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# Limiting Food Waste in Child Care Facilities through Implementation of Portion Sizes

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A thesis submitted in partial fulfillment of the requirement for the degree of Bachelors of Science in Human Environmental Sciences

by

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**ABSTRACT**

Food waste in child care facilities is both a monetary waste and a danger to the environment. The purpose of this study is to explore the impact of portion control in a child care facility on the amount of food wasted and the costs associated with food waste. It was hypothesized that establishment of portion control will result in a reduction in the amount of food waste of lunches and afternoon snacks generated by preschool children attending the Jean Tyson Child Development Study Center (JTCDSC). A four-week study was conducted where two trials were introduced: 1 two-week trial using the current "family-style" serving method that was "un-portioned" and 1 two-week trial using a "portion-sizing" that followed USDA portion serving recommendations. The study found a 12.54% reduction in the amount being served in pounds, a 33.26% reduction in the amount of food being wasted in pounds, and a reduction of $73.22 being thrown away as monetary waste when comparing the portioned method to the un-portioned method. In conclusion, it was found that using the portioning method implemented was successful in reducing food waste and monetary loss from food waste when compared to the current food serving method in a child care facility.

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-Margaret Wright

## DEDICATION

I would like to thank my mother and father for loving and supporting me in all that I do.

-Margaret Wright

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# CHAPTER 1

# INTRODUCTION

Food waste is both a monetary waste and a danger to the environment. Food that decomposes in landfills contributes to the production of carbon dioxide and methane emissions into the environment, which impacts global climate change (Hall et al., 2009). The Food and Agriculture Organization of the United Nations (FAO) has estimated that roughly one third of all edible food produced for consumption by humans is wasted or lost from the food supply, leading to 1.3 billion metric tons of food waste generated every year (Buzby & Hyman, 2012). In 2010, 31% of food at the retail and consumption level in the United States went uneaten (Buzby, Wells, & Hyman, 2014). In 2008, the estimated total of food lost at the retail and consumer levels in the United States reached $165.6 billion dollars (Buzby & Hyman, 2012).

Wherever food is served, there will most likely be food waste generated. This includes, (but is not limited to) households, hospitals, schools, and daycare facilities. The United States Department of Agriculture (USDA) has created guidelines for its sponsored programs: the Child and Adult Care Food Program (CACFP) (Federal Register, 2016). These guidelines concern the required amounts of food that infants, children, and adults should be served at breakfast, lunch, and afternoon snack (Child and Adult Care Food Program, 2015). The guidelines state that children must be served a certain amount of each of the four food components (fruits/vegetables, grains, protein, and milk), during lunch and a certain amount of two food components during afternoon snack.

The children attending the Jean Tyson Child Development Study Center in Fayetteville, Arkansas are served a morning snack, lunch, and afternoon snack. The food is served family-

style: large bowls filled completely, which are then served in the classroom, by the teachers using large serving spoons. Each child is then given a serving of food based on the teachers serving ability and the size of the spoon (which varies). The policy regarding the children's food consumption at the center is: the children are not forced to eat the amount of food that is served on their plate, and they can be served more food after finishing their initial serving. However, the amount of food given to each classroom is often much greater than both the USDA suggested serving sizes and what the children consume.

Food not consumed by the children is returned to the kitchen and discarded by throwing it into the garbage. All the food served to the classrooms cannot be reused or repurposed into "leftovers" because the food has already been exposed to potential contaminants. In addition, because children under the age of five years old are a high-risk population that is susceptible to foodborne diseases, the food cannot be re-served later ("Food Safety Concerns", n.d.). This results in a large amount of food waste from healthy and nutrient-rich foods.

**Purpose of Study**

**The purpose of this study is to explore the impact of portion control in a child care facility on the amount of food wasted and the costs associated with food waste.** It is hypothesized that establishment of portion control will result in a reduction in the amount of food waste of lunches and snacks created by children attending the Jean Tyson Child Development Study Center (JTCDSC). Results were determined by utilizing age-appropriate portion sizes established by the United States Department of Agriculture (USDA) as opposed to family style servings at designated feeding periods. Results of this study could potentially save the JTCDSC money by reducing the amount physical food inventory on hand; therefore, less food would need to be purchased for the facility. In addition, this study aims to produce

information concerning the types of foods and meals that generate the least and most amount of food waste for future use at JTCDSC.

**Problem Statement**

Food waste is a very common problem in the foodservice industry. The amount of daily food waste produced in child care facilities related to over serving, serving of foods children will not consume, and the challenge of communication between classroom workers and kitchen workers is immense. These concerns, as well as others not mentioned here, have led to an excessive amount of food being disposed of in garbage receptacles. This food loss is not only damaging financially but environmentally.

**Research Objectives**

1. Analyze the food consumption patterns of preschool children at JTCDSC.
2. Analyze the food waste patterns of preschool children at JTCDSC.
3. Observe and describe food waste differences in serving between family style and portion control cups.
4. Observe the financial implications of implementing portion control serving in a child care facility.

**Research Questions**

1. How will portion control serving cups affect the amount of food eaten by children at JTCDSC?
2. How will portion control serving cups affect the amount of food thrown away during lunchtime and snack at JTCDSC?

3. Will portion control serving cups decrease the amount of money spent on meals in the future for JTCDSC?
4. What foods/meals generate the least and most amount of food waste?

**Assumptions and Limitations**

The present study was comprised of preschool aged children attending the Jean Tyson Child Development Study Center in Fayetteville, Arkansas. This study was based on the need for regional representation and, due to budgetary limitations, the need for a convenience sample that offered cooperation and ease of access. The generalization of the results is limited in scope due to the study being performed at only one location: The Jean Tyson Child Development Study Center, University of Arkansas, in Fayetteville, Arkansas. The majority of children attending JTCDSC are Caucasian and live in a two-parent household. Children at JTCDSC do not exhibit signs of malnutrition and do not appear to suffer from food insecurity. Therefore, the findings could not be generalized beyond this target population.

# CHAPTER 2

# LITERATURE REVIEW

## Jean Tyson's Legacy

Born in 1931 to Howard and Vera Womochil, Jean Tyson spent her youth in Kansas and her adult life in Northwest Arkansas. Jean Tyson started her life in Northwest Arkansas with a trip from Kansas to visit relatives in the Springdale area. There she met Don Tyson, and they were wed in 1952. As Tyson Foods, Inc. became an international company, Jean Tyson focused on raising her three children: John, Cheryl and Carla Tyson. Jean enjoyed a considerably private life, though she enjoyed traveling, supporting the arts, and spending time in her garden. Jean Tyson passed away in 2006, leaving a considerable legacy behind. (Jean Tyson Child Development Study Center, 2014).

## University of Arkansas' Jean Tyson Child Development Study Center (JTCDSC)

Located on the campus of the University of Arkansas, the Jean Tyson Child Development Study Center is a family-centered program housed in a facility designed to provide for best practices in early childhood education and to enhance the learning experience for University students. JTCDSC provides individualized care for infants, toddlers, and preschoolers through the early childhood professionals who meet the physical, social, emotional, and cognitive needs of all children from eight weeks to five years old.

The three-fold mission of JTCDSC is:

- To provide a model early childhood facility for children from eight weeks to five years.

- To serve as a teaching laboratory for students studying in the area of Human Development and Family Sciences, and other disciplines.
- To serve as a research facility for faculty and graduate students.

The Jean Tyson Child Development Study Center, administered through the School of Human Environmental Sciences in Dale Bumpers College of Agricultural, Food and Life Sciences, is planned for a capacity of 144 children from infancy through preschool. In addition, more than 200 students and faculty per year use the center for study and research (Held, 2014).

**JTCDSC Kitchen**

The Kitchen at the JTCDSC serves morning snack, lunch, and afternoon snack to the children attending the JTCDSC for childcare and preschool. The meals served to children at JTCDSC are prepared and portioned out in the kitchen before being taken to each individual classroom via foodservice carts. The preschool children eat from "family-style"- bowls containing each food component, which are placed on a large group table and shared between children using large serving spoons. The children serve themselves using this method. Once the children are done eating, they dispose of any uneaten food in a tub and return their dishes on the foodservice cart, which is then returned to the main kitchen for cleaning or disposal.

**Childhood Nutrition in Childcare Settings**

Childcare facilities are typically designed to be a "nurturing care" environment, which is defined as being a stable environment that is sensitive to children's nutritional and health needs, while also providing protection from threats, opportunities for learning, and interactions that are emotionally supportive and developmentally supportive (Britto et al., 2017). Nurturing care consists of a core set of inter-related components, including behavior, attitudes, and knowledge

regarding caregivers, stimulation, responsiveness, and safety. These components work to shape a child's early learning experience, and can influence future attitudes and behaviors as the child grows older. The nurturing care environment can work to develop eating habits and behaviors based on foods provided by the child care facility and adult interaction during meals.

Role-modeling is an effective way for adults to encourage eating habits in children. Young children are completely dependent on adults for their nutritional needs, both at home and in child care settings. Adults who provide food to children make their food choices based on attitudes and beliefs toward nutrition, which can in turn influence a child's beliefs and attitudes concerning food. The food choices that the adult makes can encourage either positive or negative relationships with food, and studies have shown that adults who provide more fruits and vegetables, as well as eating fruits and vegetables in front of their children, positively encourage children to consume more fruits and vegetables than children who do not have a role-model that shows this behavior (Natale et al., 2014). Therefore, it is recommended that educators start with pre-school aged children and their families so that healthy eating habits are developed. Teachers at JTCDSC are required to eat with the children during meal times and exhibit positive role-modeling.

**USDA**

The United States Department of Agriculture (USDA) focuses on issues pertaining to the United States food supply, agriculture, and natural resources. The USDA also works to improve food safety and better the nutrition and health of its citizens. In the 2012 fiscal year, President Obama's budget provided $23.9 billion in discretionary funding to support the efforts of the USDA (United States Department of Agriculture, 2012). Almost $8 billion of this discretionary funding was used to improve food assistance programs for Americans which included: Special

Supplemental Nutrition Program for Women, Infants and Children (WIC) program, which aids 9.6 million low-income, nutritionally at-risk pregnant and postpartum women, infants and children up to age five, and the Supplemental Nutrition Assistance Program (SNAP), which helps more than 45 million Americans with food assistance, as well as the recent reforms to strengthen child nutrition (Whitehouse.gov, 2016). These programs, among others, are crucial to the nutritional well-being of citizens of the United States.

In addition to USDA programs that provide nutritional assistance to those who struggle with food insecurity, the department also has multiple programs that focus on the nutritional standard of schools and other institutions that serve food to children. These programs include the National School Lunch Program, the Fresh Fruit and Vegetable Program, the Special Milk Program, the Summer Food Service Program, the School Breakfast Program, the Child and Adult Care Food Program (USDA Food and Nutrition Services, 2016).

The Child and Adult Care Food Program (CACFP) contains a set of guidelines that pertain to the required amounts of food that infants, children, and adults should be served at breakfast, lunch, and afternoon snack (Child and Adult Care, 2015). The guidelines state that children must be served a specified amount of each of the 4 food groups during lunch (fruits, vegetables, grains, and protein). These guidelines were created based on recommended dietary allowances established to describe the amount of calories and nutrients that a child of a certain age needs to grow and maintain a healthy lifestyle. The lunch and snack dietary requirements for children ages 1-12 are listed in figures 1 and 2 (Child and Adult Care, 2015).

## Child Care Meal Pattern

### Lunch or Supper
Select All Four Components for a Reimbursable Meal

| Food Components | Ages 1-2 | Ages 3-5 | Ages 6-12[1] |
|---|---|---|---|
| **1 milk**[2] fluid milk | 1/2 cup | 3/4 cup | 1 cup |
| **2 fruits/vegetables** juice,[3] fruit and/or vegetable | 1/4 cup | 1/2 cup | 3/4 cup |
| **1 grains/bread**[4] | | | |
| bread or | 1/2 slice | 1/2 slice | 1 slice |
| cornbread or biscuit or roll or muffin or | 1/2 serving | 1/2 serving | 1 serving |
| cold dry cereal or | 1/4 cup | 1/3 cup | 3/4 cup |
| hot cooked cereal or | 1/4 cup | 1/4 cup | 1/2 cup |
| pasta or noodles or grains | 1/4 cup | 1/4 cup | 1/2 cup |
| **1 meat/meat alternate** | | | |
| meat or poultry or fish[5] or | 1 oz. | 1½oz. | 2 oz. |
| alternate protein product or | 1 oz. | 1½ oz. | 2 oz. |
| cheese or | 1 oz. | 1½ oz. | 2 oz. |
| egg or | 1/2 | 3/4 | 1 |
| cooked dry beans or peas or | 1/4 cup | 3/8 cup | 1/2 cup |
| peanut or other nut or seed butters or | 2 Tbsp. | 3 Tbsp. | 4 Tbsp. |
| nuts and/or seeds[6] or | 1/2 oz. | 3/4 oz. | 1 oz. |
| yogurt[7] | 4 oz. | 6 oz. | 8 oz. |

[1] Children age 12 and older may be served larger portions based on their greater food needs. They may not be served less than the minimum quantities listed in this column.
[2] Milk served must be low-fat (1%) or non-fat (skim) for children ages 2 years and older and adults.
[3] Fruit or vegetable juice must be full-strength.
[4] Breads and grains must be made from whole-grain or enriched meal or flour. Cereal must be whole-grain or enriched or fortified.
[5] A serving consists of the edible portion of cooked lean meat or poultry or fish.
[6] Nuts and seeds may meet only one-half of the total meat/meat alternate serving and must be combined with another meat/meat alternate to fulfill the lunch or supper requirement.
[7] Yogurt may be plain or flavored, unsweetened or sweetened.

Figure 1: USDA Lunch or Supper Dietary Requirements for Children ages 1-12 years

## Child Care Meal Pattern

### Snack
Select Two of the Four Components for a Reimbursable Snack

| Food Components | Ages 1-2 | Ages 3-5 | Ages 6-12[1] |
|---|---|---|---|
| **1 milk**[2] fluid milk | 1/2 cup | 1/2 cup | 1 cup |
| **1 fruit/vegetable** juice,[3] fruit and/or vegetable | 1/2 cup | 1/2 cup | 3/4 cup |
| **1 grains/bread**[4] | | | |
| bread or | 1/2 slice | 1/2 slice | 1 slice |
| cornbread or biscuit or roll or muffin or | 1/2 serving | 1/2 serving | 1 serving |
| cold dry cereal or | 1/4 cup | 1/3 cup | 3/4 cup |
| hot cooked cereal or | 1/4 cup | 1/4 cup | 1/2 cup |
| pasta or noodles or grains | 1/4 cup | 1/4 cup | 1/2 cup |
| **1 meat/meat alternate** | | | |
| meat or poultry or fish[5] or | 1/2 oz. | 1/2 oz. | 1 oz. |
| alternate protein product or | 1/2 oz. | 1/2 oz. | 1 oz. |
| cheese or | 1/2 oz. | 1/2 oz. | 1 oz. |
| egg[6] or | 1/2 | 1/2 | 1/2 |
| cooked dry beans or peas or | 1/8 cup | 1/8 cup | 1/4 cup |
| peanut or other nut or seed butters or | 1 Tbsp. | 1 Tbsp. | 2 Tbsp. |
| nuts and/or seeds or | 1/2 oz. | 1/2 oz. | 1 oz. |
| yogurt[7] | 2 oz. | 2 oz. | 4 oz. |

[1] Children age 12 and older may be served larger portions based on their greater food needs. They may not be served less than the minimum quantities listed in this column.
[2] Milk served must be low-fat (1%) or non-fat (skim) for children ages 2 years and older and adults.
[3] Fruit or vegetable juice must be full-strength.
[4] Breads and grains must be made from whole-grain or enriched meal or flour. Cereal must be whole-grain or enriched or fortified.
[5] A serving consists of the edible portion of cooked lean meat or poultry or fish.
[6] One-half egg meets the required minimum amount (one ounce or less) of meat alternate.
[7] Yogurt may be plain or flavored, unsweetened or sweetened.

Figure 2- USDA snack dietary requirements for children ages 1-12 years.

These guidelines were created to ensure that each infant and child aris served a required minimum amount of each food component during each meal while the child is at the facility her or she attends. Minimum food serving guidelines must be met for the institution serving the meals to be reimbursed by the government. While reimbursement from the USDA is the case at many childcare facilities, due to low enrollment at the JTCDSC, they do not receive any reimbursement from the USDA; however, this is part of the center's licensure.

**Food Waste**

The amount of food wasted created in the United States has become an increasingly concerning issue. Since 1974, the amount of food waste produced per capita in the US has progressively increased ~50% (Hall, Guo, Dore, & Chow, 2009).

While the food waste issue is a significant financial waste, it is also a hazard to the environment. As of 2010, an estimated 97% of uneaten food ends up in landfills (Levis et al., 2010). Food waste also contributes to excess consumption of freshwater and fossil fuels. This excess consumption, combined with the methane and CO2 gas emissions created by decomposing food, contributes to global climate change (Hall et al., 2009).

A 2014 study conducted by the USDA Economic Research Services (ERS) provided a report that analyzed the estimated amount and value of food waste created in the United States in 1 year. The report stated that in 2010 alone, 31% or 133 billion of the 403 billion pounds of food produced in the US was not available for human consumption at the consumer or retail level, leading to an estimated $161.6 billion loss annually (Coleman-Jensen, Gregory, & Singh, 2014). The top 3 food groups that accounted for the total value in food loss were meats, vegetables, and dairy products, representing a total energy loss of 387 billion calories (Buzby, Farah-Wells, &

Hyman, 2014). These statistics emphasize how detrimental food waste is to the United States both environmentally and economically.

**Food Waste in Education Settings**

A source of food waste that is of importance is the food waste generated by schools and daycares. Studies have been conducted in recent years that observe the amount of food waste produced in schools and daycares.

The USDA school meal standards have also been analyzed in regard to how changes affect food selection, consumption, and food waste generation. A 2014 study observed how certain USDA lunch guideline changes, influenced by the Healthy, Hunger Free Kids Act of 2010, observed how school meal standard changes made by the USDA influenced lunch eating habits in an urban, low-income school district of comprised of elementary and middle schools (Cohen et al., 2014). These guideline changes included an increased availability of fruits, vegetables, and whole grains, based on increasing the portion sizes of fruits and vegetables. The guidelines required the fruit and vegetable selection offered in schools to be widened, while also limiting the calorie and fat contents of lunch meals served in schools. The researchers collected plate waste data before and after the implementation of new USDA standard and found that after the new standards were implemented, fruit selection increased by 23%, entrée consumption increased by 15.6%, and vegetable consumption increased by 16.2%. The study concluded that while food waste levels were substantial both pre- and post-implementation of new USDA guidelines, the guidelines did have a positive impact on food selection and consumption and did not lead to a significant increase in the amount of food waste created when fruit and vegetable portion sizes increased. This study is significant in showing that USDA guidelines that

encourage more fruit and vegetable consumption did not necessarily lead to more food waste created in schools.

Another study analyzed the National School Lunch Program (NSLP) standards and how school food waste can lead to significant nutritional and cost implications for families, students, and policymakers. The study used plate waste measurements to observe the amount of food waste generated in low-income Boston, Massachusetts middle schools during lunch and the cost associated with such waste. The researchers found that students consumed levels less than the nutrient requirements set by the NSLP, as well as generating over $400,000 (26.1% of the total food budget) in food waste over the course of the study. The researchers concluded that students did not meet the NSLP nutrition standards and the costs associated with the middle schools' food waste was substantially high; the sample's food waste costs translated on a national level accounts for over $1.2 billion wasted annually (Cohen et al., 2013). This study emphasized the financial burden of food waste on school systems, as well as highlighting the importance of meeting nutrition standards set by the NSLP or USDA.

**University of Arkansas Food Assistance Programs**

At the University of Arkansas in Fayetteville, Arkansas, two programs have been introduced in the last decade that focus on combating the food waste problem while feeding families facing food insecurity in the process. The Full Circle Food Pantry (FCFP) is a food bank located on the University of Arkansas Campus. Established in 2011, this student-run emergency food assistance program collects food and distributes it to needy members of the U of A community (Food Programs, 2016). The only requirement for those receiving food is that they have a U of A ID. Another impressive program run at the U of A is Razorback Food Recovery (RFR). Founded in 2014, the program is run by volunteers who recover unused food from

Chartwells retail locations and dining halls on the U of A campus that would otherwise be thrown away at the end of each day. This food is either donated to the FCFP or other partners with the intention of distributing the food to those in need. (Food Programs, 2016)

These programs, among others on college campuses across the country, are helping to raise awareness of the growing food waste issue that this country is facing. While the FCFP and RFR are able to collect food from certain distributors and repurpose them to assist those struggling with food security, they are not able to reach every area of food waste. For example, the amount of surplus food produced at JTCDSC would not be sufficient enough to be stored and donated to a food pantry. The food served to classrooms which is uneaten cannot be stored for a later date due to potential contamination and CACFP regulation. These limitations prevent JTCDSC from reusing already served food and therefore participating in these programs.

**Limitations on Childcare Centers concerning Food Waste**

Due to the family-style serving method practiced at JTCDSC, a risk for food contamination is present during and after each meal is served. Because the food bowls are uncovered and in a close-proximity to young children during eating times, there is potential for contamination including, but not limited to, sneezing, coughing, spills, and placing bare hands in food. Children under the age of five years old are considered a “high-risk” population by the CDC when concerning foodborne diseases (“Food Safety Concerns”, n.d.). With the potential risk of contamination combined with the high-risk population being served, uneaten leftover food from meals cannot be re-served at a later time. The only exception to this rule is if the food bowl’s cover remains intact during the meal and is not eaten from or touched by children. In this case, the food component can be potentially stored for a later meal.

# CHAPTER 3

# METHODS

## Participant Selection

Participants were chosen based on their enrollment at JTCDSC during the August and September 2016 months. The center required parental permission of each student in order to be considered for the study. Permission slips were distributed to the 4 preschool classrooms 2 weeks before the initiation of the study (see Appendix B). A total of 45 parents signed the permission slips, allowing for a total of 45 participants within the classrooms.

## Meal Selection Process

A 10-day lunch and afternoon snack menu was created by the main cook and the research team. Food selections were based on meals to which the children had been previously exposed, and therefore would not be new or unusual to the participants. The team decided make food selections that the participants had previously demonstrated either a fondness or a lack of fondness. This was done to analyze the amount of food served and wasted for a “popular” meal, such as pizza, as opposed to an “unpopular” meal, such as barley jambalaya. This 10-day lunch and afternoon menu would be used twice, once during the un-portioned trial and once during the portioned trial, to have consistent data results (See Appendix C).

The Lunch meals consisted of 5 food components: Grain, fruit, vegetable, protein, and milk. The Afternoon snack meals consisted of at least 2 of the five food components. A table showing what was served during the lunch and afternoon snack meals of days 1-10 is shown below:

Table 3.1- Lunch Meal Components

| Day | Component 1 | Component 2 | Component 3 | Component 4 | Component 5 (extra component) |
|---|---|---|---|---|---|
| Day 1 | Macaroni and Cheese | Apple Sauce | Broccoli Flourettes | Milk | |
| Day 2 | Pizza | Strawberries (whole) | Mixed Salad | Milk | |
| Day 3 | Chicken Enchilada Casserole | Pears (canned) | Black Beans | Milk | |
| Day 4 | Barley Jambalaya with Rice | Cling Peaches (canned) | Sliced Cucumbers | Milk | |
| Day 5 | Barbeque Turkey Ham | Pineapple (canned) | Cauliflower (boiled) | Milk | Whole Grain Bread |
| Day 6 | Spinach Quesadilla | Blueberries | Green Beans (boiled) | Milk | |
| Day 7 | Barbeque Chicken | Pears (canned) | Green Beans (boiled) | Milk | |
| Day 8 | Rice and Beans | Kiwi (Fresh, Sliced) | Cauliflower (boiled) | Milk | |
| Day 9 | Turkey | Apples (whole) | Carrots (boiled) | Milk | Whole Grain Bread |
| Day 10 | Grilled Cheese Sandwich | Mandarin Oranges (canned) | Broccoli (boiled) | Milk | |

Table 3.2- Afternoon Snack Meal Components

| Day | Component 1 | Component 2 | Component 3 (extra component) |
|---|---|---|---|
| Day 1 | Lemon Bread | Milk | |
| Day 2 | Mixed Vegetables (Fresh) | Milk | Yogurt Dip |
| Day 3 | Blueberry Bread | Milk | |
| Day 4 | Trail Mix | Cheese | |
| Day 5 | Fruit Pop | Milk | |
| Day 6 | Ritz Crackers | Cantaloupe | |

| | | | |
|---|---|---|---|
| Day 7 | Strawberries & Mango (Frozen) | Milk | |
| Day 8 | Garlic Bread | Milk | |
| Day 9 | Ritz Crackers | Cheese | |
| Day 10 | Bananas (Fresh, peeled) | Pita Bread | |

**Anatomy of the Serving Carts**

Each classroom is assigned a 3-tier food cart that is used to transport food from the kitchen to the classroom before a meal and to transport uneaten food back to the kitchen for disposal after a meal. On the top two levels of the cart, food and eating utensils are placed. The eating utensils placed on the cart are plates, cups, an empty jug for milk or water, forks or spoons (depending on the meal served), spoons or tongs meant for serving food components, and a tray for each tier. The top two tiers are also where the bowls containing each food component are placed.

The third tier of the food cart is meant for the disposal of uneaten food and eating utensils after each child is done eating. Each third tier of a food cart has two bins: a blue bin for used eating utensils and a purple bin for uneaten food that was served to the child. The child is taught to pour out any unused milk from their cup into the purple bin, then place their empty cup into the blue bin. They are then supposed to dispose any uneaten food on their plate into the purple bin, and place their empty plate on the second tier of the cart.

**Meal Serving and Disposal Process**

All meals served at JTCDSC are made in the kitchen and provide morning snack, lunch, and afternoon snack to 10 classrooms that have children ranging from infants to 5 years of age.

The head cook creates a menu prior to the beginning of the week, which is to be followed for one Monday-Friday week.

After the 3-tier food carts have been set up with all of the necessary eating utensils, the food is served onto the carts. Each food component is placed a bowl and then placed on the cart. Each classroom received 2 bowls of each food component, as each classroom has 2 eating tables. Three bowls are typically placed on each tier of the serving cart: 1 for the entrée, 1 for the fruit, and 1 for the vegetable, or 6 in total. Occasionally an extra component will be placed on the cart in addition to the 3 bowls, such as a loaf of bread. The beverage, either milk or water, is stored in a small refrigerator in each classroom. Milk or water is poured into the provided beverage jug prior to meal time and served to the children.

Once all the food components are placed on the cart, the cart is taken to its respective classroom. The children eat in their classrooms "family-style" meaning that they sit at a table with their peers and 1 teacher. The food component bowls are placed in the center of the table, and the children are given an opportunity to serve themselves as much of each component as they desire. They serve directly from the bowls using a large serving spoon. They also serve themselves milk or water using the beverage jug that had been previously filled by a teacher.

When the child is done eating, he or she returns the eating utensils to the food cart. They dispose of any uneaten food into the purple bin and place their clean plate on the 2$^{nd}$ tier of the cart. When all children are done eating, the teacher will place the used food component bowls and any other eating utensils used on the cart. They will then roll the cart outside the kitchen door for a kitchen aide to retrieve and take back to the kitchen.

When the food cart is back in the kitchen, any uneaten food from food component bowls, plates, or food waste tubs is disposed of into a large trash bin. All the eating utensils are then cleaned, sanitized, and organized for future use.

**Alterations to Conduct the Experiment**

Instead of the current method of filling the food component bowls without portioning, the altered trial implemented portioning in both the kitchen and preschool classrooms.

In the kitchen, food component portions were calculated based on the number of children present in each classroom and portioned out accordingly into food component bowls. In the classrooms, teachers portioned out the suggested amount of each food component to each child using serving cups sets provided by the research team. Eight serving cup sets were purchased by the researchers with the intention that each classroom would receive 2 serving cup sets, or one for each table. This method would ensure that the child is receiving the amount of each food component as designated by the USDA.

The teachers were instructed not to eat from the food component bowls for the duration of the study, as to not skew any results. Since the teachers were required to have food in order to demonstrate good eating habits during mealtimes to the children, separate plates containing a small amount of each food component were made in addition to the food component bowls and given to the teachers in each classroom. These separate plates would not be weighed or included in the recorded food waste data.

**1st trial – Un-Portioned**

For the first trial, labeled the "un-portioned days", the amount of food served and wasted was measured using the current meal serving methods performed by JTCDSC. No special instructions were given to the classroom teachers or students on how to serve food.

Before every meal, the initial weight of the food component in the serving bowl was weighed on a scale and recorded. The weight of the bowl was subtracted from the determined weight of the food component. During the un-portioned trial, the food components were placed into the bowls by roughly guessing how much should go into the bowl and not using any precise measurements, which was practiced by the center prior to the initiation of the study. Once the food component bowls were weighed and recorded, they were placed on their intended food carts. Once every food component was recorded and placed on the food cart, the cart was transported to the classroom for meal time.

During mealtime, they children were seated at a table that already had the eating utensils, food component bowls, and beverage jugs ready. The children served themselves food from each of the food component bowls by using large serving spoons. The children could take as much food as they wanted, and could refuse putting a food component on their plate if they did not have interest in eating that certain food component.

When the children were done eating, they disposed of their eating utensils and food waste. After placing all used food component bowls and eating utensils on the cart, the teacher filled out the provided questionnaire before moving the cart outside of the classroom. This questionnaire asked 3 questions: 1. How many children ate this meal? 2. What, if any, alternative foods were eaten? 3. How much milk was served during this meal? The cart would then wait to be retrieved by a kitchen aide.

When the food cart returned to the kitchen after meal time, the amount of food waste was weighed and recorded. The weight of the food waste was measured using the same type of scale used to weigh the outgoing food. First, each food component bowl containing uneaten food, or food waste, was weighed, recorded, and disposed of in the designated trash bin. If the beverage jug contained any milk, the jug and its contents were weighed and recorded (subtracting the weight of the jug itself). When every food component bowl and beverage jug containing food waste was recorded, the purple bin containing food waste from the children's plates was weighed and recorded (subtracting the weight of the purple bin itself).

The un-portioned trial lasted for 10-days, or 2 weeks.

**2nd trial – Portioned**

For the second trial, labeled the "portioned days", the amount of food served and wasted was measured using USDA recommended guidelines for children ages 3-5 in a child care setting. Food components were pre-portioned in the kitchen prior to meal time, and the teachers assisted in serving out the designated portion to each child by following guidelines provided on the food cart.

Prior to each meal, the researcher would survey each classroom for how many children would be eating the upcoming meal. The number of participating children allowed the researcher to calculate how much of each food component needed to be served to the classroom for that meal. The researcher would determine how much of each food component, whether in cups or ounces, would be placed in the food bowls, and follow that calculation accordingly. The food component bowl would then be weighed and recorded.

Once every food component was on the cart, the cart was taken to its respective classroom. When the children were ready to eat their meal, they sat at the table as normal, but were not able to serve themselves initially. A teacher would have each food component bowl and the serving cups, and would serve each child the designated portion of every food component. Once each food component was portioned, the children were given the opportunity to serve themselves more food if they desired. They were not forced to eat any food that was placed on their plate.

For the beverage component, the desired method was to also have teachers portion out the USDA recommended milk servings of 6 oz. during lunch and 4 oz. during snack. However, this was not a practical requirement for classrooms B, C, and D to follow. They were not required to follow the milk guidelines, and continued to follow the same routine concerning beverages as they did in the previous trial. Room A did agree to follow the milk guidelines, which was practical for them to perform due to the decreased number of only 7 participating students in that classroom.

When the children were done eating, they disposed of their eating utensils and food waste as done in the previous trial. After placing all used food component bowls and eating utensils on the cart, the teacher filled out the provided questionnaire before moving the cart outside of the classroom. This questionnaire asked three questions: 1. How many children ate this meal? 2. What, if any, alternative foods were eaten? 3. How much milk was served during this meal? The cart would then wait to be retrieved by a kitchen aide.

Once the cart was returned to the kitchen, the food waste was collected, weighed, and recorded from the food component bowls and food waste bin as done previously in the first trial

with no alterations. The food utensils were then cleaned, sanitized, and organized for future meals.

The portioned trial lasted for 10 days, or 2 weeks.

**Conclusion of Study**

After the 2 trials were completed, the recorded data from was entered into an excel worksheet and analyzed. The amount of food served to each classroom, the amount of food wasted by each classroom, the amount of food and served and wasted by each child of a classroom, the amount of money spent of food during each trial, and the percentage of food wasted during each trial were analyzed using the data collected.

# CHAPTER 4

# RESULTS

## Participation Rate

Of the children currently enrolled in the pre-school classrooms at JTCDSC, 45 were given parental permission to participate in the study. Room A only had 7 parents agree to sign the participation form, which was roughly half of the classroom. It was agreed upon to split room A's children into two designated tables, one table for the 7 participating children and another table for the children who would not be participating. The participation number of children on any given day varied, which has been incorporated into the final data.

## Food Served and Wasted per Classroom based on Weight

Tables 4.1- 4.4 describe the amount of food served and wasted in ounces and pounds during the un-portioned and portioned days of the study. Tables 4.1 and 4.2 show the amount of food served during the un-portioned and portioned days, respectively. Over the 10 un-portioned days, 496 lbs. were served in total to the 4 classrooms. On the 10 portioned days, 433.6 lbs. were served, resulting in a 62.4 lbs. and 12.54% reduction in the total amount served in pounds. Of the 20 meals served in each 2week period of the study to each of the 4 classrooms, the amount of food served went down 67.5% of the time when using the portioning method as opposed to not using the portioning method. In contrast, the majority of meals where the amount of food served went up in weight was in Room A in which only ½ the children participated in the study.

Tables 4.3 and 4.4 show the amount of food wasted by each classroom in pounds in ounces during the un-portioned and portioned days. Over the 10 un-portioned days, 167.24 lbs. were wasted by the combined 4 classrooms. On the 10 portioned days, 111.5 lbs. were wasted by

the combined 4 classrooms, resulting in a 55.68 lbs. and 33.26% reduction in the amount of food wasted by the 4 pre-school classrooms over the two weeks of portioned meals. Of the 20 meals served in each 2 weeks of the study to each 4 classrooms, the amount of food wasted was reduced in 71.25% of the meals when using the portioning method as opposed to not using the portioning method. Thirteen of the 23 meals that went up in the amount of food wasted came from Room A.

Therefore, it can be ascertained that tables 4.1, 4.2, 4.3, and 4.4 represent an accurate depiction of the amount of food served and wasted during the un-portioned and portioned trials and show a reliable depiction of the differences in poundage served and wasted when comparing the two trials.

**Food Served and Wasted per Child based on Weight**

While the data presented in tables 4.1-4.4 is significant, it does not take variation in the number of children present during each meal into account. To adjust for this factor, tables 4.5 and 4.6 were made to analyze the amount of food served and wasted per child in each classroom during the un-portioned and portioned days.

Tables 4.5 and 4.6 show the amount of food served and wasted (in ounces) per child in each of the 4 classrooms during the un-portioned and portioned days of the study. Each day accounts for both the designated lunch and afternoon snack meals combined for the specified day. The total amount of food served and wasted for each day was divided by the recorded number of children participating during each individual meal, as recorded by the teacher on the tracking sheet placed on the food cart during each meal.

Table 4.5 shows the amount of food served (in ounces) per child during the un-portioned and portioned days based on each of the participating classrooms. The table indicates that the

amount of food served went down by 77.5% on the portioned days as compared to the un-portioned days. The average amount of food served per child among the four classrooms combined went down 9 out of the 10 days when comparing each un-portioned day to its respective portioned day. When comparing the amount of food served based solely on weight between the un-portioned and portioned days, the average amount of ounces served went down 2.22 oz. in Room B, 3.4 oz. in Room C, and 5.43 oz. in Room D. However, the amount of ounces served per child went up 1.75 oz. in Room A. For the 10-day average combining all 4 classrooms, the amount of food served per child went down 2.32 oz. when comparing the portioned average to the un-portioned average.

Table 4.6 shows the amount of food wasted (in ounces) per child during the un-portioned and portioned days based on each of the participating classrooms. The amount of food wasted per child went down in went down 75% of the time, with all but one of the meals that showed an increase in food waste coming from the average per child of Room A. The average amount of food wasted per child amongst the four classrooms combined went down 9 out of the 10 days when comparing each un-portioned day to its respective portioned day. When comparing the amount of food served based solely on weight between the un-portioned and portioned days, the average number of ounces wasted per child was reduced by 1.43 oz. in Room B, 3.08 oz. in Room C, and 2.5 oz. in Room D. However, the amount of ounces wasted per child in Room A went up by 0.61 oz. when comparing the portioned average to the un-portioned average.

Table 4.8 represents the percentage of food wasted during each lunch and afternoon snack during both the un-portioned and portioned days. These percentages were calculated by dividing the amount of food wasted (lbs.) by the amount of food served (lbs.) in the combined 4

participating classrooms. The table shows the difference in percentage amounts when comparing the portioned days food waste percentage to the un-portioned days food waste percentage.

This table illustrates that during the un-portioned days, 6 meals exceeded 40% of food wasted for that meal: Day 2 lunch, Day 2 afternoon snack, Day 3 lunch, Day 5 afternoon snack, Day 9 afternoon snack, and Day 10 afternoon snack. During the portioned days, 3 meals exceeded 40% of food wasted for that particular meal: Day 5 afternoon snack, Day 9 afternoon snack, and Day 10 afternoon snack. When comparing the percentage of food wasted between the portioned un-portioned days, the table shows that the percentage of food wasted was reduced in 16 out of the 20 recorded meals, or 80% of the time, when comparing the percentage of food wasted during the portioned meals to the percentage of food wasted during the un-portioned meals. The average percentage reduction for all 20 meals was -7.18% by using pre-portioning.

Therefore, it can be determined that tables 4.5, 4.6, and 4.8 represent a reliable comparison in the percentage reduction of food waste when comparing the un-portioned and portioned meal trials.

**Cost Analysis**

While understanding the significance of the reduction of food wasted is important from an environmental standpoint, the waste must also be looked at from an economic standpoint. JTCDSC is not a for-profit business in nature, but does not benefit from commodity loss. A cost-analysis for each food component of each meal was compiled using price point information provided by JTCDSC, Walmart.com, and the Book of Yields.

Table 4.7 shows the amount of money that was spent to serve the lunch and afternoon snack meals during the un-portioned and portioned days. The table also shows the amount of money “thrown away” as uneaten food waste during the un-portioned and portioned days.

During the 10 un-portioned days, $574.51 was served and $218.30 was wasted, resulting in 38% of the money being spent on food thrown away.

During the 10 portioned days, $445.40 was served and $145.08 was wasted, resulting in 32.51% of money spent on food being thrown away. The cost to serve the meals was reduced by $129.11 and the cost of food being thrown away went down $73.22 when compared to the 10 cost of day portioned days versus the cost of the un-portioned days. The cost of food went down due to the reduction in the amount of food being served to the children using the portioning method. The percentage of money being thrown away went down in 9 of the 10 days when compared to the portioned percentage of money wasted to the un-portioned percentage of money wasted. While the averaging of the percentage of money wasted only shows a 5.49% difference when comparing the un-portioned and portioned days, dollar amount saved using the portioning method does show significant results of $129.11 reduced in the amount of food served and $73.22 in the amount of food being thrown away using the portioning method when compared to the non-portioning method

Therefore, it can be determined that table 4.7 represents an accurate depiction of the cost benefits of using the portioning method when compared to the costs associated with the current non-portioning method.

Table 4.1:

**Amount of Food Served-All Classrooms Lunch and Afternoon Snack 10 Un-Portioned Days**

| Meal: Un-Portioned | Room A | | Room B | | Room C | | Room D | |
|---|---|---|---|---|---|---|---|---|
| | oz. | lbs. | oz. | lbs. | oz. | lbs. | oz. | lbs. |
| Day 1 Lunch | 129.1 | 8.1 | 209.1 | 13.7 | 168.2 | 10.5 | 193.3 | 12.1 |
| Day 1 Afternoon Snack | 32.4 | 2 | 31 | 1.9 | 32.8 | 2.1 | 43.1 | 2.7 |
| Day 2 Lunch | 76 | 4.8 | 151.9 | 9.5 | 26.6 | 8 | 88.2 | 11.8 |
| Day 2 Afternoon Snack | 42.6 | 2.7 | 40 | 2.5 | 93.8 | 5.9 | 78.2 | 4.9 |
| Day 3 Lunch | 110.8 | 6.9 | 143 | 9 | 161.3 | 10.1 | 184.6 | 11.6 |
| Day 3 Afternoon Snack | 39.6 | 2.5 | 49.2 | 3.1 | 78.8 | 4.9 | 79.7 | 5 |
| Day 4 Lunch | 82.4 | 5.2 | 131.6 | 8.2 | 156.5 | 9.8 | 162.8 | 10.2 |
| Day 4 Afternoon Snack | 18 | 1.1 | 23.9 | 1.5 | 32.7 | 2 | 31.1 | 2.2 |
| Day 5 Lunch | 88.8 | 5.6 | 152.7 | 9.6 | 179.5 | 11.2 | 181.9 | 11.4 |
| Day 5 Afternoon Snack | 23.4 | 1.5 | 68.9 | 4.3 | 91.6 | 5.7 | 103.6 | 6.4 |
| Day 6 Lunch | 62.2 | 3.9 | 141.9 | 8.9 | 136.7 | 8.6 | 185.5 | 11.6 |
| Day 6 Afternoon Snack | 21.8 | 1.4 | 24.9 | 1.6 | 49.6 | 3.1 | 29.2 | 1.8 |
| Day 7 Lunch | 84.6 | 5.3 | 219.8 | 13.8 | 185.6 | 11.6 | 201.5 | 12.6 |
| Day 7 Afternoon Snack | 52.6 | 3.3 | 72.5 | 4.5 | 78 | 4.9 | 87.7 | 5.5 |
| Day 8 Lunch | 74.3 | 4.7 | 157.1 | 9.8 | 143.3 | 9 | 180.4 | 11.3 |
| Day 8 Afternoon Snack | 24.6 | 1.5 | 45.6 | 2.9 | 51.2 | 3.2 | 54.3 | 3.4 |
| Day 9 Lunch | 93.6 | 5.9 | 181.7 | 11.4 | 209.5 | 13.1 | 221.5 | 13.9 |
| Day 9 Afternoon Snack | 11.1 | 0.7 | 21.5 | 1.3 | 19.1 | 1.2 | 18.7 | 1.2 |
| Day 10 Lunch | 91 | 5.7 | 131.9 | 8.3 | 164.1 | 10.3 | 156.8 | 9.8 |
| Day 10 Afternoon Snack | 52.4 | 3.3 | 56.4 | 3.5 | 51.4 | 3.2 | 48.8 | 3.1 |

Table 4.2:

**Amount of Food Served-All Classrooms for Lunch and Afternoon Snack 10 Portioned Days**

| Meal: Portioned | Room A | | Room B | | Room C | | Room D | |
|---|---|---|---|---|---|---|---|---|
| | oz. | lbs. | oz. | lbs. | oz. | lbs. | oz. | lbs. |
| Day 1 Lunch | 124 | 7.8 | 115.5 | 7.2 | 174.8 | 11 | 127.3 | 8 |
| Day 1 Afternoon Snack | 40.6 | 2.5 | 58.2 | 3.6 | 50.1 | 3.1 | 51.7 | 3.2 |
| Day 2 Lunch | 106. 5 | 6.7 | 158.2 | 9.9 | 166.7 | 10.4 | 153.1 | 9.6 |
| Day 2 Afternoon Snack | 58.2 | 3.6 | 66.2 | 4.1 | 45 | 2.8 | 64.4 | 4 |
| Day 3 Lunch | 80.7 | 5.1 | 140 | 8.8 | 125.3 | 7.8 | 164.3 | 10.3 |
| Day 3 Afternoon Snack | 54.3 | 3.4 | 45.4 | 2.8 | 42.1 | 2.6 | 69.8 | 4.4 |
| Day 4 Lunch | 90.6 | 5.7 | 112.5 | 7 | 126.1 | 7.9 | 131.3 | 8.2 |
| Day 4 Afternoon Snack | 57.7 | 3.6 | 25.9 | 1.6 | 26.9 | 1.7 | 16 | 1 |
| Day 5 Lunch | 87.4 | 5.5 | 136.4 | 8.5 | 176.9 | 11.1 | 128.2 | 8 |
| Day 5 Afternoon Snack | 76.9 | 4.8 | 84.1 | 5.3 | 75.7 | 4.7 | 81.4 | 5.9 |
| Day 6 Lunch | 92.2 | 5.8 | 134.2 | 8.4 | 161.2 | 10.1 | 144 | 9 |
| Day 6 Afternoon Snack | 26.7 | 1.7 | 39.4 | 2.5 | 38.1 | 2.4 | 40 | 2.5 |
| Day 7 Lunch | 89.7 | 5.6 | 151.5 | 9.5 | 177.3 | 11.1 | 147.2 | 9.2 |
| Day 7 Afternoon Snack | 72.8 | 4.6 | 78.4 | 4.9 | 72 | 4.5 | 85.1 | 5.3 |
| Day 8 Lunch | 88.1 | 5.5 | 112.8 | 7.1 | 96.4 | 6 | 132 | 8.3 |
| Day 8 Afternoon Snack | 32.9 | 2.1 | 48.4 | 3 | 45.3 | 2.8 | 54 | 3.4 |
| Day 9 Lunch | 92.9 | 5.8 | 120.4 | 7.5 | 110.2 | 6.9 | 155.2 | 9.7 |
| Day 9 Afternoon Snack | 10.8 | 0.7 | 17.7 | 1.1 | 7.9 | 0.5 | 10.6 | 0.7 |
| Day 10 Lunch | 78.8 | 4.9 | 104.6 | 6.6 | 107 | 6.5 | 143.3 | 9 |
| Day 10 Afternoon Snack | 19.7 | 1.2 | 31.8 | 2 | 33.2 | 2.1 | 49.3 | 3.1 |

Table 4.3:

**Amount of Food Wasted-All Classrooms Lunch and Afternoon Snack 10 Un-Portioned Days**

| Meal: Un-Portioned | Room A | | Room B | | Room C | | Room D | |
|---|---|---|---|---|---|---|---|---|
| | oz. | lbs. | oz. | lbs. | oz. | lbs. | oz. | lbs. |
| Day 1 Lunch | 25.9 | 1.6 | 41.3 | 2.6 | 58.9 | 3.7 | 41.2 | 2.6 |
| Day 1 Afternoon Snack | 2.2 | 0.1 | 11.2 | 0.7 | 17.8 | 1.1 | 15.6 | 1 |
| Day 2 Lunch | 11.8 | 0.7 | 50.6 | 3.2 | 51.5 | 3.2 | 39.4 | 2.5 |
| Day 2 Afternoon Snack | 17.5 | 1.1 | 33.3 | 2.1 | 32.6 | 2 | 26.9 | 1.7 |
| Day 3 Lunch | 31.1 | 1.9 | 90.1 | 5.6 | 97.1 | 6.1 | 68.7 | 4.3 |
| Day 3 Afternoon Snack | 1.2 | 0.1 | 23.9 | 1.5 | 3.1 | 0.2 | 10.6 | 0.7 |
| Day 4 Lunch | 20.5 | 1.3 | 69.9 | 4.4 | 66.6 | 4.2 | 53.8 | 3.4 |
| Day 4 Afternoon Snack | 0.4 | 0.02 | 7.6 | 0.5 | 13.3 | 0.8 | 12.4 | 0.8 |
| Day 5 Lunch | 4.6 | 0.3 | 69.5 | 4.4 | 53.7 | 3.4 | 43 | 2.7 |
| Day 5 Afternoon Snack | 7.3 | 0.5 | 38.4 | 2.4 | 40.7 | 2.5 | 66 | 4.1 |
| Day 6 Lunch | 17.5 | 1.1 | 60.8 | 3.8 | 26.3 | 1.6 | 41.4 | 2.6 |
| Day 6 Afternoon Snack | 0.6 | 0.04 | 11.9 | 0.7 | 7 | 0.4 | 18.7 | 1.2 |
| Day 7 Lunch | 10.2 | 0.6 | 99.2 | 6.2 | 60.5 | 3.8 | 75.4 | 4.7 |
| Day 7 Afternoon Snack | 11.5 | 0.7 | 26.5 | 1.7 | 52.9 | 3.3 | 18.8 | 1.2 |
| Day 8 Lunch | 23 | 1.4 | 75.1 | 4.7 | 39.1 | 2.4 | 47.8 | 3 |
| Day 8 Afternoon Snack | 0.1 | 0.006 | 8.6 | 0.5 | 10 | 0.6 | 14.2 | 0.9 |
| Day 9 Lunch | 34.2 | 2.1 | 85 | 5.3 | 68.8 | 4.3 | 76.2 | 4.8 |
| Day 9 Afternoon Snack | 5.6 | 0.4 | 13.6 | 0.8 | 11.4 | 0.7 | 6.6 | 0.4 |
| Day 10 Lunch | 6.7 | 0.4 | 75.1 | 4.7 | 33.5 | 2.1 | 22.7 | 1.4 |
| Day 10 Afternoon Snack | 21.6 | 1.4 | 22.2 | 1.4 | 44.5 | 2.8 | 11.1 | 0.7 |

Table 4.4:

**Amount of Food Wasted-All Classrooms Lunch and Afternoon Snack 10 Portioned Days**

| Meal: Portioned | Room A | | Room B | | Room C | | Room D | |
|---|---|---|---|---|---|---|---|---|
| | oz. | lbs. | oz. | lbs. | oz. | lbs. | oz. | lbs. |
| Day 1 Lunch | 20.4 | 1.3 | 28.8 | 1.8 | 26.1 | 1.6 | 11.7 | 0.7 |
| Day 1 Afternoon Snack | 11 | 0.7 | 6.9 | 0.4 | 8.3 | 0.5 | 5 | 0.3 |
| Day 2 Lunch | 20.3 | 1.3 | 68.8 | 4.3 | 48.3 | 3.0 | 34.1 | 2.1 |
| Day 2 Afternoon Snack | 13.7 | 0.9 | 23.5 | 1.5 | 11.6 | 0.7 | 20.4 | 1.3 |
| Day 3 Lunch | 14.7 | 0.9 | 56.9 | 3.6 | 37.5 | 2.4 | 54.8 | 3.4 |
| Day 3 Afternoon Snack | 14 | 0.9 | 17.9 | 1.1 | 0.9 | 0.06 | 13.6 | 0.8 |
| Day 4 Lunch | 22.1 | 1.4 | 51.7 | 3.2 | 43.6 | 2.7 | 40 | 2.5 |
| Day 4 Afternoon Snack | 1.3 | 0.1 | 8.5 | 0.5 | 8.8 | 0.6 | 3.8 | 0.2 |
| Day 5 Lunch | 3.3 | 0.2 | 34.8 | 2.2 | 46.9 | 2.9 | 20 | 1.3 |
| Day 5 Afternoon Snack | 25.4 | 1.6 | 62.2 | 3.9 | 27.3 | 1.7 | 32 | 2 |
| Day 6 Lunch | 26.5 | 1.7 | 49.8 | 3.1 | 40.1 | 2.6 | 40.9 | 2.6 |
| Day 6 Afternoon Snack | 4.9 | 0.3 | 12 | 0.7 | 5 | 0.3 | 9.2 | 0.6 |
| Day 7 Lunch | 18.3 | 1.1 | 3.2 | 2.0 | 47.6 | 3.0 | 36.1 | 2.3 |
| Day 7 Afternoon Snack | 20.1 | 1.3 | 49.4 | 3.1 | 20.1 | 1.3 | 26.9 | 1.7 |
| Day 8 Lunch | 17.5 | 1.1 | 34.9 | 2.2 | 28 | 1.8 | 42.2 | 2.6 |
| Day 8 Afternoon Snack | 7.7 | 0.5 | 7.5 | 1.1 | 11.5 | 0.7 | 5.1 | 0.3 |
| Day 9 Lunch | 16 | 1.0 | 48.1 | 3 | 14 | 0.9 | 23.2 | 1.5 |
| Day 9 Afternoon Snack | 8.6 | 0.5 | 5.8 | 0.4 | 4.5 | 0.3 | 3.7 | 0.2 |
| Day 10 Lunch | 17.2 | 1.1 | 35.6 | 2.2 | 29.3 | 1.8 | 23.1 | 1.4 |
| Day 10 Afternoon Snack | 13 | 0.8 | 19.3 | 1.2 | 17.8 | 1.1 | 11.9 | 0.7 |

Table 4.5:

**Amount of Food Served for Lunch and Afternoon Snack Combined in Ounces for Each Child During Un-Portioned and Portioned Days in Ounces.**

| Day | Class A Un-portioned (oz) | Class A Portioned (oz) | Class B Un-Portioned (oz) | Class B Portioned (oz) | Class C Un-portioned (oz) | Class C Portioned (oz) | Class D Un-Portioned (oz) | Class D Portioned (oz) | Average Food Served Per Room: Un-Portioned[4] | Average Food Served Per Room: Portioned[4] |
|---|---|---|---|---|---|---|---|---|---|---|
| Day 1 | 23.84[1] | 24.48[2] | 18.47[1] | 14.37[2] | 19.39[1] | 21.46[2] | 23.64[1] | 14.92[2] | 21.34 | 18.56 |
| Day 2 | 16.94 | 23.53 | 21.81 | 21.74 | 23.97 | 21.39 | 19.46 | 17.14 | 20.54 | 20.95 |
| Day 3 | 21.49 | 19.29 | 19.22 | 14.90 | 22.54 | 15.22 | 19.32 | 18.00 | 20.64 | 16.85 |
| Day 4 | 16.73 | 16.48 | 11.57 | 11.53 | 17.20 | 14.15 | 16.16 | 11.43 | 15.42 | 13.40 |
| Day 5 | 16.59 | 23.47 | 19.37 | 19.01 | 23.95 | 22.96 | 23.41 | 15.94 | 20.83 | 20.35 |
| Day 6 | 14 | 16.70 | 12.83 | 14.77 | 15.90 | 17.67 | 30.06 | 13.14 | 18.20 | 15.57 |
| Day 7 | 19.64 | 23.21 | 22.48 | 19.75 | 29.87 | 23.32 | 22.81 | 16.59 | 23.70 | 22.97 |
| Day 8 | 14.13 | 18.07 | 16.89 | 13.8 | 16.21 | 12.88 | 17.41 | 15.5 | 16.16 | 15.06 |
| Day 9 | 14.96 | 14.81 | 18.47 | 11.64 | 21.43 | 12.34 | 18.60 | 12.82 | 19.92 | 12.90 |
| Day 10 | 20.49 | 16.42 | 16.63 | 13.99 | 22.26 | 17.34 | 14.95 | 14.03 | 18.58 | 15.45 |
| 10-Day Average[3] | 17.88 | 19.63 | 17.77 | 15.55 | 21.27 | 17.87 | 20.38 | 14.95 | 19.53 | 17.21 |

[1]Amount of food served to each child in specified classroom in ounces

[2]Amount of food served to each child in specified classroom ounces on the portioned days

[3]Average number of ounces served to each child in specified classroom over 10-day period

[4]Average amount of food served to child in each classroom in ounces

Table 4.6:

**Amount of Food Wasted for Lunch and Afternoon Snack Combined in Ounces for Each Child During Un-Portioned and Portioned Days in Ounces**

| Day | Class A Un-portioned (oz) | Class A Portioned (oz) | Class B Un-Portioned (oz) | Class B Portioned (oz) | Class C Un-portioned (oz) | Class C Portioned (oz) | Class D Un-Portioned (oz) | Class D Portioned (oz) | Average Food Wasted Per Classroom: Un-Portioned[4] | Average Food Served Per Classroom: Portioned [4] |
|---|---|---|---|---|---|---|---|---|---|---|
| Day 1 | 4.7[1] | 4.75[2] | 4.4[1] | 3.03[2] | 7.58[1] | 3.36[2] | 5.68[1] | 1.39[2] | 5.59 | 3.13 |
| Day 2 | 4.19 | 4.86 | 11.26 | 8.87 | 8.95 | 5.96 | 4.88 | 4.32 | 7.32 | 6.00 |
| Day 3 | 4.61 | 4.1 | 11.4 | 6.00 | 9.14 | 3.49 | 5.72 | 5.26 | 7.72 | 4.71 |
| Day 4 | 3.48 | 3.9 | 5.68 | 5.02 | 7.26 | 4.84 | 5.52 | 3.39 | 5.49 | 4.29 |
| Day 5 | 1.87 | 4.1 | 8.84 | 8.55 | 8.27 | 6.75 | 9.31 | 4.10 | 7.15 | 5.88 |
| Day 6 | 3.02 | 4.49 | 5.59 | 5.24 | 2.83 | 3.90 | 5.01 | 3.58 | 4.11 | 4.30 |
| Day 7 | 3.10 | 5.49 | 9.67 | 7.09 | 14.32 | 6.34 | 7.37 | 4.50 | 8.62 | 5.86 |
| Day 8 | 3.30 | 3.78 | 6.98 | 3.59 | 4.09 | 3.59 | 4.60 | 3.94 | 4.74 | 3.73 |
| Day 9 | 5.69 | 3.51 | 8.96 | 4.54 | 7.68 | 3.68 | 6.41 | 1.96 | 7.19 | 3.42 |
| Day 10 | 4.04 | 5.1 | 8.78 | 5.70 | 9.04 | 6.49 | 2.48 | 2.57 | 6.09 | 4.97 |
| 10-Day Average[3] | 3.80 | 4.41 | 7.19 | 5.76 | 7.92 | 4.84 | 5.70 | 3.20 | 6.40 | 4.63 |

[1]Amount of food wasted by each child of specified classroom during the un-portioned days in ounces.

[2]Amount of food wasted by each child of specified classroom during the portioned days in ounces

[3]Average number of ounces wasted by each child in specified classroom over 10-day period

[4]Average amount of food wasted per child in each classroom in ounces.

Table 4.7:

**Cost Analysis of Food Served and Wasted Involving 10 Different Lunch and Afternoon Snack Combinations in All Four Classrooms Combined for Each Un-Portioned and Portioned Day**

| Day | Un-Portioned: Cost of Food Served ($)[1] | Portioned: Cost of Food Served ($)[1] | Un-Portioned: Cost of Food Wasted ($)[2] | Portioned: Cost of Food Wasted ($)[2] | Un-Portioned: Percentage Money Wasted (%)[3] | Portioned: Percentage Money Wasted (%)[3] |
|---|---|---|---|---|---|---|
| Day 1 | 51.93[4] | 39.03[4] | 13.20[5] | 6.64[5] | 25.42% | 17.01% |
| Day 2 | 65.38 | 54.25 | 33.90 | 24.07 | 51.85% | 44.37% |
| Day 3 | 47.93 | 36.50 | 22.28 | 12.72 | 44.62% | 34.85% |
| Day 4 | 59.27 | 40.32 | 20.32 | 13.76 | 34.28% | 34.13% |
| Day 5 | 69.14 | 55.98 | 22.59 | 13.76 | 32.67% | 32.44% |
| Day 6 | 54.51 | 49.88 | 22.40 | 18.17 | 41.09% | 36.43% |
| Day 7 | 70.41 | 61.85 | 28.40 | 19.25 | 40.34% | 31.12% |
| Day 8 | 49.13 | 36.71 | 14.09 | 8.35 | 28.68% | 22.75% |
| Day 9 | 60.27 | 39.47 | 24.66 | 12.72 | 40.92% | 32.23% |
| Day 10 | 46.54 | 31.41 | 16.46 | 11.24 | 35.37% | 35.78% |
| 10-Day Total | 574.51[7] | 445.40[7] | 218.30[7] | 145.08[7] | 38.00%[6] | 32.57%[6] |

[1]Sum cost, in dollars, to serve lunch and afternoon snack for one day

[2]Sum cost, in dollars, wasted from served lunch and afternoon snack for one day

[3] Cost of food wasted divided by cost of food served in one day

[4]Total cost to serve lunch and afternoon snack to all four classrooms (A, B, C, & D)

[5]Total cost wasted from lunch and afternoon snack in all four classrooms (A, B, C, & D)

[6]Average percentage of the 10-day food waste

[7]Sum cost for all ten days

Table 4.8:

**Percentage of Food Wasted for each Lunch and Afternoon Snack Meal during both Un-Portioned and Portioned days**

| | Total Served: Un-Portioned (lbs.) | Total Wasted: Un-portioned (lbs.) | Percentage of Food Wasted (%) | Total Served: Portioned (lbs.) | Total Wasted: Portioned (lbs.) | Percentage of Food Wasted (%) | Difference between Un-Portioned and Portioned (%) |
|---|---|---|---|---|---|---|---|
| Day 1 Lunch | 44.4 | 10.5 | 23.6 | 34 | 5.4 | 15.8 | -7.8 |
| Day 1 Afternoon Snack | 8.7 | 2.9 | 33.3 | 12.4 | 1.9 | 15.3 | -18 |
| Day 2 Lunch | 34.1 | 15.9 | 46.6 | 36.6 | 10.7 | 29.2 | -17.4 |
| Day 2 Afternoon Snack | 16 | 6.9 | 43.13 | 14.5 | 3.4 | 23.5 | -19.6 |
| Day 3 Lunch | 37.6 | 15.2 | 40.4 | 32 | 10.3 | 32.2 | -8.2 |
| Day 3 Afternoon Snack | 15.5 | 2.5 | 16.13 | 13.2 | 2.86 | 21.7 | +5.6 |
| Day 4 Lunch | 33.4 | 13.3 | 39.8 | 28.8 | 9.8 | 34.0 | -5.8 |
| Day 4 Afternoon Snack | 6.8 | 2.12 | 31.2 | 7.9 | 1.4 | 17.7 | -13.5 |
| Day 5 Lunch | 37.8 | 10.8 | 28.6 | 33.1 | 6.6 | 19.9 | -8.7 |
| Day 5 Afternoon Snack | 17.9 | 9.5 | 53.1 | 17.7 | 9.2 | 52 | -1.1 |
| Day 6 Lunch | 33 | 9.1 | 27.6 | 33.3 | 10 | 30 | +2.4 |
| Day 6 Afternoon Snack | 7.9 | 2.34 | 29.6 | 9.1 | 1.9 | 20.9 | -8.7 |
| Day 7 Lunch | 43.3 | 15.3 | 35.3 | 35.4 | 8.4 | 23.7 | -11.6 |
| Day 7 Afternoon Snack | 18.2 | 6.9 | 37.9 | 19.3 | 7.4 | 38.3 | +0.4 |
| Day 8 Lunch | 34.8 | 11.5 | 33 | 26.9 | 7.7 | 28.6 | -4.4 |
| Day 8 Afternoon Snack | 11 | 2 | 18.2 | 11.3 | 2.6 | 23 | +4.8 |
| Day 9 Lunch | 44.3 | 16.5 | 37.4 | 29.9 | 6.4 | 21.4 | -16 |
| Day 9 Afternoon Snack | 4.4 | 2.3 | 52 | 3 | 1.4 | 46.7 | -5.3 |
| Day 10 Lunch | 34.1 | 8.6 | 25.2 | 36.7 | 6.5 | 17.7 | -7.8 |
| Day 10 Afternoon Snack | 13.1 | 6.3 | 48.1 | 8.4 | 3.8 | 45.2 | -2.9 |

# CHATPER 5

# DISCUSSION

## Objectives of the Study

The objectives of this research study were to analyze the food consumption and food waste patterns of preschool children at JTCDSC, observe and describe the food waste differences in serving between family style and portion control cups, and to observe the financial implication of implementing portion control in a child care facility. In this chapter, the objectives presented will be analyzed, as well as answering the research questions stated in Chapter 1.

## Interpretation of Food Served and Wasted

The researcher anticipated that, by using the portion sizing method that follows the recommended USDA guidelines, the amount of food wasted in preschool classrooms would be reduced when being compared to the current food serving method used at JTCDSC. Tables 4.1-4.4 showed the amount of food served and wasted when comparing the portioning method to the current un-portioning method. When comparing tables 4.1 and 4.2, the data showed a 62.4 lb. and 12.54% reduction in the amount of food served using the portioning method compared to the non-portioning method.

A comparison of tables 4.3 and 4.4, the data showed a 55.68 lb. and 33.26% reduction in the amount of food wasted using the portioning method. Table 4.8 was also intended to show the differences in waste percentages when comparing the portioned meals to the un-portioned meals. Over the course of 20 lunch and afternoon snack meals, the percentage of food wasted went

down in 16 out of the 20 meals served, or 80%. The average percentage amount of food wasted went down -7.18%.

The findings supported the hypothesis that using the portioning method reduces the amount of food wasted. The poundage reduction accounted for a typical 2-week meal plan for the 4 preschool classrooms. If the portioning method were implemented long-term at JTCDSC, it is projected 113.6 pounds would be reduced in food wasted generated by the 4 participating classrooms in 1 month, and 1,336.32 pounds reduced in food waste in 1 year. This food waste reduction also only accounts for the four participating classrooms. If the other classrooms participated in the portioning methods, using the respective USDA guidelines meant for the children in each classroom, the total amount of food prevented from being thrown away in the garbage would be even higher.

**Financial Interpretation**

In addition to the focus on how much food was physically being thrown away, the amount of money being eating or thrown away was also analyzed. JTCDSC is a non-profit business, but parents do pay a monthly tuition fee for their children to attend, and the center has no desire or room in their budget to waste money. This cost analysis was conducted as a means of understanding how much money JTCDSC could potentially save if the portion sizing method were implemented on a long-term basis.

Table 4.7 shows the amount of money spent on making food as well as the amount of money thrown away during each of the 10 days, both during the un-portioned and portioned trials. During the un-portioned trial, a total of $574.51 was spent serving the food to the 4

participating classrooms, while $218.30 of that money spent was thrown away as food waste. This resulted in a 38.00% of money spent on food for these classrooms being thrown away.

During the portioned trial, $445.40 was spent serving food to the 4 participating classrooms, with only $145.08 of that money being thrown away as food waste, resulting in 32.57% of money spent during the portioned days being thrown away.

While the results may seem minor on the surface, the foodservice industry values every nickel and dime. The amount of money spent on serving the same 10 lunch and afternoon snack meals was reduced by $129.11, and the amount of money being thrown away was reduced by $73.22. If the center were to implement the portion sizing method introduced during the portioned trial, it is projected that the center would save $258.22 per month, or $3,098.64 per year serving the 4 participating classrooms. The center would also save $146.44 in money being thrown away as food waste a month, or $1,757.28 per year, in serving the 4 participating classrooms. These two savings totals combined indicate that the center could save potentially $4,855.92 annually by changing to a portioned serving method.

When analyzing the amount of money being saved by using the portioning method, it must also be remembered that the 4 preschool classrooms that participated are only a fraction of the total number of classrooms and students that are currently enrolled at JTCDSC. The center currently has 10 operating classrooms with students that range from -5 months to 5 years old. The amount of money calculated to be saved only accounts for 4 of 10 classrooms. Projecting the potential savings for the entire center using the portioning method based on the data collected would not be reliable because each classroom holds a different age group that has varying eating habits. However, the researcher is confident that if JTCDSC were to implement the portion

sizing method in the long term, the amount of savings in money spent on food and the reduction of money being thrown away would be over $10,000 in a 1 year period for the entire center.

**Food Waste: Family Style vs. Portion Control Cups**

The family style method currently used at JTCDSC is a relatively easy way to serve food to every classroom without putting much burden on the staff and students. The portioning method introduced in the study would involve slightly more effort into how the meals are measured and served. The total number of cups of food for each component would need to be calculated in advance based on the age group being served according to the USDA guidelines and the number of children present for the meal. Some extra food would also need to be on the cart in addition to the portioned food because the teachers in many of the classrooms are required to sit with the students and eat a small amount of food as a positive example. In addition, some children may want "seconds" or more servings of a food. It is recommend that the center follow the 20% method often used in foodservice and event management; whereas, you up your daily projected servings by 20% to ensure there is enough food for serving.

There was some frustration from the kitchen staff and teachers during the study due to the need to weigh every bowl before being placed on the serving cart in order to have an accurate measurement of how much food was served. Every bowl also needed to be weighed when the carts returned to the kitchen from the classrooms after meal time to have an accurate account of how much food was wasted. This weighing method increased the amount of time required to serve each meal. However, if the portioning method were implemented, the weighing part of the study would not be necessary, which would reduce the amount of time used to serve the food, and lessen the overall burden of the portioning method that was used in the study.

**Factors Contributing to Overall Food Waste**

There were multiple factors that contributed to the overall amount of food served and wasted at JTCDSC. During the portioned days, it was unknown how many children were actually present for the lunch or afternoon snack meals, so the kitchen staff merely "guessed" as to how much food should be served. During the portioned days, the researcher actually visited each classroom prior to the portioning of each meal, and; therefore, had a better idea of how much food to serve each classroom. It should also be pointed out that the foods had varying densities, such as one cup of peas had a differing weight from one cup of salad.

Table 4.8 showed the percentage of food wasted for each lunch and afternoon snack meal for un-portioned and portioned days when combining the amount of food served and wasted for all 4 participating classrooms during a particular meal. The intention of this table was to indicate which meals caused the most and least amount of food waste, as well as, show the differences in the amount of food wasted when comparing the portioned days to the un-portioned days.

During the un-portioned days, 6 meals exceeded 40% of food wasted: Day 2 lunch, Day 2 afternoon snack, Day 3 lunch, Day 5 afternoon snack, Day 9 afternoon snack, and Day 10 afternoon snack. These meals were (pizza, strawberries, mixed salad, & milk), (mixed vegetables, yogurt dip, & milk), (chicken enchilada casserole, black beans, pears, & milk), (Fruit pop & milk), (Ritz crackers & cheese slices), (bananas & pita bread). During the portioned days, 3 meals exceeded 40% of food wasted for that particular meal: Day 5 afternoon snack, Day 9 afternoon snack, and Day 10 afternoon snack. These meals were (Fruit pop & milk), (Ritz crackers & cheese slices), (bananas & pita bread). This data shows that certain meals are eaten less than others; therefore, the center should consider whether they should continue serving these particular meals, as they yield more than 40% waste.

These preferences should be considered when creating future meal plans at JTCDSC. There is little to no rationale in serving expensive meals to the children that they are not likely to eat. However, this does not imply that JTCDSC should only serve meals like macaroni and cheese and hot dogs. This age group needs to be exposed to different taste and textures in order to develop their palate (Held, 2014), as well as they need to maintain the nutritional standards that JTCDSC prides itself in maintaining.

**Practicality of Implementing the Study**

The study conducted has shown the impact that portion sizing can have on the amount of food wasted and amount of money spent and saved on food in a child care facility. JTCDSC could benefit from the portioning methods used in this study to reduce the amount of food being thrown away as well as the amount of money being spent and wasted on the food served. Furthermore, child care centers that are similar in nature to JTCDSC could also benefit from instituting the portioning method utilized in this study to cut costs and reduce waste while still abiding by the USDA recommended guidelines. However, this study cannot be generalized for every child care facility, as each have differing food service methods, child and staff populations, and child demographics.

**Limitations**

The entire study was conducted at the Jean Tyson Child Development Study Center in Fayetteville, Arkansas. The majority of students participating in the study were Caucasian and came from working middle- or upper middle-class families. The students participating in the study did not appear to be suffering from any form of food insecurity or malnutrition. The majority students participating in the study also appeared to be a healthy and normal weight for

their respective age. This study can only be used to interpret the potential long-term outcomes for this specific pre-school, and does not imply the exact same results would result if it were to be replicated at a different facility. Therefore, it cannot be generalized beyond this study.

**Additional Research Needed**

There is a need for more research to be done than what the researcher was able to complete during this study. While the two planned trials were completed, more trials using different meals and children in different child care facilities are needed in order to have a better understanding of how much of an impact portion sizing has on food waste. It is also important to find sustainable ways of dealing with inevitable food waste, such as composting the uneaten food and creating a community garden within the facility. This would potentially support sustainability, add to the food supply, and teach children about food and nutrition.

In conclusion, research that follows the impact of portion control on food waste and sustainability would be ideal: therefore, researchers would be able to measure whether portion control using USDA recommended serving sizes has a direct impact, significantly reducing the amount of food wasted in both the physical amount being thrown away and the amount of money wasted because of said waste.

## References


Buzby, J. C., Farah-Wells, H., & Hyman, J. (2014). The estimated amount, value, and calories of postharvest food losses at the retail and consumer levels in the United States.

Buzby, J. C., & Hyman, J. (2012). Total and per capita value of food loss in the United States. *Food Policy*, *37*(5), 561-570.

Britto, P. R., Lye, S. J., Proulx, K., Yousafzai, A. K., Matthews, S. G., Vaivada, T., ... & MacMillan, H. (2017). Nurturing care: promoting early childhood development. *The Lancet*, *389*(10064), 91-102.

Child and Adult Care Food Program (CACFP). (2017). Nutrition Standards for CACFP Meals and Snacks. Retrieved March 13, 2017, from http://www.fns.usda.gov/cacfp/meals-and-snacks

Cohen, J. F., Richardson, S., Austin, S. B., Economos, C. D., & Rimm, E. B. (2013). School lunch waste among middle school students: nutrients consumed and costs. *American journal of preventive medicine*, *44*(2), 114-121.

Cohen, J. F., Richardson, S., Parker, E., Catalano, P. J., & Rimm, E. B. (2014). Impact of the new US Department of Agriculture school meal standards on food selection, consumption, and waste. *American journal of preventive medicine*, *46*(4), 388-394.

Coleman-Jensen, A., Gregory, C., & Singh, A. (2014). Household food security in the United States in 2013. *USDA-ERS Economic Research Report*, (173).

Federal Register (2016) Vol 81, No. 79. Rules and Regulations.

Food Safety Concerns for Children Under Five. (n.d.). Retrieved February 16, 2016. Retrieved from http://www.foodsafety.gov/risk/children/

Food Programs (n.d.). Retrieved March 26, 2016. Retrieved from https://service.uark.edu/foodprograms/

Hall, K. D., Guo, J., Dore, M., & Chow, C. C. (2009). The progressive increase of food waste in America and its environmental impact. *PloS one*,*4*(11), e7940.

Held, S. M. (2014). *Leadership in food policy: raising a foodie* (Doctoral dissertation). Jean Tyson Child Development Study Center, Fayetteville, Arkansas. (2014).

Levis, J. W., Barlaz, M. A., Themelis, N. J., & Ulloa, P. (2010). Assessment of the state of food waste treatment in the United States and Canada. *Waste Management*, *30*(8), 1486-1494.

Natale, R. A., Messiah, S. E., Asfour, L., Uhlhorn, S. B., Delamater, A., & Arheart, K. L. (2014). Role modeling as an early childhood obesity prevention strategy: effect of parents and teachers on preschool children's healthy lifestyle habits. *Journal of Developmental & Behavioral Pediatrics*, *35*(6), 378-387.

USDA Food and Nutrition Services (2016). Overview. Retrieved on April 28, 2016. Retrieved from https://www.fns.usda.gov/pd/overview

USDA Child and Adult Care Food Program (2015). Child Care Meal Pattern. Retrieved on April 28, 2016. Retrieved from https://www.fns.usda.gov/cacfp/meals-and-snacks

USDA Overview (2017, March 10) Retrieved March 28, 2017. Retrieved from https://www.fns.usda.gov/pd/overview

United States Department of Agriculture (2012). Budget Summary and Annual Performance Plan. Retrieved on March 28, 2017. Retrieved from http://www.obpa.usda.gov/budsum/FY12budsum.pdf

Appendix A
University of Arkansas Institutional Review Board Protocol Form

UNIVERSITY OF ARKANSAS

Office of Research Compliance
Institutional Review Board

July 6, 2016

MEMORANDUM

| | |
|---|---|
| TO: | Margaret Wright<br>Kelly Way |
| FROM: | Ro Windwalker<br>IRB Coordinator |
| RE: | New Protocol Approval |
| IRB Protocol #: | 16-06-801 |
| Protocol Title: | *Limiting Food Waste in Child Care Facilities through Implementation of Portion Sizes* |
| Review Type: | ☐ EXEMPT ☒ EXPEDITED ☐ FULL IRB |
| Approved Project Period: | Start Date: 07/05/2016 Expiration Date: 07/04/2017 |

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (https://vpred.uark.edu/units/rscp/index.php). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

**This protocol has been approved for 40 participants.** If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 109 MLKG Building, 5-2208, or irb@uark.edu.

Appendix B
Parental Consent Form

**"*Limiting Food Waste in Child Care Facilities through Implementation of Portion Sizes*"**
Consent for a Minor to Participate in a Research Study

Principal Researcher: Dr. Kelly A. Way, PhD.
Honors Thesis Researcher: Margaret E. Wright

**This is a parental permission form for research participation.** This form contains important information concerning this study and what to expect if your child is permitted to participate. **Your child's participation is voluntary.**

Please consider the information provided carefully. If you permit your child to participate, you will be asked to sign this form and will receive a copy of the form. We must also have your child's consent to participate.

## INVITATION TO PARTICIPATE

Your child is being invited to participate in a research study concerning food waste production that occurs in child care facilities as a result of serving lunch and afternoon snacks. Your child is being asked to participate in this study because he/she is currently enrolled at the Jean Tyson Child Development Study Center in Fayetteville, Arkansas. This research is being conducted in junction with the JTDSC.

WHAT YOU SHOULD KNOW ABOUT THE RESEARCH STUDY:

*Who is the principal researcher?*
Dr. Kelly A. Way, Hospitality and Restaurant Management
HOEC 118-University of Arkansas
Fayetteville, AR 72701
479-575-4985
Kway@uark.edu

*Who is the Faculty Advisor?*
Same as the principal investigator listed above.

*What is the purpose of this research study?*
The purpose of this study is to observe the food waste trends that occur in preschool classrooms as a result of serving lunch and afternoon snack meals. For four weeks, the amount of food going into the classrooms meant for consumption and the amount of food returned back to the kitchen for disposal will be measured by weight. A two week menu will be created by the JTCDSC staff, consisting of meals that the children have eaten before, and will be used twice. During the first two weeks, there will be no alterations to the way food is served. During the second two weeks, food portions will be measured out using the USDA recommended servings sizes for 3-5 year old children in correspondence with the Child and Adult Care Food Program. This will not limit the amount of food each child can have, only making sure that each child is initially served the amount of food recommended by the USDA. This is study is intended to find the relationship between portion control and food waste produced in child care facilities.

*Who will participate in this study?*
The food waste patterns of classrooms A, B, C, and D will be monitored. An estimated 40 children total will be participating.

*What will your child be asked to do?*
Your child will be asked to eat their lunch and afternoon snack meals as they normally would for the first two weeks. During the second two weeks, your child will be asked to use serving cup sets ( 1 cup, ½ cup, 1/3 cup, and 1/4 cup) when portioning their meals that correspond with the USDA recommendations for their initial serving. This will not limit the amount of food your child can have. The teachers and aides in each classroom will be educated on how to use the serving cups. There will not be any in-classroom intervention or by the researchers, and no qualitative data concerning individual data will be collected.

*Are there any possible risks for discomfort by participating in this study?*
There are no foreseeable risks of discomfort for this study.

*What are the possible benefits for your child if he/she participates in this study?*
Based on the data collected during this study, the researchers hope to find the proper amount of food that should be served to each classroom during mealtimes to ensure that each child is receiving the amount of food recommended by the USDA while minimizing the amount of food waste created. In addition, the researchers hope to gain data pertaining to the types of meals that children are more or less likely to consume. This data will be helpful in future meals provided by JTCDSC.

*What if my child has special food needs (vegetarian, food allergies, etc.) that requires them to eat foods different from the foods typically served during meal times?*
Your child will not be forced to eat anything that he/she does not normally eat (this study does not include food or meals that are not already planned or served at the center) nor will they be prevented from eating food substitutions. If you consent to your child's participation, the type and weight of food substitution will be recorded before serving as well as the weight of food uneaten after meal time.

*How long will this study last?*
This study will last for 4 weeks, beginning on July 5$^{th}$ and ending on July 29$^{th}$, 2016.

*Will your child receive compensation for time and/or inconvenience if you choose to allow him/her to participate in this study?*
No, your child will not be given any reward or compensation for participation. They will not be asked to do any task other than using serving cups during meal times, which should not interfere will normal classroom activities.

*Will you or your child have to pay for anything to participate in the study?*
No, there will be no additional charges for your child's participation in this study.

*What are the options if I do not want my child to be in the study?*
If you choose to not allow your child to participate in this study, the child will still be able to eat their meals normally. However, their meals would have to be served in separate bowls and discarded separately so that their food waste does not interfere with the food waste generated by those participating. It is highly preferable for both everyone in the classrooms and the researchers that every child is allowed to participate for the most accurate data.

*How will my child's confidentiality be protected?*
All data concerning your child will be completely confidential. There will be no qualitative data collected in this study concerning qualities of individual children.

*Will my child and/or I know the results of the study?*
At the end of this study, you will be able to ask for feedback concerning the results upon request. You may contact the Principal Researcher, Dr. Kelly A. Way at kway@uark.edu or 479-575-4985, as well as the Honors Thesis Researcher, Margaret E. Wright at mewright@uark.edu.

Who do I contact if I have any questions regarding the study?
You have the right to contact the Principal Researcher, Dr. Kelly A. Way with any concerns or questions concerning the study.

Dr. Kelly A. Way, Hospitality and Restaurant Management
HOEC 118-University of Arkansas
Fayetteville, AR 72701
479-575-4985
kway@uark.edu

You may also contact the University of Arkansas Research Compliance office listed below if you have questions about your rights as a participant, or to discuss any concerns about, or problems with the research.
109 MLKG, 1424 W. Martin Luther King, Jr., Fayetteville, AR 72701
(479) 575-4572

I have read the above statement and have been allowed to ask questions and express concerns, which have been satisfactorily responded to by the researchers. I understand the purpose of the study as well as the potential benefits and risks that are possible as a result. I understand that participation is voluntary. I understand that significant information found as a result of this study will be provided to me upon request after the conclusion of data collection. I understand that there will be no qualitative data concerning my child will be collected during this study, and he/she identity will be protected throughout the duration of this study. I understand that no rights of me or my child will be waived by signing the consent form. I have been given a copy of the consent form.

PLEASE SIGN BELOW IF YOU AGREE TO ALLOW YOUR CHILD TO PARTICIPATE IN THE STUDY.

_____

CHILD'S NAME

_____

DATE

---

Return to the Jean Tyson Child Development Study Center

Appendix C
Food Cart Questionnaire

ROOM_____ DAY_____

LUNCH_____

1. HOW MANY CHILDREN ATE THE MEAL?

2. HOW MUCH MILK WAS SERVED?

3. DID ANYONE EAT AN ALTERNATIVE? IF SO, WHAT?

AFTERNOON SNACK_____

1. HOW MANY CHILDREN ATE THE MEAL?

2. HOW MUCH MILK WAS SERVED?

3. DID ANYONE EAT AN ALTERNATIVE? IF SO, WHAT?