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Preference for Fruits and Vegetables is Linked to Plate Waste Among Preschool Children

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Preference for fruits and vegetables is linked to plate waste among preschool children

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ABSTRACT

Background: A large portion of preschool-aged children in the United States (US) do not consume enough fruits and vegetables (FV). It is important for childcare providers to know what food choices children in their care are making at mealtime and how to encourage them to eat more FV. The objective of this pilot study was to examine the relationship between FV preference and plate waste among pre-school aged children in a childcare setting using a rapid assessment tool.

Methods: The rapid assessment tool was first pilot tested with 23 children and revised. A repeated cross-sectional design was carried out for three days during fall 2016 in one childcare center. Over three days, the research team collected 100 FV plate waste observations from 30 children who were surveyed simultaneously about their preference (did not try, tried, liked, loved) towards FV.

Results: Food preference for FV by preschool children is significantly ($p < 0.05$) related to plate waste and age. Children that indicated they loved a fruit or vegetable generated the least plate waste. Children that indicated that they did not try a fruit or vegetable generated the most plate waste.

Conclusions: FV preference and plate waste are significantly and inversely correlated. The rapid assessment tool developed should be validated to be used in implementing strategies that increase child preferences and consumption of FV that support lifelong healthy eating behaviors.

1. Introduction

The Dietary Guidelines for Americans (2015) recommends increased fruit and vegetable (FV) consumption among children over 2 years of age in order to develop healthy eating patterns, reduce lifelong obesity and chronic disease risk, and increase important nutrient intake for growth and development (US HHS, 2015). A large portion of preschool-aged children in the United States (US) do not consume enough FV (Kim et al., 2014; National Cancer Institute, 2007). Children's FV consumption is influenced by a number of factors, including taste preferences, exposure to FV, social experiences, and availability of FV (US HHS, 2015; Gibson et al., 1998; Birch, 1999; Birch et al., 2007; Ostan et al., 2010; Jansen & Tenney, 2001; Sullivan & Birch, 1990; Pérez-Rodrigo et al., 2003; Skinner et al., 2002; Bandura).

Childcare centers present an important opportunity to influence food behaviors and dietary habits of preschool children. An estimated 7.5 million children spend a substantial portion of their day being cared for in center-based programs in the US, such as day care centers, Head Start programs, and preschools (National Center for Educa, 2020). Such programs potentially contribute up to two-thirds of a child's nutrient needs per day (Neelon & Briley, 2011). At childcare centers, children are simultaneously exposed to foods and social interactions that influence their FV preferences and consumption (Story et al., 2008).

The US Department of Agriculture Child and Adult Care Food Program (CACFP) plays a vital role in improving the quality of foods offered in childcare by providing participating programs with reimbursements for nutritious meals served to children in their care (USDA, 2017a). The Healthy, Hunger Free Kids Act of 2010 required CACFP to update its meal pattern requirements according to the Dietary Guidelines for Americans (US HHS, 2010; USDA, 2017a). As of October 2017, all

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programs participating in CACFP must adhere to updated menu requirements, including increasing whole grains, reducing added sugars, serving separate vegetable and fruit components at each meal (not snacks), limiting juice, and expanding protein choices (USDA, 2017b). In addition to updated menu requirements, changes to CACFP include highly encouraging, but not requiring, family style meal service (children serve themselves from shared food platters with adult assistance as needed) to promote a pleasant eating environment that enables eating self-regulation (USDA, 2010).

It is important for childcare providers to know what food choices children in their care are making at mealtime and how to encourage them to eat more FV. Interventions previously conducted to improve FV consumption in the childcare setting demonstrate that providing choice and variety, nutrition education, multiple taste exposures, family style dining, visual appeal, and pairing with other foods improves intake. Common measures to assess plate waste and dietary intake include: direct weighing of plate waste, observation during snack and mealtimes, or intake and preference surveys completed by an adult for the child or with the child (Diep et al., 2014; Nekitsing et al., 2018). Rapid assessment tools related to FV intake or preference are lacking that are easy to implement and interpret among children in a preschool setting (Bell et al., 2013).

The primary objective of this study was to examine the relationship between FV preference and plate waste among preschool-aged children in a childcare setting. The research questions addressed by this objective include: What is the relationship between FV preference and plate waste among preschool-aged children in childcare? Does this relationship between FV preference and plate waste vary by age of a preschool-aged child in a childcare setting? A secondary objective of this study was to conduct a preliminary analysis of a rapid assessment tool of FV preferences that could be used by other researchers and practitioners in childcare settings.

2. Methods

2.1. Research with human subjects

The [blinded] Institutional Review Board approved this study and was performed in accordance with the Declaration of Helsinki and must have been approved by an appropriate independent ethics committee.

2.2. Study site and sample

This study was carried out in one non-Head Start childcare center participating in the CACFP located in the state of Montana, USA and associated with a local university in a non-metro county (USDA, 2013; USDA 2017b). The center serves children aged 2.5 through 6 years in half and full day programs, with a maximum capacity of 55 children. Children attending came from a variety of socio-economic backgrounds given that the childcare center was affiliated with the university and served children of students, staff, and faculty. Demographic information for the childcare center or children in the study were protected data and not available for publication. To protect anonymity of the childcare center, county level data is not reported.

Breakfast, morning snack, hot lunch, and afternoon snack were provided to children at the same time each day. The hot lunch, beginning at noon, was catered by the local university and held hot in the childcare center kitchen and mealtime was 30 min. The childcare center conducted physical activities, either outdoor or indoor depending upon the temperature, between breakfast and lunch time. Through review of one month of menus and discussions with the director, meals served at the study site already met the updated CACFP meal pattern requirements.

The study site observes family style meal service. In family style meal service, FV may not be selected at all or, if selected, may be consumed or thrown away unconsumed. In total, 30 children aged 3 through 6 years old were recruited for participation from the two classrooms in the study. The two classrooms ate lunch simultaneously with no difference in service. Observations and interviews with preschoolers were held during and directly after their lunchtime meal service. Sex and age of participants was collected from the childcare center. Parents were informed about the study and passive consent was provided. Verbal consent was provided from teachers for participation in the study.

2.3. Measures

This study used a repeated cross-sectional design to collect data on food preference and plate waste. Data collection occurred for three days (Monday, Wednesday, Friday) in fall of 2016. Each day, childcare center staff served students the following meal components through family style meal service using an appropriate size scoop to the relevant recommended serving sizes for children aged 3–6 according to CACFP guidelines for fruit, vegetable, meat, meat alternate, milk, soup, and grain. Each meal component was served in a separate bowl. The teacher or teaching aid at each table was instructed by the research team to proceed with lunch as usual. The usual lunch protocol at the preschool is for each table to be staffed by one teacher or teaching aid per five children. The teacher or teaching aid eats with the preschoolers and encourages preschoolers to self-serve meal components. The teacher or teaching aid did not always take all meal components. An observation sheet was used by the researchers to record the date of research, names of researchers involved, time of the start and end of lunch, number of tables at lunch, number of preschoolers at lunch, and the name of meal components.

2.4. Food preference survey development

The food preference survey was developed by first searching the literature for an existing validated measure which assesses FV preferences among preschool-aged children. This search did not yield a validated measure and thus the research team built upon an existing, but not previously validated, tool that is utilized across preschools and grade schools in the US through the organization FoodCorps (Food Corps, 2017). The existing tool, originally developed by Birch (1979) asks students to consume a food and then identify if they tried, liked, or loved the food item. (Birch, 1979) The research team of this study established face and content validity by circulating the existing survey tool to a panel of five field experts in the fields of nutrition, early childhood education, and food systems. Experts were given survey instructions, asked to review the survey, and provide feedback. Based upon feedback, researchers modified this survey to include a “did not try” response (Fig. 1). The survey tool and research protocol were then pre-tested in a separate childcare center with 23 preschool children with similar demographics to the children in the research. Originally, children were verbally asked if they did not try, tried, liked, or loved a specific fruit or vegetable. When initially pre-testing the tool, it became apparent that pointing to a sample of the fruit or vegetable versus only referring to the name of the food markedly increased the speed of recall of the fruit or vegetable for the participant, making the assessment tool even more rapid.

2.5. Food preference survey implementation

Research proceeded by documenting each participant’s first name on the back side of each preschool child’s plate before lunch began. Researchers were introduced to the children by the teachers before lunch time. Towards the end of lunch time, preschool children were instructed to leave their plates on the table when they were finished eating. When the student left the table, a researcher asked the student to join at a private station that was next to the food preparation area and out of auditory range from other children. The researcher first asked the student, “May I ask you a question about your lunch?” If the child replied

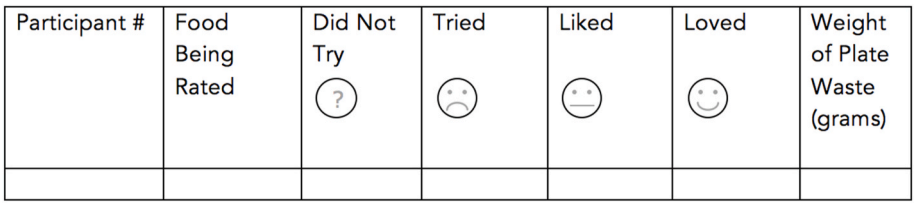

Fig. 1. *Tried It, Liked It, Loved It* food preference survey.

yes, the researcher collected the student's first name and asked the student, "Did you try [INSERT FRUIT OR VEGETABLE OF THE DAY]?" while simultaneously pointing to a plate that had the sample of the fruit or vegetable of the day. If the child indicated "NO", the researcher recorded if the child did not serve themselves fruits or vegetables or that the child served themselves FV but did not try the fruit or vegetable. Any child that did not serve themselves fruits or vegetables was excluded from the analysis. If the child indicated "YES" then the researcher asked, "Did you like or love the [INSERT FRUIT OR VEGETABLE OF THE DAY]?" The researcher recorded the child's response. If the child did not like or love the fruit or vegetable, it was recorded that the child 'tried' the fruit or vegetable because the child had previously responded "YES" to the question, "Did you try [INSERT FRUIT OR VEGETABLE OF THE DAY]?". For the 'tried' response, no assumption was made about whether or not the child liked the fruit or vegetable. The researcher first asked about the vegetable and then about the fruit.

2.6. Plate waste

Plate waste studies measure the uneaten edible portion of food served to an individual (Byker Shanks et al., 2017). Plate waste methodology can measure specific nutrients, food groups, or meal components available, consumed, or wasted (Buzby & Guthrie, 2002). This research measured plate waste to estimate how much FV were thrown away. Our goal was to examine if the food preference survey served as a proxy for understanding if the student's survey response (i.e., did not try, tried, liked, or loved) correlated with how much plate waste existed in the family style dining model.

When lunch was finished, researchers collected student lunch plates from each table. The researcher matched the corresponding student food preference survey response to the name written on the lunch plate. FV waste on the plate was scraped and weighed (grams) three times for accuracy using a calibrated scale. If the weights were discordant, the team reweighed three times to ensure precision of the weight. Food that dropped below the student's plate on the table or below the chair was added to the plate. There was enough space between tables and chairs to ascertain which plate the dropped food belonged. All FV weights were collected and recorded using a digital scale (Ohaus Valor 2000 W, Parsippany, NJ), accurate to 0.5 g. The weight of the fruit or vegetable waste was written next to the student's food preference survey response.

2.7. Statistical analysis

All statistical analyses were performed using JMP 12.0 (SAS Institute Inc). Authors considered p-values less than or equal to 0.05 statistically significant. Descriptive statistics were used to calculate food preference survey responses and the amount of plate waste. An ANOVA was conducted in conjunction with a *t*-test to determine how much FV plate waste varied by survey responses regarding food preferences and if there was a difference in plate waste between younger (3–4) and older (5–6) participants. Cluster analysis was not conducted given the sample size.

3. Results

Fifteen students were in the 3- to 4-year-old age group (Male = 80%; Female = 20%) and 15 students were in the 5- to 6-year-old (Male = 60%; Female = 40%) age group. Survey response and matched FV plate waste was collected 100 times over three days. A different fruit or vegetable was served each day (Table 1). No students declined to participate, but a small number of students were not measured each day if they left lunch before participating in the survey.

Results addressing the primary objective of this study found an inverse relationship between FV preference and plate waste (Table 2). Specifically, the ANOVA found significant differences in the means of total FV plate waste ($p < 0.001$), fruit plate waste ($p < 0.001$), and vegetable plate waste ($p < 0.001$) based on student FV preference survey responses. The weight of total FV plate waste was highest for participants who served themselves fruits or vegetables and indicated that they did not try the fruit (25.8 ± 12.8) or vegetable (16.4 ± 8.2), second highest for the students that tried but did not like or love the fruit (15.5 ± 3.9) or vegetable (9.3 ± 6.5), third highest for students that liked the fruit (6.9 ± 2.0) or vegetable (7.4 ± 7.8), while the weight of total FV plate waste was lowest for participants that indicated that they loved the fruit (0.6 ± 1.6) or vegetable (2.9 ± 1.8).

Pairwise *t*-test comparisons (Table 2) showed significant differences in total FV plate waste for all categories of food preference survey responses ($p < 0.03$). Likewise, the weight of total fruit plate waste was highest for participants that indicated that they did not try the fruit (25.8 g ± 12.8), while the weight of total fruit plate waste was lowest for participants that indicated that they loved the fruit (0.6 g ± 1.6). Pairwise *t*-test comparisons showed significant differences between fruit plate waste and each category of food preference survey responses ($p < 0.02$).

The weight of total vegetable plate waste was highest for participants that indicated that they did not try the vegetable (that is, when a student responded NO to the question "Did you try [INSERT FRUIT OR VEGETABLE OF THE DAY]?"), while the weight of total vegetable plate waste was lowest for participants that indicated that they loved the vegetable

Table 1
Fruit and vegetable preference and plate waste in a child and adult care food program (CACFPP).

Day	Fruit or Vegetable Served	Did Not Try (n)	Tried It (n)	Liked It (n)	Loved It (n)	Weight (grams) of Fruit or Vegetable Plate Waste (mean ± SD)
1	Pears, canned in 100% juice	2	1	5	7	7.1 ± 12.8
1	Carrots, dimed and cooked	6	3	5	0	10.3 ± 7.7
2	Tropical fruit salad, canned in 100% juice	1	0	2	14	1.9 ± 4.1
2	Peas, frozen and cooked	5	0	2	9	7.4 ± 9.0
3	Apricots, fresh and sliced	7	5	6	1	16.6 ± 11.9
3	Corn, frozen and cooked	2	1	11	5	9.5 ± 8.4
					Average	8.77 + 10.3

Table 2
Mean Differences in Total Weight of Fruit and Vegetable Plate Waste based on Food Preference Survey Response.

	Did Not Try	Tried It	Liked It	Loved It
Weight (grams) of Total Fruit and Vegetable Plate Waste (mean ± SD)	20.5 ± 11.2[a]	13.0 ± 5.7[b]	7.2 ± 7.9[c]	1.5 ± 2.7[d]
Weight (grams) of Total Fruit Plate Waste (mean ± SD)	25.8 ± 12.8[a]	15.5 ± 3.9[b]	6.9 ± 2.0[c]	0.6 ± 1.6[d]
Weight (grams) of Total Vegetable Plate Waste (mean ± SD)	16.4 ± 8.2[a]	9.3 ± 6.5[b]	7.4 ± 7.8[c]	2.9 ± 1.8[d]

[a, b, c, d]Symbols that do not match across the row are statistically significant ($p < 0.05$).

(Table 2). Pairwise *t*-test comparisons showed significant differences in vegetable plate waste between 'Did Not Try' and 'Loved It' ($P < 0.001$) as well as between 'Did Not Try' and 'Liked It' ($p < 0.0007$). No significant differences were found for vegetable plate waste and 'Did Not Try' and 'Tried It', 'Tried It' and 'Loved It', 'Liked It' and 'Loved It', and 'Tried It' and 'Liked It'.

Overall, there were no significant differences in total plate waste between total fruits and total vegetables or in food preference survey responses between FV (Table 2). There was clear variation in FV plate waste, with apricots yielding the greatest amount of plate waste (16.6 g ± 11.9) and tropical fruit salad yielding the lowest amount of plate waste (1.9 g ± 4.1).

Student age influenced plate waste of and preference towards FV (data not shown in Table). Specifically, younger students (13.5 g ± 1.3) were significantly more likely to waste more total FV ($p < 0.001$) than the older students (3.9 g ± 1.3). When comparing fruit alone, the younger students (13.7 g ± 2.1) were significantly more likely to waste more fruit ($p < 0.002$) than the older students (3.5 g ± 2.2). When comparing vegetable alone, the younger students (13.3 g ± 1.4) were significantly more likely to waste more vegetables ($p < 0.001$) than the older students (4.3 g ± 1.5). The variation of total FV waste, fruit waste, and vegetable waste by food preference was significantly different ($p < 0.001$) for both age groups.

4. Discussion

This study examined the relationship between FV food preference and plate waste among preschool-aged children in a childcare setting using a rapid assessment tool. Students who had greater preference for FV wasted fewer FV, while students who had lower preference or students who served themselves FV but did not try FV wasted higher quantities of FV. Students who did not try specific FV wasted the greatest amount. The amount of FV waste significantly increased as food preference decreased.

The fact that plate waste for fruits alone, vegetables alone, and FV combined was significantly correlated with food preference data is noteworthy. Children generally meet consumption guidelines for fruits but not for vegetables (US HHS, 2015) and the new CACFP guidelines suggest greater FV variety and require FV to be offered at every meal (USDA, 2017b). The rapid assessment tool demonstrated an inverse relationship with preference and plate waste, even with research repeatedly documenting differing consumption trends towards FV (Kim et al., 2014).

From a public health perspective, these study results demonstrate that greater preference for FV and less plate waste of FV likely leads to greater consumption of FV. The contribution of both FV consumption to a child's dietary quality and health outcomes during childhood and throughout life across the globe is significant (IOM, 2011; World Health Organization, 2003).

Additionally, younger children significantly wasted more and had a greater preference towards FV when compared to older children. These findings were not surprising given that food neophobia, or the reluctance to eat new foods, reaches a peak during the preschool years and decreases as children age (Doveyet al., 2008). Previous research demonstrates that children need to be exposed to a new or previously disliked food eight to ten times to increase consumption of the food (Anzman-Frasca et al., 2012).

Lastly, when nutritious foods and balanced meals are made available to the child for selection, self-regulation is extremely important to encourage in order for the child to develop natural abilities to regulate energy intake as they age (Birch, 1999; Birch et al., 2007). Exposure to foods and self-regulation is particularly important to highlight as we found significantly more waste in total FV, fruit alone, and vegetable alone among younger versus older children. Some amount of plate waste is to be expected due to self-regulation and the need for increased exposure, but the public health goal is to minimize FV waste while simultaneously encouraging preference for FV among preschool children of various ages.

Behavioral strategies are called for that target different ages of preschool children to find a balance between self-service in family style meals, exposing children to new foods, decreasing plate waste, and increasing food consumption. Potential strategies to encourage students to try FV include continuously exposing children to FV frequently throughout their curriculum and lunchtime in order to build familiarity (Birch et al., 1987), role-modeling healthy eating behaviors (Birch & Fisher, 1998), rewards (Horne et al., 2011), peer influence (Cullen et al., 2001), and nutrition education (Bellows & Anderson, 2006) including farm to preschool interventions (Izumi et al., 2015), and influencing child feeding strategies of parents and caregivers (Nicklas et al., 2001). Interventions to increase FV consumption should be theory-based and take into account multiple approaches given that evidence suggests that multi-component programs are more effective than single-component programs in increasing food acceptance among children (Campbell & Hesketh, 2007; Hesketh & Campbell, 2010; Larson et al., 2011; Mikkelsen et al., 2014).

This study conducted a preliminary analysis of a rapid assessment tool of food preferences towards FV that can be used by other researchers and practitioners in childcare settings. The food preference survey tested here can be used as a rapid assessment tool for understanding preference for and plate waste of FV in other studies, interventions, and programs among pre-school aged children.

4.1. Limitations

This formative study was carried out at one childcare center during a three-day period with a small sample that had more males than females. As such, the study does not represent the total childcare population, and therefore generalizability is limited. The study was conducted on a Monday, Wednesday, and Friday which may influence variability of what children choose to consume. For example, food insecure students may eat more on Mondays due to a lack of consumption on the weekend. This study also does not take into account a large variety of FV, only what was served at the preschool. Future research is needed to test serving sizes and consumption levels of FV in addition to waste. Additionally, studies should validate the food preference survey against a comprehensive plate waste study and/or dietary recalls, with a larger sample of preschoolers and across diverse contexts.

5. Conclusions

The formative work to measure plate waste with the rapid FV preference tool allows researchers to further develop and validate with a wider range of childcare populations and various ages. Once validated, childcare researchers and practitioners can use this simple tool to evaluate meal program offerings according to student preferences to control meal program costs, understand adherence to meal dietary recommendations, prevent plate waste, and inform future food and

nutrition interventions that seek to promote healthy eating habits among preschool-aged children. Examining the relationship between food preference for FV and plate waste among preschool-aged children in childcare centers and beyond using a rapid assessment of FV preferences is useful in developing effective strategies that seek to increase preschool-aged children's willingness to consume FV towards supporting lifelong healthy eating habits.

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Research with human subjects

Montana State University Institutional Review Board approved this study and was performed in accordance with the Declaration of Helsinki and must have been approved by an appropriate independent ethics committee.

Author statement

The authors have no conflicts of interest to report. CBS conceptualized the research. CBS and SA wrote the first version of the manuscript. CBS, SA, AM, ES contributed to data collection. All authors contributed to subsequent versions of the manuscript.

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