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THE RELATIONSHIP BETWEEN CHILDREN'S BODY
DISSATISFACTION AND OVEREATING IN THE LABORATORY

SOFIE RUGH LUTFY
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Reviewed and approved* by the following:

Dr. Kathleen Keller
Associate Professor, Department of Nutritional Sciences
Thesis Supervisor

Dr. Jung In Kim
Assistant Research Professor, Department of Statistics
Faculty Reader

*Electronic Signatures are on file in the Schreyer Honors College

ABSTRACT

This study focuses on body dissatisfaction in children and overeating in the laboratory through a 7-visit series of studies tested on the same subjects. Thirty-seven children (age 7-8) participated in this longitudinal Food and Brain study that was designed to understand risk factors for overeating and obesity in children. The study consisted of 7 overall visits, outlined in Appendix A, Table 8, that measured different items during each individual visit. The subjects rated their level of body dissatisfaction through a questionnaire on the initial visit, figure 13-16 depicts the figure rating scale questionnaire used in the study. They were also presented with a variety of food portions and were put through an eating in the absence of hunger test and portion size test. All children were of healthy weight status, 46.1% were male subject and 49.4% female. This thesis aims to relate children's perceived body dissatisfaction to objectively assessed food intake in response to larger portions of food and when children are served tasty treats immediately following a meal (i.e., eating in the absence of hunger). It was hypothesized that higher levels of body dissatisfaction would be positively associated with intake in response to portion size and with eating in the absence of hunger. From the study, we found no evidence of a relationship between body dissatisfaction and either eating in the absence of hunger or intake in response to larger portions. We conclude that among a small sample of healthy weight, 7-8-year-old children, we found no relationship between body dissatisfaction and laboratory measures of overeating.

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Chapter 1

Introduction

Body Dissatisfaction

Body Dissatisfaction results when individuals feel unsatisfied with how their actual body differs from their ideal image. Body image dissatisfaction is highly studied and occurs across the lifespan, starting as early as childhood. It has been widely studied across adults and adolescents, however, in recent years it has shown to increase in children (Paxton, Truby, 2002). Body dissatisfaction at these young ages can lead to more severe psychological disorders in the future (Paxton, Truby, 2002).

Body dissatisfaction is related to eating behaviors. Specifically, children who diet and have a stronger awareness of eating are more prone to high levels of body dissatisfaction (Rolls, Roe, Kral, Meengs, Wall, 2004). Specific verbiage is used by children who diet, and they perceive dieting as “eating less” not “eating healthier” (Schur, Sanders, Steiner, 2000). Extreme levels of dieting are a concern because they can predispose children to the development of body dissatisfaction or even eating disorders later in their life (Schur, Sanders, Steiner, 2000).

Typical measurements utilized for body dissatisfaction include the body image rating scale test which measures a child’s perception of their actual vs. ideal image, the figure rating scale has been utilized in multiple studies to obtain an accurate measurement of body dissatisfaction (Schur, Sanders, Steiner, 2000). This requires participants to rate their actual

perception of their body vs. what they want their body to look like; comparing actual vs. ideal it gives a score for that individual's body dissatisfaction.

The reason the Child Figure Rating Scale proves to be effective is it is direct and less abstract. The child judges based off of visuals as opposed to interpreting questions based off of a child's thought (Paxton, Truby, 2002) which is generally more accurate from a child's perspective. The scale is also very simple, easy to utilize, and inexpensive which are all favorable qualities in research (Paxton, Truby, 2002).

One particular study done using the figure rating scale looked at how doll size and style of dress impact 6-8-year-old girl perceptions of body image. The children were presented with dolls in different dress and size for both Study 1 and 2, and were able to play with dolls ranging from thin to full in either bathing suits or conservative clothing. The Child Figure Rating Scale questions children of these ages to rate their "actual" body size based off of images of 7 different figures ranging from very thin to obese. The children were asked to rate what they wish to look like of these 7 different silhouettes, which would refer to their "ideal" body rating. Positive scores indicated a participant's desire to be thinner, zero indicated being satisfied, and negative scores indicated a desire to gain weight. Girls who played with thinner dolls were more likely to have a higher level of body discrepancy than girls who played with normal sized dolls. Girls who played with full-figured dolls expressed less body dissatisfaction than girls who played with thin dolls (Jellinek, Myers, Keller, 2016). This experiment was a representation of how the figure rating scale can be utilized to assess body dissatisfaction.

Another factor that can be useful when looking at relationships in body dissatisfaction is a child's weight status (BMI percentile). The body mass index (BMI) of a child is measured by taking their weight divided by their height, and the percentile is calculated by comparing to the general population of other children. BMI has been a useful tool in screening children who are obese (Rolls, Roe, Kral, Meengs, Wall, 2004). Additionally, there has been multiple studies that examined the association between body dissatisfaction and BMI. One study in particular, examined children in their late childhood and the results showed that there was association between BMI and body dissatisfaction, however, they were gender-specific (Calzo, Sonnevile, Austin, 2012). Girls above the 50th BMI percentile reported higher body dissatisfaction, and boys reported higher body dissatisfaction if they were above the 75th percentile or below the 10th percentile (Calzo, Sonnevile, Austin, 2012). This study shows that body dissatisfaction is likely to be associated with BMI percentile levels. Another study associating body dissatisfaction with high weight status was done among 574 South Asian children aged 5-7 years. BMI levels were measured and body dissatisfaction scores were recorded using the figure rating scale. The results show that perceived body image was positively correlated to weight status in the children (Pallan, Hiam, Duda, Adab, 2011).

It is clear, from previous studies that body dissatisfaction is present for both male and female children and understanding the underlying factors behind these rates is important. Two specific factors being analyzed in this study are children's susceptibility to overeating from large portions of food and their tendencies to eat tasty treats and snacks when not hungry (i.e., eating in the absence of hunger). This specific study will be determining if these two factors also directly affect children experiencing body dissatisfaction.

Eating in the Absence of Hunger (EAH)

Eating in the absence of hunger is defined as the act of indulging in food beyond what the body needs for nourishment and is studied to be a leading factor in obesity (Feig, Piers, Kral, Lowe, 2018). Often children overindulge in tasty snacks despite not being hungry because of the satisfying taste, which can lead to overconsumption of calories (Fogel, Mccrickerd, Pries, 2018).

EAH has been measured through multiple experiments. One specific study measured children between ages 4.5 and 6 years and determined that the subjects who ate in the absence of hunger were more likely to experience adiposity and higher BMI in the future (Fogel, Mccrickerd, Pries, 2018). To measure EAH in the study the children were served lunch and then after 20 min were given 2 sweet and 2 savory snacks and were allowed to consume as much as they wanted. After 5 minutes of free access to the snacks, they were re-weighed to see how much energy was consumed by the child. This amount consumed in the absence of hunger is used as the measure of EAH. This variable has been shown to be stable over time and highly related to body adiposity (Feig, Piers, Kral, Lowe, 2018). In studies that have split cohorts by gender, girls showed consistent behavior over time with EAH, while boys did not. In addition, several other studies have shown that boys tend to eat more in the absence of hunger than girls. It is recommended to split male and female when examining EAH because it can have an effect on the results future (Fogel, Mccrickerd, Pries, 2018).

In another study that was done, EAH was assessed in children at age 7-years-old, and children returned at age 15 years-old when self-reported binge eating was assessed (Livingstone, Pourshahidi, 2014). They tested binge eating using a 16-item scale which

analyzed behaviors that would be categorized as increased likelihood to take part in binge eating. Scores below 18 were at risk for not binge eating, 18-26 was moderate risk, and above 26 would be severe (Livingstone, Pourshahidi, 2014). EAH was measured at baseline using a similar method to the study involving children 4.5-6 years old. It was determined in this study that EAH at age 7 was positively correlated to binge eating disorder at 15. The results align with other studies done relating EAH to the development of disordered eating behaviors and the relationship between the two factors would be useful to utilize in predicting disordered eating at an earlier age (Livingstone, Pourshahidi, 2014). Because body dissatisfaction is a frequent symptom of eating disorders, it is possible that EAH may be related to high levels of body dissatisfaction early in a child's development. Therefore, early emergence of body dissatisfaction may be a risk factor for the development of disordered eating and obesity.

A child's willingness to consume palatable foods in the absence of hunger may contribute to the development of obesity (Feig, Piers, Kral, Lowe, 2018). One study looked at 192 children from ages 5-7 over a 2-year period, and found that the young girls who ate in the absence of hunger showed an increase likelihood to experience weight gain/becoming overweight (Feig, Piers, Kral, Lowe, 2018). Studies have also supported the link between EAH and adiposity, and therefore this thesis hypothesizes with greater amount of body dissatisfaction will be positively related to EAH assessed in the laboratory. Obesity is associated with dissatisfaction in body image in children and therefore dissatisfaction could be linked to EAH as well, but there is a lack of studies that measure this theory.

Portion sizes

Since the late 1970s portion sizes of many common foods and beverages have been increasing, especially with high energy density foods (Harrington, Staiano, Katzmarzyk, 2013). Larger portion sizes are a concern because they are related to the development of obesity. Multiple studies with children have correlated the increased portion size with weight gain and obesity and moderating portion size is a strategy to help with weight management (Harrington, Staiano, Katzmarzyk, 2013).

The amount of food served (i.e., portion size) has a strong effect on how much food children consume at a snack or meal. Children if presented with a larger portion of food are more likely to eat a greater amount than they would if they served themselves or if they were served a smaller portion (Fogel, Mccrickerd, Fries, 2018). A study was conducted that measured portion size recognition in children. Children were given a series of 8 photos that ranged from 20kcal to 900kcal the energy differences represented the varying portion size. They were asked to choose which plate they would prefer to eat. This study runs parallel to the study done with eating in the absence of hunger previously explained; children who were more likely to eat regardless of being hungry were also more likely to select a higher portion size as their ideal (Fogel, Mccrickerd, Fries, 2018).

The portion size effect (PSE) has been the term used to describe the phenomenon where individuals consume more food when served larger portions, despite the fact that they do not report feeling fuller as a result (Schur, Sanders, Steiner, 2000). Numerous laboratory studies in adults (Rolls, Roe, Meengs, Kral, Wall, 2004; Rolls, Roe, Meengs, Wall, 2004), and children (Keller, English, Fearnbachm, 2018; Kling, Roe, Keller, Rolls, 2016) have

demonstrated this effect. Recent studies have also shown a relationship between the PSE and other behaviors related to overeating, including EAH. More specifically, an individual that is influenced by the PSE has a higher likelihood to consume excess energy which can lead to a higher risk of obesity (Schur, Sanders, Steiner, 2000). This study will look deeper into the relationship between the PSE and determine whether greater consumption will be positively correlated with higher body dissatisfaction.

When there is a higher consumption of food it likely leads to obesity, and this can further result in body dissatisfaction. Therefore, the hypothesis that greater susceptibility to the PSE will be associated with higher body dissatisfaction.

Study Goals

The purpose of this thesis is to use research from an ongoing longitudinal study (i.e., the Food and Brain Study) to determine if body dissatisfaction is associated with children's laboratory eating behaviors. Some particular questions that will be looked into detail using the studies done will be:

1. If a child reports greater dissatisfaction with their body will consume more tasty snacks in the lab in the absence of hunger?
2. If a child reports greater dissatisfaction with their body will they be more susceptible to overeating larger portions of food?

Previous studies have looked into the relationships between eating in the absence of hunger and portion size in relation to obesity/overeating. Body dissatisfaction is also higher for children who experience weight gain or are generally overweight. This thesis hypothesizes higher body dissatisfaction is associated with greater eating in the absence of hunger and greater portion intake.

Chapter 2

Methods

Overview and Participants

There were 86 unique ID participants in the study, all children had a healthy body mass index (BMI) defined as a BMI-for-age % < 85. By design, half of the children had parents with healthy BMI (25 kg/m² or below) and the other half had parents who had obesity (30 kg/m² or greater).

The study was approved by The Pennsylvania State University Internal Review Board. Parents signed informed consent to allow their child to participate and children gave written and verbal assent.

Study Design

The Food and Brain Study is a prospective, within subject's crossover design study funded by the National Institutes of Health. The purpose of this study is to test the association between children's behavioral and neural response to portion size cues, laboratory intake, and the development of obesity. As part of the study, children come in for 7 laboratory visits, 6 of which are conducted at baseline and 1 which occurs 1 year later. All laboratory visits are conducted at usual meal times, either lunch (11am – 1pm) or dinner (4:30 – 6:30 PM). All visits are kept at consistent times within families, and to the extent possible, counter-balanced across families. The current thesis will present on secondary aims of the Food and Brain Study, which involve understanding the association between disordered eating, including body dissatisfaction, and the development of obesity.

Visit 1 and 7 occurred in the Noll Lab, visit 2-5 took place in the Metabolic Kitchen and Children's Eating Behavior Laboratory, and visit 6 was in the SLEIC fMRI lab. During visit 1 food items were prepared for the eating in the absence of hunger test. All food items were weighed prior to being administered to the children. Prior to being presented with the eating in the absence of hunger foods, children were provided with a multi-item meal and instructed to eat until sated. The eating in the absence of hunger Pre-Meal Foods prepared included: Peanut butter and jelly, ham & cheese, turkey & cheese, and cheese sandwiches. In addition, snacks involved in the meal pre-meal portion include applesauce, baby carrots, potato chips, chocolate chip cookies, milk, and sauces (ketchup, mayo, & mustard). The eating in the absence of hunger snack foods include Hershey's kisses, starbursts, oreos, cheesy popcorn, fritos, pretzels, skittles, little bite brownies, vanilla ice cream cups, and water as a drink.

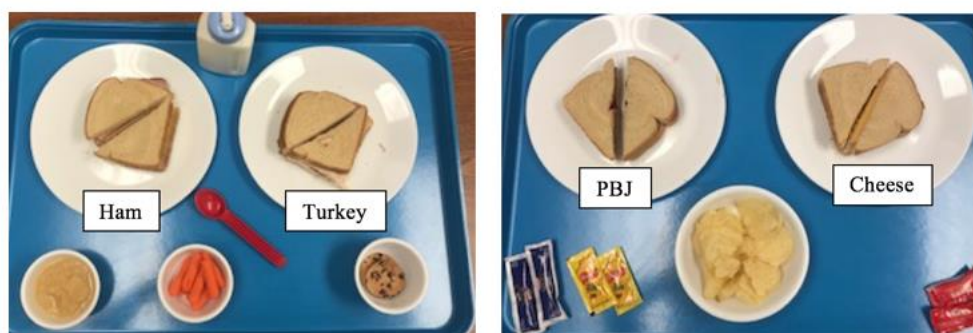
Table 1: EAH Pre-Meal Summary

EAH Pre-Meal Foods	Amount
1. 2 slices Wegmans White Whole Grain Bread 2. 2 tbsp Jif Peanut Butter 3. 1 tbsp Smuckers Strawberry Jelly	1 sandwich, cut into 2 triangles with bread knife
1. 2 slices each Wegmans White Whole Grain Bread 2. 2 slices Wegmans Old Fashioned Ham Off the Bone 3. 2 slices Wegmans Sliced Yellow American Cheese	1 sandwich, cut into 2 triangles with bread knife
1. 2 slices Wegmans White Whole Grain Bread 2. 2 slices Wegmans Turkey Breast Meat 3. 2 slices Wegmans Sliced Yellow American Cheese	1 sandwich, cut into 2 triangles with bread knife
1. 2 slices Wegmans White Whole Grain Bread 2. 2 slices Wegmans Sliced Yellow American Cheese	1 sandwich, cut into 2 triangles
Motts Unsweetened Applesauce, Apple flavor	~ 110 g (1 package) in small bowl
Wegmans Baby Carrots	8 carrots in small bowl
Lays Original Potato Chips	~30 g in medium bowl
Chips Ahoy Chocolate Chip Cookies	2 cookies
Wegmans 2% Milk	~290 g (fill 8 oz bottle to capacity)
Ketchup, Mayo, and Mustard Packets	2 packets of each

In Table 1, shown below refer to the amounts that were used for the EAH Pre-Meal.

In Figure 1 below, reference the portion size layout of the EAH Pre-Meal Foods.

Figure 1: EAH Pre-Meal Set-up



Foods and serving layout used for the meal served to children prior to eating in the absence of hunger. Children were provided free access to consume as much as they wanted from various sandwiches, chips, carrots, cookies, and apple sauce.

Table 2 summarizes the snack foods that were utilized in the experiment for eating in the absence of hunger.

Table 2: EAH Snack Summary

EAH Snack Foods	Amount
Hershey's Kisses Original	~66 g (12-13 pieces) in small bowl
Starbursts Original (roughly same number of each color)	~66 g (12-13 pieces) in small bowl
Oreos Original	~66 g (5-6 cookies) in small bowl
O-KE-DOKE Cheesy Popcorn	~15 g (1 large handful) in small bowl
Fritos Corn Chips	~58 g (2 large handfuls) in medium bowl
Rold Gold Tiny Twists Pretzels	~39 g (2 normal handfuls) in small bowl
Skittles Original	~66 g (Heaping ¼ cup) in small bowl
Entenmann's Little Bites Brownies	~51 g (1 package) in small bowl
Wegmans Vanilla Ice Cream Cups	~48 g (1 package) in small bowl
Water from Culligan's in 8 oz cup with blue lid	Fill to water line (for EAH VAS ratings)

In Figure 2 below, reference the EAH Snack Foods placement on the trays in the experiment.

Figure 2: EAH Snack Food Set-up



Snack layout used for the snack period served to children after meal was administered in eating in the absence of hunger. Children were read a story and given the option to play with toys while the snacks were placed as an option to consume.

The beginning of the visit both child and parent were weighed and their heights were measured. The children are to rate their level of fullness before performing the experiment using the Freddy Fullness image, figure 18. The child is then instructed to try and rate each food item based off how much they like the food. After rating the food based off how “tasty” the children were then left to consume the snacks left in front of them. Children were provided with the opportunity to play with toys when the EAH snacks were presented. This is standard to ensure the child isn’t just eating out of boredom, but is choosing to eat because they are attracted to the snacks. The children ate while a researcher read a book to them, and fullness was measured before and after the meal.

Visit 2 for this particular thesis focused on the portion size meal study where the child is presented with a pre-meal questionnaire, Child Portion Size Survey and then consumes one of the portion sized meals of food listed in Table 3 below, the portion sizes are pre-assigned in

a randomized order. Additionally, figure 3-6 show what each portion size looked like when given to the children. Children ate one-on-one with a researcher; the child was allowed 30 minutes to eat and were not provided second servings. Fullness and liking of food was assessed prior to the meal.

Table 3: Portion Meal Size Outline

Food	Portion Size 1	Portion Size 2	Portion Size 3	Portion Size 4
Kraft Mac & Cheese, The Original	270 g (1 box)	351 g (1 box)	432 g (1 box)	513 g (1 box)
Wegmans 2% Milk (for mac)				
Wegmans Margarine (for mac)				
Perdue Chicken Breast Nuggets	100 g (~8)	133 g (~9)	166 g (~10)	199 g (~12)
Birdseye Frozen Broccoli Florets	180 g	239.4 g	298.8 g	358.2 g
Wegmans Margarine (Broccoli)	19 g	22 g	26 g	31 g
Fresh Red Seedless Grapes	200 g	266 g	332 g	398 g
Water (Culligan's Water Cooler)	1 8 oz blue cup	1 8 oz blue cup	1 8 oz blue cup	1 8 oz blue cup
Ketchup in 2 oz soufflé cup	~ 48 g	~ 48 g	~ 48 g	~ 48 g

Figure 4: Portion Size 1 Meal



Figure 3: Portion Size 2 Meal

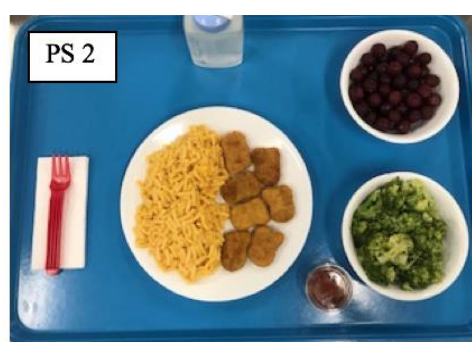
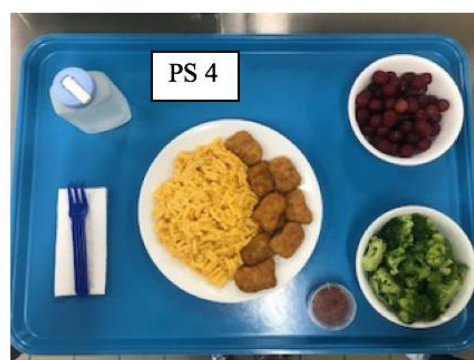


Figure 6: Portion Size 3 Meal



Figure 5: Portion Size 4 Meal



Meal layout of four different portion sizes, children were given 30min to freely eat any of the food; mac and cheese, chicken nuggets, broccoli, ketchup, grapes, and water. Portion size was randomly assigned for the particular visits.

Children again received test-meals on visits 3, 4, and 5, delivered according to the pre-established randomized order. In addition to the meals, children also completed a number of surveys on eating behavior and cognitive assessments to measure inhibitory control and executive functions. As these measurements are not the focus of the current thesis, they will not be reviewed in detail.

For a brief understanding of what is measures see Table 8 in Appendix A which provides a summary.

Visit 7 took place in the Noll Lab and it was conducted annually after the other six visits were performed. At Visit 7, children again had EAH assessed, and they completed a selection of cognitive tests and questionnaires on eating behavior.

Refer to Table 8 in Appendix A section of this paper which provides a clear summary of each component that went into the 7 separate visits regarding both the child and parent.

Study Measurements

In order to measure body dissatisfaction in the lab, the child figure rating scale was the measurement tool, Appendix B. Children were first asked to identify what they look like from a series of 7 gender-specific figures. Then children were asked to identify from the same set of figures their “ideal” body shape. The difference between actual vs. ideal is then calculated to determine body dissatisfaction, with higher values denoting greater body dissatisfaction. The images are provided in Appendix B (Figure 7-10) for reference.

Children’s susceptibility to the PSE was assessed across visits 2-5. On each visit, a multi-item meal was presented to children where the portion sizes of all items varied (See Figure 3 – Figure 6). Children did not know that the purpose of the study was to vary the

portion sizes of the foods, and they were blinded to what portion size condition they would receive. Children were provided with 30 minutes to eat as much from the meal as they wanted. They ate one-on-one with a researcher and were read a non-food related book during the meal. The before/after measurements were taken for grams eaten and converted into calories using information from the nutrition facts label to measure how much a child ate throughout the meal.

For EAH they were required to rate fullness using a pictorial visual analog scale (i.e., Freddy Fullness) (Assur, Keller, Torres, Lofink, Thornton, Faith, Kissileff, 2006). The child was then administered a pre-snack Freddy Fullness questionnaire and post-snack one, refer to appendix B with the Freddy Fullness questionnaire example. The Freddy Fullness survey essentially was used to determine how full a child was and it has been widely studied that a child who is able to determine their level of fullness can prevent becoming overweight (Assur, Keller, Torres, Lofink, Thornton, Faith, Kissileff, 2006). For the portion size experiment, the children were given the child portion size survey questions assessing how hungry they were and what kinds of food they prefer to eat, refer to appendix B for the survey questions.

Data Analysis

The purpose of these analyses was to determine whether body dissatisfaction was related to children's EAH and intake with increasing portions.

The first piece of data that was necessary to include in the analysis was the demographics of the individuals included in the study. The frequencies and percentages are

shown below (Table 4-6). Most parents are married and the majority of the parents/children were Caucasian, the child's sex was split evenly between male and female.

Table 4: Descriptive Statistics on Children's Race and Sex

Child Race	Frequency	Percent
Asian	2	2.2
Black / African American	1	1.1
White / Caucasian	83	93.3
Total	86	96.6
Child Sex	Frequency	Percent
Male	41	46.1
Female	44	49.4
Total	85	95.5

Table 5: Descriptive Statistics on Parents of Children Race

Parent Race	Frequency	Percent
Asian	1	1.1
Black / African American	1	1.1
White / Caucasian	83	93.3
Don't want to answer	1	1.1
Total	86	96.6

Table 6: Descriptive Statistics on Parents of Children Marital Status

Marital Status	Frequency	Percent
Married	73	82.0
Single (Never Married)	2	2.2
Divorced	4	4.5
Separated	2	2.2
Living together (but not married)	5	5.6
Total	86	96.6

After the demographics were recorded and accounted for in the study, the descriptive statistics, including mean and standard deviation, for all quantitative pieces in the study were determined.

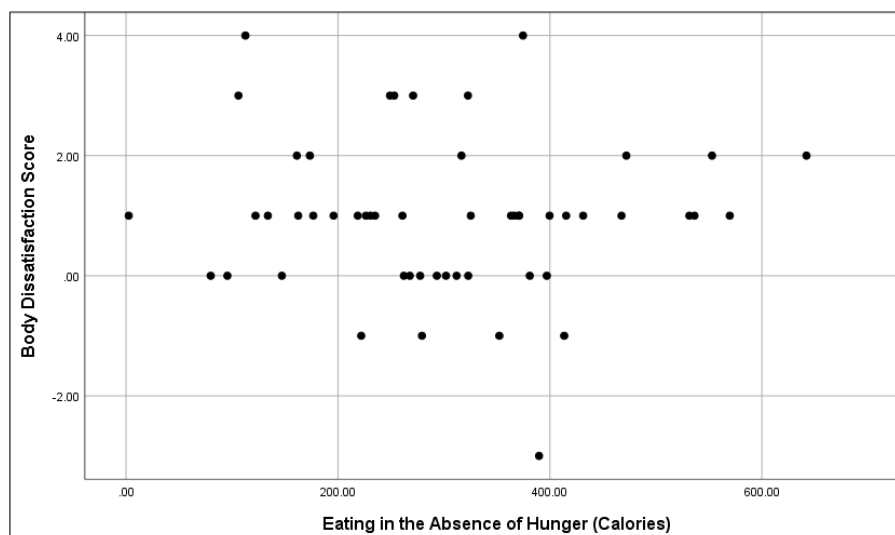
Table 7: Descriptive Statistics of Quantitative Data

Statistics	Mean	Std. Deviation
Child's BMI Score	16.00	1.42
Child BMI Percentile	50.66	23.71
Body dissatisfaction score total (perceived minus ideal)	0.96	1.30
Eating in the Absence of Hunger	289.81	135.53
Portion 1 Total Calories	617.41	245.49
Portion 2 Total Calories	688.19	274.97
Portion 3 Total Calories	737.28	336.36
Portion 4 Total Calories	709.30	308.99

Before running correlations between the variables, checking to determine if the data modeled a normal distribution using the Shapiro-Wilk's test and looking at the Kurtosis statistic. The statistic did not have a significant p-value it was greater than 0.05; it was reasonable to move forward using regular parametric statistics in the analysis. An additional correlation checked before proceeding was whether there was a relationship between child's sex and body dissatisfaction through an independent sample t-test; this was to determine if sex would act as a confounding variable. There was no significant difference between male and female in regards to the relationship of body dissatisfaction; moving forward for this study they were not separated in the analysis.

The first correlation measured was between eating in the absence of hunger data and body dissatisfaction data (Figure 7).

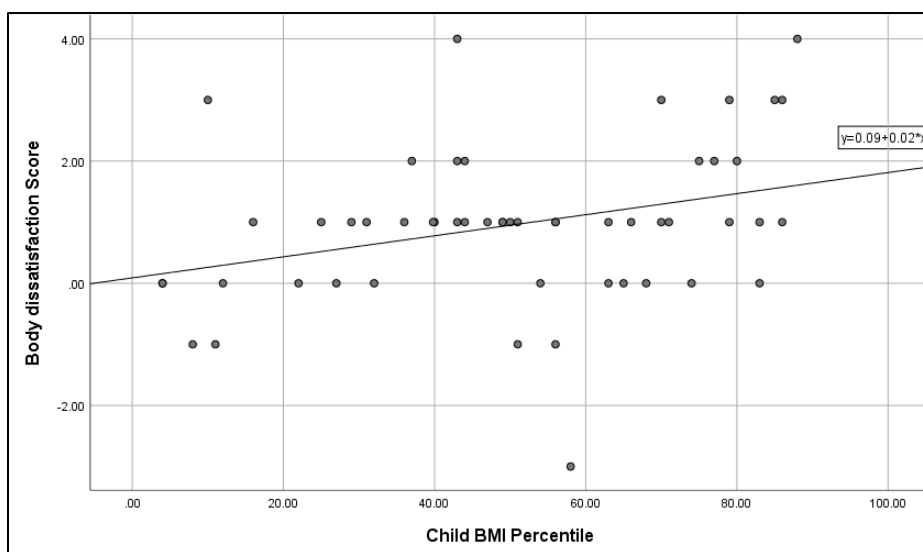
Figure 7: Relationship between EAH and Body Dissatisfaction



Graphic relationship representing the association between eating in the absence of hunger and body dissatisfaction in the laboratory.

A correlation test was utilized and after running it was determined that there was no significant relationship between eating in the absence of hunger and body dissatisfaction, the analysis continued to look at whether body dissatisfaction related to weight status (BMI percentile). Weight status could potentially be a confounding variable.

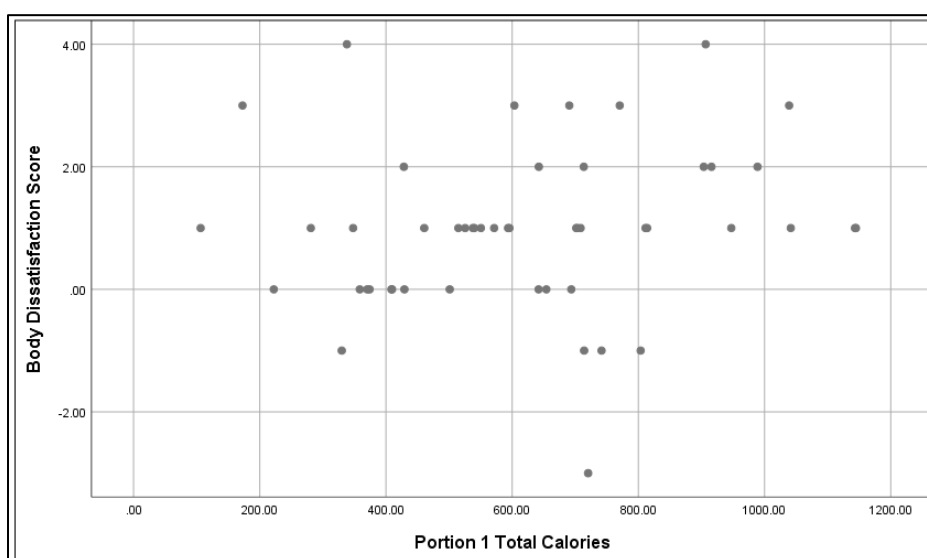
Figure 8: Relationship between Weight Status and Body Dissatisfaction



Graphic relationship representing the association Child's BMI percentile and body dissatisfaction score in the laboratory.

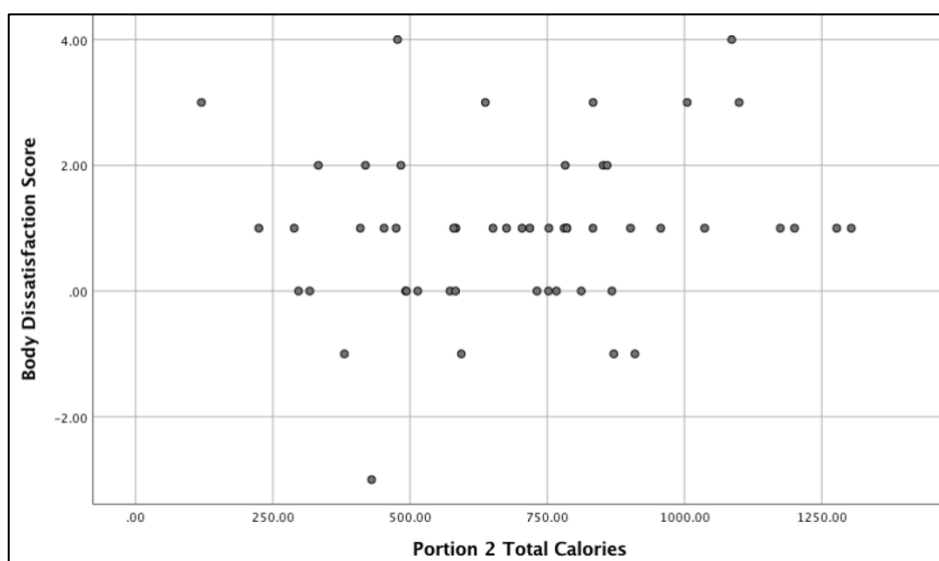
Following this piece of the analysis, portion size was analyzed in comparison to body dissatisfaction. Portion size is a repeated measure over 4 separate visits with each child, a mixed linear model was utilized for the analysis to account for this reason. Calories (measured in amount child intakes) was the dependent variable, portion sizes were the independent variable, and body dissatisfaction was the covariate. The linear mixed model was formulated to determine whether there was a relationship with portion size, intake, and body dissatisfaction. The correlations were recorded and assessed once the multivariate model was run. Random effects were considered for both the intercepts and slopes in the model. After this was run each individual portion was compared with body dissatisfaction score to determine if an interaction was stronger at a specific meal. Figure 9-12 shown below, represent the individual correlations between each portion size meal.

Figure 9: Relationship Portion 1 Meal and Body Dissatisfaction



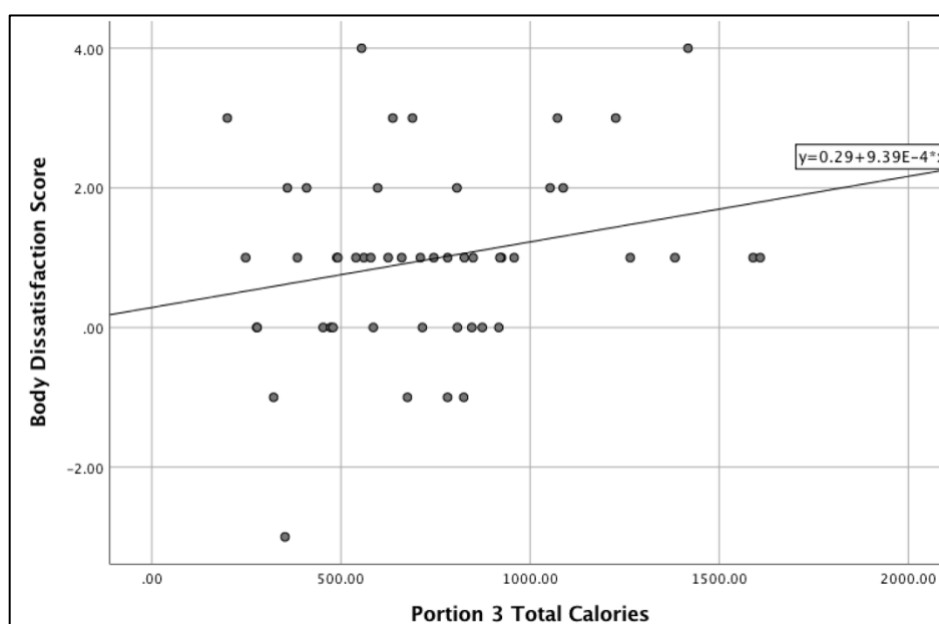
Graphic relationship representing the association between Portion Meal 1 and body dissatisfaction score in the laboratory.

Figure 10: Relationship Portion 2 Meal and Body Dissatisfaction



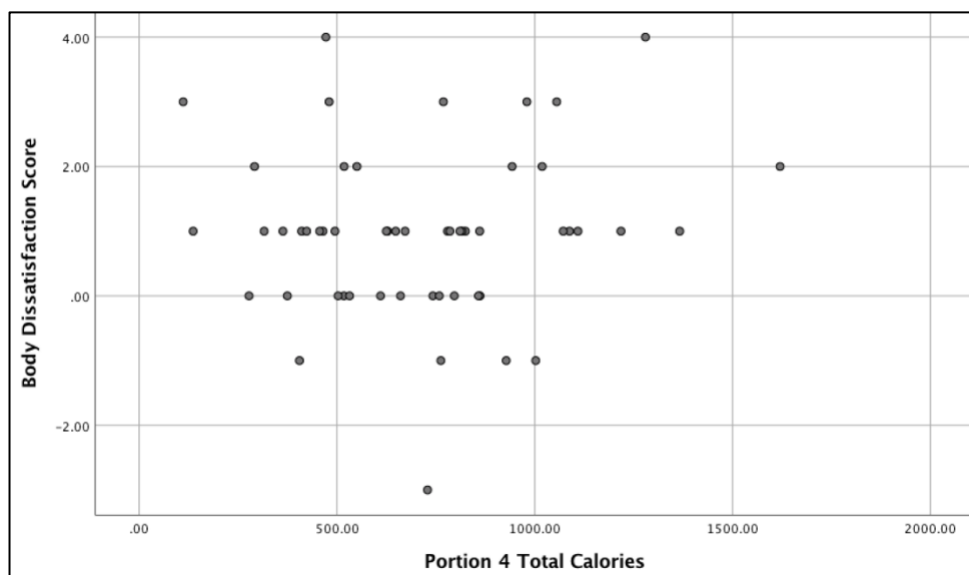
Graphic relationship representing the association between Portion Meal 2 and body dissatisfaction score in the laboratory.

Figure 11: Relationship Portion Meal 3 and Body Dissatisfaction



Graphic relationship representing the association between Portion Meal 3 and body dissatisfaction score in the laboratory.

Figure 12: Relationship Portion 4 Meal and Body Dissatisfaction



Graphic relationship representing the association between Portion Meal 4 and body dissatisfaction score in the laboratory.

Figures 9-12 give a clear representation of the individual meals that were conducted in the portion test. The data analysis was conducted using SPSS software version 26.0 and all p-values were deemed significant if they were less than 0.05. The data summarized: it looked at the relationship between eating in the absence of hunger and body dissatisfaction, weight status and body dissatisfaction, and used a mixed linear model to determine whether portion sizes had an effect on body dissatisfaction and then broke it up individually by portion size to look at each one separately from one another.

Chapter 3

Results

After running the analysis, there was no significant relationship determined between body dissatisfaction and eating in the absence of hunger (Figure 7). The method to define whether a value was significant or not significant in this study was using the p-value (P). When calculated significance is if the p-value is less than 0.05 and it is not significant if it is greater than 0.05. The correlation found initially was -0.048 which was not significant ($P=0.732>0.05$). The scatterplot (Figure 7) shows the randomly scattered dots which represents the lack of correlation between the variables. Weight status (BMI percentile), was measured following this as discussed in the analysis to determine whether this was related with body dissatisfaction. There was a positive correlation, $r=0.319$ between these two variables when compared and a significant relationship ($P=0.02<0.05$). Figure 8 shows the positive relationship between body dissatisfaction and BMI percentile.

Following the analysis of the EAH vs body dissatisfaction, the portion size meals (PortionCondition) were compared against body dissatisfaction (BD). In the mixed linear model, the overall model equation was: $\text{PredictedCalories} = 662.266 + 0.701\text{PortionCondition} + 4.969\text{BD} + 0.318\text{PortionCondition}*\text{BD}$. The interaction between body dissatisfaction and portion size condition was not significant ($P=0.813>0.05$). To query the data further, exploratory correlations were conducted to see if body dissatisfaction as related to children's intake at each of the portion size meals considered independently. Intake at the smallest portion condition showed a weak, positive correlation to body dissatisfaction, but this was non-significant ($r=0.147$, $P=0.309$). Similarly, intake at the second smallest portion size condition showed a weak, positive correlation to children's body dissatisfaction,

but again, this was not significant ($r=0.149$, $P=0.288$). Intake at portion size 3 showed a slightly stronger correlation to body dissatisfaction ($r=0.239$, $P=0.094$). Intake at the largest portion size showed no relationship to body dissatisfaction ($r=0.086$; $P=0.542$).

The portion sizes were then individually compared with body dissatisfaction to determine whether an individual meal had an association with body dissatisfaction. No meal was significantly correlated with body dissatisfaction but portion meal 3 did have some interesting evidence that is worth noting. Portion 3 there was an interesting measure that showed the most calorie intake during this meal, and although not a significant correlation it did have the strongest positive correlation between the two variables, body dissatisfaction and portion size. Portion meal three had the highest caloric intake across the four portioned meals, likely being driven by increased intake from the portion size effect. Although at portion 4, children were served more food, it could have been an overwhelming amount which could hinder the child's intake and almost cause it to flat line at that point or decline slightly. Portion size 3 is where children consumed the most, and this also seemed to be the meal most likely to be related to body dissatisfaction.

Chapter 4

Discussion

Summary of Results

This study first examined the relationship between eating in the absence of hunger and body dissatisfaction, the results determined that there was no significant relationship between the two. Referencing previous studies, examining the relationship between obesity and eating in the absence of hunger and their positive correlated relationship (Feig, Piers, Kral, Lowe, 2018). With this in mind since higher weight status was associated with eating in the absence of hunger, it was hypothesized that higher body dissatisfaction would also be associated with eating in the absence of hunger. Although this was not the result in this particular experiment there are some reasonable explanations as to why the results were not as expected. One reason could be the small sample size, only 86 children were utilized in this study and although a lot of data was drawn from these children it still could have hindered the overall results. Additionally, the children were all drawn from a healthy weight population, having greater variation in weight status could have given a better range to understand the predicted result. Also, the demographics did not represent a large portion of different ethnicities; previous studies done on African American and Asian cultures impact results as well which could have been something to vary in this study. Weight status was another measure looked at in comparison to body dissatisfaction, and the results indicated a slightly positive correlation between the two variables. Potentially, with a larger subject pool this result would be even stronger and would also make sense, with higher weight status (BMI percentile) a child would most likely experience higher body dissatisfaction.

The second piece in the study asked how do portion size and body dissatisfaction interact with one another. Again, the results between portion size and body dissatisfaction in the mixed linear model were not significant, all p-values were over the 0.05 threshold. The data analysis then looked at portion size 1, 2, 3, 4 separately compared to body dissatisfaction. There was no significant relationship determined from any of the individual interactions. Body dissatisfaction in relation to portion size 3 meal did have a slightly stronger positive correlation in comparison to the other meals. Which indicated that at portion 3 the children consumed the greatest number of calories. A reasonable assumption behind this result is that as portion size increases children tend to consume more, this is due to the portion size effect notion (Schur, Sanders, Steiner, 2000). The data showed a slight drop in total calories consumed at portion meal 4, however, there can be factors affecting their levels of consumption at each visit. Portion meal 3 and 4 had similar means of total calories consumed, 737kcal and 709kcal. The child's desire to consume greater amounts as portion size increases tends to plateau once portion sizes become very large as shown in the data (Schur, Sanders, Steiner, 2000). Considering the sample size is small that could impact the credibility of the results found. Additionally, the level of a child's hungriness can vary by day. They could have played sports, ate less earlier that day, ate prior to coming to the visit. These are some factors that are out of the experimenters control and could act as confounding variables. Having a larger sample could help mitigate these confounding variables.

Strengths and Limitations

Overall strengths include the specific experimental measures on the children. The measurements taken were for the most part experimental not observed, this gives strict and

clear analysis behind the quantitative data collected. Also, the children were followed-up with prospectively and data for the eating in the absence of hunger study and portion size study were collected more than once on the same subjects. This allows for more consistency and averages were taken to help mitigate for variability and outliers that children may exhibit on some experimental visits.

Limitations include the measurement of body dissatisfaction is based off the child's opinion and is not quantitatively measured such as weight status. Some children could report an inaccurate number to their actual and ideal appearance and throw off the results. Food intake by visit can be effected by the child's individual day, considering if they played sports that day (were more active), ate a larger lunch causing them to consume less, or have other distractions from their day that could inhibit their focus on the actual experiment. The sample size is not very large and the confounding variables have a larger impact on the results for this reason. There is a low ethnic diversity, the majority of the children are Caucasian, this study therefore does not capture the entire population. Different ethnicities have different attitudes and eating patterns, therefore, if this study was repeated having more diversity would be useful. The last component that was not diversified in the study is weight status. All children were of healthy BMI and did not vary much from one another. Having weight variation when conducting this study could add more credibility to the results. Considering higher weight has a relationship with higher body dissatisfaction, children with BMI levels over the average would be valuable to use in this study to add more validity to the hypotheses.

Future Research Suggestions

Going forward after examining and acknowledging the limitations for this study it would be interesting to further this study with a larger sample size for all measures. Additionally, looking at the relationship between body dissatisfaction and weight status by using children of differing weights would be interesting to capture in a future study. Previous studies examined a potential relationship between body dissatisfaction and weight status and have shown a positive association between the two variables. This particular study even with a small sample size gave a weak but positive correlation. With larger samples, it could bring clearer understanding to the expected results.

Another potential consideration is doing female and male separately to eliminate any confounding variable influences. Gender can have a strong impact on a child's eating behavior (Keller, Kling, Hickok, 2019), separating male from female could help eliminate any further variables that could impact the desired results. On average females tend to like a wider variety of foods than males (Cooke, Wardle, 2005; Caine-Bish, Scheule, 2009). Particular food show that female rate fruit and veggies higher and males report higher liking for meat, poultry, etc. (Cooke, Wardle, 2005; Caine-Bish, Scheule, 2009). For these reasons, it would be reasonable to separate the groups from one another.

The last major component that could be addressed in future research is improving the diversity of the subjects. Having children of all healthy weight status could impact their perception on body dissatisfaction because most of them are likely to be satisfied with their overall appearance (Paxton, Truby, 2002; Schur, Sanders, Steiner, 2000). Additionally, having children from diversified ethnic backgrounds could also improve the research

considering eating patterns and perception of body image can be largely influenced by a child's cultural background (Pallan, Hiam, Duda, Adab, 2011). As with any study there is always room to improve and continue to build on the research. These suggestions would help develop a stronger platform for the results.

Conclusion

This thesis hypothesized that portion size/intake and eating in the absence of hunger are factors leading to higher level of body dissatisfaction. The overall study produced non-conclusive results, however, there are various reasons as to why this could have been the case as described above. It was concluded that there was no significant relationship between body dissatisfaction and eating in the absence of hunger or body dissatisfaction and portion size intake.

Appendix A

Study Outline

Table 8: Summary of Experimental Visits

Child Visit 1 1. Consent 2. Height and Weight 3. DXA Scan 4. Eating in the Absence of Hunger (EAH) 5. Portion Size Discrimination (PSD) Child Portion Size Survey (PSS)	Parent Visit 1 1. Consent 2. Height and Weight 3. Household Demographics 4. Child Puberty & Tanner 5. Child Physical Activity 6. Parent Portion Size Survey (PSS) Feeding Strategies
Child Visit 2 1. Portion Size Meal 2. Kid's Food (KFQ) 3. Tempest Self-Regulation Eating (TESQE) 4. Revised Child Manifest Anxiety (RCMAS) Go-No-Go Computer Task (GNG)	Parent Visit 2 (Actigraph Out) 1. Child Behavior (CBQ) 2. Child Eating Behavior (CEBQ) 3. Child Feeding (CFQ) 4. Binge Eating Scale (BES) 5. Family Food Behavior (FFB) Child Sleep Habits
Child Visit 3 1. Portion Size Meal 2. N-Back Task (NBACK) Delay Discounting – Computer (DD-C)	Parent Visit 3 (Actigraph Return) 1. Lifestyle Behavior Checklist (LBC) 2. Parent Sensitivity to Reward & Punishment (SPSRQP) 3. Behavioral Approach & Inhibition (BIS/BAS) 4. Parent Weight Loss Behavior (PWLB) 3 Factor Eating (TFEQ)
Child Visit 4 1. Portion Size Meal 2. Child Weight Concerns (CWC) 3. Child Body Image Scale (CBIS) 4. Parent Responsiveness (PRM/PRF) 5. WASI Matrix Reasoning and Vocabulary 6. Space Game Decision Making Task Mock Scanner Practice	Parent Visit 4 1. Household Food Security Survey Module (HFFSM) 2. Household Food Insecurity Access Scale (HFIAS) 3. Community Childhood Hunger ID Project (CCHIP) Behavior Rating Inventory of Exec Funct-2 (BRIEF-2)
Child Visit 5 1. Portion Size Meal	Parent Visit 5

2. Loss of Control Eating (LOC) 3. Communities that Care (CtC) 4. Interoception Heart Monitor Test Mock Scanner Practice	Alcohol Use (AUDIT)
Child Visit 6 1. CAMS Pre, MRI Scan, CAMS Post 2. Delay Discounting- Physical (DD-P) 3. fMRI Image Behavioral Assessment (split) Stop Signal Task (SST)	Parent Visit 6 Finish questionnaires if needed
	Parent Visits 2-6: Update Form
Child Visit 7 1. Height, Weight, and DXA scan 2. Eating in the Absence of Hunger (EAH) 3. N-Back Task (NBACK) 4. Communities that Care (CtC) 5. Space Game Decision Making Task 6. Child Weight Concerns (CWC) 7. LOC Puberty and Tanner	Parent Visit 7 1. Height and Weight 2. Household Demographics 3. Child Puberty & Tanner 4. Child Physical Activity 5. Parent PSS 6. CEBQ and CFQ 7. Child Sleep Habits BRIEF-2 and AUDIT

Appendix B

Questionnaires

Children's Body Image Scale

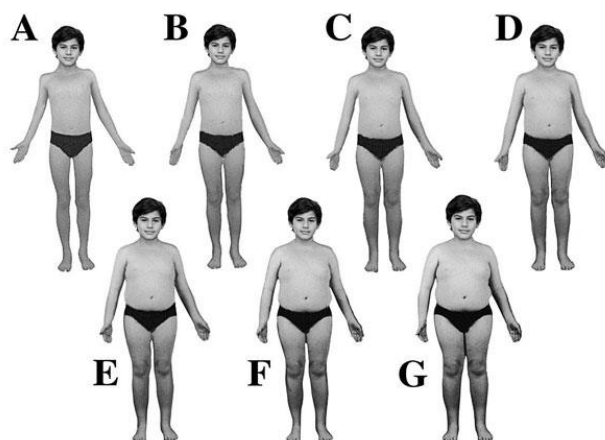
Child Gender:

Male

Female

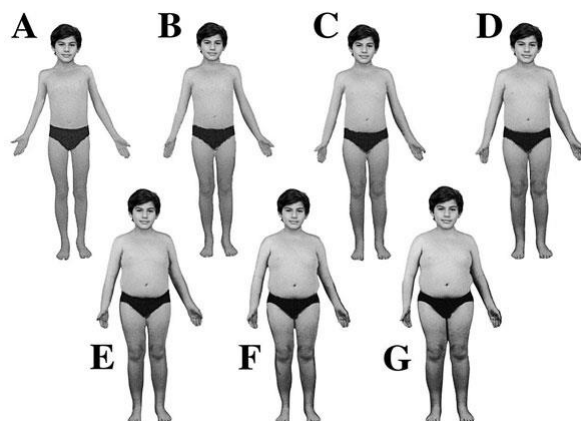
(If male): I want you to look at the pictures of different boys below. Each picture shows a boy with a different body shape. Out of these pictures, which body shape looks most like yours?

Figure 13: Body Image Rating Scale for Males for Actual Body Shape



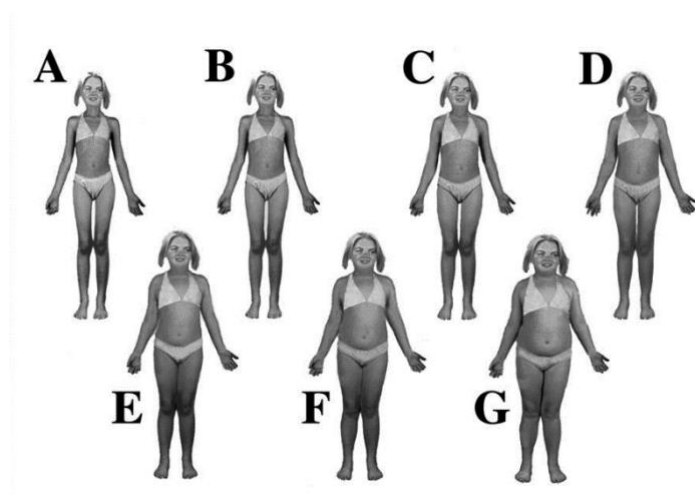
(if Male): Out of these pictures, which body shape would you most like to have?

Figure 14: Body Image Rating Scale for Males for Ideal Body Shape



(if female): I want you to look at the pictures of different girls below. Each picture shows a girl with a different body shape. Out of these pictures, which body shape looks most like yours?

Figure 15: Body Image Rating Scale for Females for Actual Body Shape



(if female): Out of these pictures, which body shape would you most like to have?

Figure 16: Body Image Rating Scale for Females for Ideal Body Shape

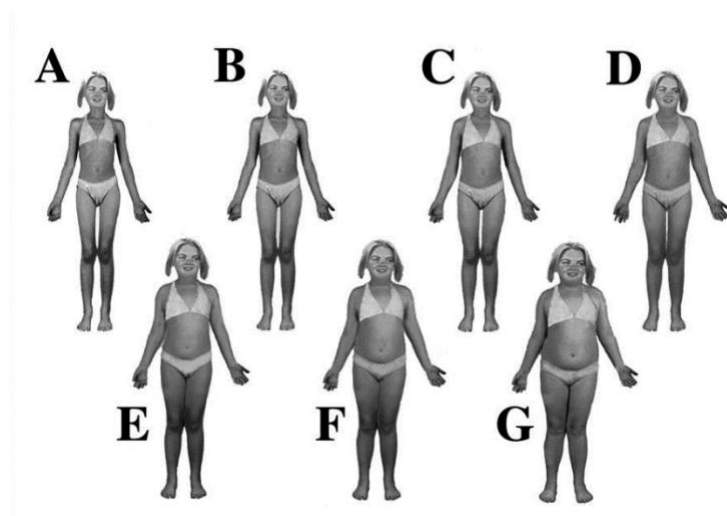


Figure 17: Child Portion Size Questionnaire

Child PSS Questionnaire

"Okay, now I'd like you to look at some pictures of food and answer questions about them. We're going to use this slide (point to it) to answer the questions. The circle can go anywhere along the line to show your answer (move circle to demonstrate). You should point to where the circle should go along the line to answer each question. I'll move the circle for you. Do you have any questions?" (Answer questions).

"Here's a practice question: How thirsty do you feel right now? In this slide, the 2 sides say "Not at all" (point to it) and "Extremely" (point to it). If you don't feel thirsty at all, you should point to the "Not at all" part of the slide. If you are REALLY thirsty, you should point to the "Extremely" part of the slide. If you're somewhere in between, point to where the circle should be."

1	
---	--

How hungry are you right now?

1	
---	--

How much food do you think you could eat right now?

1	
---	--

How full do you feel right now?

1	
---	--

"For this part, we'll keep using the slide to answer the questions. You can point and I'll move the circle for you. But this time, I want you to tell me how much of each food you want to eat, and how much you like that food. Instead of words at each side of the slide, there are 5 pictures of each food (point to pictures). The picture on the left (point to it) will have a little bit of the food, and each picture will have more as you go to the right (point to other pictures). Here's a practice question. How much chips and salsa would you eat for snack? If you would eat the exact amount in the first picture, you can point to it (point to picture). But if you would eat a little more than in the first picture, but not as much as the second picture, you can point in between the pictures (point in between 1 and 2). Do you have any questions?"

1	
---	--

Do you ever eat apple slices?

How much apple slices would you eat for snack?

1	
---	--

How much do you like apple slices?

1	
---	--

Do you ever eat lightly buttered broccoli?

How much lightly buttered broccoli would you eat at dinner?
How much do you like lightly buttered broccoli?

Do you ever eat cake?
How much cake would you eat at dessert?
How much do you like cake?

Do you ever eat chocolate candy?
How much chocolate candy would you eat at snack?
How much do you like chocolate candy?

Do you ever eat carrots?
How much carrots would you eat at snack?
How much do you like carrots?

Do you ever eat cornflakes or other cereal?
How much cornflakes or other cereal would you eat at breakfast?
How much do you like cornflakes or other cereal?

Do you ever eat cheeseburger?
How much cheeseburger would you eat at dinner?
How much do you like cheeseburger?

Do you ever eat chicken nuggets?
How much chicken nuggets would you eat at snack?
How much do you like chicken nuggets?

Do you ever eat French fries?
How much french fries would you eat at dinner?
How much do you like french fries?

Do you ever eat garlic bread?
How much garlic bread would you eat at dinner?
How much do you like garlic bread?

Do you ever eat goldfish crackers?
How much goldfish crackers would you eat at snack?
How much do you like goldfish crackers?

Do you ever eat grapes?
How much grapes would you eat at snack?
How much do you like grapes?

Do you ever eat ice cream?
How much ice cream would you eat at dessert?
How much do you like ice cream?

Do you ever eat macaroni and cheese?
How much macaroni and cheese would you eat at dinner?
How much do you like macaroni and cheese?

Do you ever drink milk?
How much milk would you drink at dinner?
How much do you like milk?

Do you ever drink orange juice?
How much orange juice would you drink at breakfast?
How much do you like orange juice?

Do you ever eat peanut butter and jelly sandwich?
How much peanut butter and jelly sandwich would you eat at lunch?

How much do you like peanut butter and jelly sandwich?

Do you ever eat peas?
How much peas would you eat at dinner?
How much do you like peas?

Do you ever eat pizza?
How much pizza would you eat at lunch?
How much do you like pizza?

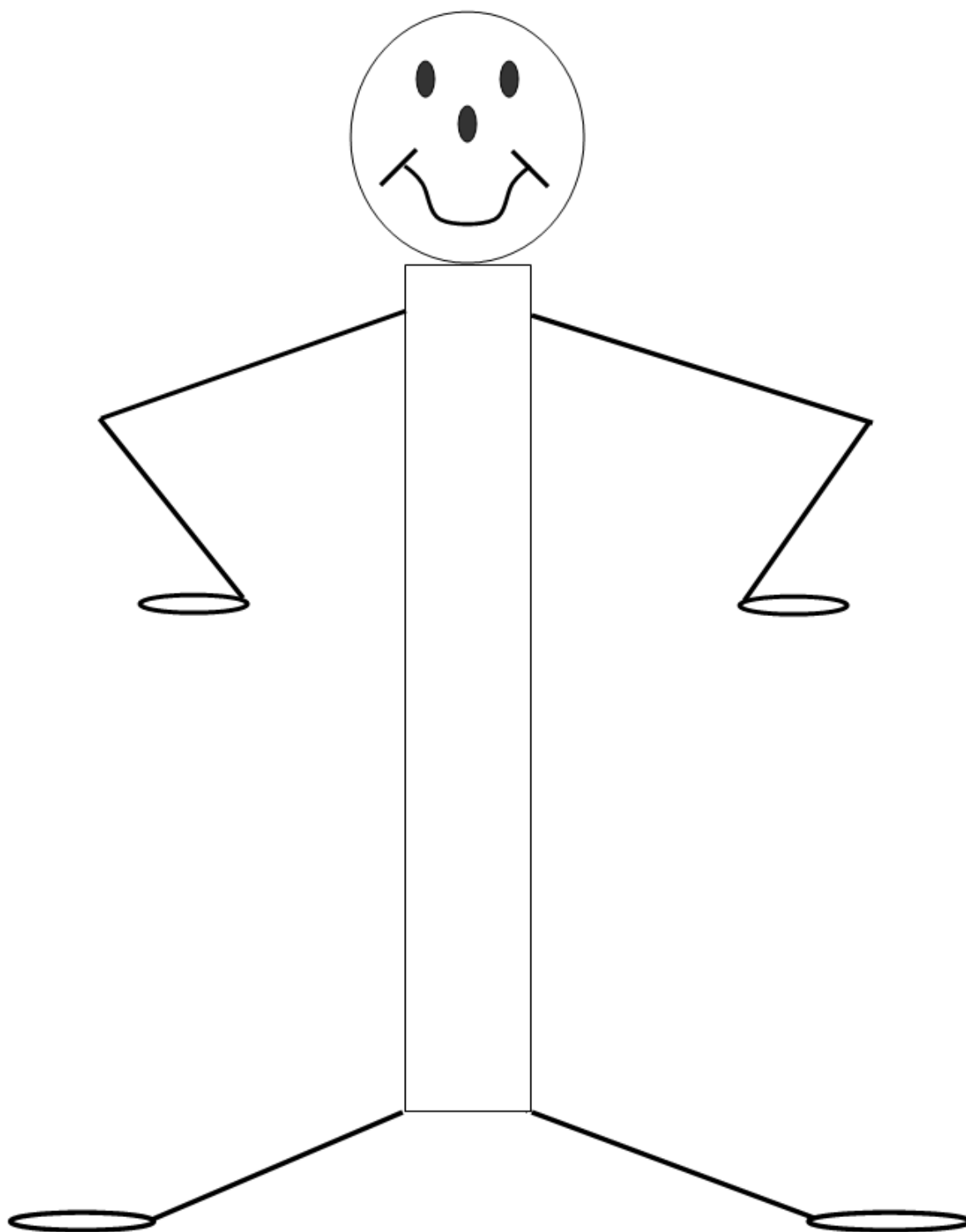
Do you ever drink regular soda?
How much regular soda would you drink at dinner?
How much do you like regular soda?

Do you ever eat tomato soup?
How much tomato soup would you eat at dinner?
How much do you like tomato soup?

Do you ever eat tomatoes?
How much tomatoes would you eat at dinner?
How much do you like tomatoes?

Do you ever eat strawberry yogurt?
How much strawberry yogurt would you eat at breakfast?
How much do you like strawberry yogurt?

Figure 18: RO1 Brain and Overeating Study – Freddy Fullness V1 Pre-wanting



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ACADEMIC VITA

SOFIE R. LUTFY

EDUCATION

Penn State Smeal College of Business <i>Master of Business Administration</i> Concentrations: Finance and Consulting	University Park, PA 5/21
The Pennsylvania State University Schreyer Honors College <i>Bachelor of Science in Science with Honors in Nutritional Sciences</i>	University Park, PA 5/20

RELEVANT EXPERIENCE

Johnson & Johnson <i>Finance Co-op / Treasury Services</i> - Delivered high level risk analysis on monthly and quarterly basis determining Sovereign Risk Ratings for all 75 countries in which J&J has legal business presence initiating decisions whether to do further business in volatile countries - Ensured direct communication between 12 members of finance team allowing leasing processes to operate efficiently - Presented quarterly pricing strategies and risk analysis to three separate teams within treasury	New Brunswick, NJ 1/19 – 7/19
IMG Learfield Ticket Solutions <i>Data Analytics Intern</i> - Cleaned data from secondary markets for Power Five Conference football game tickets communicating with 65 schools to gather necessary data to complete analysis - Performed predictive analytics on datasets to complete final report, gathering data for 65 schools on all seating areas for stadiums and sharing detailed pricing metrics for 95% of conferences - Proposed new insight determining prices for 65 schools in both basketball and football stadium arrangements	University Park, PA 9/18 – 12/18

LEADERSHIP EXPERIENCE

Alpha Kappa Psi Professional Business Fraternity <i>Inductee / Special Events Chair</i> - Collaborated with class of 18 inductees to coordinate professional, philanthropic, and fundraising events for brotherhood of 108 members to enhance the unity, skillsets, and community involvement of the organization - Spearheaded professional, networking, and interviewing skills through 108 mock interviews, resume workshops, professional presentations, and information sessions held by experts in their career as well as students	University Park, PA 1/17 – 1/19
Penn State Equestrian Team <i>Competitive Rider</i> Competed 3 times a semester, showing in the Federal Dressage Association, which recognizes students for their ability to compete in upper level, training level, and first level dressage tests while being critiqued by a judge	University Park, PA 9/16 – 12/17
Schreyer Honors College SHOTime Mentor <i>Mentor</i> Onboarded 25 incoming students by giving tours, assisting with move-in, and presenting in panels with over 50 students	University Park, PA 8/17
Johnson and Johnson annual Case Competition <i>Competitor</i> - Participated alongside 4 members to present new high-end, cutting edge, and innovative product to the hair care market - Obtained 1st place in the Penn State competition moving onto the national level competing against 10 other teams across the country	University Park, PA 4/18
Deloitte Consulting LLP UG Case Competition <i>Competitor</i> - Initiated team proposal to improve online presence of new company, working with three team members to present a unique idea - Earned 2nd place in final round of the competition, performing in front of the entirety of judges and students participating in the event	University Park, PA 2/17

HONORS, SKILLS, & INTERESTS

- Honors:** Dean's List (4/4), Valedictorian of Delaware Valley High School, AP Scholar, C-3/H-B certified United States Pony Club, Phi Eta Sigma National Honors Society
- Skills:** Excel, Public Speaking, R-studio, SPSS Software