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Limiting food waste in child care facilities through implementation of portion sizes

Margaret E. Wright and Kelly A. Way†*

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 University of Arkansas Bumpers College Jean Tyson Child Development Study Center (JTCDS). A four-week study was conducted where two trials were introduced: 1) a two-week trial using the current “family-style” serving method that was “un-portioned”, and 2) a two-week trial using a “portion-sizing” that followed USDA portion serving recommendations. A 12.54% reduction in the amount being served in kilograms, a 33.26% reduction in the amount of food being wasted in kilograms, and a reduction of \$73.22 being thrown away as monetary waste occurred when comparing the portioned method to the un-portioned method. In conclusion, the portioning method as 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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† Kelly A. Way, the faculty mentor, is an Associate Professor in Human Nutrition and Hospitality Innovation.

Meet the Student-Author



Margaret Wright

I was born and raised in Dallas, Texas and graduated from Highland Park High School in the spring of 2013. I graduated in May 2017 from the Dale Bumpers College of Agricultural, Food and Life Sciences with a degree in Food, Human Nutrition and Hospitality, concentrating in Dietetics, and a minor in Human Development and Family Sciences. After graduation, I participated in the UAMS/VA dietetic internship in Little Rock, Arkansas with the intention of becoming a Registered Dietitian.

I am a member of Phi Upsilon Omicron Honor Society, and served as Vice President my junior year. I represented the Bumpers College as a New Student Orientation Mentor in the summer after my sophomore year. I am also a member of Alpha Delta Pi Sorority, where I served as Homecoming Co-Chair my junior year.

I would like to thank Dr. Kelly Way for being my honors thesis mentor, for guiding me through this process and always encouraging me to succeed. Dr. Sabrina Trudo and Mardell Crandall were also instrumental in conducting this study, as their expertise in data collection and child development, respectively, were indispensable. I would also like to thank Cathy Moses, Doug Walsh, and Debra Modisette for their help throughout the study.

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). Wherever food is served, there will most likely be food waste generated, including child care facilities. The USDA programs, such as the Child and Adult Care Food Program (CACFP), provide nutritional assistance to those who struggle with food insecurity and the USDA has multiple programs that focus on the nutritional standard of schools and other institutions that serve food to children. The 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 (CACFP, 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) and at least 2 of the 4 food groups during snack. 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 the establishment of portion control will result in a reduction in the amount of food waste of lunches and snacks created by children attending the University of Arkansas Bumpers College Jean Tyson Child Development Study Center (JTCDSC).

Materials and Methods

Participants were chosen based on their enrollment at JTCDSC during the months of August and September 2016. A total of 45 parents signed required permission slips, allowing for a total of 45 participants within four classrooms (classrooms A, B, C, and D) to participate in the study. 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; therefore, the food chosen would not be new or unusual to the participants. 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 5 food components listed above.

All meals served at JTCDSC are made in the on-site kitchen and provide morning snack, lunch, and afternoon snack. The preschool children currently 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. Instead of the current method of filling the food component bowls without portioning, the altered trial implemented consisted of pre-portioning food in both the kitchen and the preschool classrooms.

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 JTCD-SC. No special instructions were given to the classroom teachers or students on how to serve food. The food components were pre-weighed in the kitchen before being served to the classroom. Each bowl containing a food component, as well as a disposal bin containing food waste was weighed and recorded when the food was returned to the classroom after mealtime for disposal. 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. Once each food component was portioned, the children were given the opportunity to serve themselves more food if they desired. Each bowl containing a food component, as well as a disposal bin containing food waste was weighed and recorded when the food was returned to the classroom after mealtime for disposal. Each trial lasted 10 days, or two school weeks, each. After the trials were completed, the obtained data were analyzed to observe the amount

of food eaten, the amount of food thrown away, and the cost of food served during lunch and snack meals for both un-portioned and portioned meals.

Results and Discussion

During the 10 un-portioned days, 224.98 kg of food were served in total to the 4 classrooms (Table 1). On the 10 portioned days, 196.68 kg of food were served (Table 2), resulting in a 28.3 kg and 12.54% reduction in the total amount served. The amount of food served decreased in 67.5% of the 20 meals served in the 2-week period to each of the four classrooms when using the portioning method as compared to not using the portioning method.

Over the 10 un-portioned days, 75.86 kg were wasted by the combined 4 classrooms (Table 3). On the 10 portioned days, 50.58 kg were wasted by the combined 4 classrooms (Table 4), resulting in a 25.28 kg and 33.26% reduction in the amount of food wasted by the 4 preschool classrooms over the 2 weeks of portioned meals. Of the 20 meals served to 4 classrooms in each 2-week trial, 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 increased in the amount of food wasted came from Room A.

Table 1. Amount of food served: all classrooms for lunch and afternoon snack 10 un-portioned days.

Meal: un-Portioned	Room A (kg)	Room B (kg)	Room C (kg)	Room D (kg)
Day 1 Lunch	3.68	6.22	4.77	5.49
Day 1 Afternoon Snack	0.91	0.86	0.95	1.23
Day 2 Lunch	2.18	4.31	3.63	5.36
Day 2 Afternoon Snack	1.23	1.14	2.68	2.22
Day 3 Lunch	3.13	4.09	4.59	5.27
Day 3 Afternoon Snack	1.14	1.41	2.22	2.27
Day 4 Lunch	2.36	3.72	4.45	4.63
Day 4 Afternoon Snack	0.50	0.68	0.91	1.00
Day 5 Lunch	2.54	4.36	5.08	5.18
Day 5 Afternoon Snack	0.68	1.95	2.59	2.91
Day 6 Lunch	1.77	4.04	3.90	5.27
Day 6 Afternoon Snack	0.64	0.73	1.41	0.82
Day 7 Lunch	2.41	6.27	5.27	5.72
Day 7 Afternoon Snack	1.50	2.04	2.22	2.50
Day 8 Lunch	2.13	4.45	4.09	5.13
Day 8 Afternoon Snack	0.68	1.32	1.45	1.54
Day 9 Lunch	2.68	5.18	5.95	6.31
Day 9 Afternoon Snack	0.32	0.59	0.54	0.54
Day 10 Lunch	2.59	3.77	4.68	4.45
Day 10 Afternoon Snack	1.50	1.59	1.45	1.41

Table 2. Amount of food served: all classrooms for lunch and afternoon snack 10 portioned days.

Meal: Portioned	Room A (kg)	Room B (kg)	Room C (kg)	Room D (kg)
Day 1 Lunch	3.54	3.27	4.99	3.63
Day 1 Afternoon Snack	1.14	1.63	1.41	1.45
Day 2 Lunch	3.04	4.49	4.72	4.36
Day 2 Afternoon Snack	1.63	1.86	1.27	1.82
Day 3 Lunch	2.32	4.00	3.54	4.68
Day 3 Afternoon Snack	1.54	1.27	1.18	2.00
Day 4 Lunch	2.59	3.18	3.59	3.72
Day 4 Afternoon Snack	1.63	0.73	0.77	0.45
Day 5 Lunch	2.50	3.86	5.04	3.63
Day 5 Afternoon Snack	2.18	2.41	2.13	2.68
Day 6 Lunch	1.63	3.81	4.59	4.09
Day 6 Afternoon Snack	0.77	1.14	1.09	1.14
Day 7 Lunch	2.54	4.31	5.04	4.18
Day 7 Afternoon Snack	2.09	2.22	2.04	2.41
Day 8 Lunch	2.50	3.22	2.72	3.77
Day 8 Afternoon Snack	0.95	11.36	1.27	1.54
Day 9 Lunch	2.63	3.41	3.13	4.40
Day 9 Afternoon Snack	0.32	0.50	0.23	0.32
Day 10 Lunch	2.22	3.00	2.95	4.09
Day 10 Afternoon Snack	0.54	0.91	0.95	1.47

Table 3. Amount of food wasted: all classrooms for lunch and afternoon snack 10 un-portioned days.

Meal: Un-Portioned	Room A (kg)	Room B (kg)	Room C (kg)	Room D (kg)
Day 1 Lunch	0.73	1.18	1.68	1.18
Day 1 Afternoon Snack	0.05	0.32	0.50	0.45
Day 2 Lunch	0.32	1.45	1.45	1.14
Day 2 Afternoon Snack	0.50	0.95	0.90	0.32
Day 3 Lunch	0.86	2.54	2.77	1.95
Day 3 Afternoon Snack	0.05	0.23	0.10	0.32
Day 4 Lunch	0.59	2.00	1.91	1.54
Day 4 Afternoon Snack	0.01	0.23	0.36	0.36
Day 5 Lunch	0.01	2.00	1.54	1.23
Day 5 Afternoon Snack	0.23	1.09	1.14	1.86
Day 6 Lunch	0.50	1.73	0.73	1.18
Day 6 Afternoon Snack	0.02	0.32	0.18	0.54
Day 7 Lunch	0.27	2.81	1.73	2.13
Day 7 Afternoon Snack	0.32	0.77	1.50	0.54
Day 8 Lunch	0.64	2.13	1.09	2.13
Day 8 Afternoon Snack	0.00	0.23	0.27	1.36
Day 9 Lunch	0.95	2.41	1.95	0.41
Day 9 Afternoon Snack	0.02	0.36	0.32	2.18
Day 10 Lunch	0.02	2.13	0.95	0.64
Day 10 Afternoon Snack	0.64	0.64	1.27	0.32

Table 4. Amount of food wasted: all classrooms for lunch and afternoon snack 10 portioned days.

Meal: Portioned	Room A (kg)	Room B (kg)	Room C (kg)	Room D (kg)
Day 1 Lunch	0.59	0.82	0.73	0.32
Day 1 Afternoon Snack	0.32	0.18	0.23	0.14
Day 2 Lunch	0.59	1.95	1.36	0.95
Day 2 Afternoon Snack	0.41	0.68	0.32	0.59
Day 3 Lunch	0.41	1.63	1.09	1.54
Day 3 Afternoon Snack	0.41	0.50	0.03	0.36
Day 4 Lunch	0.64	1.45	1.23	1.40
Day 4 Afternoon Snack	0.05	0.23	0.27	0.09
Day 5 Lunch	0.09	1.00	1.32	0.59
Day 5 Afternoon Snack	0.73	1.77	0.77	0.91
Day 6 Lunch	0.77	1.41	1.18	1.18
Day 6 Afternoon Snack	0.14	0.32	0.14	0.27
Day 7 Lunch	0.50	0.91	1.36	1.04
Day 7 Afternoon Snack	0.59	1.41	0.59	0.77
Day 8 Lunch	0.50	1.00	0.80	0.73
Day 8 Afternoon Snack	0.23	0.50	0.32	0.14
Day 9 Lunch	0.45	1.36	0.41	0.68
Day 9 Afternoon Snack	0.23	0.18	0.14	0.09
Day 10 Lunch	0.50	1.00	0.82	0.64
Day 10 Afternoon Snack	0.36	0.54	0.50	0.32

Table 5. Amount of food served for lunch and afternoon snack combined for each child during un-portioned and portioned days.

Day	Rm. A unport. (kg)	Rm. A port. (kg)	Rm. B unport. (kg)	Rm. B port. (kg)	Rm. C unport. (kg)	Rm. C port. (kg)	Rm. D unport. (kg)	Rm. D port. (kg)	Avg. food served/Rm. unport.^d (kg)	Avg. food served/ Rm. port.^d (kg)
Day 1	0.67 ^a	0.69 ^b	0.52 ^a	0.40 ^b	0.54 ^a	0.60 ^b	0.66 ^a	0.42 ^b	0.60	0.52
Day 2	0.47	0.66	0.61	0.61	0.67	0.60	0.54	0.48	0.58	0.58
Day 3	0.60	0.54	0.54	0.42	0.63	0.43	0.54	0.50	0.58	0.47
Day 4	0.47	0.46	0.32	0.32	0.48	0.40	0.45	0.32	0.43	0.38
Day 5	0.46	0.66	0.54	0.53	0.67	0.64	0.66	0.45	0.58	0.57
Day 6	0.39	0.47	0.36	0.41	0.45	0.49	0.84	0.37	0.51	0.44
Day 7	0.55	0.65	0.63	0.55	0.84	0.65	0.64	0.46	0.66	0.64
Day 8	0.40	0.51	0.47	0.39	0.45	0.36	0.49	0.43	0.45	0.42
Day 9	0.42	0.41	0.52	0.33	0.60	0.35	0.52	0.36	0.56	0.36
Day 10	0.57	0.46	0.47	0.39	0.62	0.49	0.42	0.39	0.52	0.43
10-Day Total ^c	0.50	0.55	0.50	0.44	0.60	0.50	0.57	0.42	0.55	0.48

^a Amount of food served to each child in specified classroom.

^b Amount of food served to each child in specified classroom on the portioned days.

^c Average number of ounces served to each child in specified classroom over 10-day period.

^d Average amount of food served to child in each classroom.

The amount of food served decreased by 77.5% on the portioned days as compared to the un-portioned days (Tables 5 and 6). The average amount of food served per child among the 4 classrooms combined decreased 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 grams served decreased 62.94 g in Room B, 96.39 g in Room C, and 151.39 g in Room D, and increased 49.61 g in Room A. For the 10-day average combining all 4 classrooms, the amount of food served per child decreased 65.77 g when comparing the portioned average to the un-portioned average. The amount of food wasted per child decreased in 75% of the meals served. The average amount of food wasted per child amongst the 4 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 grams wasted per child was reduced by 40.54 g in Room B, 87.32 g in Room C, and 70.87 g in Room D, and increased by 17.29 g in Room A.

A cost analysis was also conducted to measure the financial implication of portion sizing meals at JTCDSC (Table 7). During the 10 un-portioned days, \$574.51 was served and \$218.30 was wasted, resulting in 38% of money spent on food being thrown away. During the 10 portioned days, \$445.40 was served and \$145.08 was wasted, result-

ing 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 thrown away was reduced by \$73.22 when comparing the cost of serving meals during the 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. If the center were to implement the portion sizing method utilized during the portioned trial, it is projected that the center would save \$258.22 per month, or \$3098.64 per year serving the 4 participating classrooms.

Throughout the process of this study, every child was allowed as much food as they desired to eat. No child was denied access to additional food after the initial portion was given. The results of this study support other studies that found portion-sizing meals to children can reduce the amount of food wasted in a school setting.

Conclusions

Portion-sizing lunch and afternoon snack meals for preschool children showed a reduction in the amount of food thrown away and the amount of money spent on food, as well as reducing the amount of money being diminished because of food waste. It is advised that the JTCDSC consider incorporating the portion sizing method used during

Table 6. Amount of food wasted for lunch and afternoon snack combined for each child during un-portioned and portioned days.

Day	Rm. A unport. (kg)	Rm. A port. (kg)	Rm. B unport. (kg)	Rm. B port. (kg)	Rm. C unport. (kg)	Rm. C port. (kg)	Rm. D unport. (kg)	Rm. D port. (kg)	Avg. food wasted/Rm. unport. ^d (kg)	Avg. food wasted/Rm. port. ^d (kg)
Day 1	0.13 ^a	0.13 ^b	0.12 ^a	0.08 ^b	0.21 ^a	0.10 ^b	0.16 ^a	0.04 ^b	0.16	0.09
Day 2	0.12	0.14	0.32	0.25	0.25	0.17	0.14	0.12	0.20	0.17
Day 3	0.13	0.11	0.32	0.17	0.26	0.10	0.16	0.15	0.22	0.13
Day 4	0.10	0.11	0.16	0.14	0.20	0.14	0.15	0.09	0.15	0.12
Day 5	0.05	0.11	0.25	0.24	0.23	0.19	0.26	0.11	0.20	0.16
Day 6	0.08	0.13	0.16	0.15	0.08	0.11	0.14	0.10	0.12	0.12
Day 7	0.09	0.15	0.27	0.20	0.40	0.18	0.21	0.13	0.24	0.16
Day 8	0.09	0.11	0.20	0.10	0.11	0.10	0.13	0.11	0.13	0.10
Day 9	0.16	0.10	0.25	0.13	0.22	0.10	0.18	0.05	0.20	0.10
Day 10	0.11	0.14	0.25	0.16	0.25	0.18	0.07	0.07	0.17	0.14
10-Day Total ^c	0.10	0.12	0.20	0.16	0.22	0.14	0.16	0.09	0.18	0.13

^a Amount of food wasted by each child in specified classroom.

^b Amount of food wasted by each child in specified classroom on the portioned days.

^c Average number of kg wasted by each child in specified classroom over 10-day period.

^d Average amount of food wasted child in each classroom.

this study into their regular foodservice practices. Further research pertaining to the impact of portion sizing on amounts wasted and cost is encouraged, such as research performed in different child care facilities with children of varying socioeconomic backgrounds or adding a composting component to the facility for composting uneaten food rather than having the food wasted.

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Table 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 (\$) ^a	Portioned: cost of food served (\$) ^a	Un-portioned: cost of food wasted (\$) ^b	Portioned: cost of food wasted (\$) ^b	Un-portioned: percentage money wasted (%) ^c	Portioned: percentage money wasted (%) ^c
Day 1	51.93 ^d	39.03 ^d	13.20 ^e	6.64 ^e	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 ^f	445.40 ^f	218.30 ^f	145.08 ^f	38.00	32.57

^a Sum cost, in dollars, to serve lunch and afternoon snack for one day.

^b Sum cost, in dollars, wasted from served lunch and afternoon snack for one day.

^c Cost of food wasted divided by cost of food served in one day.

^d Total cost to serve lunch and afternoon snack to all four classrooms (A, B, C, and D).

^e Total cost wasted from lunch and afternoon snack in all four classrooms (A, B, C, and D).

^f Sum cost for all ten days.