The Power of Food Scale (PFS): Development and Theoretical Evaluation of a Self-Report Measure of the Perceived Influence of Food

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Elizabeth Rose Didie
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DEDICATIONS

With love to my parents, Beverly and Bill,

Who set my feet upon the path

To Paul, in adoration from your wife,

With you, all seems possible
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TABLE OF CONTENTS

LIST OF TABLES ........................................................................................................ viii
ABSTRACT.................................................................................................................. ix

1. INTRODUCTION ................................................................................................ 1
   Development of Restraint Theory ........................................................................ 2
   Critique of Restraint Theory ............................................................................. 15
   Appetitive Hyper-Responsiveness ..................................................................... 22
   Development of the Power of Food Scale (PFS) .............................................. 26
   Present Study ................................................................................................... 31
   Dependent Measures ....................................................................................... 32
   Covariates ......................................................................................................... 32

2. METHODS ................................................................................................扫描结果 35
   Participants ...................................................................................................... 35
   Procedure ...................................................................................................... 37
   Measures ......................................................................................................... 41
   Statistical Analyses ....................................................................................... 49
   Hypothesized Results .................................................................................... 51

3. RESULTS .......................................................................................................... 53
   Response Rate .............................................................................................. 53
   Final Sample Demographics .......................................................................... 53
   Scale Reliability ............................................................................................. 55
   Subscale Composition .................................................................................... 55
Changes in Salivation Following Presentation to Olfactory Stimuli .......... 56
Relationship between PFS, Restraint, and Salivation.......................... 58
Body Mass Index and Salivary Responsiveness .................................. 60
Covariates Related to Salivary Reactivity........................................... 61
Convergent and Discriminant Validity of the PFS............................... 62
Relationship between PFS, Restraint, Disinhibition and Binge Eating .......................................................... 63

4. DISCUSSION ............................................................................. 64
  Theoretical Development .................................................................. 64
  Psychometric Properties ................................................................... 66
  Validity of Salivation Measure .......................................................... 67
  Tests of Hypotheses ................................................................. 71
  Discriminant and Convergent Validity of the PFS........................... 76
  Limitations ................................................................................ 80
  Clinical Applications and Future Directions .................................... 82

LIST OF REFERENCES .................................................................... 85
APPENDIX A: TABLES .................................................................. 96
APPENDIX B: DEMOGRAPHIC INFORMATION .................................. 109
APPENDIX C: POWER OF FOOD SCALE ........................................ 110
APPENDIX D: REVISED RESTRAINT SCALE .................................... 112
APPENDIX E: HUNGER SCALE ...................................................... 114
APPENDIX F: DUTCH EATING BEHAVIOR QUESTIONNAIRE ........... 115
APPENDIX G: MARLOWE-CROWNE SOCIAL DESIRABILITY SCALE ... 117
LIST OF TABLES

1. Demographic Characteristics of Participants ......................................................... 96
2. Means, Standard Deviations, and Reliability Coefficients for the PFS ................. 97
3. Corrected Item-Total Correlations for the Items on the PFS ............................... 98
4. Pearson Product-Moment Correlations for the Three Subscales of the PFS ...... 100
5. Means and Standard Deviations for Independent and Dependent Variables ..... 101
6. Correlations for Salivary Weight, Measures of Restraint and the PFS ............. 102
7. Multiple Regression Predicting Salivary Responsiveness to Olfactory Cues ... 103
8. Mean for the PFS, Restraint Scale and Salivation Among Unrestrained Non-dieters, Restrained Non-dieters and Dieters ................................. 104
10. Correlations for the Convergent and Discriminant Validity of the PFS ......... 106
11. Multiple Regression Analysis Predicting Disinhibition Scores ...................... 107
12. Multiple Regression Analysis Predicting Binge Eating Scores ....................... 108
ABSTRACT
The Power of Food Scale (PFS): Development and Psychometric Evaluation of a Self-Report Measure of the Perceived Influence of Food
Elizabeth Rose Didie
Michael R. Lowe, Ph.D.

Current thinking about overeating and preoccupation with food is dominated by restraint theory (Herman & Polivy, 1980). It is plausible however, that a pre-existing vulnerability toward over-responsiveness to food produces overeating in a food abundant environment and a subsequent need to diet. A predisposition toward being highly responsive to a food plentiful environment may be detectable even in the absence of actual food consumption. The 21-item Power of Food Scale (PFS) was developed to assess the psychological influence of the mere presence or availability of food. The current study: 1) evaluated the validity of the PFS; and 2) compared the relative ability of the PFS and the Restraint Scale (RS) to predict salivary response to olfactory food cues using a sample of 81 undergraduate women.

Results indicated that the PFS had acceptable internally consistency and was sufficiently homogeneous. Findings supported the convergent validity of the PFS, as it is positively correlated with measures of disinhibition, external eating, and binge eating. Contrary to expectations the PFS was not correlated with a self-report measure of dietary restraint. Furthermore, the PFS was only weakly associated with a measure of social desirability, indicating that scores on the PFS are not likely to be contaminated by a desire to respond in a socially desirable manner.

Methodological problems undermined the usefulness of the salivary responsiveness procedure as a measure of appetitive drive. Contrary to predictions,
neither the PFS nor the RS predicted salivary responsiveness to food cues. Current dieting status could not account for the failure to find a relationship between RS and salivation. The PFS and the RS independently contributed to the prediction of both disinhibitory and binge eating. These results suggest that the PFS may tap a preexisting tendency toward heightened appetitive responses to food that could contribute to the development of obesity and some forms of disordered eating.
1. INTRODUCTION

Dieting among Americans is on a steady incline. National surveys conducted between 1950 and 1966 reported that 7% of men and 14% of women were trying to lose weight; the corresponding numbers were 16% of all adults in 1978 and 25% of men and 45% of women in 1985 (Williamson, Serdula, Anda, Levy & Byers, 1992). Two large national surveys indicate that approximately 24% of men and 38% of women are currently dieting (Horm & Anderson, 1993; Serdula et al., 1993). Other studies have reported the prevalence of current dieting at 20.6% (Rand & Kulda, 1991) and 16% (Jeffery, et al., 1984) for men and women respectively, and 25% among women (Jeffery, Adlis & Forster, 1991). Furthermore, it is estimated that Americans spend approximately $55 billion dollars annually on dieting aids and products, with over 65 million people currently on a diet (Brownell, 1993).

Concern with weight loss has become a normative phenomenon, particularly among women. Many women view themselves as overweight and see dieting as the solution to their weight-related discontent (Polivy & Herman, 1995). At the same time as there is an emphasis on weight loss among normal weight individuals, there has been an increase in obesity within the general population. Approximately 64% of American adults are now considered overweight or obese as defined by a body mass index (BMI) of 25 kg/m² or greater (Flegal, Carroll, Ogden & Johnson, 2002). As a result, more than half of Americans are at an increased risk for coronary heart disease, hypertension, type II diabetes, osteoarthritis, and colorectal cancer. The total indirect and direct health care costs attributable to overweight and obesity were estimated to be...
$99 billion dollars in 1995, equivalent to 7% of the gross domestic product (Wolf & Colditz, 1998).

On the one hand it has been suggested that dieting is potentially harmful and counterproductive (Polivy & Herman, 1985); on the other, the prevalence of obesity has increased substantially, suggesting that greater dietary resolve is necessary. There is evidence, however, to question the utility of dieting. Chronic dieting may disrupt normal appetitive responses, which could increase vulnerability to overeating and weight gain (Garner & Wooley, 1991; Polivy, & Herman, 1985). Furthermore, chronic, severe dieting is a cardinal feature of, and may be related to, the etiology of eating disorders (Hsu, 1990; Wilson, 1993). Moreover, while current weight-loss interventions typically result in medically significant reductions in body weight, most weight is regained within five years (Foster, Wadden, Kendall, Stunkard, & Vogt, 1996). These discouraging rates of relapse in clinical samples challenge the belief that obesity can be treated efficaciously (Garner & Wooley, 1991; Wooley & Wooley, 1984). Finally, the potential metabolic and health effects of weight cycling, that is repeatedly losing and regaining weight, is unclear (Wing, 1992). Anti-dieting advocates have used weight cycling as an additional anti-dieting argument, suggesting that weight is controlled by genetics and that efforts to lose weight and keep it off will be futile (Garner & Wooley, 1991).

Development of Restraint Theory

A resolution to the dieting debate is impossible without a clear definition of the construct in question. Dietary restraint has been defined as a self-initiated attempt to restrict food intake for the purpose of weight control (Lowe, 1993). There is increasing
evidence that dieting is not a one-dimensional construct; thus a clearer understanding of the concept of restraint is needed. Therefore, it is important to trace the development of restraint theory and potential alternatives to it.

Prior to the development of restraint theory, it was purported that overweight individuals’ vulnerability to overeating evolved from a combination of over-responsiveness to external cues and under-responsiveness to internal cues signaling hunger and satiety (Schachter, 1968, 1971). Evidence for this assertion came from findings that overweight individuals’ consumption was greater than normal weight individuals’ food intake in response to external stimuli such as the visual salience of food cues (Rodin, 1975; Rodin et al., 1977; Ross, 1974), appetizing verbal descriptions of sweets (Herman, Olmstead and Polivy, 1983), and the perceived passage of time (Schachter & Gross, 1968). A further assertion of this externality theory was that obese individuals were less responsive to internal appetitive signals such as hunger and satiety. Studies in which individuals were given a “preload” of a pleasant-tasting, high-calorie food such as a milk shake and were then asked to taste or eat additional foods demonstrated that normal weight subjects ate less food after a preload while obese subjects failed to compensate for the increased caloric intake (Schachter et al., 1968; Pliner, 1973; Tom and Rucker, 1975).

Additional research, however, has indicated that support for Schachter’s theory is equivocal. Many studies failed to demonstrate that overweight individuals are more responsive to external cues than their normal weight peers (Meyers, Stunkard, & Coll, 1980; Hibscher & Herman, 1977; Hill & McCutcheon, 1975; Nisbett & Storms, 1975; Rodin & Slochower, 1976). In fact, hyper-responsiveness to external food cues is
evident among individuals in all weight categories (Rodin & Slochower, 1976; Milstein, 1980). Furthermore, internal sensitivity to cues of hunger and satiety is not a unique characteristic of normal weight persons (Rodin, 1981). Indeed, studies on attitudes, behaviors, and eating styles have generally failed to establish consistent differences between obese individuals and normal weight controls (Stunkard, Coll, Lindquist & Meyers, 1980; Spitzer & Rodin, 1981). As such, it was deemed simplistic to expect that the internal-external dichotomy was sufficient to differentiate normal weight and overweight individuals (Rodin, 1981). After all, the development of obesity is influenced by a variety of factors including fat cells and genetic and metabolic factors; it is not primarily a function of external responsiveness. The influence of these factors suggests that across equally externally responsive people, some people will gain weight whereas others will not.

During the height of popularity for externality theory, Nisbett (1972) proposed a “set point” theory to explain why external responsiveness among normal and overweight people might occur. It was purported that each person has a biologically determined and defended weight termed his or her set point. For the obese, their set point was relatively high and therefore these individuals had to eat large amounts of food to achieve their biologically predetermined weight. For others, their set point was set much lower and therefore these individuals ate smaller amounts naturally. Because of cultural preferences for a slimmer physique, Nisbett suggested that many individuals tried to keep their weight suppressed below its biologically determined level. According to this view, characteristics such as external responsiveness were
actually a consequence of obese individuals’ weight suppression and caloric deprivation (Nisbett, 1972).

Support for Nisbett’s hypothesis, however, has been varied. Set point theory leads to the conclusion that obese individuals, simply by virtue of holding their weight below a set point, should create external responsiveness. This has been suggested because those overweight individuals are under strong social pressure to lose weight and therefore may diet, but dieting in these individuals may lead to a state of chronic hunger. Contrary to predictions, external responsiveness does not vary as a function of weight loss (Rodin, Slochower & Fleming, 1977). Furthermore, while it seems plausible that overweight individuals may diet in order to adhere to cultural preferences for weight and shape, there is no empirical evidence to suggest that these individuals are below their biologically determined set point (for review see Ruderman, 1986).

While the veracity of the set point model of weight and eating regulation is questionable, the influential role of dieting in the regulation of eating has been the focus of a tremendous amount of research. Herman and Polivy (1980) argued that externality in obese people was an artifact of dieting. That is, they suggested that it may be dieting per se that produces an internal insensitivity to signals of hunger and satiety; and that overweight individuals must therefore rely on external cues to guide eating. These authors also suggested that Nisbett’s (1972) argument should also apply to normal-weight people who attempted to suppress their weight below its biologically predetermined point. Thus, normal weight individuals who suppressed their weight
should demonstrate the same susceptibility to food cues previously thought to typify obese individuals.

The cognitive process that is necessary to deter eating in the face of biological pressures toward weight gain is called restraint (Herman & Mack, 1975), and the Restraint Scale (RS; Herman & Polivy, 1980) was devised to assess this construct. Given the struggle of battling biological pressures to eat, restrained eaters develop aberrant eating patterns characterized by dieting and periodic indulgences (Herman & Polivy, 1980). The “disinhibition hypothesis” proposes that the self-control of restrained eaters may be temporarily undermined by certain events, such as high calorie foods, negative emotions, or pharmacological substances such as alcohol (for a review see Ruderman, 1986). Herman and Polivy (1980) suggested that stimuli that disrupted dietary self-control would permit restrained eaters’ underlying biological hunger to resurface in the form of overeating.

Herman and Mack (1975) found that restrained eaters increased, and unrestrained eaters decreased, their ice cream consumption after drinking a high-calorie milkshake. The restrained eaters’ response was labeled “counterregulatory eating.” Presumably, the preload sabotages the dieter's current diet intentions and makes further dieting seem temporarily futile (Heatherton et al., 1988). Herman and Polivy (1975) showed that fear affected restrained eaters similarly to preloads. In this study, restrained eaters ate somewhat more when distressed than when calm, whereas unrestrained eaters ate significantly less when distressed. It was suggested that strong emotional states, such as fear or anxiety, overwhelmed the restrained eater and decreased motivation to diet (Polivy & Herman, 1983). More
recent studies have shown that increasing restrained eaters’ negative affect through false feedback related to their weight also produces the disinhibitory reaction (McFarlane, Polivy & Herman, 1998), whereas unrestrained eaters are unaffected by the misleading information. Women with high levels of dietary restraint also increase consumption when distressed. This effect has been observed in restrained eaters following speech stressors (Heatherton, Herman & Polivy, 1991), frightening films (Schotte, Cools, & McNally, 1990), threat of shock (Herman & Polivy, 1975), or after having been told that they failed at a given task (Ruderman, 1985). Presumably, negative affect leads to a disinhibition of restraint that results in elevated intake of available food. Many investigators have replicated the differential responses of restrained and unrestrained eaters to both preloads and emotional distress (for reviews, see Heatherton & Baumeister, 1991; Lowe, 1993; Ruderman, 1986).

To comprehend the response of restrained eaters to preloads and emotional disinhibitors, the boundary model of eating was developed (Herman & Polivy, 1984). It was based on a combination of physiological, social and psychological factors. The diet boundary is comprised of cognitive rules for limiting caloric intake to reach or maintain a desirable weight. These cognitive mechanisms mediate restraint and impact behaviors such as external responsiveness to food (Herman & Polivy, 1984). According to the boundary model, people are assumed to begin eating when their deprivation level creates aversive physiological conditions associated with hunger. The aversive nature of hunger operates to keep consumption above some minimum level. Eating ceases when dietary intake creates aversive physiological sensations associated with satiety. Therefore, the aversive qualities of satiety work to
keep the sensation below some maximum threshold (Herman & Polivy, 1984). The area between the boundaries of hunger and satiety is referred to as the “zone of biological indifference.” It is in this intermediary state that social and psychological factors, rather than physiological factors, are of primary importance in regulating the consumption of food (Herman & Polivy, 1984).

For the restrained eater, their self-imposed diet boundary falls within their zone of biological indifference, and is closer to the zone of hunger than satiety. In the absence of a preload, restrained eaters eat only a small amount of food to avoid a breach to their diet boundary. After preloading, restrained eaters have violated the diet boundary and therefore motivation to restrict food intake is diminished, resulting in an overeating episode (Herman and Polivy, 1984). As a result of past dieting and overeating, the restrained eaters’ hunger and satiety boundaries shift to create a larger zone of biological indifference. For unrestrained eaters, when not preloaded they are somewhat hungry and can eat a substantial amount of palatable food, such as ice cream, before encountering satiety pressures. When preloaded, they are moved toward their satiety boundary and are therefore not able to eat as much before experiencing sensations of fullness.

It has been proposed that differences in the level of restraint are responsible for obese-normal differences in eating behavior rather than weight status per se (Herman & Polivy, 1980; Hibscher & Herman, 1977). Overweight individuals are expected to demonstrate higher levels of restraint than normal weight individuals in order to fit into Western cultural expectations. Therefore, it has been proposed that earlier findings of externality in obese can be accounted for by higher restraint in this
population (Herman & Polivy, 1980). According to restraint theory, restrained eaters are presumably less responsive to internal appetitive states and more responsive to external cues. Therefore, the restrained eater may not interpret internal appetitive signals, such as hunger and satiety, accurately. The impact of past dieting and overeating results in the overriding of hunger and satiety signals in the restrained eater.

There are several examples of the influence of cognitive manipulations on the subsequent eating of restrained eaters. Manipulations of the belief that one has consumed a high calorie preload influence to a greater degree subsequent eating than actual caloric intake (Polivy, 1976; Spencer & Fremouw, 1979; Woody, Costanzo, Liefer & Conger, 1981). Furthermore, sensations of hunger can be manipulated by the suggestion that one is hungry or sated. After given a pill described as either promoting hunger or satiety when ingested, restrained eaters responded with eating that was determined by the label the pill was given. However, unrestrained eaters consumed less ice cream when given the “hungry” message than when given the “full” message, acting in accordance with internal sensations of satiety (Heatherton, Polivy, & Herman, 1989). The results of this study support contentions of restraint theory in that restrained eaters are unresponsive to their internal state, whereas unrestrained eaters are relatively responsive to internal cues because the cognitive manipulation of hunger resulted in a placebo effect only for restrained eaters (Heatherton et al., 1989). It is the lack of responsiveness to one’s internal hunger state, and an over-reliance on external cues, that characterize restrained and not unrestrained individuals.
Other external cues, such as self-monitoring and public attention to food intake, also impacts regulation of eating. Restrained eaters consumed the greatest number of candies after consuming a two-milkshake preload. The addition of either self-attention or implied public attention, through the manipulated availability of a wastebasket for disposing candy wrappers, inhibited eating substantially (Polivy, Herman, Hackett, & Kuleshnyk, 1986). For non-dieters, the preload itself inhibited candy consumption, which was reduced further when public attention to candy intake was added. Experimenter observation of the subject during the free eating phase resulted in restrained eaters consuming less after the large preload than after the small preload (Polivy, Herman, Younger, & Erskine, 1979). These findings suggest that restrained eaters are especially responsive to social evaluation or monitoring of their eating and will regulate their appetitive desires to consume larger quantities of food in response to social norms.

Restrained and unrestrained eaters have demonstrated differential physiological reactivity related to appetitive cues. Restraint, as measured by the RS (Herman & Polivy, 1980), is positively associated with cephalic phase responses elicited by exposure to the sensory properties of food. These include the sight, smell, taste, as well as thought of palatable food stimuli (Nederkoorn, Smulders, Jansen, 2000). Cephalic phase responses such as salivation can enhance digestion and lessen the physiological impact of food by readying the body for digestion (Herman, Polivy, Klajner, Esses, 1981). Furthermore, while cephalic phase responses may be the direct result of sensory stimulation, they may also be elicited by conditioning (Mattes, 1997).
Studies on salivary responsiveness among restrained eaters have yielded mixed results (Mattes, 2000). The paradigm for the study of salivary response involves obtaining a baseline assessment of salivary output and comparing salivary response after sensory exposure to the presence of appetitive cues, most often through visual or olfactory stimuli. Some studies have found differential salivary responses among women with abnormal eating behaviors such as bulimia nervosa and anorexia nervosa when compared with unrestrained eaters (LeGoff, Leichner, & Spigelman, 1988; Bulik, Lawson, & Carter, 1996). In one study (Bulik, Lawson & Carter, 1996) participants were presented with a plate of their favorite foods, and salivary response was measured as the difference in weight of dental rolls pre- and post-presentation of food. Bulimic women displayed less salivary reactivity than either restrained or unrestrained eaters, classified as such by their scores on the short form of the RS (Herman & Mack, 1980). Current dieting status, however, was not documented among the group of restrained eaters. This failure to do so may have resulted in a heterogeneous group of restrained eaters, with the active dieters salivating less to the food stimuli.

Contrary to these findings, salivary response to olfactory food stimuli was heightened among bulimics and diminished among anorexic patients compared to a group of unrestrained eaters, identified by their low scores on the RS (LeGoff, Leichner, & Spigelman, 1988). Bulimic women who were high in dietary restraint but reported significant variability in caloric consumption, salivated more to food than did women matched on age, height and weight. Anorexic patients, who scored high on restraint but reported little caloric variability in the content of their meals, salivated
less to food than did unrestrained controls that were matched on age and height. Caloric variability accounted for a significant proportion of variance in salivary output, whereas dietary restraint measured by the RS did not predict salivary response to food (LeGoff, Leichner, & Spigelman, 1988). These data indicate that successful dietary restraint, that is strictly maintained restricted food intake, may lower the salivary response, whereas unsuccessful dieting, that is alternating between periods of dieting and overeating, may lead to heightened salivation response. As bulimic and anorexic women were equal in restraint, dietary restraint, as defined by the RS, is insufficient to account for differences in salivary response to food in all types of dieters. Two groups that were equally restrained had salivary responses to food in opposite directions. It appears that cephalic responses among dieters who are more variable in their eating patterns reflect greater responsiveness to appetitive cues. There is, however, an alternative explanation for these results: people who eat more (in whatever pattern) salivate more than those who eat less.

Among non-eating disordered women, cephalic phase salivation is generally higher in restrained, relative to unrestrained eaters as measured by the RS (Klajner, Herman, Polivy, Chhabra, 1981; LeGoff & Speigelman, 1987; Sahakian, Lean, Robbins, & James, 1981), although some studies have reported no increase or even a decrease in salivation in restrained eaters in response to appetitive cues when identified as such by the Three Factor Eating Questionnaire-Cognitive Restraint scale (TFEQ-CR; Karhunen, et al., 1997; Tepper, 1992; Mitchell & Epstein, 1996). In one study of obese and normal weight women, a RS score of 18 was used to classify participants as restrained eaters (Klajner, Herman, Polivy & Chhabra, 1981).
Restrained eaters responded to visual and olfactory food cues with a greater salivary response than unrestrained eaters. Salivary response was taken as the difference between a 15-minute rest and 15-minute visual-olfactory exposure to hot slices of pizza. Participants were also told that they could eat the pizza if they wished in order to minimize any anxiety that may have been elicited from the belief that they would have to eat the pizza. Saliva was collected with a whole-mouth suction technique, using a dental fluid ejector placed under the tongue to draw saliva into a cylinder (Klajner, Herman, Polivy & Chhabra, 1981). The findings of this study are significant, as they contradict earlier studies that attributed differential cephalic responsiveness to relative weight status. Restraint status, as measured by the RS, appeared to better account for the physiologic reactivity to appetitive cues.

LeGoff & Spielgman (1987) replicated the impact of dietary restraint using the RS on salivation rate and substantiated the finding that dieting restraint, rather than relative weight, is associated with heightened salivary responses to food. Salivation was collected using three pre-weighed cotton rolls that remained in the mouth of the participant for 150 seconds. Participants were required to smell each substance of the non-food and food categories for 30 seconds. Salivary change was measured as the difference in salivary response to the non-food and food stimuli.

Other studies that have used comparable paradigms of salivary collection have failed to find increased salivation in restrained eaters identified as such by the TFEQ-CR scale after exposure to food cues (Karhunen et al., 1997). One study examined cephalic phase responses to exposure of food cues amongst obese binge eating and non-binge eating women (Karhunen et al., 1997). Restraint was assessed by scores on
the TFEQ-CR, with no significant differences found on the scale between binge and non-binge eating women. For both groups of equally restrained women, salivary response decreased in the presence of food cues. Anxiety related to exposure to diet-prohibited foods and the expectation that participants would be forced to eat these foods may explain the decrease in salivary response.

In another study (Tepper, 1992) restrained eaters classified as such by their scores on the TFEQ-CR scale (Stunkard & Messick, 1985). In this paradigm baseline saliva was collected prior to food exposure by having participants tilt their heads forward over a funnel fitted over their mouths for three minutes and expectorate saliva into a tube. Participants were then requested to sit quietly for five minutes with no food present. The final collection was conducted while the participant viewed a hot slice of cheese pizza for five minutes. Restrained eaters’ salivary responsiveness to viewing and smelling hot pizza was comparable to that exhibited by the unrestrained eaters.

In one study, participants were classified on the basis of both scales (with an earlier version of the TFEQ) but positive associations were found only with the RS (Sahakian, Lean, Robbins, & James, 1981). It may be that scores on the TFEQ-CR reflect successful dieting, that is, those who maintain a restricted food intake, and as such are associated with reduced salivary response. In contrast, scores on the RS may measure a more chronic, intractable type of dieting that is associated with alternating between periods of dieting and overeating and enhanced responsiveness to appetitive cues.
Taken together, many of the studies examining the relationship between salivary responsiveness and restraint found a positive association when restrained eaters were identified with the RS. Differences in salivary reactivity to food cues, however, were not apparent when restraint was measured using the TFEQ-CR. This conclusion is also consistent with the assumption that the RS reflects appetitive hyper-responsiveness and that those who are actively restricting their food intake (i.e., restrained eaters on the CR) at least temporarily normalize their food intake and their salivary hyper-responsiveness. Of note, the extent to which the findings from these controlled studies can be generalized to situations outside the laboratory has yet to receive adequate empirical attention.

Critique of Restraint Theory

One of the primary assertions of restraint theory is that dieting results in the disinhibition of dietary restraint. While there is consistent evidence in support of a relationship between RS-restraint and disinhibition, there are a number of reasons to question dieting as the mechanism responsible for this association. First, alternative, psychometrically superior measures of restraint have been developed and have failed to demonstrate counterregulatory eating in the classic preload paradigm (Lowe, 1993). The Three Factor Eating Questionnaire-Cognitive Restraint scale (TFEQ-CR; Stunkard & Messick, 1985) and the Dutch Eating Behavior Questionnaire-Restrained Eating scale (DEBQ-RE; Van Strien, Frijters, Bergers and Defares, 1986) are similar to one another but differ from the RS (Herman & Polivy, 1983) in that they exclude references to overeating and to weight fluctuations and describe specific cognitive and behavioral strategies for reducing caloric intake (Allison, 1995).
Studies that have relied on the TFEQ-CR scale (Stunkard & Messick, 1985) and the DEBQ-RE subscale (Van Strien, Frijters, Bergers and Defares, 1986) to identify restrained eaters demonstrate that neither cognitive restraint nor dietary restraint can explain the anomalies in eating of restrained eaters. Restrained eaters identified by these alternative measures endorse items that assess weight and eating concerns (Laessle et al., 1989), and assess the translation of these concerns into reduced caloric intake in the real-life eating environment (Laessle, Tuschl, Kotthaus, & Pirke, 1989; Wardle & Beales, 1987). Restrained eaters, however, on these scales do not exhibit preload- or affect-induced overeating in the laboratory (Jansen, Oosterlaan, Merckelbach, & van den Hout, 1988; Lowe & Maycock, 1988; Wardle & Beales, 1987). Furthermore, neither the DEBQ-RE scale (Frijters, 1984) nor the TFEQ-CR scale (Karhunen et al., 1997; Tepper, 1992; Sahakian, Lean, Robbins, & James, 1981) is consistently related to salivation, whereas the RS has repeatedly been found to predict salivary output (Klajner, Herman, Polivy, & Chhabra, 1981; LeGoff & Spigelman, 1987). The TFEQ-CR scale showed a weak inverse correlation with binge eating (Lowe & Caputo, 1991; Marcus, Wing, & Lamparski, 1985), whereas the Restraint Scale was positively correlated with binge eating (Wardle, 1980). Finally, when restrained eaters were identified using the DEBQ-RE scale, a manipulation of perceived hunger and satiety had no effect on their subsequent eating (Ogden & Wardle, 1990). However, when scores on the RS were used to identify restrained eaters, manipulations of perceived hunger significantly impacted restrained eaters' subsequent eating (Heatherton, Polivy, & Herman, 1989). Thus, restrained eaters on the TFEQ-CR and DEBQ-RE scales do not show any of the
appetitive and behavioral abnormalities exhibited by restrained eaters selected by the RS.

Secondly, contrary to restraint theory’s interchangeable use of the terms “restraint” and “dieting,” most restrained eaters are not currently dieting to lose weight (Lowe et al., 1991). While the dietary concerns and weight fluctuations assessed by RS reflect a history of dieting, a high score on the RS usually does not reflect current dieting. The RS was used to identify individuals who are chronically concerned about their weight and who try to control it by limiting their intake. The scale has received much criticism for its lack of face validity, that is, only 1 out of the 10 items mention dieting. If only some restrained eaters are actually on diets to lose weight at a given time, the question arises as to whether restrained eaters who are currently dieting to lose weight differ from those restrained eaters who are not currently dieting (Lowe, Whitlow, & Bellwoar, 1991).

Furthermore, elevated RS scores do not predict reduced levels of caloric intake in the natural environment (Lowe, 1993). Two studies have shown that restrained eaters identified by the RS did not differ from unrestrained eaters in their naturalistic caloric intake (Kirkley, Burge, Ammerman, 1988; Klesges, Klem, Bene, 1989). One study has demonstrated that restrained eaters, identified by the TFEQ-CR scale, consumed a daily caloric intake that was significantly less than the unrestrained eaters. However, even these cognitive restrained eaters were not in a negative energy balance because their energy needs were lower (Laessle, Tuschl, Kotthaus, & Pirke, 1989).

Even more important, those who are dieting to lose weight, and who presumably have imposed a clear-cut “diet boundary” on their eating, would be
predicted by restraint theory to show even more dramatic counterregulation than restrained eaters who are not dieting. Instead, they show clear-cut eating regulation. Current dieters ate more than restrained non-dieters when not preloaded, and reduced their intake following a high-calorie preload (Lowe, Whitlow, & Bellwoar, 1991; Lowe, 1995).

Thirdly, in a test of Herman and Polivy’s (1984) cognitive theory, Jansen, Merckelbach, Oosterlaan, Tuiten, and van den Hout (1988) examined cognitive processes that may mediate counterregulatory eating in restrained eaters. Self-talk of preloaded and nonpreloaded restrained and unrestrained eaters was assessed during and after an ice cream taste test. Participants verbalized their thoughts as they ate the ice cream and rated the frequency of 25 disinhibitory thoughts after the test was over. In line with past findings, there was a significant interaction; that is, preload was associated with an increase in restrained eaters’ consumption and a significant decrease in unrestrained eaters’ consumption. However, contrary to expectations no significant restraint by preload interactions were found for any of the measures of disinhibitory thinking. These findings are inconsistent with restraint theory because if the non-regulatory eating of preloaded restrained eaters was mediated by disinhibitory thinking, then a number of significant restraint by preload interactions on measures tapping such thinking should have been found. Another study induced disinhibitory eating in restrained eaters and examined diet-related cognitions and found no evidence for specific diet-related cognitions (Ward & Mann, 2000). These findings suggest that the hypothesized mediator of disinhibition, that is disrupted cognitive control, is not
supported. Therefore disinhibition apparently cannot be explained by one’s transgression of dietary rules.

Fourth, prior to the onset of dieting, the impact of restraint on counterregulation among a group of obese clinic attendees was studied (McCann, et al., 1992). Participants in the preload condition demonstrated the classic counter-regulatory pattern of eating. This study can be viewed as critical of restraint theory because when obese individuals first enroll in a weight control program, most of them have been gaining weight and obviously are not dieting – yet the obese individuals in this study showed clear-cut counterregulatory eating.

Fifth, according to restraint theory a cycle of weight loss and regain should exacerbate binge eating and emotional distress. However, evidence from studies of weight cycling fail to demonstrate support for this hypothesis (Foster, Wadden, Kendall, Stunkard, & Vogt, 1996). Cognitive restraint was virtually identical before and after a cycle of weight loss and regain. Weight loss and regain of 21 kilograms were associated significant improvements in mood and binge eating, as well as reductions in hunger and disinhibition (Foster, et al., 1996). Both binge eating and the scores on the Beck Depression Inventory (BDI) were lower after five years (and almost complete weight regain) than at pretest, which shows that a full weight cycle does not exacerbate either.

The relationship between cognitive restraint and the psychosocial consequences of weight cycling has yielded comparable results. It has been postulated that every cycle of dieting and overeating and subsequent weight gain results in greater distress and lower self-esteem. This impact has a “spiral” effect on the
psychosocial well-being and self-esteem of those who cycle through patterns of weight loss and regain. Accordingly, dieters who continue on a dieting/overeating cycle gradually worsen, sometimes to the point of becoming eating disordered (Heatherton & Polivy, 1992). Even among normal weight women a history of weight cycling, defined as: (1) the reported lifetime total cycle weight lost; and (2) the number of times participants lost 10 pounds or greater, is not associated with adverse psychological consequences such as increased depression, stress, anxiety or anger (Simkin-Silverman, Wing, Plantinga, Matthews, Kuller, 1998).

One prospective study examined the changes in eating self-efficacy, that is, an individual’s confidence to resist overeating in particular situations, using an obese clinical population subsequent to weight regain. Eating self-efficacy was unchanged despite experiencing weight loss and then regain (Clark & King, 2000). These data suggest that weight loss and regain are not associated with long-term adverse psychological effects or with an increased risk of binge eating. The findings from the weight cycling literature dispute restraint theory claims that a history of repeated weight losses and gains results in a downward spiral of psychological and eating problems.

Finally, additional research found that a measure of External Locus of Control for Indulgence, which did not mention dieting, predicts laboratory-based disinhibited eating better than the RS (Rotenberg & Flood, 2000). The measure provided an assessment of the causal attributions that an individual ascribes to their indulgence in the consumption of fattening foods (e.g., “buying favorite candy bars on Halloween and, before the first child arrives, eating them all”; “meeting a friend and eating a Big
Mac, large fries, and a large chocolate milkshake”). Causal attributions may be either internal (something about them) or external (something about other people or circumstances). The External Locus of Control for Indulgence predicted counterregulation better than the Restraint Scale did, even though the Locus of Control measure does not mention dieting, overeating, or eating and weight concerns.

There are two studies that have found that dieting – as opposed to restrained eating – was associated with disinhibitory eating. In one study, Baucom and Aiken (1981) found that subjects who said they were dieting ate more when emotionally distressed than non-dieting subjects. In another, obese clinic attendees who dieted to lose weight showed a trend toward greater counterregulatory eating than a non-dieting group who had lost no weight (Lowe, Foster, Kerzhnerman, Swain, & Wadden, 2001). Nonetheless, the preponderance of evidence does not support restraint theory’s premise that dieting – either current or past – can account for the pattern of appetitive hyper-responsiveness shown by restrained eaters.

Taken together the findings presented above suggest that restraint theory’s explanation for heightened responses to food related cues (that is salivation, counterregulation, social cues to eat, and perceived hunger) is flawed. That literature suggests that neither current dieting/actual restrictive eating nor a history of chronic dieting (as indexed by weight loss and regain) appear capable of accounting for the diverse effects associated with Herman and Polivy’s (1980) concept of restraint. Therefore, an alternative explanation for appetitive pattern shown by restrained eaters is still necessary. It is possible that the RS measures not food restriction but a predisposition toward appetitive hyper-responsiveness. Calorie deficit dieting appears
to reduce – at least temporarily, this predisposition in restrained eaters. Thus restrained eaters’ chronic dieting may be a consequence, rather than a cause, of their susceptibility to appetitive cues.

Appetitive Hyper-Responsiveness

An alternative explanation for the appetitive abnormalities associated with restrained eating is that appetitive hyper-responsiveness gives rise to both eating problems and the subsequent need to diet. Appetitive hyper-responsiveness is defined as a tendency to demonstrate stronger than average appetitive responses to a range of food-related stimuli. On the RS nearly all of the items reflect eating or weight concerns and problems, not dieting behavior, per se. It may be that the scale predicts overeating in various situations because it is assessing a construct reflecting vulnerability to eating control problems. It may be that the key, causal construct the RS is measuring is not dieting (successful or unsuccessful), but a predisposition to appetitive hyper-responsiveness that may both cause and undermine dieting.

There are several observations consistent with this alternative explanation. First, three-month old infants at greater risk for the development of obesity, as determined by their mothers’ obesity, show greater sucking avidity for breast milk or infant formula than those infants at lower risk for obesity (Stunkard, Berkowitz, Stallings, & Schoeller, 1999). Energy intake as measured by three-day food records kept by the infants’ mothers, as well as the infants’ sucking avidity, also predict the infants’ weights at 12-months. Furthermore, measures of energy expenditure did not predict future weight gain. These findings suggest that a genetic predisposition toward obesity may be partially manifested through a stronger appetitive drive.
Second, restrained eaters, identified as such by scores on the RS, show elevated salivary responsiveness to palatable foods (Klajner, Herman, Polivy, Chhabra, 1981; LeGoff & Speigelman, 1987; Sahakian, Lean, Robbins, & James, 1981). Cephalic phase responses are elicited by exposure to the sensory properties of food, such as its sight, smell, and taste. These bodily responses are considered adjustments of the body to a coming meal, elicited by exposure to food or food cues, either by direct sensory stimulation or by conditioned processes. The body gears up to facilitate the digestion of food, and to reduce the negative impact of digestion on the body (Mattes, 1997).

Exposure to food seems to enhance salivation, particularly among restrained eaters, identified by the RS, but not for the TFEQ-CR (Epstein et al., 1997; Nederkoorn et al, 2000; LeGoff et al., 1988; Tepper, 1992; Karhunen et al., 1997; Tepper, 1992; Sahakian, Lean, Robbins, & James, 1981). Successful restrained eaters, that is, those who score highly on the TFEQ-CR scale, do not demonstrate elevated salivary response; therefore actual dieting cannot be responsible for increased cephalic responsiveness (Karhunen et al., 1997; Tepper, 1992; Sahakian, Lean, Robbins, & James, 1981). The emergence of cephalic phase responses, like salivation are thought to increase the amount of food one can eat (Nederkoorn et al., 2000). Given that some individuals show an increase in salivary responsiveness to food cues, it seems plausible that restrained eaters identified by the RS may have to become restrained to counteract their stronger appetitive (in this case salivary) responses to food.

Furthermore, it appears that restrained eaters, identified by scores on the RS, are more sensitive and reactive to food cues. Prior to exposure to a palatable, well-
liked food (e.g., pizza), both restrained and unrestrained eaters had comparable ratings of cravings, liking, and desire to eat the pizza. After a visual and olfactory exposure to the food, restrained eaters reported significantly greater desires on each of the appetitive urges than unrestrained eaters (Fedoroff, Polivy, & Herman, 1997). Food cues generated an appetitive urge to eat in restrained eaters but not among unrestrained eaters on the Herman and Polivy measure. In another study, the combination of visual, olfactory and cognitive cues during an exposure period prior to eating stimulated counterregulatory eating in restrained eaters, identified by the RS (Jansen & van den Hout, 1991). After seeing and concentrating on the smell of a variety of palatable foods, restrained eaters ate significantly more than restrained eaters who were not exposed to the appetitive cues. The pattern of consumption was non-significant for unrestrained eaters, who ate less after exposure to food cues than after no exposure (Jansen & van den Hout, 1991). These studies suggest that restrained eaters may be particularly vulnerable to external food cues that may result in consumption or even an overconsumption of highly desirable foods.

The incentive value of food appears to vary between individuals, particularly among the obese and non-obese. Evidence suggests that obese, relative to non-obese, individuals find eating highly desirable foods more reinforcing than engaging in pleasurable sedentary activities (Saelens & Epstein, 1996). Participants completed a concurrent-schedules choice task to earn points to be traded in for high-fat, calorically dense snacks, or to be traded for time to engage in pleasant sedentary activities, such as playing video games, or reading popular magazines. When the cost of obtaining the food rewards forced participants to work harder, obese women showed an initial
increase in responding to food reinforcers. However, their responding decreased sharply only after substantial increases were required to obtain the sought-after food rewards. Non-obese women showed a linear decrease in responding for food reinforcers as requirements increased, without the initial boost in responding (Saelens & Epstein, 1996). These individual differences in the reinforcing value of food may have a substantial impact on one’s eating behavior and subsequent weight gain.

In sum, there is a general pattern of magnified appetitive responses among restrained eaters that cannot be accounted for by dieting. Appetitive hyper-responsiveness is a robust phenomenon that occurs in so-called restrained eaters across multiple areas of appetitive related contexts. However, a re-interpretation of the causal factors associated with this vulnerability is needed. If a person is driven by appetitive urges and indeed acts upon these desires to consume palatable foods, that person is likely to end up in a positive energy balance that over time will result in weight gain. It is this weight gain, or the concern of weight gain, that induces one’s desire to restrain what they are eating and to restrict caloric consumption.

Furthermore, this appetitive disposition does not diminish. Instead, engaging in active dieting may simply temporarily reduce one’s desires and physiological responsiveness to the plentiful appetitive cues in the environment.

If certain individuals are “hyper-responsive” to the food environment, how might they be identified? Many measures of overeating currently exist. Moreover, it is circular reasoning to use overeating as a measure of hyper-responsiveness if what one is trying to explain is overeating to begin with. An alternative way to measure this construct is to assess the influence of the mere presence or availability of food – that
is, when food intake is not impending or underway, does the constant availability of food influence one’s thoughts, attention, and/or behavior? To the extent that this occurs, then such people presumably are more appetitively sensitive to food or simply the potential availability of food in the environment – and food potentially has more “power” over them.

The RS contains items that measure multiple constructs, such as dieting, weight loss and regain, eating and weight concerns, and overeating. It attempts to assess the behavioral and cognitive manifestations of a desire to diet, but it does not directly assess the impetus behind the need to restrict one’s consumption of highly palatable foods. Moreover, the precise construct assessed by the scale is questionable. The RS may predict appetitive related phenomenon because it describes some of the very outcomes it is attempting to measure. A scale is needed that that measures this appetitive vulnerability without making reference to the multiple constructs assessed with the RS. If a measure predicted restraint-related phenomena as well as or better than the RS, it would provide further evidence that the appetitive anomalies associated with the RS do not result from dieting. It was with these outcomes in mind that the Power of Food Scale (PFS) was developed.

*Development of the Power of Food Scale (PFS)*

The current version of the PFS has resulted from multiple revisions of the instrument. Initial construction of the items for the PFS was based on the Perceived Control Over Eating Scale (PCOES; Greeno, Jackson, Williams, Fortmann, 1998). This measure is a 7-item instrument in which each item is rated on a 5-point scale. Scores are averaged across the seven items, with higher scores indicating more control
over eating. The scale consists of the following items: (1) “I just can’t keep myself from eating snacks between meals”; (2) “I just can’t resist eating sweet desserts”; (3) “It’s impossible for me to resist eating when I am around others who are eating”; (4) “I have trouble keeping myself from eating a lot when I go out to eat”; (5) “I feel powerless to prevent myself from eating when I am anxious or unhappy”; (6) “It seems as though almost everything I really enjoy is bad for me”; (7) “How often do you eat when you are nervous or tense?” The Perceived Control Over Eating Scale (PCOES) is considered a valid measure that is highly correlated with the TFEQ Disinhibition subscale (r = -.61) (Greeno, et al., 1998).

In order to ensure that the PFS is representative of persons who most frequently experience hyper-responsiveness to food cues, suggestions for items were elicited from women enrolled in a clinical weight loss trial. Information obtained from this sample of women was used to supplement the questions on the PCOES. Prior to treatment, the women were asked to describe ways in which food that they were not eating or about to eat influenced their thoughts, feelings and behavior. Responses to this inquiry, along with items from the PCOES were used to formulate the original 13-item measure re-named the Feelings of Loss of Control Scale (FLECS). Items were rated on a five-point Likert scale (1) strongly disagree to (5) strongly agree and were summed to produce a total score.

Initial item analysis revealed that 5 of the original 13 items showed relatively weak (rs < .52) correlations with the total scale scores (with the item removed). These items specifically made reference to eating or overeating and were therefore dropped from the scale. Factor analysis identified that 8 of the original 13 items loaded on one
factor (all loadings >.69), which accounted for 58.6% of the variance. The remaining 8 statements used in the analysis of the PFS included:

1. When I first taste a delicious food, I begin to feel like I could lose control of my eating;
2. I sometimes feel that food is to me like liquor is to an alcoholic;
3. If I eat when I’m emotionally upset, I am more likely to feel out of control of my eating;
4. Sometimes it’s scary to think of the power that food has over me;
5. I feel almost powerless to prevent myself from eating something when I am anxious or unhappy;
6. When I know a delicious food is available, I can’t help myself from thinking about having some;
7. Sometimes I feel like food controls me rather than the other way around;
8. Sometimes I find myself thinking about food when I should be thinking about other things.

The 8-item PFS demonstrated adequate temporal stability; its one-month test-retest reliability was good (r = .84, p < .001). Scores on the scale correlated positively with TFEQ-Disinhibition scale (.77), and the Binge Eating Scale (.70), and were not significantly associated with TFEQ-Cognitive Restraint (.03). These preliminary findings support the validity of PFS with women enrolled in a clinical weight loss trial (Didie, et al., 2001).

Items reflecting emotional eating was removed from the current version of the PFS to reduce variance overlap with measures of emotional and disinhibitory eating.
Additional items, derived from examples suggested by overweight clinic participants, were added to the latest version of the scale. An equal number of items were included that reflected the perceived influence of food in each of three contexts. The contexts reflect a distal-to-proximal continuum of food stimuli. The first “context” is abstract—these items reflect how the mere availability of food in the environment influences a person’s thoughts and behavior (items 1, 4, 7, 8, 13, 16, 19). The second context involves the actual presence of food stimuli (items 2, 5, 6, 10, 12, 18, 21). The third context involves the pleasure derived from food itself, especially the taste of food (items 3, 9, 11, 14, 15, 17, 20). Thus the three dimensions measure the perceived effects of food when it is available but not present, present but not tasted, and tasted.

The first two factors assess the influence of appetitive stimuli when it is either distal or proximal to the individual. The third factor assesses the degree to which one’s motivation to eat is impacted by the pleasure that one obtains from food itself. The final 21-item version consists of questions designed to assess the perceived psychological influence of food. Anchors used to score responses were also changed to (1) *don’t agree at all* to (5) *strongly agree*. The current version of PFS intentionally omits items that refer to disinhibited eating, emotionality, body mass, weight fluctuations or dieting.

Two studies have examined the relationship of the PFS and the RS with weight status and disinhibited eating. In the first study (Annunziato & Lowe, 2002), the measures were administered to normal weight female college students and obese clinic patients. It was predicted that if the power of food causes some individuals to diet more often in order to counteract a hyper-responsive appetite, then both normal weight
restrained and obese individuals (both of whom diet frequently) should score higher than unrestrained individuals on this measure. PFS scores of three groups (e.g., normal weight unrestrained eaters, normal weight restrained eaters, and obese individuals) were compared. The groups differed significantly on the PFS, ($F = 11.2$, $p < .01$). A Tukey’s HSD post hoc analysis found a significant difference between obese individuals and restrained eaters on one hand, and unrestrained eaters on the other. There was no difference between obese individuals and restrained eaters. The results of this study are consistent with the hypothesis that overeating tendencies shown by so-called restrained eaters may be a function of a hyper-responsive appetite that gives rise to both overeating and the need to diet.

In the second study (Annunziato & Lowe, 2002), the PFS, RS and the Three-Factor Eating Questionnaire (TFEQ) were administered to college freshmen women. One of the scales of the TFEQ, Disinhibition, assessed one’s propensity toward overeating for a variety of reasons (e.g. mood, smell of delicious foods, inability to stop eating, etc). A linear regression was conducted to determine if the PFS and the RS predict Disinhibition controlling for the other. The PFS alone was significantly predictive of Disinhibition ($t = 6.98$, $p < .001$). The addition of RS scores added significantly to the amount of variance explained ($t = 3.49$, $p < .01$). These results indicate that the PFS and the RS independently contribute to the prediction of disinhibitory eating. Since the PFS – unlike the RS – contains no items about overeating, weight status, or dieting, these results suggest that the PFS is tapping a dimension related to disinhibitory eating that cannot be explained by restrained eating or concerns about eating and weight.
Present Study

This study examined the development and psychometric evaluation of a self-report measure designed to assess the perceived psychological influence of food. Current thinking about overeating and preoccupation with food is dominated by restraint theory; however, it is plausible that a predisposition toward hyper-responsiveness to food cues produces overeating and a subsequent need to diet. Numerous measures of overeating (e.g., Binge Eating Scale) and restrained eating (e.g., Cognitive Restraint from the Three Factor Eating Questionnaire) currently exist. Newer measures suggest that perceived control over eating may be an important predictor of life satisfaction (Greeno et al., 1998). Moreover, the incentive value of food (i.e. in the absence of food deprivation) likely differs widely between individuals. Therefore, the mere presence of food may have a stronger psychological impact on some people independent of their weight. Anecdotal observations suggest that “naturally thin” people usually think about food only when it’s time to eat; weight conscious people often think about food even when they are not physically deprived. Such differences may not result from dieting but may reflect a predisposition that - in our thinness-obsessed society - gives rise to the need to diet.

The rationale for this study was twofold. This study attempted: 1) to use salivary responsiveness to evaluate the validity of a measure of appetitive hyper-responsiveness using a sample of college women; and 2) to compare the relative power of the PFS and the RS in predicting salivary response. The rationale for using these variables is based on the reasoning that the validity of the PFS can be better understood by: (a) identifying which factor is more powerful at predicting salivary
responsiveness to food stimuli; and (b) whether or not the variance they are explaining is completely redundant. Specifically, if the PFS is a valid and reliable measure of appetitive hyper-responsiveness, and if such responsiveness accounts for heightened appetite better than the RS does, then the PFS should account for a greater percentage of the variance in salivary response than RS.

**Dependent Measure**

Salivary response was identified as the dependent measure in the study. Cephalic phase responses (CPRs) of the body are elicited by exposure to the sensory properties of food (e.g., sight, smell, taste). The CPRs are the adjustments of the body to a coming meal, elicited by exposure to food or food cues, either by direct sensory stimulation or by conditioned processes. The body gears up to facilitate the digestion of food, or its anticipatory responses are compensated to diminish the negative consequences of food intake (Mattes, 1997). As described previously, exposure to food enhances salivation among restrained eaters identified by the RS (Klajner, Herman, Polivy, & Chhabra, 1981; LeGoff & Spigelman, 1987; Franchina & Slank, 1988; Nederkoorn et al, 2000). If the PFS is a valid alternative to restraint for explaining appetitive responsiveness than the dependent variable must be one that has demonstrated a robust relationship with restraint. Salivary reactivity to food stimuli was identified as the primary dependent variable because of its robust correlation with measures on the RS.

**Covariates**

Depression scores, as measured by the Beck Depression Inventory (BDI) have been found to negatively impact salivary rate. In a study of women diagnosed with
bulimia (Bulik, Lawson, & Carter, 1996), BDI scores were significantly correlated with salivary reactivity and reduced the effects of the eating disorder diagnosis when entered into an analysis of covariance (Bulik, Lawson & Carter, 1996). The degree of depression may have impacted salivary responsiveness to food stimuli. Therefore, as previously suggested by Wooley and Wooley (1981), depression may affect salivation and could account for a failure to show positive salivary response in studies.

It is a widely held belief that anxiety has effects on salivation. In particular, studies that have examined salivary response to palatable foods among restrained eaters’ ratings of current anxiety have been significantly associated with salivation (for review, see Mattes, 2000). Moreover, different methods of salivary collection may produce different levels of anxiety, with some procedures resulting in higher levels of anxiety and reduced salivary responsiveness to food stimuli. Similarly, the nature of instructions given to subjects during the experimental procedure has been hypothesized to affect anxiety levels (Wooley & Wooley, 1981). When subjects know in advance that they will be required to eat high-risk food during the experimental procedure that break a rigid dietary rule, anxiety may increase and could possibly inhibit salivation (Herman, et al., 1981).

Prior to restraint theory differences in responsiveness to food stimuli was attributed to relative weight. Salivary responsiveness to appetitive cues was found to be greater in obese than in nonobese individuals (Guy-Grand & Goga, 1981). Obese restrained eaters, identified as such by scores on the RS, showed a salivary response three times greater than that shown by normal weight unrestrained eaters (Kljajner, Herman, Polivy, & Chhabra, 1981). As relative weight may impact salivary response
independent of restraint, the correlation between body mass index and salivary reactivity to food cues was examined.

When hungry, the thought of or exposure to a familiar palatable food can stimulate salivary flow (Mattes, 2000). In a review of the impact of hunger on salivation, Wooley & Wooley (1981) reported that the rate of salivary flow in humans is generally directly proportional to the length of food deprivation, and inversely proportional to pharmacological agents that suppress hunger. Other studies have demonstrated that salivary volume is directly related to the level of food deprivation (Franchina & Slank, 1988). As the degree of hunger may impact salivary response, the association between hunger and salivation was examined.
2. METHODS

Participants

A total of 81 participants\(^1\) who met the following inclusion criteria were selected as described below. Women who were 18-30 years of age and currently enrolled at Drexel University in an undergraduate program were invited to participate. Men were excluded from this study as the pioneering research that developed the concept of restraint relied exclusively on women to explore the relationship between restrained eating and appetitive responses. Therefore, in order to replicate past results and make valid inferences from our findings only women were asked to participate. Furthermore, if males had been included the number of females would have had to be reduced by one-half, and this would have undermined the ability to test the hypotheses in question with adequate statistical power.

College aged students were employed in the present study, as the great majority of restraint effects have been found with college students. For the purposes of evaluating the PFS and making comparisons with the RS it was essential to use a comparable sample to maximize the likelihood that the RS-salivation relationship found in previous studies would be replicated. Furthermore, while the early college

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\(^1\) Power calculations were conducted for the most stringent analyses. The most stringent analyses involved the multivariate analyses testing the PFS/salivation semi-partial correlation, that is, with the RS controlled. The power was based on the Cohen (1988) table for multiple regression with two predictors. Results suggested that a minimum of 80 participants be utilized in order to achieve a sufficient power of .80 in a multiple regression analysis with two predictor variables. Therefore, the sample size provided ample power for the analyses.
years are a high-risk period for weight gain (Hovell, Mewborn, Randle, & Fowler-Johnson, 1985), they are also a time when social and dating concerns lead to heightened self-consciousness about body weight and shape (Polivy & Herman, 1985; Striegel-Moore, Silberstein, & Rodin, 1986). Because of this, restrained eating is common in college undergraduates (Polivy & Herman, 1985). The PFS may therefore be used to understand the mechanisms behind restraint, that is—dieting is necessary to counterbalance the effects of a hyper-responsive influence to appetitive cues.

Interested women were excluded from the study if they had a history of an eating disorder within the last five years or were current binge eaters. In addition, women that were taking any medications that affect salivary response (e.g., antidepressants and antihistamines) were excluded. Women that were current smokers were excluded. Finally, no more than 1/3rd of the sample had a body mass index (BMI) over 25 kg/m². As there is some question of the validity of restraint theory among overweight and obese individuals, limiting the sample to mostly women in the normal weight range allowed for optimal exploration of the variables in question.

Participants were recruited from multiple sources. First, announcements regarding the study were made in psychology classes on campus. Prospective participants were told that the study was examining the “sensory perception of food” (the focus of the study was not advertised initially to avoid selecting only students with concerns about dieting). Prospective participants were offered ten dollars for their enrollment. In some cases participants were offered course credits instead of monetary compensation for their participation. In situations where Drexel psychology professors offered an opportunity for students to earn extra credits for their
participation in graduate research projects, this option was presented to students instead of the ten dollars. Women who expressed interest in participating in the study were given a questionnaire packet (as described below) and asked to provide their e-mail address and telephone number for the assessment interview. Additional women were invited to participate via e-mail from a sample that were excluded from participation in a nutrition study due to their body mass index (BMI).

Screening interviews to determine eligibility were conducted over the phone. Participants were asked basic health-related information including height, weight, smoking status, and current medications. Interested participants were asked if they had been diagnosed with an eating disorder (Bulimia Nervosa, Anorexia Nervosa, or Eating Disorder-NOS) in the last five years or if they currently engaged in binge eating episodes more than twice a week. The informed consent was explained verbally to the participant and any questions or concerns they may have had were addressed. Eligible students were invited to participate in the study by the co-investigator or one of the research assistants.

Procedure

Each of the 81 participants were given: 1) a consent form explaining the purposes of the research; 2) a demographics sheet; 3) the Power of Food Scale (PFS); 4) the Herman and Polivy Restraint Scale (RS); 5) the Three Factor Eating Questionnaire (TFEQ); 6) the External Eating factor of the Dutch Eating Behavior Questionnaire (DEBQ); 7) the Marlowe-Crowne Social Desirability Scale (MCSD); 8) the Eating Habits Checklist (EHC); and 9) a questionnaire assessing dieting and weight history.
All individuals were instructed that participation was completely voluntary. Use of code numbers was used to protect participants’ anonymity. Participants were instructed to complete the questionnaire packet and to return it in the envelope provided when they arrived at their scheduled appointment. All data was separated from the consent form. Participants were provided with a contact telephone number, so that any questions may be answered prior to their participation in the experiment.

Furthermore, participants were instructed that if they completed the questionnaire packet and the experimental session they would receive ten dollars. When applicable, students received course credits for their participation in the study. The purpose of the money and course credits were to act as an incentive for participants, and to reduce the likelihood of non-responding.

Participants were told that the sensory perception of various foods was being studied. They were informed that they would be asked to smell various foods and answer some questionnaires. In addition, respondents were told that saliva would be collected using dental rolls. On the day of the scheduled appointment participants completed a Beck Depression Inventory-II (BDI-II), the State Scale of the Spielberger State-Trait Anxiety Inventory (STAI-S), and a visual analogue hunger scale prior to the start of the salivary response test.

The laboratory procedure that was used demonstrated differential salivary response to olfactory food cues between restrained and unrestrained eaters as measured by the RS (LeGoff & Spigelman, 1987; LeGoff, Leichner & Spigelman, 1988). Most procedures replicated that of previous studies (LeGoff & Spigelman, 1987; LeGoff, Leichner & Spigelman, 1988). Testing of all participants occurred in
the morning hours from 9 a.m. to 12 p.m. Participants were requested to eat a typical breakfast and then asked not to eat or drink anything for at least two hours prior to arrival at the lab. Adherence to the breakfast instructions was checked by verbal report to the experimenter. The method of salivary collection was then explained to the participants. The purpose of the experiment was explained to subjects after the experiment was completed.

The Strongin-Hinsie-Peck procedure (Peck, 1959) was used to collect saliva. Upon arrival to the lab, participants rested in a seated position for ten minutes. During this period of time participants were given the option of rinsing their mouth with water prior to the experimenter inserting the dental rolls into the participants’ mouth. For those participants who requested water, they were asked to swallow all the fluid to ensure that no extraneous liquids would contaminate the dental rolls. After the ten-minute period elapsed three pre-weighed 3.8-cm cotton dental rolls were placed in the mouth. The first and second of the rolls were placed between the cheek and the lower gum and the third roll was placed under the tongue. These remained in the participants’ mouth for a total testing time of 150 seconds. When the time expired, participants removed the dental rolls and placed them into a labeled ziplock plastic bag that was sealed for post-testing weighing. A three-minute rest period followed the initial baseline collection, at which time the participant was encouraged to talk to return salivation to normal levels. Once again, during this three-minute period, participants were given the option of rinsing their mouth with water prior to the presentation of food odors. For participants who rinsed their mouths, they were asked to swallow the water to ensure their mouths were free of additional fluids. Unlike the
conditions used for the collection of the baseline measure participants were not given the option of resting for ten minutes prior to collecting stimulated saliva.

Following the baseline collection, saliva was collected once for food odors. The five food odors presented in the study have been shown to have stable and recognizable odors, and to produce a reliable increment in saliva flow rate from baseline in normal-weight, unrestrained eaters (LeGoff & Spigelman, 1987; LeGoff, Leichner & Spigelman, 1988). The food odors were taco-flavored corn chips, grape bubble gum, cinnamon bun, chocolate bar and salt-and-vinegar flavored potato chips. A small amount of each of the food stimuli (15 grams) was placed in its’ own 100-ml opaque plastic bottle with an opening 2.5 centimeters in diameter. Participants were requested to close their eyes and attempt to identify the substance in the bottle from its odor. Food odors were presented in a random order. The subjects were required to smell each substance for 30 seconds. When five odors were presented and 150 seconds expired, the participant removed the swabs and placed them in a labeled ziplock plastic bag. Food stimuli were changed on a daily basis to ensure that the intensity of the odors was comparable across testing days.

At the end of the procedure each participant’s height and weight was measured. Weight was determined to the nearest 0.1 kilogram using a Seca electronic scale. Height was measured to the nearest 0.1 centimeter using a mounted tape measure. Participants stood without footwear with their back and heels against the wall where the tape measure was mounted.
Collected samples were frozen in an airtight container in order to minimize evaporation until they could be weighed. Samples were weighed on a daily basis not longer than four hours after being collected.

**Measures**

*Demographics Questionnaire:* (see Appendix A) The demographics questionnaire is a self-report measure that asked participants to identify characteristics about themselves. Specifically, participants were instructed to provide information regarding their age, ethnicity, and highest level of education completed.

*Power of Food Scale (PFS):* (see Appendix B) The PFS is a 21-item self-report questionnaire that assesses the perceived effect of the presence or availability of food on people’s thoughts and feelings. The scale measures the influence of food in three contexts: food stimuli are generally available but are not immediately present, food stimuli are present but are not being tasted or consumed, and food is being tasted. It was designed to tap the degree to which the omnipresence of food in the environment influences people’s attention, thoughts, or behavior when food consumption was not impending or underway. Respondents indicate the extent to which each statement described them during the past month. Responses are on a 5-point Likert scales ranging from (1) *don’t agree at all* to (5) *strongly agree*. Individual items on the three subscales are summed to produce total scale scores.

As the purpose of this study was to assess the psychometric properties of the scale, only preliminary data on the reliability and validity of the PFS was available. All data are on slightly different versions of the PFS. Tests of an earlier 10-item version of the PFS found it to be reliable (1-month test-retest reliability = .84) and
internally consistent (Cronbach’s alpha = .93; corrected item-total correlations ranged from .53 to .74) (Annunziato & Lowe, 2002). The construct validity of the PFS was supported by showing that both obese clinic attendees (M = 23.8) and restrained normal weight individuals (M = 25.2) scored significantly higher on the PFS than unrestrained eaters (M = 17.4).

The PFS was positively correlated with the Disinhibition subscale of the TFEQ (.77) and with the Eating Habits Checklist (.70), a measure of binge eating. The PFS was not significantly related to the cognitive restraint scale of the TFEQ (.03). In sum, these findings support the convergent validity of the PFS, as it was positively correlated with measures that it should theoretically be related to, and its discriminate validity, because it was unrelated to a measure of current cognitive control of eating (the TFEQ-CR scale). Questions remained as to the ability of the PFS to measure a construct that is sufficiently discriminable from existing measures (Didie et al., 2001).

In a study with 70 normal weight college women (Annunziato & Lowe, 2002), the PFS was more strongly related than the RS to the TFEQ-Disinhibition scale (t_s = 6.98 versus 3.49) in a regression analysis. When the two items on the RS that explicitly measure overeating were removed from the RS total score, the correlation between the RS and Disinhibition decreased from .57 (p < .001) to .19 (p = .12) and the amount of variance the 8-item RS explained in Disinhibition (with PFS scores held constant) decreased (t = 2.09, p = .04).

The Restraint Scale: (RS; Herman & Polivy, 1980) (See Appendix C) was developed to identify individuals who are chronically concerned about their weight and who try to control it by limiting their intake. The measure is a 10-item self-report
questionnaire that has 4 or 5-point scales, with scale anchors that varied. Items are summed to produce total scores. Research has generally classified females who score 16 or higher as restrained eaters and those below 16 as unrestrained eaters (Polivy, Herman & Howard, 1988).

Psychometric data on the RS indicated good internal consistency in normal weight individuals. For the entire scale, Cronbach’s α typically exceeds .75. (Allison, Kalinsky, & Gorman, 1992; Herman & Polivy, 1975; Klem, Klesges, Bene, et al., 1990). Test-retest reliability trials have shown temporal stability for the entire scale ranging from .74 to .95 (Allison, Kalinsky, & Gorman, 1992; Klesges et al., 1991). The total score for the measure correlated positively with disinhibitory eating in laboratory settings (Herman & Mack, 1975; Fedoroff, Polivy & Herman; McFarlane, Polivy, Herman, 1998; Polivy & Herman, 1999).

Hunger Visual Analogue Scale: (See Appendix D) a 100-mm visual analogue scale was used to assess current state of hunger. The hunger scale was anchored at either end with the labels “not hungry at all” at one end and “extremely hungry” at the other end of the continuum. Participants were instructed to mark the point on the line that best represented their current state of hunger. Scores were calculated by measuring the line from its beginning to the point where participants made their mark. Visual analogue scales have been used successfully to assess current emotional and hunger states in prior experiments on salivation and restraint (Nederkoorn, Smulders, Jansen, 2000; Bulik, Lawson, & Carter, 1996; Karhunen et al., 1997; Rosen, 1981).

Dutch Eating Behavior Questionnaire-External Eating Subscale: (DEBQ-External Eating; Van Strien et al., 1986) (See Appendix E) is a 10-item self-report
scale designed to assess external eating. The external eating scale contains items that refer to eating behaviors that are triggered by the sight and odor of foods or the presence of other people who are eating. An example of an item from this scale is, “If you walk past the baker do you have the desire to buy something delicious?” Responses to each item of the DEBQ are on a 5-point Likert scale ranging from (1) never to (5) very often. Summing the scores on items and dividing the sum by the number of items on the scale obtained a total score. The DEBQ has demonstrated good psychometric properties. Depending on the study, for the external eating subscale test-retest reliability ranged from .68 to .91 (Schlundt, 1995). Cronbach’s a for the subscale was .81 and .85 for normal weight and obese women, respectively (VanStrien et al., 1986). The DEBQ external eating subscale has been shown to correlate significantly with a measure of sweet cravings among women (Hill, et al., 1991). In addition, the external eating subscale of the DEBQ was positively correlated with the disinhibition and hunger scales of the TFEQ. In sum, this subscale of the DEBQ appears to have high internal consistency and there is evidence for its validity.

Three Factor Eating Questionnaire: (TFEQ; Stunkard & Messick, 1985) The 51-item TFEQ was designed to assess three aspects of eating behavior: cognitive restraint, disinhibition, and hunger. Cognitive restraint assesses conscious attempts to monitor and limit intake. Disinhibition is the dysregulation of eating in response to cognitive or emotional cues, and Hunger is one’s susceptibility to eating when feeling hungry. In Part 1, each of the 36 items is rated as true or false. The 15 items in Part 2 generally have 4-point scales, but the number of scale points and the scale anchors vary. The item scores are summed for the three factors. The Restraint scale consists
of 21 items, the Disinhibition scale consists of 16 items and the Hunger scale consists of 14 items. Scores in the 0-10 range are classified as “low to average,” those in the 11-13 range as “high” and 14 or more as in the “clinical range” for the cognitive restraint subscale (Stunkard & Messick, 1985).

It has been suggested that restraint is not a homogenous construct (Westenhoefer, 1991). Two factors have been identified within the Cognitive Restraint Scale of the TFEQ. The first factor was Rigid Control (RC) and is associated with an all or nothing approach to eating control and with high levels of Disinhibition, as measured by the scores on the Disinhibition scale of the TFEQ. The second factor is Flexible Control (FC) and is associated with a more flexible approach to eating control and lower Disinhibition scores. The additional items suggested by Westenhoefer, Stunkard and Pudel (1999) were added to explore the flexible and rigid subtypes of restraint.

The psychometric properties of the TFEQ are considered acceptable. The TFEQ restraint subscale has a high internal consistency of .80, and retest-reliability of .91 over a two-week span (Allison, Kalinsky & Gorman, 1992). The TFEQ-R correlates significantly with the Herman and Polivy RS (.74) and the DEBQ-R (.89), indicating adequate convergent validity. Conversely, the TFEQ-R scale correlates minimally with the Marlowe-Crowne Social Desirability Scale (.05) (Allison, Kalinsky, & Gorman, 1992). The disinhibition and hunger subscales also have sound psychometric properties. The subscales have adequate internal consistency ranging from .85 for the hunger scale to .91 for the disinhibition scale (Stunkard & Messick, 1985).
*State-Trait Anxiety Inventory, State Version, Form Y:* (STAI-S; Spielberger, 1983) The STAI is composed of two separate 20-item scales constructed to measure “state” and “trait” anxiety. On the State Scale, the respondent is asked to indicate how they feel right now, that is, the moment they complete each of the 20 items, using a 4-point scale. The State Version of the STAI has adequate internal consistency (.86) (Spielberger, 1983). The subscale scores correlate with expected emotional and behavioral effects under stressful and non-stressful experimental conditions. The STAI has been used successfully to assess the effects of anxiety on disinhibitory eating among restrained eaters (Polivy, Herman, McFarlane, 1994).

*Marlowe-Crowne Social Desirability Scale:* (MCSD; Crowne & Marlowe, 1960) (See Appendix F) consists of 33 true-false items designed to assess and individual’s tendency to respond to questions in a socially desirable manner. In particular, the measure has most often been used to estimate the degree to which self-report measures may be contaminated by such a response (Crino, Svoboda, Rubenfield, & White, 1983). The scale has demonstrated adequate internal consistency (.88), test-retest reliability (.89), and convergent validity with another self-report measure of social desirability, the Edwards Social Desirability Scale (.35). The MCSD has been used to assess the degree to which socially desirable responding influences self-report measures of cognitive and dietary restraint, such as the Herman and Polivy RS, and the TFEQ-R (Allison, Kalinsky, & Gorman, 1992).

*Beck Depression Inventory-II:* The Beck Depression Inventory-II (BDI-II; Beck, Steer, Ball, & Ranieri, 1996) is one of the most widely used measures for the assessment of depression and was constructed to measure the severity of depression.
according to current diagnostic criteria in both adolescent and adult populations (Beck, Steer, Ball, & Ranieri, 1996). The BDI-II is a 21-item self-report measure. Each item is rated on a 4-point scale ranging from 0 to 3. The total score is based on the summation of the highest rating for each of the items. Total scores range from 0 to 63. Scores ranging from 0 to 13 are categorized as ‘minimal depression,’ from 14 to 19 are categorized as ‘mild depression,’ from 20 to 28 are ‘moderate depression,’ and scores between 29 and 63 are categorized as ‘severe depression.’ The psychometric properties of the BDI-II are sound. Specifically, the BDI-II has a high internal consistency of .91, retest-reliability of .93, and convergent validity of .71 with the Hamilton Psychiatric Rating Scale for Depression (Beck et al., 1996). The BDI has been used in numerous studies to assess depressive symptoms among restrained eaters (Williams, Surwit, Babyak, & McCaskill, 1998; Oates-Johnson & DeCourville, 1999).

Eating Habits Checklist: (EHC; Gormally, Black, Daston, & Rardin, 1982) (See Appendix G) is a widely used 16-item measure that assesses the behavioral aspects of binge eating episodes as well as the feelings and thoughts associated with binge behavior. Items are summed to produce a total score. This measure had been used in clinical studies to categorize patients according to severity of binge eating (Marcus et al., 1985). The EHC has demonstrated adequate internal consistency and has been shown to accurately identify ranges of binge eating severity when compared with ratings of trained clinical interviewers (Gormally et al., 1982).

Dieting and Weight History Questionnaire: (See Appendix H) assesses an individual’s current dieting status as well as objective and subjective experience of herself as being a weight cycler. Respondents were asked to respond to the question,
“Are you currently on a diet?” Respondents answering affirmatively were also asked, “Are you currently dieting to lose weight or to avoid gaining weight?”

Research suggests that an individual’s perception of being a weight cycler may be more related to psychological functioning than the actual history of being a weight cycler (Friedman, Schwartz & Brownell, 1998). Experience of weight cycling refers to the individual’s overall assessment of his or her ability to lose weight and maintain that weight loss. The assessment of subjective weight cycling was based on three items designed to assess an individual’s experience of herself as being a weight cycler. First, the participant was asked to respond to the statement, “I am a yo-yo dieter (intentionally lose weight, but then often regain the weight).” Participants responded using a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree).

Participants were then asked, “If you lose weight but then begin regaining, how likely are you to have the following response…. “Feel terrible, go off the diet and regain.” Answers are based on a 5-point Likert scale ranging from 1 (extremely likely) to 5 (not at all likely). The third question to assess participants’ subjective experience as a weight cycler was “If you gain back weight after dieting, do you typically gain back the same weight you started at, less than the weight you started at, or more then the weight you started at?” The ratings of the scale ranged from 1 (much less than starting weight) to 5 (much more than starting weight). The responses to these three items were then summed for the total score that represent subjective weight cycling.

Objective history of weight cycling refers to the individual’s assessment of the actual number of times weight has been lost and regained throughout one’s life.
Participants were asked the number of times they had lost and regained weight in each of the following categories: 1-4 pounds, 5-10 pounds, 11-15 pounds, 16-25 pounds, 26 pounds or more. The ranges of weight loss and regain were reduced in this study from those used in previous studies, as the majority of the sample were normal weight college women. Given the smaller weight fluctuation in this sample, the spread of range was reduced.

*Salivary Response:* the Strongin-Hinsie-Peck (Peck, 1959) procedure (as described above) was used to collect salivary response. The cotton swabs from each of the food and non-presentation conditions were stored in ziplock plastic bags to preserve the sample. Samples were frozen until they could be weighed. The swabs were weighed within four hours after collection and the weights of each set of dental rolls were recorded to the nearest 0.001 gram. The dependent measure of salivary reactivity was determined by the difference in weight of the dental rolls between the baseline and presentation of the olfactory stimuli.

*Body Mass Index (BMI):* Height without shoes was measured to the nearest quarter inch (.6 centimeter) using a mounted tape measure. Participants were then weighed without shoes using an electronic scale; weight was obtained to the nearest quarter pound (.1 kilogram). BMI was calculated using the formula: weight (kilogram)/height (meter)$^2$.

**Statistical Analyses**

First, descriptive analyses were conducted to characterize the sample. Second, bivariate correlations were calculated to assess the relationship between scores on the PFS, Herman and Polivy RS, and salivary output. Third, to identify predictors of
salivary reactivity in the sample, a simultaneous multiple regression analysis using scores on the PFS and RS was conducted. Individual correlations between salivation and scores on the BDI, STAI-S, hunger rating scales and BMI were examined. Finally, bivariate correlations between scores on the PFS and the TFEQ-Disinhibition subscale, the EHC, the DEBQ-External Eating subscale, and MCSD were calculated to determine convergent and discriminant validity of the PFS.

Restraint is traditionally treated as a categorical variable in the literature. However, restraint is more accurately conceptualized as a continuous variable, with no clear boundary defining high restrainers from low restrainers (Gorman & Allison, 1995). Categorizing a continuous variable was shown to have harmful consequences on data analysis. Stein (1988) cautioned against using a median split on the RS to form subject groups for use in ANOVA designs. He showed more predictive power could be gained when using a continuous measure of restraint in regression analyses. Maxwell and Delaney (1993) showed the use of median splits to form levels of factors in analyses of variance might produce erroneous conclusions about interaction among factors. Therefore, both RS and PFS scores were treated as continuous variables in the present study.

In other forms of multiple regression, such as hierarchal and stepwise the order in which the predictor variables are reintroduced to the analysis are manipulated by either the researcher and/or empirical relationships between the dependent variable and other predictors. An important consideration when using hierarchal regression is the order in which variables are entered into the regression influences the comparability of the variables to one another at later points in the analysis. Therefore,
the researcher chooses the order of entry based on theoretical considerations. The order of variable entry for stepwise regression is based on which variable will provide the greatest increase of variance at that step. Therefore, hierarchal regression is theoretically derived and stepwise regression is empirically derived. The purpose of the study was to test: 1) the incremental validity of the PFS when examined simultaneously with the RS; and 2) to determine the relative amount of variance each accounted for when tested together.

Hypothesized Results

1. Scores on the Herman and Polivy Restraint Scale (RS) will be positively correlated with salivary output.
2. Scores on the Power of Food Scale (PFS) will be positively correlated with salivary output.
3. The percentage of variance accounted for by the scores on the PFS will be greater that the percentage of variance accounted for by scores on the RS when both were used simultaneously as predictors of salivary reactivity to olfactory food cues.
4. PFS scores will be significantly correlated with the DEBQ external eating questionnaire, the EHC and the Disinhibition factor of the TFEQ. Bivariate correlations between scores on the PFS and MCSD scale will be lower than correlations between the PFS and DEBQ-External Eating scale and the TFEQ-Disinhibition scale.
5. If the RS is correlated with salivary output, partial correlations will be conducted to determine the extent to which this correlation can be explained by
current and historical dieting (with the latter measured in both subjective and objective terms). Exploratory analyses will be conducted to determine the relationship between current dieting, weight cycling and salivary reactivity to olfactory food cues.
3. RESULTS

Response Rate

Of the 187 Drexel University psychology students who expressed initial interest in participating in the study, 128 (68.4%) were screened over the phone. The remaining 59 (31.6%) women did not respond to repeated phone calls or the contact information given to the investigator was incorrect. Of the 128 women who were initially screened by phone, 27 women were excluded from participation. Some fell outside of the specified age range that is, three were under the age of 18 and one was older than 30. Other interested participants were excluded for the following reasons: taking medication known to effect salivation (n = 3); smoking on a regular basis (n = 16); or had a body mass index (BMI) greater than 25 kg/m\(^2\) (n = 4). Six participants had a time conflict and were unable to complete the experiment in the morning. Eleven women were no longer interested in participating in the study when contacted. The remaining three participants had completed the experiment and questionnaires, but their age precluded participation (> 30) and therefore, their data were not included in the subsequent analyses.

Final Sample Demographics

Eighty-one eligible women completed the questionnaire packet and experiment. The demographic characteristics of these women are presented in Table 1. Participants were an average age of 19.8 ± 1.6 years old (range = 18 to 27). The majority of subjects were Caucasian (66.6%), 17.3% were Asian American, and 9.9% were African American. The remaining subjects characterized themselves as Hispanic
(2.5%) and other (3.7%). The mean education level was 13.8 ± 1.3. Most subjects were enrolled as freshmen (39.5%), 28.4% of the sample was sophomores, 23.5% were juniors and 8.6% were seniors.

The average body mass index (BMI) of participants was 23.1 ± 4.3 kg/m$^2$ (range = 16.5 to 45.2). The majority of participants had a BMI in the ideal range for their height. Approximately one quarter of participants was overweight, as defined by a BMI of 25 kg/m$^2$ or greater (23.5%). Four of the participants had a BMI greater than 30 kg/m$^2$. The average weight of the sample was 61.5 ± 11.1 kilograms (range = 38.7 to 94.8), and average height of 1.63 ± .004 meters (range = 1.3 to 1.8).

Subjects were instructed to follow their normal patterns of consumption the morning of the study, which could mean eating or not eating breakfast. The morning of the experiment participants reported on their breakfast consumption to the investigator. Approximately half, 46.9% (n = 38) of the women acknowledged eating breakfast and 53.1% (n = 43) denied eating breakfast the morning of the experiment. This was checked by verbal report to the examiner and almost all of the women (95%) reported that they ate according to their usual consumption patterns. Those who did consume breakfast did so at least two hours prior to their arrival at the lab. Those who did consume breakfast reported significantly less hunger than those who did not (t (79) = -2.80, p < .006). Breakfast eaters also scored significantly higher on the Dutch Eating Behavior Questionnaire-External Eating subscale than those who did not eat breakfast (t (79) = 2.44, p < .02). There were no other significant differences that distinguished breakfast eaters from those who abstained from a morning meal. Those who reported that they did not consume a morning meal did not demonstrate greater
salivary reactivity to the olfactory food cues than those participants who ate breakfast
(t (79) = -.44, ns).

Scale Reliability

Internal consistency for the PFS was estimated by computing the alpha
coefficient for the three 7-item subscales as well as the total 21-item scale. As can be
seen in Table 2, these coefficients ranged from .80 to .93. The total scale had the
highest reliability coefficient (Cronbach’s a = .93). Nunnally (1978) has suggested
that the generally accepted standard for reliability estimates is above .70. Using this
criterion, the PFS demonstrated acceptable levels of internal consistency.

Further evidence of the homogeneity of the scale is suggested by the corrected
item-total correlations. Item-total correlations, that is, the correlation of the item with
the total score when that item is removed and the total recalculated, ranged from .39 to
.79. All item-total correlations were significant at the p < 0.01 level. These are
presented in Table 3. Four of the items of the PFS had relatively low (< .50) part-
whole correlations. Taken together, these findings imply that the scale is sufficiently
homogeneous—that is, the items satisfactorily measure the same construct.

Subscale Composition

The PFS was designed to assess the psychological influence of the mere
presence of food (i.e., in contexts that fell short of full consumption). Items tapped the
influence of food when it is available but not present (PFS-Absent), present but not
tasted (PFS-Present) and tasted (PFS-Pleasure) using three theoretically derived
subscales. To assess the relationship between the three 7-item subscales, pearson
product-moment correlation coefficients were calculated. As presented in Table 4, the
three subscales are highly and significantly correlated with each other. A significant degree of association was found between the PFS-Absent and PFS-Present subscales, \( r = .77, p < .01 \), the PFS-Absent and PFS-Pleasure subscales, \( r = .82, p < .01 \), and the PFS-Present and PFS-Pleasure subscales \( r = .78, p < .01 \). Given the very high level of association between these subscales, and its overall internal consistency, it appears that the scale should be scored and interpreted as a single, total score. Therefore, the single, total score for the scale will be used in further analyses.

*Changes in Salivation Following Presentation to Olfactory Stimuli*

Two sets of three unused dental rolls were weighed prior to use. One set was used in the baseline collection of saliva prior to the presentation of food odors. The second set was used in the collection of saliva following food odor presentations. This was done in order to reduce error variance resulting from slight variations in the cotton dental rolls. Having participants hold the three dental rolls between the cheek and the lower gum and under the tongue for 150 seconds collected a baseline sample of salivation. The difference in weights between the original dental rolls prior to use was subtracted from the baseline weights after the 150 seconds expired. The weight of the dental rolls was calculated to the nearest 0.001 gram. The mean change in the weight of the baseline dental rolls after being in the mouth of the participant was \( 1.50 \pm 1.10 \) (range = -.29 to 4.30). The range reflects the difference between pre- and post-measurement. Unexpectedly, two negative values were found.

A comparable procedure was used for the dental rolls used to collect salivation elicited with the presentation of food odors. The mean change in the weight of the dental rolls used to collect stimulated salivation was \( 2.10 \pm 1.45 \) (range = -.05 to 6.59).
This range reflects the difference between pre- and post- measurement. One negative value was calculated. As negative values in this calculation represent a procedural error, rather than actual error variance resulting from variations in the weight of the cotton dental rolls, the three negative values calculated were eliminated from further analyses that examined the relationship of salivary reactivity to other variables used in the study.

The dependent variable for this study, salivation to olfactory food cues, was determined by subtracting the weights of the baseline dental rolls from the weights of the dental rolls used to collect salivation to the food odors. The mean difference in dental roll weight was .60 ± 1.06 (range = -1.60 to 4.45). Nineteen of these weights (23.8%) reflected a negative value, indicating that baseline salivation was greater than salivation to food odors, when this method was employed.

Given that almost one quarter of the sample had higher salivary reactivity at baseline versus after the presentation of food odors, a matched paired t-test was conducted to explore whether salivation significantly increased following presentation of the olfactory food cues. The difference between the mean salivation at baseline and the mean salivation to food cues was indeed significant (t (79) = -5.07, p < .001). This finding may indicate that the observed differences in salivation between baseline and those that were produced with the presence of the olfactory stimuli resulted from the effect of the food odors.

A Pearson product moment correlation was conducted in order to assess the degree to which the change in salivation was due to the olfactory manipulation versus effects of baseline salivation. There was a significant degree of association between
the baseline level of salivation and salivation to the food cues, \( r = .69, p < .01 \). This high and significant correlation between baseline and stimulated salivation is problematic. The higher this correlation, the lower the potential of salivation differences to differentiate groups as participants’ baseline values are explaining a substantial portion of their stimulated values. As such, the potential effect of food stimulation per se is substantially reduced.

Relationship between PFS, Restraint, and Salivation

Pearson product moment correlations were calculated to assess the relationship between scores on the PFS, RS, and salivary output. Mean scores and standard deviations for all self-report measures completed by participants and salivary responsiveness to olfactory food cues are presented in Table 5. Table 6 shows that salivary responsiveness to olfactory food cues was not significantly correlated with restraint, as measured by the RS, \( r = .13, \text{ ns} \) or the PFS total score, \( r = .07, \text{ ns} \). An item-by-item analysis was conducted to assess the relationship between individual items on the PFS and salivation. Only one item, “Hearing someone describe a great meal makes me really want to have something to eat,” was significantly associated with salivation, \( r = .33, p < .008 \). Salivation was not significantly correlated with any other single item. Salivation was not significantly correlated with the cognitive restraint scale on the Three Factor Eating Questionnaire (TFEQ), \( r = .15, \text{ ns} \), the rigid restraint TFEQ subscale, \( r = .07, \text{ ns} \) or the flexible restraint TFEQ subscale, \( r = .12, \text{ ns} \).

A simultaneous multiple regression was conducted to test the extent to which the PFS and RS predicted salivary responsiveness to olfactory food cues. The regression equation predicting salivation was not significant, adjusted \( R^2 = -.007; \text{ ns} \).
As shown in Table 7 the total score on the PFS and the total RS score did not account for unique variance in salivary output.

There is some evidence to suggest that current dieters, that is, those who report being on a diet to lose weight may salivate to food cues less than those who are dieting to maintain their weight or unrestrained eaters (Lowe, 1993). It may be that pooling the subjects of dieters and non-dieters undermined the potential relationship between overall restraint scale scores and salivary responsiveness. In order to determine if current dieting suppressed the relationship between restraint and salivation, participants who reported that they were currently on a diet to lose weight (n = 14) were removed from the analyses. Of the remaining participants, the median restraint scale score (median score = 12) was used to differentiate between restrained non-dieters (n = 32) and unrestrained non-dieters (n = 32) and to perform subsequent analyses.

A one-way analyses of variance procedure was performed for each of the major variables, that is, salivation, PFS scores and RS scores to determine whether differences existed between current dieters, restrained non-dieters and unrestrained non-dieters. There was a significant difference in RS scores (Table 8) among the three groups, F (2,74) = 61.58, p < .001. However, there were no significant differences in salivation, F (2, 74) = 1.30, p < .28 or in PFS scores, F (2, 74) = .08, p < .92. Significant F statistics were followed by Tukey’s post-hoc contrasts designed to investigate mean differences among the three groups. As would be expected the unrestrained non-dieters reported significantly lower RS scores than either the restrained non-dieters or the current dieters (both at p < .05). Restrained non-dieters
and current dieters did not differ significantly on RS scores. Current dieters did not differ from restrained non-dieters on changes in salivary responsiveness to food odors (t (44) = 1.26, p < .21), although restrained non-dieter’s salivation difference scores were more than twice the size of current dieters’ (.82 versus .33).

Because dieters scored well below restrained non-dieters on salivation, the correlations among salivation and RS and PFS were examined among participants to assess whether the presence of dieters interfered with the ability to detect a relationship between RS and salivation. Among non-dieters (n = 64), salivary responsiveness to olfactory food cues was not significantly correlated to scores on the PFS (r = .001, ns) or RS (r = .12, ns). However, among current dieters (n =14) salivation was significantly and positively related to RS score (r = .60, p < .02), but not to PFS scores (r = .33, ns).

*Body Mass Index and Salivary Responsiveness*

It has been suggested that body mass index (BMI) may be related to salivary responsiveness to olfactory food cues (Klajner, Herman, Polivy & Chhabra, 1981). Obese individuals generally have higher RS scores than normal weight individuals. It may be that differences in the degree of restraint are responsible for obese-normal weight differences in salivary reactivity rather than weight status per se. However, it is unclear whether relative weight status impacts salivary responsiveness independent of restraint. In an attempt to understand these findings, Pearson product moment correlations were calculated examining the relationship between BMI and salivary responsiveness. BMI was not significantly associated with salivation, r = .003, ns when restraint was left uncontrolled.
An independent t-test compared the normal weight and overweight participants’ responses on RS, PFS and salivation. There was a significant difference in RS scores between the two groups, $t(76) = 1.95, p < .05$. However, there were no significant differences between the two groups on salivary responsiveness, $t(76) = -.35, p < .23$. Although not statistically significant, the differences between groups on the PFS approached significance, $(t(76) = -1.90, p < .06)$, indicating a trend for normal weight participants to have higher scores on the PFS.

*Covariates Related to Salivary Reactivity*

Individual correlations between salivation and scores on the Beck Depression Inventory-II (BDI-II), State-Trait Anxiety Inventory-State (STAI-S), the visual analogue hunger rating scale and body mass index (BMI) were examined. As depicted in Table 9, salivary responsiveness was not significantly correlated with BDI-II scores, $r = -.03, p < .78$ or STAI-S scores, $r = .001, p < .99$. Surprisingly, salivation was not significantly associated with the hunger rating scale, $r = .14, p < .21$ or with BMI, $r = .003, p < .99$. As none of the variables were significantly correlated with salivation and the main regression analysis was non-significant, these variables were not entered as covariates in the multiple regression analysis.

An independent t-test compared restrained and unrestrained eaters responses on the visual analogue scale of hunger. Although not statistically significant, the differences between groups on hunger approached significance, $(t(74) = 1.72, p < .09)$, indicating a trend for unrestrained eaters to report greater feelings of hunger than restrained eaters. Current dieters were removed from the sample of restrained eaters and the independent t-test was used to compare restrained and unrestrained non-dieters.
on hunger. These groups did not differ on reported levels of hunger, $t(60) = 1.38, p < .17$. Current dieters did not differ from unrestrained non-dieters on reported hunger, $t(43) = 1.48, p < .14$.

**Convergent and Discriminant Validity of the PFS**

Pearson product-moment correlations were calculated between scores on the PFS and measures of social desirability, binge eating, disinhibition, and external eating to investigate convergent and discriminant validity of the PFS. As demonstrated in Table 10, scores on the PFS were marginally significantly related to social desirability, as measured by the Marlowe-Crowne Social Desirability Scale (MCSD), $r = -.21, p < .06$. Higher scores on the PFS corresponded with somewhat lower scores on social desirability, which might suggest that reporting that food has power over a person is viewed as somewhat socially undesirable. Pearson product moment correlations were calculated to assess the relationship between scores on the PFS, RS, Three Factor Eating Questionnaire (TFEQ)-Disinhibition and the Eating Habits Checklist (EHC), which assessed binge eating. The correlation matrix illustrated in Table 10 for the total sample revealed moderate positive correlations between the scores on the PFS and binge eating, as assessed by the EHC, $r = .43, p < .001$ and disinhibition, as assessed by the TFEQ, $r = .54, p < .001$. Those subjects who reported being influenced by the mere presence or availability of food also reported increased eating when confronted with external appetitive cues. Scores on the PFS were positively correlated to external eating as measured by the Dutch Eating Behavior Questionnaire (DEBQ), $r = .73, p < .001$. Furthermore, the RS scale was
also significantly and moderately correlated with the TFEQ-Disinhibition subscale, \( r = .34, p < .002 \) and the EHC, \( r = .38, p < .001 \).

**Relationship between PFS, Restraint, Disinhibition and Binge Eating**

A simultaneous multiple regression was conducted to test the extent to which the PFS and RS predicted Disinhibition. The regression equation predicting Disinhibition was significant, adjusted \( R^2 = .35; p < .001 \). The PFS was more strongly related than the RS to the TFEQ Disinhibition subscale (\( t_s = 5.55 \) versus 3.19) and accounted for more unique variance in Disinhibition in the regression analysis. When the two items on the RS that explicitly measure overeating were removed from the RS total score, the correlation between RS and Disinhibition decreased from .35 (\( p < .001 \)) to .31 (\( p < .002 \)) and the amount of variance the 8-item RS explained in Disinhibition (with PFS scores held constant) decreased (\( t = 2.66, p < .01 \)).

A simultaneous multiple regression was also performed to assess the degree to which the PFS and RS predicted binge eating as measured by the Eating Habits Checklist. The regression equation predicting binge eating was significant, adjusted \( R^2 = .28, p < .001 \). Both the PFS and the RS independently predicted binge eating, \( t_s = 4.10 \) and 3.59, respectively. Once again, when the two items that measure overeating were eliminated from the RS, the correlation between RS and binge eating decreased from .39 (\( p < .000 \)) to .33 (\( p < .001 \)) and the amount of unique variance the 8-item RS accounted for in the binge eating scale (when controlling for PFS scores) decreased (\( t = 2.86, p < .005 \)).
4. DISCUSSION

Theoretical Development

Several lines of research have converged to suggest that restrained eaters show a general pattern of appetitive hyper-responsiveness (overeating following a preload or emotional distress, heightened salivation to food, increased responsiveness to eating-related social cues). Restraint theory has traditionally viewed chronic, unsuccessful dieting as the explanation for this pattern of appetitive responses. Herman and Polivy (1980) suggested that this pattern of chronic, unsuccessful dieting overrides natural hunger and satiety signals and leaves the restrained eater less responsive to internal appetitive states and more responsive to external cues. This pattern results in restrained eaters’ susceptibility to disrupted dietary self-control and permits restrained eaters’ underlying biological hunger to resurface in the form of heightened appetitive responses.

However, the preponderance of evidence does not support restraint theory’s premise that dieting - either current or past - can account for the pattern of appetitive over-responsiveness shown by restrained eaters. It may be that the Restraint Scale (RS) predicts heightened appetitive responses in various situations because it is assessing a construct that reflects a vulnerability to over-responsiveness to food and food-related cues. It may be that the key causal construct the RS is measuring is not current or past dieting, but a predisposition to appetitive hyper-responsiveness that may both cause and ultimately undermine the feasibility of successful dieting.
Magnified appetitive responses among restrained eaters are robust phenomena that occur across multiple areas of appetite-related contexts. If the reason for this relationship does not have to do with current or past dieting another explanation is needed. One possibility is that a pre-existing vulnerability to being over-responsive to food and food related cues leads to overeating in a food-abundant environment. Overeating will lead to a positive energy balance, weight gain, and a subsequent need to diet. It is plausible that a vulnerability to the food-laden environment may be detectable even in the absence of actual food consumption. One way of assessing the construct of appetitive hyper-responsiveness is to measure people’s perception of the influence of food on their thoughts, feelings, and behaviors in various contexts where food is available but is not being consumed.

The vulnerability to food likely differs widely between individuals. Therefore, the mere presence of food may have a stronger psychological impact on some people. The theory behind the RS purports that restrained eating is accountable for much of the individual differences in appetitive drive. However, the dimension tapped by the PFS may explain the nature of restrained eaters’ vulnerability to food cues and may account for restraint-related phenomenon better than the RS. In modern, developed countries, food is ever-present and easily accessible. To the extent that some people are more sensitive to the mere availability of food in the environment, the omnipresence of food and food cues may have more “power” over them. If such an individual difference does indeed exist, it would be expected that those more sensitive to food cues would consume greater amounts of food resulting in a positive energy balance and, over time, weight gain. Given current sociocultural norms for women to
have a thin muscular physique, this would create pressure on overweight women, and those prone to weight gain, to engage in restrained eating.

To further investigate this idea, the current study evaluated the Power of Food Scale (PFS). The measure was designed to assess the influence of food prior to its actual consumption. As previously described, the PFS was developed to offer an alternative explanation to findings that have been obtained with Herman and Polivy’s RS. Items on the PFS intentionally avoid references to confounding criteria that characterize the RS. These include references to dieting behavior, disinhibited eating, emotionality, body mass, and weight fluctuations. This study used salivary responsiveness to evaluate the validity of the PFS using a sample of 81 Drexel University undergraduate women, and compared the relative power of the PFS and the RS in predicting salivary response to olfactory food cues.

Psychometric Properties

Results indicated that the PFS has acceptable internally consistency and homogeneity, as evidenced by a high alpha coefficient for the total 21-item scale and significant corrected item-total correlations. These findings suggest that the items on the PFS adequately measure the same construct. However, four of the items of the PFS had relatively low part-whole correlations. These items included: “When I’m around a fattening food I love, it’s hard to stop myself from at least tasting it;” “Sometimes, when I’m doing everyday activities, I get an urge to eat “out of the blue” (for no apparent reason);” “It’s very important to me that the foods I eat are as delicious as possible;” and “Before I eat a favorite food my mouth tends to flood with saliva.” While these lower correlations are of concern, a previous investigation
demonstrated larger part-whole correlations for these items (Annunziato & Lowe, 2002), suggesting that their inclusion in the PFS is justified.

The proximity of food to a person may intensify the impact of the food on the person’s thoughts, feelings, and behavior. An equal number of items were included on the PFS that reflect the perceived influence of food in each of three contexts, reflecting a distal to proximal continuum of food stimuli. However, the current results suggested that the PFS should be scored and interpreted as a single factor, rather than these separate empirical factors. The internal consistency of the measure was high, all the items showed moderate to high part-whole correlations with that item removed, and when scored as three separate subscales, the three subscales were very highly inter-correlated (correlations ranged from .77-.82). These findings suggest that an individual who is strongly influenced by food will be similarly influenced regardless of the proximity of the individual to food stimuli. However, further research is required to determine the accuracy of this conclusion.

Validity of Salivation Measure

The validity of the main dependent measure used in this study, salivary change, is questionable for three reasons. First, for two participants the unused dry cotton dental rolls weighed more than the same dental rolls after being placed in the participants’ mouths. This resulted in a negative value for the baseline weight of the cotton swabs. In addition, this same problem emerged for the stimulated salivation collection. One stimulated weight was negative, indicating that the dry dental rolls weighed more before than after the rolls were placed in the participant’s mouth. Second, nineteen of the participants were characterized as ‘minimal responders,’ that is, for these
individuals’ baseline weights of the dental swabs and stimulated weights of the dental swabs were nearly zero. Minimal responders were identified as having dental roll weights that were within one standard deviation below the mean for both baseline and stimulated salivation. This meant that baseline weights were less than .40 gram and stimulated weights were less than .65 gram. Values close to zero in this calculation imply, though do not prove, that some aspect of the procedure used resulted in anomalous results. Third, baseline salivation was greater than stimulated salivation for almost one-quarter of participants. That is, the weights of the unstimulated salivary response were greater than the stimulated salivary response. This resulted in a significant portion of the sample with a negative value for the change scores.

There are several possible sources of error variance that may have produced these problems. The experimental technique used in this study varied somewhat from the experimental procedure on which it was modeled (LeGoff & Spiegelman, 1987). First, at baseline collection some participants had difficulty holding the dental rolls in their mouth for an extended period of time, as this aspect of the procedure resulted in an excessively dry mouth. Subjects were offered a drink of water to ease their discomfort. Those who consumed the liquid were asked to swallow before the dental rolls were inserted in their mouths. This same offer of a drink of water was extended to participants prior to the stimulated salivation collection procedure. However, this experimental modification resulted in some participants’ drinking water prior to baseline and then not consuming water prior to stimulated salivation. As a result, there may have been water residue in the mouth of these participants that resulted in a higher baseline weight rather than a higher stimulated salivation weight. Furthermore,
those subjects that requested the drink may have been systematically different in a way that separated them from those who did not request a drink, resulting in some unknown influence that differentially impacted results.

Secondly, in the original LeGoff & Spigelman (1987) paper, baseline salivation was collected for non-food odors, that is, subjects were requested to smell five non-food odors (e.g., pencil shavings, clothing detergent, tobacco, pine needles and white vinegar) while the baseline dental rolls were held in the participant’s mouth. At baseline, participants in the current study were simply required to hold the dental rolls in their mouths without the additional presentation of non-food odors. The addition of non-food odors was viewed as unnecessary for the present study. However, it could be that the non-food odors primed saliva flow in some way, resulting in enhanced salivation when presented with the food odors. Alternatively, the non-food odors used in previous studies may have reduced baseline salivation, resulting in a larger change score when compared to stimulated salivation. Eliminating this experimental component may have indirectly impacted the secretion of salivation.

Third, after use the plastic bags and dental rolls were stored in an airtight plastic container and placed in a freezer for several hours. This was done because access to the scale that was used to calculate weights was limited and the samples needed to be preserved. Saliva evaporates at 7 mg/hour when sealed in an airtight container (Wooley & Wooley, 1981). It may be that freezing and gradual thawing of the dental rolls adversely impacted the weights of the used dental rolls.

Another major problem with the current study was that there was a large and statistically significant correlation between the baseline and stimulated salivation. The
higher this correlation, the lower the potential of salivation change scores to adequately differentiate groups and test hypotheses. As such, the potential to find effects was substantially reduced -- in fact by about 50% (i.e., the square of the observed correlation of .69 was about .50). Unfortunately, previous studies using this technique failed to report the correlations they found between baseline and stimulated salivation, so it is impossible to know if the current correlation is within expected limits. Regardless of the reason for this high correlation, such a high degree of association limits our ability to get significant results.

However, even with these potential methodological problems, the difference between baseline and stimulated salivation was still significant for the entire sample. The mean of the change scores is consistent with that observed in other studies examining change scores from baseline to stimulated salivation. One study found that the mean salivary change scores from baseline to stimulated scores was smaller than that found in the present sample (Bulik, Lawson, Carter, 1996). In this study, participants were defined as unrestrained or restrained eaters based on scores on the short form of the RS (Herman & Mack, 1975) Mean change salivation scores were actually lower than that found in the present sample using comparable procedures. The mean change scores for unrestrained eaters from baseline to stimulated salivation were .31 ± .71 grams. The mean change scores for the restrained eaters were .49 ± .60 grams (Bulik, Lawson, & Carter, 1996).

Another study compared salivary change scores between recovered bulimic and anorexic women and unrestrained eaters using comparable methodology (LeGoff & Spigelman, 1988). The mean change score from baseline to stimulated salivation
for unrestrained eaters was $.84 ± .08 grams (LeGoff & Spigelman, 1988). The mean change score for recovered anorexic and bulimic patients was $.58 ± .06 grams and $.84 ± .17 grams, respectively. These findings indicate that the change scores obtained in the current study were consistent with past studies and perhaps the procedure was at least marginally effective at producing an increased salivary response following stimulation by olfactory food stimuli.

Tests of Hypotheses

Given the potential problems of the salivation measure, many of the proposed hypotheses related to salivary reactivity could not adequately be tested. As such interpretations based on the salivation measure were not feasible. Four main hypotheses were examined in this study, three of which will be discussed in the following section.

First, it was predicted that the RS would be positively correlated with salivary responsiveness to food stimuli. Contrary to study hypotheses, the scores on RS were not positively correlated with salivary reactivity to olfactory food cues. The second hypothesis was that scores on the PFS would also be positive correlated with salivary reactivity. Contrary to predictions, a significant relationship was not found between PFS scores and salivation. The third hypothesis was that the percentage of variance accounted for by the scores on the PFS would be greater that the percentage of variance accounted for by scores on the RS when both are used simultaneously as predictors of salivary reactivity to olfactory food cues. However, since neither measure showed a correlation with salivary change, this hypothesis could not be tested.
A plausible alternative for the fact that the current study failed to have significant findings was that restrained eaters, consisting of both current dieters and restrained non-dieters were included as part of the total sample. Most restrained eaters are not currently dieting to lose weight and those that are dieting respond differently on a variety of appetitive and eating related measures than those who are not (Lowe, 1993). For instance, among restrained eaters, those who are currently dieting to lose weight tend to salivate less to food cues than those restrained eaters who are not currently dieting. A trend in this direction was also found here. A shortcoming of the current study was the combination of all restrained eaters—dieting or not into one group. It was speculated that current dieters are actively suppressing their desire for food and therefore may have a diminished response to sensory stimulation. Clarifying current dieting status—that is, current dieters versus restrained non-dieters and unrestrained non-dieters, may serve to separate a heterogeneous group of restrained eaters and potentially illuminate our findings.

A few studies documented the inverse relationship between current dieting and salivation. In one study, salivation to food cues was examined among obese women participating in a metabolic study (Durrant, 1981). Over the course of three weeks, participants were fed 1000 kcals/day for the first week, 500 kcals/day for the second week and 1000 kcals/day for the third week. This intake was a substantial reduction in their usual caloric consumption. Salivation was measured three times throughout the day. The first reading was basal with no food; the next two were stimulated values with food visible. As a control experiment, eight different obese subjects were fed 800 kcals/day for all three weeks and were similarly tested. Results indicated that on
the 800 kcals/day for three weeks, all measures of salivation (basal and stimulated) declined. The authors concluded that the decrease in salivation was a direct adaptation to reduced energy consumption. This also occurred when subjects were changed from 1000 to 500 kcal/day. Stimulated salivation rose in response to the increase in caloric intake from 500 to 1000 kcal/day in week three. The authors concluded that for obese patients confined to a metabolic unit, salivation over a three-week period became conditioned to the level of energy intake.

In a study that examined differences in salivation between restrained non-dieters and restrained dieters, it was predicted that participants who strictly and uniformly restrict caloric intake would salivate less to food odors than participants whose dietary restraint was more sporadic (LeGoff, Leichner, & Spigelman, 1988). Anorexic individuals, who could be characterized as consistent dieters, were compared to bulimic individuals who could be characterized as inconsistent dieters. Anorexic and bulimic women were also compared to control women. LeGoff et al (1988) found that salivary output to food odors was substantially reduced among anorexics, moderate in controls and high in bulimics. They also found that in an analysis that pooled all subjects that variability in caloric intake correlated with salivation. Finally, when patients’ food intake was normalized after treatment, differences between groups disappeared. The authors concluded that dietary restraint alone could not account for findings in different types of dieters—the two groups of participants who were equally restrained (as identified by the RS) had salivary responses to food cues that differed from controls in opposite directions (LeGoff et al., 1988). The authors speculated that
active dieting, such as that engaged in by anorexic patients inhibit normal appetitive responses to food.

To identify if the inclusion of restrained dieters negatively impacted the ability to get a positive association between RS and salivation, salivary responsiveness was examined between restrained eaters and unrestrained eaters. Differences in salivation to olfactory food cues between restrained and unrestrained eaters were in the expected direction but were not significantly different. This finding is inconsistent with previous reports (Klajner et al., 1981; LeGoff & Spigelman, 1987; Sahakian et al., 1981). One possibility is that the degree of restraint exhibited by our sample was insufficient to elicit the expected response. Participants scoring greater than 12 on the RS were defined as restrained eaters. Previous research used the short version of the RS that consisted of five items instead of the ten items on the current version (LeGoff & Spigelman, 1987). Using the short version, normal weight participants that had a mean score of 11 were classified as restrained eaters. Additional studies that examined salivation to food cues and found a positive association between restraint and salivation categorized participants that had a mean score greater than 15 on the 10-item version of the RS as restrained eaters (Perkins, Mitchell, & Epstein, 1995; Klajner, Herman, Polivy & Chhabra, 1981). Perhaps the current sample was not sufficiently restrained as defined by scores on the RS to detect a significant relationship between salivation and restraint.

In the present study, current dieters scored higher on the RS than restrained non-dieters and unrestrained non-dieters, which is not surprising. However, restraint theory would predict that those with greater RS scores would actually have greater
salivation than those with lower RS scores. However, current dieters, who have the highest RS scores, actually had the lowest levels of salivary reactivity. In fact, their salivation response was less than one-half that of restrained non-dieters. As previously discussed, the inclusion of current dieters in the sample may have substantially reduced the mean of the entire sample and therefore reduced our ability to detect a relationship between RS and salivation.

This being said, removing the current dieters from the sample should have resulted in significant association between restraint and salivation. However, this was not the case. The differences on salivary reactivity between the three groups, that is—current dieters, restrained non-dieters and unrestrained non-dieters did not reach significance. The removal of the 14 current dieters from the restrained eaters group did not result in a significant degree of association between restraint and salivation. So while an interesting restraint versus dieting difference might exist, this problem does not account for absence of restraint-salivation relationship in the current study.

Alternatively, differences in the level of hunger may have contributed to the failure to find an association between RS and salivation. However, hunger and salivation were not significantly correlated, and when controlling for hunger the relationship between restraint and salivation was still not significant. This finding is consistent with earlier studies that measured hunger and have failed to find an association with salivary flow rates (Klajner et al., 1981; Tepper, 1992). Once again, the effect of current dieting status on the relationship between hunger and salivation was explored. It may be that current dieters, who generally report less hunger than unrestrained or restrained non-dieters (for review, see Mattes, 2000), diminished the ability to detect a
relationship between salivation and hunger. Restrained eaters in the current study reported less hunger than unrestrained eaters. When restrained eaters were divided into current dieters and restrained non-dieters, current dieters reported less hunger than unrestrained non-dieters and restrained non-dieters, however, differences in reported hunger between groups were not significant. Hunger status, therefore cannot account for the current negative findings between restraint and salivation.

**Discriminant and Convergent Validity of the PFS**

The fourth hypothesis of this study was that scores on the PFS would be significantly correlated with the DEBQ-External Eating scale, the TFEQ-Disinhibition scale, and the EHC. The results supported this hypothesis. As predicted total PFS scores were significantly correlated with the DEBQ-External Eating scale, the Disinhibition factor of the TFEQ, and the EHC. These associations were moderate and positive. These correlations support the construct validity of the PFS since individuals who say that they are more strongly influenced by food cues in the environment would presumably also be more likely to consume those foods more often. However, there are at least two ways of explaining this pattern of correlations. One is that they partly or entirely reflect shared method variance. That is, all of the measures are based on self-report and all describe the influence of food on people’s behavior. Thus the correlations may reflect a tendency for people to describe their thoughts, feelings, and behavior related to food in consistent ways, regardless of their actual inter-relationship. The other is that the PFS is a valid measure of a predisposition toward hyper-responsiveness to food cues that is also manifested in greater levels of food consumption.
There was a large, positive correlation with the DEBQ-External Eating scale and the PFS. Both the PFS (food present) and PFS (pleasure) had the highest correlations with the External Eating subscale (.68), and PFS (food absent) was also significantly correlated with the External Eating subscale. There is particular overlap in constructs between the second subscale of the PFS (food present) and the external eating measure. Seven of the items in the current version of the PFS involve the presence of food stimuli in the immediate environment. The DEBQ-External Eating scale contains items that refer to eating behaviors that are triggered by the sight and odor of foods or the presence of other people who are eating. The fact that all three PFS subscales correlate about the same with the External Eating scale may just mean (as was suggested earlier) that individual differences in the “power of food” may be consistent across different levels of proximity of food to the individual.

A large correlation with the External Eating scale and the PFS may actually enhance support for the PFS. The fact that the correlation between the PFS and External Eating scales was higher than between the PFS and both Disinhibition and EHC supports the validity of the PFS since the External Eating scale comes closest to measuring a similar construct as the PFS. The External Eating scale, like the PFS, is more a measure of the perceived influence of the presence of food rather than a measure of binge eating or overeating itself, which the other two scales are.

The PFS appears to be more strongly related to measures of disinhibition, binge eating and external eating than the RS. Scores on the RS were moderately correlated to disinhibition (.34) and to binge eating (.38) and were not significantly associated to external eating (.04). Given restraint theory’s presumption that
restrained eating results in a loss of cognitive control over appetitive drives, as measured by the RS, it would be expected that these correlations would be as large as, if not larger, than those obtained with the PFS. However, PFS scores were more strongly related to these measures. These findings are consistent with the hypothesis that the PFS assesses a diathesis that predisposes certain people to respond to a food plentiful environment with over-consumption.

Two linear regressions were conducted to assess the ability of the PFS and RS to predict over-consumption. These analyses demonstrated that the PFS alone was significantly predictive of disinhibition and binge eating when controlling for RS. Results indicate that the PFS and the RS independently contribute to the prediction of disinhibitory and binge eating. Since the PFS – unlike the RS – contains no items about overeating, emotional eating, weight status, or dieting, these results suggest that the PFS is measuring a dimension related to disinhibitory and binge eating that cannot be explained by restrained eating or concerns about eating and weight. It may be that disinhibition can in fact occur in the absence of a loss of control and is not isolated to the collapse of cognitive control over eating.

One of the questions of previous versions of the PFS was if the scale measures a construct that is sufficiently discriminable from existing measures. The relationship been scores on the PFS and Marlowe-Crowne Social Desirability scale was marginally significant and the correlation between the two measures were lower than correlations between the PFS, and the DEBQ-External Eating scale, EHC, and TFEQ-Disinhibition subscale. This result illustrates that the PFS is not very susceptible to contamination by socially desirable responding. Higher scores on the PFS corresponded with
somewhat lower scores on social desirability, which might suggest that reporting that food has power over a person is viewed as somewhat socially undesirable. However, the size of the relationship was quite small, indicating that social desirability does not represent a threat to the validity of the PFS.

The presumption behind the development of the PFS was that the measure might tap a predisposition that might contribute to, rather than result from, restrained eating. While there is some empirical support for this proposition in the current study, there is some disconfirming evidence as well. The assumption is that those who have a vulnerability to over-responsiveness to food will overeat when exposed to a food plentiful environment, resulting in a positive energy balance and subsequent weight gain. Many of these individuals will presumably respond with a restrained style of eating. It would therefore be expected that RS and PFS scores would be significantly correlated.

It was somewhat surprising therefore, that the correlation between the RS and PFS was not significant. It may be that the relationship between restraint and appetitive hyper-responsiveness holds true for women who are already overweight and may be under greater pressure to restrain their urges to consume calorically dense foods. To explore this idea, the correlations between the PFS and RS were re-examined with groups of women whose BMI was greater than 27 (n =11) and then again with women with a BMI greater than 30 (n = 4). Among obese women there was a trend for restraint to be correlated with appetitive hyper-responsiveness, however the association did not reach significance. Clearly, the sample of women was too small to draw any significance, but it is suggestive that for obese college aged
women (defined as a BMI greater to or equal than 30), perhaps food has greater allure and there is greater resistance to indulge in its consumption. Following this line of logic, it would be expected that overweight individuals would report higher scores on the PFS than normal weight participants. Contrary to expectations, evidence from the current study demonstrated that normal weight participants reported greater appetitive drives as measured by the PFS than did overweight participants. 

Taken together with evidence that neither current nor chronic dieting can account for disinhibitory or binge eating, these results are consistent with the hypothesis that a predisposition toward appetitive hyper-responsiveness (tapped by the PFS) may give contribute to both disinhibition and binge eating. The dimension represents a predisposition that should make some people more likely to need to diet, but there apparently are many people with high PFS scores that do not need to diet (perhaps the “naturally thin”) or that are susceptible to obesity but are not actively resisting this predisposition (the unrestrained overweight). It may be that longitudinal studies of those that report high PFS scores would demonstrate evidence for future weight gain among those who do not demonstrate such a consequence of these appetitive drives presently.

Limitations

Several caveats should be considered when interpreting the results of this study. Reliance on salivation change measure was an obvious limitation. Salivation itself is sensitive to many factors, including cognitive controls (i.e., what the participant thinks about), time of day, dietary variability, nutritional status (i.e., current and past dieting patterns), mood (anxiety and depression), and general stress. Some of
the subjects were tested during finals week (due to experimenter availability) and this could have impacted general saliva secretion or responsiveness to stimuli. Given the highly sensitive nature of the measure it is crucial that investigators deciding to use this measure in the future establish an experimental situation that is conducive to the elicitation of salivary responses.

The effective stimuli for salivation and their relative potency have not been clearly characterized, thus a check of the stimuli manipulation is needed prior to commencement of any study using this measure to ensure that the stimuli (whether olfactory, visual, or gustatory) is potent enough to elicit the desired response. Moreover, participants were also told that they would be weighed at the end of the procedure. Cognitive responses may have influenced salivary responses (Herman, Polivy, Klajner, & Esses, 1981; Rosen, 1981), and subjects concerned about their body weight, may have shown inhibited salivation responses knowing that they were to be weighed at the end of the procedure.

An obvious limitation of these results is that the data are based on participants that were not sampled in a completely random fashion. It is also important to note that the applicability of the PFS to clinical populations remains to be determined. The participants were non-clinical college women. It is unknown if men had been invited to participate, if they would have volunteered to take part in the study and how they would have responded. In addition, it may well be that clinical populations, (i.e., those that are coming for weight loss treatment or diagnosed eating disorder) would not demonstrate comparable results and the findings of the study are unique to non-clinical samples. Current data are also limited to college aged women most of whom
fall within the ideal weight range for their height. Results may have been different had the study been conducted with a larger range of subjects, including men and a larger percentage of overweight and obese participants. Given the contradictory finding that normal weight participants seemed to score higher on the PFS than overweight participants, studying the PFS among overweight and obese individuals is necessary in determine the utility of the PFS among this population.

Clinical Applications and Future Directions

Taken together, the results of this study may have important clinical implications. These results suggest that the PFS may tap a preexisting tendency toward heightened appetitive responses to food that could contribute to the development of obesity and some forms of disordered eating. Individuals that demonstrate a propensity for heightened responsiveness to food, may be one identifying marker of those who develop a problem with weight or control over their eating in the future. It may be that the PFS can identify those prone toward, but not yet showing the impact of their drive for food in excess weight gain. Problems with food are generally thought about in terms of behavior that is, excessive food consumption or lack of control over eating. However, this understanding of problematic relationships with food ignores or minimizes the psychological component of eating difficulties. The PFS attempts to address this issue and assess the psychological influence of food when eating is not imminent or underway. Indeed, the reason that the PFS does not contain any items describing actual food consumption or overeating is that there are large individual differences in food intake among individuals independently of BMI. Thus, although BMI is generally correlated with
caloric intake, there are normal weight individuals who can eat a great deal and overweight individuals who eat relatively little. Furthermore, attempting to measure eating or overeating is very difficult because of strong biases in people’s reporting of their food intake. Therefore, if it is the case that the constant presence of food and food stimuli differentially affects people even when they are not eating, then assessing cognitive and emotional reactions to the food-laden environment may represent a better way to assess appetitive drive despite (or perhaps because of) the fact that it does not focus on food consumption per se. Of course much more research on the validity of the PFS will be needed to evaluate this perspective.

These findings have positive implications because it appears that those who demonstrate appetitive hyper-responsivity to food generally are more likely to engage in disinhibitory or binge eating. It may be that those participants who are more influenced by food are more susceptible to aberrant eating patterns that result in weight gain and a subsequent need to diet. Future research in this area should examine the response of not only obese participants but bulimic and anorexic patients as well. It may be that bulimic patients and obese binge eaters, who have a more chaotic, less controlled approach to eating regulation think about food more frequently and feel more influenced by the presence or availability of food than anorexic patients. Comparing bulimic patients’ responses to anorexic patients responses on the PFS could provide an understanding to factors that influence control over eating.

Additional questions and avenues of exploration remain with respect to the PFS. A better understanding of factors that might increase the power of food is
needed. The relative power of food may vary for certain types of food (e.g. calorically dense, high fat, high sugar) versus less tempting foods. This difference may be important in helping patients regulate consumption. The association between appetitive responsiveness and physical activity has yet to be determined. Perhaps those that have a stronger than average appetitive drive attempt to manage the psychological influence of food through increased or excessive physical activity. Individual differences in relation to the degree of the power of food for different groups such as obese and non-obese individuals remain unclear. It is also unknown whether this appetitive hyper-responsiveness is physiologically-based predisposition, a learned condition, or both. If this is a learned phenomenon, perhaps such influences can be re-learned in order to elicit more adaptive responses to food.
LIST OF REFERENCES


APPENDIX A: TABLES

Table 1. Demographic Characteristics of Participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Participants (n = 81)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number (%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>81 (100)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>8 (9.9)</td>
</tr>
<tr>
<td>Asian</td>
<td>14 (17.3)</td>
</tr>
<tr>
<td>Caucasian</td>
<td>54 (66.6)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2 (2.5)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (3.7)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>32 (39.5)</td>
</tr>
<tr>
<td>Sophomore</td>
<td>23 (28.4)</td>
</tr>
<tr>
<td>Junior</td>
<td>19 (23.5)</td>
</tr>
<tr>
<td>Senior</td>
<td>7 (8.6)</td>
</tr>
<tr>
<td>Body Mass Index (kg/m^2)</td>
<td></td>
</tr>
<tr>
<td>≤ 25</td>
<td>62 (76.5)</td>
</tr>
<tr>
<td>&gt; 25</td>
<td>19 (23.5)</td>
</tr>
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</table>
Table 2. Means, Standard Deviations, and Reliability Coefficients for the PFS

<table>
<thead>
<tr>
<th>Variable (Measure)</th>
<th>Mean</th>
<th>SD</th>
<th>Reliability</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFS-Absent</td>
<td>14.60</td>
<td>5.37</td>
<td>.85</td>
<td>7</td>
</tr>
<tr>
<td>PFS-Present</td>
<td>18.15</td>
<td>5.42</td>
<td>.82</td>
<td>7</td>
</tr>
<tr>
<td>PFS-Pleasure</td>
<td>16.18</td>
<td>5.19</td>
<td>.80</td>
<td>7</td>
</tr>
<tr>
<td>PFS-Total</td>
<td>48.94</td>
<td>14.79</td>
<td>.93</td>
<td>21</td>
</tr>
</tbody>
</table>

Note.  PFS-Absent = Power of Food Scale-Food Absent Subscale; PFS-Present = Power of Food Scale-Food Present Subscale; PFS-Pleasure = Power of Food Scale-Food Tasted Subscale; PFS-Total = Power of Food Scale-Total Score
Table 3. Corrected Item-Total Correlations for the Items on the PFS

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Item-Total Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I find myself thinking about food even when I’m not physically hungry.</td>
<td>.538</td>
</tr>
<tr>
<td>When I’m in a situation where delicious foods are present but I have to wait to eat them, it is very difficult for me to wait.</td>
<td>.628</td>
</tr>
<tr>
<td>I get more pleasure from eating than I do from almost anything else.</td>
<td>.793</td>
</tr>
<tr>
<td>I feel that food is to me like liquor is to an alcoholic.</td>
<td>.713</td>
</tr>
<tr>
<td>If I see or smell a food I like, I get a powerful urge to have some.</td>
<td>.574</td>
</tr>
<tr>
<td>When I’m around a fattening food I love, it’s hard to stop myself from at least tasting it.</td>
<td>.493</td>
</tr>
<tr>
<td>I often think about what foods I might eat later in the day.</td>
<td>.699</td>
</tr>
<tr>
<td>It’s scary to think of the power that food has over me.</td>
<td>.649</td>
</tr>
<tr>
<td>When I taste a favorite food, I feel intense pleasure.</td>
<td>.592</td>
</tr>
<tr>
<td>When I know a delicious food is available, I can’t help myself from thinking about having some.</td>
<td>.714</td>
</tr>
<tr>
<td>I love the taste of certain foods so much that I can’t avoid eating them even if they’re bad for me.</td>
<td>.545</td>
</tr>
<tr>
<td>When I see delicious foods in advertisements or commercials, it makes me want to eat.</td>
<td>.630</td>
</tr>
</tbody>
</table>
Table 3 (Continued)

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Item-Total Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel like food controls me rather than the other way around.</td>
<td>.592</td>
</tr>
<tr>
<td>Just before I taste a favorite food, I feel intense anticipation.</td>
<td>.613</td>
</tr>
<tr>
<td>When I eat delicious food I focus a lot on how good it tastes.</td>
<td>.500</td>
</tr>
<tr>
<td>Sometimes, when I’m doing everyday activities, I get an urge to eat “out of the blue” (for no apparent reason).</td>
<td>.495</td>
</tr>
<tr>
<td>I think I enjoy eating a lot more than most other people.</td>
<td>.770</td>
</tr>
<tr>
<td>Hearing someone describe a great meal makes me really want to have something to eat.</td>
<td>.697</td>
</tr>
<tr>
<td>It seems like I have food on my mind a lot.</td>
<td>.762</td>
</tr>
<tr>
<td>It’s very important to me that the foods I eat are as delicious as possible.</td>
<td>.385</td>
</tr>
<tr>
<td>Before I eat a favorite food my mouth tends to flood with saliva.</td>
<td>.386</td>
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</table>
Table 4. Pearson Product-Moment Correlations for the Three Subscales of the PFS

<table>
<thead>
<tr>
<th>Variable (Measure)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PFS</td>
<td>--</td>
<td>.93**</td>
<td>.92**</td>
<td>.93**</td>
</tr>
<tr>
<td>2. PFS-Absent</td>
<td>--</td>
<td>.77**</td>
<td>.82**</td>
<td></td>
</tr>
<tr>
<td>3. PFS-Present</td>
<td>--</td>
<td></td>
<td>.78**</td>
<td></td>
</tr>
<tr>
<td>4. PFS-Pleasure</td>
<td></td>
<td></td>
<td></td>
<td>--</td>
</tr>
</tbody>
</table>

Note.  PFS = Power of Food Scale-Total Score; PFS-Absent = Power of Food Scale-Food Absent Subscale; PFS-Present = Power of Food Scale-Food Present; PFS-Pleasure = Power of Food Scale-Food Tasted

** p < 0.01.
Table 5. Means and Standard Deviations for Independent and Dependent Variables

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean</th>
<th>SD</th>
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</thead>
<tbody>
<tr>
<td>Difference in Salivary Weight</td>
<td>.60</td>
<td>1.06</td>
</tr>
<tr>
<td>Power of Food Scale</td>
<td>48.94</td>
<td>14.80</td>
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<tr>
<td>Restraint Scale</td>
<td>13.83</td>
<td>5.42</td>
</tr>
<tr>
<td>Three Factor Eating Questionnaire-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disinhibition</td>
<td>5.86</td>
<td>3.42</td>
</tr>
<tr>
<td>Cognitive Restraint</td>
<td>8.59</td>
<td>4.71</td>
</tr>
<tr>
<td>Rigid Restraint</td>
<td>5.80</td>
<td>3.63</td>
</tr>
<tr>
<td>Flexible Restraint</td>
<td>5.38</td>
<td>3.14</td>
</tr>
<tr>
<td>Eating Habits Checklist</td>
<td>11.07</td>
<td>7.22</td>
</tr>
<tr>
<td>External Eating</td>
<td>4.60</td>
<td>2.91</td>
</tr>
<tr>
<td>Marlowe-Crowne Social Desirability</td>
<td>16.59</td>
<td>4.74</td>
</tr>
<tr>
<td>Visual Analogue Hunger Scale</td>
<td>41.35</td>
<td>27.05</td>
</tr>
<tr>
<td>Beck Depression Inventory-II</td>
<td>8.43</td>
<td>6.09</td>
</tr>
<tr>
<td>State-Trait Anxiety Inventory-State</td>
<td>34.26</td>
<td>8.81</td>
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</table>
Table 6. Correlations for Salivary Weight, Measures of Restraint and the PFS

<table>
<thead>
<tr>
<th>Variable (Measure)</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Salivary Weight</td>
<td>--</td>
<td>.07</td>
<td>.13</td>
<td>.15</td>
<td>.07</td>
<td>.12</td>
</tr>
<tr>
<td>2. Power of Food Scale</td>
<td>--</td>
<td>.12</td>
<td>-.18</td>
<td>-.03</td>
<td>-.19</td>
<td></td>
</tr>
<tr>
<td>3. Restraint Scale</td>
<td>--</td>
<td>.55**</td>
<td></td>
<td>.59**</td>
<td></td>
<td>.45**</td>
</tr>
<tr>
<td>Three Factor Eating Questionnaire--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Cognitive Restraint</td>
<td></td>
<td></td>
<td></td>
<td>.81**</td>
<td>.86**</td>
<td></td>
</tr>
<tr>
<td>5. Rigid Restraint</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.65**</td>
<td></td>
</tr>
<tr>
<td>6. Flexible Restraint</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>--</td>
</tr>
</tbody>
</table>

** p < 0.01.
Table 7. Multiple Regression Predicting Salivary Responsiveness to Olfactory Cues

<table>
<thead>
<tr>
<th>Predictor Variables</th>
<th>B</th>
<th>SE</th>
<th>Beta</th>
</tr>
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<tbody>
<tr>
<td>Power of Food Scale</td>
<td>.004</td>
<td>.008</td>
<td>.057</td>
</tr>
<tr>
<td>Restraint Scale</td>
<td>.024</td>
<td>.022</td>
<td>.121</td>
</tr>
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</table>
Table 8. Means for PFS, Restraint Scale and Salivation Among Unrestrained Dieters, Restrained Non-dieters and Dieters

<table>
<thead>
<tr>
<th>Measure</th>
<th>Unrestrained Nondieters</th>
<th>Restrained Nondieters</th>
<th>Current Dieters</th>
<th>F(2,74)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference in Salivary Weight</td>
<td>.49 (.82)</td>
<td>.82 (1.28)</td>
<td>.33 (1.04)</td>
<td>1.30</td>
</tr>
<tr>
<td>Power of Food Scale</td>
<td>48.64 (14.35)</td>
<td>50.03 (13.29)</td>
<td>50.14 (20.24)</td>
<td>.08</td>
</tr>
<tr>
<td>Restraint Scale</td>
<td>8.64ₐ (2.43)</td>
<td>16.69ₐ (3.42)</td>
<td>18.79ₐ (5.00)</td>
<td>61.58**</td>
</tr>
</tbody>
</table>

Note. Within each row, means with different subscripts differ at the .05 level of significance according to Tukey’s HSD test.

Standard deviations for each variable are within parentheses.

Unrestrained Nondieters n = 31; Restrained Nondieters n = 32; Current Dieters n = 14
Table 9. Pearson Product-Moment Correlations for Salivation and Covariates

<table>
<thead>
<tr>
<th>Variable (Measure)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Salivary Weight</td>
<td>--</td>
<td>.00</td>
<td>.14</td>
<td>-.03</td>
<td>.00</td>
</tr>
<tr>
<td>2. Body Mass Index</td>
<td>--</td>
<td>-.27*</td>
<td>-.16</td>
<td>-.07</td>
<td></td>
</tr>
<tr>
<td>3. Visual Analogue Hunger Scale</td>
<td>--</td>
<td>-.10</td>
<td>.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Beck Depression Inventory</td>
<td>--</td>
<td></td>
<td>.51**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. State Trait Anxiety Inventory-State</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p < .05.  ** p < .01.
Table 10. Correlations for the Convergent and Discriminant Validity of the PFS

<table>
<thead>
<tr>
<th>Variable (Measure)</th>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
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</thead>
<tbody>
<tr>
<td>PFS</td>
<td>--</td>
<td>.93**</td>
<td>.92**</td>
<td>.93**</td>
<td>.73**</td>
<td>.54**</td>
<td>.43**</td>
<td>-.21</td>
<td>.12</td>
</tr>
<tr>
<td>PFS-Absent</td>
<td>--</td>
<td>.77**</td>
<td>.82**</td>
<td>.66**</td>
<td>.59**</td>
<td>.54**</td>
<td>-.15</td>
<td>.19</td>
<td></td>
</tr>
<tr>
<td>PFS-Present</td>
<td>--</td>
<td>.78**</td>
<td>.68**</td>
<td>.48**</td>
<td>.30**</td>
<td>-.29**</td>
<td>.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PFS-Pleasure</td>
<td>--</td>
<td>.68**</td>
<td>.42**</td>
<td>.35**</td>
<td>-.15</td>
<td>.11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEBQ-EE</td>
<td>--</td>
<td>.51**</td>
<td>.39**</td>
<td>-.23*</td>
<td>.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TFEQ-D</td>
<td>--</td>
<td>.65**</td>
<td>-.26*</td>
<td>.34*</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>EHC</td>
<td>--</td>
<td>-.12</td>
<td>.38**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>MCSD</td>
<td>--</td>
<td>.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS</td>
<td>--</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. PFS = Power of Food Scale; PFS-Absent = Power of Food Scale-Food Absent Subscale; PFS-Present = Power of Food Scale-Food Present; PFS-Pleasure = Power of Food Scale- Food Tasted; DEBQ-EE = Dutch Eating Behavior Questionnaire-External Eating Subscale; TFEQ-D = Three Factor Eating Questionnaire-Disinhibition Scale; EHC = Eating Habits Checklist; MCSD = Marlowe-Crowne Social Desirability Scale; RS = Restraint Scale.

* p < .05. ** p < .01.
Table 11. Multiple Regression Analysis Predicting Disinhibition Scores

<table>
<thead>
<tr>
<th>Predictor Variables</th>
<th>B</th>
<th>SE</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power of Food Scale</td>
<td>.116</td>
<td>.021</td>
<td>.502</td>
</tr>
<tr>
<td>Restraint Scale</td>
<td>.182</td>
<td>.057</td>
<td>.289</td>
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</tbody>
</table>
Table 12. Multiple Regression Analysis Predicting Binge Eating Scores

<table>
<thead>
<tr>
<th>Predictor Variables</th>
<th>B</th>
<th>SE</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power of Food Scale</td>
<td>.191</td>
<td>.047</td>
<td>.391</td>
</tr>
<tr>
<td>Restraint Scale</td>
<td>.456</td>
<td>.127</td>
<td>.342</td>
</tr>
</tbody>
</table>

APPENDIX B: DEMOGRAPHIC INFORMATION

ID# __________________

1. Name _______________________________________________________

2. Age________________   3. Date of Birth____________

4. Height_______ft _______inches 5. Weight________________ lbs.

6. Ethnicity (circle all that apply):
   American Indian      Asian  African American Hispanic       White
   Other:____________

7. Highest Level of Education Completed (circle one):
   1 2 3 4 5 6 7 8 9 10 11 12     13 14 15 16     Masters     Doctorate
   High School                 College
APPENDIX C: POWER OF FOOD SCALE

Please indicate the extent to which you agree that the following items describe you. Use the following 1-5 scale for your responses.

1. don’t agree at all
2. agree a little
3. agree somewhat
4. agree
5. strongly agree

1. I find myself thinking about food even when I’m not physically hungry.

2. When I’m in a situation where delicious foods are present but I have to wait to eat them, it is very difficult for me to wait.

3. I get more pleasure from eating than I do from almost anything else.

4. I feel that food is to me like liquor is to an alcoholic.

5. If I see or smell a food I like, I get a powerful urge to have some.

6. When I’m around a fattening food I love, it’s hard to stop myself from at least tasting it.

7. I often think about what foods I might eat later in the day.

8. It’s scary to think of the power that food has over me.

9. When I taste a favorite food, I feel intense pleasure.

10. When I know a delicious food is available, I can’t help myself from thinking about having some.

11. I love the taste of certain foods so much that I can’t avoid eating them even if they’re bad for me.

12. When I see delicious foods in advertisements or commercials, it makes me want to eat.

13. I feel like food controls me rather than the other way around.
14. Just before I taste a favorite food, I feel intense anticipation.

15. When I eat delicious food I focus a lot on how good it tastes.

16. Sometimes, when I’m doing everyday activities, I get an urge to eat “out of the blue” (for no apparent reason).

17. I think I enjoy eating a lot more than most other people.

18. Hearing someone describe a great meal makes me really want to have something to eat.

19. It seems like I have food on my mind a lot.

20. It’s very important to me that the foods I eat are as delicious as possible.

21. Before I eat a favorite food my mouth tends to flood with saliva.
APPENDIX D: REVISED RESTRAINT SCALE

Each question in below is followed by a number of answer options. After reading each question carefully, choose the one option which most applies to you. Read each one carefully and circle the number that best describes you in general.

1. In general, how often are you dieting?
   
   1) Never  2) Rarely  3) Sometimes  4) Often  5) Always

2. Would a weight fluctuation of 5 pounds affect the way you live your life?
   
   1) Not at all  2) Slightly  3) Moderately  4) Very Much

3. Do you eat sensibly in front of others and splurge alone?
   
   1) Never  2) Rarely  3) Sometimes  4) Often  5) Always

4. Do you give too much time and thought to food?
   
   1) Never  2) Rarely  3) Sometimes  4) Often  5) Always

5. Do you have feelings of guilt after overeating?
   
   1) Never  2) Rarely  3) Sometimes  4) Often  5) Always

6. How conscious are you of what you are eating?
   
   1) Not at all  2) Slightly  3) Moderately  4) Very Much

7. What is the maximum amount of weight (in pounds) you have ever lost in one month?
   
   1) 0-4  2) 5-9  3) 10-14  4) 15-19  5) 20+

8. What is your maximum weight gain within a week?
   
   1) 1  2) 1.1 – 2  3) 2.1 – 3  4) 3.1 – 5  5) 5.1+
9. In a typical week, how much does your weight fluctuate?

1) 1        2) 1.1 – 2        3) 2.1 – 3        4) 3.1 – 5        5) 5.1+

10. How many pounds over your ideal weight were you at your maximum weight?

1) 0-1         2) 2-5         3) 6-10         4) 11-20         5) 21+
APPENDIX E: HUNGER SCALE

Directions: For each item, please place a slash somewhere on the line to indicate how you feel right now, that is, at this present time. Mark any place on the line.

FOR EXAMPLE:

How happy are you today?

____________________________________________________
Not at all happy | Extremely happy

1. How hungry do you feel now?

____________________________________________________
Not at all hungry | Extremely hungry
APPENDIX F: DUTCH EATING BEHAVIOR QUESTIONNAIRE

Each question in below is followed by a number of answer options. After reading each question carefully, choose the one option which most applies to you. Read each one carefully and circle the number that best describes you in general.

1. If food taste good to you, do you eat more than usual?
   1) Never  2) Seldom  3) Sometimes  4) Often  5) Very Often

2. If food smells and looks good to you, do you eat more than usual?
   1) Never  2) Seldom  3) Sometimes  4) Often  5) Very Often

3. If you see or smell something delicious, do you have a desire to eat it?
   1) Never  2) Seldom  3) Sometimes  4) Often  5) Very Often

4. If you have something delicious to eat, do you eat it straight away?
   1) Never  2) Seldom  3) Sometimes  4) Often  5) Very Often

5. If you walk past the baker do you have the desire to buy something delicious?
   1) Never  2) Seldom  3) Sometimes  4) Often  5) Very Often

6. If you walk past a snack bar or café, do you have the desire to buy something delicious?
   1) Never  2) Seldom  3) Sometimes  4) Often  5) Very Often

7. If you see others eating do you have the desire to eat?
   1) Never  2) Seldom  3) Sometimes  4) Often  5) Very Often
8. Can you resist eating delicious foods?

   1) Never  2) Seldom  3) Sometimes  4) Often  5) Very Often

9. Do you eat more than usual, when you see others eating?

   1) Never  2) Seldom  3) Sometimes  4) Often  5) Very Often

10. When preparing a meal are you inclined to eat something?

    1) Never   2) Seldom   3) Sometimes   4) Often   5) Very Often
APPENDIX G: MARLOWE-CROWNE SOCIAL DESIRABILITY SCALE

Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is true or false as it pertains to you personally.

T/F

1. Before voting I thoroughly investigate the qualifications of all candidates.       ____
2. I never hesitate to go out of my way to help someone in trouble.            ____
3. It is sometimes hard for me to go on with my work if I am not encouraged.      ____
4. I have never disliked anyone intensely.               ____
5. On occasion I have had doubts about my ability to succeed in life.           ____
6. I sometimes feel resentful when I don’t get my way.             ____
7. I am always careful about my manners of dress.              ____
8. My table manners at home are as good as when I eat out at a restaurant.           ____
9. If I could get into a movie without paying and be sure I was not seen I would probably do it.                  ____
10. On a few occasions, I have given up on something because I thought too little of my ability.                 ____
11. I like to gossip at times.                 ____
12. There have been times when I felt like rebelling against people in authority even though I knew they were right.       ____
13. No matter who I’m talking to, I always am a good listener.            ____
14. I can remember “playing sick” to get out of something.          ____
15. There have been occasions when I took advantage of someone.      ____
16. I’m always willing to admit it when I make a mistake.  
17. I always try to practice what I preach.  
18. I don’t find it particularly difficult to get along with loud mouthed, obnoxious people.  
19. I sometimes try to get even rather than forgive and forget.  
20. When I don’t know something I don’t mind admitting it.  
21. I am always courteous, even to people who are disagreeable.  
22. At times I have really insisted on having things my own way.  
23. There have been occasions when I felt like smashing things.  
24. I would never think of letting someone else be punished for my wrongdoings.  
25. I never resent being asked to return a favor.  
26. I have never been irked when people expressed ideas very different from my own.  
27. I never make a long trip without checking the safety of my car.  
28. There have been times when I was quite jealous of the good fortune of others.  
29. I have almost never felt the urge to tell someone off.  
30. I am sometimes irritated by people who ask favors of me.  
31. I have never felt that I was punished without cause.  
32. I sometimes think when people have a misfortune they only got what they deserved.  
33. I have never deliberately said something to hurt someone’s feelings.
APPENDIX H: EATING HABITS CHECKLIST

Instructions. Below are groups of numbered statements. Read all of the statements in each group, and fill in the circle on the answer sheet of the one that best describes the way you feel about the problems you have controlling your eating behavior. (Choose one statement in each group.) Please note that some groups only contain three statements.

1. a I don’t feel self-conscious about my weight or body size when I’m with others.
   b I feel concerned about how I look to others, but it normally does not make me feel disappointed with myself.
   c I do get self-conscious about my appearance and weight which makes me feel disappointed in myself.
   d I feel very self-conscious about my weight and frequently, I feel intense shame and disgust for myself. I try to avoid social contacts because of my self-consciousness.

2. a I don’t have any difficulty eating slowly in the proper manner.
   b Although I seem to “gobble down” foods, I don’t end up feeling stuffed because of eating too much.
   c At times, I tend to eat quickly, and then I feel uncomfortably full afterwards.
   d I have the habit of bolting down my food, without really chewing it. When this happens I usually feel uncomfortably stuffed because I’ve eaten too much.

3. a I feel capable to control my eating urges when I want to.
   b I feel like I have failed to control my eating more than the average person.
   c I feel utterly helpless when it comes to feeling in control of my eating urges.
   d Because I feel so helpless about controlling my eating I have become very desperate about trying to get in control.

4. a I don’t have the habit of eating when I’m bored.
   b I sometimes eat when I’m bored, but often I’m able to “get busy” and get my mind off food.
   c I have a regular habit of eating when I’m bored, but occasionally, I can use some other activity to get my mind off eating.
   d I have a strong habit of eating when I’m bored. Nothing seems to help me break the habit.

5. a I’m usually physically hungry when I eat something.
   b Occasionally, I eat something on impulse even though I am not hungry.
   c I have the regular habit of eating foods, which I might not really enjoy, to satisfy a hungry feeling, even though physically I don’t need the food.
   d Even though I’m not physically hungry, I get a hungry feeling in my mouth that only seems to be satisfied when I eat a food, like a sandwich, that fills my mouth. Sometimes, when I eat the food to satisfy my mouth hunger, I then spit the food out so I won’t gain weight

6. a I don’t feel any guilt or self-hate after I overeat.
   b After I overeat, occasionally I feel guilt or self-hate.
   c Almost all the time I experience strong guilt or self-hate after I overeat.
7. a I don’t lose total control of my eating when dieting even after periods when I overeat.
b Sometimes when I eat a “forbidden food” on a diet, I feel like I “blew it” and eat even more.
c Frequently, I have the habit of saying to myself, “I’ve blown it now, why not go all the way” when I overeat on a diet. When that happens I eat even more.
d I have a regular habit of starting strict diets for myself but I break the diets by going on an eating binge. My life seems to be either a “feast” or “famine.”

8. a I rarely eat so much food that I feel uncomfortably stuffed afterwards.
b Usually about once a month, I eat such a quantity of food that I end up feeling very stuffed.
c I have regular periods during the month when I eat large amounts of food, either at mealtime or at snacks.
d I eat so much food that I regularly feel quite uncomfortable after eating and sometimes a bit nauseous.

9. a My level of calorie intake does not go up very high or go down very low on a regular basis.
b Sometimes after I overeat, I will try to reduce my caloric intake to almost nothing to compensate for the excess calories I’ve eaten.
c I have a regular habit of overeating during the night. It seems that my routine is not to be hungry in the morning but overeat in the evening.
d In my adult years, I have had week-long periods where I practically starve myself. This follows periods when I overeat. It seems I live a life of either “feast” or “famine.”

10. a I usually am able to stop eating when I want to. I know when “enough is enough”.
b Every so often, I experience a compulsion to eat which I can’t seem to control.
c Frequently, I experience strong urges to eat which I seem unable to control, but at other times I can control my eating urges.
d I feel incapable of controlling urges to eat. I have a fear of not being able to stop eating voluntarily.

11. a I don’t have any problem stopping eating when I feel full.
b I usually can stop eating when I feel full but occasionally overeat, leaving me feeling uncomfortably stuffed.
c I have a problem stopping eating once, I start and usually I feel uncomfortably stuffed after I eat a meal.
d Because I have a problem not being able to stop eating when I want, I sometimes have to induce vomiting to relieve my stuffed feeling.

12. a I seem to eat just as much when I’m with others (family, social gathering) as when I’m by myself.
b Sometimes, when I’m with other persons, I don’t eat as much as I want to eat because I’m self conscious about my eating.
c Frequently, I eat only a small amount of food when others are present, because I’m very embarrassed about my eating.
d I feel so ashamed about overeating that I pick times to overeat when I know no one will see me. I feel like a “closet eater.”
13.  a  I eat three meals a day with only an occasional between meal snack.  
    b  I eat three meals a day, but I also normally snack between meals.  
    c  When I am snacking heavily, I get in the habit of skipping regular meals.  
    d  There are regular periods when I seem to be continually eating, with no planned meals.  

14.  a  I don’t think much about trying to control unwanted eating urges.  
    b  At least some of the time, I feel my thoughts are pre-occupied with trying to control my eating urges.  
    c  I feel that frequently I spend much time thinking about how much I ate or about trying not to eat anymore.  
    d  It seems to me that most of my waking hours are preoccupied by thoughts about eating or not eating. I feel like I’m constantly struggling not to eat.  

15.  a  I don’t think about food a great deal.  
    b  I have strong cravings for food but they last only brief periods of time.  
    c  I have days when I can’t seem to think about anything else but food.  
    d  Most of my days seem to be pre-occupied with thoughts about food. I feel like I live to eat.  

16.  a  I usually know whether or not I’m physically hungry. I take the right portion of food to satisfy me.  
    b  Occasionally, I feel uncertain about knowing whether or not I am physically hungry. At these times it’s hard to know how much food I should take to satisfy me.  
    c  Even though I might know how many calories I should eat, I don’t have any idea what is a “normal” amount of food for me.
Suppose you ate as much as you wanted of any food you felt like whenever you felt like it, every day for the next month. Do you think you would gain weight during the month, and if so how much?

____ No, I don't think I'd gain weight

____ Yes, I think I'd gain about _____ pounds

1. What is the most you have ever weighed since reaching your current height? (do not count any weight gains due to medical conditions or medications)? The most I have weighed since reaching my current height is: _______ pounds

2. Are you currently on a diet? (circle one)  Yes         No  (If no, go to number 4).

3. Are you currently dieting to lose weight or to avoid gaining weight? (circle one)

   To lose weight (go to # 5)   To avoid gaining weight (go to # 5)

4. Have you ever been on a diet to control your weight?  Yes         No (If no go to #7)

5. About how old were you when you went on your first diet? ______ years old

6. Please estimate as best you can the number of times in your life you have dieted and lost the indicated amount of weight:

How many times have you dieted and lost:

____ 1-4 pounds

____ 5-10 pounds

____ 11-15 pounds

____ 16- 25 pounds

____ 26 pounds or more
7. How much effort are you currently putting into eating the healthiest possible diet you can? (circle one):

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<td>No effort</td>
<td>A moderate effort</td>
<td>A great deal of effort</td>
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8. We would like you to rate how much pleasure you get from eating. To do this, please think about all the major sources of pleasure in your life, including the pleasure you get from eating. Then read all five options shown below and circle one letter below to indicate which statement best describes the pleasure you get from eating.

A. The pleasure I get from eating is the strongest source of pleasure in my life.

B. The pleasure I get from eating is about the same as the strongest source of pleasure in my life.

C. The pleasure I get from eating is slightly weaker than the strongest source of pleasure in my life.

D. The pleasure I get from eating is moderately weaker than the strongest source of pleasure in my life.

E. The pleasure I get from eating is much weaker than the strongest source of pleasure in my life.

9. Now we’d like to ask about the pleasure you get from eating in a different way. Please rate how much you enjoy eating by comparing yourself to other people you know well. Circle the letter of the one statement that best describes you.

A. Other people seem to enjoy eating much more than I do.

B. Other people seem to enjoy eating a little more than I do.

C. Other people seem to enjoy eating about as much as I do.

D. Other people don’t seem to enjoy eating quite as much as I do.

E. Other people don’t seem to enjoy eating nearly as much as I do.
Using the 1-5 scale shown below, please indicate the extent to which you agree or disagree with the following statement.

1. I am a yo-yo dieter (intentionally lose weight, but then often regain the weight…)

   1  2  3  4  5  
   Strongly Agree Neither agree Disagree Strongly agree
   nor disagree

(If you have never tried to lose weight, skip items 2-9) Suppose you lose weight, but then you begin regaining. Based on this scenario, please indicate how likely or unlikely you are to do the following, using the 1-5 scale shown below.

   1  2  3  4  5  
   Extremely likely Very likely Moderately likely Slightly likely Not at all likely

2. Treat it as a small mistake, recover, and lose the pounds again  
3. Feel terrible, go off the diet, and regain  
4. Increase exercise  
5. Start watching food intake more carefully  
6. Start skipping meals, or going for a day or more without eating  
7. Ask a friend, spouse, or family member for help  
8. Start a weight loss program (diet, meal replacement, etc.)

9. If you gain the weight back after dieting, do you typically gain back to the same weight you started at, less that the weight you started at, or more than the weight you started at? Please use the 1-5 scale below to describe you.

   1  2  3  4  5  
   Much less than starting weight Somewhat less than starting weight Close to my starting weight Somewhat more than starting weight Much more than starting weight
VITA

Elizabeth Rose Didie was born September 16, 1973 in Stony Brook, Long Island. She graduated summa cum laude and as a member of Phi Beta Kappa from Fordham University, Bronx, New York with the Bachelor of Arts in Psychology in 1995. After graduation, Elizabeth worked for New York University/Bellevue Hospital-Division of Alcohol and Drug Abuse. She left New York to pursue her graduate studies at The American University in Washington, D.C. where she graduated with a Master of Arts in Psychology in 1998. After completing her first master’s degree she started her doctoral studies in Clinical Psychology at Drexel University in Philadelphia that same year. Elizabeth is currently completing her clinical internship at Northwestern Memorial Hospital/Northwestern University Medical School in Chicago and will obtain her doctorate from Drexel University in the summer of 2003. She will be completing a post-doctoral fellowship at Northwestern Memorial Hospital/Northwestern University Medical School specializing in obesity and eating disorders.