

EFFECTS OF DISHWARE SIZE AND DESIGN ON PORTION SIZES  
SERVED BY LOW-INCOME CAREGIVERS TO THEIR  
PRESCHOOL AGED CHILDREN

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A Thesis  
Submitted to  
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MASTER OF SCIENCE OF EPIDEMIOLOGY

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## ABSTRACT

**Background:** Larger dishware sizes have been shown to increase food portion sizes served and consumed by adults and children. Less is known about whether dishware size and design influences the amount of food caregivers serve to children. Whether smaller portion design plates can be used to help parents serve age-appropriate portion sizes to their children is unknown. This research is the first to examine the effects of dishware size and design on portion sizes served by caregivers.

**Methods:** A within-subjects quasi-experimental design was used to determine the effects of dishware size and design on the portion sizes served by low-income caregivers to their preschool aged children during a buffet style meal. Three plate conditions were compared: a portion design plate, a plain child size plate, and an adult size plate. We hypothesized that when using the portion design plate, caregivers would serve the smallest amount of food compared to when using either the plain child size plate or the adult size plate. The amount of food served by caregivers to children was assessed using weighted methods.

**Results:** The total amount of food (g) and energy (kcal) served did not differ across dishware conditions.

**Conclusions:** Dishware size and design did not influence portion sizes served by caregivers. Additional factors may affect caregiver serving behaviors.

## **DEDICATION**

I dedicate this thesis to my family.

Their support and love has helped

me get to where I am today.

## ACKNOWLEDGMENTS

I would like to thank Dr. Jennifer Fisher, my thesis committee member for the vast amount of support and knowledge you have provided me during this process. I am so honored and grateful to have such an intelligent, successful, and creative researcher apart of my committee. Thank you for all that you have helped me with and being such a great role model. I would also like to thank my mentor and friend, Alex Kachurak. Alex has been there for me every step of the way and has taught me so much. Not only is Alex someone who I greatly admire and look up to, but she has also provided me with an opportunity to experience working in the research field. I am so grateful to have worked with her and followed in her footsteps. She has not only help me get to where I am today, but she has become a great friend. I would also like to thank my thesis advisor, Dr. Levent Dumenci, for his commitment and time spent on this project, and his helpful guidance and feedback.

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## **CHAPTER 1**

### **INTRODUCTION**

Eating environments with access to large portions of palatable, energy-dense foods are thought to contribute to the development of obesity in children by promoting excessive energy intake (Fisher, 2007; Fisher, Arreola, Birch, & Rolls, 2007; French, Story, & Jeffery, 2001; J.O. Hill, 1998; J. O. Hill, Wyatt, & Melanson, 2000; W. S. C. Poston & Foreyt, 1999). Portion sizes available have increased over time where portions currently found in restaurants are 2 to 8 times larger than USDA standards (Fisher & Kral, 2008; Young & Nestle, 1995). This increase has occurred over the same period in which the prevalence of overweight/obesity has increased throughout the United States (Fisher & Kral, 2008; Young & Nestle, 2002). Numerous studies have demonstrated effects of large portion sizes to promote food and energy intake at meals among young children (Fisher, 2007; Fisher, Arreola, et al., 2007; Fisher, Liu, Birch, & Rolls, 2007; Fisher, Rolls, & Birch, 2003) Fisher et al. (2007) examined portion sizes and intake in 5-year-old Hispanic and African-American low-income children by doubling portion sizes of several foods and snacks served during a 24-hour period, resulting in an increase in energy intake by 12% (Fisher, Arreola, et al., 2007).

Size-related visual cues of the eating environment are believed to affect serving and eating behaviors by increasing consumption norms and interfering with the capability to accurately comprehend the amount of food selected (DiSantis et al., 2013; Van Ittersum & Wansink, 2012; Wansink, 2004; Wansink & van Ittersum, 2003). Dishware size acts as a visual cue during the eating experience and has been shown to influence

portion sizes in both adults and children (DiSantis et al., 2013; Wansink, van Ittersum, & Painter, 2006). Experimental research has demonstrated that larger dishware increases the portion sizes served and consumed by adults (Wansink & van Ittersum, 2003; Wansink et al., 2006). To date, there has only been one study that examined the effects of dishware size on children's eating behaviors. In an experimental study on dishware size and portion sizes self-served by school aged children, adult-sized dishware promoted an increase in energy (DiSantis et al., 2013).

While evidence of dishware size effects on serving has been demonstrated in both adults and children, no studies to date have considered whether dishware size influences the portion sizes served to children by adults. It is important to understand the influence of size-related visual cues on caregiver serving behaviors, especially in populations at high risk of childhood obesity (Elías-Boneta, Toro, Garcia, Torres, & Palacios, 2015; Johnson et al., 2014; Ogden, Wei, Curtin, & Flegal, 2010). Understanding caregiver feeding behaviors could potentially improve eating behaviors of the child and substantially prevent over consumption of food and obesity. It has been shown that the amount of food that parents serve themselves are related closely to the amount that they serve their children (Johnson et al., 2014). It has been suggested that parents lack an understanding of age-appropriate portions for their children (Crocker, Sweetman, & Cooke, 2009). How caregivers respond to visual cues, like dishware size, when serving their children is unknown.

This research experimentally evaluated the effects of dishware size and design using three plate conditions: a portion design plate, a child size plate, and an adult size

plate to compare portion sizes served by caregivers to their preschool aged children at a buffet meal. We hypothesized that caregivers would serve smaller portions of food when using a child size portion plate than when compared to when using either a plain adult size plate or a plain child size plate. The results of this study will contribute to receiving a better understanding of the role that dishware has on caregiver feeding behaviors and if it influences the amount of food they serve to their child.

## **CHAPTER 2**

### **BACKGROUND**

Obesity is one of the largest public health issues of the 21<sup>st</sup> century (Karnik & Kanekar, 2012). The prevalence of overweight and obesity in adults and children have increased at concerning rate, particularly in low-income minority adolescences (Bohnert, Randall, Tharp, & Germann, 2011). Globally in 2010, the number of overweight children under the age of five is estimated to be over 42 million (Sahoo et al., 2015). The trends in overweight and obese children differ by age where the prevalence is relatively minimal among infants and toddlers and then increases through the preschool period (Rolls, Engell, & Birch, 2000). Childhood obesity has severe consequences for a child's health and well-being including psychological and physical health problems, such high blood pressure and type 2 diabetes (Karnik & Kanekar, 2012). Being overweight during childhood is the most robust predictor of obesity in adulthood beyond family history of obesity; Up to 80% of overweight adolescents will become obese adults (Guo & Chumlea, 1999; Mossberg, 1989; Whitaker, Wright, Pepe, Seidel, & Dietz, 1997). It also increases the risk of developing chronic diseases like diabetes and cardiovascular diseases at younger ages (Dehghan, Akhtar-Danesh, & Merchant, 2005; Sahoo et al., 2015).

Obesity is fundamentally caused by an imbalance between energy intake and energy requirements (Hill, Wyatt, & Peters, 2012). For children, energy requirements include needs for growth. The causes of excessive energy consumption relative to needs are complex and are influenced by many factors, including genetics (Karnik & Kanekar,

2012). Recent increases in the prevalence of obesity, however, cannot be explained by genetic factors alone. Rather, obesity is thought to be expressed when genetically susceptible children are placed in environments that promote obesity-favoring behaviors (Fisher et al., 2003).

### **Obesogenic environment**

Environments that offer convenient access to large portion sizes are considered obesogenic and promote excessive energy intake by offering accessibility to large portion sizes of inexpensive, palatable, energy dense foods (Fisher, 2007). Children become increasingly responsive to environmental cues, such as large portion sizes, during the preschool years (Fisher & Birch, 2002; Rolls et al., 2000). This exposure to large portion sizes have become more common due to the increase availability in the marketplace (Fisher & Kral, 2008; French et al., 2001; Hill, 1998; Hill, Goldberg, Pate, & Peters, 2001; Poston & Foreyt, 1999; Young & Nestle, 1995). Analysis of portion sizes available in the marketplace showed that portions were often 2 to 8 times larger than USDA standards (Young & Nestle, 1995).

### **Response to large portion sizes**

A number of studies have provided evidence that that large portion sizes of food result in an increase in energy intake (English, Lasschuijt, & Keller, 2015). This response has been seen in both adults and children in various settings (Fisher & Kral, 2008). For example, using a sample of fifty-one adults, Rolls et al. (2002) examined the effect of portion size on energy intake during a single lunchtime meal. Using a between-subjects design with repeated measures, portion sizes of a macaroni and cheese entrée

varied in size (500, 625, 750, or 1,000g) so that energy intake could be compared. Results showed that portion size significantly influenced energy intake at lunch ( $p < 0.001$ ), and that participants consumed 30% more energy when offered larger portions compared to those that were offered smallest portions (Rolls, Morris, & Roe, 2002). A study of 75 young adults used a within-subjects design with repeated measures to examine the effect of increasing a portion size served as discrete food unit on energy intake (Rolls, Roe, Meengns, & Wall, 2004). Participants were served one of four sizes of deli sandwiches (6, 8, 10, or 12 inches) during a lunchtime meal in a laboratory setting. Results found that the portion size of the sandwich significantly influenced energy intake ( $p < 0.0001$ ). Using a between-subjects, parallel-group design, Dilbert et al. examined the effect of portion size and food and energy intake among adults in a setting of a public cafeteria style restaurant at a University. Portion sizes of an entrée varied in size from 248 g to 377 g on different days. Portion size had a significant effect on increased energy intake from the entrée ( $p < 0.0001$ ) and total energy intake of the meal by 43% (Diliberti, Bordi, Conklin, Roe, & Rolls, 2004).

Like adults, children respond to larger portion sizes resulting in an increase in energy intake (Fisher & Kral, 2008). Using a 2 x 2 within-subject factorial design, Fisher et al. (2007) examined the effect of portion size and energy density on 5-6-year-old children's food and energy intakes during a single meal. Children were seen in four randomly assigned conditions that differed only in portion size (250 g or 500 g) and energy density (1.3kcal/g or 1.8 kcal/g) of a macaroni and cheese entrée. Findings demonstrated a significant effect of portion size and energy density on entrée intake independently. Children with the larger entrée portion consumed 76% more energy from

the entrée and 34% more energy from the meal compared to those with the smaller entrée portion (Fisher, Liu, et al., 2007). Mooreville et al. studied the association of children's susceptibility large portion sizes and total energy intake. A sample of normal weight non-Hispanic black children aged 5-6 years were observed during four dinner meals where portions of all foods offered were systematically increased (100%, 677 kcal; 150%, 1015 kcal; 200%, 1353 kcal; and 250%, 1691 kcal). Total energy intake significantly increased across conditions of increasing food portion size ( $p < 0.001$ ) (Mooreville et al., 2015). Portion size effects on children's intake have even been observed with fruits and vegetables. Using a 2 x 2 within-subjects design, side dishes of fruits and vegetables varied in portion size, fruit (75 vs. 150 g) and vegetable (75 vs. 150 g), during multiple dinner meals. When the portion size of the side dish was doubled, participants increased their vegetable intake by 37% (12 g;  $p < 0.01$ ) and their fruit intake by 70% (41 g;  $p < 0.01$ ) (Mathias et al., 2012).

Finally, portion size effects have been observed beyond single meals and demonstrated to have effects on children's energy intake over 24 hour periods. A within-subjects experimental design was used to examine the effect of portion size on daily energy intake among 59 low-income Hispanic and African preschool aged children. During two 24 hour conditions, portion sizes of 3 entrées (breakfast, lunch, and dinner) and an afternoon snack were served in either a reference size in one condition and doubled in the other condition. Doubling the size of the entrees and snack resulting in an increase in energy intake from those foods by 23% and an increase in total daily energy intake by 12% (Fisher, Arreola, et al., 2007).

Although the response to large portion sizes has been consistently observed, the mechanisms that contribute to that response are not entirely understood. Some have argued that this effect is due to a cognitive explanation referred to as consumption norms (Fisher & Kral, 2008). Consumption norms are based on the normal amount of food a person typically eats and are greatly influenced by environmental factors, like large portion sizes. These factors influence what constitutes as "normal amounts" of food that people consume and drastically flout consumption norms due to the more common exposure to obesogenic environments (Wansink, Painter, & North, 2005). Consumption norms are believed to have a strong influence on adults, but not as much in children (Fisher & Kral, 2008).

Evidence suggests that the effect large portion sizes have on consumption may be related to perceptual factors as well as physiological ones (Wansink et al., 2005). Size-related visual cues of the eating environment are believed to affect eating behaviors by increasing consumption norms and interfering with the ability to accurately comprehend the amount of food selected (DiSantis et al., 2013; Van Ittersum & Wansink, 2012; Wansink, 2004; Wansink & van Ittersum, 2003). Visual cues are thought to convey consumption norms, especially in children (Fisher & Kral, 2008). Large portion sizes may visually impair judgement of an appropriate amount of food to consume. It is believed that the amount of food served acts as a visual cue that impacts consumption so portion sizes provide a visual reference for the amount of food available during the meal (English et al., 2015).

### **Influence of dishware**

Like food portion sizes, dishware and food packaging sizes may also provide visual cues about how much to consume (Wansink et al., 2005). In addition to the increase in available portion sizes, over the past few decades the average dishware size increased more than a third (36%) (Wansink, 2007). This increase in plate size is concurrent with the rate of increased obesity prevalence throughout the US (Young & Nestle, 2002).

Much of the research on food packaging and dishware size has been conducted in adults. Adults have been shown to serve larger hypothetical portions when the amount of food available and the food packaging sizes were experimentally increased (Wansink et al., 2006). In one study, even trained nutrition experts could not determine an appropriate portion size when given larger bowls to serve themselves ice cream (Wansink et al., 2006). Subjects were randomly assigned to either a small (17 oz) bowl or a large (34 oz) bowl and either a smaller (2 oz) or larger (3 oz) ice cream scoop. Subjects that were assigned the larger bowls served themselves 31.0% more (127 calories) than those that used the smaller bowls, suggesting that larger bowls provided larger consumption cues.

To date, there have only been two studies that have examined the influence of dishware on portion sizes in children. One study showed that when the size of a bowl used by experimenter was doubled, preschool aged children requested more than twice the amount of a cereal to eat for a hypothetical morning snack (Wansink, Payne, & Werle, 2008). DiSantis et al. evaluated the influence of the larger dishware and children's self-served portions. Results showed that during a lunchtime meal, children

served themselves more energy when using adult-sized dishware compared to child size. The use of the adult-sized dishware promoted energy intake indirectly (DiSantis et al., 2013). While studies of adults and children are generally consistent, no studies have looked at whether dishware size affects the portions served by parents to their children.

Although it is understood how adults respond when dishware and portion sizes are increased, it is unclear how adults respond when feeding their child. Understanding how adults respond to visual cues like large portion size and dishware while feeding their child is essential to better understand caregiver feeding mechanisms and the factors that contribute to serving behaviors. Caregivers have significant roles in shaping children's eating behavior because they provide access to food, and serve as models of eating which children learn to emulate and use feeding practices to socialize eating behavior. Caregivers not only determine which foods children have access to but also the portion sizes to which children are exposed. It has been shown that the amounts that parents serve themselves is closely related to the amount that they serve their children (Johnson et al., 2014).

It is possible that dishware size could alter caregiver serving behaviors via visual illusions. Wansink and Van Ittersum found that larger dishware is a driver of larger portion sizes and that the increase in dishware size influences perception (Van Ittersum & Wansink, 2012). The size of the dishware can alter the ability to perceive the size or shape of food served. For example, appropriate sized portions of food may look smaller on a large plate compared to when on a small plate. The inference in perception can be understood as a visual illusion that uses the perceived size of one object related to another

(English et al., 2015). This is known as the Delboeuf illusion. This theory can bias perception by the contrast and assimilation of the dishware and portion size, causing a change in eating behavior (Van Ittersum & Wansink, 2012). In caregivers, it is thought that larger dishware sizes could cause a bias in perception and influence the ability to determine an appropriate child size portion to serve to their child.

In addition to dishware size, the design of dishware could influence caregiver serving behaviors by providing immediate visual cues of food choices in appropriate portions at the time when food is being served and consumed (Bohnert et al., 2011). Current US dietary guidance (i.e. *ChooseMyPlate*) uses dishware design to convey messages about healthy eating (McGuire, 2011). Portion design plates, like *MyPlate*, are strategically developed and designed to portray images of healthy foods in appropriate portions acting as an aid for consumers to make healthy food choices. *MyPlate* was a way to connect consumers to science based nutrition recommendations and comprehend the recommendations in ways that are actually relevant to their lives (Post, 2011).

There is limited research available on dishware design. Only two studies have evaluated the effect of plate design on portion sizes and consumption. Findings from a recent clinical trial found that obese adults who used a plate designed to guide their selection of healthy food portions daily for six months demonstrated significant weight loss as compared to adults receiving standard nutrition education (Kesman, Ebbert, Harris, & Schroeder, 2011). Bohnert et al. examined the effect of a portion design plate on food intake among adolescences. Participants who ate off the portion design plate selected less food compared to those with a plain plate (Bohnert et al., 2011). These

findings suggest that portion design plates are beneficial in guiding appropriate consumption and can educate consumers on healthy food options.

It has been suggested that parents are not aware and do not comprehend what age-appropriate portions for their children look like (Crocker et al., 2009). Portion design plates are thought to help shape eating behaviors and could be a strong tool for caregivers when feeding their child. To date, there have not been any studies that examine portion design plates as a mechanism for caregivers to promote healthy child size portions.

### **Hypotheses**

The overarching goal of this research was to experimentally evaluate the influence of dishware on portion sizes served by caregivers. The primary aim was to determine the effects of dishware size and design on the total amount of food (g) and energy (kcal) served by caregivers to their preschool aged child during a buffet dinner meal. Three plate conditions were used: a portion design plate, a plain child size plate, and an adult size plate to compare the effects of size and design on the total amount of food served. Understanding the influence of dishware on caregiver feeding could help to improve consumption norms and decrease overconsumption for the child. It was expected that caregivers would use the portion design plate as a guide for the amount of food to serve to their child. When using the portion design plate, caregivers were expected to serve significantly less food compared to when using either a plain child size plate or a plain adult size plate.

## CHAPTER 3

### MATERIALS AND METHODS

#### Study Design

A within-subjects quasi-experimental design involving three dishware conditions was used to evaluate the effects of dishware size and design on the portion sizes served by caregivers to their preschool aged children during a buffet-style dinner. As shown in Table 1, dishware conditions included a 7.25" portion design plate with photo-realistic age-appropriate portion sizes printed on the plate; portion images on the design plate followed the MyPlate dietary guidance for preschool aged children (McGuire, 2011). The child portion size plate was compared to two control conditions: a 10.25" adult size plate which was used as a comparison of dishware size (99.9% increase in surface area of a plate), and a 7.25" plain child size plate which was used as a comparison of dishware design, holding size constant. Foods offered at a buffet meal were those depicted on the child portion size plate. Serving was assessed using weighed intake methods. Condition order was randomly assigned. A standard menu was employed such that types and amounts of foods available did not vary between conditions. Household food security, caregiver body mass index, child body mass index, and demographic data were collected to use for descriptive purposes and to include as potential covariates.

Condition	Type of plate	Plate size
1	Portion design plate	7.25-inch plate with portion designs
2	Plain child size plate	7.25-inch plate
3	Plain adult size plate	10.25-inch plate

## **Participants**

Subjects were low-income caregivers of healthy 3-5-year-old children from the Philadelphia area. To be eligible, caregivers had to be the primary person responsible for feeding the participating child as well as income eligible for the Supplemental Nutrition Assistance Program (SNAP) (Centers for Disease & Prevention, 2013). Caregivers were excluded from participating if they were under the age of 18 years, non-English speaking, or if their child had a developmental disorder (e.g. cerebral palsy), birth defect (e.g. cleft palate), or chronic illness or a condition (e.g. diabetes, cystic fibrosis) known to affect food intake or growth.

Convenience sampling was used where participants were recruited through newspaper advertisements, flyers in public locations, and in person recruitment at Women, Infants, and Children (WIC) clinics waiting area. Families were compensated for their participation with a \$25 Visa gift card for each of the three visits. All study procedures were reviewed by and conducted in accordance with standards set by the Temple University Institutional Review Board. Data were collected between August 2016 to May 2017.

## **Procedures**

Caregiver-child dyads were seen in one plate condition per week for three consecutive weeks during normal dinner times (e.g. between 4:30 and 6:30 pm). Caregivers were instructed to refrain from giving their child any food two hours prior to the visits. During the first visit, consent was obtained, demographic and eating behavior

questionnaires were administered to caregivers, and anthropometric data were collected for both the caregiver and child.

The plate caregivers used to serve their child varied by condition assignment (Figure 1). Caregivers were instructed to serve their child foods from individual pre-measured serving bowls containing the foods depicted on the portion design plate, presented in a buffet style setting. Four clear, plastic serving bowls were filled with four times the food label recommended serving size to minimize potential “ceiling” effects on caregiver’s portions served. The experimental menu consisted of: pasta (Kraft Macaroni & Cheese – The Cheesiest Original), chicken nuggets (Tyson Chicken Nuggets), sliced red apples (Mott’s Pre-sliced Red Apples), and baby carrots (Shoprite Baby Carrots) (Table 2). Serving bowls were placed on platform scales with remote digital readouts.

### Figure 1

Dishware conditions

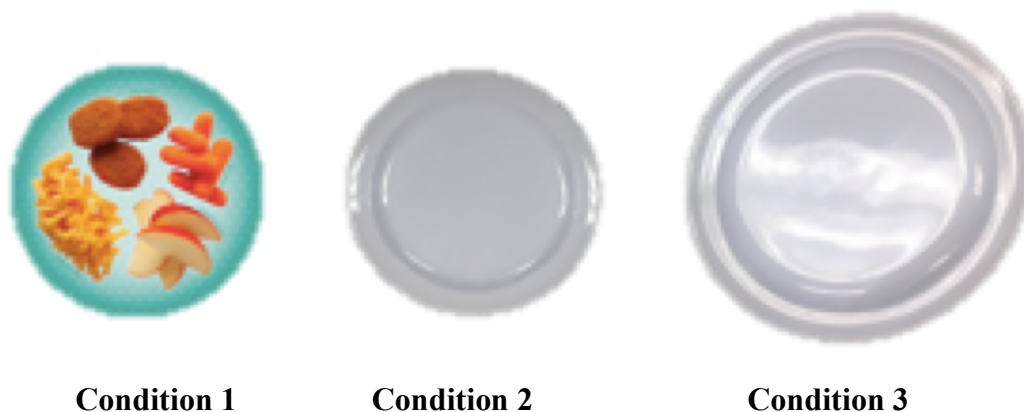


Figure one demonstrates the three dishware conditions that caregivers were randomly assigned during each visit. Condition 1 is a 7.25-inch portion design plate, condition 2 is a 7.25-inch plain child size plate, and condition 3 is 10.25-inch adult size plate that has 99.9% increase in surface area of plate compared to the other two conditions.

**Table 2**  
Experimental menu

Menu Item	Manufacturer Serving Size		Buffet Portions 4x Serving Portion	
	Weight (g)	Energy Density (kcal/g)	Weight (g)	Energy Density (kcal/g)
Chicken Nuggets (Tyson)	5 nuggets (90.0g)	3.0	20 nuggets (360.0g)	3.0
Baby Carrots	85.0	0.04	340.0	0.4
Mac and Cheese	220.0	2.0	880.0	2.0
Small Apple Slices	140.0	0.02	560.0	0.5

Caregivers were instructed to serve their child as many times as they desired within the allotted 20-minute dinner period. Once the researcher recorded the post weights of all foods served to the child, caregivers could serve themselves. Caregivers and their child ate dinner together in a separate room from the buffet setup. Research assistants were present to ensure that all servings caregivers served to their child were recorded as well as to observe that no food was shared.

## Measures

### Portion sizes

The amount of food caregivers served to their children was measured in grams by comparing the weights of each serving bowl before and after caregivers served their child. Each serving bowl was discretely placed on a digital platform scale with remote readout (Acculab SVI-10A, Edgewood, NY). Caregivers were instructed to leave the room each time they served their child so that research assistants could record post weights of the individual foods. Each serving for the child was recorded to the nearest 0.1g.

**Demographic data**

Caregivers self-reported their level of education, race/ethnicity, employment status, participation in federal low-income programs (WIC, Head Start, SNAP, free/reduced meals at school), and number of children living in the household using a demographic questionnaire. The short version of the U.S. Department of Agriculture Household Food Security Scale was used to classify household food security status (Bickel, Nord, Price, Hamilton, & Cook, 2000; Blumberg, Bialostosky, Hamilton, & Briefel, 1999). This measure has been tested and indicates a 92% sensitivity and 99% specificity for identifying food insecurity (Bickel et al., 2000; Blumberg et al., 1999).

**Caregiver and child weight status**

Height and weight measurements were obtained for caregivers and children in light clothing, without shoes, using procedures described by Lohman, Roche, and Martorell (Lohman, Roche, & Martorell, 1988). A digital scale (Detecto, model 758C, Webb City MO) was used to obtain duplicate weight measures to the nearest 0.1 kg, and a wall-mounted stadiometer (Holtain Limited, Harpenden, Pembrokeshire UK) was used to obtain duplicate height measured to the nearest 0.1 cm. A third measurement was taken and the discrepant measure discarded in cases where the weight measurements varied by  $>0.1$  kg or height measurements varied by  $>0.1$  cm.

Body Mass Index (BMI) and weight status were calculated for caregivers using CDC reference data (Kuczmarski et al., 2000). BMI was calculated by weight in kilograms divided by height in meters squared (Kuczmarski et al., 2000). A BMI 24.9

and below was considered normal weight and a BMI of 25.0 and above was considered overweight/obese weight status (Kuczmarski et al., 2000).

BMI-for-age percentiles and z-scores (BMIz) were calculated for children using CDC reference data (Kuczmarski et al., 2000). BMI-for-age percentiles were used to classify kids as normal weight (<85<sup>th</sup> percentile) or overweight/obese ( $\geq$  85<sup>th</sup> percentile) (Kuczmarski et al., 2000).

### **Statistical Analyses**

Statistical analyses were performed using Stata/SE (Version 14, College Station, TX). Descriptive statistics were generated for the child's gender, race, weight status, caregiver gender, race, level of education, employment status, and participation in federal low-income programs. Means and standard deviations were calculated for child and caregiver age and BMI.

The association between dishware condition and total grams and kcal served was tested using within-subjects ANOVA. All models were adjusted for child gender, weight status, and food security level. For all analysis, a *p*-value of <0.05 was used to infer statistical significance.

## **CHAPTER 4**

### **RESULTS**

Participants were thirty-nine African American (100%) caregivers (98% female) and their child (Table 3). On average, caregivers were  $40.0 \pm 8.5$  years with more than half (53.9%) having a high school education or greater. Most caregivers were overweight or obese (88.2%) and more than half reported a high or marginal food security (58.8%). Children were  $4.0 \pm 1.0$  years with the majority being African American (95%), male (56.4%) and normal weight (76.5%).

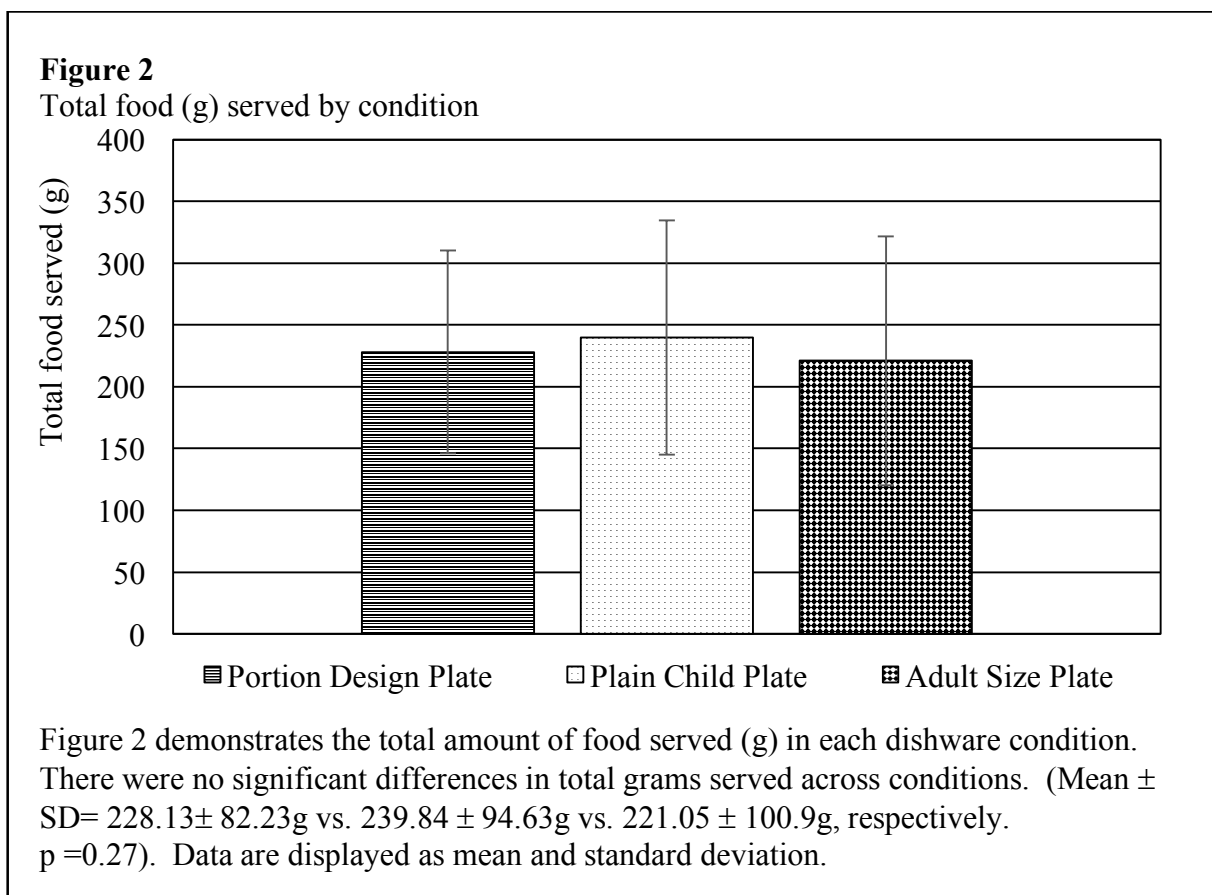
**Table 3**  
Caregiver baseline demographic variables (*n*=39)

	<b>n (%)</b>
Age (mean $\pm$ SD)	31 $\pm$ 7.52
Sex	
Male	2 (5.13%)
Female	37 (94.87%)
Ethnicity	
Hispanic	1 (2.56%)
Non-Hispanic	38 (97.44%)
Race	
Black/African-American	39 (100%)
Marital Status, %	
Married	7 (17.95%)
Single	32 (82.05%)
Education, %	
$\leq$ High school	18 (46.15%)
$\geq$ High school	21 (53.85%)
Employment, %	
Employed	25 (64.10%)
Unemployed	14 (35.90%)
Body Mass Index (BMI) (mean $\pm$ SD)	35.07 $\pm$ 10.88
Weight status, %	
Normal Weight	4 (11.76%)
Overweight/obese	30 (88.24%)
Received government assistance	
Yes	36 (97.30%)
no	1 (2.70%)
Household	
Children living in household	3.0 $\pm$ 1.82
Food Security	
High or marginal food security	20 (58.82%)
Low food security	11 (32.35%)
Very low food security	3 (8.82%)

<b>Table 4</b>	
Child baseline demographic variables ( <i>n</i> =39)	
	<b>n (%)</b>
Age (mean ± SD)	3.97 ± 0.79
Sex, %	
Male	23 (58.97%)
Female	16 (41.03%)
Ethnicity, %	
Hispanic	3 (9.09%)
Non-Hispanic	30 (90.91%)
Race, %	
Black/African-American	31 (93.94%)
More than once race	2 (6.06%)
BMI-for-age percentile (mean ± SD)	66.05 ± 30.24
Weight Status, %	
Healthy weight	26 (76.47%)
Overweight/Obese	8 (23.53%)

#### **Effects of dishware on the amount of food served by caregivers**

As illustrated in Figure 2, the total amount of food served (g) did not differ when comparing the portion size plate, plain child size plate, and adult size plate (Mean ± SD = 228.13 ± 82.23g vs. 239.84 ± 94.63g vs. 221.05 ± 100.79g, respectively. *p*=0.27).



As shown in Figure 3, the total amount of energy (kcal) served did not differ when comparing portion size plate, plain child size plate, and adult plate (Mean  $\pm$  SD=399.41 $\pm$  148.84kcal vs. 411.78  $\pm$  183.67 kcal vs. 391.58  $\pm$  207.95 kcal, respectively; p =0.37)

**Figure 3**

Total food (kcal) served by condition

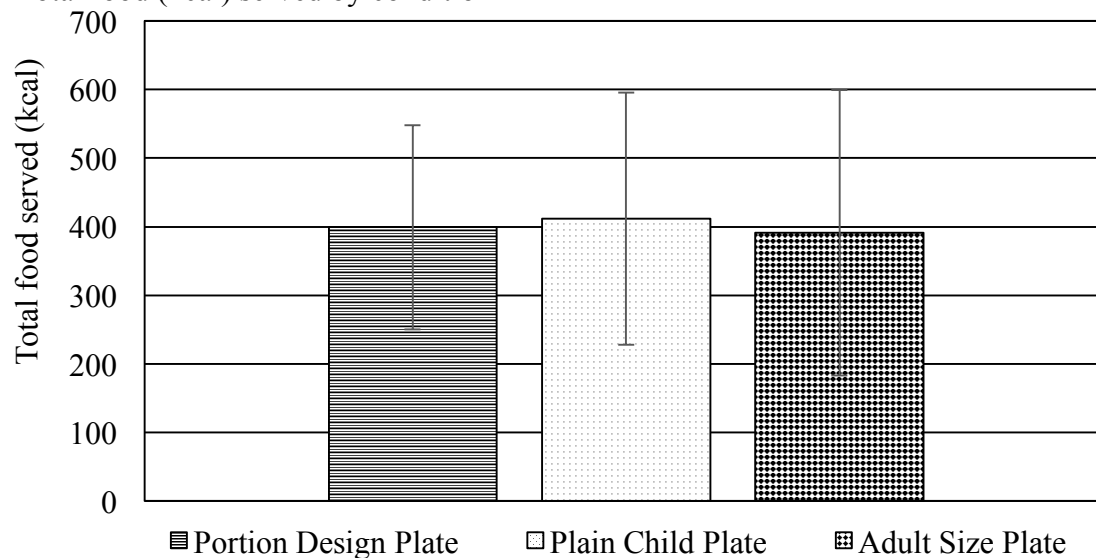


Figure 3 demonstrates the total amount of energy served (kcal) in each dishware condition. There were no significant differences in total kcal served across conditions. (Mean  $\pm$  SD=399.41 $\pm$  148.84 kcal vs. 411.78  $\pm$  183.67 kcal vs. 391.58  $\pm$  207.95 kcal, respectively;  $p=0.37$ ). Data are shown as means and standard deviations.

## **CHAPTER 5**

### **DISCUSSION**

To our knowledge, this is the first study designed to evaluate the effects of dishware size and design on portion sizes served by caregivers to their preschool aged child. We did not find an effect on amount of the total amount of food or energy served based on plate condition. These results indicate caregivers did not appear to use the size or design of the plate as a reference or guide to determine an appropriate amount of food to their child.

Most, but not all, of the research on this topic suggests that dishware size influences serving and consumption behavior among children and adults. Our findings are consistent with those of Rolls et al. (2007) who demonstrated that dishware size had no significant effect on energy intake among a sample of adults. Subjects using smaller dishware made significantly more trips to the buffet compared to when given a larger plate (Rolls, B. J., Roe, L. S., Halverson, K. H., & Meengs, J. S., 2007). Similarly, among a sample of female undergraduate students, Koh & Pilner also found no effect of dishware size on the amount of food served and consumed. Participants who ate from large plates did not serve or consume more than those who ate from small plates (Koh & Pliner, 2009). Ayaz et al. examined the influence of plate size in normal weight women with the use of three different sizes of plates during a buffet style meal. Findings demonstrated that plate size did not influence the amount of food participants consumed (Ayaz, Akyol, Cetin, & Besler, 2016).

Although dishware did not influence caregiver feeding, it is possible that with other foods, or in a natural setting, an effect might be seen. DiSantis et al. found that adult size dishware increased portion sizes self-served by elementary school students during lunch in their classroom (DiSantis et al., 2013). Generalization across dishware size studies are challenging because of the variation in dishware size and type, whether participants could serve themselves or were served, as well as type of food included in the experimental menu. Alternative visual cues could have influenced the amount served, like the amount of food present in the bowls of the buffet, or the act of serving food from multiple dishes on to the plate could have distracted or flawed judgment while serving (Rolls et al., 2007).

Perhaps caregivers were influenced by their own eating behaviors and habits while feeding their child. Johnson et al. demonstrated that the amount of food parents serve to themselves is significantly related to the amount they serve their child. Factors like parent's hunger state and food liking may contribute to the type and amount of food they serve to their child. These factors may affect the amount of food caregivers serve to their child by unconsciously influencing the judgement of age appropriate portion sizes for their child (Johnson et al., 2014).

Several limitations qualify the results of the study. The use of a small sample, which was further exacerbated by dyads not attending all planned sessions, is the primary limitation of the present study. Additionally, with the use of an unfamiliar laboratory setting, it is possible that the measurements did not accurately depict caregiver's typical

feeding behaviors. All caregivers that participated were African American, so findings may not be generalizable to caregivers of other race and ethnicities.

In conclusion, dishware did not influence the total amount of food or energy served by caregivers served to their children at a buffet style meal. Further research is needed to get a better understanding of the factors that shape caregiver serving behavior. Understanding caregiver feeding behaviors could potentially improve eating behaviors of the child and substantially prevent over consumption.

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**APPENDIX A**  
**TEMPLE UNIVERSITY IRB RE-APPROVAL**



Research Integrity & Compliance  
Student Faculty Center  
3340 N. Broad Street, Suite 304  
Philadelphia PA 19140

Institutional Review Board  
Phone: (215) 707-3390  
Fax: (215) 707-9100  
e-mail: [irb@temple.edu](mailto:irb@temple.edu)

Modifications are Approved

Date: 07-Feb-2017

Protocol Number: 23704  
PI: FISHER, JENNIFER O.  
Review Date: 06-Feb-2017  
Committee: A2  
School/College: PUBLIC HEALTH (0900)  
Department: CPH:SOCIAL & BEHAVIORIAL SCIENCES (09160)  
Sponsor: US DEPARTMENT OF AGRICULTURE  
Project Title: Choosy Chewers

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On 06-Feb-2017, the IRB approved the following modifications:

Lauren Dabritz has been added to this protocol.

Please contact the IRB at (215) 707-3390 if you have any questions.

## APPENDIX B

## PRACTICE RUNS TRAINING

## COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COMPLETION REPORT - PART 1 OF 2  
COURSEWORK REQUIREMENTS\*

\* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Lauren J Dabritz (ID: 4288334)
- **Institution Affiliation:** Temple University (ID: 926)
- **Institution Email:** lauren.dabritz@temple.edu
  
- **Curriculum Group:** Human Research
- **Course Learner Group:** Practice Runs Training
- **Stage:** Stage 1 - Basic Course
  
- **Record ID:** 13690297
- **Completion Date:** 12-Aug-2014
- **Expiration Date:** 12-Aug-2015
- **Minimum Passing:** 100
- **Reported Score\*:** 100

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
Practice Runs Training (ID: 16313)	12-Aug-2014	2/2 (100%)

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

Verify at: [www.citiprogram.org/verify/?kc55a1626-340d-48a5-8be1-c671c6c296c9-13690297](http://www.citiprogram.org/verify/?kc55a1626-340d-48a5-8be1-c671c6c296c9-13690297)

Collaborative Institutional Training Initiative (CITI Program)

Email: [support@citiprogram.org](mailto:support@citiprogram.org)  
Phone: 888-529-5929

Web: <https://www.citiprogram.org>

## APPENDIX C

## SOCIAL/BEHAVIORAL RESEARCH COURSE

## COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COMPLETION REPORT - PART 1 OF 2  
COURSEWORK REQUIREMENTS\*

\* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Lauren J Dabritz (ID: 4288334)
- **Institution Affiliation:** Temple University (ID: 926)
- **Institution Email:** lauren.dabritz@temple.edu
  
- **Curriculum Group:** Human Research
- **Course Learner Group:** Social/Behavioral Research Course
- **Stage:** Stage 1 - Basic Course
- **Description:** Choose this group to satisfy CITI training requirements for Investigators and staff involved primarily in Social/Behavioral Research with human subjects.
  
- **Record ID:** 17856418
- **Completion Date:** 08-Nov-2015
- **Expiration Date:** 07-Nov-2017
- **Minimum Passing:** 75
- **Reported Score\*:** 79

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
Temple University (ID: 1758)	08-Nov-2015	No Quiz
Belmont Report and CITI Course Introduction (ID: 1127)	08-Nov-2015	3/3 (100%)
Students in Research (ID: 1321)	08-Nov-2015	9/10 (90%)
History and Ethical Principles - SBE (ID: 490)	08-Nov-2015	5/5 (100%)
Defining Research with Human Subjects - SBE (ID: 491)	08-Nov-2015	4/5 (80%)
The Federal Regulations - SBE (ID: 502)	08-Nov-2015	5/5 (100%)
Assessing Risk - SBE (ID: 503)	08-Nov-2015	4/5 (80%)
Informed Consent - SBE (ID: 504)	08-Nov-2015	5/5 (100%)
Privacy and Confidentiality - SBE (ID: 505)	08-Nov-2015	5/5 (100%)
Research with Prisoners - SBE (ID: 506)	08-Nov-2015	2/5 (40%)
Research with Children - SBE (ID: 507)	08-Nov-2015	2/5 (40%)
Research in Public Elementary and Secondary Schools - SBE (ID: 508)	08-Nov-2015	4/5 (80%)
International Research - SBE (ID: 509)	08-Nov-2015	1/5 (20%)
Internet-Based Research - SBE (ID: 510)	08-Nov-2015	4/5 (80%)
Research and HIPAA Privacy Protections (ID: 14)	08-Nov-2015	4/5 (80%)
Vulnerable Subjects - Research Involving Workers/Employees (ID: 483)	08-Nov-2015	4/4 (100%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	08-Nov-2015	4/5 (80%)
Unanticipated Problems and Reporting Requirements in Social and Behavioral Research (ID: 14928)	08-Nov-2015	4/5 (80%)

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

Verify at: [www.citiiprogram.org/verify/?k63e991d0-578e-4e7b-a21c-b47cd61c85bd-17856418](http://www.citiiprogram.org/verify/?k63e991d0-578e-4e7b-a21c-b47cd61c85bd-17856418)

Collaborative Institutional Training Initiative (CITI Program)

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