restrained and unrestrained individuals accounted for the obtained results.

Synopsis (see Tables 1,2,3,4)

It appears that the results of field studies and laboratory experiments examining the relationship of stress and food consumption in humans are inconsistent. Of those studies which do not measure restraint, five report that obese subjects increase food consumption during stress (Leon & Chamberlain, 1973; McKenna, 1972; Slochower et al., 1980; Slochower et al.,1981; Stunkard et al., 1955), while two have reported no change in obese subjects' food consumption as a result of stress (Abramson & Wunderlich, 1972; Schachter et al., 1968), and one (Reznick & Balch, 1977) reports a decrease in food consumption or weight loss in the obese in response to stress (see Table 1). Four of these studies find little or no effect of stress on consumption in the normal weight subject (McKenna, 1972; Slochower & Kaplan, 1980; Reznick & Balch, 1977; Slochower et al., 1981), while one (Schachter et al., 1968) finds a decrease in consumption for the normal weight subject (see Table 2). Of those studies

Table 1

OBESE SUBJECTS

AUTHOR	**STRESSOR**	**FOOD**	**SEX**
INCREASES IN FOOD CONSUMPTION			
Leon & Chamberlain (1973)	life stress	all	88% female
McKenna (1972)	medical procedures	sweet	male
Slochower et al. (1981)	final exams	sweet	female
Slochower & Kaplan (1980)	HR feedback	salty nut	male
Stunkard et al. (1955)	life events	all	female
DECREASES IN FOOD CONSUMPTION			
Reznick & Balch (1977)	concept formation	sweet	71% male
NO CHANGE IN FOOD CONSUMPTION			
Abramson & Wunderlich (1972)	interpersonal anx.	crackers	male
Schachter et al. (1968)	shock	crackers	male

Table 2

NORMAL WEIGHT SUBJECTS

AUTHOR	**STRESSOR**	**EFFECTS**	**FOOD**	**SEX**
McKenna (1972)	medical procedures	no effect	sweet	male
Reznick & Balch (1977)	concept formation	no effect	sweet	71% male
Schachter et al. (1968)	shock	decrease	crackers	male
Slochower & Kaplan (1980)	heartrate feedback	no effect	salty	male
Slochower et al. (1981)	final exams	no effect	sweet	female

Table 3

RESTRAINED SUBJECTS

AUTHOR	**STRESSOR**	**FOOD**	**SEX**
INCREASES IN FOOD CONSUMPTION			
Baucom & Aiken (1981)	concept formation	crackers	67% female
Frost et al. (1982)	induced depression	sweet	female
Herman et al. (1987)	self report	sweet	female
Polivy & Herman (1976)	depression	all	66% female
NO CHANGE IN FOOD CONSUMPTION			
Herman & Polivy (1975)	shock	sweet	female

Table 4

UNRESTRAINED SUBJECTS

AUTHOR	**STRESSOR**	**FOOD**	**SEX**
DECREASES IN FOOD CONSUMPTION			
Baucom & Aiken (1981)	concept formation	crackers	67% female
Herman & Polivy (1975)	shock	sweet	female
Polivy & Herman (1976)	depression	all	66% female
NO CHANGE IN FOOD CONSUMPTION			
Frost et al. (1982)	induced depression	sweet	female
Herman et al. (1987)	self report	sweet	female
Ruderman (1985)	induced dysphoria	crackers	female

reporting an increase in food consumption in the obese, three used almost exclusively female subjects (Stunkard et al., 1955; Leon & Chamberlain, 1973; Slochower et al., 1981) and two used all male subjects (Slochower & Kaplan, 1980; McKenna, 1972). One male study used salty nut consumption as the dependent variable, while the other measured sweet food consumption. Those studies that used females as subjects used either sweet food consumption or weight gain as the index of food consumption.

Of those studies reporting no effect of anxiety on food consumption among the obese, both used all male subjects (Schachter et al., 1968; Abramson & Wunderlich, 1972). The study which indicated an inhibitory effect of anxiety upon food consumption used both male and female subjects (Reznick & Balch, 1977). Both studies using exclusively male subjects used crackers as the measure of food consumption (Schachter et al., 1968; Abramson & Wunderlich, 1972). The study using both male and female subjects included foods from three different taste groups.

Considering those studies that measured restraint, restrained individuals increased their food consumption during stress in four studies (Polivy & Herman, 1976; Baucom & Aiken, 1981; Frost et al., 1982; Herman et al., 1987), while stress had no effect upon consumption in restrained individuals in one study (Herman & Polivy, 1975) (see Table 3). For unrestrained individuals (see Table 4), food consumption decreased during stress in three studies (Polivy

& Herman, 1976; Herman & Polivy, 1975; Baucom & Aiken, 1981) and remained unaffected in three studies (Frost et al., 1982; Herman et al., 1987; Ruderman, 1985). In these studies, subjects were either all female or predominantly female. Either sweet foods or crackers were the test foods in all but one of these studies. In the other study, self-reported consumption of all foods was used as the measure of consumption.

Recent investigations relevant to stress and food consumption

Grunberg, Sibolboro, and Talmadge (1988) performed a study which included all of the major variables that appear to have affected the results of other food consumption studies. Male and female subjects who were restrained or unrestrained eaters had access to (but were not required to taste) sweet, salty, and bland foods under stress or control conditions. This study included self-report, psychophysiological, and biochemical measurements to assess stress responses. Previous studies of stress and eating in humans either did not perform a manipulation check at all or used only self-report to validate their stress manipulation. Subjects in the Grunberg et al. (1988) study completed three self-report measures: the Profile of Moods States, the Multiple Adjective Affective Check List, and a questionnaire designed by the authors to assess anxiety created in the subjects by the manipulations. In addition, heart rate, blood pressure, and urinary catecholamine measures (epinephrine and norepinephrine) were obtained pre and post manipulation. Stress was manipulated by showing a workshop accident prevention film (Lazurus, Opton, Nomikos, & Rankin, 1965) that has been used as a stressor in many studies that assessed the effects of various treatment strategies on film-induced stress stimuli (see Rolf & Chesney, 1986); persons in the control condition saw a travelogue film.

The authors found that all three variables, i.e., restraint, sex, and food type available affected the results. Overall, stress decreased total food consumption. However, this effect was entirely due to significant effects of stress upon sweet food consumption by men. In men, neither bland food consumption nor salty food consumption was affected by the stress manipulation. Considering restrained and unrestrained women together, stress did not affect food consumption in women; women in the control and stress conditions ate similar amounts of sweet, salty, and bland foods. So, the overall findings that stress reduces food consumption held for men only in this study.

Restrained women ate less salty foods than did unrestrained women. Restraint did not affect sweet, salty, bland, or total food consumption in men. In the stress condition, restrained women ate more sweets than did unrestrained women. Unrestrained women under stress ate less sweets than did unrestrained women in the control condition.

For men, within the stress and control conditions, restrained and unrestrained men ate similar amounts of foods.

Although the study included all of the variables that appear to have affected the results of other food consumption studies, it did not provide a definitive answer to the question of how stress affects food consumption. Because the stressor was a workshop accident film, it is reasonable to assume that it may have affected males and females differently. The indices of stress support this supposition; males and females differed on whether or not they showed a stress response on various manipulation checks. The anxiety and hostility subscales of the MAACL and the POMS hostility, anxiety, and depression measures were significantly higher for women who saw the workshop accident film. On the authors' questionnaire, females viewing the workshop film found it more stressful than females viewing the travelogue. By self-report, females found the workshop film to be more stressful than the travelogue.

The catecholamine assays partially confirmed the self-report indications that the stress manipulation worked for females. Changes in concentration of the epinephrine and the norepinephrine assays were in the expected direction but were not significant. The increase in concentration of epinephrine was higher in the females who were in the stress condition, and the levels of norepinephrine in the urine decreased more in those females who saw the travelogue film.

The psychophysiological measures of heart rate and blood pressure changes also lend some support to the interpretation that the manipulation was successful. The systolic blood pressure of the women in the control condition went down after viewing the travelogue, while it went up for those women who saw the stressful film. This blood pressure effect approached significance ($p = 0.14$), but the difference between control and stress changes in heart rate and diag45 stolic blood pressure did not.

Neither of the two general mood scales indicated that control and stress males differed after the stress manipulation. None of the MAACL or POMS subscales were significantly affected by the stress manipulation. However, on the questionnaire designed to assess the effects of the film, males reported that they found the workshop accident to be significantly more anxiety provoking and stressful than those men who watched the travelogue.

Turning to the biochemical indicators of stress in the men, neither the epinephrine nor the norepinephrine assays differed in the pre versus post manipulation change in concentration between stress and control groups. Changes in concentration of the epinephrine assay was in the expected direction, but changes in concentration of the norepinephrine assay was in the opposite direction from what would be expected. Neither change in concentration was significant. So, the biochemical assays do not support the manipulation as being successful in the men.

Measures of heart rate and blood pressure changes do support the interpretation that the men found the workshop film to be stressful. The heart rate and the systolic and dystolic blood pressure of the men who saw the control film went down, while these same indicators all went up in those men who saw the workshop film. While all these measures were in the correct direction, only the systolic blood pressure changes reached significance. Considering all the manipulation checks for both men and women, it appears that the stressor was weak.

The results of the Grunberg et al.(1988) study do clarify seeming inconsistencies in the literature and indicate that taste of food available is important in the findings for men and women, and that restraint is an important variable to consider if women are used as subjects. However, the weak stress response to the stressor limits the generalizeability of the results.

In addition to this limitation, there is a relevant question that has not been addressed by previous studies: Whether or not the presence of food is a stressor to those individuals who are high in restraint but not to those low in restraint. It might be that the presence of food and the opportunity to eat requires high restrainers to exercise psychological work to "avoid the temptation" of eating, while those individuals low in restraint do not have to exercise this same self-control and thus the opportunity to eat is not a stressor. If so, then the opportunity to eat has been a stressor to some subjects (high restrainers) in the control condition of previous studies who were presumably not stressed, and those previous studies that compare food consumption during stress in high and low restrainers may not have stressed them equally.

There is some empirical evidence that high and low restrainers may experience different affect associated with the opportunity to eat. Bowen and Grunberg (N. E. Grunberg, personal communication, April, 1988) measured restraint in a study of human food consumption changes across the menstrual cycle. They found that specific taste preferences changed over the menstrual cycle; sweet food consumption was significantly higher during the premenstrual period. Salty and bland food consumption was unaffected. Interestingly, they report that high restrainers had a significantly higher level of affect (more dysphoria) on a composite score of the anxiety, depression, and hostility scales of the MAACL than the low restrainers. One explanation for these results could be that the opportunity to eat required high restrainers to exercise psychological work to "avoid the temptation" of eating. If so, then the opportunity to eat was a stressor. More research is needed to determine whether the opportunity to eat is differentially stressful to restrained versus unrestrained individuals.

Another question that has not been addressed by previous studies is whether or not eating alters scores on the Restraint scale. Most previous studies that have measured restraint have assumed that it is a trait measure of eating habits, although Herman and colleagues suggest that stress reduces restraint temporarily in the high restrainer. Yet, previous studies have not measured restraint both before and after the stress manipulation to determine if this is true. A finding that Restraint scale scores are reduced (in the high restrainers) after the stress manipulation would provide additional support for the theory that stress causes a reduction in restraint in the high restrainers. This finding would have clinical implications for treatment of high restrained individuals seeking treatment for weight control. If restraint is reduced during stress, then stress reduction techniques and relaxation training should be integral components of the treatment approach to weight control for the restrained individual.

The restraint of eating may be a specific example of a more general phenomenon of self-imposed delay of gratification. In a series of experiments Mischel and his colleagues have examined factors that are involved in delay of gratification (Mischel & Coates, 1968; Mischel & More, 1973; Mischel, Ebbesen, & Zeiss, 1972; Mischel & Grusec, 1967). In the Mischel, Ebbesen, & Zeiss (1972) study, the paradigm involved offering school children two food rewards, a marshmallow and a pretzel stick. After the child had chosen the preferred food object, they were instructed that they could have the least preferred food at any time or, if they waited until the experimenter returned, they could then have the more desired food. Experimental conditions varied so that the children had toys to distract them, were told to think certain thoughts to distract them, or were given no delay of gratification instructions. The authors found that children waited a much greater length of time when they had available either an external or cognitive distractor during the delay period. This finding suggests that effective delay behavior may be enhanced by the avoidance or reduction of the frustrative effects of delay of gratification. In the previously discussed study, reduction of the frustration of waiting for the more desired goal seems to have been achieved when the subjects shifted attention away from the potential gratification and instead distracted themselves with competing cognitions or with overt activity. Perhaps individuals who are attempting to restrain themselves from eating or who are dieting (high restrainers) are more successful when they are distracted from the reward objects (food) than when they are less distracted. On the basis of Mischel's findings, individuals who are trying to delay gratification and who find distractions present during their attempts to delay should be more successful than those individuals who find less distractions available during the attempt to delay gratification.

Present Study

The present study was designed to replicate and extend the study of the relationship between stress, restraint, and specific food consumption. The present study addressed the following questions:

1) How does stress affect food consumption in restrained and unrestrained women?

2) Does the opportunity to eat food differentially stress high versus low restrainers?

3) Does eating alter scores on the Restraint scale?

4) Does distraction enable high restrainers to successfully avoid eating?

Subjects in the present study were offered snacks from three different taste groups "to make their participation more enjoyable," rather than under the guise of a taste test. This strategy avoided the possible confound that differences exist between restrained and unrestrained individuals in certainty of their decision-making processes, a criticism made of past studies using a taste test methodology. Sweet, salty, and bland snacks were used because type of food available has been shown to affect the outcome. Speech anxiety, a particular form of social anxiety, was used as the stressor. This stressor has been used as an acute stressor in other studies (Morokoff, Baum, McKinnon, & Gillilland, 1987; Rozanski, 1988) because it is a potent stressor. The use of speech anxiety avoids questions about the effectiveness of the stress manipulation. Female subjects were used in a repeated measures, counterbalanced design in which one condition afforded high and low restrainers the opportunity to eat during stress and control conditions, while the other condition was the same but no food was available. Female subjects were used because other studies have demonstrated that restraint most clearly applies to females. Grunberg et al. (1988) found that restraint did not affect the results for the male subjects, and almost all previous studies which included a measure of restraint used female subjects.

Subjects were administered the Herman Restraint questionnaire (Appendix C) prior to beginning the experiment and at the conclusion of each condition in the experiment in order to test the effects of stress on restraint scores. In addition, pre and post manipulation measures of blood pressure and heart rate were taken. These measures indicate psychophysiological responses to the manipulations. Each subject completed the Multiple Adjective Affective Checklist (MAACL) (Appendix D) and the Spielberger State Trait Anxiety Inventory (STAI) (Appendix E) pre and post manipulation. These questionnaires served as self-report measures to validate the effectiveness of the stress manipulation. At the conclusion of the study subjects were administered a questionnaire designed to assess the degree to which they were distracted during the experiment (Appendix F) and a questionnaire provided information about the effects of the subjects' menstrual cycle upon their eating habits (Appendix G).

Hypotheses

A. Food consumption:

1. Sweet food consumption will be affected more than salty or bland food consumption.

2. High restrainers will eat more sweets during stress than will low restrainers.

3. High restrainers will eat less or equal amounts of sweets compared to low restrainers in the control condition.

4. High restrainers will eat more sweets during stress than will high restrainers in the control condition.

5. Low restrainers will eat similar amounts of sweets in the stress and control conditions.

Rationale: Four studies (Polivy & Herman, 1976; Baucom & Aiken, 1981; Frost et al. 1982; Herman et al. 1987) have found that restrained individuals eat more during stress than when not stressed. Baucom and Aiken (1981), Herman and Polivy (1975), and Polivy and Herman (1976) found that unrestrained individuals decreased their food consumption during stress, and Frost et al. (1982), Herman et al. (1987) and Ruderman (1985) found that the unrestrained did not change their food consumption during stress. Frost et al.

(1982), Herman and Polivy (1975), and Herman et al. (1987) measured changes in sweet food consumption. Grunberg et al. (1988) found that sweet food consumption increased during stress in restrained women, but salty and bland food consumption was not significantly altered.

B. Anxiety measures:

1. High restrainers will score higher on measures of anxiety in the opportunity to eat condition as opposed to the no opportunity to eat condition.

2. Low restrainers will score similarly on measures of anxiety in both conditions.

3. High restrainers in the opportunity to eat condition will score higher on the MAACL, STAI, and heart rate and blood pressure measures (anxiety measures) than low restrainers in the opportunity to eat condition.

4. High restrainers and low restrainers will score similarly on measures of anxiety in the no opportunity to eat, control condition.

5. Stressed, high restrainers in the opportunity to eat condition will score higher on measures of anxiety than stressed, high restrainers in the no opportunity to eat condition.

6. Non-stressed, high restrainers in the opportunity to eat condition will score higher on measures of anxiety than non-stressed, high restrainers in the no opportunity to eat condition.

7. Stressed, low restrainers in the opportunity to eat condition will score similarly on measures of anxiety to stressed, low restrainers in the no opportunity to eat condition.

8. Non-stressed, low restrainers in the opportunity to eat condition will score similarly on measures of anxiety to non-stressed, low restrainers in the no opportunity to eat condition.

Rationale: The presence of food requires high restrainers to resist eating because they are biologically underweight, while the low restrainer does not have to exercise this self-control because they are at their biological setpoint for weight and thus are not chronically hungry. This difference in required self-control will be manifested in the measures of anxiety only when there is an opportunity to eat.

C. Restraint scale score:

1. Restraint scale scores in the high restrainer will be reduced after the stress manipulation.

2. Restraint scale scores in the low restrainer will be unaffected after the stress manipulation.

3. Restraint scale scores in the high restrainer will be unaffected after the control manipulation.

4. Restraint scale scores in the low restrainer will be unaffected after the control manipulation.

Rationale: Herman and Polivy have suggested that the restrained eater's self-control can be disrupted by strong emotions such as those exhibited in depressed and anxious states, and that this disruption in self-control leads to increased eating. Unrestrained eaters decrease their eating in response to anxiety and depression as a result of physiological factors (Herman & Polivy, 1975, Polivy & Herman, 1976). If self-control (restraint) is reduced during stress in the high restrainer, then their scores on the restraint scale should be reduced. Self-control is not hypothesized to be affected during stress in the low restrainer and therefore no change in restraint is predicted.

D. Distraction

1. High restrainers that are more distracted as measured by the distraction questionnaire will eat less food as compared to high restrainers that are less distracted.

2. The amount of distraction as measured by the distraction questionnaire will not affect the amount of food consumed by the low restrainers. It is assumed that low restrainers do not find the food frustrating because they are not trying to avoid eating.

Rationale: Mischel, Ebbesen, & Zeiss (1972) found that children waited longer for a desired outcome if they had toys or thoughts to distract them from another, less preferred object during the required delay period.

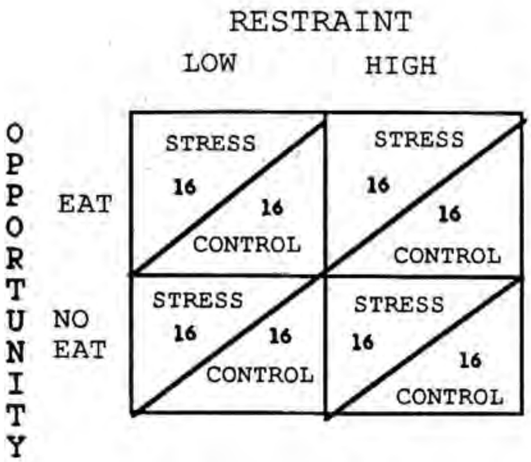
METHOD

Subjects

Sixty-four healthy female nonsmokers, ages 18-45, were recruited through local newspaper advertisements for a study that was introduced as an investigation of cognitive processes required for effective communication. Subjects were paid twenty-five dollars for their participation.

Experimental Design

The design of the study was a 2 (stress and control) X 2 (high restraint and low restraint) X 2 (opportunity to eat and no-opportunity to eat). It was a repeated measures design, with each subject within the opportunity to eat condition exposed to both the stress and control manipulations and each subject within the no-opportunity to eat condition exposed to both the stress and control manipulations. There were 16 subjects per cell, with a total of 64 subjects. This number of subjects per cell has been sufficient to find significance in previous studies of restraint and/or stress and eating behavior (Abramson & Wunderlich, 1972; Frost et al. 1982; Herman & Polivy, 1975; McKenna, 1972; Reznick & Balch, 1977; Schachter et al. 1968).



The experiment was conducted so that one-half the subjects were in the opportunity to eat condition and one-half were in the no-opportunity to eat condition. Within these two conditions, the order of the control and stress presentations was counterbalanced so that one-half of the subjects received the control instructions first and the other half received the stress instructions first. Subjects were assigned to high or low restraint groups prior to their arrival for the experimental session. The experimenter asked each subject during an initial screening over the telephone to provide some medical and background information prior to the experiment proper. Embedded within this screening was the Restraint questionnaire (see Appendix H). Subjects with a score of 13 or greater were assigned to the high restraint group; subjects with a score below 13 were assigned to the low restraint group. This cutoff score was chosen on the basis of empirical precedent reported by Herman et al. (1987). All experimental sessions were conducted between

2:00 and 5:00 P.M. and 7:00 and 9:00 P.M. to maximize the likelihood that subjects would eat the snack foods. Subjects were not asked to refrain from eating prior to the sessions to prevent any suspicions as to the true purpose of the experiment.

Procedure

Upon arrival, subjects were escorted to a room (L = 2.74 meters X W = 1.69 meters X H = 2.72 meters) with two chairs and a table. Several magazines were on the table, as well as an automatic blood pressure and heart rate monitoring machine (Spacelab 2000). Subjects were welcomed to the study and told the following:

> This study is concerned with investigating various components of effective communication. I am especially interested in studying the physiological and cognitive components that are involved in allowing an individual to successfully convey information to others. Two reasons for my interest in this topic are that a better understanding of the components that enable some to communicate better than others will help us to be better instructors and, since we teach medical students here at the university, they need to learn how to more effectively communicate with their patients. I am also interested in how preparing for communication at one point in time affects later communication. Today you

will be asked to participate in a two part study of the components of effective communication. In order to save time, both parts of the study will be conducted today, one after the other. The study will require about two hours of your time. Because we are interested in the cognitive processes that are involved in effective communication, I would like to start today's experiment by getting you to fill out these questionnaires. Also, to help us understand differences in physiological responses to public speaking, I will take your pulse and blood pressure after you complete the questionnaires.

After these instructions, the subject was asked to sign a consent form and to complete two questionnaires (MAACL and STAI). After the subject had completed the questionnaires she was told to sit quietly and relax. When approximately 3-4 minutes had elapsed, her heart rate and blood pressure were measured by an automatic monitor (Spacelab 2000). Then she was told to just sit back and relax because her blood pressure would be measured again shortly. After 2-3 more minutes, her heart rate and blood pressure were measured again with the same automatic monitor, she was told that the next part of the study was beginning, and was escorted to an adjacent laboratory designed to look like an office. (The second readings were used as the baseline physiological measures). The lab had a desk and swivel desk chair, with a lamp, a pad of ruled white paper and two pens. The room measured 2.41 meters long by 1.78 meters wide and was 2.73 meters high. A videocamera was placed in a conspicuous part of the room during the experimental manipulation but not the control manipulation. Snack foods from sweet (M&Ms), salty (peanuts), and bland (rice crackers) taste groups were placed in bowls forming a semicircle on the table. The bowls of food were weighed before and after the experiment to determine exact amounts eaten. A pitcher of cold water was also available.

Experimental Manipulation

In the experimental manipulation, subjects were told:

> In this part of today's study, I would like you to prepare a five minute speech about the part of your personality that you most like (or dislike). We use that topic because each person in the study is equally familiar with it, and it is relatively difficult to talk about. So I will leave the room for 15 minutes to give you time to prepare, then I'll come back and give you some questionnaires to fill out. After you complete them, I'll get your heart rate and blood pressure and then I'm going to videotape your speech so that a panel of psychologists can review it in greater detail later. You can use the paper here to help you prepare and to make notes, but you should not read your presentation in front of the camera.

After these instructions the experimenter left the room, telling the subject that he would return in fifteen minutes to administer questionnaires and to videotape her speech. Upon returning, the experimenter took the subject's notes and placed them on a podium away from the subject, asking her not to refer back to them until it was time to give her speech. He then gave her the MAACL, STAI, Herman Restraint scale, and a bogus reading questionnaire to complete, and stated that when he returned he would obtain heart rate and blood pressure measures and then videotape the speech. Subjects were asked to "sit tight" if they completed the questionnaires prior to the experimenter's return. The experimenter returned exactly two minutes after the last questionnaire was completed except for the first three subjects. The experimenter returned immediately after the questionnaires were completed for the first three subjects.

When the experimenter returned, the subject's heart rate and blood pressure were measured with an automatic monitor (Spacelab 2000) and then she was asked to move behind a podium and the videocamera was turned on and the speech was taped by the experimenter. After the speech was given, the subject's blood pressure and heart rate were obtained again (except for the first three women). Subjects in this manipulation first were escorted to the first room and told to relax and that the experimenter would return in about 5 or 6 minutes. If this was the second manipulation for a particular subject, her height and weight were recorded and she was escorted to the first room where she filled out the post experimental questionnaires, and was paid and debriefed.

Control manipulation

Subjects in the control manipulation were told:

In this part of today's study, I want you to prepare a five minute speech about the part of your personality that you most like/dislike. We use this topic because each person in the study is equally familiar with it, and it is relatively difficult to talk about. I am going to leave the room for fifteen minutes to give you time to prepare your speech, and then I am going to return and give you some questionnaires to complete and I'll get your heart rate and blood pressure. Don't worry, you don't have to present the speech; I am only interested in the steps that you take to prepare the speech. Even though you don't have to give the speech you should just prepare it as though you were going to present it. I assure you that you will not be required to give the speech, neither out loud nor in written form.

After these instructions the experimenter left the room, telling the subject that he would return in 15 minutes to "sit and talk about the steps the subject had gone through to prepare the speech." Upon returning the experimenter removed the subjects notes and placed them on the podium, asking the subject not to refer back to them until he returned to talk about the steps taken to prepare for the speech. Then he administered the MAACL, Herman Restraint scale, STAI and the bogus reading questionnaires and told the subject to "sit tight" in case she finished before he returned because he would be right back. For all but the first three subjects, the experimenter returned exactly 2 minutes after the subject completed the last questionnaire. Upon returning he obtained heart rate and blood pressure measures and then talked about the subject's speech preparation for about 3-4 minutes. After the discussion about the speech preparation was concluded, the subject's heart rate and blood pressure were measured using the same automatic monitor that was used during the experimental manipulation (except for the first three subjects). The experimenter then either escorted the subject to the first room and suggested that she read some magazines to relax for 5 or 6 minutes before the next part of the experiment began or he obtained her height and weight, led her to the first room, and administered the post experimental questionnaires and then debriefed and paid the subject.

Manipulation of Opportunity to Eat

There were two conditions of food availability. In the opportunity to eat condition, subjects were told the following at the end of the explanation for the experimental manipulation (stress or control) for which they were in: "As you see, we have provided these snacks for you to eat while you work on your speech. Some people like to snack while they work on the talk and some don't. Feel free to help yourself." In the no opportunity to eat condition, no food was in sight and the experimenter did not mention food. (See Table 5 for a time line that summarizes the procedures.)

Post-Experimental Questionnaires

At the conclusion of the experiment the subject was asked to complete a series of questionnaires. The distraction questionnaire was described as a way of controlling for various factors that might influence the results of the experiment. Those subjects which were in the no opportunity to eat condition were told to ignore the questions about snack foods because they do not apply to them.

Table 5

Time Line

telephone screening - assignment to restraint condition - arrival - introductory monologue - MAACL, STAI administered - HR and BP measured - assignment to one of two conditions:

OPPORTUNITY TO EAT

stress monologue - 15 minute preparation - HR and BP measured - MAACL, STAI, Restraint administered - speech given - wait 5 minutes - control monologue - 15 minute preparation - HR and BP measured - MAACL, STAI, distraction, menstrual questionnaires administered - debriefed and paid

OR

control monologue - 15 minute preparation - HR and BP measured - MAACL, STAI, Restraint administered - no speech - wait 5 minutes - stress monologue - 15 minutes - HR and BP measured - MAACL, STAI, distraction, menstrual questionnaires administered - debriefed and paid

NO OPPORTUNITY TO EAT

stress monologue - 15 minute preparation - HR and BP measured - MAACL, STAI, Restraint administered - speech given - wait 5 minutes - control monologue - 15 minute preparation - HR and BP measured - MAACL, STAI, distraction, menstrual questionnaires administered - debriefed and paid

OR

control monologue - 15 minute preparation - HR and BP measured - MAACL, STAI, Restraint administered - no speech - wait 5 minutes - stress monologue - 15 minutes - HR and BP measured - MAACL, STAI, distraction, menstrual questionnaires administered - debriefed and paid

RESULTS

Multivariate analyses, and separate, repeated measures analyses of covariance were performed to analyze the data. The dependent measures were food consumption; MAACL anxiety, depression, and hostility scales; Spielberger anxiety scales; the Restraint scale; the distraction questionnaire; and heart rate and blood pressure measurements. The within-subject factor was the manipulation of stress and control, and the between-subjects factors were restraint (low or high) and order of the manipulation (control-stress or stress-control). Subsequent univariate analyses of variance were performed on each dependent variable. All results are based on a two-tailed test of significance, and the alpha level for all analyses was set at 0.05. Appendices contain all statistical results; only significant results are reported with values in the text.

FOOD CONSUMPTION

This section presents the food consumption data. The multivariate analyses are reported first, and then separate univariate analyses are reported by taste class: sweet, salty, and bland. Table 6 presents the food consumption data for low and high restrainers during stress and control. For complete reporting of all statistical results of food consumption analyses see Appendix I.

Table 6

Food Consumption in Grams

(Mean ± standard deviation)

	LOW RESTRAINERS (N=16)	HIGH RESTRAINERS (N=16)	ALL SUBJECTS (N=32)
SWEET			
CONTROL	6.107 ± 10.84	2.965 ± 4.56	4.536 ± 8.33
STRESS	13.124 ± 26.05	2.839 ± 6.91	7.891 ± 19.46
SALTY			
CONTROL	2.584 ± 4.14	0.768 ± 2.05	1.676 ± 3.34
STRESS	4.289 ± 12.51	0.863 ± 2.06	2.576 ± 8.99
BLAND			
CONTROL	1.439 ± 2.95	0.315 ± 0.91	0.877 ± 2.22
STRESS	0.578 ± 1.54	0.108 ± 0.43	0.343 ± 1.14
TOTAL			
CONTROL	10.130 ± 13.94	4.048 ± 6.51	7.089 ± 11.14
STRESS	17.991 ± 31.43	3.809 ± 8.03	10.900 ± 23.69

Total Food Consumption

This section compares total food consumption during stress and during control for the 32 subjects (16 low restrainers and 16 high restrainers) who had the opportunity to eat.

There were significant main effects for restraint because low restrainers consumed significantly more food than high restrainers ($F[1,28] = 4.59$, $p = 0.041$). There were no significant differences in food consumption comparing order of manipulation (control-stress vs. stress-control), and the restraint-by-order interaction was not significant.

There were significant main effects for food because of differences in the consumption of sweet, salty, and bland foods ($F[3,84] = 9.21$, $p = 0.001$). The manipulation-by-order interaction (control-stress vs. stress-control) was significant ($F[1,28] = 4.30$, $p = 0.048$). Subjects who were in the control condition first ate more during control than they did during stress, while those who were in the stress condition first ate more during stress than they ate during control. The food-by-manipulation-by-order interaction was also significant ($F[3,84] = 2.90$, $p = 0.040$). Combining food consumption by the low and high restrainers together, there was not a manipulation effect because similar amounts of food were consumed in the stress and control conditions. The manipulation-by-restraint interaction was also not significant, although low restrainers ate more during stress and high restrainers ate slightly less during stress. No other interactions were significant.

Individual Food Consumption

This section compares consumption of each individual type of food during stress and during control for the 32 subjects (16 low restrainers and 16 high restrainers) who had the opportunity to eat. Table 6 presents the individual food consumption data for low and high restrainers during stress and control.

Sweet Food

Combining consumption during both manipulations, low restrainers ate more MMs than did high restrainers, but the difference was not statistically significant. Combining restraint categories, more MMs were consumed in the stress condition than in the control condition, but again this difference was not significant. Restraint did not interact with the manipulation to affect amount of MMs consumed. Low restrainers ate about twice as much during stress as they ate during control, while high restrainers ate almost identically during both manipulations. These findings can not be explained by examining the effects of order because the between-subjects order variable was not significant.

Salty Food

Combining consumption during both manipulations, low restrainers ate about four times as much as high restrainers ate, but the difference was not statistically significant. Combining restraint categories, more nuts were consumed in the stress condition than in the control condition, but this difference was not significant. The manipulation-by-restraint interaction was not significant, even though low restrainers ate about twice as much during stress as they did during control, while high restrainers ate only slightly more during stress than they ate during control. There was not a main effect for order, and no other interactions were significant.

Bland Food

Combining consumption during both manipulations, low restrainers ate more than high restrainers, but not significantly so. Combining restraint categories, subjects ate fewer crackers during stress than during control, and this difference approached significance. There was a significant restraint-by-order interaction ($F[1,28] = 4.03$, $p = 0.054$) because low restrainers ate more than high restrainers in one order and high restrainers ate more than low restrainers in the other order. The interaction of manipulation-by-order was also significant ($F[1,28] = 3.86$, $p = 0.059$) because in one order the control subjects ate more than the stress subjects, while the opposite was true in the other order. No other term in the ANOVA was significant.

Summary

Considering the multivariate analysis of all foods together, and the univariate tests of each individual food separately, low restrainers ate more than high restrainers except in the case of bland food. High restrainers ate more bland food than low restrainers. The difference between low and high restrainers' food consumption was significant when all foods were considered in the MANOVA, but for each food considered separately in an ANOVA, the difference was not significant. More food was consumed during stress than during control, although the opposite was true for bland food. However, the increase in consumption during stress did not attain statistical significance in either the MANOVA for all foods together or any of the ANOVAs for the individual foods. Low restrainers ate more sweet, salty, and total foods during stress than they ate during control, while high restrainers ate similar amounts during the two manipulations.

ORDER OF MANIPULATION AND FOOD CONSUMPTION

A multivariate analysis of variance for all foods and three separate repeated measures analyses of variance on sweet, salty, and bland foods were performed for the control-stress order of presentation and the stress-control order of presentation because some of the interactions of order with other variables (see above) were significant. See Table 7 for reporting of food consumption data in the separate orders and Appendix J for complete reporting of all order analyses statistics.

In both orders, low restrainers ate more than high restrainers ate, but the predicted manipulation by restraint interaction was not significant. In the control-stress manipulation order, subjects generally ate more during control than they ate during stress, although this was not true for salty foods because subjects ate very similar amounts of nuts during both manipulations. In the stress-control manipulation order, subjects generally ate similar amounts during control and stress, although this was not true for sweet foods because subjects ate more during stress than they ate during the control manipulation.

Table 7

Food Consumption in Grams by Order of Manipulation

(Mean ± standard deviation)

CONTROL-STRESS ORDER OF MANIPULATION

	LOW RESTRAINERS (N=8)	HIGH RESTRAINERS (N=8)
SWEET		
CONTROL	8.147 ± 12.06	1.884 ± 3.75
STRESS	4.886 ± 9.77	0.339 ± 0.95
SALTY		
CONTROL	2.884 ± 5.02	0.994 ± 2.81
STRESS	1.580 ± 2.25	0.346 ± 0.98
BLAND		
CONTROL	2.877 ± 3.73	0.212 ± 0.60
STRESS	0.930 ± 2.10	0.000 ± 0.00
TOTAL		
CONTROL	13.910 ± 15.96	3.090 ± 7.06
STRESS	7.396 ± 11.13	0.685 ± 1.27

STRESS-CONTROL ORDER OF MANIPULATION

	LOW RESTRAINERS (N=8)	HIGH RESTRAINERS (N=8)
SWEET		
CONTROL	4.067 ± 9.81	4.046 ± 5.27
STRESS	21.361 ± 34.69	5.339 ± 9.34
SALTY		
CONTROL	2.284 ± 3.35	0.542 ± 1.01
STRESS	6.998 ± 17.71	1.380 ± 2.75
BLAND		
CONTROL	0.000 ± 0.00	0.417 ± 1.18
STRESS	0.226 ± 0.62	0.215 ± 0.61
TOTAL		
CONTROL	6.351 ± 11.37	5.006 ± 6.25
STRESS	28.585 ± 41.67	6.934 ± 10.69

Time Analyses

A repeated measures, multivariate analysis of variance was performed to determine whether individuals ate differently during the first manipulation they were exposed to compared to the second manipulation they received. See Table 8 for reporting of time analyses data and Appendix K for complete reporting of statistical analyses of the time data.

Although subjects ate more sweet, salty, and bland foods during their first session (regardless of manipulation) than they ate during their second session, there were no statistically significant differences. A multivariate analysis of variance was also performed which compared consumption of foods during stress if stress was the first manipulation the subject received with consumption during control if control was the first manipulation the subject received. A similar analysis was performed comparing consumption during the second manipulation the subject received (stress vs. control). In addition, separate analyses for each individual food were performed comparing time one stress consumption with time one control consumption and time two stress consumption with time two control consumption. These analyses found no significant differences.

Table 8

<u>Food Consumption in Grams Based on Time</u>

(Mean ± standard deviation)

	LOW RESTRAINERS (N=16)	HIGH RESTRAINERS (N=16)	ALL SUBJECTS (N=32)
<u>SWEET</u>			
TIME 1	14.754 ± 26.00	3.611 ± 7.10	9.183 ± 19.59
TIME 2	4.477 ± 9.47	2.193 ± 4.13	3.335 ± 9.28
<u>SALTY</u>			
TIME 1	4.941 ± 12.75	1.187 ± 2.69	3.064 ± 9.26
TIME 2	1.934 ± 12.51	0.444 ± 2.06	1.189 ± 2.18
<u>BLAND</u>			
TIME 1	1.552 ± 2.92	0.214 ± 0.58	0.883 ± 2.18
TIME 2	0.465 ± 1.52	0.209 ± 0.84	0.337 ± 1.21
<u>TOTAL</u>			
TIME 1	21.247 + 31.05	5.012 ± 8.97	13.129 ± 24.17
TIME 2	6.876 ± 10.88	2.846 ± 4.89	4.861 ± 8.55

Time of Experiment Analyses

A repeated measures, multivariate analysis of variance was performed to determine whether individuals ate differently during afternoon experimental sessions compared to the evening experimental sessions. See Table 9 for reporting of session time analyses data and Appendix L for complete reporting of statistical analyses of the session time data.

Subjects tended to eat more during control than during stress in the afternoon sessions. In the evening sessions, they tended to eat more during stress than during control. Overall, subjects ate more during the afternoon sessions than the evening sessions. However, there were no discernible patterns and no significant differences were found between the afternoon and evening sessions.

Table 9

Food Consumption in Grams Based on Session Times

(Mean ± standard deviation)

	AFTERNOON	EVENING
SWEETS		
CONTROL	11.375 ± 25.61	3.727 ± 7.25
STRESS	3.802 ± 8.85	5.369 ± 7.93
SALTY		
CONTROL	3.937 ± 12.18	1.033 ± 2.12
STRESS	1.625 ± 3.70	1.733 ± 3.01
BLAND		
CONTROL	0.544 ± 1.50	0.115 ± 0.44
STRESS	1.035 ± 2.69	0.697 ± 1.61
TOTAL		
CONTROL	16.216 ± 31.04	4.875 ± 8.27
STRESS	6.462 ± 12.51	7.799 ± 9.75

Variability of Eating Among Subjects and Manipulations

Although low restrainers ate about four times as much as high restrainers, this difference was not statistically significant. Also, while low restrainers ate more during stress than they did during control, this difference was not significant. To test whether the variances in eating behavior differed among experimental groups or between manipulations, F tests were performed on the variances of the groups and manipulations (see Tables 10 and 11). These comparisons indicated that the variance in low restrainers' consumption of each food was significantly greater than high restrainers' variance during both the control and stress manipulations. In addition, considering low and high restrainers' consumption together, the variance in eating was significantly greater during stress than during control. Moreover, comparisons of the variance in food consumption between the stress and control manipulations for the low and high restrainers were made separately. These comparisons revealed that low restrainers' food consumption varied significantly between the two manipulations. The variance in low restrainers' consumption of sweet and salty food was significanlty more during stress than during control, but their consumption of bland crackers varied significantly more during control than it did during stress. Considering total amount eaten, low restrainers' consumption varied significantly more during stress than during control. The high restrainers' consumption of bland crackers also varied significantly more during control than during stress. There was no significant difference in high restrainers' variance in consumption of sweet and salty foods during control and stress, and considering their total food consumption, they did not vary significantly more during stress than they did during control.

Taken together, these findings indicate that the food consumption of low restrainers varies more than the food consumption of high restrainers. Low restrainers as a group tend to vary their food consumption more during stress than during nonstressful situations, whereas high restrainers tend to eat similarly during stress and nonstressful situations. Stress seems to create more variability in eating behavior, especially for low restrainers.

Table 10

Variance of Amount Eaten

	LOW RESTRAINERS		HIGH RESTRAINERS	
	STRESS	CONTROL	STRESS	CONTROL
MMs	678.550	117.397	47.762	21.050
NUTS	156.475	17.106	4.256	4.215
CRACKERS	2.378	8.691	.185	.830
TOTAL FOOD	987.782	194.435	64.432	42.432

	STRESS Low and High Restrainers	CONTROL Low and High Restrainers
MMs	378.769	69.405
NUTS	80.802	11.168
CRACKERS	1.297	4.932
TOTAL FOOD	561.026	124.166

Table 11

F Values of Comparisons of Variance of Amount Eaten

LOW RESTRAINERS (n=16) VS. HIGH RESTRAINERS (n=16)

CONTROL MANIPULATION

MMs	5.651 *
NUTS	4.059 *
CRACKERS	10.472 *
TOTAL FOOD	4.582 *

LOW RESTRAINERS (n=16) VS. HIGH RESTRAINERS (n=16)

STRESS MANIPULATION

MMs	14.207 *
NUTS	37.119 *
CRACKERS	12.859 *
TOTAL FOOD	15.330 *

* $p < 0.05$

Table 11 (continued)

F Values of Comparisons of Variances of Amount Eaten

MANIPULATION

	STRESS (n=16) vs. CONTROL (n=16)
	LOW AND HIGH RESTRAINERS
MMs	5.457 *
NUTS	7.235 *
CRACKERS	.263
TOTAL FOOD	4.518 *

	STRESS (n=8) vs. CONTROL (n=8)
	LOW RESTRAINERS
MMs	5.800 *
NUTS	9.147 *
CRACKERS	.274 *
TOTAL FOOD	5.080 *

	STRESS (n=8) vs. CONTROL (n=8)
	HIGH RESTRAINERS
MMs	2.299
NUTS	1.010
CRACKERS	.223 *
TOTAL FOOD	1.518

MOOD

Multiple Affective Adjective Checklist

A repeated measures, multivariate analysis of variance was performed to analyze the MAACL mood scales together. The mood measures consisted of the anxiety, depression, and hostility subscales. Subjects' baseline scores on these subscales were the covariate for that particular analysis when separate analyses of covariance were performed using only one subscale at a time as the dependent variable. See Table 12 for group means and Appendix M for all statistical results of mood analyses and for significant findings.

Overall Mood Based on all Three Scales

This section compares overall mood during stress and during control for the 32 subjects (16 low restrainers and 16 high restrainers) who had the opportunity to eat with overall mood during stress and during control for the 32 subjects (16 low restrainers and 16 high restrainers) who did not have the opportunity to eat.

The Effects of Restraint and Order

The main effects for restraint, condition (food vs. no-food), and order of manipulation (control-stress vs. stress-control) were not significant.

Table 12

MAACL Mood Scales

(mean ± standard deviation)

(More negative numbers are less negative mood.)

	LOW RESTRAINERS (N=32)	HIGH RESTRAINERS (N=32)	ALL SUBJECTS (FOOD AND NO FOOD COMBINED) (N=64)
ANXIETY			
CONTROL			
NO FOOD	-2.938 ± 2.57	-3.625 ± 3.07	CONTROL
FOOD	-4.603 ± 3.07	-3.398 ± 3.64	-3.641 ± 3.07
STRESS			
NO FOOD	-1.063 ± 3.89	-2.125 ± 4.16	STRESS
FOOD	-1.563 ± 4.16	1.875 ± 5.17	-0.719 ± 4.537
DEPRESSION			
CONTROL			
NO FOOD	-5.688 ± 4.48	-6.188 ± 5.37	CONTROL
FOOD	-7.625 ± 3.83	-6.938 ± 4.17	-6.609 ± 4.45
STRESS			
NO FOOD	-4.000 ± 4.95	-5.438 ± 4.76	STRESS
FOOD	-6.188 ± 5.62	-5.000 ± 4.56	-5.156 ± 4.94
HOSTILITY			
CONTROL			
NO FOOD	-4.125 ± 2.50	-4.750 ± 3.04	CONTROL
FOOD	-4.625 ± 2.90	-5.000 ± 2.56	-4.625 ± 2.71
STRESS			
NO FOOD	-2.938 ± 2.62	-3.313 ± 3.14	STRESS
FOOD	-3.563 ± 3.05	-2.750 ± 2.49	-3.141 ± 2.79

The condition-by-order interaction approached significance ($F[1,55] = 3.74$, $p = 0.058$) because, for those subjects who had the control manipulation first, those without food available were less anxious than those who had food available, while subjects who had the stress manipulation first were slightly less anxious if food was present than those subjects who did not have food available. No other interaction was significant.

The Effects of Manipulation and Condition

There was an overall difference among the mood measures of the MAACL (anxiety, depression, and hostility) $F[2,111] = 11.89$, $p = 0.001$). Subjects also differed significantly on the three scales of the MAACL in response to the manipulation ($F[1,56] = 39.98$, $p = 0.001$) suggesting that the stress manipulation effectively altered the subjects' mood. The interaction of condition-by-manipulation-by-order was significant ($F[1,56] = 4.30$, $p = 0.043$). Subjects in both the no-food and food conditions who received the control-stress order of manipulation had more negative mood after stress than after control. Subjects in the food condition who received the stress manipulation first had more negative mood after stress than they had after control. Subjects in the no-food condition who received the stress-control manipulation order had more negative mood after control than they did after stress. The manipulation-by-order interaction approached significance ($F[1,56] = 3.63$, p

= 0.062) because subjects in the control-stress order reported more negative mood after stress than they did after control, while subjects' mood after stress and after control were similar if they were in the stress-control order. The manipulation-by-mood ($F[2,112] = 8.87$, $p = 0.001$), condition-by-mood-by-order ($F[2,111] = 5.82$, $p = 0.004$), order-by-manipulation-by-mood ($F[2,112] = 4.48$, $p = 0.013$), and condition-by-manipulation-by-restraint-by-order ($F[1,56] = 5.18$, $p = 0.027$) interactions were significant. No other interaction terms were significant.

Subscale Analyses

This section reports the findings for each individual subscale of the MAACL. Repeated measures analysis of covariance were performed separately on each of the scales of the MAACL because the MANOVA showed a significant difference between them. Refer to table 12 for group means and Appendix M for complete reporting of all statistical results.

Anxiety Subscale

The Effects of Restraint and Order

Combining opportunity-to-eat and no-opportunity-to-eat conditions together and both manipulations together, low and high restrainers did not differ in their anxiety levels. Combining restraint categories together and manipulations together, condition (food vs. no food) did not create differences in anxiety. Order (control-stress vs. stress-control) was not significant. The interaction between restraint and condition was significant ($F[1,55] = 4.42$, $p = 0.040$) because, combining manipulations together, high restrainers were more anxious when food was available than they were when food was not available, but low restrainers were more anxious when no food was available than when food was available. No other interactions were significant.

The Effects of Manipulation and Condition

Subjects reported significantly more anxiety after the stress manipulation than after the control manipulation $F[1,55] = 42.47$, $p = 0.001$) suggesting that the manipulation of stress was effective. The interactions of condition-by-manipulation and condition-by-manipulation-by-restraint were significant ($F[1,55] = 7.58$, $p = 0.008$; $F[1,55] = 4.23$, $p = 0.044$) because subjects with the opportunity-to-eat were more anxious during stress than control, while the difference in anxiety between stress and control was not as great when food was not available. Considering the significant interaction between restraint and condition described above, it seems that food is anxiety-producing for high restrainers in particular.

Low restrainers were slightly more anxious than high restrainers during both the control and stress manipulations if there was no-food available. However, if food was available, low restrainers were less anxious than high restrainers during the control manipulation, and the anxiety level of high restrainers was markedly increased during stress if food was available. The interaction of condition-by-manipulation-by-order was significant ($F[1,55] = 4.23$, $p = 0.044$). No other interaction term was significant.

Depression Subscale

The Effects of Restraint and Order

Combining both manipulations together and both conditions together, low and high restrainers did not differ in their depression levels. Combining both manipulations together and both restraint categories together, condition (food vs. no food) did not create differences in depression. The main effect for order (control-stress vs. stress-control) was not significant. The condition-by-order interaction was significant ($F[1,55] = 7.90$, $p = 0.007$), but no other interaction was significant.

The Effects of Manipulation and Condition

Combining restraint categories together and conditions together, subjects reported significantly more depression after the stress manipulation than after the control manipulation ($F[1,56] = 13.65$, $p = 0.001$) consistent with an effective manipulation. The manipulation-by-order interaction was significant ($\underline{F}[1,56] = 5.13$, $p = .027$), and the condition-by-manipulation-by-restraint-by-order interaction approached significance ($\underline{F}[1,56] = 3.49$, $p = 0.067$). No other interactions were significant.

Hostility Subscale

The Effects of Restraint and Order

Combining manipulations together and conditions together, low and high restrainers did not differ in their hostility levels. Combining restraint categories together and manipulations together, condition (food vs. no food) did not create differences in hostility. Order was not significant. No interaction was significant.

The Effects of Manipulation and Condition

Combining both restraint categories together and both conditions of food availability together, subjects reported significantly more hostility after the stress manipulation than they reported after the control manipulation ($\underline{F}[1,56] = 24.71$, $p = 0.001$) partially confirming the effectiveness of the stress manipulation. The four-way interaction of condition-by-manipulation-by-restraint-by-order was significant ($\underline{F}[1,56] = 7.69$, $p = 0.008$), but all other interactions were nonsignificant.

The Effects of Amount of Food Consumed on Mood

This section examines the possibility that amount eaten rather than the presence of food created the changes in subjects' moods. Correlations between amount eaten and mood measures were computed for all subjects who had the opportunity eat to determine the relationship between amount of food consumed and mood. These correlations were computed separately for high and low restrainers. MAACL anxiety, depression, and hostility measures obtained after the stress manipulation were correlated individually with the amount of sweet, salty, bland, and total food consumed during the stress manipulation. MAACL anxiety, depression, and hostility measures taken after the control manipulation were correlated individually with amount of sweet, salty, bland, and total food consumed during the control manipulation. In addition, control and stress scores were combined for each subscale and these combined scores were correlated with consumption during control combined with consumption of sweet, salty, bland, and total food for the control and stress sessions combined. Table 13 presents the correlations. None of the correlations were significant, suggesting that amount of consumption was not related to anxiety, depression, or hostility.

Summary

Subjects reported significantly worse mood on all three measures of mood (anxiety, depression, and hostility) after the stress manipulation than they did after the control manipulation. High restrainers reported more anxiety when food was available than they did when there was no food available. Low restrainers reported more anxiety when there was no food available than they did if food was available. High and low restrainers did not differ on their moods, and, considering high and low restrainers together, availability or nonavailability of food did not create differences in mood. Amount of food consumed was not significantly related to mood for either the high or low restrainer.

Table 13

Correlations of Food Consumption with Mood

LOW RESTRAINERS

STRESS MANIPULATION (N = 16)

	MMs	NUTS	CRACKERS	TOTAL
MAACL				
anxiety	.091	.341	-.064	.208
probability =	.737	.196	.815	.439
depression	-.033	.051	.076	-.003
probability =	.904	.850	.779	.991
hostility	-.015	.229	-.3171	.063
probability =	.955	.394	.231	.817

CONTROL MANIPULATION (N = 16)

	MMs	NUTS	CRACKERS	TOTAL
MAACL				
anxiety	.232	.119	.022	.220
probability =	.388	.662	.935	.413
depression	.423	.363	.099	.458
probability =	.102	.167	.714	.075
hostility	.391	.107	-.126	.309
probability =	.135	.693	.643	.245

Table 13 (continued)

Correlations of Food Consumption with Mood

HIGH RESTRAINERS

STRESS MANIPULATION (N = 16)

	MMs	NUTS	CRACKERS	TOTAL
MAACL				
anxiety	-.252	-.147	-.199	-.265
probability =	.347	.586	.458	.321
depression	.006	-.278	-.234	-.079
probability =	.982	.297	.383	.772
hostility	.187	.005	-.027	.161
probability =	.487	.987	.922	.552

CONTROL MANIPULATION (N = 16)

	MMs	NUTS	CRACKERS	TOTAL
MAACL				
anxiety	.267	.055	.430	.264
probability =	.318	.838	.096	.323
depression	.336	.202	.260	.335
probability =	.203	.452	.331	.204
hostility	.296	-.026	.238	.232
probability =	.266	.924	.375	.387

Spielberger Anxiety

A repeated measures, multivariate analysis of variance was performed to analyze the Spielberger state and trait subscale measures together. Also, subjects' baseline score on the Spielberger subscales were used as the covariate for separate, repeated measures analyses of covariance for each subscale. The dependent measures were the scores on the scales of the Spielberger obtained during the stress and control manipulations. See Appendix M for complete reporting of statistical results of analyses of the Spielberger measures and Table 14 for reporting of the group means on the Spielberger anxiety scales.

The Effects of Restraint and Order

This section reports the effects of restraint and order for the combined mood scales of the Spielberger for all 64 subjects. Combining manipulations together and conditions together, high and low restrainers did not differ on the Spielberger mood measures. Order was not a significant factor. Combining restraint categories together and manipulations together, there was no difference on mood measures of the Spielberger created by condition (food vs. no food). The condition-by-order interaction was not significant. The condition-by-restraint-by-order interaction was significant ($\underline{F}[1,55] = 4.30$, $p = 0.043$). If there was

Table 14

Spielberger State-Trait Anxiety Scales

(mean ± standard deviation)

	LOW RESTRAINERS (N=32)	HIGH RESTRAINERS (N=32)	ALL SUBJECTS (FOOD AND NO FOOD COMBINED) (N=64)
STATE ANXIETY			
CONTROL			
NO FOOD	37.313 ± 7.319	33.348 ± 6.60	CONTROL
FOOD	32.063 ± 9.081	35.438 ± 10.19	41.703 ± 11.842
STRESS			
NO FOOD	42.938 ± 10.56	38.563 ± 8.02	STRESS
FOOD	39.250 ± 12.23	46.063 ± 14.99	34.563 ± 8.46
TRAIT ANXIETY			
CONTROL			
NO FOOD	37.313 ± 7.319	33.348 ± 6.60	CONTROL
FOOD	32.063 ± 9.081	35.438 ± 10.19	41.703 ± 11.842
STRESS			
NO FOOD	34.813 ± 8.70	33.500 ± 7.44	STRESS
FOOD	32.500 ± 6.64	36.313 ± 7.79	34.281 ± 7.63

no-food available, low restrainers were more anxious than high restrainers. However, in the control-stress order, if food was available, high restrainers were more anxious than low restrainers, but in the stress-control order if food was available, high restrainers were less anxious than low restrainers.

<u>The Effects of Manipulation and Condition</u>

This section presents the effects of the manipulation and the effects of condition on the scores of both scales of the Spielberger, combined for statistical analysis. There was an overall difference among the state anxiety and trait anxiety scales of the Spielberger ($F[1,55] = 27.13$, $p = 0.001$). Subjects also differed significantly in response to stress and control manipulations $F[1,56] = 31.09$, $p = 0.001$) indicating that the stress manipulation increased anxiety. The interaction terms were not significant.

Subscale Analyses

Repeated measures analysis of covariance were performed separately on each of the scales of the Spielberger because the MANOVA showed a significant difference between them.

State Anxiety Subscale

The Effects of Restraint and Order

Combining manipulations together and conditions of food availability together, low and high restrainers did not differ in their state anxiety levels. Combining restraint categories together and manipulations together, condition (food vs. no food) did not create differences in state anxiety. The main effect for order was not significant, and the interaction terms were not significant either.

The Effects of Manipulation and Condition

Combining restraint categories together and conditions together, subjects reported significantly more state anxiety after the stress manipulation than they reported after the control manipulation ($F[1,56] = 30.83$, $p = 0.001$). This difference partially validated the effectiveness of the stress manipulation. None of the interactions reached significance.

Trait Anxiety Subscale

The Effects of Restraint and Order

Combining manipulations together and conditions of food availability together, low and high restrainers did not differ in their trait anxiety levels. Combining restraint categories together and manipulations together, condition did not create differences in trait anxiety. The main effect for order (control-stress vs. stress-control) was not significant, and the interactions were not significant.

The Effects of Manipulation and Condition

Subjects did not report significantly more trait anxiety after the stress manipulation than they reported after the control manipulation. The interaction of manipulation-by-restraint-by-order was significant ($F[1,56] = 7.89$, $p = 0.007$) but other interactions were not.

Summary

The amount of state anxiety reported by subjects was significantly more after the stress manipulation than reported after the control manipulation. However, trait anxiety reports were not different after the two manipulations. Low and high restrainers did not differ on the anxiety measures of the Spielberger. The availability or non-availability of food and the order of presentation of the manipulations did not create differences in anxiety as measured by the Spielberger scales.

PSYCHOPHYSIOLOGICAL MEASURES

Subjects' baseline scores on each of the measures was the covariate for this particular analysis. See Appendix O for complete reporting of statistical analyses of heart rate, systolic, and diastolic blood pressure, and Table 15 for means of the psychophysiological measures.

COMBINED PSYCHOPHYSIOLOGICAL MEASURES ANALYSES

The Effects of Restraint and Order

There was a significant difference between subjects in the opportunity-to-eat and the no-opportunity-to-eat conditions on the three physiological measures ($F[1,54] = 10.89$, $p = 0.002$), and there was a main effect for order (control-stress or stress-control) ($F[1,54] = 4.05$, $p = 0.049$). Combining manipulations together and conditions of food availability together, high and low restrainers did not differ on the physiological measures. The interaction terms were not significant.

The Effects of Manipulation and Condition

There was an overall significant difference among the physiological measures (heart rate, systolic, and

Table 15

Psychophysiological Measures

(mean ± standard deviation)

	LOW RESTRAINERS (N=32)	HIGH RESTRAINERS (N=32)	ALL SUBJECTS (FOOD & NO FOOD COMBINED) (N=64)
HEART RATE			
CONTROL			CONTROL
NO FOOD	76.750 ± 11.81	69.267 ± 8.22	
FOOD	73.688 ± 10.45	75.375 ± 12.74	73.841 ± 11.07
STRESS			STRESS
NO FOOD	76.000 ± 10.81	74.200 ± 8.79	
FOOD	76.375 ± 14.02	82.563 ± 9.59	77.333 ± 11.21

	LOW RESTRAINERS (N=32)	HIGH RESTRAINERS (N=31)	ALL SUBJECTS (FOOD & NO FOOD COMBINED) (N=63)
SYSTOLIC			
CONTROL			
NO FOOD	104.625 ± 9.19	116.400 ± 18.83	CONTROL
FOOD	114.938 ± 14.00	117.875 ± 8.85	113.413 ± 13.95
STRESS			
NO FOOD	112.250 ± 9.57	117.467 ± 15.48	STRESS
FOOD	120.063 ± 14.92	118.313 ± 9.80	117.016 ± 12.73

	LOW RESTRAINERS (N=32)	HIGH RESTRAINERS (N=31)	ALL SUBJECTS (FOOD & NO FOOD COMBINED) (N=63)
DIASTOLIC			
CONTROL			
NO FOOD	63.500 ± 11.93	74.400 ± 15.40	CONTROL
FOOD	67.250 ± 12.06	72.250 ± 10.24	69.270 ± 12.92
STRESS			
NO FOOD	64.313 ± 8.16	73.133 ± 11.70	STRESS
FOOD	64.438 ± 9.70	73.250 ± 12.41	68.714 ± 11.26

diastolic measures) ($F[2,109] = 34.19$, $p = 0.001$). Subjects also differed significantly on the three measures in response to the manipulation ($F[1,55] = 6.47$, $p = 0.001$). The manipulation-by-physiological measures-by-restraint ($F[2,110] = 6.05$, $p = 0.003$) interaction was significant. The remaining interactions were not significant.

A repeated measures analysis of covariance was performed separately on the heart rate, systolic, and diastolic physiological measures because the MANOVA showed a significant difference among them.

HEART RATE

The Effects of Restraint and Order

Combining manipulations together and conditions together, low and high restrainers did not differ in heart rate. Combining restraint categories together and manipulations together, condition (food vs. no food) did not create differences in heart rate. The effect of order also was not significant. The interaction terms were not significant.

The Effects of Manipulation and Condition

Combining both restraint categories together and both conditions of food availability together, subjects had significantly higher heart rates after the stress manipulation than after the control manipulation ($F[1,56] = 8.97$, $p = 0.001$). This difference partially validates the effectiveness of the stress manipulation. The interaction of manipulation-by-restraint was significant ($F[1,56] = 4.77$, $p = 0.033$) because the high restrainers' heart rate was more affected by the stress manipulation than was the low restrainers' heart rate. Other interactions were not significant.

SYSTOLIC BLOOD PRESSURE

The Effects of Restraint and Order

Combining conditions together and manipulations together, low and high restrainers did not differ in systolic pressure. Combining restraint categories together and manipulations together, condition (food vs. no food) created differences in systolic pressure ($F[1,54] = 9.24$, $p = 0.004$). The main effect for order was not significant, and the interaction terms also were not significant.

The Effects of Manipulation and Condition

Combining restraint categories together and conditions together, subjects had significantly higher systolic pressure after the stress manipulation than they had after the control manipulation ($F[1,55] = 8.32$, $p = 0.006$). This difference partially validated the effectiveness of the stress manipulation. The interaction of manipulation-by-restraint was significant ($F[1,55] = 5.06$, $p = 0.029$) because the increase in systolic pressure during stress was more marked for the low restrainers. No other interactions were significant.

DIASTOLIC BLOOD PRESSURE

The Effects of Restraint and Order

Low and high restrainers did not differ in diastolic pressure ($F[1,54] = 1.11$, $p = 0.296$). Combining restraint categories together and manipulations together, condition did not create differences in diastolic pressure. The main effect for order was significant ($F[1,54] = 4.54$, $p = 0.038$) because individuals in control-stress order had a statistically significant, slightly lower diastolic pressure. None of the interactions were significant.

The Effects of Manipulation and Condition

Combining restraint categories together and conditions together, subjects did not have significantly higher diastolic pressure after the stress manipulation than they had after the control manipulation. The interactions were not significant.

Summary

The manipulation of stress created significantly different physiological measurements. Heart rate and systolic pressure were significantly higher after the stress manipulation than after the control manipulation. However, because baseline measurements were taken on one automatic monitor and control and stress measurements were taken on a different automatic monitor, and these two monitors were not calibrated against each other, it can not be stated with certainty that the stress manipulation increased psyschophysiological measurements above baseline measurements. Considering all the physiological measures together, food availability versus no food available resulted in similar measurements. However, considering systolic pressure separately, it was significantly higher if food was available. High and low restrainers did not differ on the measurements, and order was not a significant factor except for the diastolic pressure because those presented with the control manipulation first had a slightly lower diastolic pressure than those presented with the stress manipulation first.

RESTRAINT

This section discusses the findings regarding changes in restraint scale scores. A repeated measures, multiple analysis of covariance was performed to analyze the hypothesis that stress would result in a decrease in restraint scores of the high restrainer but not the low restrainer. Subjects' baseline score on the restraint scale was the covariate. Table 16 presents the data for restraint scale scores and Appendix P reports all statistical analyses for the restraint scale scores.

All Subjects

Combining restraint categories together and manipulations together, subjects in the two conditions (availability or nonavailability of food) had no differences in stress and control restraint scores. However, the opportunity-to-eat subjects had a higher average restraint score than subjects in the no-opportunity-to-eat condition. Combining restraint categories and the two conditions of food availability together, the main effect for manipulation was not significant because stress and control restraint scale scores were similar. The condition-by-manipulation interaction was not significant either. Separate repeated measures analysis of covariance were performed for low and high restrainers.

Low Restrainers

Combining manipulations together, there were no differences in restraint scores caused by the two conditions (food vs. no food), although the opportunity-to-eat condition resulted in a slightly higher average restraint score than the no opportunity-to-eat condition. Combining the two conditions of food availability together, the main effect for the manipulation was not significant, but the condition-by-

Table 16

Restraint Scale Scores

(mean ± standard deviation)

	STRESS RESTRAINT SCORE
LOW RESTRAINERS	
NO FOOD (N=32)	8.188 ± 3.27
FOOD (N=32)	8.313 ± 2.68
NO FOOD + FOOD (N=64)	8.250 ± 2.94
HIGH RESTRAINERS	
NO FOOD (N=32)	17.500 ± 4.57
FOOD (N=32)	21.000 ± 4.05
NO FOOD + FOOD (N=64)	19.250 ± 8.46
	CONTROL RESTRAINT SCORE
LOW RESTRAINERS	
NO FOOD (N=32)	7.938 ± 3.49
FOOD (N=32)	8.813 ± 2.68
NO FOOD + FOOD (N=64)	8.375 ± 3.19
HIGH RESTRAINERS	
NO FOOD (N=32)	17.125 ± 4.32
FOOD (N=32)	20.000 ± 4.02
NO FOOD + FOOD (N=64)	18.563 ± 4.36

manipulation interaction was significant ($F[1,30] = 6.43$, $p = 0.017$) because restraint was higher during stress if no-food was available but lower during stress if food was available.

High Restrainers

Combining manipulations together, there were no statistically significant differences in restraint scores caused by the two conditions, although the opportunity to eat resulted in a higher restraint score than the no-opportunity-to-eat condition. Combining the two conditions of food availability together, the main effect for the manipulation was significant ($F[1,30] = 5.55$, $p = 0.025$) because restraint scores were higher after stress than they were after control. The condition-by-manipulation interaction was not significant because restraint was higher during stress regardless of whether food was available to the high restrainer.

Summary

High and low restrainers in the food condition had nonsignificantly higher restraint scale scores than did high and low restrainers in the no-food condition. Opposite from predictions, high restrainers in both conditions (food vs. no food) scored higher on the restraint scale after they were exposed to the stressor than they did after they were exposed to the control manipulation. This was true for low restrainers in the no-food condition, but not true for low restrainers in the food condition.

DISTRACTION

This section discusses the effects of distraction on food consumption. To test the hypothesis that more distracted high restrainers would eat less food than less distracted high restrainers, and that the amount of distraction would not affect the amount of food consumed by the low restrainers, product-moment correlations were computed between the sum of the distraction questions and the amount of each specific food eaten and the total amount of food eaten. These correlations were computed separately for low and high restrainers. Table 17 reports the correlations for low and high restrainers. The amount of sweet and salty food that low restrainers ate during the control manipulation was significantly correlated with the amount of distraction that they reported. The amount that low restrainers ate during stress, and the amount that high restrainers ate during both stress and control were not significantly correlated with their reports of distraction during the experiment.

Table 17

Correlations between Amount Eaten and Distraction

LOW RESTRAINERS

	MMs	NUTS	CRACKERS	TOTAL
CONTROL	0.557	0.627	-0.073	0.604
probability =	0.025	0.00	0.788	0.013
STRESS	-0.227	-0.035	-0.376	-0.221
probability =	0.398	0.897	0.150	0.411

HIGH RESTRAINERS

	MMs	NUTS	CRACKERS	TOTAL
CONTROL	0.206	0.202	0.107	0.222
probability =	0.445	0.454	0.693	0.408
STRESS	-0.250	0.148	0.041	0.256
probability =	0.350	0.585	0.881	0.339

DISCUSSION

This study was designed to answer several questions related to stress and food consumption. Some of these questions have been addressed in previous studies and some have not been addressed before this experiment. The stress and food consumption and restraint and food consumption relationships which have been studied previously will be discussed first. Then, questions that have not previously been studied such as how stressful food might be to high restrainers and how distraction is involved in eating will be addressed. The discussion will suggest possible explanations for the findings, clinical implications, and future research needs.

In general, subjects ate more food during the stress manipulation than they ate during the control manipulation. This overall finding is consistent with 3 of 4 human studies that used female subjects (Leon & Chamberlain, 1973; Slochower et al., 1981; Stunkard et al., 1955; Slochower et al., 1981) and most of the animal studies (Antelman & Caggiula, 1977; Antelman, Rowland, & Fisher, 1976; Immelman, 1980), but type of food, restraint, and order of manipulation made a difference in the results. Subjects ate more sweet and salty food during stress than they ate during control, but this was not true for bland food. Subjects who experienced the stress manipulation first and the control manipulation second ate more during stress than they ate during control. When both orders of manipulation were collapsed into one analysis of the manipulation effects, subjects ate more during stress than during control. In addition, a between-subjects comparison of stress presented first with control presented first revealed the same effect, i. e., that more was eaten during stress than was eaten during control. However, subjects who experienced the control manipulation first and the stress manipulation second ate less during stress than they ate during control.

The prediction that low restrainers would eat more than high restrainers was confirmed. However, the difference in food consumption between high and low restrainers was not statistically significant for sweet, salty, or bland food considered individually, even though for each individual food, low restrainers ate approximately four times as much as high restrainers.

Under control conditions high restrainers ate less than low restrainers. Under stress, high restrainers still ate less than low restrainers and the difference between high and low restrainers' consumption was somewhat amplified. Low restrainers ate more during stress than during control, while high restrainers ate similarly during both manipulations. So, overall, people in this study ate somewhat more during stress than during control, especially if they were low in restraint.

High restrainers' scores on the restraint scale were significantly higher after the stressor than they were after the control manipulation, an opposite pattern than was predicted. Surprisingly, only the low restrainers' scores on the restraint scale decreased after stress compared to after control. Low restrainers also ate more during stress than they ate during control, although the difference was not significant. It seems that the previously hypothesized stress-imposed reduction in restraint may not be the mechanism responsible for the increased eating of the high restrainers in other studies.

In the present experiment, high restrainers ate similarly during stress and control. Also, high restrainers' restraint scores increased during stress. This finding of change in restraint is opposite from Herman et al.'s (Herman & Mack, 1975; Herman & Polivy, 1975) prediction. However, the increase in restraint under stress is consistent with the fact that high restrainers did not eat more under stress. Future studies are needed in this area because no other studies have been conducted which test the hypothesized relationship between stress and restraint reduction, and because this finding is in a direction different from that hypothesized.

Contrary to other studies in which high restrainers ate more after a preload and low restrainers ate less after a preload, this experiment found that all subjects ate less after a preload. Subjects were not required to eat as part of a taste test as subjects were required to do in Herman's preload studies. Perhaps high restrainers eat more after a preload only when they feel that they are not responsible for eating, i.e., the experimental situation requires them to eat.

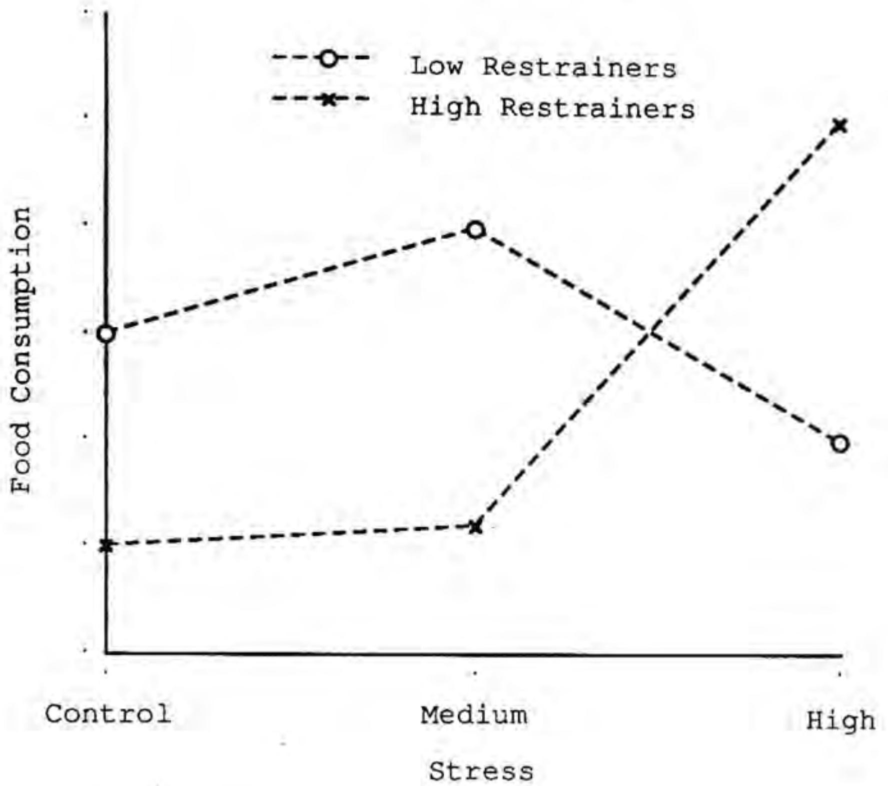
It was hypothesized that the presence of food would be a stressor to high restrainers but not to low restrainers. This prediction was partially confirmed when high restrainers reported significantly more anxiety on the MAACL when food was present than when food was absent, while low restrainers reported more anxiety when no food was available than when it was present. The anxiety reported by high restrainers when food was present does not seem to result from consumption of food because amount of food consumed was not related to mood. It does not seem to be the case that eating led to altered mood because restrainers became distraught due to breaking their usual self-imposed diet.

It was postulated that high restrainers' food consumption would be negatively and significantly correlated with distraction. However, eating behavior of the high restrainers was not significantly correlated with the amount of distraction that they reported during their session. The lack of a significant correlation was true during both the stress and control manipulations for the high restrainer. The eating behavior of the low restrainers during the stress manipulation was not significantly correlated with the amount of distraction that they reported occurring during their session. However, their food consumption during the control manipulation was significantly correlated in a positive direction with their reports of distraction. This finding is surprising and contrary to the distraction hypothesis because one would expect high restrainers would be able to maintain their restraint easier when they can use distractions to avoid thinking about food, and because non-stressed low restrainers ate more as they became more distracted.

The present study found several different results than did other studies with regard to the effects of stress on food consumption and how stress differentially affects high and low restrainers. One possible reason for these discrepant findings could result from the counterbalanced, within-subjects design used in this study. However, this explanation is unlikely because subjects did not eat significantly different in the two orders. To further explore possible differences caused by the within-subjects design, an analysis was performed to compare food consumption of those subjects who received the stress manipulation first with those who received the control manipulation first. This analysis is similar to previous studies that employed a between-subjects design. No term in this analysis was significant, although the effect of restraint on eating approached significance. It does not seem that the within-subjects design is responsible for the results that are contrary to previous findings.

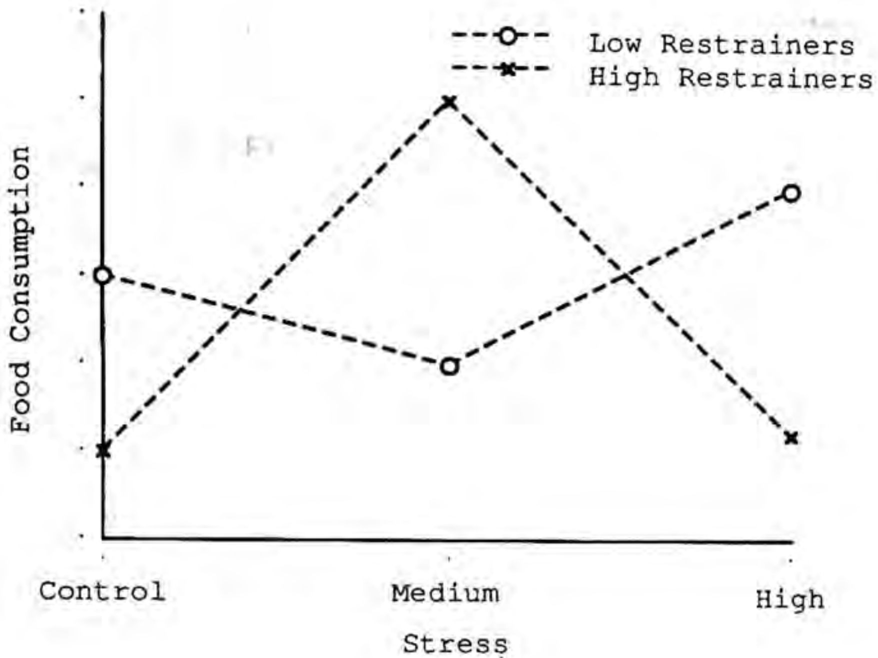
Another possible reason why this experiment found different results from other studies could be that the stress-food consumption relationship may not be a linear function. In other words, different levels of stress might interact differently with restraint to affect food consumption and the various stress and eating studies may have differentially stressed subjects. The results of the present study would be consistent with the reported findings of previous studies if it is assumed that the stress created in the current experiment was less than that created in previous studies and the true relationship between stress, restraint, and food consumption is as follows (See Figure 1): At moderate levels of stress, low restrainers eat more than they eat during control, but during more extreme stress, they eat less than they eat during control. Perhaps high restrainers eat only slightly more during moderate stress than they eat during control and they eat significantly more during more extreme stress than they eat during control. If this described function is correct, then studies such as Herman's may have used control and high levels of stress, whereas the present study may have used control and moderate levels of stress.

Figure 1



The data from the present study also would be consistent with the reported findings of previous studies if it is assumed that the stress created in the current experiment was more than that created in previous studies and the true relationship between stress, restraint, and food consumption is as follows (See Figure 2): Low restrainers eat more during more extreme stress than they eat during control, but eat less during moderate stress than they eat during control. High restrainers eat similarly during more extreme stress and control, but eat more during moderate stress than they eat during control.

Figure 2



The model presented in Figure 2 is more likely because subjects' psychophysiological measures in the present experiment indicated significantly higher heart rate and systolic blood pressure after the stress manipulation than after the control manipulation. Also, subjects reported significantly more depression, hostility, and anxiety on the mood scales after the stress manipulation than they did after the control manipulation. Therefore, it seems that they were stressed by the manipulation in this experiment. Other studies have not included as many manipulation checks as this study, so it is unclear whether or how much previous studies manipulated stress. Probably, other studies stressed their subjects but the amount of stress created in this study may have been higher, and subjects food consumption patterns differ depending upon the level of stress. In order to determine which of these functions would reconcile findings of this study and previous studies, it would be advantageous for future studies to differentially stress subjects with several levels of stress and then examine food consumption of the high and low restrainers at different levels of stress. These studies should carefully validate the manipulation of stress using psychophysiological and self-report measures. Future studies might also address the question of why low restrainers eat more during stress than during control. Perhaps the food consumption serves some palliative coping function, or perhaps through some yet unelucidated physiological mechanism, specific food consumption serves some facilitative coping function in coping with stress.

Finally, it is recommended that future studies attempt to replicate the new findings of this experiment. The finding that stress increased restraint scores in the high restrainers was opposite of predictions based on the work of Herman (Herman and Polivy, 1975; Polivy and Herman, 1976). Therefore, Herman's interpretation of restraint reduction and increased eating in the high restrainer is questionable. The fact that high restrainers ate less when under stress and that restraint scores increased during stress is consistent with the idea that restraint can change over short periods of time and that these changes translate into changes in eating behavior. The confirmation of the hypothesis that the presence of food is stressful to the high restrainer is another new finding. The expected interplay between distraction and food consumption was not as predicted but distraction may have affected eating by the low restrainers during the control manipulation.

In summary, this experiment found that women who are typically more concerned about their weight and their eating behavior ate less than women who are relatively less concerned. Under stress, these more concerned women did not change food consumption, but the relatively less concerned women increased food consumption during stress. Because concern with eating habits and weight increased with stress, and because the restrained women did not eat more when stressed, weight loss therapies for those women who are chronically more concerned about weight control and eating habits might not need to focus on stress reduction as part of the weight loss treatment per se. On the other hand, weight loss therapy for women who are usually relatively less concerned about their weight and their eating behavior should probably include stress reduction techniques because these low restrainers ate more in this study during stress. In addition, although distraction is a common therapeutic approach towards reduced food consumption, the findings of this study suggest that distraction is not significantly related to food consumption in high restrainers but is significantly related to food consumption in low restrainers during nonstressful situations. During these nonstressful situations, the low restrainer may eat more as they become more distracted. Findings from this experiment indicate that the opportunity to eat stresses the high restrainer and that high restrainers eat similarly during stress and control. The findings also indicate that the high restrainers' restraint increases during stress. Does this finding suggest that presenting food to the individual on a diet may assist him or her not to eat because it will increase his or her restraint? Only future studies which replicate the new findings of this study will be able to answer this question with more certainty.

APPENDICES

Appendix A

Herman and Mack Restraint Scale (1975)

1. How often are you dieting? (rarely; sometimes; usually; always) (score: 1-4)

2. What is your maximum weight gain within a week? (score: 1pt./3 lbs.)

3. Do you eat sensibly before others and make up for it alone? (never; rarely; often; always) (score: 0-3)

4. Do you give too much time and thought to food? (never; rarely; often; always) (score: 0-3)

5. Do you have feelings of guilt after overeating? (never; rarely; often; always) (score: 0-3)

Appendix B

Herman and Polivy Restraint Scale (1975)

1. How many pounds over your desired weight were you at your maximum weight? (score: 1point/5 pounds)

2. How often are you dieting? rarely, sometimes, usually, always.(score: 1-4)

3. Which best describes your behavior after you have eaten a "not allowed" food while on your diet? return to diet, stop eating for an extended period of time in order to compensate, continue on a splurge, eating other "not allowed" foods. (score: 0-2)

4. What is the maximum amount of weight that you have ever lost within 1 month? (Score: 1 point/5 pounds)

5. What is your maximum weight gain within a week? (score: 1 point/3 pounds)

6. In a typical week, how much does your weight fluctuate (maximum-minimum)? (score: 1 point/3 pounds)

7. Would a weight fluctuation of 5 lb affect the way you live your life? Not at all, slightly, moderately, very much. (Score: 0-3)

8. Do you eat sensibly before others and make up for it alone? never, rarely, often, always. (score: 0-3)

9. Do you give too much time and thought to food? never, rarely, often, always. (score: 0-3)

10. Do you have feelings of guilt after overeating? never, rarely, often, always. (score: 0-3)

11. How conscious are you of what you're eating? Not at all, slightly, moderately, extremely. (Score: 0-3)

Appendix C

Herman and Polivy Restraint Scale (1980)

1. How often are you dieting? never; rarely; sometimes; often; always. (scored 0-4)

2. What is the maximum amount of (in pounds) that you have ever lost within one month? 0-4; 5-9; 10-14; 15-19; 20+. (scored 0-4)

3. What is your maximum weight gain within a week? 0-1; 1.1-2; 2.1-3; 3.1-5; 5.1+. (scored: 0-4)

4. In a typical week, how much does your weight fluctuate? 0-1; 1.1-2; 2.1-3; 3.1-5; 5.1+. (scored: 0-4)

5. Would a weight fluctuation of 5 lb affect the way you live your life? Not at all; slightly; moderately; very much. (Scored 0-3)

6. Do you eat sensibly in front of others and splurge alone? never; rarely; often; always. (scored 0-3)

7. Do you give too much time and thought to food? never; rarely; often; always. (scored 0-3)

8. Do you have feelings of guilt after overeating? never; rarely; often; always. (scored 0-3)

9. How conscious are you of what you are eating? Not at all; slightly; moderately; extremely. (Scored 0-3)

10. How many pounds over your desired weight were you at your maximum? 0-1; 1-5; 6-10; 11-20; 21+. (scored 0-4)

11. Right now, how concerned are you with how much you eat? Not at all; slightly; moderately; very much. (Scored 0-3)

12. Right now, can you limit how much you eat? Not at all; slightly; moderately; very much (Scored 0-3)

Appendix D
Multiple Adjective Affective Checklist

ON THIS QUESTIONNAIRE PLEASE MARK ONLY THE WORDS THAT DESCRIBE YOU NOW

1 ☐ active
2 ☐ adventurous
3 ☐ affectionate
4 ☐ afraid
5 ☐ agitated
6 ☐ agreeable
7 ☐ aggressive
8 ☐ alive
9 ☐ alone
10 ☐ amiable
11 ☐ amused
12 ☐ angry
13 ☐ annoyed
14 ☐ awful
15 ☐ bashful
16 ☐ bitter
17 ☐ blue
18 ☐ bored
19 ☐ calm
20 ☐ cautious
21 ☐ cheerful
22 ☐ clean
23 ☐ complaining
24 ☐ contented
25 ☐ contrary
26 ☐ cool
27 ☐ cooperative
28 ☐ critical
29 ☐ cross
30 ☐ cruel
31 ☐ daring
32 ☐ desperate
33 ☐ destroyed
34 ☐ devoted
35 ☐ disagreeable
36 ☐ discontented
37 ☐ discouraged
38 ☐ disgusted
39 ☐ displeased
40 ☐ energetic
41 ☐ enraged
42 ☐ enthusiastic
43 ☐ fearful
44 ☐ fine
45 ☐ fit
46 ☐ forlorn
47 ☐ frank
48 ☐ free
49 ☐ friendly
50 ☐ frightened
51 ☐ furious
52 ☐ gay
53 ☐ gentle
54 ☐ glad
55 ☐ gloomy
56 ☐ good
57 ☐ good-natured
58 ☐ grim
59 ☐ happy
60 ☐ healthy
61 ☐ hopeless
62 ☐ hostile
63 ☐ impatient
64 ☐ incensed
65 ☐ indignant
66 ☐ inspired
67 ☐ interested
68 ☐ irritated
69 ☐ jealous
70 ☐ joyful
71 ☐ kindly
72 ☐ lonely
73 ☐ lost
74 ☐ loving
75 ☐ low
76 ☐ lucky
77 ☐ mad
78 ☐ mean
79 ☐ meek
80 ☐ merry
81 ☐ mild
82 ☐ miserable
83 ☐ nervous
84 ☐ obliging
85 ☐ offended
86 ☐ outraged
87 ☐ panicky
88 ☐ patient
89 ☐ peaceful
90 ☐ pleased
91 ☐ pleasant
92 ☐ polite
93 ☐ powerful
94 ☐ quiet
95 ☐ reckless
96 ☐ rejected
97 ☐ rough
98 ☐ sad
99 ☐ safe
100 ☐ satisfied
101 ☐ secure
102 ☐ shaky
103 ☐ shy
104 ☐ soothed
105 ☐ steady
106 ☐ stubborn
107 ☐ stormy
108 ☐ strong
109 ☐ suffering
110 ☐ sullen
111 ☐ sunk
112 ☐ sympathetic
113 ☐ tame
114 ☐ tender
115 ☐ tense
116 ☐ terrible
117 ☐ terrified
118 ☐ thoughtful
119 ☐ timid
120 ☐ tormented
121 ☐ understanding
122 ☐ unhappy
123 ☐ unsociable
124 ☐ upset
125 ☐ vexed
126 ☐ warm
127 ☐ whole
128 ☐ wild
129 ☐ willful
130 ☐ wilted
131 ☐ worrying
132 ☐ young

Appendix E
Spielberger Anxiety Scale

SELF-EVALUATION QUESTIONNAIRE

SUBJECT ______________________ ________

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

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

SELF-EVALUATION QUESTIONNAIRE

SUBJECT ______________________ ________

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

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

APPENDIX F

1. How much did the knowledge that you were in a psychological experiment distract you from your speech preparation?

not very much						very much
1	2	3	4	5	6	7

2. How much did the videocamera distract you from concentrating on preparing the speech?

not very much						very much
1	2	3	4	5	6	7

3. Did the fluorescent lighting distract you from the experiment?

not very much						very much
1	2	3	4	5	6	7

4. Did any noises outside the room distract you from the experiment?

not very much						very much
1	2	3	4	5	6	7

5. How much did the snack foods distract you from the speech preparation?

not very much						very much
1	2	3	4	5	6	7

6. How much did you think about the snack foods?

not very much						very much
1	2	3	4	5	6	7

7. How much did life problems distract you from working on the speech?

not very much						very much
1	2	3	4	5	6	7

8. Did any physical sensations such as illness or fatigue distract you from the experiment?

not very much						very much
1	2	3	4	5	6	7

9. Did working on the speech keep you from eating the snack foods?

not very much 1 2 3 4 5 6 very much 7

10. How much were you distracted by irrelevant thoughts during the experiment today?

not very much 1 2 3 4 5 6 very much 7

11. How much more of the snack foods would you have eaten if you had been left in the room without anything to do?

not very much 1 2 3 4 5 6 very much 7

12. Were you distracted by an uncomfortable room temperature during the experiment?

not very much 1 2 3 4 5 6 very much 7

13. How much did the experimenter distract you ?

not very much 1 2 3 4 5 6 very much 7

14. When you are confronted with a task, are you usually distracted to the point where you have difficulty completing the task?

not very much 1 2 3 4 5 6 very much 7

15. Usually, whenever you are trying to avoid eating something, do distractions help keep you from eating the food?

not very much 1 2 3 4 5 6 very much 7

Appendix G

Subject #____

Supplementary Questionnaire for Women

1. What was the date of the first day of your last menstrual period?______

2. On what date do you expect your next period to start?_____

3. Do your periods come regularly? (Circle one)
   YES NO
   If yes, approximately how many days is your cycle?_____

4. At any time during the month do you regularly experience any symptoms such as weight gain, irritability, cramps, etc.?
   (Circle one) YES NO If yes:

When	What symptoms
1.________________	1.________________
2.________________	2.________________
3.________________	3.________________

5. Do you experience a preference for any foods or tastes during any time during your monthly cycle?
   (Circle One) YES NO

   If yes:

When	Which foods or tastes
1.________________	1.________________
2.________________	2.________________
3.________________	3.________________

Appendix H
Telephone screening questionnaire

1. How often are you dieting? never; rarely; sometimes; often; always. (scored 0-4)

2. What is the maximum amount of (in pounds) that you have ever lost within one month? 0-4; 5-9; 10-14; 15-19; 20+. (scored 0-4)

3. What is your maximum weight gain within a week? 0-1; 1.1-2; 2.1-3; 3.1-5; 5.1+. (scored: 0-4)

4. In a typical week, how much does your weight fluctuate? 0-1; 1.1-2; 2.1-3; 3.1-5; 5.1+. (scored: 0-4)

5. Would a weight fluctuation of 5 lb affect the way you live your life? Not at all; slightly; moderately; very much. (Scored 0-3)

6. Do you eat sensibly in front of others and splurge alone? never; rarely; often; always. (scored 0-3)

7. Do you give too much time and thought to food? never; rarely; often; always. (scored 0-3)

8. Do you have feelings of guilt after overeating? never; rarely; often; always. (scored 0-3)

9. How conscious are you of what you are eating? Not at all; slightly; moderately; extremely. (Scored 0-3)

10. How many pounds over your desired weight were you at your maximum? 0-1; 1-5; 6-10; 11-20; 21+. (scored 0-4)

11. Do you smoke cigarettes?

12. Have you ever smoked cigarettes? If so, how long ago and how many?

13. Do you take any prescription medications?

14. Do you have any serious medical problems such as hypertension, diabetes, or heart problems?

15. Are you likely to wait to go to the doctor until you are seriously ill?

16. How conscious are you of your physical health?

17. What is the maximum time you have ever missed work or been "out of commission" because of an illness?

18. Have you or one of your family members ever had a speech impediment?

19. Would you say that you are in good athletic condition?

20. When is the last time you saw a physician?

APPENDIX I

Statistical Analyses of Food Consumption

ANALYSIS FOR ALL FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	10008.83	28	357.46		
RESTRAINT CATEGORY	1642.38	1	1642.38	4.59	.041
ORDER	475.08	1	475.08	1.33	.259
RESTRAINT X ORDER	29.88	1	29.88	.08	.775
ERROR TERM					
WITHIN CELLS		18.91			

TESTS INVOLVING FOOD WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	8570.42	84	102.03		
FOOD	2820.06	3	940.02	9.21	.001
RESTRAINT CAT X FOOD	841.24	3	280.41	2.75	.048
FOOD X ORDER	421.65	3	421.65	1.38	.255
RSTCAT X FOOD X ORDER	61.32	3	20.44	.20	.896

TESTS INVOLVING MANIPULATION WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	7132.74	28	254.74		
MANIPULATION	232.37	1	232.37	0.91	.348
RESTRAINT X MANIP	262.40	1	262.40	1.03	.319
MANIPULATION X ORDER	1094.20	1	1094.20	4.30	.048
RSTCAT X MANIP X ORD	596.03	1	596.03	2.34	.137
ERROR TERM					
WITHIN CELLS		15.96			

TESTS INVOLVING FOOD BY MANIPULATION WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	5878.64	84	69.98		
FOOD X MANIPULATION	207.41	3	69.14	0.99	.403
RSTCAT X FOOD X MANIP	216.14	3	72.05	1.03	.384
FOOD X MANIP X ORD	608.27	3	202.76	2.90	.040
RSTCAT X FOOD X MANIP X ORDER	339.14	3	113.05	1.62	.192

Statistical Analyses of Food Consumption
ANOVAs FOR INDIVIDUAL FOODS

SWEET FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	7152.57	28	255.45		
RESTRAINT CATEGORY	721.19	1	721.19	2.82	.104
ORDER	382.50	1	382.50	1.50	.231
RESTRAINT X ORDER	27.38	1	27.38	.11	.746

ERROR TERM
WITHIN CELLS 15.98

TESTS INVOLVING MANIPULATION WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	4543.90	28	162.28		
MANIPULATION	189.89	1	189.89	1.17	.289
RESTRAINT CAT. X MANIP	204.06	1	204.06	1.26	.272
MANIPULATION X ORDER	547.21	1	547.21	3.37	.077
RESTRAINT X MANIP X ORDER	313.91	1	313.91	1.93	.175

ERROR TERM
WITHIN CELLS 12.74

SALTY FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	1306.61	28	46.66		
RESTRAINT CATEGORY	109.88	1	109.88	2.35	.136
ORDER	29.16	1	29.16	.62	.436
RESTRAINT X ORDER	17.94	1	17.94	.38	.540
ERROR TERM					
WITHIN CELLS		6.83			

TESTS INVOLVING MANIPULATION WITHIN-SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	1300.16	28	46.43		
MANIPULATION	12.96	1	12.96	0.28	.601
RESTRAINT X MANIP	10.37	1	10.37	0.22	.640
MANIPULATION X ORDER	56.29	1	56.29	1.21	.280
RESTRAINT X MANIP X ORDER	20.54	1	20.54	.44	.511
ERROR TERM					
WITHIN CELLS		6.81			

BLAND FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	111.24	28	3.97		
RESTRAINT CATEGORY	10.17	1	10.17	2.56	.121
ORDER	9.99	1	9.99	2.52	.124
RESTRAINT X ORDER	16.01	1	16.01	4.03	.054

ERROR TERM
WITHIN CELLS 1.99

TESTS INVOLVING MANIPULATION WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	34.58	28	1.24		
MANIPULATION	4.56	1	4.56	3.69	.065
RESTRAINT X MANIP	1.71	1	1.71	1.38	.250
MANIPULATION X ORDER	4.77	1	4.77	3.86	.059
RESTRAINT X MANIP X ORDER	4.68	1	4.68	3.79	.062

ERROR TERM
WITHIN CELLS 1.11

APPENDIX J
CONTROL-STRESS ORDER OF MANIPULATION:

ANOVA FOR ALL FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	2618.03	14	187.00		
RESTRAINT CATEGORY	614.60	1	614.60	4.69	.091

ERROR TERM
WITHIN CELLS 13.67

TESTS INVOLVING FOOD WITHIN-SUBJECT EFFECTS

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	1898.86	42	45.21		
FOOD	565.19	3	188.40	4.17	.011
RESTRAINT X FOOD	279.43	3	93.04	2.06	.120

TESTS INVOLVING MANIPULATION WITHIN-SUBJECT EFFECTS

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	392.50	14	28.04		
MANIPULATION	159.04	1	159.04	5.67	.032
RESTRAINT X MANIP	33.74	1	33.74	1.20	.291

ERROR TERM
WITHIN CELLS 5.30

TESTS INVOLVING FOOD BY MANIPULATION WITHIN SUBJECT EFFECTS

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	299.85	42	7.14		
FOOD X MANIPULATION	63.15	3	21.05	2.95	.044
RSTCAT X FOOD X MANIP	12.77	3	4.26	0.60	.621

CONTROL-STRESS ORDER OF MANIPULATION:

ANOVA FOR INDIVIDUAL FOODS

SWEET FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	1581.38	14	112.96		
RESTRAINT CATEGORY	233.77	1	233.77	2.07	.172

ERROR TERM
WITHIN CELLS 10.63

TESTS INVOLVING MANIPULATION WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	212.43	14	15.17		
MANIPULATION	46.20	1	46.20	3.04	.103
RESTRAINT X MANIP	5.89	1	5.89	.39	.543

ERROR TERM
WITHIN CELLS 3.89

SALTY FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	218.79	14	15.63		
RESTRAINT CATEGORY	19.52	1	19.52	1.25	.283

ERROR TERM
WITHIN CELLS 3.95

TESTS INVOLVING MANIPULATION WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	55.33	14		3.95	
MANIPULATION	7.61	1	7.61	1.93	.187
RESTRAINT X MANIP	.86	1	.86	0.22	.648

ERROR TERM
WITHIN CELLS 1.99

BLAND FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	98.69	14	7.05		
RESTRAINT CATEGORY	25.85	1	25.85	3.67	.076

ERROR TERM
WITHIN CELLS 2.65

TESTS INVOLVING MANIPULATION WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	32.09	14	2.29		
MANIPULATION	9.33	1	9.33	4.07	.063
RESTRAINT X MANIP	6.02	1	6.02	2.63	.127

ERROR TERM
WITHIN CELLS 1.51

STRESS-CONTROL ORDER OF MANIPULATION:
ANALYSIS FOR ALL FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	7390.80	14	527.91		
RESTRAINT CATEGORY	1057.66	1	1057.66	2.00	.179

ERROR TERM
WITHIN CELLS 22.98

TESTS INVOLVING FOOD WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	6671.56	42	45.21		
FOOD	2676.52	3	892.17	5.62	.002
RESTRAINT X FOOD	623.44	3	207.81	1.31	.284

TESTS INVOLVING MANIPULATION WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	6740.20	14	481.45		
MANIPULATION	1167.53	1	1167.53	2.43	.142
RESTRAINT X MANIP	824.69	1	824.69	1.71	.212

ERROR TERM
WITHIN CELLS 21.94

TESTS INVOLVING FOOD BY MANIPULATION WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	5578.79	42	132.83		
FOOD X MANIPULATION	752.53	3	250.84	1.89	.146
RSTCAT X FOOD X MANIP	542.50	3	180.83	1.36	.268

STRESS-CONTROL ORDER OF MANIPULATION:

ANOVA FOR INDIVIDUAL FOODS

SWEET FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	5571.19	14	397.94		
RESTRAINT CATEGORY	514.80	1	514.80	1.29	.274

ERROR TERM
WITHIN CELLS 19.95

TESTS INVOLVING MANIPULATION WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	4331.47	14	309.39		
MANIPULATION	690.90	1	690.90	2.23	.157
RESTRAINT CAT. X MANIP	512.08	1	512.08	1.66	.219

ERROR TERM
WITHIN CELLS 17.59

SALTY FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	1087.82	14	77.70		
RESTRAINT CATEGORY	108.30	1	108.30	1.39	.257

ERROR TERM
WITHIN CELLS 8.81

TESTS INVOLVING MANIPULATION WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	1244.83	14	88.92		
MANIPULATION	61.63	1	61.63	.69	.419
RESTRAINT X MANIP	30.05	1	30.05	.34	.570

ERROR TERM
WITHIN CELLS 9.43

BLAND FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	12.55	14	.90		
RESTRAINT CATEGORY	.33	1	.33	.37	.554

ERROR TERM
WITHIN CELLS .95

TESTS INVOLVING MANIPULATION WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	2.49	14	.18		
MANIPULATION	.00	1	.00	.01	.938
RESTRAINT X MANIP	.37	1	.37	2.06	.173

ERROR TERM
WITHIN CELLS .42

Appendix K

STATISTICAL ANALYSES OF FOOD CONSUMPTION
(FIRST MANIPULATION VERSUS SECOND MANIPULATION)

MANOVA FOR ALL FOODS

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	10512.99	30	350.43		
RESTRAINT	1642.68	1	1642.68	4.69	.038

ERROR TERM
WITHIN CELLS 18.72

TESTS INVOLVING FOOD WITHIN-SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	9053.19	90	92.99		
FOOD	2820.19	3	940.06	9.35	.001
RESTRAINT X FOOD	841.32	3	280.44	2.79	.045

TESTS INVOLVING TIME WITHIN-SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	7628.00	30	254.27		
MANIPULATION	1093.96	1	1093.96	4.30	.047
TIME X RESTRAINT	595.85	1	595.85	2.34	.136

ERROR TERM
WITHIN CELLS 15.95

STATISTICAL ANALYSES OF FOOD CONSUMPTION
(FIRST MANIPULATION VERSUS SECOND MANIPULATION)
ANOVAS FOR INDIVIDUAL FOODS

SWEET FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	7562.45	30	252.08		
RESTRAINT CATEGORY	721.19	1	721.19	2.86	.101

ERROR TERM
WITHIN CELLS 15.88

TESTS INVOLVING TIME WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	4937.85	30	164.59		
TIME	547.21	1	547.21	3.32	.078
RESTRAINT X TIME	313.91	1	313.91	1.91	.177

ERROR TERM
WITHIN CELLS 12.83

SALTY FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	1353.50	30	45.12		
RESTRAINT CATEGORY	109.96	1	109.96	2.44	.129

ERROR TERM
WITHIN CELLS 6.72

TESTS INVOLVING TIME WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	1323.58	30	44.12		
TIME	56.23	1	56.23	1.27	.268
RESTRAINT X TIME	20.51	1	20.51	.46	.501

ERROR TERM
WITHIN CELLS 6.64

BLAND FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	137.24	30	4.57		
RESTRAINT CATEGORY	10.17	1	10.17	2.22	.146

ERROR TERM
WITHIN CELLS 2.14

TESTS INVOLVING TIME WITHIN SUBJECT EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	40.85	30	1.36		
TIME	4.77	1	4.77	3.50	.071
RESTRAINT X TIME	4.68	1	4.68	3.44	.074

ERROR TERM
WITHIN CELLS 1.17

STATISTICAL ANALYSES OF FOOD CONSUMPTION
(FIRST STRESS VERSUS FIRST CONTROL)

MANOVA FOR ALL FOODS

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	15084.18	28	538.72		
RESTRAINT	2108.60	1	2108.60	3.91	.058
STRESS VS CONTROL	685.98	1	685.98	1.27	.269
RSTCAT X STR VS CONTROL	234.69	1	234.69	.44	.515

ERROR TERM
WITHIN CELLS 23.21

STATISTICAL ANALYSES OF FOOD CONSUMPTION
(SECOND STRESS VERSUS SECOND CONTROL)

MANOVA FOR ALL FOODS

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	2057.11	28	73.47		
RESTRAINT	129.93	1	129.93	1.77	.194
STRESS VS CONTROL	21.52	1	21.52	.29	.593
RSTCAT X STR VS CONTROL	57.51	1	57.51	.78	.384

ERROR TERM
WITHIN CELLS 8.57

APPENDIX L

Statistical Analyses of Food Consumption Based On Session Time

MANOVA FOR ALL FOOD

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	11757.34	30	391.91		
AM:PM	398.82	1	398.82	1.02	.321
ERROR TERM					
WITHIN CELLS		19.80			

TESTS INVOLVING FOOD WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	9695.81	90	107.73		
FOOD	2716.73	3	905.58	8.41	.001
AM:PM X FOOD	198.82	3	66.27	.62	.607

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	8444.88	30	281.50		
MANIPULATION	185.84	1	185.84	0.66	.423
AM:PM X MANIPULATION	640.49	1	640.49	2.28	.142
ERROR TERM					
WITHIN CELLS		16.78			

TESTS INVOLVING FOOD BY MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	6640.67	90	73.79		
FOOD X MANIPULATION	172.66	3	57.55	0.78	.508
AM:PM X FOOD X MANIP	401.50	3	133.83	1.81	.150

Appendix M

MANOVA FOR COMBINED MAACL SCALES

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	1525.73	55	27.74		
REGRESSION	1956.46	1	1956.46	70.53	0.001
RESTRAINT CATEGORY	.14	1	.14	.00	0.944
ORDER EFFECTS	7.84	1	7.84	.28	0.597
CONDITION	6.14	1	6.14	.22	0.640
RSTCAT X ORDER	1.82	1	1.82	.07	0.799
RSTCAT X CONDITION	82.33	1	82.33	2.97	0.091
CONDITION X ORDER	103.87	1	103.87	3.74	0.058
RSTCAT X COND X ORDER	26.75	1	26.75	.96	0.330

ERROR TERM
WITHIN CELLS 5.27

TESTS INVOLVING MOOD WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	360.64	111	3.25		
REGRESSION	357.49	1	357.49	110.03	0.001
MOOD	77.23	2	38.61	11.89	0.001
MOOD X RESTRAINT	9.91	2	4.96	1.53	0.222
MOOD X ORDER EFFECTS	10.91	2	5.45	1.68	0.191
CONDITION X MOOD	13.28	2	6.64	2.04	0.134
MOOD X RSTCAT X ORDER	0.29	2	0.15	0.05	0.956
MOOD X RSTCAT X COND	13.24	2	6.62	2.04	0.135
CONDITION X MOOD X OR	37.82	2	18.91	5.82	0.004
RSTCAT X COND X ORDER X MOOD	11.83	2	5.91	1.82	0.167

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	512.94	56	9.16		
MANIPULATION	366.21	1	366.21	39.98	0.001
MANIP X RSTCAT	10.34	1	10.34	1.13	0.293
MANIP X ORDER	33.25	1	33.25	3.63	0.062
CONDITION X MANIP	28.71	1	28.71	3.13	0.082
MANIP X RSTCAT X ORDER	9.69	1	9.69	1.06	0.308
MANIP X RSTCAT X COND	24.50	1	24.50	2.68	0.108
MANIP X COND X ORDER	39.40	1	39.40	4.30	0.043
COND X MANIP X RSTCAT X ORDER	47.46	1	47.46	5.18	0.027

ERROR TERM
WITHIN CELLS 3.03

TESTS INVOLVING MOOD BY MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	284.38	112	2.54		
MOOD X MANIPULATION	45.06	2	22.53	8.87	0.001
MANIP X RSTCAT X MOOD	11.44	2	5.72	2.25	0.110
MANIPULATION X ORDER	6.27	2	3.14	1.23	0.295
MANIP X MOOD X ORDER	22.75	2	11.38	4.48	0.013
RSTCAT X ORDER X MOOD X MANIPULATION	8.40	2	4.20	1.65	0.196
RSTCAT X COND X MOOD X MANIPULATION	8.58	2	4.29	1.69	0.189
ORDER X COND X MOOD X MANIPULATION	3.81	2	1.91	0.75	0.474
RSTCAT X ORDER X COND X MOOD X MANIP	1.31	2	.66	0.26	0.773

SEPARATE ANOVAS FOR INDIVIDUAL SCALES

ANXIETY

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	777.20	55	14.13		
REGRESSION	390.24	1	390.24	27.62	0.001
RESTRAINT CATEGORY	1.88	1	1.88	.13	0.716
ORDER EFFECTS	16.79	1	16.74	1.19	0.280
CONDITION	12.32	1	12.32	.87	0.355
RSTCAT X ORDER	2.89	1	2.89	.20	0.653
RSTCAT X CONDITION	62.53	1	62.53	4.42	0.040
CONDITION X ORDER	30.73	1	30.73	2.17	0.146
RSTCAT X COND X ORDER	6.21	1	6.21	.44	0.510

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	360.19	55	6.43		
MANIPULATION	273.20	1	273.20	42.47	0.001
MANIP X RSTCAT	17.26	1	17.26	2.68	0.107
MANIPULATION X ORDER	11.88	1	11.88	1.85	0.180
CONDITION X MANIP	48.76	1	48.76	7.58	0.008
MANIP X RSTCAT X OR	17.26	1	17.26	2.68	0.107
MANIP X RSTCAT X COND	27.20	1	27.20	4.23	0.044
MANIP X COND X ORDER	27.20	1	27.20	4.23	0.044
COND X MANIP X RSTCAT X ORDER	9.57	1	9.57	1.49	0.228

ERROR TERM
WITHIN CELLS 2.54

DEPRESSION

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	756.84	55	13.76		
REGRESSION	1544.22	1	1544.22	112.22	0.001
RESTRAINT CATEGORY	9.79	1	9.79	.71	0.403
ORDER EFFECTS	.78	1	.78	.06	0.813
CONDITION	.11	1	.11	.01	0.930
RSTCAT X ORDER	1.24	1	1.24	.09	0.765
RSTCAT X CONDITION	21.42	1	21.42	1.56	0.217
CONDITION X ORDER	108.72	1	108.72	7.90	0.007
RSTCAT X COND X ORD	38.50	1	38.50	2.80	0.100

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	277.31	56	4.95		
MANIPULATION	67.57	1	67.57	13.65	0.001
MANIPULATION X RSTCAT	.38	1	.38	.08	0.782
MANIPULATION X ORDER	25.38	1	25.38	5.13	0.027
CONDITION X MANIP	1.76	1	1.76	.35	0.554
MANIP X RSTCAT X ORDER	.20	1	.20	.04	0.843
MANIP X RSTCAT X COND	4.13	1	4.13	.83	0.365
MANIP X COND X ORDER	7.51	1	7.51	1.52	0.223
COND X MANIP X RSTCAT X ORDER	17.26	1	17.26	3.49	0.067

ERROR TERM
WITHIN CELLS 2.23

HOSTILITY

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	377.58	55	377.58		
REGRESSION	354.23	1	354.23	51.60	0.001
RESTRAINT CATEGORY	6.60	1	6.60	.96	0.331
ORDER EFFECTS	.13	1	.13	.02	0.893
CONDITION	.00	1	.00	.00	0.980
RSTCAT X ORDER	2.03	1	2.03	.30	0.589
RSTCAT X CONDITION	9.01	1	9.01	1.31	0.257
CONDITION X ORDER	1.12	1	1.12	.16	0.687
RSTCAT X COND X ORDER	.82	1	.82	.12	0.731

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	159.81	56	2.85		
MANIPULATION	70.51	1	70.51	24.71	0.001
MANIPULATION X RSTCAT	4.13	1	4.13	1.45	0.234
MANIPULATION X ORDER	2.26	1	2.26	.79	0.378
CONDITION X MANIP	.95	1	.95	.33	0.567
MANIP X RSTCAT X ORDER	.63	1	.63	.22	0.640
MANIP X RSTCAT X COND	1.76	1	1.76	.62	0.436
MANIP X COND X ORDER	8.51	1	8.51	2.98	0.090
COND X MANIP X RSTCAT X ORDER	21.95	1	21.95	7.69	0.008

ERROR TERM
WITHIN CELLS 1.69

Appendix N

Spielberger

MANOVA FOR COMBINED SCALES

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	3641.04	55	3641.04		
REGRESSION	7498.90	1	7498.90	113.28	0.001
RESTRAINT CATEGORY	41.95	1	41.95	.63	0.429
ORDER EFFECTS	20.61	1	20.61	.31	0.579
CONDITION	1.05	1	1.05	.02	0.900
RSTCAT X ORDER	61.62	1	61.62	.93	0.339
RSTCAT X CONDITION	115.26	1	115.26	1.74	0.192
CONDITION X ORDER	45.02	1	45.02	.68	0.413
RSTCAT X COND X ORD	284.79	1	284.79	4.30	0.043

TESTS INVOLVING SPIELBERGER MOOD WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	1961.53	55	35.66		
REGRESSION	426.66	1	426.66	11.96	0.001
MOOD	967.43	1	967.43	27.13	0.001
MOOD X RESTRAINT	12.07	1	12.07	.34	0.563
MOOD X ORDER EFFECTS	140.20	1	140.20	3.93	0.052
CONDITION X MOOD	2.18	1	2.18	.06	0.806
MOOD X RSTCAT X ORDER	105.92	1	105.92	2.97	0.090
MOOD X RSTCAT X COND	55.04	1	55.04	1.54	0.219
CONDITION X MOOD X OR	1.29	1	1.29	.04	0.850
RSTCAT X COND X ORDER X MOOD	123.77	1	123.77	3.47	0.068

ERROR TERM
WITHIN CELLS 5.97

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	1675.44	56	29.92		
MANIPULATION	930.25	1	930.25	31.09	0.001
MANIP X RSTCAT	5.06	1	5.06	.17	0.682
MANIPULATION X ORDER	92.64	1	92.64	3.10	0.084
CONDITION X MANIP	33.06	1	33.06	1.11	0.298
MANIP X RSTCAT X ORD	107.64	1	107.64	3.60	0.063
MANIP X RSTCAT X COND	16.00	1	16.00	.53	0.468
MANIP X COND X ORDER	3.52	1	3.52	.12	0.733
COND X MANIP X RSTCAT X ORDER	74.39	1	74.39	2.49	0.120

ERROR TERM
WITHIN CELLS 5.47

TESTS INVOLVING MOOD BY MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	1432.69	56	25.58		
MOOD X MANIPULATION	708.89	1	708.89	27.71	0.001
MANIP X RSTCAT X MOOD	13.14	1	13.14	.51	0.477
MANIPULATION X ORDER	81.00	1	81.00	3.17	0.081
MANIP X MOOD X ORDER	70.14	1	70.14	2.74	0.103
RSTCAT X ORD. X MOOD X MAN	16.00	1	16.00	.63	0.432
RSTCAT X COND X MOOD X MAN	15.02	1	15.02	.59	0.447
ORDER X COND X MOOD X MAN	5.06	1	5.06	0.20	0.658
RSTCAT X ORDER X COND X MOOD X MANIP	39.06	1	39.06	1.53	0.222

ERROR TERM
WITHIN CELLS 5.06

ANOVAS FOR SEPARATE SCALES

STATE ANXIETY SCALE

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	4639.48	55	84.35		
REGRESSION	2667.96	1	2667.96	31.63	0.001
RESTRAINT CATEGORY	6.34	1	6.34	.08	0.785
ORDER EFFECTS	66.76	1	66.76	.79	0.378
CONDITION	.58	1	.58	.01	0.934
RSTCAT X ORDER	177.72	1	177.72	2.11	0.152
RSTCAT X CONDITION	262.97	1	262.97	3.12	0.083
CONDITION X ORDER	89.56	1	89.56	1.06	0.307
RSTCAT X COND X ORDER	538.23	1	538.23	6.38	0.014

ERROR TERM
WITHIN CELLS 9.18

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	2963.94	56	52.93		
MANIPULATION	1631.63	1	1631.63	30.83	0.001
MANIPULATION X RSTCAT	17.26	1	17.26	.33	0.570
MANIPULATION X ORDER	173.45	1	173.45	3.28	0.076
CONDITION X MANIP	99.76	1	99.76	1.88	0.175
MANIP X RSTCAT X ORDER	103.32	1	103.32	1.95	0.168
MANIP X RSTCAT X COND	31.01	1	31.01	.59	0.447
MANIP X COND X ORDER	8.51	1	8.51	.16	0.690
COND X MANIP X RSTCAT X ORDER	110.63	1	110.63	2.09	0.154

ERROR TERM
WITHIN CELLS 7.27

TRAIT ANXIETY SUBSCALE

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	1365.93	55	24.84		
REGRESSION	4854.75	1	4854.75	195.48	0.001
RESTRAINT CATEGORY	44.84	1	44.84	1.81	0.185
ORDER EFFECTS	.01	1	.01	.00	0.949
CONDITION	.01	1	.01	.00	0.985
RSTCAT X ORDER	8.57	1	8.57	.36	0.552
RSTCAT X CONDITION	262.97	1	262.97	.35	0.559
CONDITION X ORDER	.65	1	.65	.03	0.872
RSTCAT X COND X ORDER	14.44	1	14.44	.58	0.449

ERROR TERM
WITHIN CELLS 4.98

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	144.19	56	2.57		
MANIPULATION	7.51	1	7.51	2.92	0.001
MANIPULATION X RSTCAT	.95	1	.95	.37	0.547
MANIPULATION X ORDER	.20	1	.20	.08	0.784
CONDITION X MANIP	3.45	1	3.45	1.34	0.252
MANIP X RSTCAT X ORD	20.32	1	20.32	7.89	0.007
MANIP X RSTCAT X COND	.01	1	.01	.00	0.956
MANIP X COND X ORDER	.07	1	.07	.03	0.869
COND X MANIP X RSTCAT X ORDER	2.82	1	2.82	1.10	0.300

ERROR TERM
WITHIN CELLS 1.60

Appendix O

Psychophysiological Measures

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F.VALUE	SIGN
WITHIN CELLS	7789.41	5	144.25		
REGRESSION	15110.77	1	110.77	104.76	0.001
RESTRAINT CATEGORY	58.69	1	58.69	.41	0.526
ORDER EFFECTS	584.43	1	584.43	4.05	0.049
CONDITION	1570.31	1	1570.31	10.89	0.002
RSTCAT X ORDER	3.07	1	3.07	.02	0.885
RSTCAT X CONDITION	17.54	1	17.54	.12	0.729
CONDITION X ORDER	59.42	1	59.42	.41	0.524
RSTCAT X COND X ORDER	4.02	1	4.02	.03	0.868

ERROR TERM
WITHIN CELLS 11.01

TESTS INVOLVING PSYCHOPHYSIOLOGICAL WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	11204.33	109	3.25		
REGRESSION	6011.75	1	6011.75	58.48	0.001
PSYPHYS	7029.63	2	3514.81	34.19	0.001
PSYPHYS X RSTCAT	397.96	2	198.98	1.94	0.149
PSYPHYS X ORDER	196.49	2	98.24	.96	0.388
CONDITION X PSYPHYS	267.32	2	133.66	1.30	0.277
PSYPHYS X RSTCAT X OR	219.31	2	109.65	1.03	0.348
PSYPH X RSTCAT X COND	334.06	2	167.03	1.64	0.202
COND X PSYPHYS X ORD	250.64	2	125.32	1.22	0.299
RSTCAT X COND X ORDER X PSYPHYS	401.24	2	200.62	1.95	0.147

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	3834.83	55	69.72		
MANIPULATION	451.01	1	451.01	6.47	0.001
MANIP X RSTCAT	.49	1	.49	.01	0.933
MANIPULATION X ORDER	139.92	1	139.92	2.01	0.162
CONDITION X MANIP	.67	1	.67	.01	0.922
MANIP X RSTCAT X ORD	6.96	1	6.96	.10	0.753
MANIP X RSTCAT X CON	26.69	1	26.69	.38	0.539
MANIP X COND X ORD	33.17	1	33.17	.48	0.493
COND X MANIP X RSTCAT X ORDER	29.92	1	29.92	.43	0.515

ERROR TERM
WITHIN CELLS 8.35

TESTS INVOLVING PSYCHOPHYSIOLOGICAL BY MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	4112.21	110	37.38		
PSYPHYS X MANIP	345.08	2	172.54	4.62	0.012
MANIP X RSTCAT X PSYPHYS	452.69	2	226.34	6.05	0.003
MANIPULATION X ORD	55.15	2	27.57	.74	0.481
MANIP X PSYPHYS X OR	89.63	2	44.82	1.20	0.305
RSTCAT X ORD. X PSYPHYS X MAN	58.88	2	29.44	.79	0.458
RSTCAT X COND X PSYPHYS X MAN	45.80	2	22.90	.61	0.544
ORDER X COND X PSYPHYS X MAN	101.77	2	50.89	1.36	0.261
RSTCAT X ORDER X COND X PSYPHYS X MANIP	20.19	2	10.09	.27	0.764

ANOVAS FOR INDIVIDUAL PSYCHOPHYSIOLOGICAL MEASURES

HEART RATE

TESTS of BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	5979.03	55	108.71		
REGRESSION	5506.03	1	5506.03	50.65	0.001
RESTRAINT CATEGORY	10.53	1	10.53	.10	0.757
ORDER EFFECTS	151.36	1	151.36	1.39	0.243
CONDITION	240.80	1	240.80	2.22	0.142
RSTCAT X ORDER	24.11	1	24.11	.22	0.640
RSTCAT X CONDITION	77.14	1	77.14	.71	0.403
CONDITION X ORDER	3.04	1	3.04	.03	0.868
RSTCAT X COND X ORD	.00	1	.00	.00	0.997

ERROR TERM
WITHIN CELLS 10.43

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	2558.31	56	45.68		
MANIPULATION	409.70	1	409.70	8.97	0.001
MANIP X RSTCAT	217.88	1	217.88	4.77	0.033
MANIP X ORDER	3.45	1	3.45	.08	0.785
COND X MANIPULATION	59.13	1	59.13	1.29	0.260
MANIP X RSTCAT X ORDER	2.26	1	2.26	.05	0.825
MANIP X RSTCAT X COND	4.13	1	4.13	.09	0.765
MANIP X COND X ORD	4.13	1	4.13	.09	0.765
COND X MANIP X RSTCAT X ORDER	8.51	1	8.51	.19	0.668

ERROR TERM
WITHIN CELLS 6.76

SYSTOLIC

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	7139.31	54	132.22		
REGRESSION	9523.78	1	9523.78	72.03	0.001
RESTRAINT CATEGORY	91.93	1	91.93	.70	0.408
ORDER EFFECTS	11.82	1	11.82	.09	0.766
CONDITION	1221.62	1	1221.62	9.24	0.004
RSTCAT X ORDER	30.53	1	30.53	.23	0.633
RSTCAT X CONDITION	104.68	1	104.68	.79	0.378
CONDITION X ORDER	27.98	1	27.98	.21	0.647
RSTCAT X COND X ORD	275.42	1	275.42	2.08	0.155

ERROR TERM
WITHIN CELLS 11.50

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	2666.53	55		48.48	
MANIPULATION	403.51	1	403.51	8.32	0.006
MANIP X RSTCAT	245.14	1	245.14	5.06	0.029
MANIP X ORDER	140.48	1	140.48	2.90	0.094
COND X MANIPULATION	20.19	1	20.19	.42	0.521
MANIP X RSTCAT X ORD	45.17	1	45.17	.93	0.339
MANIP X RSTCAT X COND	6.33	1	6.33	.13	0.719
MANIP X COND X ORDER	1.35	1	1.35	.03	0.868
COND X MANIP X RSTCAT X ORDER	.01	1	.01	.00	0.987

ERROR TERM
WITHIN CELLS 6.96

DIASTOLIC

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	6769.96	54	125.37		
REGRESSION	5226.75	1	5226.75	41.69	0.001
RESTRAINT CATEGORY	139.72	1	139.72	1.11	0.296
ORDER EFFECTS	568.58	1	568.58	4.54	0.038
CONDITION	214.90	1	214.90	1.71	0.196
RSTCAT X ORDER	184.24	1	184.24	1.47	0.231
RSTCAT X CONDITION	37.33	1	37.33	.30	0.588
CONDITION X ORDER	376.98	1	376.98	3.01	0.089
RSTCAT X COND X ORD	225.16	1	225.16	1.80	0.186

ERROR TERM
WITHIN CELLS 11.20

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	2734.43	55	49.72		
MANIPULATION	8.43	1	8.43	.17	0.682
MANIP X RSTCAT	7.31	1	7.31	.15	0.703
MANIP X ORDER	52.69	1	52.69	1.06	0.308
COND X MANIPULATION	4.74	1	4.74	.10	0.759
MANIP X RSTCAT X ORD	16.85	1	16.85	.34	0.563
MANIP X RSTCAT X COND	63.76	1	63.76	1.28	0.262
MANIP X COND X ORDER	127.44	1	127.44	2.56	0.115
COND X MANIP X RSTCAT X ORDER	38.85	1	38.85	.78	0.381

ERROR TERM
WITHIN CELLS 7.05

APPENDIX P

RESTRAINT SCALE SCORES

LOW RESTRAINERS

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	214.28	29	7.39		
REGRESSION	352.47	1	352.47	47.70	0.001
CONDITION	7.94	1	7.94	1.08	0.308

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	10.50	30	.35		
MANIPULATION	.25	1	.25	.71	0.405
COND X MANIPULATION	2.25	1	2.25	6.43	0.017

HIGH RESTRAINERS

TESTS OF BETWEEN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	504.64	29	17.40		
REGRESSION	536.23	1	536.23	30.82	0.001
CONDITION	21.16	1	21.16	1.22	0.279

TESTS INVOLVING MANIPULATION WITHIN-SUBJECTS EFFECTS:

	S.S.	DF	M.S.	F. VALUE	SIGN
WITHIN CELLS	40.88	30	1.36		
MANIPULATION	7.56	1	7.56	5.55	0.025
COND X MANIPULATION	1.56	1	1.56	1.15	0.293

REFERENCES

References

Abramson, E. E., & Wunderlich, R. A. (1972). Anxiety, fear and eating: A test of the psychosomatic concept of obesity. Journal of Abnormal Psychology, 79, 317-321.

American Psychiatric Association. (1987). Diagnostic and Statistical Manual (3rd edition, rev.). Washington, D. C.: Author.

Antelman, S. M., & Caggiula, A. R. (1977). Tails of stress related behavior: A neuropharmacological approach. In I. Hanin & E. Usdin (Eds.), Animal Models in Psychiatry and Neurology. Oxford: Pergammon Press.

Antelman, S. M., Rowland, N. E., & Fisher, A. E. (1976). Stimulation bound ingestive behavior: A view from the tail. Physiology and Behavior, 17, 743-748.

Baucom, D. H., & Aiken, P. A. (1981). Effect of depressed mood on eating among obese and nonobese dieting and nondieting persons. Journal of Personality and Social Psychology, 41, 577-585.

Beck, A., Ward, C., Mendelson, H., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. Archives of General Psychiatry, 4, 561-571.

Burish, T. G., Levy, S. M., & Meyerowitz, B. E. (Eds.). (1985). Cancer, Nutrition, and Eating Behavior: A Biobehavioral Perspective. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Downes, J. (1953). Association of the chronic diseases in the same person and their association with overweight. Milbank Memorial Fund Quarterly, 31, 125-132.

Frost, R. O., Goolkasian, G. A., Ely, R. J., & Blanchard, F. A. (1982). Depression, restraint, and eating behavior. Behavior Research and Therapy, 20, 113-121.

Grunberg, N. E., Sibolboro, E. C., & Talmadge, S. A. (1988, August). Stress and eating: Restraint, sex, and specific foods are important. Poster presented at the meeting of the American Psychological Association, Atlanta, GA.

Herman, C. P., & Mack, D. (1975). Restrained and unrestrained eating. Journal of Personality, 43, 647-660.

Herman, C. P., Polivy, J., Lank, C. N., & Heatherton, T. F. (1987). Anxiety, hunger, and eating behavior. Journal of Abnormal Psychology, 96(3), 264-269.

Herman, C. P., & Polivy, J. (1975). Anxiety, restraint and eating behavior. Journal of Abnormal Psychology, 84, 666-672.

Hibscher, A. & Herman, C. P. (1977). Obesity, dieting and the expression of "obese" characteristics. Journal of Comparative Physiological Psychology, 91, 374-380.

Immelman, K. (1980). Introduction to Ethology, New York: Plenum Press.

Kaplan, H., & Kaplan, H. (1957). The psychosomatic concept of obesity. Journal of Nervous and Mental Disease, 125(2), 181-189.

Keck, J. N., & Fiebert, M. S. (1986). Avoidance of anxiety and eating disorders. Psychological Reports, 58, 432-434.

Kupferman, I. (1964). Eating behavior induced by sounds. Nature, 201, 324.

Kruijt, J. P. (1966). Development of ritualized displays in jungle fowl. Philosophical Transactions of the Royal Society of London, series B, N772, 479.

Lazarus, R. S., Opton, E. M., Nomikos, M. S., & Rankin, N. O. (1965). The principle of short-circuiting of threat: further evidence. Journal of Personality, 33, 622-635.

Leon, G. R., & Chamberlain, K. (1973). Emotional arousal, eating patterns, and body image as differential factors associated with varying success in maintaining a weight loss. Journal of Consulting and Clinical Psychology, 40(3), 474-479.

Levine, A. S. & Morley, J. E. (1981). Stress induced eating in man. American Journal of Physiology, 241, R72-R76.

Levine, A. S., Morley, J. E., Wilcox, G. L., Brown, D. M., & Handwerger, B. S. (1982). Tail pinch behavior and analgesia in diabetic mice. Physiology and Behavior, 28, 39-43.

McFarland, D. J. (1965). Hunger, thirst, and displacement pecking in the barbary dove. Animal Behavior, 13, 293-300.

McKenna, R. J. (1972). Some effects of anxiety level and food cues on the eating behavior of obese and normal subjects: A comparison of the Schachterian and psychosomatic conceptions. Journal of Personality and Social Psychology, 22, 311-319.

Meyer, J. E., & Pudel, V. E. (1977). Experimental feeding in man: A behavioral approach to obesity. Psychosomatic Medicine, 39, 153-159.

Mischel, W. and Coates, B. (1968). Effects of success and failure on self-gratification. Journal of Personality and Social Psychology, 10(4), 381-390.

Mischel, W., Ebbeson, E., & Zeiss, A. (1972). Cognitive and attentional mechanisms in delay of gratification. Journal of Personality and Social Psychology, 21(2), 204-218.

Mischel, W. and Grusec, J. (1967). Waiting for rewards and punishments: effects of time amd probability on choice. Journal of Personality and Social Psychology, 5(1), 24-31.

Mischel, W. and Moore, B. (1973). Effects of attention to symbolically presented rewards on self-control. Journal of Personality and Social Psychology, 28(2), 172-179.

Morley, J. E., Levine, A. S., & Rowland, N. E. (1983). Stress induced eating. Life Sciences, 32(19), 2169-2182.

Morokoff, P., Baum, A., McKinnon, W., & Gillilland, R. (1987). Effects of chronic unemployment and acute psychological stress on sexual arousal in men. Health Psychology, 6(6), 545-560.

Nisbett, R. E. (1968). Taste, deprivation, and weight determinants of eating behavior. Journal of Personality and Social Psychology, 10, 107-116.

Nisbett, R. E. (1972). Hunger, obesity, and the ventromedial hypothalamus. Psychological Review, 79(6), 433-453.

Osserman, K., & Dolger, H. (1951). Obesity in diabetes: A study of therapy with anorexigenic drugs. Annals of Internal Medicine, 34, 72-79.

Polivy, J., & Herman, C. P. (1976). Clinical depression and weight change: A complex relation. Journal of Abnormal Psychology, 85, 338-340.

Powers, P. S. (1980). Obesity, the regulation of weight. Baltimore: Williams and Wilkins.

Reznick, H., & Balch, P. (1977). The effects of anxiety and response cost manipulations on the eating behavior of obese and normal weight subjects. Addictive Behaviors, 2, 219-225.

Rolf, J. G., & Chesney, M. A. (1986). Psychological and behavioral methods to reduce cardiovascular reactivity. In Matthews, K. A., Dembroski, T. M., Falkner, B., Manuck, S. B., & Williams, R. B., Jr. (Eds.), Handbook of stress, reactivity, and cardiovascular disease. (pp. 417-457). New York: John Wiley and Sons.

Rowland, N. E., & Antelman, S. M. (1976). Stress induced hyperphagia and obesity in rats: A possible model for the understanding of human obesity. Science, 191, 310-312.

Rozanski, A., Bairev, C., Krantz, D., Friedman, J., Resser, K., Morell, M., Hilton-Chalfen, S., Hestrin, L., Bietendorf, J., & Berman, D. (1988). Mental stress and the induction of silent ischemia in patients with coronary artery disease. The New England Journal of Medicine, 318(16), 1005-1011.

Ruderman, A. J. (1985). Dysphoric mood and overeating: A test of restraint theory's disinhibition hypothesis. Journal of Abnormal Psychology, 94(1), 78-85.

Schachter, S. Emotion, Obesity, and Crime. New York: Academic Press, 1971.

Schachter, S., & Rodin, J. Obese Humans and Rats. Washington, D.C.: Erlbaum-Halstead, 1974.

Schachter, S., Goldman, R., & Gordon, A. (1968). Effects of fear, food deprivation and obesity on eating. Journal of Personality and Social Psychology, 10, 91-97.

Slochower, J., & Kaplan, S. (1980). Anxiety, perceived control, and eating in obese and normal weight persons. Appetite, 1, 75-83.

Slochower, J., Kaplan, S., & Mann, L. (1981). The effects of life stress and weight on mood and eating. Appetite, 2, 115-125.

Stunkard, A. J., Grace, W. J., & Wolff, H. G. (1955). The night eating syndrome: A pattern of food intake among certain obese patients. American Journal of Medicine, 19, 78-83.

Tugendhat, B. (1960). Feeding in conflict situations and following thwarting. Science, 132, (3431), 896-897.

U. S. Public Health Service. Obesity and health. Washington, D. C.: Public Health Service Publication No. 1485, U. S. Government Printing Office, 1966.

Willenbring, M. L., Levine, A. S., & Morley, J. E. (1986). Stress induced eating and food preference in humans: A pilot study. International Journal of Eating Disorders, 5, (5), 856-864.