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Rating Hunger and Satiety:  
Comparing Dieting and Non-  
Dieting Women

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Dissertation

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Sharon Braverman

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# Table of Contents

<b>ABSTRACT</b> .....	<b>5</b>
<b>CHAPTER 1 INTRODUCTION</b> .....	<b>9</b>
<b>CHAPTER 2 - LITERATURE REVIEW</b> .....	<b>19</b>
<b>CHAPTER 3 – METHODS</b> .....	<b>63</b>
<i>Demographic Information Questionnaire (see Appendix Page 168)</i> .....	65
<i>The Diet and Weight History Questionnaire</i> .....	66
<i>The Three Factor Eating Questionnaire</i> .....	66
<i>Hunger and Satiety Rating Tools</i> .....	67
EATING SESSION LOGISTICS .....	68
<i>Reliability and Cronbach’s Alpha</i> .....	73
<i>Data Analysis Procedures</i> .....	75
<i>Power</i> .....	76
<b>CHAPTER 4 - FINDINGS AND RESULTS</b> .....	<b>78</b>
<i>Sample Description</i> .....	79
RESULTS .....	82
<i>Comparing Hunger and Satiety Ratings by Dieter Group</i> .....	82
<i>SLIMSCALE Ratings by Race</i> .....	90
<i>Early Family Eating Behavior and Group Status</i> .....	91
<i>Comparing Taste by Group</i> .....	93
<i>Multiple Regression Analysis for BMI</i> .....	93
<i>Compensation by BMI, Dieter Group and Restraint</i> .....	98
<i>BMI by Dieter Status and Class in College</i> .....	99
<i>Age of Participants and BMI</i> .....	100
<i>BMI by Dieter and Number of Times Participants Lost Weight</i> .....	101

<b>CHAPTER 5 –DISCUSSION.....</b>	<b>102</b>
LIMITATIONS TO THE STUDY.....	112
<b>CHAPTER 6-TOPICS FOR NEW RESEARCH .....</b>	<b>118</b>
COMPENSATION .....	118
EATING ON THE COLLEGE CAMPUS .....	119
PHYSICAL ACTIVITY ENGAGEMENT AND WEIGHT .....	121
TECHNOLOGY BASED COMPUTER TRACKING FOR EATING AND PHYSICAL ACTIVITY.....	123
LISTING THE CALORIES IN FOODS ON CAMPUS.....	124
<b>BIBLIOGRAPHY .....</b>	<b>126</b>
<b>APPENDIX I: RESEARCH DOCUMENTS AND FORMS.....</b>	<b>160</b>
CENTRAL CONNECTICUT STATE UNIVERSITY CONSENT FORM .....	161
DEMOGRAPHIC INFORMATION.....	168
DIET AND WEIGHT HISTORY QUESTIONNAIRE .....	171
THREE FACTOR EATING QUESTIONNAIRE .....	173
FOOD LIKING.....	177
SCALING TRAINING.....	178
HORIZONTAL APPETITE RATING SCALE –FASTED/FED.....	179
SLIMSCALE FASTED & FED .....	182
TASTE ESTIMATION SCALE.....	183
EVALUATION FORM .....	184
COMPOSITE VARIABLES SES AND EARLY FAMILY EATING BEHAVIOR.....	185

## Appendix II: List of Tables

TABLE 1-MATRIX PLOT OF SLIMSCALE FED .....	74
TABLE 2 -TABLE OF SAMPLE DEMOGRAPHICS AND DIET EXPERIENCES .....	79
TABLE 3 AGE OF FIRST DIET BY BMI CATEGORIES .....	80
TABLE 4 -PAIRED T-TEST FASTED AND FED DIFFERENCES.....	82
TABLE 5 -ANALYSIS OF VARIANCE FOR TWO-SAMPLE FASTED FED RATING DIFFERENCES ON SLIMSCALE .....	83
TABLE 6 - MULTIPLE REGRESSION DIFFERENCE BETWEEN FASTED AND FED SLIMSCALE RATINGS BY DIETER GROUP, RESTRAINT, BMI, RACE, AND AGE.....	85
TABLE 7 -RATING DIFFERENCES IN SLIMSCALE SCORES BY DIETER GROUP AND AGE.....	86
TABLE 8 -TWO-SAMPLE T TEST BMI BY DIETER GROUP .....	87
TABLE 9 -VARIANCE RATIO TEST BMI BY GROUP.....	87
TABLE 10 -TWO-SAMPLE T TEST RESTRAINT BY DIETER GROUP.....	88
TABLE 11 -VARIANCE RATIO TEST RESTRAINT BY DIETER GROUP .....	88
TABLE 12 -MEAN DIFFERENCES FOR BMI BY DIETER GROUP AND RESTRAINT STATUS.....	89
TABLE 13 -BMI BY DIET STATUS .....	90
TABLE 14 -SLIMSCALE SCORES FASTED BY RACE .....	90
TABLE 15 -SLIMSCALE SCORES FED SCORES BY RACE.....	91
TABLE 16 -TWO-SAMPLE T TEST EARLY FAMILY EATING BEHAVIOR BY GROUP .....	92
TABLE 17 -ANALYSIS OF VARIANCE AND VARIANCE RATIO TEST EARLY FAMILY EATING BEHAVIOR BY DIETER GROUP.....	92
TABLE 18 -MULTIPLE REGRESSION FOR BMI BY FAMILY EATING BEHAVIOR, CURRENT EATING AND DIETING BEHAVIOR, APPETITE AND SWEET TASTE RATING INDICATORS.....	96
TABLE 19 -MULTIPLE REGRESSION FOR COMPENSATION BY DIETER GROUP, RESTRAINT SCORE, AND BMI.....	98
TABLE 20 -BMI BY DIETER GROUP AND CLASS IN COLLEGE.....	99
TABLE 21 -ANOVA BMI BY DIETER GROUP AND CLASS IN SCHOOL.....	100
TABLE 22 -BMI'S BY GROUP AND AGE CATEGORIES .....	100
TABLE 23 -ANOVA BMI BY TIMES LOST WEIGHT AND DIETER GROUP .....	101

## **Abstract**

### **Rating Hunger and Satiation: Comparing Dieting and Non-dieting Women**

The purpose of this study was to test the hypothesis that Dieters would have less variation between their pre and post prandial ratings than Non-dieters. We compared 159 female college students' hunger and satiety ratings before and after their consumption of a 420 calorie portion of Entemann's Butter French Crumb Cake and a 9oz cup of water. Dieter status was assigned by questionnaire responses to Lowes' Diet and Weight History Questionnaire (Lowe, Kissileff, 2005) yielding 96 Dieters and 63 Non-dieters.

## **Methods**

The primary assumption was that of our 159 participants, the 96 Dieters, because of their lack of familiarity in using hunger and satiation as a behavioral strategy to initiate or stop eating, would demonstrate less of a difference between their fasted and fed ratings than the 63 Non-dieters. We studied whether the participants' BMI was a factor associated with their hunger and satiety ratings and whether their 'restraint' level was correlated with their status as a Dieter or Non-dieter and BMI by group and the number of times participants lost weight [a component of the Early Family Eating Behavior construct. Analyses by diet group status, Restraint level and BMI were performed for the difference in hunger to fullness ratings, Race, SES, Early Family Eating Behavior and for Taste, both Prop {bitter taste} sweet taste and the sweetness of coke. Two constructs, one focused on hunger utilization and one focused on Compensation assessed the 159 participants' implementation of these concepts.

## Results

Contrary to expectation, all 159 female college participants rated their fed scores higher than their fasted scores on the Visual Analogue Scale [VAS] question that asked "How Physically Full Do You Feel". This yielded a significant result with a  $t$  of -12.0558 and a  $p$ -value of 0.000. We found that there were no significant hunger and fullness rating differences between the Dieters and Non-dieters in this study.

BMI varied by group [ $t$  of 5.2467 and a  $p$  of 0.000] with a [mean of  $26.72343 \pm .605001$ ] for the 96 dieters compared with a [mean BMI of  $22.8090 \pm .437262$ ] for the 63 Non-dieters and this was a significant finding.

The Dieters' Restraint scores were higher [mean of  $11.14583 \pm .4125177$ ] than the Non-dieters Restraint scores [mean of  $6.047619 \pm .5016249$ ] and this was a significant finding [ $t$  of 7.8499 and a  $p$ -value of 0.000]. This finding illustrated the Dieters' engagement in 'Restrained Diet Behavior' and was statistically significant.

There were significant differences between the Dieters and Non-dieters in their Early Family Eating Behavior Construct scores (with a mean of  $3.052083 \pm 1.45363$  for the Dieters) and for the Non-dieters, a mean of ( $1.555556 \pm .9466031$ ) and a [ $t$  of 7.8619 and a  $p$ -value of 0.0000] for the differences between the two groups.

A Multiple Regression with Compensation as the dependent variable and Restraint, BMI and group as the independent variables was a significant finding for the use of compensation behaviors as measured by the compensation construct and differential use by the two groups [ $t$  of -1.97 and  $p$ -value of 0.000].

A Multiple Regression with BMI scores as the dependent variable and group, Restraint, Hunger for the Next meal, Sweet taste ratings, Compensator scores, Early family Eating Behaviors, Diet to Avoid Gaining Weight and 'I wish I weighed less' as the independent variables showed significance for the EFEB construct [ $t$  of 6.18  $p$ -value of 0.00] and 'I wish I weighed less' [ $t$  of 3.44 and  $p$ -value of 0.0001].

BMI was significantly associated with our participants' class in college [ $f$  of 25.03 and  $p$ -value of 0.000] their current Age [ $f$  of 14.94 and  $p$ -value of 0.0002] and BMI was significant for the number of times our participants lost weight, a dichotomous component on the Early Family Eating Behavior Construct where a score of three weight loss attempts or more scored a 1 and two or fewer weight loss attempts was scored a 0 [ $f$  of 16.93 and a  $p$ -value of 0.0001].

## **Implications**

It was an important finding that a healthy BMI was achieved and maintained by 101 of the 159 {50 were Dieters and 51 were Non-dieters} students in our study. We also found that eating behavior on the college campus today included a focus on 'watching what they ate in order not to gain weight' (Nichter, Ritenbaugh, Nichter, Vuckovic, Aicken, 1995) as well as dieting and non-dieting behaviors.

Dieting, historically, was believed to be equivalent to Restrained Eating by Polivy and Herman (Herman, Polivy, 1975; Lowe, Foster, Kerzhnerman, Swain, Wadden, 2001 p254)) but there is now debate as to whether Dieting and Restrained Dieting do not reflect the same eating behaviors in those Non-obese, with BMI's below 30 (Lowe, Doshi, Katteran, Feig, 2013, p1).

It is a positive outcome, we believe, that the 63 {Non-dieters} do not to 'diet' for weight loss, but our results also indicate that an educational intervention teaching the utilization of hunger and satiety sensations to those 'chronically dieting' (46) students with BMI's outside the normal range is still necessary on the University campus.



## **Chapter 1 Introduction**

### **Demographics of Obesity and Overweight and the Impact on Health**

The category of overweight and obese persons includes more than two-thirds of all Americans (Flegal, Carroll, Ogden, Curtin, 2010). As of 2015, these rates have increased over a period of thirty years and have shown little sign of decreasing (Flegal, Carroll, Kit, Ogden, 2012). The increased prevalence of obesity and overweight negatively impacts cardiovascular health, hypertension, Type 2 Diabetes, dyslipidemia and depression (Pi-Sunyer, 2009, p1771), conditions that are associated with excess weight (Abelson, Kennedy, 2004; Armstrong, King, 1993).

On the college campus, the prevalence of overweight and obesity has also increased in females of all racial categories (Webb, Butler-Ajibade, Robinson, Lee, 2013, p245) with 32% of college students in America falling into the overweight or obese categories (Gillen, Lefkowitz, 2011, p261).

#### **Dieting Demographics**

One in three Americans of all weight levels have attempted to lose weight by dieting and 65% of the overweight and obese reported that they also diet to lose weight (Alhassan, Kim, Bersamin, King, Gardner, 2008). Although studies have suggested that as many as forty-four percent of all dieters are female (Serdula, Mokdad, Williamson, Galuska, Mendlein, Health, 1999), two thirds of all American women in 2008 were overweight (Flegal, Carroll, Ogden, Curtin, 2010, p240). For college aged women, Serdula found that 43.7% of women aged 18-29 were trying

to lose weight, with 89.8% reporting using a weight loss diet (Serdula et al. 1999). Singer reported that young women may come to college with a *diet mentality* (Singer, 2006) and this may be based on early eating and dieting behaviors that pre-date attending college, but that continue when on campus (Gillen, et al. 2011).

“Dieters are those persons who restrict their intake of food in order to achieve or maintain a lower weight (Heatherton, Polivy, Herman, 1991, p78)”. Restricting food intake by dieting was seen as the solution to a real or perceived overweight status, (Polivy, Herman, 1983, p5). However, multiple studies have demonstrated that restricting food intake is not a permanent solution as dieters typically lose an average of 10% of their body weight on a weight loss program, but regain all lost weight within three to five years (Niemeier, Phelan, Fava, Wing, 2007). “Given the increase in obesity in the Western world, since the 1970’s when the dieting ethic began to dominate societal consciousness, it could be argued that the emphasis on dieting may have contributed to the increase in overweight (Polivy, 1996, p589)”.

## **Theory**

Two foundational theories have been proposed to explain the eating and dieting behavior and associated sensitivity (or lack of) to hunger and satiety for participants: Schachter’s Model of Internal and External Cues for Eating (Schachter, 1968) and the Restraint Theory originated by Polivy and Herman in 1983. Because many dieters go on formal diets to control their eating behavior instead of using the internal sensation of awareness, would be a smaller difference between the pre and post prandial ratings of hunger and satiety (fullness) in the 96 Dieters {a mean of 24.18} when compared with mean ratings {25.8254} of the 63 Non-dieters and this

theory was supported. We believe the Non-dieters have more experience and confidence in their ability to utilize hunger and fullness sensations in their daily lives to determine portions chosen and ingested.

Schachter originally postulated that the obese were external and did not recognize signals of hunger and satiation, but the non-obese were internally focused (Schachter, 1968). Schachter theorized that eating is triggered by a different set of stimuli in obese than in normal weight subjects and that the eating behavior of the obese is relatively unrelated to any internal state, but is under external control, "initiated and terminated by stimuli external to the organism (Schachter, 1968, p753)."

Dieting, historically, was believed to be equivalent to Restrained Eating by Polivy and Herman (Herman, Polivy, 1975; Lowe, Foster, Kerzhnerman, Swain, Wadden, 2001 p254)) but there is now debate as to whether Dieting and Restrained Dieting do not reflect the same eating behaviors in those Non-obese, with BMI's below 30 (Lowe, Doshi, Katteran, Feig, 2013, p1). In the past, 'restraint' was thought to include disinhibited or counter regulatory eating behavior which is characterized by a lack of control when eating and eating in the absence of hunger (Zocca, Shomaker, Tanofsky-Kraff, Columbi, Raciti, Brady, Crocker, Ali, Matheson, Yanovski, Yanovski, 2011, p324; Westenhoeffer, 1991).

"The concept of Restraint has been developed to describe the state of chronic dietary concern exercised by people who feel they need to regulate their weight and it related to an intention to restrict food intake, which is not necessarily identical with actual adherence to a weight reducing diet (Wardle, Beales, 1987, p179)." Early

Restraint theory may have predicted variation between Restraint and BMI {weight status} when the Restrained were said to resemble the obese while unrestrained subjects were more like normal eaters, but there may also be an association between weight level and eating behaviors (Herman, Polivy, 1975, p666).

Previous Restraint theory research reflected that weight change in female college student dieters often followed the weight cycling restraint paradigm (Mills, Polivy, McFarlane, Crosby, 2012, p302) therefore, exploring the differences in eating behavior in those 'Restrained' college females when compared with the 'Non-restrained' requires further exploration since research by Lowe and his team at Drexel University reported that weight loss dieting or particular behaviors that dieters practice varied by Restraint level as well as diet status (Lowe, Doshi, Katterman, Feig, 2013, p6).

### **Previous studies on Hunger and Satiety**

A link, or a lack of one, between hunger, satiety and restrained eating could explain the lack of success that dieting women have experienced in maintaining lost weight (Polivy, Herman, 1991 p97). Polivy and Herman wrote that "dieting demands that hunger be, to some extent ignored (Polivy, Herman, 1983, p21)" and "since dieting per se produces (or demands) an inability or unwillingness to be guided by one's internal signals, especially as they bear on whether to, or how much to eat (Herman, Olmstead, Polivy, 1983, p932)." More recently they have claimed that "dieting, and the hunger it causes, is the sort of threat we have evolved to combat (Polivy, Herman, 2006, p32)."

Hunger can be defined as the body's need for food (Polivy, Herman, 1983) and hunger is a subjectively expressed construct that focuses on a motivation to eat (Stubbs, Hughes, Johnstone, Rowley, Reid, Elin, Stratton, Delargy, King, Blundell, 2000, p407). The definition of satiation is "a complex of sensations which impel the organism to stop eating because hunger and appetite have been satisfied, even though food is still available (Wagner, Hewitt, 1975, p344)." Differences in the ability to utilize hunger and satiety sensations between dieters and non-dieters have been reported as far back as the late 1960's (Schachter, Gross, 1968; Polivy, Herman, Hackett, Kuleshnyk, 1986).

### **On the College Campus**

Restrained eating has been found to predict food intake and weight gain (Giesen, Havemans, Nederkoorn, Strafacci, Jansen, 2009,p13) but there is now debate as to whether Dieting and Restrained Dieting do not reflect the same eating behaviors in those non-obese, with BMI's below 30 (Lowe, Doshi, Katteran, Feig, 2013,p1). First-year female students reported worrying about their weight while attending college with a heightened concern about gaining weight, a concern which then predicted actual weight gain (Webb, Butler-Ajibade, Robinson, Lee, 2013, p245). Of the 231 participants who dieted at the University of Arizona, Nichter and colleagues found 31% of these students reported that their diet lasted less than one week, 23% reported diets lasting from 7 to 14 days, 25% from 15 to 31 days, and 18% of the participants reported dieting for about a month (Nichter et al. 1995, pp156-157). Eating behaviors on the college campus today may also involve a new motivation regarding the older ideology of Dieting to Lose Weight compared with a

newer mantra of 'Dieting to Avoid Gaining Weight' (Goldstein, Katterman, Lowe, 2013 p237).

Regarding portion estimation on the campus, Burger looked at the relationship between BMI and real food amounts selected but not consumed by participants as a typical amount of food they would choose to eat (Burger, Kern, Coleman, 2007, p611). BMI was found to be a strong predictor of the choice of larger than recommended amounts of food by participants and suggests that persons with a higher BMI may view a larger portion as typical (Burger et al., 2007, p617).

Levitsky found that freshmen ate 174 calories more each day than they expended and reported that students ate more (i.e. finished the large portions) served in the cafeteria in the college setting (Levitsky, Halbmaier, Mrdjenovic, 2004, p1439) than before attending college.

### **The Study Population**

One hundred fifty-nine female students who attend Central Connecticut State University (CCSU) in New Britain, Connecticut, a regional comprehensive public university of 12,500 students and the home school of researcher Braverman, comprised the study population.

### **Primary Aim:**

Assessing differences in the ability of dieting [96 Dieters] women to utilize and be aware of hunger and satiety signals as the reason for eating when compared with non-dieting [63 Non-dieters] women was the primary aim of this study. With a sample of a minimum of at least 40 participants in each group we would be able to

detect an effect size of approximately 12.686 in mean appetitive rating differences between the two groups and find ratio variances of 1.04 with 80% power for the differences in hunger and satiety ratings between the Dieters and Non-dieters.

The assumption was that of our 159 participants, the Dieters, because of their lack of familiarity in using hunger and satiation as a behavioral strategy to initiate or stop eating, would demonstrate less variation between their fasted and fed ratings than the 63 Non-dieters.

The study also explored the differences in restraint and 'watching what one eats' (Nichter, Ritenbaugh, Nichter, Vuckovic, Aickin,1995) in CCSU participants by diet group status and BMI (Reid,Hammersly,Rance, 2005; Galloway, Farrow, Martz,2009). In the analysis of data from the study, the analysis compared the hunger and satiety ratings of 159 research participants on two types of appetitive rating scales, The SLIMSCALE, [Appendix, page 182] and the Horizontal Appetitive Rating Scale [Appendix, page 179] before and after consuming a 420 calorie serving of Entemann's Butter French Crumb Cake [one-fourth of the 14 ounce cake].

## **The Hypotheses**

The study also examined differences between and within the 159 participants by group, by BMI and by Restraint level on the distribution of hunger and fullness ratings, as well as by race, SES and by Early Family Eating Behavior, Compensation and Hunger construct scores. The Compensation Construct was assessed from responses to questions taken from The Three Factor Eating Questionnaire that address an internally focused 'postponing' behavior for one's eating, as in question

23, 'I often stop eating when I am not really full as a conscious means of limiting the amount that I eat' or question 28, 'I consciously hold back at meals in order not to gain weight.' The compensation eating behavior concept was also a recommendation by Polivy and Herman in their 1983 book, *Breaking the Diet Habit* (Polivy, Herman, 1983p205) as a method for returning to a natural weight without dieting.

For the Hunger construct the responses to fifteen questions, Questions taken from the Three Factor Eating Questionnaire, were examined. These questions all included the word *hunger* or *hungry* as in question 5, 'Dieting is too hard for me because I just get too hungry.'

We assessed participants by group for their 'taster status for PROP' [a measurement of the number of alleles that exist on the tongue which allows for greater taste response] where this has been associated with diet status and Restraint level in the literature (Tepper,Ulrich,1999,p234; Tepper, 1999) as well as a paper and pencil rating for Strongest Sweetness (sweet taste) and the sweetness of Coke.

A Multiple Regression with BMI scores as the dependent variable assessed a relationship with diet group status, a sweet taste assessment, the participants hunger composite score, their compensation construct score, whether they diet to avoid gaining weight, their Early Family Eating Behavior Construct score and whether our participants wish they weighed less. We also assessed whether BMI scores were associated with participants class in college, their current age, their age of first diet, the number of times they had lost weight previously and how much



they liked the coffee cake. A secondary theoretical objective compared the use of 'awareness and mindful' behaviors in the Dieters and Non-dieters where we applied these constructs as factors that also measured their Restraint.

To explore the theory that formal dieting rules may have obscured the awareness of hunger and satiety signals to control eating behavior, we assessed the differences in the 96 dieting female student's judgment of hunger and satiety sensations when compared with the 63 non-dieting participants on two rating tools, a 100 mm SLIMSCLALE {Labeled Magnitude Scale }[LMS] and the 100 mm Horizontal Appetite Rating Scale {a Visual Analogue Scale} [VAS]. The prediction was that there would be a greater difference, and also larger variance, in the pre and post prandial ratings in the Non-dieters when compared with the Dieters. BMI was assessed by the participants' weight and height measurements and the correlation of BMI with participants' restraint score and group status was a primary research topic for this study since BMI levels, though displaying a leveling effect, are still increasing at the higher BMI levels (Flegal,Carroll, Kit, Ogden, 2012p491). Restraint was measured from 21 specific questions of the total of 51 questions on the Three Factor Eating Questionnaire (Stunkard, Messick. 1985) where a score of >10 was Restrained and <=10 assignment was Unrestrained.

We propose that these 21 specific Restraint Scale questions may also measure the 'Mindfulness' construct where 'mindful' behaviors can improve an individual's ability to monitor and regulate dietary intake and serving sizes consume (Beshara, Hutchinson, Wilson, 2013p26). "Mindful eating is the process of being more aware of and less reactive to distressing thoughts about food, body and shape and

overwhelming emotions about food (Albers, 2011,p98).” A link between Restraint and Mindfulness may have been demonstrated by Drapeau et al, where a satiety quotient for fullness predicted energy intake in women when restraint was not measured but ‘clinical meaningfulness’ (mindfulness awareness) was evaluated (Drapeau, King, Hetherington, Doucet, Blundell, Tremblay, 2007 p165).

## **Chapter 2 - Literature Review**

### **Overweight, Obesity and Restrained Dieting**

The category of overweight and obese persons includes more than two thirds of all Americans (Flegal, Carroll, Ogden, Curtin, 2010) although there was, and is, pervasive pressure to be thin in American culture (Dolan, Gitzinger, 1994; Berg, 2000). Overweight and obesity rates have increased over the past thirty years despite the prevalence of myriad diet behaviors to lose weight over this same time frame (Polivy, 1996). The level of obesity alone is predicted to increase to 42% by 2030 from the current obesity rate of 35.7% (McKay, 2012, pA3) although there is debate as to whether the peak of obesity has already been reached for women and children (Belleck, 2010).

The idealized thinner shape as the standard of beauty for women in the 1960's occurred at the same time, and because of improved nutrition, females under thirty years of age became heavier (Garner, Garfinkel, Schwartz, Thompson, 1980p489). Rates of obesity began to increase significantly around 1980, concomitantly when the USDA Dietary Guidelines recommended low fat food consumption as the healthy way to eat to control heart disease (Teicholz, 2014, pA19).

Dieting was seen as the solution to real or perceived overweight status and has been the primary public health response to the prevalence of overweight and obesity and the adverse health effects of that excess weight (Abelson, Kennedy, 2004; Armstrong, King, 1993). That solution has thus created an ideal that provided the motivation for a "diet culture (Polivy, Herman, 1983, p7)" even though dieting

has physical and emotional costs and yields few positive results as measured by maintenance of lost weight (Polivy, Herman, 2006; Levy, Heaton, 1993).

The relationship between body weight and eating behavior communicates more than information about eating habits, it speaks to issues of personality and social status (Gilbert, 1986). Weight control by dieting, for example, is synonymous in the developed world for discipline, personal strength, willpower and success, and in adolescents, for their image of self-esteem and self-control as we have historically coupled desired social status with thinness (Dolan, Gitzinger, 1994). But our American culture was, and is, obsessed with women's body size as ultimate statements about their worth and state of mind (Orbach, 1978) where food is for others, not something one gives themselves (Orbach, 1982). American women are currently in a difficult situation: they have been coerced into dieting to conform to an unrealistically thin body image in an attempt to achieve higher social status. A greater number of females are overweight than males (Williamson, 1993) and more women view themselves as overweight than males (Chang, Christakis, 2003). This quest for the appropriate body image creates cycles of restrained and disinhibited eating episodes throughout women's lives (Polivy, et al. 1983).

Rules about eating often carry with them a belief that thinness connotes control, power, wealth, competence and success; beliefs that are most meaningful to women who, if they fall outside prescribed norms, feel less valued (Counihan, 1999, p9). *Lookism* (Piper, 1995) is defined as that state of thinking that occurs when women compare their body size to that of another woman, and tend to judge their own body as inadequate and requiring a weight loss diet that restricts food (Normandi,

Roark, 1998). Cultural beliefs about beauty and body shape place pressure on females to be thin (Brown, Konner, 1987, p43). In a study conducted by Chan and Christakis, for example, women, including those of normal weight, had five times greater odds of viewing themselves as overweight than males did (Chang, Christakis, 2003). Similarly, a study conducted by Berg found that many women perceived their body to be too big or perceived some body parts as oversized (Berg, 2000, p31).

The solution to perceived overweight was often to attempt to lose weight by dieting. Lowe (2003) defined the term "diet" using the definition from the American Heritage College Dictionary, (1997) is "to eat and drink according to a regulated system, especially so as to lose weight." (Lowe, 2003, p 46S).<sup>1</sup> Significantly, one in three Americans of all weight levels have attempted to lose weight by dieting and 65% of the overweight and obese report that they diet to lose weight (Alhassan, Kim, Bersamin, King, Gardner, 2008). Forty-four percent of all dieters are female (Serdula, Mokdad, Williamson, Galuska, Mendlein, Health, 1999) yet, two thirds of all American women remain overweight (Flegal, Carroll, Ogden, Curtin, 2010, p240). In 1996, as part of the BRFSS random digit telephone survey, Serdula and colleagues asked respondents if they were trying to lose weight or trying to maintain their weight by not gaining weight (Serdula et al. 1999, p1353). They found that 43.7% of women aged 18-29 were trying to lose weight, (89.8% by a weight loss diet) and 36.5% of these women were trying to maintain their weight by modifying their diet; 65% of this age group reporting eating less as their maintenance strategy (Serdula et al. 1999, pp1354-1356).

Yet as reported in 2014, only one in six overweight and obese individuals had lost weight and maintained that loss for at least one year (Ludwig, Friedman, 2014, p6). Self-reported dieting has served as a surrogate measure of weight gain and restrained dieting behavior has not resulted in maintained lost weight (Juhaeri, Stevens, Chambless, Tyroler, Harp, Jones, Arnett, 2001, p921). Dieters reported losing an average of 10% of their body weight on a weight loss program, but regained all lost weight within three to five years (Niemeier, Phelan, Fava, Wing, 2007).

Previous diet behavior has created the circular pattern of feeling overweight, embarking on a diet, experiencing the constant hunger of a restrictive diet, feeling demoralized, engaging in disinhibited eating which is then followed by another round of dieting (Polivy et al. 1983). Traditional diet programs that focus on limiting portions and dividing foods into good and bad categories tend to lead to anxiety, guilt, depression, and a regain of weight (Carrier, Steinhardt, Bowman, 1993; McFarlane, Polivy, McCabe, 1999). Polivy and Herman wrote decades ago that “dieting demands that hunger be to some extent ignored (Polivy, Herman, 1983, p21)” and recently they have claimed that “dieting, and the hunger it causes, is the sort of threat we have evolved to combat (Polivy et al. 2006).” But this is often difficult since “our brains were designed for a time when food was scarce and starvation was a common cause of death (Page, 2013, p4)”.

Washington Post writer Maggie Fard has described her life as a dieter in which “each success on the scale was short-lived, I jumped between plans and pant sizes for about 15 years (Fard,2013, pD3)”. But today’s dieting women have no basis to

trust themselves as self-feeders (Hirschmann, Munter, 1988, p122) and Ms. Fard's story represents one of the few success stories describing a young woman "who has jumped off the diet food train unscathed (Fard,2013, pD3)."

Even in the late 60's, Schachter believed that most diets were doomed. "Restricted, low-calorie diets should be effective just as long as the obese dieter is able to blind himself to food-relevant cues or so long as he exists in a world barren of such cues (Schachter, 1968; Schachter, 1971)." This lack of long-term dieting success has created a group of women for whom dieting to lose weight has become "their normative eating pattern (Reid, Hammersley, Rance, 2005, p120)".

Since restrained dieters are those 'persons, no matter their actual weight, who are dieters a good portion of the time (Polivy,Herman, 1983pp133,134)' they may feel the physical signals of hunger and satiation but may be not 'mindful' of these signals when making decisions of whether to initiate or stop eating. The behavioral and psychological concept of 'mindful eating' may be a helpful method for teaching body awareness (Albers, 2011) which would include a focus away from restrained dieting to a healthy internal control by the individual. "Being healthy means being aware of and enjoying the sensations of eating in a social context (Anderson, 2007, p280)" supporting an inverse relationship between mindful and disordered eating (Alberts,Raes,2012p847). This technique enables individuals to choose to act in accordance with their personal values and life goals and refrain from overeating (Tapper, Shaw, Ilsley,Hill, Bond, Moore, 2009p397).

## **DiETING On the College Campus**

On the college campus, the prevalence of individuals who are overweight or obese has increased in females of all racial categories (Webb, Butler-Ajibade, Robinson, Lee, 2013, p245) with 32% of college students falling into the overweight or obese categories (Gillen, Lefkowitz, 2011, p261). There is, and has been, debate as to whether weight change occurs when attending, or because of attending, college and whether this weight change varies by race (Gillen, et al. 2011). First-Year female students reported worrying about their weight while attending college with a heightened concern about gaining weight, a concern which then predicted actual weight gain (Webb, Butler-Ajibade, Robinson, Lee, 2013, p245). Singer reported that young women may come to college with a diet mentality (Singer, 2006) and this may be based on early eating and dieting behaviors used before attending college, but which continue while on the campus (Gillen, et al. 2011). It is possible therefore, that the restrictive early childhood monitoring used by parents can have long-term consequences on their children's BMI as they mature (Galloway, Farrow, Martz, 2010). When asked about their parental involvement in decisions about portions and foods given to them as adolescents, positive correlations were reported between controlling feeding practices by parents and emotional eating as well as to the BMI of college students (Galloway et al.2010, p1333).

Weight change in female college student dieters often followed the weight cycling restraint paradigm (Mills, Polivy, McFarlane, Crosby, 2012, p302); however, diet mentality may be changing on the University campus today. Eating behavior on the college campus today includes a focus on 'watching what they ate in order not



to gain weight' (Nichter, Ritenbaugh, Nichter, Vuckovic, Aicken, 1995) as well as dieting and non-dieting behaviors.

Female undergraduate students who wanted to lose weight were asked to choose an apple or chocolate bar after being surveyed as to the degree to which they considered themselves 'not to be at their ideal weight' (Giesen, Havermans,, Nederkoorn, Strafacci, Jansen, 2009, p17). The closer to ones ideal weight, the more likely they were to choose the candy bar and the explanation for this is progress towards ones goal liberates one to pursue 'inconsistent' goals like eating a high calorie snack (Giesen et al. 2009,p17).

Gillen reported that 12% of college students gained the "Freshmen 15" pounds, but the others, on average, only gained three pounds from the first semester to their third semester (Gillen et al. 2011, p264). At Cornell University, Levitsky found that freshmen ate 174 calories more each day than they expended and reported that students ate more (i.e. finished the large portions) served in the cafeteria in the college setting (Levitsky, Halbmaier, Mrdjenovic, 2004, p1439) than before attending college.

Of 231 participants who dieted at the University of Arizona, Nichter and colleagues found 31% of these students reported that their diet lasted less than one week, 23% reported diets lasting from 7 to 14 days, 25% from 15 to 31 days, and 18% of the participants reported dieting for about a month (Nichter et al. 1995, pp156-157).

Among racial groups attending college, 85.8% of Black Female students believed that first year weight gain is common compared with 94.6% of white female

students; however, Black females were less concerned about that potential weight gain than white students (Webb et al., 2013, p246). Most recently, overweight black female students have shown increasing concern about weight gain freshmen year and the explanation for this possible ideological shift for black females, away from the curvaceous body shape to a thinner ideal, may be because of new role models like Michelle Obama and Jennifer Hudson (Webb et al. 2013, p247).

In a study by Blow and colleagues (2014) body dissatisfaction among Hispanic female college students was predicted but no association was found in Latin women across BMI categories (Blow et al, 2014, p3). Latin participants were highly accurate in self-reporting weight and even those in higher weight categories were aware of the dichotomy between their real and ideal weight and were not upset when receiving accurate feedback on their weight from researchers (Blow et al. 2014).

Regarding portions estimation on the campus, Burger looked at the relationships between BMI and portion estimation, measured by the participant as a typical amount of food they would select and eat (Burger, Kern, Coleman, 2007, p611). BMI was found to be a strong predictor of choosing larger than recommended amounts of food by participants and suggests that persons with a higher BMI may view a larger portion as typical (Burger et al., 2007, p617).

Mook and Votaw asked college students to respond to:

“I usually stop eating when”.... and then choose one of the following responses:

Everyone else is finished (the social alternative);

I’ve had all I’m allowed (restrained choice);

The food stops tasting good (the hedonic response);

The food is all gone (the externality option);

A write in option for half the participants

or I feel full. (Mook, Votaw, 1992, p71).

The reason given most often was I feel full, but whether these college students were dieters or non-dieters is not known.

## **Psychological Constructs of Awareness, Mindfulness and Impulsivity on the University Campus**

Lowe and his Drexel team hypothesized that there may be a difference between the behaviors involved in Dieting to lose weight and Dieting to avoid gaining weight on the campus and believe that 20% of individuals who say they are currently dieting are doing so to prevent weight gain (Goldstein, Katterman, Lowe, 2013,p237). Lowe and team also believe that restrained eaters do not eat less than unrestrained eaters in the natural environment (Goldstein et al. 2013p237).

The psychological tenets of awareness, mindfulness and impulsivity are personality traits that are associated with eating behavior on and outside the college campus. "Mindful eating is the process of being more aware of and less reactive to distressing thoughts about food, body and shape and overwhelming emotions about food (Albers, 2011,p98)." Impulsivity is a personality trait that can be a causal behavioral factor regarding eating behaviors (Guerrieri, Nederkoorn, Schrooten, Martjin, Jansen,2009,p93).

Mindfulness is a psychological construct that can be used as a strategy to address 'mindless' overconsumption and healthy eating (Tapper, Shaw, Ilsley, Hill, Bonk, Moore, 2009). For dieters or students with an Early Family Eating Behavior

history, 'being aware of the urge to restrict before acting on it she could more accurately identify her feelings and respond with more adaptive coping skills (Albers,2011,p102).' "Despite my fear of life without proportioned food and nutrition labels, I didn't lose control. I didn't regain all the weight I'd lost. I now know it is possible to jump off the diet food train unscathed (Fard,2013,pD3)." Those engaged in higher levels of mindful eating were more likely to abstain from readily available energy dense foods like ice cream and less likely to snack without noticing (Beshara,Hutchinson,Wilson, 2013,p28).

Impulsivity is of importance in understanding how individuals who are sensitive to rewards are likely to have more pronounced neural images to appetizing food and why high-impulsive normal weight women were shown to have significantly more of such images than low-impulsive women (Guerrieri et al. 2009p93). The counter-regulation experienced by "Restrained Eaters" may be linked to impulsivity because overconsumption of a preload acts as a disinhibitor for restrained eaters (Guerrieri et al. 2009p94). Lowe has theorized that restraint and dieting are different factors that have different effects on eating behavior (Lowe, 1993). Guerrieri and team influenced food intake by inducing impulsivity by a cognitive method called priming and in a second study, a behavioral training method. The 'priming' of participants with an impulsivity manipulations increased calorie consumption when compared to 'inhibiting' participants and supported a causal link between impulsivity and overeating (Guerrieri et al. 2009, p95). Their research supports Lowe's theory that Restraint and dieting are different concepts that affect eating regulation in different ways (Guerrieri et al. 209, p99. The behavior that

explained participant responses in their study was whether they were on a diet, not whether they were restrained (Guerrieri et al. 2009, p99).

The results of these psychological constructs may explain impulse to over eating and obesity. Guerrieri and colleagues believe that impulsivity may even 'cause' overeating (Guerrieri, et al. 2009,p100). And for those who engage in 'Mindful Eating', the validity of their appetite sensations in response to a test meal predicted individual spontaneous energy intake and body weight loss (Drapeau, King, Hetherington,Doucet, Blundell, Tremblay, 2007 p165).

## **Hunger, Satiation and Dieting**

"Appetite can be divided into three components, hunger, satiation and satiety, where hunger describes the sensations that promote eating, and as that eating continues, hunger subsides and satiation, the sensation that controls meal size and duration dominates (Mattes, Hollis, Hayes, Stunkard, 2005, pS87)."

Hunger should be considered as the primary reason for the initiation of eating, but the immediate presence or perception of hunger is not a prerequisite for humans to start eating (Tuomisto, Tuomisto, Hetherington, Lappalainen, 1998). Others have labeled hunger as the body's need for food (Polivy, Herman, 1983) and the definition of satiation as "a complex of sensations which impel the organism to stop eating because hunger and appetite have been satisfied, even though food is still available (Wagner, Hewitt, 1975, p344)." In 1971 Stunkard and Fox wrote that what most people defined hunger was a judgment as to "whether they wanted to eat, what they wanted to eat and the probability of that eating behavior addressing their

needs, plus physiological abdominal internal sensations like growls, pangs or emptiness (Stunkard, Fox, 1971, p123)". Stunkard, in 1975, defined hunger as "when nutrients, restored by a meal are again depleted, and satiety as a conditioned reflex controlled by sensory correlates of eating (Stunkard, 1975, p383)". Tuomisto and team concluded that the majority of eating situations are initiated because of external factors like time of day and not hunger, and cognitions were the main reasons for cessation of eating, not satiety (Tuomisto et al.1998, p220). An external focus on issues other than food choices such as attentional resources may cause persons to miss key signals of satiety and how hungry we are (Ferdman, 2014).

"Although hunger may be on the opposite end of a scale of appetite sensation from satiation or satiety, one is not merely the absence of the other (Mattes et al. 2005, pS87)". Hilde Bruch believed that the physiological symptoms characteristic of food deprivation are not labeled "hunger" by the obese (Bruch, 1973) and that "food was closely intermingled with interpersonal and emotional experiences so that its physiological and psychological aspects cannot be strictly differentiated (Bruch, 1973, p5)." In 1972, Meyer and Pudiel wrote that overweight was a "simple problem of the balance between intake and output (Meyer, Pudiel, 1972, p305), but that balance depends on the accurate sensing of the amounts one eats each day. Nonetheless, verbally-based hunger measures more adequately reflected the experience of hunger in normal weight persons (Lowe, Friedman, Mattes, Kopyt, Gayda, 2000, p573).

Though hunger refers to the state or level that disposes one to food consumption and possibly is based on nutrient depletion (Stunkard, 1975), hunger

is not an all-or-none state but is discerned by levels (Kissileff, VanItallie, 1982, p373). Hunger is associated with an “internal state of nutrient depletion or repletion” but the role hunger plays in the timing or amount of food eaten is still unclear (DeCastro, Elmore, 1988, p159), especially in the food choices made by chronic dieters. “The denial of hunger occurs in persons with a conflict over eating who are simultaneously subjected to strong social pressures (Stunkard, 1959, p288)”.

Dieting per se produces (or demands) an inability or unwillingness to be guided by one’s internal signals, especially as they bear on whether to, or how much to eat (Herman, Olmstead, Polivy, 1983, p932). Those internal signals are gastric distention, contraction, rumbling, gurgling and are not consistently utilized by the overweight or obese who are more sensitive to external signals like taste, the sight or the smell of food and the time of day, for eating initiation (Wagner, Hewitt, 1975). Simply being exposed to food can increase the amount consumed and may encourage snacking behavior, variability in eating habits, and disinhibited eating, all associated with increased energy intake, overweight and weight gain (Ferriday, Brunstrom, 2011). “This cognitive/intentional regulation eventually results in dieters’ losing access to the natural physiological signals of hunger and satiety; thus it would not be surprising if dieters were uncertain of their hunger and correspondingly strongly affected by attentional manipulations (Herman, Fitzgerald, Polivy, 2003, pp 15-16).”

Hunger ratings often fail to correlate with energy intake (Mattes, 1990). In 1959, Stunkard reported that obese women consistently denied feelings of hunger

and reported hunger differentially than non-dieting normal weight women (Stunkard, 1959). “Under most circumstances, dieters eat little; thus they are probably hungry much of the time, which may explain why they don’t simply use hunger as a cue for when and how much to eat—they can’t afford to (Polivy, Herman, 1983, pp153-154)”.

The physiological regulation of the tuning of the sensations of hunger and fullness had been thought to be responsible for eating itself (Blundell, 2006) but this does not explain the number of overweight dieters who do not eat when hungry and often eat well beyond satiation. Meyer and Pudal found that ingestive research was focused on the “overdependence of appetite on external cues: the prolonged and distorted feed-back (satiety); the possible early conditioning (EFEB) to a higher satiety level (Meyer, Pudal, 1972, p305). “Unlike [normal eaters], the subjective report of hunger in the obese appears to be relatively independent of food deprivation and of gastric motility (Pliner, 1974, p25).” The average caloric intake of normal subjects was related to their height and weight but in obese subjects no relationship between intake and height was found (Meyer et al. 1972,p307). The amount of food eaten varies by gender as women reported stopping eating because the food stopped tasting good while men stopped eating because the food was gone (Tuomisto et al. 1998, pp211-212).

Hunger and satiety are both behavioral and physiological sensations that, ideally, are used for choosing what, when and how much to consume (Polivy et al.1983). “Satiety refers to a subjective feeling of an absence of the motivation to eat (de Graff, 2011, p778).” Booth defined satiety as a response to stimuli



distinctive to states created by eating, whether physiological, cultural, interpersonal, or sensed (Booth, 2009, p745). Westenhoefer hypothesized that an impairment of the satiation process may result in chronic overeating once cognitive control by dieting (external) is no longer in effect (Westenhoefer, Pudel, Maus, 1990) and this is demonstrated by overweight women who often eat more calories than they require to be satiated during the cyclical times when they are not dieting, hence their weight regain (Polivy et al, 1983, p178). Healthy non-dieting research volunteers who were given a high protein test breakfast did not equate the high calorie high protein breakfast as reducing their hunger or increasing their satiety (van der Klaaw, Keogh, Henning, Trowse, Dhillon, Ghater, Farooqi, 2013 p1605). Cohen and Farley described the eating behavior of chronic dieters, where “effort is not required to continue eating when food is present; effort is required to refrain from eating when food is present (Cohen, Farley et al. 2008, p3)”.

The dieter who consistently fails at dieting by regaining lost weight (Farley, Cohen, 2005 p154) has a more positive attitude toward palatable food and experiences greater difficulty in refraining from eating it (Papies, Stroebe, Aarts, 2009; Houben, Roefs, Jansen, 2010). Since dieting, by definition, demands ignoring one’s hunger and satiety signals as to whether to start to eat or how much to eat, dieting dissociates eating from normal hunger and satiety and creates a form of artificial regulation (Polivy, Herman, 1983, p127). And restrained eating behavior is cognitive in nature as one decides to diet, (Polivy, 1976, p238) but because of the chronic hunger experienced and reported by dieters, these diets are often a bridge to the overconsumption of palatable foods. “Dieters who are more “external”

(because of genetics or behavioral eating development) are prone to overeat [necessitating dieting and the consequent hunger stage] (Herman, Polivy, 2008, p727)". And weight loss diets do not simply fail, they eventually fail after initially succeeding (Polivy, Herman, 1999). "This suggests that in a country facing a battle with obesity, a seemingly constant interest in dieting can be counterproductive (Ferdman, 2014, pD1)."

Polivy and Herman wrote, "instead of eating when they are hungry and abstaining when sated, dieters seem to eat for various cognitive or emotional reasons." (Polivy, Herman, 1983, p153)" Dietary restraint was a significant predictor of how much food was eaten at lunch and the presentation of a large portion to restrained subjects served as an environmental trigger that counteracted self-imposed cognitive control over portions selected (Kral, Roe, Rolls, 2004, p968). Restrained eaters who routinely attempt to restrict their daily food intake more often overeat than they sustain their diet regimen (Polivy, Herman, 1999).

Since restrained overweight dieters consistently report that they are often hungry or thinking about food (Lowe, Friedman, Mattes, Kopyt, Gayda, 2000; Polivy, 1976, Nisbett, 1968) lost weight is regained because of a lack of a relationship between the dieter's pattern of eating and sensations of hunger and satiation (Barkeling, King, Naslund, Blundell, 2007). Dieters deliberately restrict their food intake to lose weight and then they develop a dependence on cognitive regulatory mechanisms like explicit prescriptive diets and thus do not have access to natural physiological signals of hunger and satiety (Herman, Fitzgerald, Polivy, 2003p15). In focus group discussions with dieters, hunger and fullness are typically described

as polar opposites, experiencing one sensation means total absence of the other (Murray, Vickers, 2009).

Chronic dieters do not report getting more pleasure from food when eating (Snyder, Bartoshuk, 2008), but they tend to eat in a disinhibited fashion, as a defensive strategy to avoid the constant hunger that accompanies dieting (Polivy, Herman, 1992; Polivy et al, 1983, p21). Moreover, it appears that if women are gaining and regaining weight, they are eating beyond hunger and satiation signals and consuming more than the calories needed by their body (Houben, Roefs, Jansen, 2010). People today have more control over what they choose to eat than how much they choose to eat (Ludwig et al. 2014, p6).

Differences in rating hunger and satiety sensations between dieters and non-dieters were reported by Polivy Herman, Hackett and Kuleshnyk in the late '80s when comparing preloaded unrestrained eaters with preloaded restrained controls (Polivy, Herman, Hackett, Kuleshnyk, 1986, p1259). Until "feeling fuller after every meal lowers energy intake" (Booth, Nouwen, 2010, p718) and the awareness of that satiety affects consumption, the prevalence of overweight persons will continue to grow along with the number of dieters. Mindful eating may be the approach that assists dieters as they cope with food restriction (Albers, 2011, p105).

## **Portions**

The sensations of hunger and satiation are separate constructs from portion estimation in the overweight and obese (Hirschmann, Munter, 1988). Because dieters have relied on their diet adviser to define their portions, they lack a paradigm to determine for themselves how much and what to eat (Normandi, Roark, 1998,

p54). Cohen and Farley suggest that dieters are not aware of how much they are eating and did not acknowledge that portions they were given were really large and not normal size (Cohen, Farley, 2008).

When assessing portions, one takes the size given as an indicator of what one should eat in someone's estimation (Herman, Polivy, 2008) at a single sitting (Schwartz, Byrd-Bredbenner, 2006, p1412). This follows the same external structure as a diet if portions are determined by others and permission to eat these amounts can be done without reflection or focus.

Increased portion sizes from pre-packaged foods to restaurant portions may also now be perceived as the appropriate amount to eat (Schwartz, et.al, 2006p1412; Young, Nestle, 2002, p247) and has created a normalization of high calorie intake (Davis, Curtis, Tweed, Patte, 2007, p171). Cues suggesting appropriate amounts to eat are needed by dieters because they do not have a clear sense of how hungry or sated they are, except at the extremes of those sensations (Herman, Polivy, 2008, p727). Normative and sensory food cues are part of the class of external stimuli (Herman, Polivy, 2008p726) that have a stronger effect on obese and dieting individuals than on others (Herman, Polivy, 2008). "Normative cues refer to environmental indicators of what or much one should eat but sensory cues refer to properties of the food that make one more (or less) likely to eat it (Herman, Polivy, 2008, p725)".

This behavioral disconnect between the portions selected and physical hunger and fullness sensations is supported by research examining the size of the plate as the determinant factor in the amount chosen for consumption (Hevrdejs, 2011,

pD7). Thus far, portion estimation has not been shown to be an effective strategy for determining the amount of a desired food to consume (Bolland, Yuhas, Bolland, 1988) given that portions are both over and underestimated in food diaries, especially by obese women (Lansky, Brownell, 1982; Zegman, 1984). Serious errors were found in portion estimation, even among those actively involved in a formal diet program (Blake, Guthrie, Smiciklas-Wright, 1989).

In lower economic communities, female WIC participants reported having problems estimating accurate portions and serving sizes (Webb, Yuhas, 1988) suggesting that without having a hunger and satiation behavioral paradigm, women could underestimate portions and overeat certain foods unintentionally. For example, WIC mothers correctly rated the portion sizes of cottage cheese and corn flakes, but were highly inaccurate when it came to measuring potato chip servings (Webb, Yuhas, 1988). The resulting recommendation was visual (external) portion education to improve portion estimation (Webb et al. 1988) when the response should have been hunger/ satiation training. Similarly, obese four year olds in New Britain, Connecticut, attending an Early Childhood Collaborative through the local school system, were educated on healthy foods to choose, but were not given instructions on determining or estimating a healthy portion, or on hunger/satiety tenets (Koenig, 2011, p4). A second program in the same community involved using motivational interviewing methods to include the entire family in teaching 'healthy eating', but this program is also without the hunger/fullness portion component (Whipple, 2011, pp1, 3). A National strategy is needed to improve food scarcity and prevent obesity in lower income communities, and must include a

revision in the SNAP program recommendations which prevents hunger through food quantity but does not always include healthy options to families (Ludwig, Blumenthal, Willet, 2012, p2568).

Media reports acknowledge that Americans are not accurate portion estimators when choosing appropriate amounts of foods to consume and or how full they will be. This issue was illustrated when life size pictures of foods were shown to participants in New Britain, Connecticut. The resulting newspaper article titled "100 Calories: What does that look like?" (Hevrdejs, 2011) affirmed that most people cannot estimate portions correctly, even if they know the calorie amount. Wansink believed that people of all sizes have difficulty estimating calories from large portions (Wansink, 2010). Brunstrom found that normal weight persons could quantify satiation for familiar foods, but he acknowledged that he did not know why they made those decisions (Brunstrom, Collingwood, Rogers, 2010; Brunstrom, Shakeshaft, Scott-Samuel, 2008). When normal weight persons were asked to use a computer picture to choose how long an amount of food would appease hunger, it was found that as participants became more familiar with the foods chosen, they became more precise about their expected satiation (Brunstrom, Shakeshaft, Scott-Samuel, 2008; Brunstrom, Shakeshaft, Alexander, 2010). Ueland investigated whether telling research participants that a portion was half the size of a normal portion, a normal portion or a portion and a half, would change satiation ratings but the results showed no effect of portion size information on satiation ratings or on food intake (Ueland, Cardello, Merrill, Lesher, 2009) though hunger ratings did change post prandial (Ueland et al, 2009).

Bernstein and colleagues reported that normal weight persons appropriately ate larger amounts without time cues and increased intervals between meals, but their study did not include overweight or obese persons (Bernstein, Zimmerman, Czeisler, Weitzman, 1981). Schachter found that normal weight individuals also responded appropriately to time manipulations, but obese individuals overate just because they “thought” it was mealtime (Schachter, Gross, 1968).

Linking an internal control of ‘appropriate awareness’ of portions may be a solution to current overweight and obesity levels in those still struggling with their weight. Jean Nidetch, the founder of Weight Watchers, the first large-scale diet group to define what one was allowed and how much to consume thirty-seven years ago, noted at age 87, “but I’m in control of the fork (Sortal, 2011, ppD1, D3).” Today this equates to a shift in ideology for her, from following the rules of a diet to being in control of what and how much she chooses to consume. “Future studies should attempt to examine portion size reduction in a more realistic setting and with prolonged exposure to smaller portions” (Lewis, Ahern, Solis-Trapala, Walker, Reimann, Gribble, Jebb, 2015, p1369). “Higher energy intake at lunch would not be problematic if people spontaneously reduced their intake at other meals (French, Mitchell, Wolfson, Harnack, Jeffery, Gerlach Blundell, Pentel, 2014, p1400).” “A new strategy must be developed to help women return to a normal weight, safely and permanently, not by dieting, but by recognizing hunger and appetite and responding to them (Orbach, 2009, p13).”

## Compensation

Compensation Research conducted by Hirschmann and Munter (1988) suggests that non-dieting normal eaters take control over their food consumption by acknowledging that outside forces do not know how much they should eat, and no matter how large the portion served, they often do not finish all the food on their plate as a behavioral method not to gain weight (Hirschmann, Munter, 1988). Strategies for compensating for larger portions eaten by normal eaters include waiting to eat again until one is comfortably hungry, not just because it is time for a meal (Normandi, Roark, 1998).

It is possible that the concept of compensation is a solution revolving around the awareness behavior that is used by those with a healthy BMI. 'Examining the role of pre-consumption decision making [mindfulness] in explaining the influence that portion size has on energy intake is now warranted (Robinson, te Raa, Hardman, 2015 p89)'. An example of compensatory behavior is reported by French and colleagues, "Higher energy intake at lunch would not be problematic if people spontaneously reduced their intake at other meals (French, Mitchell, Wolfson, Harnack, Jeffery, Gerlach Blundell, Pentel, 2014, p1400)."

Compensation is a direct outcome of being mindful of ones eating, therefore, shifting towards utilizing learned and trustworthy satiety to control food intake and body weight may be the solution to our current overeating epidemic (de Graaf, 2011, p778). Thin individuals who are resistant to gaining weight are more adept at sensing excess calories eaten and make appropriate changes in later ad libitum



intake, but the overweight and obese do not sense extra calories eaten nor compensate at later meals (Corneir, Grunwald, Johnson, Bessesen, 2004, p254).

Educational strategies that teach the behavioral concept of satiety to decrease energy intake and curb overconsumption at a meal are recommended (Williams, Roe, Rolls, 2014, p322), but may not go far enough to effect long term change. A more global concept of compensation [delaying the initiation of eating until feeling hunger sensations] would be an effective methodology to address the return to a natural weight (Hirschmann, Munter, 1988) leading to an internal awareness of hunger and fullness sensations for daily food consumption.

## **Race**

Beliefs about “acceptable weight” vary by both gender and race/ethnicity (Flegal et al. 2010). Race/ethnicity may reflect socio-cultural factors where some groups are more accepting of larger body size and higher weight is valued as a positive sign of health in populations where there has been a history of scarcity (Chang, Christakis, 2003) and where hierarchies have been maintained over differential control and access to food (Counihan, 1999). Atlas and colleagues found no correlation between race and SES and eating behavior at college and concluded that SES was not an important influence on eating disorder risk, neither within nor across race (Atlas, Smith, Holstein, McCarthy, Kroll, 2002, p332). But Frank Hu concludes that “declining diet quality over time may actually widen the gap between the poor and the rich (Tanner, 2014, p7).”

A sense of control was thought to be a mediating factor between educational attainment and quality of diet since women of lower educational attainment tended

to feel more out of control of their lives in general and in food choices particularly (Barker et al. 2009). The incidence of obesity differed by educational level and income in American women in 1977 (Garn, Bailey, Cole, Higgins, 1977, p725) and as was the case at this writing.

There have been consistent increases in BMI in all racial groups and annual variation by race/ethnicity with Asians having the slowest annual BMI increases. In an analysis conducted by Krueger and colleagues, Hispanics showed the most rapid annual increases in BMI and the level of increase in BMI in both blacks and whites fell between the category of the BMI's of the Asians and Hispanics (Krueger, Coleman-Minahan, Rooks, 2014 p1744). Asian Americans, in a study by Gee and colleagues, were, as follows, 65% normal weight or underweight, 27% overweight, and 9% obese (Gee, Ro, Gavin, Takeuchi, 2008, p495).

Black women have consistently been reported to have the highest obesity rate of any Americans with four of five black women estimated to have a BMI in the overweight category (Anderson, 2012, p16). Moreover, in studies of overweight and obesity conducted by James, 69% of African American women were in either the overweight or obese category (James, 2003,p1360); similarly Belleck found that 50% of African American women were in the obese category (Belleck, 2010, pA30). To date, it appears as if there has been no culturally relevant method for black women to reverse this trend of weight gains should they desire to do so (Domel, Alford, Cattlett, Rodriguez, Gench, 1992, p347).

Significantly, when shown body figures to compare with their own shape, only 25% of white women were satisfied with their current body image compared with

more than 50% of African American women (Becker, Yanek, Koffman, Bronner, 1999, p381). When a church weight loss intervention was attempted for adolescent African American girls who were severely overweight, enrolling the girls in the program proved a significant challenge with limited results (Resnicow, Taylor, Baskin, McCarty, 2005, p1745). Underreporting energy intake by African American preadolescence girls was investigated and found to correlate with higher BMI, increased age, disordered or unhealthy eating behaviors and self-efficacy for healthy eating but also higher levels of restrained eating (Lanctot, Klesges, Stockton, Klesges, 2008, pp1410-1411). Environmental and cultural factors like self-expression through food and eating may be responsible because of today's availability of food as well as the lesser stigma of obesity on the beauty ideals of women of color (Kumanyika, 1998; Hargreaves, Schlundt, Buchowski, 2002, p134).

Black women were less focused on dieting for weight loss than white women and were more accepting of being overweight than white women (Kumanyika, Wilson, Guilford-Davenport, 1993p416). Moreover, African American women were less likely to participate in weight loss programs (Davis, Clark, Carrese, Gary, Cooper, 2005, p1539) though Davis's group unexpectedly found that the African American women in their study were dissatisfied with being overweight (Davis. et al. 2005, p1542).

If Black women do participate in diet behaviors, they tend to lose less weight than whites when engaged in the same weight loss interventions (Wang, You, Lenchik, Nicklas, 2010; Davis et al. 2005), and black women were found to stay on

diets for a shorter time period than white women (Kumaniyaka, 1998). When enrolled in weight loss programs, black women are less successful than whites in losing weight, both in the short and long term (Kumanayaka, Obarzanek, Stevens, Hebert, Whelton, 1991, p16345). Black women, because they are more satisfied with their bodies, are less likely to diet compared to white women whose desire to be thinner is a motivating factor for dieting (Sobal, Stunkard, 1989; Story, French, Resnick, Blum, 1995). Black women were also less likely to perceive themselves as overweight when compared to white women (Dawson, 1988, p1327).

An explanation for Black women's acceptance of a larger body may be because African-American men are reported to prefer a woman of heavier body size and with more curves than white males do (Freedman, Carter, Sbrocco, Gray, 2004). The majority of lean African American men preferred the body image of an overweight woman when surveyed (Gilliard, Lackland, Mountford, Egan, 2007; Atlas et al. 2002p333). This male preference for a larger woman may explain the reduced motivation for women of color to attempt to diet and explain why women of color were more accepting of their own larger, overweight body than their white counterparts (Dacosta, Wilson, 1996, p189). A group of obese black women complained to an interviewer about "how hard it is to keep this weight on (Brown, 2007, p186)." A black female professor had to resist her professorial husband's exhortations not to lose "the sugar down below" when she started a new diet (Randal, 2012, p5). "How many middle-aged white women fear their husbands will find them less attractive if their weight drops below 200 pounds? (Randal, 2012, p5)."

African-American college women reported that they expected less life improvement from becoming thin than white female students (Atlas, Smith, Hohlstein, McCarthy, Kroll, 2002; Fitzgibbon, Stolley, Schiffer, Sharp, Singh, Dyer, 2010; Zhang, Wang, 2004). When compared, overweight black women's self-esteem was rated higher than average size white women's self-esteem (Anderson, 2012). And the acceptance of a larger body image as the norm by lower income women may be internalized by their childhood (Franko, Thompson, Russell, Schreiber, Crawford, Daniels, Striegel-Moore, 2005) potentially creating the next generation of overweight persons of color. Additionally, "do the food preferences of today's young black woman reflect her own likes and dislikes or those of older black women in her family (Dacosta et al. 1996, p190)?"

In many Hispanic communities, obesity is often blamed on the over consumption of cheap unhealthy food but the answer is not to deprive themselves of foods they are accustomed to, but eat them in moderation (Acevedo, 2005, pA7). The trend of increases in the numbers of overweight and obese Mexican-Americans persists (Carrera, Gao, Tucker, 2007, p1737) however, research by Carrera and colleagues suggests that this prevalence is not wholly explained by dietary choices (Carrera et al. 2014, p1740). Lower-income women of all racial/ethnic groups are more likely to be obese (Scheier, 2005).

## **Social Economic Status**

Social economic status (SES) has been found to influence obesity and obesity has been found to influence SES (Sobal, 1991, p236). "One's place in the social system is revealed by what, how much and with whom one eats and these

differential consumption patterns are some of the ways the rich distinguish themselves from the poor (Counihan, 1999, p8).” Socioeconomic status is inversely related to body weight and the risk for overweight and obesity in women (Ball, Mishra, Crawford, 2002) and it has been found the amount of calories eaten increases as the level of SES declines (Sobol, Stunkard, 1989).

The cultural variations in preferred body images may be based on our historical survival in times of food shortages and where famine was a constant threat (Polivy, Herman, 2006). “For most citizens of the world today, as it has been in the past, the possibility of obesity is remote, whereas the possibility of hunger is close to home (Brown, 2007, p179).” Having surplus food became associated with rank and respect as countries developed economically and obesity became a sign of health and wealth (Sobal et al. 1989).

Dietary restraint may be the explanatory factor in the SES differences in weight categories (Wardle, Robb, Johnson, Griffith, Brunner, Power, Tovee, 2004 p276) and “the most important variable mediating the relationship between SES and obesity (Sobal et al, 1989 p268)”. In America, 20 million people are hungry because they are on a serious calorie reduction diet where many of these individuals are middle class or higher and most are women (Brown, 2007). There are another 20 million people who are hungry because they lack the economic access to purchase enough food to sustain themselves, suggesting that in the US, both voluntary and involuntary hunger are present (Brown, 2007, p179). The meaning of eating may vary by contextual factors related to culture and ethnicity (McClain, Pentz, Nguyen-Rodriguez, Shin, Riggs, Spruijt-Metz, 2011) and levels of cultural affluence mean

that even the poor have access to enough food to become obese (Brown, Konner, 1987, p29).

## **Socio-Cultural and Familial Effects On Childhood Obesity**

Educational attainment has been associated with dietary quality and healthier eating in women (Robinson, Crozier, Borland, Hammond, Barker, Inskip, 2004) and the ability to model healthy eating to their children (Barker, Lawrence, Crozier, Robinson, Baird, Margetts, Cooper, The Food Choice Group, 2009). Educational levels are a marker for income, and having less economic success makes it more difficult to eat for health and restricts food selection options and may make the foods chosen through necessity, less enjoyable (Barker, Lawrence, Woadden, Crozier, Skinner, 2008, p465).

Research with Latino children conducted by Kaiser and colleagues (1999) attempted to assess intake by the selection of certain foods and serving sizes. The children were asked by their parents to adjust their energy intake in their second course based on caloric content for their first course. Those children who did not adjust their meal intake were significantly heavier than those children who did (Kaiser, Martinez, Harwood, Garcia, 1999) and children whose intake was overly controlled by their parents did not compensate as well as children whose parents were less controlling over their food selections (Kaiser et al. 1999).

The increase in the obesity rate of urban children in Hartford, Connecticut has been linked to food insecurity and a limited access to healthy food (De La Torre, 2013, pB1) by families, but parental control may also be explanatory regarding their children's extra weight. The fear of being too thin, which may be explanatory for the

increase in childhood overweight and obesity rates among African Americans, has been frequently cited in the research literature (Kumanyika, Gary, Lancaster, Samuel-Hodge, Banks-Wallace, Beech, Hughes-Halbert, Karanja, Odoms-Young, Prewitt, Whitt-Glover, 2005, p2043). In Connecticut, CDC findings report food restriction was higher in ninth grade Hispanic teens (11.9%) compared to African American teen (8.4%) and white teens (8.0%) (Olivero, 2014, B3).

In a study conducted by Olvera and colleagues (2005), the cultural emphasis on thinness for Hispanic girls was associated with body dissatisfaction and food restriction (dieting) and was, on occasion, based on the mother's perception of the daughter's actual body size in relation to an ideal one (Olvera, Suminski, Powers, 2005, p1975).

In Connecticut, the state obesity rate is 18.2%, but one in four Latino third graders are considered obese compared with 22.5% non-Hispanic black third graders and 12.4% non-Hispanic whites (Levinson, 2013, p5). In New Britain, Connecticut, students had four times (39%) the National rate of obesity or overweight for children (Storace, 2014, p3). Preschool children's obesity rate for those living in poverty demonstrated a modest improvement from 2003 to 2010, compared to 13% of obese urban preschoolers in 1998, which then increased to 15% in 2003 but then dropped slightly below 15% by 2013 (Health News, 2013, pA6).



## **The Effect of Early Family Eating Behavior**

The rate of childhood obesity has increased about threefold over the past thirty years (Graziano, Lumsden, 2010, pA11) leaving a population of overweight youth who, if they follow the historical path of their peers, may become the next generation of overweight adults (Galloway, Farrow, Martz, 2010). At this writing, more than 30% of the youth in the US are overweight or obese (Abrahamsen, 2014, pA12) with the rate of obesity in children alone being reported at approximately 16.9% in 2009/2010 (McKay, 2012, pA3). However, excess weight in children is often not acknowledged by their parents (Health News, 2014, pA4). In 1988 to 1994, 61% of parents of overweight girls identified her as about the right weight and in 2005 to 2010 that number of overweight girls classified as normal weight by their parents increased to 78% (Health News, 2014pA6). In 1972, Stunkard found 29% of lower class six-year old girls were obese compared with 3% of upper class girls (Stunkard, d'Aquili, Fox, Filion, 1972, p580).

Pressure to eat by parents has been linked to a lower weight in teens, but restrictive feeding practice was positively related to a heavier body weight after adolescence (Galloway et al. 2010, p1330). As for high school students, Serdula reported that 44% of high school females were trying to lose weight and 26% were trying to avoid gaining weight (Serdula, Collins, Williamson, Anda, Pamuk, Byers, 1993, p668). There is a belief that in high school, adolescents may misperceive the norms and reasons for their peer's food consumption and over-estimate their consumption of snack foods and underestimate their consumption of fruits and

vegetables (Lally, Bartle, Wardle, 2011, p626) which may predispose them to a diet mentality just before attending college.

It is hypothesized that this increase in overweight youth may be linked to parental control over children's eating, which leads to overweight children who may remain overweight as adults. "For children, highly controlling approaches to child feeding may have unintended effects on children's eating by diminishing the effect to which children learn to use their own hunger and satiation cues to initiate and terminate eating (Carper, Fisher, Birch, 2000, pp 121-122)." Zocca and colleagues found that children and mothers exhibit similar and specific disinhibited eating behaviors that could reflect genetics or environmental influences (Zocca, Shomaker, Tanofsky-Kraff, Columbo, Raciti, Brady, Crocker, Ali, Matheson, Yanmovski, Yanovski, 2011 p331).

Eating in the absence of hunger has been found to be stable over time and is positively correlated with weight during childhood (Kral, Moore, Stunkard, Berkowitz, Stettler, Stallings, Tanaka, Kabay, Faith, 2010). "Parents who try to control what their children eat may find their efforts backfiring (Berg, 2004, p47)". Highly restrictive parents can create longer term negative eating behaviors like overeating in the absence of hunger and creating a preference for forbidden foods that are often eaten in large quantities (Gray, Janicke, Wistedt, Dumont-Driscoll, 2010, p333). Maternal criticism of daughters' eating or appearance, along with their daughters' perceptions of this criticism, was associated with a higher frequency of weight loss behavior by the girls (Baker, Whisman, Brownell, 2000, p380) and an earlier onset of that behavior. Girls as young as seven or eight, and commonly by

age eleven, were reported to be dieting so often that it is the norm for girls (Berg, 2004) as it is for their mothers (Benedikt, Wertheim, Love, 1998).

In research conducted by Leahey and colleagues (2011) one's chance of becoming obese increases by more than 50% if a friend becomes obese, and the odds of becoming obese increase by 40% if a sibling is obese leading to the conclusion that close social ties like partners, friends and family have a greater influence on obesity than geographically close social ties like coworkers or neighbors (Leahey, LaRose, Fava, Wing, 2011, p1160). Family and friends may be a source of role modeling and peer pressure for consuming high fat foods or for trying new foods (Inglis, Ball, Crawford, 2005). At meals eaten at home, a family member may claim fullness but parents and siblings may ask them to have dessert creating a complex system centered around satiation, but interlaced with other mealtime activities (Laurier, Wiggins, 2010).

Daughters' moderate weight-loss attempts and body dissatisfaction were significantly associated with their mothers wanting them to be thinner (Galloway et al, 2010). Moreover, these larger daughters reported that they were actively encouraged to lose weight by their mothers (Benedikt, Wertheim, Love, 1998). Girls as young as seven or eight, and commonly by age eleven, are dieting so often that dieting is as normative for these girls (Berg, 2004) as it is for their mothers. Even five year old girls were found to be influenced by maternal pressure on their eating behaviors and had knowledge about dieting and about weight control (Abramovitz, Birch, 2000) with 30% of them reporting moderate levels of dietary restraint (Carper et al.2000). Girls who were not overweight were still encouraged by their mothers

to diet to become thinner though the girls were at a healthy weight (Benedikt et al.1998, p53).

Controlling feeding practices by parents may increase a child's overeating and their ability to respond appropriately to hunger and satiety sensations (Harris, Mallan, Nambiar, Daniels, 2014, p519). Overt control over children's portions by parents often creates a child who no longer knows how to utilize their hunger and satiation sensations when eating, and this is especially true for girls (Fisher, Birch, 1999). "When parents give up control, trust the child, and provide patience, then the child is free to choose (Langone, 2004, pF8)". Controlling mothers had daughters who weighed more than those who did not control their daughter's eating (Brown, 2006; Cutting, Fisher, Grimm-Thomas, Birch, 1999) and tight control over a daughter's consumption actually promoted food consumption in girls (Fisher, Birch, 1999). To restore normal eating and interrupt the obesity epidemic for children, parents must give up the control over their child's eating and trust the child by stopping all diets and chaotic eating patterns (Langone, 2004; Birch, Fisher, Davison, 2003; Galloway et al, 2010). "In the absence of adults' attempts to impose external controls on eating, children are capable of adequate self-control of food intake (Birch, McPhee, Shoba, Steinberg, Krehbiel, 1987, p302)."

Schachter believed that emotional distress caused confusion in children which led them to equate hunger with that emotional distress (Schachter, 1968) but an additional aspect of his model could be the effect of parental control over children's eating. This may lead to an increase in emotional distress but also may interrupt hunger and satiation signals leading to excess weight (Birch, Fisher, Division, 2003;

Birch, Fisher, 2000). We theorize it may be because of mothers (or others in the family) who attempt to control their preteens or younger aged daughter's eating that forces this separation of sensations. Stunkard believed that the obese deny hunger sensations because of social pressures (Stunkard, 1959, p288) but these social pressures may have been caused by family members or most likely, maternal control over eating which created extreme guilt in the young girls who ate large amounts when not being controlled (Fisher, Birch, 1999).

Eating a meal when hungry and eating until full is normal for children because they are attuned with hunger and satiation signals and they aim to satisfy these needs successfully (Berg, 2004). "If they happen to overeat or under-eat, their bodies can be trusted to regulate calorie needs with caloric intake (Berg, 2004, p80)". If the mothers (or other family members) influence is found to be an important factor, this may be where the daughters' diet ideology begins as an unintended consequence of the mothers own lack of success at controlling her own weight (Schoenberg, Cheung, Finn, 2006).

## **Taster Status**

The ability to respond to both bitter and sweet tastes, and the association of the ability to taste with weight status is an important concept to address in ingestive research as the ability to perceive taste sensations significantly influences food choice (Snyder, Bartoshuk, 2009, p574).

## **Bitter Taste**

For bitter taste, the response categories for tasting are: non-taster, medium taster and super taster, and are physiologically based on the number of papillae on

the tongue (Tepper, Nurse, 1997). Supertasters often get intense pleasure from food and are also often considered fussy eaters (Reddy, 2013). No association had been found in the literature between restrained women, their BMI and their ability to respond to bitter taste "PROP status" (Keller, Tepper, 2004), but dietary restraint was believed to mask an association between restraint and tasting ability (Tepper, Ullrich, 1999). Female nontasters and medium tasters were found to be significantly heavier than supertasters who exhibited low dietary restraint, (Tepper, Ullrich, 2002) and supertasters tend to be leaner than the general population (Reddy, 2013) and supertasters had lower BMI's than medium or nontasters (Tepper et al. 1999, p234) therefore the ability to taste may be an important construct associated with the etiology of obesity in women. The PROP phenotype may play a role in the development and expression of food preferences that can influence dietary habits and weight status (Tepper, 1999) and the ability to taste this bitter (PROP) compound has been associated with women's food intake and their body weight (Tepper, Ullrich, 1999, p234).

The ability to discern taste varies within the oral senses, especially the intensity of bitter and sweet tastes (Bartoshuk, Duffy, Chapo, Fast, Yiee, Hoffman, Ko, Snyder, 2004) and perceived intensity ranges from a minimum threshold to maximum assessment (Bartoshuk, 2000). And regardless of concentration, temperature or stimulation method, sucrose was found consistently to be sweeter to tasters than nontasters (Gent, Bartoshuk, 1983, p271).

The ability to taste food is genetic, and is based on having recessive or dominant (or heterozygous) alleles that correlate with the intensity of the bitter

PROP 6-n-propylthiouracil (Bartoshuk, Duffy, Miller, 1994) and the genetic ability to taste various sweeteners as well (Faurion, Saito, MacLeod, 1980, p119). The ability to taste the bitter PROP compound is present in children as well and they can also be identified as tasters or non-tasters (Keller, Tepper, 2004). The response categories to bitter taste are: Non-Taster, Medium Taster, and Super Taster (Bartoshuk et al. 2004). The physiological explanation for tasting is in the number of papillae on the tongue tip; supertasters have the greatest number, a somewhat lesser amount for medium tasters, and the smallest amount is found in non-tasters (Tepper, Nurse, 1997). Women have been shown to be Super Tasters to PROP in the laboratory (Bartoshuk et al. 2004) where PROP is intensely bitter to supertasters and weak or tasteless to non-tasters (Duffy, Fast, Cohen, Chodos, Bartoshuk, 1999). The ability to sense bitter taste is thought to co-vary with BMI in women (Ullrich, Touger-Decker, O'Sullivan-Maillet, Tepper, 2004; Bartoshuk, personal communication, 2010).

The PROP paper holds 1.6 mg of PROP and was used to assess whether the 159 participants are super tasters, medium tasters or non-tasters on a 100mm labeled magnitude scale. Cut-offs for the categories are: Non-tasters  $\leq 15$ mm, medium tasters  $\geq 15$ mm--- $\leq 67$ mm, and supertasters  $\geq 67$ mm (Zhao, Kirkmeyer, Tepper, 2003, p630). Assessments can be calculated by percentiles, the highest 25% are supertasters, lowest 25% are non-tasters and the middle category are the middle tasters (Bartoshuk et al. 2004). These ratings were completed on a seven category gLMS rating scale anchored with Strongest Experienced Sensation of Any Kind, Very Strong, Strong, Moderate, Weak, Barely Detectable, (Zhao, 2003)

and No Sensation (Bartoshuk et al. 2004; Bartosuk, Personal Communication, 2011).

## **Sweet Taste**

Because an increasing proportion of our food consumption appears to be driven by pleasure and not just the need for calories (Lowe, Butryn, 2007), the ability to physically taste may be strongly associated with getting pleasure from the taste of that food. Burger noted that there is a correlation between obesity and sugar consumption; both conditions have increased over the past twenty years (Burger, Stice, 2014). A physical requirement for glucose, more than calories alone, may drive food intake (Hussain, Richardson, Holton, De Backer Buckley, Dhillon, Bewick, Zhang, Carling, Bloom, Gardiner, 2014, p9). And sugar sweetened beverage intake is linked to obesity and poor diet quality in the adolescents who consume soft drinks and who demonstrate less striatal brain activity when consuming palatable foods when compared to lean individuals; which may delay ending a meal if they are seeking previously experienced pleasure from food intake (Burger, Stice, 2014, p441). Brain activity on an MRI illustrated greater neural pleasure responses in oral somato-sensory on regions that were more sensitive both intake and anticipated intake to high fat/high sugar milkshakes and Coke (Burger et al. 2014, pp448-449). In a study by Latner and colleagues, women with a Binge Eating Disorder (BED) reported less enjoyment of their food and rated it less pleasant than controls. However, participants reported a greater prospective



consumption for their next meal, and a greater desire for dessert, than controls but less enjoyment for meals overall (Latner, Rosewall, Chisholm, 2008).

A liking for sweet taste may be a factor in eating behavior and weight status and increased energy intake from sugar sweetened beverages may be a factor in weight gain (Chen, Appel, Loria, Lin, Champgagne, Elmer, Ard, Mitchell, Batch, Svetkey, Caballero, 2009 p1299). NHANES results reflected that consumption for sugar sweetened beverages (SSB's) had increased for all demographic, body weight and weight loss groups with blacks having the highest per capita SSB consumption of all racial groups and this was significant for gender, race-ethnicity, education, income, weight status, and intention to lose (Bleich, Wang, Wang, Gortmaker, 2009, p374).

Do overweight and obese dieters have an affinity for sweet tastes in greater numbers than those who do not diet? This seems to be the case as shown in research conducted by Catenaci and colleagues reported that diet drinks and sweeteners may be a weight maintenance strategy for those who desire a sweet taste but do not want to gain weight as indicated by a sample of 207 females who said they use low calorie sweetened beverages:

	Number	%
To help me avoid gaining weight	36	17.4
So I can consume my calories elsewhere	27	13.0
To satisfy a craving for something sweet	25	12.19
To help me feel less hungry	21	10.1
To tide me over between meals	13	6.3
Before eating a meal in order to eat less	0	0.0

(Catenacci et al. 2014, p2249).

But the use of intense sweeteners like Aspartame may not possess the same satiating capacity as glucose and sucrose and may not reduce hunger or food intake (Rogers, Blundell, 1989, p1098; Tordoff, Alleva, 1990, p963) and nonnutritive sweeteners may actually increase hunger (Mattes, Popkin, 2009, p9) although there remains debate on this topic (Kahn, Sievenpiper, 2014). The effect of the potential satiating effects of artificial sweeteners compared with actual sugar and that effect on weight status is an issue for future research.

## **Eating in the Research Laboratory**

The laboratory is an environment that allows for the possible assessment of aspects of appetite and eating in a controlled circumstance outside participant's normal environment (Blundell, de Graaf, Finlayson, Halford, Hetherington, King, Stubbs, 2009). Laboratory eating can study appetite free from normal life intrusions, and, with control measures planned for, can isolate specific factors in order to study their effects on appetite without extraneous input (Blundell et al. 2009). The laboratory is a methodological platform with a specific tool kit that can be consistently used to obtain reliable results in diverse locations with greater precision than the natural setting (Blundell et al. 2009). Some subjects have reported that "eating alone in a laboratory setting is similar to eating alone in other environments (Kim, Kissileff, 1996, p38)". Research assessments can be accomplished by changing meal size, meal frequency or both (Spiegel, 1973, pp25, 26). If natural meal choices are available, the difficult task of constructing realistic foods is not needed (Meiselman, 1992) and the laboratory becomes more realistic venue for

participants. Additionally, the use of a fixed laboratory test meal can decrease social bias that might be found with an ad libitum test meal (Drapeau, King, Hetherington, Doucet, Blundell, Tremblay, 2007).

For consistency in studying food intake and to optimize the ability to replicate conditions participants should be given, the following factors should be present:

- A single meal consisting of a homogeneous course
- A consistent interval from the last meal eaten
- Constant size of last meal
- Eating alone in the laboratory
- No competing activities
- Reproducible instructions (written and read or taped)
- Minimal environmental variation
- No extraneous sounds
- No unusual visual stimuli
- No odors other than the food being served
- Elimination of time cues
- Use of common foods people normally eat
- Use of customary utensils (Kissileff, 1985, p957).

Since the laboratory is not the real world for participants, they may not act in same way in the research laboratory as they do in their home, cafeteria or restaurant. One criticism often verbalized by research participants is that the laboratory is a place where they are compelled to eat by formal instructions and this aspect of the digestive research paradigm is not at all similar to eating at home (Meiselman, 1992). Participants might be influenced by the instructions given by the staff or because of the research paradigm itself (Lowe, 1994) where eat a normal amount versus eat as much as you can may have influenced the amount eaten (Kissileff, 1989). Asking participants in the laboratory to choose a normal portion when they may not know what a normal portion looks like or feels like may also yield inconsistent results.

The physical sensations of laboratory hunger and satiation often do not equate with the mental ideas of hunger and fullness in focus group reports (Murray, Vickers, 2009). The reproducibility of hunger and satiation ratings in laboratory research is important to assess because within five to twenty minutes after a person begins a meal, satiation develops and eating would terminate and not occur again for several hours if these sensations work properly (Kissileff, 1984). Cognitive control, disinhibition, hunger assessments and BMI were not confounding effects in laboratory eating research (Hubel, Laessle, Lehrke, Jass, 2006,p62). If the aim of ingestive research is to control where, when and what is eaten, then the laboratory may not be the optimum site, but if the goal is to study the factors that affect how much people eat and when they stop eating, which is a vital component to controlling obesity in women, then the laboratory is an appropriate site to study eating behavior (Kissileff,1992).

### **Rating tools for the Laboratory**

We used two appetitive rating tools for our study, the SLIMSCALE, (see Appendix page 182) a Labeled Magnitude Scale and the Horizontal Appetite Rating Scale (see Appendix page 179) a Visual Analogue Scale. Studies of eating behavior in the laboratory using these types of rating scales to assess perceived appetite, hunger and fullness are considered valid indices of strength of appetite (Merrill, Kramer, Cardello, Schultz, 2002, p181).

A Labeled Magnitude Scale is based on 'category ratio' originally devised for the measurement of perceived exertion (Green,Dalton,Cowart,Shaffer,Rankin, Higgins,1996,p323). The SLIMSCALE is a ratio {LMS} scale that was designed for

magnitude estimation where sensations are scaled by having subjects assign numbers to each sensation in such a way that the ratio between assigned numbers is the same as the ratio between the sensations they represent (Green, Shaffer, Gilmore, 1993p683). This technique coupled with the use of a true zero point for null sensations, establishes a ratio scale for the data (Cardello, Schutz, Lesher, Merrill, 2005, p3). As a labeled magnitude scale, the SLIMSCALE places verbal labels of expressed intensity at specific locations on a linear graph and these are usually a phrase involving maximal or strongest imaginable as a fixed endpoint creating a sensory ruler (Cardello et al. 2005p3). There are adjacent modifiers that do not constitute perceptually equivalent intervals such as Extremely full and Very Full and Extremely Hungry and Very Hungry, and their placements on the assessment line is based on ratio units for comparison (Cardello et al. 2005, p5) and a LMS does not require the assumption are equally responsive to a comparison modality (Green, Shaffer, Gilmore, 1993, p698). The SLIMSCALE has equal or better reliability than Visual Analog Scales. The SLIMSCALE is positively correlated with bi-directional hunger-fullness (0.90) but negatively correlated with the unidirectional hunger (-.81) (Cardello et al.2005, p9). The continuous nature of the scale makes it amenable to encoding and allows for vertical or horizontal presentation (Cardello et al. 2005), and, because it is a ratio scale, the numerical mean can be calculated as a measure of central tendency.

The Horizontal Appetite Rating Scale we used was modeled after the visual analogue horizontal scale used by Dr. Harry Kissileff and his team at St. Lukes Roosevelt Center for Ingestive Research in 2005.

There is evidence in the literature that participants can differentiate hunger more easily than fullness on appetitive rating scales (Merrill, Kramer, Cardello, Schutz, 2002,p183). Using a VAS [horizontal versus a vertically oriented Labeled Magnitude Scale] may affect the validity and reliability of appetite ratings if there is a difference because of instrumentation [post-prandial] as reported by Flint, Raben, Blundell and Astrup (Flint, Raben, Blundell, Astrup, 2000 p46).

## **Chapter 3 – Methods**

### **The Study Protocol**

The purpose of this study was to test the hypothesis that dieters would have less variation between their pre- and post-prandial ratings than when compared with the non-dieters. The primary assumption was that dieters, because of their lack of familiarity in using hunger and satiation as a behavioral strategy to initiate or stop eating, would demonstrate less of a difference between their fasted and fed ratings than the non-dieters. This study examined whether dieters use hunger and satiation in the same way as non-dieters utilize these signals to guide their food intake and whether this is based on a reliance on formal dieting for the dieters' eating behaviors. We also examined the extent to which the family's early influence on their children's eating patterns had impacted students' current eating behavior. Additional analyses examined whether there was variation between the dieters and non-dieters in their BMI's and their Restraint scores.

### **Recruiting Participants**

Participants were recruited via classroom visits by researcher Braverman, from July 14<sup>th</sup>, 2014 at summer school classes and at Fall, 2014 courses through September 23<sup>rd</sup>, 2014 at Central Connecticut State University. Professors were contacted for permission to recruit in their classes. After an introduction, students were told that the study was focused on assessing eating behaviors of college women, and that it was being conducted as part of researcher Braverman's doctoral

dissertation. The message to potential participants was that this study would measure their feelings and reactions to foods before and after eating, using paper and pencil rating tools. Classes were told that participation is for females only because digestive research is most often completed with a female cohort. The consent process, procedures for assessing fasting and eating, and data collection forms were all briefly described and as well as inclusion and exclusion criteria. Potential participants were told that "You will not be able to participate in this study if you have food allergies to wheat, nuts of all kinds, cinnamon, soybean oil or palm oil, soy flour, egg yolks, apples; or medical conditions like Type I or Type II Diabetes, Hypoglycemia, known Eating Disorders, Graves' Disease, a suspected pregnancy, or an allergy to 6-n-Propylthiouracil which is a drug used to treat hyperthyroidism (Graves' Disease) by decreasing the amount of thyroid hormone produced by the thyroid gland and which will be used to measure your ability to discern a bitter taste". This information was reiterated before participants signed their consent form at their respective sessions.

Incentives for participating were brought to all recruiting sessions as a "Show and tell" and it was announced that all participants would receive:

1. A free one week pass to LA Fitness
2. A purse-sized flashlight in CCSU Blue
3. An extra incentive for joining the study in the form of entry into a lottery drawing for three winners who will receive tickets to attend Dr. Mehmet Oz' TV show in New York City, and cost of transportation by AMTRAK train to New York from Berlin, Connecticut (3% chance of winning, 3/100).



Contact Information Cards were distributed to interested students, completed and then collected by researcher Braverman during classroom recruiting. Students were told that these information cards would be used to schedule study participation and also would be used for the Dr. Oz Show lottery. Eating research sessions were scheduled by researcher Braverman by contacting interested students by telephone or email from data from these Contact Information Cards. When scheduling eating sessions, participants were told not to eat for two hours before their research session.

The exclusion criteria were communicated on all materials during recruitment and were reiterated just prior to when participants signed their Consent Forms. No interested participant was asked to be, or was, excluded from the study once enrolled.

## **Measures and Assessment Tools**

### **Demographic Information Questionnaire** (see Appendix Page 168)

The Demographic Information Questionnaire provided contact information for each participant, their class in college, their race/ethnicity from the State of Connecticut list of racial categories for Race, (Asian, Black, Hispanic or White) and the seven variables for the SES Composite score that were:

1. Participant's mother's level education
2. Participant's place of birth
3. The language spoken at home
4. Whether the family qualified for free or reduced lunch in elementary school
5. Whether the family has received food stamps
6. Do the female students receive financial aid?
7. Are they the first member of their family to attend college?

## **The Diet and Weight History Questionnaire**

(see Appendix Page 171)

We used information from the Diet and Weight History Questionnaire for participants' height, their self-reported weight, their history of weight cycling and whether they "Are you currently dieting to lose weight?" as done by Lowe and colleagues (Lowe, Timko, 2004, p202; Lowe, Kissileff, 2005). Data on the Early Family Eating Questionnaire provided the following information for the EFEB (Early Family Eating Behavior) construct:

1. Do you wish you weighed less than you currently do?
2. Is dieting common in your family?
3. How old were you when you went on your first diet?
4. How many dieters in your family
5. Who determined your portions as a child?
6. Who decides your portions currently?
7. Who decides what you eat each day?

The information for the EFEB Composite Score was taken from Lowe's Diet and Weight History Questionnaire (Lowe, Timko, 2004, p202; Lowe, Kissileff, 2005).

## **The Three Factor Eating Questionnaire**

(see Appendix Page 173)

The Three Factor Eating Questionnaire (Stunkard, Messick, 1985) was designed to measure three aspects of eating, (1) cognitive control (restrained eating and dieting) (2) disinhibition, where the dieter tries to maintain control of their eating over diet-disrupting influences that produce excess eating and a loss of control (Lowe, Kleifield, 1988, p161) and (3) a hunger construct since dieters must also ignore hunger signals to maintain weight loss efforts (McFarlane, Polivy, McCabe,

1999). The same scoring matrix used by Lowe and colleagues was used to assess restraint (Lowe, Kissileff, 2005) and a Restraint score greater than 10 equaled a Restraint assessment.

### **Hunger and Satiety Rating Tools**

(see Appendix Pages 179 - 182 )

The SLIMSCALE and the Horizontal Appetite Rating Scale were the two hunger and satiety rating tools used, given pre- and post-prandial to all participants. The SLIMSCALE is a labeled magnitude scale designed for magnitude estimation of hunger or fullness, anchored with the extremes of "Greatest Imaginable Fullness" and "Greatest Imaginable Hunger" with four categories on either side of a neutral midpoint of "Neither Hungry nor Full" (Cardello et al. 2005).

Our Horizontal Appetite Rating Scale is based on a series of visual analogue questions assessing hunger and satiety such as "How hungry are you? Rate the intensity of your hunger on the line" (Flint, Raben, Blundell, Astrup, 2000). Other questions include "How strong is your desire for eating your favorite food right now?" "How physically sick do you feel?" and a question rating feelings of anxiety. The 100mm horizontal lines were anchored with "No sensation" and the "Strongest Experienced Sensation of any kind" (Bartoshuk, 2011). The last question depicted a color image of a stack of seven pancakes and participants were asked "How many pancakes could you eat right now?"

## **Taster Status**

(see Appendix Page 183)

We assessed all participants for their taster status using a paper strip saturated with PROP, a bitter compound that indicates degree of taste response, as well as a paper and pencil rating for Strongest Sweetness (sweet taste) and the sweetness of Coke. PROP tasting was determined using paper strips with 50 mmol/l concentration of 6-n-propylthiouracil (Bartoshuk, 2011; Zhao, Kirkmeyer, Tepper, 2003). Participants were instructed to put the paper on their tongue to become saturated with saliva and report rating of the intensity of the taste using the Taste Estimation Scale, a labeled magnitude scale anchored by "No Sensation" and "Strongest Experienced Sensation of any Kind." Participants were classified as super tasters, medium tasters or non-tasters based on their rating on the Taste Estimation Scale.

## **Eating Session Logistics**

On days when research appointments were scheduled, between 12 noon and 2pm predominantly, for each scheduled participant, researcher Braverman cut one fourth of an Entenmann's Butter Crumb Cake, each portion being 420 calories (14 ounces and 397 grams for the total cake), placed it on a 6-inch paper plate and wrapped it in plastic wrap for freshness. These were stored in a cabinet with easy access by researcher Braverman. Two 9-ounce plastic cups were readied. The first was for water that was filled at a Poland Spring water dispenser and served with the Butter French Crumb Cake served after the three questionnaires were completed.

The other cup held the PROP envelope for later use. A fork and napkin were readied for each participant.

Hanging folders for storing all documents were pre-numbered ranging from SRB 101 through SRB 259, visible on the outside of the folder. These were organized during the summer of 2014. Each folder contained all pre-numbered forms and questionnaires with the same (SRB ID) on each form ready for distributing to participants and stored in a locked drawer in researcher Braverman's office until needed. Each participant's contact card served as their identification on the hanging file folder once they had scheduled their research session. These folders were opened, placed on the desk of researcher Braverman, and out of sight of the participant. Forms were taken out one by one for completion by the participant and then placed back in the folder for later assessment.

These were:

1. The Consent Form
2. The Demographic Information Form
3. The Diet and Weight History Questionnaire
4. The Three Factor Eating Questionnaire
5. The Scaling Training Form\*
6. A Fasted SLIMSCALE
7. A Fed SLIMSCALE
8. A Fasted Horizontal Rating Form
9. A Fed Horizontal Rating Form
10. The Taster Assessment
11. An evaluation form that asked which method they preferred, horizontal or vertical and asked how many calories they thought was in the portion of Butter French Crumb Cake.

Participants came to researcher Braverman's Office for their research session and checked in with a student receptionist. Participants had been told to abstain from eating for two hours before their session. Forty students' sessions were individual sessions in the office of Researcher Braverman, and seventy-two of the participants were fed in small group eating sessions ranging from 2-5 participants, also in the office of Researcher Braverman. The sessions for both EOP participants (26) and the female athletes (21) were conducted as group sessions because of scheduling issues for these two groups. These larger group sessions took place in a classroom across from researcher Braverman's office. All procedures, whether part of individual, small or larger group sessions, followed the same order and processes.

Participants were seated at a round table that could seat five persons (except for the two larger group sessions where participants were seated in a small tiered horseshoe shaped classroom) and their name and SRB ID were confirmed. Participants were given their incentives at onset of the session, the flashlight and the one-week pass to LA Fitness and a pen for their use in filling out all the forms. The consent form was taken out of their hanging numbered folder, explained once again and then signed by the participant. Researcher Braverman stood at her computer with her back to the participants while they completed all questionnaires and forms (or at the front of the room for the two larger sessions).

Researcher Braverman signed the consent form and made a copy for their file and gave the participant the original. Then the Demographic Information form was distributed for completion and filed, as was their Diet and Weight History

Questionnaire and then Three Factor Eating Questionnaire. The concept of scaling was explained on the Scaling Training form and participants rated their reactions on the horizontal line anchored with 'No Sensation' or 'The Strongest Experienced Sensation of Any Kind' (0 to 100mm) or somewhere in between, to prepare them for rating their hunger and satiety ratings (Bartoshuk, 2011). This Scaling Training assessment included the two questions to rate on sweet taste and the Sweetness of a Coke and The Strongest Sweetness You Have Experienced (Bartoshuk, 2011). Participants height was measured on a wall height chart which was on the back of the door of researcher Braverman's office, and they were each weighed on a Homedics scale privately in her office after they completed the three questionnaires, but before they ate their portion of Butter French Crumb cake. Their height and weight were entered on the Scaling Training form for later input. BMI's were later calculated from these measurements.

The participants were then given the two Fasted rating sheets, the SLIMSCALE and the Horizontal Appetite Rating Scale, and they were asked to complete them both. Everyone was told that there is debate about which is more efficient for use, a horizontal or vertical rating form and the participants should see which they prefer.

After completing their ratings Fasted sheets, and placing these in their file, researcher Braverman gave the participants their portion of Butter French Crumb cake and the cup of water, a fork and a napkin and they were told to "Please finish the entire portion in Front of You". Researcher Braverman sat at the table with every participant, talking about student issues, majors, current events, but nothing about dieting or eating. When finished with the cake, researcher Braverman took

away their plate, fork and napkin, and gave them the Peryam Cake Liking scale 1-9 (Peryam, Pilgram,1957) post-prandial. Six participants rated the cake below the mean of 5, but because of the small number, a decision was made to include their scores with the other 153 participants.

Then participants were given the Fed rating forms to complete and their cup of water for the PROP taste test was refilled by researcher Braverman. The completed Fasted and Fed ingestive rating forms were placed in the participant's folders for analysis.

The Bitter Taste assessment was next and was conducted with the impregnated PROP filter paper. The PROP gLMS scale was distributed to participants with the PROP envelope placed into an empty plastic cup and given to the participants. They were told to take the PROP paper out of the envelope and place it under or on their tongue but let it get well moistened with saliva. The PROP was held in their mouths for 15 to 20 seconds, removed and placed in the empty cup, and then participants were asked them to rate the sensation they were feeling on the Taster gLMS Rating Scale. A bowl of peppermints was placed on the table and every participant happily took a mint after discarding the PROP. Because of NCAA Regulations the group of 21 female athletes could not participate in the PROP assessment, and two other non-athletes refused to complete the PROP assessment but completed all other study components.

A Sweetness Taste Assessment was based on responses on the Scaling Training form; ratings of the Sweetness of a Coke, and the Strongest Sweetness



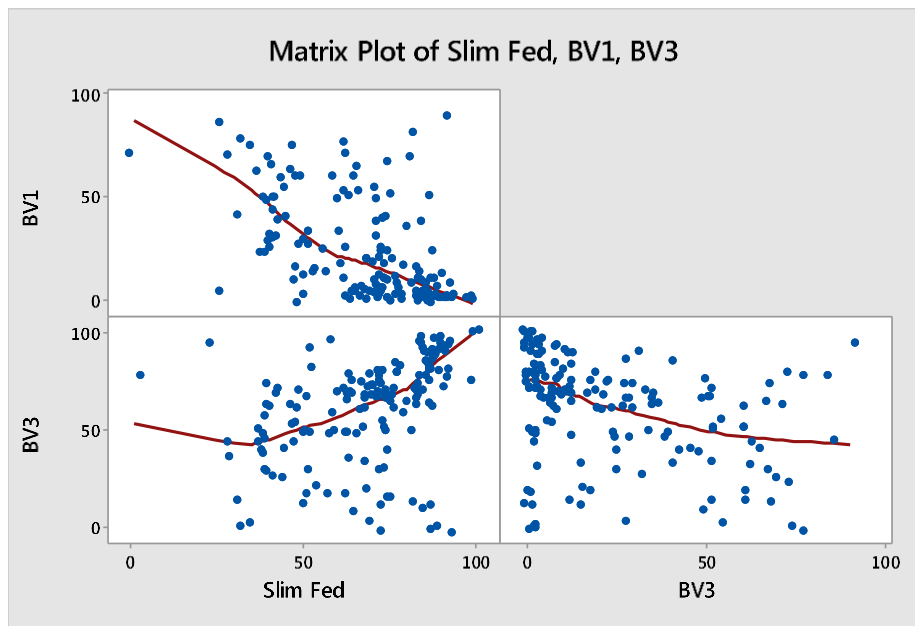
ever experienced on the visual analog measure between “no sensation” and “strongest experienced sensation of any kind.”

The Participant Evaluation form for the research session was distributed last. Participants were asked questions about length and convenience of the sessions and their preference for the horizontal or vertical rating forms. Each participant was also asked to guess how many calories they thought were in the cake. Participants were thanked for their time told that we would hold the drawing for the Dr. Oz show later in the semester and findings would be shared with them at that time.

### **Reliability and Cronbach’s Alpha**

The reliability of the SLIMSCALE Fed scores and the scores for Question 3 on the Horizontal Appetite Rating of How Full do You Feel Pre and Post Prandial [BV1 and BV3], was assessed by a **Cronbach’s Alpha** of 0.74. Notice that the Matrix Plot suggests that there is a negative relationship between the SLIMSCALE Fed and BV1 {Horizontal Question 3 Fasted} and BV3 {Horizontal Question 3 Fed}. This suggests that the SLIMSCALE and the Horizontal Appetite Rating Scale Fed and Fasted, [BV1 and BV3] are reliable in measuring the construct of satiety.

Table 1-Matrix Plot of SLIMSCALE Fed



## Group Assignment Criteria

We assigned the 159 participants as a Dieter (n=96) based on an affirmative response to any **one** of following three questions taken from Lowe's Diet and Weight History Questionnaire:

- (1). Have you ever dieted? (n=91 affirmative)
- (2). Are you currently dieting to lose weight? (n=38 affirmative)
- (3). Are you currently dieting to avoid gaining weight? (n=59 affirmative)

Negative responses to all three questions assigned participants as a Non-dieter (n=63). Restraint scores were analyzed as a separate variable of interest.

The primary focus of this study was to assess whether participants differed by Dieter Group in being aware or mindful of hunger and satiety sensations measured by their hunger and satiety rating responses pre and post prandial.

## **Data Analysis Procedures**

Data entry started at the beginning of October 2014 after the completion of the 159<sup>th</sup> participant's research session. Each participant's SRB ID was entered into Excel with their demographic information and that was the only time the participant's names were included. All subsequent data entry was done by SRB ID only. For the statistical analysis, all questionnaires and hunger/fullness rating tools, labeled only with the participant's SRB identification number, were placed in locked files in the secure office of researcher Braverman.

We compared the participants' hunger and satiety rating responses, the differences between their fasted and fed ratings by Dieter group, on the SLIMSCALE (LMS) and the Horizontal Appetite Rating Scale (VAS) (see Appendix Pages 179 – 182).

We also assessed the ratings for Dieter group differences, by BMI, and Restraint level, as well as by race/ethnicity, by their SES composite score, by their Early Family Eating Composite Score and by their Taster scores as well as the Hunger and Compensation construct scores. A Multiple Regression compared SLIMSCALE ratings by Dieter group, Restraint, BMI, race and age and a second Multiple Regression Analysis modeled the relationship between BMI and additional covariates taken from items on Lowe's Diet and Weight History Questionnaire, Stunkard and Messick's Three Factor Eating Questionnaire and the Scaling Training Form.

These variables were:

<b>Variables</b>	<b>Data From</b>
The ability to rate their strongest sweetness	Scaling Training Form
Participant's months at their current weight	Lowe's Diet and Weight History Questionnaire
The Hunger Construct	The Three Factor Eating Questionnaire
The Compensation Composite Score	The Three Factor Eating Questionnaire
Whether participants diet to avoid gaining weight	Lowe's Diet and Weight History Questionnaire
Participants EFEB composite score	EFEB Score
Whether participants wish they weighed less	Lowe's Diet and Weight History Questionnaire

We also compared BMI among 96 Dieters and 63 Non-dieters by their class in school, their age, their age of first diet, the number of times they lost weight by dieting and how much they liked the coffee cake.

## **Power**

A power analysis was conducted pre-experiment and for a power level of 80% we found that a sample size of 40 from each group, Dieters and Non-dieters, would detect a difference of approximately 12.0 mean change scores comparing fasted and fed appetitive rating differences between the two groups. Based on other empirical studies of differences in fasted and fed appetitive ratings scale scores, it would seem a study with an anticipated 63 participants in each group would have sufficient power to detect differences in appetitive ratings. Reported differences between dieters and non-dieters mean appetitive ratings were found in studies by Kral, Roe, Rolls in 2004 and Polivy, Herman, Hackett and Kuleshnyk in 1986.

With 63 cases each for the two group comparison, a difference in means that was one-half of the standard deviation would provide a power level of 80% for the proposed analysis of variance. Given the theoretical expectation of greater variance in fasted and fed differences appetitive ratings among dieters compared to non-dieters, the anticipated sample size was considered appropriate (Polivy, Herman, 1985). However, given the nature of this type of research, it is very difficult to know, a priori, the number of participants that would fall in each group.

### **Protection of Human Subjects**

The Consent Form explained the purpose, exclusionary criteria, an overview of the duration and timing of the study, risks and benefits to participating, a confidentiality statement, an "if you are injured" statement, contact information for the PI, compensation questions, and the process for withdrawal by subjects. Potential participants were told that "You will not be able to participate in this study if you have food allergies to wheat, nuts of all kinds, cinnamon, soybean oil or palm oil, soy flour, egg yolks, apples; or medical conditions like Type I or Type II Diabetes, Hypoglycemia, known Eating Disorders, Graves' Disease, a suspected pregnancy, or an allergy to 6-n-Propylthiouracil which is a drug used to treat hyperthyroidism (Graves' Disease) by decreasing the amount of thyroid hormone produced by the thyroid gland and which will be used to measure your ability to discern a bitter taste". This information was reiterated before participants signed their consent form at their sessions. The exclusion criteria were communicated on all materials during recruitment and were reiterated when signing their Consent Forms.

No one who volunteered and agreed to participate in this study was excluded.

## Chapter 4 - Findings and Results

### Study Sample

Two hundred seventeen [217] female students completed information cards at the classroom recruiting sessions. Fifty-eight students chose not to participate after being contacted to schedule a research session, giving a total yield of 159 participants for the study. The race/ethnicity of participants in this study was assessed by self-report from options on the Demographic Information Form and based on these responses four racial categories were created: (1) Asian n=11(6.9%); (2) Black/African American n=24(15.0%); (3) Hispanic/Latin n=35(22.0%); and (4) White, n=89 (56%). Compared to the full time female student population, the study population has a higher proportion of ethnic minority women. At Central Connecticut State University, 3.2% report they are Asian, 10.2% Black/African American, 11.1% Hispanic, and 68.8% White (Central Connecticut State University's Institutional Data Warehouse, August, 2014). Study participants appear to come from fairly high SES families. Participants scored 5.16 on the 7-point SES composite score described above. Fewer than 30% were the first in their families to attend college; only 4% of mothers had not completed high school.

Most of the women reported having dieted (57%) and of these, 36% had first dieted when they were less than 15 years old, some at age 10 or younger. Younger age at first diet was associated with current weight status; those currently overweight or obese reported earlier experience with dieting (See Table 3 -Age of First Diet by BMI Categories). Among those currently dieting, 24% report dieting to lose weight and 37% report dieting to avoid gaining weight.

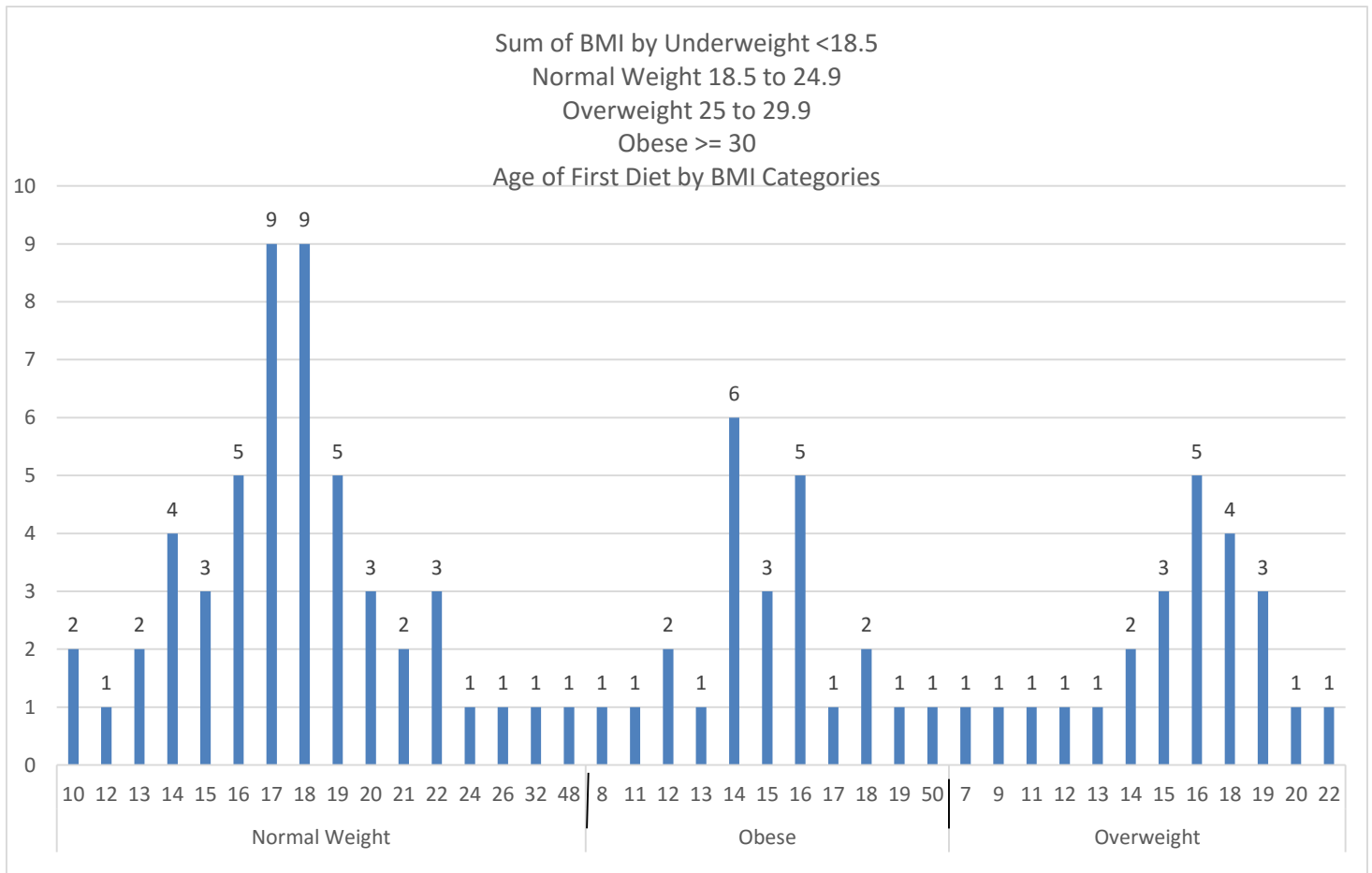
## Sample Description

Table 2 -Table of Sample Demographics and Diet Experiences

Sample Descriptives	Total Sample n = 159	N	%
<b>Age</b>			
17- 20 years old		86	54%
21- 30 years old		66	42%
31+ years old		7	4%
Mean(stddev) age	21.62(6.3)		
<b>Year in school</b>			
Freshman		42	27
Sophomore		31	19
Junior		31	19
Senior		35	22
Graduate		20	13
<b>Race/ethnicity</b>			
White		89	55.98
Hispanic		35	22.01
Black		24	15.09
Asian		11	6.92
<b>Mothers education</b>			
Less than high school		6	4
High school graduate		153	96
<b>Place of birth</b>			
U.S		124	77.99
Foreign born		29	18.24
No Response		6	3.77
<b>Language spoken at home</b>			
English		132	83
Other		27	17
<b>Free lunch eligible in elementary or high school</b>			
Yes		58	36.48
No		101	63.52
<b>Family used food stamps</b>			
Yes		26	16
No		133	84
<b>Ever dieted</b>			
Yes		101	63.5
No		58	36.5
<b>Age of First Diet among ever dieted</b>			
≤ 15 years old		36	35.6
16+ years old		65	64.4
<b>Currently Dieting To Avoid Gaining Weight</b>			
Yes		59	37.11
No		100	62.89
<b>Currently Dieting To Lose Weight</b>			
Yes		38	23.90
No		121	76.10

# Age of First Diet by BMI Categories

Table 3 Age of First Diet by BMI Categories





## Introduction to Experimental Findings and Results

The primary goals were to compare differences in hunger and satiety ratings by group (dieter v non-dieter), by BMI and by Restraint level. The analysis examined whether there were dieter group differences among the 159 participants' hunger and fullness ratings by race and by SES, their Early Family Eating Behavior construct scores, their taster status for both bitter and sweet taste and the sweetness of Coke. Compensation and hunger constructs were analyzed and a Multiple Regression predicted BMI scores with the following variables:

<b>Variables</b>	<b>Data From</b>
The ability to rate strongest sweetness	{Scaling Training Form}
Participant's months at their current weight	{Lowe's Diet and Weight History Questionnaire}
The Hunger Construct	{The Three Factor Eating Questionnaire}
A composite score on compensating with present eating on future intake	{The Three Factor Eating Questionnaire}
Whether participants diet to avoid gaining weight	{Lowe's Diet and Weight History Questionnaire}
Participants EFEB composite score*	EFEB Score
Whether participants wish they weighed less*.	{Lowe's Diet and Weight History Questionnaire}

A multiple regression analysis assessed participants' SLIMSCALE ratings, their Restraint scores, their BMI, their race and their age and we looked at whether BMI scores were associated with participants' class in college, their age, their age of first diet, the number of times they lost weight and how much they liked the coffee cake.

## RESULTS

### Comparing Hunger and Satiety Ratings by Dieter Group

All 159 female college participants rated their fed scores higher than their fasted scores on the Horizontal Appetite Rating Scale {Visual Analogue Scale [VAS]} question 3 that asked “How Physically Full Do You Feel”. This yielded a significant result with a  $t$  of -12.0558 and a  $p$ -value of 0.000. See Table 4, below which shows Fasted and Fed Differences based on the Horizontal Rating Questionnaire Question 3, “How physically full do you feel?”

*Table 4 -Paired T-test Fasted and Fed differences*

#### Paired t test

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% conf. Interval]
q3_fasted	159	32.75472	2.077852	26.20071	28.65077 36.85867
q3_fed	159	60.66038	2.097778	26.45197	56.51707 64.80368
Diff	159	-27.90566	2.3147	29.18726	-32.47741 -23.33391

Mean(diff) = mean(q3\_fasted – q3\_fed) T = -12.0558

Ho: mean(diff) = 0

Degrees of freedom = 158

Ha: mean(diff) < 0

Ha: mean(diff) != 0

Ha: mean(diff) > 0

Pr(T < t) = 0.0000

Pr(|T| > |t|) = 0.0000

Pr(T > t) = 1.0000

We also assessed differences in fasted and fed hunger and satiety ratings of participants on the SLIMSCALE Appetitive rating tool {a Labeled Magnitude Scale [LMS]}. These mean rating differences by dieter group were not statistically significant, with an  $f$  of 0.39 and a  $p$ -value of 0.5330.

Table 5 -Analysis of Variance for Two-Sample Fasted Fed Rating Differences on SLIMSCALE

Variance ratio test						
Group	N	Mean diff SLIMSCALE scores	Std. Deviation	Variance	Confidence Interval for Variance Ratio	Confidence Interval Variance Ratio
Dieter	96	24.1875	16.3006	265.712	0.626	1.720
Non-Dieter	63	25.8254	15.9571	254.630	0.641	1.746

Significance Level  $\alpha = 0.05$

Ratio of standard deviations = 1.022

Ratio of variances = 1.044

Analysis of Variance						
Source	SS	df	MS	f	Prob > F	
Between Groups	102.044063	1	102.044063	0.39	0.5330	
Within Groups	41029.7044	157	261.335697			
Total	41131.7484	158	260.327522			

Bartlett's test for equal variances:  $\chi^2(1) = 0.0337$  Prob> $\chi^2 = 0.854$

Bartlett's test of equal variances where the null hypothesis means the variances are the same has not been violated since there is a p-value that is greater than 0.05 as reflected by  $\chi^2(1) = 0.0337$  and Prob > $\chi^2 = 0.854$ . This addressed the variation between the groups as well as within the Dieters and Non-dieters. The HO and HA Ratios tested the variances in differences in fasted and fed SLIMSCALE ratings between the two groups, Dieters and Non-Dieters, where the p-value suggested no difference in the variability between the groups.

Regarding the validity of this null finding, the ratio of variances is 1.04, which is minimally more than 1.00, which would indicate zero variance. The more this ratio deviates from 1, the stronger the evidence for unequal population variances, thus we can have confidence in the finding of no difference in variance. However a post hoc power analysis for a two-sample variance test indicates that there is insufficient power to have complete confidence in the null finding.

A Multiple Regression Analysis looked at fasted and fed differences in SLIMSCALE Ratings as the independent variable and compared these by group, Dieter (1) or Non-dieter (0) controlling for Restraint score, BMI, Race and Age. For the Racial categories, White was the reference category. Restraint was measured categorically with Restraint scores greater than 10 scoring a (1) and Restraint scores that were equal or less than 10 scoring a (0). BMI was also a categorical variable with BMI's equal to or higher than 25 scoring a (1) and BMI's of 24.99 or lower scoring a (0). These categorical variables are noted in Table 5 with an asterisk. The model results were not significant, with an  $f$  of 1.10 and  $P$  of 0.369. Neither dieter group nor restraint score were statistically significant predictors of differences in fasted and fed SLIMSCALE ratings. The age of participants explained the greatest amount of variation in that analysis with a  $t$  of 1.97 in Table 6 below.

Table 6 - Multiple Regression Difference between Fasted and Fed SLIMSCALE Ratings By Dieter Group, Restraint, BMI, Race, and Age

Source	SS	Df	MS	Number of Observations	159
Model	1987.15772	7	283.879674	F(7,151)	1.10
Residual	39144.5907	151	259.235700	Prob > f	0.3692
Total	41131.7484	158	260.327522	R-squared	0.0483
				Adj-R-Squared	0.0042
				Root MSE	16.101

SLIMSCALE Difference	Coef.	Std. Err	t	P> t	Confidence Interval Minimum	Confidence Interval Maximum
Dieter Group <sup>1</sup>	-5.863794	4.77544	-1.23	0.221	-15.2991	3.571515
Restraint <sup>2</sup>	.1129324	.4983037	0.23	0.821	-.8716155	1.09748
BMI <sup>3</sup>	.073171	.2494066	0.29	0.770	-.4196063	.5659483
Asian <sup>4</sup>	-3.517192	5.18713	-0.68	0.449	-13.76592	6.731534
Black	-1.411874	3.727515	-0.38	0.705	-8.776694	5.952946
Hispanic	-4.103423	3.324005	-1.23	0.219	-10.67099	2.464143
Age	.4101935	.2084326	1.97	0.051	-.0016274	.8220144
_cons	16.63275	8.092814	2.06	0.042	.6429733	32.62252

1 Dieter =1

2 Restraint score >10 =1

3. BMI > 25 =1

4. White is reference for all race/ethnic categories

In order to better understand relationships among these variables, we also conducted a series of bivariate analyses.

Fasted and Fed Rating Differences in SLIMSCALE Scores by Group and Age.

**Table 7** below displays the mean SLIMSCALE rating differences by Age and dieter group and illustrated that those participants aged 23, 24 and 25 had the greatest variation by dieter group, with 11.50 higher ratings for the Non-dieters than the Dieters. Those participants 26 years of age and older had the largest mean ratings for both the Dieters and Non-Dieters but the difference between the groups was not as large as that for women age 23-25. The 72 youngest participants had the smallest difference {0.20} between the Dieters and Non-dieters ratings.

*Table 7 -Rating Differences in SLIMSCALE Scores by Dieter Group and Age.*

Rating Differences in SLIMSCALE Scores by Group & Age					Rating Differences by Group Non-dieter compared to Dieter	Age Frequency Totals	
Age Categories	N	Dieter	N	Non-dieter			
1	18,19	[44]	24.77	[28]	24.57	-0.20	72
2	20, 21,22	[27]	22.00	[26]	24.15	2.15	53
3	23,24,25	[10]	21.50	[6]	33.00	11.50	16
4	26>	[15]	28.20	[3]	37.67	9.47	18

There was little difference in hunger and fullness ratings between the Dieters and Non-dieters for the younger age groups. Although the case base is small, the wide variation in ratings by Age for participants age 23-25, and 26 or older requires further analysis.

**BMI**

As shown in Table 8, *T* test for comparing BMI among dieter groups was significant with a *t* of 5.2467 and *p-value* of 0.000 indicating a difference between mean BMI scores, 26.72 for Dieters and 22.81 for Non-dieters. Analysis of variance indicates significant differences ( $f=22.425$ ,  $p < .001$ ); however, variances for the two groups are not equal. The Variance Ratio is 2.917.

Table 8 -Two-sample *t* test BMI by Dieter Group

Group	N	Mean	Standard Error	Std. Deviation	Confidence Interval Minimum	Confidence Interval Maximum
Dieter	96	26.72343	.605001	5.92775	25.52235	27.92451
Non-Dieter	63	22.80690	.437262	3.47066	21.93283	23.68098
Combined	159	25.1716	.4310814	5.43573	24.32017	26.02303
Differences		3.916531	.746475		2.441973	5.391089

T = 5.2467  
Pr(T>t) = 0.0000

Table 9 -Variance ratio test BMI by Group

Variance ratio test BMI by Group

Group	N	Mean BMI scores	Std. Deviation	Variance	Confidence Interval for Variance Ratio	Confidence Interval Variance Ratio
Dieter	96	26.72343	5.92775	35.139	1.418	5.817
Non-Dieter	63	22.80690	3.47066	12.046	1.401	5.383

Significance Level  $\alpha = 0.05$   
 Ratio of standard deviations = 1.708  
 Ratio of variances = 2.917

## RESTRAINT

A *t* test for Restraint Score and dieter group demonstrated higher Restraint scores in the 96 dieters and this was a significant finding with a *t* of 7.84 and a *p*-value of 0.000 with the mean Restraint Scores for Dieters of 11.14 and for Non-dieters, a mean of 6.047. Analysis of variance showed significant differences in mean score by dieter group ( $f=61.236$ ,  $p<.001$ ) and a variance Ratio of 1.031. This finding illustrated the Dieters' greater engagement in 'Restrained Diet Behavior' but there was little variance in scores between the two groups.

Table 10 -Two-sample T test Restraint by Dieter Group

Group	N	Mean	Standard Error	Std. Deviation	Confidence Interval Minimum	Confidence Interval Maximum
Dieter	96	11.14583	.4125177	4.041832	10.32688	11.96478
Non-Dieter	63	6.047619	.5016249	3.981524	5.044885	7.050353
Combined	159	9.125786	.7450620	4.722344	8.386102	9.865470
Differences		5.098214	.6494601		3.813710	6.382719

T = 7.8499  
Pr(T>t) = 0.0000

Table 11 -Variance ratio test Restraint by Dieter Group

Variance ratio test Restraint by Group						
Group	N	Mean Restraint scores	Std. Deviation	Variance	Confidence Interval for Variance Ratio	Confidence Interval Variance Ratio
Dieter	96	11.14583	4.042	16.336	0.661	1.621
Non-Dieter	63	6.047619	3.982	15.853	0.746	1.924

Significance Level  $\alpha = 0.05$   
Ratio of standard deviations = 1.015  
Ratio of variances = 1.031



Table 12 shows mean differences for BMI by Dieter Group and Restraint status. There is a higher mean BMI for the Restrained Dieters [28.19] when compared to the Unrestrained Non-dieters [24.10]. However, restraint is not independently associated with BMI and the interaction effect with Dieter Group is not significant.

*Table 12 -Mean Differences for BMI by Dieter Group and Restraint status*

Means [standard deviation] for BMI by Diet Group and Restraint Status			
Diet Group/Restraint	Restraint = 0	Restraint = 1	Frequency
Dieter	24.36 [4.86]	28.19 [6.95]	96
Non-Dieter	24.10 [4.88]	24.59 [3.27]	63

			Sum of Squares	df	Mean Square	F	Sig.
BMI	Main Effects	(Combined)	566.545	2	283.273	10.849	.000
		Dieter Group	196.618	1	196.618	7.530	.007
		Restraint Group	35.803	1	35.803	1.371	.243
	2-Way Interactions	Dieter Group * Restraint	5.323	1	5.323	.204	.652
Model			621.462	3	207.154	7.934	.000
Residual			4046.989	155	26.110		
Total			4668.450	158	29.547		

a. All effects entered simultaneously

There was a wider range of BMI's for the Dieters (19.017 to 51.210) than the Non-dieters (range 16.389 to 35.787) but the range in Restraint scores by dieter group was narrower with only a three point difference between the highest scores of Dieters (20) and Non-dieters (17). In our study population of young college

women, 'dieting' did not equate with a healthy normal BMI for 46 of the Dieting participants though 50 of the Dieters did have a healthy BMI. The lack of association between restraint score and BMI among the dieter group indicates being 'mindful of what one eats through dieting' may not lead to a healthy weight.

*Table 13 -BMI by Diet Status*

<b>BMI by Diet Status</b>			
BMI	Dieters	Non-dieters	Totals
<= 25	50	51	101
> 25	46	12	58
Totals	96	63	159

Chi sq = 12.464; p<.001

## **SLIMSCALE Ratings by Race**

Differences in mean SLIMSCALE satiety rating scores by race/ethnicity were not statistically significant for either Fasted or Fed conditions. A two-way ANOVA showed that race differences in scores were not significant by Dieter Group (data not shown).

*Table 14 -SLIMSCALE Scores Fasted by Race*

Fasted	N	Mean	Std. Deviation	Minimum	Maximum
Asian	11	45.727	22.720	22	90
Black	24	37.708	17.640	5	80
Hispanic	35	41.171	21.946	1	90
White	88	44.409	19.065	8	85
Total	158	42.766	19.768	1	90

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1036.951	3	345.650	0.88	0.4516
Within Groups	60317.384	154	391.671		
Total	61354.335	157	390.792		

Table 15 -SLIMSCALE Scores Fed scores by Race

Fed	N	Mean	Std. Deviation	Minimum	Maximum
Asian	11	67.818	21.985	27	98
Black	24	62.167	19.314	30	90
Hispanic	35	63.571	20.833	1	90
White	88	70.943	17.106	24	99
Total	158	67.759	18.867	1	99

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2256.604	3	752.201	2.16	0.095
Within Groups	53628.257	154	348.235		
Total	55884.861	157	355.955		

## Early Family Eating Behavior and Group Status

When assessing the Early Family Eating Behavior (EFEB) Composite scores a Two-Sample *t* test demonstrated that the 96 Dieters had higher EFEB scores compared with the 63 Non-dieters and this was significant with a *t* of 7.8619 and a *p*-value of 0.00. Analysis of variance showed significant differences (*f* 52.185, *p*<.001) and a Variance Ratio of 2.358. The mean EFEB for the Dieters was 3.05

compared with 1.55 for the Non-dieters indicating less portion control by others and less dieting in the non-dieters' family as a child.

Table 16 -Two-sample t test Early Family Eating Behavior by Group

Group	N	Mean	Standard Error	Std. Deviation	Confidence Interval Minimum	Confidence Interval Maximum
Dieter	96	3.052083	.1483608	1.45363	2.75755	3.346617
Non-Dieter	63	1.555556	.1192608	.9466031	1.31715	1.793954
Combined	159	2.459119	.1165892	1.470134	2.228845	2.689394
Differences		1.496528	.1903524		1.120546	1.87251

T = 7.8619  
Pr(T>t =0.0000

Table 17 -Analysis of Variance and Variance ratio test Early Family Eating Behavior by Dieter Group

Variance ratio test Early Family Eating Behavior by Dieter Group

Group	N	Mean EFEB scores	Std. Deviation	Variance	Confidence Interval for Variance Ratio	Confidence Interval Variance Ratio
Dieter	96	3.052083	1.45363	2.113	1.453	4.480
Non-Dieter	63	1.555556	0.9466031	0.896	1.551	5.637

Significance Level  $\alpha = 0.05$   
Ratio of standard deviations = 1.536  
Ratio of variances = 2.358

Analysis of Variance

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	85.189	1	85.189	52.185	.000
Within Groups	256.295	157	1.632		
Total	341.484	158			

## **Comparing Taste by Group**

Bitter taste (Prop) rating assessments (0-100) did not show significant differences by Dieter Group. The same was true for the sweet taste assessment and for the Sweetness of Coke. The means by Dieter Group for Bitter Taste were somewhat higher for the Non-dieters and in agreement with the literature (Tepper et al, 1999) but the issue of tasting, both bitterness and sweetness, in our college population, requires further study.

## **Multiple Regression Analysis for BMI**

A multiple regression analysis was undertaken to assess the relationship between BMI as the dependent variable and a) Early Family Eating Behavior score; b) Restraint Score; c) Currently dieting to avoid gaining weight; d) Wish I Weighed Less; e) Sweetness score; f) Compensation score (consciously limiting or postponing intake as weight management strategy; and g) How hungry for next meal (part of appetite rating scale).

These seven factors represented scales and indicators taken from items on Lowe's Diet and Weight History Questionnaire (Lowe, Kissileff, 2005), the Three Factor Eating Questionnaire (Stunkard and Messick's 1985), and the Scaling Training Form and were included in the model based on their prevalence in the literature.

**The Early Family Eating Behavior construct** was included in this analysis because of the potential link between parental control which may diminish their children's use of their own hunger and satiety sensations (Carper, Fisher, Birch,

2000 pp 121,122) Those college women who diet also had families who were greatly involved in their food selection and portions as children (Fisher,Birch,2002).

Participants' **Restraint Score** was included as a factor, following Polivy and Herman's observation that "restrained dieters are those persons, no matter their actual weight, who are dieters a good portion of the time" (Polivy, Herman, 1983,pp133,134). These results are relevant to the literature as there is now debate as to whether Dieting and Restrained Dieting reflect the same eating behaviors in those Non-obese, with BMI's below 30 (Lowe, Doshi,Katteran,Feig, 2013,p1).

**Dieting to Avoid Gaining Weight** was used given that 59 study participants (37%) responding "yes" in comparison with those in the Dieting to Lose Weight group for whom 38 (23%) said "yes." It is possible that there may have been a paradigm shift in eating behavior on the college campus at the time of this study in which a focus on watching what is eaten in order not to gain weight has become the norm (Nichter, Ritenbaugh, Nichter, Vuckovic, Aicken, 1995pp 156-157) and (Goldstein, Katterman, Lowe, 2013 p237).

The variable, '**I wish I weighed less**' was examined because of the significant affirmative response by participants' that they did wish they weighed less (a question on the Diet and Weight History Questionnaire but not part of the Early Family Eating construct). This was a surprising finding in that the 99 participants who responded "**yes they wish they weighed less**" were already at a healthy weight and BMI.

The **sweet taste analysis** was included because of the reported relationship between obesity and sugar consumption and because both conditions have increased over the past twenty years (Burger, Stice, 2014). A liking for sweet taste may be a factor in eating behavior and weight status as well as increased energy intake from sugar sweetened beverages that also may be a factor in weight gain (Chen, Appel, Loria, Lin, Champgagne, Elmer, Ard, Mitchell, Batch, Svetkey, Caballero, 2009 p1299).

The **compensation construct** was included in this analysis because it may be part of awareness and mindfulness behavior that is used by those with a healthy BMI. Thin individuals who are resistant to gaining weight are more adept at sensing excess calories eaten and make appropriate changes in later ad libitum intake, but the overweight and obese do not sense extra calories eaten nor compensate at later meals (Corneir, Grunwald, Johnson, Bessesen, 2004, p254). An example of compensatory behavior is reported by French and colleagues, "Higher energy intake at lunch would not be problematic if people spontaneously reduced their intake at other meals (French, Mitchell, Wolfson, Harnack, Jeffery, Gerlach Blundell, Pentel, 2014, p1400)."

To assess whether there were differences between the Dieters and Non-dieters in their ability to plan for their next meal as well as assessing their 'hunger state' we analyzed their responses to the question '**How Hungry will you be for your next meal**' [Question 8 on the Horizontal Appetite Rating Scale]. This question was

included because of the literature that reports that hunger ratings often fail to correlate with energy intake (Mattes, 1990). Cohen and Farley described the eating behavior of chronic dieters, where “effort is not required to continue eating when food is present; effort is required to refrain from eating when food is present (Cohen, Farley et al. 2008, p3)”.

Only two of the predictor variables were statistically significant: the **Early Family Eating Behavior Composite Score**, *p-value* of 0.00, *t* of 6.38 and **“I wish I weighed less”** *p-value* of 0.001 and *t* 3.62. A one point increase in EFEB scores was associated with a 2.08 increase in BMI. Those who answered yes to **“I wish I weighed less”** had a 3.46 higher BMI than those who were happy with their current weight (Table 18). None of the variance inflation factors (VIF’s)) are above 5, indicating that the independent variables are not highly correlated with one another in this sample.

*Table 18 -Multiple Regression for BMI by family eating behavior, current eating and dieting behavior, appetite and sweet taste rating indicators*

Source	SS	Df	MS	Number of Observations	120
Model	1973.83	8	246.72937	F(8,111)	13.17
Residual	2079.2343	111	18.731840	Prob > f	0.0000
Total	4053.06927	119	34.0594056	R-squared	0.4870
				Adj-R-Squared	0.4500
				Root MSE	4.328



	Coef.	SE Coef	t-Value	P- Value	Confidence Interval Minimum	Confidence Interval Maximum
Early Family Eating Behavior	2.076	0.326	6.38	0.000	-1.43704	2.71496
Restraint Score	-0.104	0.143	-0.73	0.468	0.38428	0.17628
Diet To Avoid Gaining Weight	-1.34	1.00	-1.34	0.184	3.3	0.62
Wish I Weighed Less	3.463	0.957	3.62	0.000	-1.58728	5.33872
Sweetness Score	-0.009	0.0162	-0.58	0.565	0.040752	0.022752
Compensation Score	0.749	0.402	1.87	0.065	0.03892	1.53692
Hunger for Next Meal Rating	-0.027	0.0160	-1.66	0.099	0.05836	0.00436
_cons	19.39	1.63	11.89	0.000	-16.1952	22.5848

The Regression Equation for this analysis was:

BMI=19.39 ++2.076+EFEB -+0.104+Restraint -+1.34+Avoid Gaining  
++3.436+Weighed less -+0.0093+Sweetness ++0.749+Compensator -  
+0.0265+Hunger for Next Meal.

### **Association of Hunger Construct with Dieter Group and BMI**

A Hunger Construct Composite Score was examined an alternative measure for assessing hunger and was based on a true response to fifteen questions from Stunkard & Messick's Three Factor Eating Questionnaire (1985). The Questions used for the Hunger Assessment each included the word 'hunger' or 'hungry'. The Hunger Composite Score was not significantly associated with either dieter group or BMI.

## Compensation by BMI, Dieter Group and Restraint

The Compensation score is an indicator of conscious choices for daily eating. We would expect that the indicator of restrained eating, current dieter status, as well as BMI would be associated with compensation. A multiple regression analysis illustrated that Restraint Score and BMI were strongly associated with Compensation and dieter group marginally associated. Dieters scored .378 lower on the Compensation indicator than Non-dieters ( $t -1.97, p=.051$ ) and a one point increase in Restraint score was associated with .027 higher Compensator score ( $t 13.87, p=.000$ ). A one point higher BMI was associated with a .04 increase in Compensation score. The Coefficient of Variation predicted 62% of the variability in the model.

*Table 19 -Multiple Regression for Compensation By Dieter Group, Restraint Score, and BMI*

Source	SS	Df	MS	Number of Observations =159	
Model	244.82618	3	81.6087268	F	86.72
Residual	145.86564	155	.9410686	Prob > f	0.0000
Total	390.691824	158	2.4727330	R-squared	0.6266
				Adj-R-Squared	0.6194
				Root MSE	0.9701

	Coef.	Std. Err	t	P> t	Confidence Interval Minimum	Confidence Interval Maximum
Dieter Group <sup>1</sup>	-.3780582	.1918143	-1.97	0.051	-.7569657	.0008492
Restraint Score <sup>2</sup>	.2689089	.0193838	13.87	0.000	.2306184	.3071995
BMI <sup>2</sup>	.0366426	.0152692	2.40	0.018	.0064799	.0668052
_cons	-1.192121	.375567	-3.17	0.002	-1.93399	-.4502506

1 Dieter =1

2 Continuous

## BMI by Dieter Status and Class in College

There was a significant association between dieter status and BMI by Class in College with the mean BMI's of the Freshmen Dieters [28.02 BMI] and Sophomore Dieters BMI (29.39) being the highest. This is an important finding if the younger women attending college are heavier than the Juniors, Seniors and Graduate students.

*Table 20 -BMI by Dieter Group and Class in College*

Means [standard deviations] for BMI by Group and by Class			
Class/Diet Status	Dieter	Non-Dieter	Frequency
Freshman	28.02 [6.18]	23.84 [3.34]	42
Sophomore	29.39 [6.07]	23.19 [2.83]	31
Junior	26.69 [7.28]	22.36 [3.60]	31
Senior	24.42 [3.38]	22.87 [3.80]	35
Graduate	24.34 [4.48]	19.19 [2.53]	20

The ANOVA below shows that Dieter status and class in school are both associated with the variation in BMI. The interaction effect is not significant.

Table 21 -ANOVA BMI by Dieter Group and Class in School

			Sum of Squares	df	Mean Square	F	Sig.
BMI	Main Effects	(Combined)	818.342	5	163.668	6.697	.000
		Year in School	304.758	4	76.189	3.117	.017
		Dieter Status	611.738	1	611.738	25.030	.000
	2-Way Interactions	Year in School * Dieter Status	94.638	4	23.659	.968	.427
	Model		1026.853	9	114.095	4.668	.000
	Residual	3641.597	149	24.440			
	Total	4668.450	158	29.547			

### Age of Participants and BMI

The age of study participants varied from 17 to 31 years of age or higher with a mean age of 21.62. Similar to BMI differences by class in school, across all student age categories, the Dieters had a higher BMI than the Non-dieters. The 18 and 19 year old Dieters had the largest mean BMI.

Table 22 -BMI's by Group and Age categories

BMI by Age Means [standard deviations]			
Age/Diet Status	Dieter	Non-dieter	Frequency
18, 19	28.46 [6.10]	23.37 [3.36]	72
20, 21, 22	24.39 [3.99]	22.78 [3.88]	53
23, 24, 25	26.41 [2.91]	21.49 [1.81]	16
26 >	26.04 [8.29]	20.40 [2.57]	18

## BMI by Dieter and Number of Times Participants Lost Weight

A multiple regression modeled the relationship between BMI as the dependent variable and the number of times participants lost weight, a dichotomous component on the Early Family Eating Behavior Construct where a score of three weight loss attempts or more was scored a 1 and two or fewer weight loss attempts was scored a 0. This was significant with an  $f$  of 16.93 and a  $p$ -value of 0.0001. Since the more times participants' lost weight was associated with both group and BMI we believe that the number of diet attempts may be related to family control over eating in their youth where monitoring and restricting of daughters' intake was reported by parents and was associated with college age daughters having higher BMI's and reporting more emotional eating and less eating behavior because of physical hunger and satiety currently and as children (Galloway et al. 2010, p1333).

### ANOVA BMI by Times Lost Weight and Dieter Group

Table 23 -ANOVA BMI by Times Lost Weight and Dieter Group

Source	Partial SS	Df	MS	F	Prob >F
Model	1209.112	3	403.037	18.06	0.000
Times Lost Weight <sup>1</sup>	377.822	1	377.822	16.93	0.0001
Dieter Group <sup>2</sup>	8.076	1	8.076	0.36	0.5483
Times lost * Group	10.174	1	10.174	0.46	0.5006
Residual	3459.337	155	22.318		
Total	4668.450	158	29.547		

<sup>1</sup> Lost weight  $\geq 3$  times = 1

<sup>2</sup> Dieter = 1

Number of observations 159

R-squared 0.2590

Adj-R-Squared 0.2447

Root MSE 4.7242

## **Chapter 5 – Discussion**

### **Rating Hunger and Satiety**

The 159 Central Connecticut State University female research participants may reflect a change in eating behavior in college students as all 159 participants rated their satiety scores higher than their fasted scores on the Horizontal Rating, VAS tool in our study. In our opinion, however, the 63 Non-dieters demonstrated a greater comfort level and familiarity in using hunger and satiety as demonstrated by a larger difference between the mean difference between their pre and post-prandial scores than the 96 Dieters [a difference of 26.02 for the Non-dieters and 24.19 for the Dieters.

It was an important finding, we believe, that a healthy BMI was achieved and maintained by 101 of the 159 {50 were dieters and 51 were non-dieters} students. We believe this indicates a positive paradigm shift in eating behavior on the college campus today where a focus on 'watching what they ate in order not to gain weight' is the norm (Nichter, Ritenbaugh, Nichter, Vuckovic, Aicken, 1995). At Central Connecticut State University, this new paradigm of Dieting to Avoid Gaining weight may have replaced the Restraint paradigm as fifty-nine of our participants responded affirmatively [100 did not] to the 'diet to avoid gaining weight by watching what is eaten' question. Also the 63 Non-dieters wider variation between their fasted and fed rating assessments indicates, we believe, a greater comfort level and more experience in their using hunger and satiety sensations in their daily lives to determine portions.

## **Restraint on the Campus**

Our findings and new literature reflect that eating behaviors on the college campus today may also involve a new motivation regarding the older ideology of Dieting to Lose Weight when compared with the newer mantra of 'Dieting to Avoid Gaining Weight' (Goldstein, Katterman, Lowe, 2013 p237). In the past, weight change in female college student dieters often followed the weight cycling restraint paradigm (Mills, Polivy, McFarlane, Crosby, 2012, p302), but there is now debate as to whether Dieting and Restrained Dieting reflect the same eating behaviors in those Non-obese, with BMI's below 30 (Lowe, Doshi, Katteran, Feig, 2013, p1). Differences in the responses on the Three Factor Eating Questionnaire, the basis for our Restraint score evaluations, showed that the 63 Dieters had significantly higher Restraint scores than the 96 Non-dieters. This finding should be addressed in future ingestive research in light of Lowe's team's research on the differentiation between restrained and unrestrained dieting behavior on college campus.

Our rating results overall suggest, however, that in our Central Connecticut State University population of female college students, the 'restrained diet mentality' may no longer be as prevalent as it may have been for the participants' mothers, aunts and grandmothers, but an effective educational paradigm that teaches how to use hunger and satiety sensations as a methodology for controlling the amounts of foods eaten needs to be implemented on the college campus for those participants who are in the overweight or obese BMI categories such as our 58 participants who had BMI's above the normal range.

## Mindfulness and Awareness

The rating differences for all the questions on the Horizontal Appetite Rating Scale may reflect variation between Dieters and Non-dieters on an awareness and mindfulness construct. The TFEQ may provide an alternative method to study differences between dieters and non-dieters regarding these psychological behaviors. The Compensation construct also involves 'being aware and mindful' and should be included in any new paradigm to study eating behaviors since the students in our study seemed to want to 'be in control' and empowered with eating options and this may have been part of a more positive attitude towards food based on mindful eating behavior.

## **RACE**

We did not find significant variation in hunger and satiety ratings by race but there were several items of interest regarding race. On racial differences in weight status, our findings supported the literature in that the 24 black females had the highest BMI's of the four racial categories. Regarding diet status, all four racial groups had a greater number of Dieters than Non-dieters. The variation in SLIMSCALE ratings by race illustrates the necessity for education across race and culture in being aware of hunger and satiety as the tool to maintain a healthy weight. For future research, I would retain the current four racial categories used here since these reflect the CCSU population appropriately.



## SES

We found no statistically significant difference in the mean SES composite scores by diet group. This could have been due to the validity of the composite score or because there is little variation by SES and diet status at Central Connecticut State University. Replicating a similar research paradigm using this SES composite and a new SES measure to assess construct validity is of interest.

The SES composite score for our current study was calculated by the following:

1. Participant's Mother's level of education  
[high school or less or some college] their mother's level of education, with high school or less as one category and some college or more the second category (Kimm, Glynn, Obarzanek, Aston, Daniels, 2006, p158).
2. Participant's place of birth  
[United States or Outside of the U.S].
3. The primary language that is spoken at home  
[English or other]
4. Whether participants received free or reduced lunch in elementary, middle or high school.
5. Whether their family receives food stamps
6. Whether they are the first ones in their family to attend college
7. Whether they receive financial aid in college.

A revised SES composite would assess Mother's type of education more comprehensively, whether the students work off campus, and whether they have a loan to pay for college.

<b>Composite variables SES from Demographic information (14)</b>			
<b>Higher score = higher SES</b>			
*Are they the first to attend college no (1)	<b>1</b>	yes (0)	<b>(0)</b>
*Participant's Mother's level of education. Training Certificate (1)	<b>1</b>	No Training Certificate (0)	<b>(0)</b>
Participant's Mother's level of education. Some College (1)	<b>1</b>	No College (0)	<b>(0)</b>
Participant's Mother's level of education. Associates Degree (1)	<b>1</b>	No Associates degree (0)	<b>(0)</b>

Participant's Mother's level of education. Bachelor's degree (1)	<b>1</b>	No Bachelor's degree (0)	<b>(0)</b>
Participant's Mother's level of education. Master's degree (1)	<b>1</b>	No Master's degree (0)	<b>(0)</b>
Participant's Mother's level of education. Doctoral degree (1)	<b>1</b>	No Doctoral degree (0)	<b>(0)</b>
*Participants place of birth USA (1)	<b>1</b>	not USA (0)	<b>(0)</b>
*The language that is spoken at home English (1)	<b>1</b>	Not English (0)	<b>(0)</b>
*Whether participants received free or reduced lunch in elementary, middle or high school no (1)	<b>1</b>	yes (0)	<b>(0)</b>
*Did their family receive food stamps no (1)	<b>1</b>	yes (0)	<b>(0)</b>
*Do they receive financial aid no (1)	<b>1</b>	yes (0)	<b>(0)</b>
Do they have a loan to finance college no (1)	<b>1</b>	yes (0)	<b>(0)</b>
Do they work off campus to finance college no (1)	<b>1</b>	yes (0)	<b>(0)</b>

### Early Family Eating Behavior

The Early Family Eating Behavior Composite scores were statistically significant by group, which supported our theory that parental control over portions and food choices allowed in childhood may be associated with our participants' ability to rate hunger and satiety sensations later as adult college students. Empowering children to use the tenets of the Early Family Eating Behavior strategies {do not engage in diet behavior but focus on hunger and fullness to determine portions} may be an effective intervention for overweight and obese pre-adolescents who have not found success as yet (Jeffery, Drewnowski, Epstein, Stunkard, Wilson, Wing, Hill, 2000 p14).

The Early Family Eating Behavior Composite Score was based on the following:

1. Participant's age of first diet
2. How long they have been at their current weight
3. The number of dieters among family members
4. Who determined their portions as a child
5. Who determines their portions today

6. How many times they have they lost 1-10 pounds
7. How many times they have lost 11-20 pounds.

There was a significant difference in group status and mean EFEB composite scores (1-7) therefore EFEB factors may important predictors of future eating behavior. To improve the validity of this construct, additional variables should be added about second helpings, times dieted in the past year and times dieted in your life rather than discriminate between different reasons for dieting.

**Early Family Eating Behavior. From Diet and Weight History Questionnaire (7) Higher score =dieter [revised version]**

Participants age of first diet q10	<=15	<b>(1)</b>	>=16	<b>(0)</b>
How long have you been at your current weight q2	< 1 year	<b>(1)</b>	>=1year	<b>(0)</b>
Number of dieters among family members q11	>=3	<b>(1)</b>	<=2	<b>(0)</b>
Who determined your portions as a child q12	Others	<b>(1)</b>	self	<b>(0)</b>
Were you allowed to take second helpings as a child? <b>revised</b>	no	<b>(1)</b>	yes	<b>(0)</b>
How many times have you dieted in the past year? <b>revised</b>	>=3	<b>(1)</b>	<=2	<b>(0)</b>
How many times have you dieted, to lose or to avoid gaining weight in your life? <b>revised</b>	>=3	<b>(1)</b>	<=2	<b>(0)</b>

A new solution for interrupting both current and future overweight and obesity levels would be by encouraging and empowering a daughter's (and son's) early

eating (portions and food options) by lessening parental or outside control over their children's eating. Based on our sample, those college women who diet also had families who were greatly involved in their food selection and portions as children compared with our Non-dieters, whose EFEB scores on average were significantly lower than the Dieters. Positive behaviors which empower children to determine their own portions and foods selected should begin with the family but at an early age (Fisher, Birch, 2002).

### **Tasting Ability Bitter and Sweet Sensations**

The mean taster score for the 96 dieters was higher than the non-dieters and was reflective of the findings in the literature (Tepper, 1999).

(PROP) assessments (0-100) were associated with group assignment but not significantly. The mean Sweetness score for the 96 Dieters was lower when compared with the 63 Non-dieters as were their ratings for the Sweetness of Coke, but these differences were not statistically significant.

To improve construct validity for future research, the actual Entenmann's Cake used to assess hunger and satiety ratings should be used for sweetness assessments as well. We did not address what our participants' preferred sweet foods were and how often they consume these foods and this should be part of future research as well. We did not compare our participants PROP ratings with their liking for a sweet taste or for Coke or other sweetened beverages and this type of correlation should be planned for future Taste assessments.

## **Hunger Assessment**

There was no significant difference in mean HungerConstruct scores by group. We had thought, a priori, that not being able to recognize hunger or satiety would be associated with being a dieter since dieting does not involve only eating when hungry or stopping when full but this was not a significant finding.

We assessed how hungry our participants would be for their next meal, {from The Horizontal Appetite Rating Scale question 8], and though not significant by group, should be instructive in planning for future research and creating an educational component to utilize hunger and satiety to initiate or stop eating and is related to the Compensation Behavior Construct. This is a skill that can be taught successfully to teenage girls as reported by Jane Brody where “All the successful losers restructured their eating habits. They learned to eat when they were hungry and to stop eating when satisfied (Brody, 2007, pF7)”. This is the same success strategy that was recommended by Susie Orbach back in the '70's and remains a viable option for maintaining a lifelong healthy weight without dieting.

## **Compensation as a strategy for Weight Maintenance**

Our Compensation construct was significant by group, restraint level and BMI. This is an important outcome for this research and should pave the way for a new methodology to restore internal control to portions and food selection on the college campus and in the community

Exploration as to what compensation methods Non-dieters use to maintain their healthy weight is of interest and will be explored post hoc. Compensatory behavior (waiting to eat until appropriately hungry) could be a solution for dieters and could be a useful strategy taught on the college campus as well. This would be a strategy that does not include restricting types or portions of foods, and uses mindfulness as a compensation methodology to self-empower and to create a personal eating paradigm.

## **BMI**

In a Multiple Regression analysis, with BMI as the dependent variable, and Early Family Eating Behavior, Restraint, Dieting to Avoid Gaining Weight, I Wish I Weighed Less, Sweet taste assessment, the Compensation construct and Hunger for the Next meal, as the independent variables, BMI was significantly associated with Early Family Eating Behavior Composite scores and whether participants they wished they weighed less.

EFEB is an innovative concept for ingestive research and we believe is an important tool in interrupting the obesity epidemic both on and off the campus and where the campus can provide an environment for understanding the link of early eating behaviors and BMI as students mature.

The significant response by participants to the issue: Whether wish they weighed less, (The Diet and Weight History Questionnaire), surprised us in that the 99 participants who responded “yes they wish they weighed less” were already at a

healthy weight and BMI. Exploring the reasoning behind that choice of “I Wish I Weighed Less” is an important topic that warrants future study.

A second Multiple Regression assessed SLIMSCALE ratings by group as well as restraint scores, BMI, race and age, but was not significant. Future research with a greater number of eating sessions should reanalyze these variables on the college campus.

In an analysis with BMI as the dependent variable, our participants’ class in college variable was significant and demonstrates the variation in both weight and diet status within a four year period. This variable should be included for future research to assess any trends in eating occurring in participants over their attendance at college.

We assessed how much our participants liked the crumb cake by BMI and group, and though not significant, could be part of a future taste analysis for sweetness as well as creating a bottom threshold for the liking of crumb cake for participant’s inclusion in a future study.

The current dieting paradigm on the college campus is a relevant topic for our future research agenda where dieting to avoid gaining weight can be an initial vital step on the college campus towards what Polivy & Herman had called the “Natural Weight Un-diet” process (Polivy, Herman, 1983, p199). Exploring the etiology of the group differences by diet status and Restraint should be addressed in future research in light of Lowe, Doshi, Katterman and Feig’s 2013 new findings.

## **LIMITATIONS to the study**

The primary aim of this study was to assess whether there were differences in the pre- and post-prandial hunger and satiety ratings between Dieters and Non-dieters on the Central Connecticut State University campus. Our findings of a lack of significance between the Dieters and Non-dieters appetitive ratings could have been because of limited data set since we only had hunger and fullness ratings for one eating session and one caloric amount. We assigned the participants as a dieter based on an affirmative answer to any one of three questions from the Diet and Weight History Questionnaire (including the original, Are you currently dieting to lose weight? [38 said yes] and/or Have you ever dieted? [91 said yes] and/or Do you diet to avoid gaining weight? [59 said yes]).

This yielded 96 dieters and 63 non-dieters who responded negatively to all three diet status questions.

We had originally planned for five eating sessions, but because of recruiting issues and a lack of participation by students, a decision was made to change to a single eating session. Many studies on the college campus have used single session models to assess eating behavior, portions chosen or foods liked (Timko, Perone, 2005, Nichter et al, 1995, Reid et al, 2005 and Burger et al 2007). Though our original paradigm was a five research session model with varied calorie amounts at each, our revised methodology for a one time laboratory eating session with a 420



calorie portion of Entenmann’s Butter French Coffee Cake will provide a baseline for future study on a university campus.

Our original research methodology was a dose-response (HDR) evaluation in which on a succession of five non-consecutive days, participants would receive a different caloric amount of a breakfast consisting of a pastry and apple juice, given in a counterbalanced Latin Square Sequence Design. After consuming the entire breakfast, dose-effect functions of the ratings of satiation against intake would have been used to measure the participant’s sensitivity.

That paradigm’s five eating sessions included a logged dose response function (HDR) of self-reports on appetitive rating by participants, both when fasted and after eating five levels (155, 231, 345, 514, 766 kcal) of Entenmann’s coffee cake and apple juice in the designated ratio caloric amounts but assigned in random order via a 5 X 5 Latin Square design. Portions of Entenmann’s coffee cake and apple juice would have been given to all participants with 14.36% of each session’s calories portioned for servings of apple juice.

155 calories	133 kcal crumb cake [1.00 oz]	+	22 kcal apple juice ¼ c.
231 calories	198 kcal crumb cake [1.50 oz]	+	33 kcal apple juice 1/3c.
345 calories	295 kcal crumb cake [2.25 oz]	+	55 kcal apple juice 1/2c
514 calories	440 kcal crumb cake [3.25 oz]	+	74 kcal apple juice 3/4c.
766 calories	656 kcal crumb cake [5.00 oz]	+	110kcal apple juice 1c.

The slope of the regression line and its error would have been used to generate the Half Discriminated Ratio (HDR) devised by David Booth, which assesses the

amount of change in intake needed for unit change in the stimulus, the calorie amounts of the food. The higher the HDR the less sensitive the subject would be to the satiating effects of the stimulus, the calories in the coffee cake and apple juice. The formula for the HDR is:

$$\left( HDR_{predieters} = 10^{\frac{-2 * 0.675 * \hat{\sigma}}{b}} \right)$$

The HDR calculation shows that the variable  $b$  is the estimate of the y-intercept of the regression line. The variable  $\hat{\sigma}$  is the standard deviation of the residuals. The greatest issue with the HDR formula is that it is unbounded and it can easily approach infinity when either the standard deviation of the residuals is large, or when  $b$  get close to zero or both and this was what was found in the early planning stages of this research.

These issues, involving the calculation of the HDR's, required a change in methodology. And because of issues with recruiting participants for five separate morning eating sessions, the decision was made to hold the entire research session during one sixty minute afternoon session for all study components: viz. consent forms and questionnaire completions, hunger and fullness ratings and taste assessments, weight and height measurement and the evaluation of the session. A midrange calorie amount of 420 calories [one fourth of the entire Butter French crumb cake [1680 calorie cake] and a 9 ounce glass of water {the apple juice was deemed too sweet when ingested with the crumb cake by a five student test panel} was given to all participants.

At this point, we had planned to assign the participants to two groups, Dieter or Non Dieter, based on two factors, their Restraint Score on the Three Factor Eating Questionnaire and their answer to question (5) on the Diet and Weight History Questionnaire, which asked whether they are currently dieting for weight loss (Lowe, Kissileff, 2005). However, mixed responses to these criteria necessitated creating two new groups; Restrained Non-dieters (27) and Unrestrained Dieters, (7) the original group of Dieters (31) and Non-dieters (94). Because of the extreme variation in the size of the membership of the four groups [94 versus 7] a decision was made to revert to a two-group model of 96 dieters and 63 non-dieters without taking restraint into consideration for group assignment, but as a separate study construct.

Changing the study paradigm from using an HDR and five eating sessions for two groups, then four groups with one eating session with a mid-range calorie amount {420 calories of the 1680 calorie Butter French cake} and finally two groups Dieters and Non-dieters with the 420 calorie amount, could have affected the validity of our results. A future paradigm should include five eating sessions of varied calorie amounts using a stratified sampling procedure to create equivalently sized groups based on diet status alone, with Restraint status as a separate research variable.

Having variation [from individual to small groups to two large groups] in the number of participants at our research sessions may have affected the construct validity of this study. A future paradigm should be organized to include five to six

participants at each of five sessions, as this was a manageable number of participants organizationally.

We only assessed our participants liking for sweetness on a paper and pencil evaluation in our current methodology, but since a Sweetness (taste assessment) and sugared soda consumption is an important issue for its effect on weight status, future research on the campus should evaluate the consumption of both sugared and artificially sweetened beverages and sweet foods by students. This would begin to explore whether the role of taste is a barrier to healthy eating habits (Drewenowski, Henderson, Shore, Barratt-Fornell, 1998, p797). We could then confirm whether the tasters perceive sweetness more strongly than non-tasters with a future model (Gent, Bartoshuk, 1983, p270) and can compare whether they like sweets or not (Looy, Weingarten, 1992) and whether our tasters perceive sucrose to be more intensely sweet than do non-tasters (Tepper, Nurse, 1997). We should assess our students' consumption of Sugar Sweetened beverages as children and adolescents as previous researchers have (Ebbeling, Feldman, Chomitz, Antonelli, Gortmaker, Osganian, Ludwig, 2012; de Ruyter, Olthof, Seidell, Katan, 2012) and compare soda intake as children with students' current BMI.

To comprehensively study sweet taste assessment, we should also address how often sugar or sweet taste is a factor in food selection by college students. On the campus, what effect do Low/No Calorie beverages have on levels of consumption of soda (Catenacci et al.2014) and how often do they consume non-nutritive sweeteners (Peters, Wyatt, Foster, Pan, Wojitanowski, Vander Vuer, Herring, Brill,

Hill, 2014) are important questions. Are sweet foods chosen by college students as comfort foods today as in the past, (Hoffman, 2014, pD6)? This will be something to address on the campus today as well as the effect of sugar-sweetened beverages on satiety and weight (Malik, Willet, Hu, 2013, p1100) and sugar's effect on appetite (Kahn, Stevenpiper, 2014, p959).

If our research results at CCSU are replicated at other campuses, this may reflect a return to an internal control over eating by college women today and a possible end to the prevalence of fifty years of externally focused restrained dieting ideology and eating behavior.

## **Chapter 6-Topics for New Research**

1. Compensation
2. Eating on the College Campus (Two and Four Year Schools)
3. Assessing Physical Activity on the Campus
4. Technology tools for health awareness
5. Advertising Calories in Foods on the campus

### **Compensation**

Culturally and on the campus as well, there is still the “mainstream medical model” for weight loss and weight maintenance, which does not stress self-motivation, efficacy (or compensation) but is centered around someone, usually a physician, telling women (usually) as to what is best for them regarding portions and food selection, i.e. the “Don’t ” model. “This model centers on: Don’t skip meals all day to attend a party in the evening. Don’t drink socially. Keep your portions reasonable (Garavel, 2014, p17).” Implementing the Compensation construct on the campus could be used to interrupt that “Don’t” restrained diet behavior where breaking ones diet leads to an eating binge (Polivy, 1976). This empowering eating strategy may also improve well-being and confidence in young women (Slof, Mazzeo, Bulik, 2003) and would have the added benefit of improving health while incorporating favorite foods into daily eating (Polivy, 1996). This would be a strategy that could prevent freshmen weight gain and weight gain generally (Levitsky et al, 2004) and could transform dieters into watchers who never diet but who are aware (Nichter, et al. 1995; Reid et al. 2005).

Non-dieting normal eaters take control over their food consumption by acknowledging that outside forces do not know how much they should eat, and no matter how large the portion served, they often do not finish all the food on their plate as a compensation method not to gain weight (Hirschmann, Munter, 1988). Strategies for compensating for larger portions eaten include waiting to eat again until one is comfortably hungry, not just because it is time for a meal (Normandi, Roark, 1998). “Higher energy intake at lunch would not be problematic if people spontaneously reduced their intake at other meals (French, Mitchell, Wolfson, Harnack, Jeffery, Gerlach, Blundell, Pentel, 2014, p1400)”.

Implementing the compensation concept written about in 1984 by Tomarken and Kirschenbaum where, “thoughts and expectation about food, and potentially related components of planning, deserve further study to clarify their relative contribution to problematic and regulatory eating behavior (Tomarken, Kirschenbaum, 1984, p471)” would be an innovative strategy to assist students struggling with their weight at college.

## **Eating on the College Campus**

Exploring the reasons underlying eating behaviors on the college campus requires further study. These include assessing the eating behaviors of students at public universities comparing, for example, transfer students with students who started at their home school. Examining the effect of full time or part time status on student’s eating, whether students diet in order not to gain weight and what behaviors they use for this behavior and the future of eating on the campus as to

why do students choose the foods they do as well as what needs to change from the campus' perspective are also worth further examination.

Eating on the college campus is a continuation of early eating behaviors learned at home, before attending college, we believe. At CCSU, the total student population of 11,865 students includes 2,167 transfer students from predominantly two-year community colleges (Central Connecticut State University Data Warehouse, 2014). If our transfer population of females reflects the literature, we will find differences in weight status and weight control behaviors in transfer female students from a two year school when compared to the female students who started their education at four year college (Laska, Pasch, Lust, Story, Ehlinger, 2011). Future research should document whether there is a difference between the transfer students' BMI and eating styles when compared with students who started their careers at a Four Year University as a freshman and did not transfer colleges.

With a shrinking 18 year old demographic who attend college as freshmen and an increase in the number of transfer students attending four year schools from community colleges, the age of the participants attending four year schools and their eating behaviors will be an important variable for community health research.

The college campus is an ideal site for eating research since the campus has become a heterogeneous site with diverse populations in attendance and myriad opportunities for interaction with participants for researching weight and behavioral changes attributable to collegiate life (Mills, Polivy, McFarlane, Crosby, 2012, p301; Gillen, Lefkowitz, 2011; Singer, 2006). New research hypotheses as to whether



restrained eating is still prevalent on the campus can be explored in the future (Lowe et al. 2013; Sysko et al. 2007) as well as the effect of 'control' and its relation on eating behavior (Timko, Perrone, 2005).

The dining hall setting on the campus is an appropriate place to study hedonics and whether palatability is a factor in the amount eaten by college students (Mook, Votaw, 1992) and their portions selected (Burger, Kern, Coleman, 2007) as well as the effect of early family eating behaviors on grown children's (now college students) weight and eating patterns (Galloway et al. 2010).

Continuing to use the campus as a research site for eating behavior can provide an accessible opportunity to assess (via focus groups or individual interviews) whether students diet for weight loss or to avoid gaining weight, why students choose specific foods (low fat, ethnic foods, carbohydrates) to eat as opposed to other foods, how they address weight gain and the influence of their Early Familial Eating on their food selections both on and off the campus, are topics we would like explore.

## **Physical activity engagement and weight**

The level of physical activity engaged in by college students is important topics for both ingestive and health research. Looking for a relationship between SES and physical activity on the campus as suggested by Sobal and Stunkard (Sobal et al. 1989 p268) will be informative to ingestive research and should be designed to assess the level of physical activity engaged in by college students as well as what type of exercise activity is done, and why and how often they engage in physical

exercise and whether this varies by race and SES. . The combination of increased leisure time and over consumptions of a calorie dense diet, have been major contributors to the prevalence in obesity (Britton, Lee, Gaziano, Manson, Buring, Sesso, 2012, p1096) and these may be factors influencing daily behavior for college students also. Increasing the level of 'exercise activity paradigm' was shown to be an effective weight maintenance tool for European men but they had also reduced their caloric ingestion by 1800 calories to an intake of 360 calories per day (Reynolds,2014).

To address current levels of overweight and obesity, increases in exercise time are recommended: physical activity recommendations for weight loss or weight maintenance are 3-5 days per week for 30 to 45 minutes (Bish, Blanck, Serdula, Marcus, Kohl, Khan, 2005). Additionally, physical activity was associated with lower food and caloric intake (Delany, Kelley,Hames, Jakicic, Goodpaster, 2014). Would our students' current level of activity be adequate or will our students perceive too many barriers to physical activity to meet these levels (Napolitano, Papandonatos, Borradaile, Whiteley, Marcus, 2011)? Bringing a NEAT (Non-exercise activity thermogenesis) could be an innovative model to implement to increase activity on the college campus (Levine, 2007). Brisk walking and biking are also beneficial for prevention of weight gain, and maintenance of lost weight, in normal weight women (Lusk, Mekary, Feskanich, Willet, 2010, p1050) and are exercise behaviors easy to implement on the campus. Plus exercise "improves the body's ability to judge the amount of calories consumed and adjust for that afterward" (Reynolds, 2013), a

component of our compensation construct. Rosenbaum stated that physical activity not only increases caloric expenditure but promotes dietary compliance (Rosenbaum, 1997, p403). We can explore whether exercise is associated with the compensation construct on the college campus as well as the level of physical activity engaged in by our students.

### **Technology based computer tracking for eating and physical activity**

We can also assess whether new technology for tracking foods and exercise may improve health on the campus overall. We can survey college students as to whether they would utilize these electronic gadgets and would this vary by BMI, race and SES. Wearable activity tracker fitness applications like FITBIT are increasing in popularity (Weber, Silverman, 2014) have replaced Weight Watcher meetings for many health focused individuals creating an app-store diet (Harwell, 2014, pA10;). These new 'trackers of physical activity' are a new component of a healthy exercise lifestyle (Jesdanun, 2014; Fowler, Stern, 2014; Bachman, 2014). Shape Up Inc. uses social applications and Jawbone is now selling discounted fitness brands and data analysis to their customers (Weber et al., 2014). Would these be effective strategies on the college campus? Using focus groups we can assess the acceptance and ease of use of technology with these types of devices on the CCSU campus.

## **Listing the calories in foods on campus**

On the campus, there is great interest from students for calories to be listed on menus in the dining halls on campus. The FDA is requiring chain restaurants, bakeries, cafeterias, coffee shops convenience stores, movie theatres and vending machines to list the calories of foods within the next twelve months and this new ruling should have a positive effect on consumer behavior and public health (Sunstein, 2014). Since Americans eat and drink one-third of their calories away from home this new rule will help people make more informed choices about the food they eat (Dennis, 2014, pA7) and make them aware of the calories being consumed and should theoretically help in the battle against obesity (Shea, 2014, p D1).

Will this knowledge make a difference in the portions or types of foods chosen by college students? We can create a natural experiment assessing foods and portions selected pre calorie disclosure (Fall 2015) and then post calorie disclosure in early 2016. An interesting component to the calorie listing focus will be who would use this caloric data more, dieters or non-dieters, overweight or normal weight individuals. This can be part of our natural experiment on the effectiveness of the caloric disclosures as well.

The focus of these new topics, eating on today's campus, compensation methods, assessing sweet taste, moderating exercise, using technology to track eating and physical activity, the posting of calories should have a proactive effect on natural eating and self-acceptance on the college campus and will be "positive

additions as a redirected goal instead of the old diet paradigm (McFarlane, Polivy, McCabe, 1999, p272)" so prevalent in the past. A beneficial eating paradigm for the college campus would include what was recommended by Hirschmann and Munter thirty years ago:

1. "Give up dieting forever and discover that you can eat much less without the restraints of a diet.
2. Learn to eat from physiological hunger and perhaps for the first time enjoy the enormous satisfaction of meeting that hunger with the foods you most desire.
3. Stop overeating and lose the weight that has been its by-product.
4. Move beyond your negative preoccupation with eating and weight into a fuller life (Hirschmann, Munter, 1988 p3)."

Based on our findings at Central Connecticut State University, restrained dieting may no longer be the prevalent eating behavior for university women, signaling a possible end to dieting and the restricted eating patterns that accompany that dieting.

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## Appendix I: Research Documents and Forms

	Page Number
CCSU Consent Form.....	161
Demographic Information Form.....	168
Diet and Weight History Questionnaire .....	171
Three Factor Eating Questionnaire .....	173
Food Liking .....	177
Scaling Training.....	178
Horizontal Appetitive Rating Scale.....	179
SLIMSCALE Scale Rating Scale .....	182
Taste Estimation Scale .....	183
Evaluation Form .....	184
Composite Variables SES and Early Family Eating Behavior.....	185



# CENTRAL CONNECTICUT STATE UNIVERSITY CONSENT FORM

Title: Rating Hunger and Satiation: Comparing Dieting Women to Non-Dieters

Contact: Sharon Braverman Researcher

[braverman@ccsu.edu](mailto:braverman@ccsu.edu)

tel. 860 832-3276

CCSU Office. Vance Academic Center 210 New Britain CT 06050

SRB ID \_\_\_\_\_

## CENTRAL CONNECTICUT STATE UNIVERSITY CONSENT FORM

### DESCRIPTION OF STUDY

#### 1. PURPOSE

- A statement that the study involves research. You have been asked to participate in a research project that is sponsored by Central Connecticut and Columbia University's Medical Center. All research will take place at Central Connecticut State University in New Britain, Connecticut.
- An explanation of the purpose. The purpose of the study is to compare your reactions to foods in a relatively fed vs. a relatively fasted state. At the beginning of the study, you will have already been interviewed to determine if you are eligible to participate in the study. To be eligible, you must be a full time student at CCSU, female, at least 18 years old

#### **AND**

- You must not currently have or have had a history of an Eating Disorder.
- Since this study will require eating specific amounts of Entemann's Classic Butter French Crumb cake and water, participants must have no known food allergies to wheat, nuts, cinnamon, soybean or palm oil, soy flour, egg yolks, apples or medical conditions that could negatively impact them or their performance. These would include Type I or Type II Diabetes, Hypoglycemia, known eating disorders, Graves Disease, an allergy to 6-n-Propylthiouracil or a suspected pregnancy.
- You will be asked to fill out questionnaires on eating patterns, weight and dieting. You will also be asked to fill out questionnaires on level of hunger and satiety ratings as well as a physical symptoms checklist. You will be asked to respond to 6-n-propylthiouracil (Prop) to assess your ability to rate taste on a glms tool. The ability to taste food is genetic, and is based on whether you have the recessive or dominant (or heterozygous) alleles which correlate with the intensity you can 'taste' the bitter PROP 6-n-propylthiouracil (Bartoshuk, Duffy, Mille, 1994). Propylthiouracil or 6-n-Propylthiouracil is a drug use to treat hyperthyroidism (Graves Disease) by decreasing the amount of thyroid hormone produced by the thyroid gland. There is a risk of liver damage with Prop if patients have a

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hyperactive thyroid (Graves Disease) where they would take 200 mg per day for an extended period of weeks or months where we are having you taste one time 1.6 mg for our study. (Bartoshuk, 2011) Prop has been used in taste studies around the world for more than 60 years without incident (Tepper, 2012).

- On all eating evaluation days you will come to the research center (Faculty Dining Room) without having eaten for at least 1 hour. There will be five days of eating evaluations.
- At each of the eating sessions you will be given specific amounts of a commercially manufactured pastry and a 6 ounce bottle of water.. You will be asked not to eat drink anything one hour prior to your eating session.
- Identification of procedures which are experimental. All of the above are considered experimental, rather than standardized laboratory procedures. However, they have been done in hundreds of volunteers like yourself over the past 25 years.
- A statement describing why the subject is being asked to participate in the study The experimenters want to find out whether reactions to foods differ across populations with different attitudes about eating and dieting.
- Any significant new findings that might relate to the subject's willingness to continue participation. The findings in this study will help the investigators identify both positive and negative attitudes that could be helpful in the provision of eating research.
- The approximate number of subjects involved in the study. There will be approximately 100 participants,
- A statement that this is a multi-institutional or single institutional study. This is a single institutional study at Central Connecticut State University. My sponsor and advisor is Robert Fullilove from Columbia University, where I am completing in my Doctorate in Public Health.

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## 2. DURATION

- There will be one eating session in this study combined with the consent signing and questionnaire completions and PROP assessment and will take about one hour. The consent sessions will be held between 2 and 4 pm during the summer and fall of 2014.

## 3. RISKS

- During the study we will be asking you personal questions such as your weight, age, eating habits, and dieting history. If you are not comfortable answering these questions, please inform principle investigator Braverman whose name and contact information is listed on top of each page of the consent form. You do not have to answer any questions that you are not comfortable with.
- Medical conditions that could negatively impact your performance in this study include Type I or Type II Diabetes, Hypoglycemia, known Eating Disorders, Graves Disease, a suspected pregnancy, or an allergy to 6-n-Propylthiouracil (PROP). The genetic ability to taste food is based on whether one has recessive or dominant (or heterozygous) alleles on the tongue which correlate with the intensity one can 'taste' the bitter PROP 6-n-propylthiouracil (Bartoshuk, Duffy, Miller, 1994). Propylthiouracil or 6-n-Propylthiouracil is a drug used to treat hyperthyroidism (Graves Disease) by decreasing the amount of thyroid hormone produced by the thyroid gland.
- There is a risk of liver damage associated with the compound called Prop that you will taste. This compound is given to patients who have a hyperactive thyroid (Grave's Disease). If PROP were prescribed for you, you would take about 200 mg per day for weeks or months. The amount of PROP you will taste one time as part of our research is 1.6 mg. We know of no negative effects that can occur with such a small amount and has been used for more than 60 years around the world without incident (Tepper, 2012). However, there could be a risk that no one knows about at this time. We suggest that anyone concerned about allergies, pregnancy, or any other reason, even when there is no physical risk, the PROP taste could produce anxiety in individuals cautious about tasting unknown items to be cautious not taste the PROP paper. You can still remain part of the eating sessions if you decide not to participate with the Prop taste test.

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## **4. BENEFITS**

- There may be no direct benefits to you from your participation in this study at this time, but the results of your participation may provide information that will be useful to others and possibly to you in the future.

## **5. ALTERNATIVES**

- While there are no alternatives to participation in this study, you may opt not to participate.

## **6. CONFIDENTIALITY**

- All records and questionnaires will be maintained in the locked office of PI Braverman at Central Connecticut State University and will be obtainable only by individuals authorized to do so. All identifying information, such as your name, will be separate from the participant ID number assigned to you at the start of the study.
- There is no commercial sponsor for this research.
- If you consent to participate in this research, your personal information will be kept confidential and will not be released without your written permission, except as described in this section or as required by law. Your personal information may be shared, to the extent necessary, among the research staff at Central Ct. State University for purposes such as data analysis.
- The health information that may be asked during the interview will include: your height and weight, your BMI, your demographic information, diet and weight history data, your level of ability to taste 6-n-Propylthiouracil, your hunger and satiety ratings over the five eating sessions.
- Columbia University Medical Center's IRB and the OHRP at CUMC are entities that may access Research Records.
- Your name will not be reported in any publication; only the data obtained as a result of your participation in this study will be made public.
- After admittance to the study, only the SRB id will be used to access data of individuals without any identification by individual characteristics.
- You may change your mind and revoke this Authorization at any time for any reason. To revoke this Authorization, contact PI Sharon Braverman at Vance

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210 at CCSU. Even if you revoke this Authorization, the Researchers may continue to use and disclose the information already collected as permitted.

- Confidentiality of all participants will thus be maintained and all data, questionnaires, demographic information and somatic rating forms will be stored in a secure locked cabinet in the office of investigator, Sharon Braverman. All raw data will be destroyed as per APA guidelines once the study is complete. Data from subjects not selected, those excluded or who choose not to participate, will be discarded (shredded) without identification.
- This Authorization will expire when the research is completed.

## 7. INJURY

- If you are injured during the study, only immediate and essential medical treatment will be provided free of charge by Central Connecticut State University Health Center or Central Connecticut State University's Counseling and Wellness Center.

## 8. CONTACT

- If you have questions at any time about this study, your rights as a participant, and/or the available options in the event of a research-related injury you can contact the Primary Investigator Sharon Braverman 860 832-3276. Contact PI Sharon Braverman if you have questions or concerns or Dr. Bradley Waite, Chair CCSU. Human Studies Council-IRB 860 832-3115 or Kim DeMichele, HSC Administrator at CCSU at 860 832-2366. You may change your mind and withdraw this Authorization at any time and for any reason.

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## **9. VOLUNTARY PARTICIPATION**

- Participation is voluntary and refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled. Contact PI Sharon Braverman if you have questions or concerns or wish to revoke this Authorization to participate.

## **10. COMPENSATION**

- An extra incentive for joining our study is that if you enter the study, your study ID number will be placed in a hat for a lottery drawing for 3 lucky winners who will be given tickets to attend Dr. Mehmet Oz' TV show in New York. You have a 3% chance of winning [3/100]. The cost of transportation by AMTRAK train from Berlin Ct. to New York will be paid by researcher PI Braverman for the three winners. All participants will be given a pass for one month of membership at LA Fitness in Berlin, Connecticut, which is free to the study participants and no cost to researcher PI Braverman, a flashlight with both CCSU and Columbia's logos to illustrate that Research Lights the Way at a cost of \$5.00 each and this cost will be paid by researcher PI Braverman.

## **11. QUESTIONS**

- The principal investigator Braverman will answer to the best of her ability all questions posed by you and will answer to the best of their ability any questions that you may have in the future. A debriefing session will be organized to explain the results and the conclusions drawn when the study is completed.

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## 12. COPY

I am not waiving (giving up) any of my legal rights by participating in this study. You will receive a copy of this consent form for your records.

## 13. TERMINATION

- You may be asked to terminate the study before you have completed it if you do not comply with all the instructions given to you.
- You may also be asked to terminate the study if your responses do not match certain predetermined patterns.

## 14. COSTS TO SUBJECT

- There will be no cost to you for participation in this research study.

## 15. WITHDRAWAL BY SUBJECTS

- There will be no consequences to you if you decide to withdraw from this study.

## 16. SUBJECT'S SIGNATURE

- Your signature on this form and your initials on the bottom of each page indicate that you have been told about the research and are willing to participate in the study.

### Signature

Study Coordinator

Print Name \_\_\_\_\_ Signature \_\_\_\_\_

Date & Time \_\_\_\_\_

Study Subject

Print Name \_\_\_\_\_ Signature \_\_\_\_\_

## DEMOGRAPHIC INFORMATION

SRB ID \_\_\_\_\_

Date: \_\_\_\_\_

Time: \_\_\_\_\_

Name \_\_\_\_\_

Email \_\_\_\_\_

Cell Phone number \_\_\_\_\_

Your Age \_\_\_\_\_

Your Date of Birth \_\_\_\_\_

I am a {Please check the appropriate line}

Freshmen \_\_\_\_\_

Sophomore \_\_\_\_\_

Junior \_\_\_\_\_

Senior \_\_\_\_\_

Graduate student \_\_\_\_\_



Race/Ethnicity..... Please check all that apply to you:

- |  |  |
|--|--|
| <input type="checkbox"/> Hispanic, Mexican,<br>Mexican American, Chicano                           | <input type="checkbox"/> Armenian            |
| <input type="checkbox"/> Puerto Rican  | <input type="checkbox"/> Brazilian           |
| <input type="checkbox"/> Cuban   | <input type="checkbox"/> Eastern European    |
| <input type="checkbox"/> Argentinean, Columbian,<br>Dominican, Nicaraguan,<br>Salvadoran, Spaniard | <input type="checkbox"/> Polish              |
| <input type="checkbox"/> White   | <input type="checkbox"/> Russian             |
| <input type="checkbox"/> Black, African American, Negro,   | <input type="checkbox"/> Middle Eastern/Arab |
| <input type="checkbox"/> American Indian or Alaska Native  | <input type="checkbox"/> French              |
| <input type="checkbox"/> Asian Indian  | <input type="checkbox"/> French Canadian     |
| <input type="checkbox"/> Chinese   | <input type="checkbox"/> German              |
| <input type="checkbox"/> Filipino  | <input type="checkbox"/> Ghana               |
| <input type="checkbox"/> Japanese  | <input type="checkbox"/> Iranian/Persian     |
| <input type="checkbox"/> Korean  | <input type="checkbox"/> Iraqi               |
| <input type="checkbox"/> Vietnamese  | <input type="checkbox"/> Irish               |
| <input type="checkbox"/> Native Hawaiian   | <input type="checkbox"/> Italian             |
| <input type="checkbox"/> Guamanian or Chamorro   | <input type="checkbox"/> Jamaican            |
| <input type="checkbox"/> Samoan Other Pacific<br>Islander/Fijian Tongan                            | <input type="checkbox"/> Jewish              |
| <input type="checkbox"/> Other Asian Hmong, Laotian,<br>Thai, Pakistani, Cambodian                 | <input type="checkbox"/> Lebanese            |
|  | <input type="checkbox"/> Syrian              |
|  | <input type="checkbox"/> Turkish             |

DEMOGRAPHIC INFORMATION

SRB ID \_\_\_\_\_

Please Indicate the Highest Level of Education Your Mother Has Completed

less than High School

GED or High School

Associates Degree or Certificate

Bachelors Degree

Masters Degree

Doctorate

Were you born in the U.S.? Yes\_\_\_\_No\_\_\_\_

If No, where were you born? \_\_\_\_\_

What is the primary language spoken in your home? \_\_\_\_\_

Did you receive Free and Reduced Price Lunches during your elementary, middle and high school education? Yes\_\_\_\_ No\_\_\_\_

Has your family ever received Food-stamps? Yes\_\_\_\_ No\_\_\_\_

Do you qualify for Financial Aid? Yes\_\_\_\_ No\_\_\_\_

Are you the first member of your family to attend college? Yes\_\_\_\_ No\_\_\_\_

Thank you.

## Diet and Weight History Questionnaire

SRB ID \_\_\_\_\_

1. My current weight is \_\_\_\_\_ pounds.
2. For about how long have you been at or close to this weight? \_\_\_\_\_
3. Have you ever dieted to control your weight? Yes\_\_\_\_ No\_\_\_\_\_
4. What is the most you have ever weighed since reaching your current height?  
\_\_\_\_\_Pounds.
5. Are you currently dieting to lose weight? Yes\_\_\_\_ No\_\_\_\_\_
6. Do you currently diet to avoid gaining weight? Yes\_\_\_\_ No\_\_\_\_\_
7. How many times have you dieted and purposely lost  
1-4 pounds \_\_\_\_\_ times  
5-10 pounds \_\_\_\_\_ times  
11-20 pounds \_\_\_\_\_ times  
More than 21 pounds \_\_\_\_\_ times
8. Do you wish you weighed less than you currently do? Yes\_\_\_\_ No\_\_\_\_
9. Is dieting common in your family? Yes \_\_\_\_\_ No\_\_\_\_\_
10. How old were you when you went on your first diet? [ \_\_\_\_\_ years old]  
[Put NA if you have not dieted in the past]

11. Who do you consider a dieter of your family or friends? [please check all that apply]

Mother

Grandmother

Father

Aunt

Sister/Brother

Cousins

Friends

Myself

12. Who determined your portions as a child? [please check all that apply]

Mother

Grandmother

Father

Aunt

Sister/Brother

Cousins

Friends

Myself

13. Who decides your portions currently? [please check all that apply]

Mother

Grandmother

Father

Aunt

Sister/Brother

Cousins

Friends

Myself

14. Who decides what you eat each day? [please check all that apply]

Mother

Grandmother

Father

Aunt

Sister/Brother

Cousins

Friends

Myself

### Three Factor Eating Questionnaire

**Please circle the items True or False based on your feelings:**

1. When I smell a sizzling steak or see a juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal. T F
2. I usually eat too much at social occasions, like parties and picnics. T F
3. I am usually so hungry that I eat more than three times a day. T F
4. When I have eaten my quota of calories, I am usually good about not eating any more. T F
5. Dieting is so hard for me because I just get too hungry. T F
6. I deliberately take small helpings as a means of controlling my weight. T F
7. Sometimes things just taste so good that I keep on eating even when I am no longer hungry T F
8. Since I am often hungry, I sometimes wish that while I am eating, an expert would tell me that I have had enough or that I can have something more to eat. T F
9. When I feel anxious, I find myself eating. T F
10. Life is too short to worry about dieting. T F
11. Since my weight goes up and down, I have gone on reducing diets more than once. T F
12. I often feel so hungry that I just have to eat something. T F
13. When I am with someone who is overeating, I usually overeat too. T F
14. I have a pretty good idea of the number of calories in common food. T F
15. Sometimes when I start eating, I just can't seem to stop. T F
16. It is not difficult for me to leave something on my plate. T F
17. At certain times of the day, I get hungry because I have gotten used to eating then. T F
18. While on a diet, if I eat food that is not allowed I consciously eat less for a period of time to make-up for it. T F
19. Being with someone who is eating often makes me hungry enough to eat also. T F
20. When I feel blue, I often overeat. T F
21. I enjoy eating too much to spoil it by counting calories or watching my weight. T F

SRB ID\_\_\_\_\_

### Three Factor Eating Questionnaire

Please circle the items True or False based on your feelings:

- 22. When I see a real delicacy, I often get so hungry that I have to eat right away. T F
- 23. I often stop eating when I am not really full as a conscious means of limiting the amount that I eat. T F
- 24. I get so hungry that my stomach often seems like a bottomless pit. T F
- 25. My weight has hardly changed at all in the last ten years. T F
- 26. I am always hungry so it is hard for me to stop eating before I finish the food on my plate. T F
- 27. When I feel lonely, I console myself by eating. T F
- 28. I consciously hold back at meals in order not to gain weight. T F
- 29. I sometimes get very hungry late in the evening or at night. T F
- 30. I eat anything I want, any time I want. T F
- 31. Without even thinking about it, I take a long time to eat. T F
- 32. I count calories as a conscious means of controlling my weight. T F
- 33. I do not eat some foods because they make me fat. T F
- 34. I am always hungry enough to eat at any time. T F
- 35. I pay a great deal of attention to changes in my figure. T F
- 36. While on a diet, if I eat a food that is not allowed I often then splurge and eat other high calorie food. T F

Part II: please answer the following by circling the number above which response is appropriate to you.

- 37. How often are you dieting in a conscious effort to control your weight?  
1                                      2                                      3                                      4  
rarely                                      sometimes                                      usually                                      always
- 38. Would a weight fluctuation of 5 lbs. affect the way you live your life?  
1                                      2                                      3                                      4  
not at all                                      slightly                                      moderately                                      very much

### Three Factor Eating Questionnaire

Please circle the items True or False based on your feelings:

39. How often do you feel hungry?

1	2	3	4
only at mealtime	sometimes between meals	often between meals	almost always

40. Do your feelings of guilt about overeating help you to control your food intake?

1	2	3	4
never	rarely	often	always

41. How difficult would it be for you to stop eating halfway through dinner and not eat for the next four hours?

1	2	3	4
easy	slightly difficult	moderately difficult	very difficult

42. How conscious are you of what you are eating?

1	2	3	4
not at all	slightly	moderately	very much

43. How frequently do you avoid 'stocking up' on tempting foods?

1	2	3	4
almost never	seldom	usually	almost always

44. How likely are you to shop for low calorie foods?

1	2	3	4
unlikely	slightly likely	moderately likely	very likely

45. Do you eat sensibly in front of others and splurge alone?

1	2	3	4
never	rarely	often	always

46. How likely are you to consciously eat slowly in order to cut down on how much you eat?

1	2	3	4
unlikely	slightly likely	moderately likely	very likely

47. How frequently do you skip dessert because you are no longer hungry?

1	2	3	4
almost never	seldom	at least once a week	almost always

48. How likely are you to consciously eat less than you want?

1	2	3	4
unlikely	slightly likely	moderately likely	very likely

SRB ID \_\_\_\_\_

### Three Factor Eating Questionnaire

**Please circle the items True or False based on your feelings:**

49. Do you go on eating binges though you are not hungry?

1  
never

2  
rarely

3  
sometimes

4  
at least once a week

50. On a scale of 0 to 5, where 0 means no restraint in eating (eating whatever you want, whenever you want it) and 5 means total restraint (constantly limiting food intake and never 'giving in'), what number would you give yourself?

0eat whatever you want, whenever you want it

1usually eat whatever you want, whenever you want it

2often eat whatever you want, whenever you want it

3often limit food intake, but often 'give in'

4usually limit food intake, rarely 'give in'

5constantly limiting food intake, never 'giving in'

51. To what extent does this statement describe your eating behavior: "I start dieting in the morning, but because of any number of things that happen during the day, by evening I have given up and eat what I want, promising myself to start dieting again tomorrow."

1  
not like me

2  
little like me

3  
pretty good  
description of me

4  
describes me  
perfectly



# Food Liking

SRB ID\_\_\_\_\_

## Food Liking

In order to say how much you like or dislike a food, look at the following scale and circle the appropriate number below the category:

LIKE EXTREMELY	LIKE VERY MUCH	LIKE MODERATE	LIKE SLIGHTLY	NEITHER	DISLIKE SLIGHTLY	DISLIKE MODERATE	DISLIKE VERY MUCH	DISLIKE EXTREMELY
9	8	7	6	5	4	3	2	1

(Peryam, Pilgrim, 1957)

# Horizontal Appetite Rating Scale

SRB ID \_\_\_\_\_

## Scaling Training

SRB ID \_\_\_\_\_

Have you ever had a tonsillectomy? Y \_\_\_ N \_\_\_

For Females, Number of Full Term Pregnancies \_\_\_\_\_

Did you have severe nausea and vomiting with pregnancy? \_\_\_\_\_

Do you ever have persistent salty, sweet, sour, or bitter tastes in your mouth?

1. never \_\_\_\_\_ 2. occasionally \_\_\_\_\_ 3. sometimes \_\_\_\_\_ 4. always \_\_\_\_\_

Have you ever suffered from a head injury?

1. no \_\_\_\_\_ 2. yes, but not serious \_\_\_\_\_ 3. yes, had either a concussion or loss of consciousness \_\_\_\_\_

4. yes, both concussion and loss of consciousness, and/or loss of memory \_\_\_\_\_

Have you ever suffered from middle ear infections?

1. no \_\_\_\_\_ 2. yes, but not serious \_\_\_\_\_ 3. yes, required antibiotics more than once \_\_\_\_\_

4. yes, required tubes in ears \_\_\_\_\_.

<i>No Sensation</i>	<i>Strongest Experienced Sensation of any Kind</i>
brightness of a well-lit room	
brightness of a dimly lit restaurant	
brightest light you have seen	
loudness of a whisper	
loudness of a conversation	
loudest sound you have heard	
warmth of warm bread in your mouth	
strongest smell of a flower	
sweetness of a coke	
bitterness of celery	
strongest saltiness experienced	
strongest sweetness experienced	
strongest sourness experienced	
strongest bitterness experienced	
strongest oral burn experienced (like chili peppers)	
strongest oral pain experienced (like a toothache)	
strongest pain of any kind experienced (type of pain)	
strongest sensation of any kind experienced (type of sensation)	

# Horizontal Appetite Rating Scale

SRB ID \_\_\_\_\_

## Horizontal Appetite Rating Scale –Fasted/Fed

Please rate the intensity of each of the sensations indicated below by placing a vertical stroke (|) anywhere on the horizontal line. The line below is intended to reflect experiences of intensity of any kind.

1. How **hungry** are you? Rate the intensity of your hunger on the line.

No Sensation \_\_\_\_\_ Strongest Experienced  
Sensation of any Kind

2. How strong is your **desire** for eating your favorite food right now? Rate the intensity of your desire on the line.

No Sensation \_\_\_\_\_ Strongest Experienced  
Sensation of any Kind

3. How physically **full** do you feel? Rate the intensity of your fullness on the line.

No Sensation \_\_\_\_\_ Strongest Experienced  
Sensation of any Kind

4. How physically **sick** do you feel? Rate the intensity of your sickness on the line.

No Sensation \_\_\_\_\_ Strongest Experienced  
Sensation of any Kind

# Horizontal Appetite Rating Scale

SRB ID \_\_\_\_\_

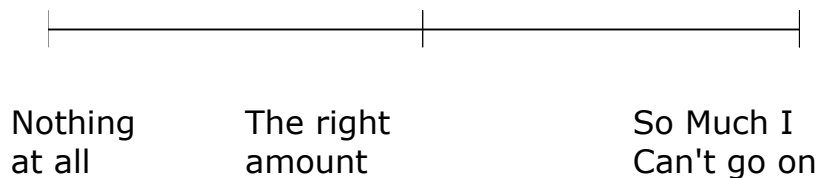
Horizontal Appetite Rating Scale –Fasted (continued)

Please rate the intensity of each of the sensations indicated below by placing a vertical stroke (|) anywhere on the horizontal line. The line below is intended to reflect experiences of intensity of any kind.

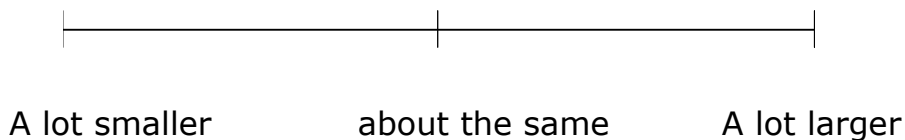
5. How much **anxiety** and **nervousness** do you feel? Rate the intensity of your anxiety on the line.



6. How much have you eaten?



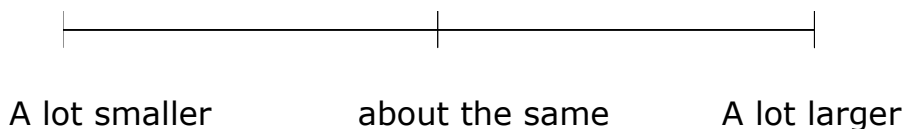
7. How did this amount compare to a normal meal?



8. How hungry will you be for your next meal?



9. How did today's portion compare to the portion you ate on the day you signed your consent form?



## Horizontal Appetite Rating Scale

SRB ID \_\_\_\_\_

10. How many pancakes could you eat right now?

ONE -

TWO -

THREE -

FOUR -

FIVE -

SIX -

SEVEN -



# SLIMSCALE

SRB ID \_\_\_\_\_

## SLIMSCALE Fasted & Fed

[Please put a slash (/) mark somewhere on the line below]

-Greatest Imaginable Fullness

-Extremely Full

-Very Full

-Moderately Full

-Slightly Full

-Neither Hungry nor Full

-Slightly Hungry

-Moderately Hungry

-Very Hungry

-Extremely Hungry

-Greatest Imaginable Hunger

SRB ID \_\_\_\_\_

### **Taste Estimation Scale**

[Please put a slash (/) mark somewhere on the line below]

Strongest Experienced Sensation of any Kind

-Very Strong

-Strong

-Moderate

-Weak

-Barely Detectable

-No Sensation

SRB ID \_\_\_\_\_ DAY \_\_\_\_\_ DATE \_\_\_\_\_ TIME \_\_\_\_\_

## Evaluation Form

1. How would you rate the length of the today's session?

A good length                  an okay length                  Too long

2. Was the timing of the session convenient for you?

Yes                  Unsure                  No

3. Was the SLIMSCALE [vertical scale] hunger/fullness rating tool easy to use?

Yes                  Unsure                  No

4. Was the Horizontal Rating Scale hunger/fullness rating tool easy to use?

Yes                  Unsure                  No

5. Which form was easier to use to rate hunger and fullness:

a. The Horizontal Appetite Rating form:                 

b. The vertical SLIMSCALE Rating tool:                 

6. Would you like information on maintaining or returning to a natural weight without dieting?

Yes for sure                  not interested                  no

7. Would you like to be part of another study on eating?

Yes for sure                  not interested                  no

8. How many calories do you think were in the Butter French Crumb cake you ate today? \_\_\_\_\_ calories.

9. Additional comments are welcome.



**Composite Variables SES and Early Family Eating Behavior  
SES from Demographic information (7) Higher score = higher SES**

Participant's Mother's level of education high school or more (1)	<b>(1)</b>	less than high school (0)	<b>(0)</b>
Participants place of birth USA (1)	<b>(1)</b>	not USA (0)	<b>(0)</b>
The language that is spoken at home English (1)	<b>(1)</b>	Not English (0)	<b>(0)</b>
Whether participants received free or reduced lunch in elementary, middle or high school no (1)	<b>(1)</b>	yes (0)	<b>(0)</b>
Did their family receive food stamps No (1)	<b>(1)</b>	yes (0)	<b>(0)</b>
Are they the first to attend college no (1)	<b>(1)</b>	yes (0)	<b>(0)</b>
Do they receive financial aid no (1)	<b>(1)</b>	yes (0)	<b>(0)</b>

**Early Family Eating Behavior From Diet and Weight History Questionnaire  
(7) Higher score =dieter**

Participants age of first diet q10	<=15	<b>(1)</b>	>=16	<b>(0)</b>
How long have you been at your current weight q2	< 1 year	<b>(1)</b>	>=1year	<b>(0)</b>
Number of dieters among family members q11	>=3	<b>(1)</b>	<=2	<b>(0)</b>
Who determined your portions as a child q12	Others	<b>(1)</b>	self	<b>(0)</b>
Who determines your portions today q13	others	<b>(1)</b>	self	<b>(0)</b>
How many times have you lost 1~10 lbs?	>=3	<b>(1)</b>	<=2	<b>(0)</b>
How many times have you lost 11-20 pounds?	>=3	<b>(1)</b>	<=2	<b>(0)</b>