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Children eat more food when they prepare it themselves

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Abstract

Encouraging children to participate in food preparation is recommended by pediatric guidelines and has been included in public health interventions. However, little is known about whether the act of preparing a food specifically increases children's intake of that food, nor is it known whether this effect might differ for healthy and familiar unhealthy foods. The present study examines whether 5- to 7-year-old children eat more of a food they prepared themselves compared to the same food prepared by someone else. Children participated in a laboratory study in which they prepared either a salad or a dessert and then had the opportunity to eat the food they prepared and/or a nearly identical food prepared by someone else. We found that children ate more of a food they prepared themselves, but no significant difference was observed in children's ratings of each food. In addition to eating more healthy foods they prepared themselves, children ate more *unhealthy* foods they prepared themselves, including familiar and well-liked desserts. More specific recommendations are needed if the goal of involving children in food preparation is to promote health.

Keywords: Social cognition; food preparation; eating behavior; obesity

Children eat more food when they prepare it themselves

Many factors influence human food selection, ranging from considerations of a food's taste and composition to the context in which foods are provided. A few common preferences, such as for sweet and salty tastes, arise early in development and across cultures (Beauchamp, Cowart, & Moran, 2004; Birch, 1990; Desor, Maller, & Turner, 1973; Mennella, Lukasewycz, Griffith, & Beauchamp, 2011; Ventura & Mennella, 2011). Familiarity is also an important early driver of food preferences, as infants and young children tend to prefer foods they have been exposed to previously, and children's willingness to eat a food increases with repeated exposure (Aldridge, Dovey, & Halford, 2009; Hausner, Nicklaus, Issanchou, Mølgaard, & Møller, 2009; Mennella, Jagnow, & Beauchamp, 2001; Sullivan & Birch, 1990). In addition to the inherent properties of foods themselves (i.e., a food's taste or familiarity), children are sensitive to many contextual factors when deciding what and how much to eat. Children are more likely to eat foods their peers and ingroup members eat (Birch, 1980; Cruwys, Bevelander, & Hermans, 2015; Frazier, Gelman, Kaciroti, Russell, & Lumeng, 2012; Hendy & Raudenbush, 2000; Shutts, Kinzler, McKee, & Spelke, 2009), to consider the messages provided by adults about food (DeJesus, Shutts, & Kinzler, 2018; Lumeng, Cardinal, Jankowski, Kaciroti, & Gelman, 2008; VanderBorght & Jaswal, 2009), to adapt to the food preferences they observe in their culture (Rozin & Schiller, 1980), and to select foods adorned with popular brand labels (Roberto, Baik, Harris, & Brownell, 2010; Robinson, Borzekowski, Matheson, & Kraemer, 2007).

These studies highlight diverse influences on children's food selection beyond a food's perceptual features but have primarily focused on foods that are served to children. An important additional factor that has been theorized to influence children's eating behavior is the experience of preparing foods. Several previous educational interventions and experimental studies have included food preparation as a novel activity, with the goal of understanding children's willingness to eat healthy foods (Davis, Ventura, Cook, Gyllenhammer, & Gatto, 2011; Ensaff, Canavon, Crawford, & Barker, 2015; Gibbs et al., 2013). These studies find several potential health benefits, including increasing children's intake of and preferences for healthy foods (such as fruits and vegetables), decreasing their reluctance to try new foods (Allirot, da Quinta, Chokupermal, & Urdaneta, 2016; Chu et al., 2013; Chu, Storey, & Veugelers, 2014; Connell, Finkelstein, Scott, & Vallen, 2016; van der Horst, Ferrage, & Rytz, 2014), and decreases in children's weight and blood pressure (Davis et al., 2011). These studies employ a variety of designs (e.g., educational interventions vs. experiments) and address different aims (e.g., lowering child body mass index z-scores over the course of the intervention vs. understanding influences on children's food choices in the moment), but together they contribute to the conclusion that food preparation can influence children's eating behavior and resulting health outcomes. These findings are important in light of evidence that children in the United States are not meeting recommendations for fruit and vegetable intake (Kim et al., 2014; Muñoz, Krebs-Smith, Ballard-Barbash, & Cleveland, 1997). Indeed, the American Academy of Pediatrics currently recommends involving children in food preparation in some way (Shelov, 2009) and some researchers have advocated for culinary education at school (Lichtenstein & Ludwig, 2010; Nelson, Corbin, & Nickols-Richardson, 2013).

These findings provide initial support for the proposal that participating in food preparation activities influences children's eating. However, they also reveal two important questions regarding the mechanism(s) underlying this effect, which the present study is designed to examine. First, food preparation has typically not been the sole focus of previous multi-component interventions, making it difficult to evaluate its individual effect. Additional study components, such as nutrition education for children and their parents (Cunningham-Sabo & Lohse, 2013; Davis et al., 2011), cooking demonstrations in which students watch others cook but do not participate in cooking activities themselves (Chen et al., 2014), food tastings outside of the cooking intervention (Cunningham-Sabo & Lohse, 2013), and gardening (Davis et al., 2011), rather than food preparation specifically, may influence children's eating behavior, including their knowledge about and exposure to foods, and health outcomes. As one review notes, many different methods and measurements have been implemented (e.g., two sessions vs. repeated sessions over two years); therefore, best practices have been difficult to identify (Hersch, Perdue, Ambroz, & Boucher, 2014). To examine food preparation directly, we created a controlled task in which children assembled a food in a laboratory setting, removed from parents and peers, and without additional lessons about food. Because involving children in food preparation activities has long been a popular home activity (Anliker, Laus, Samonds, & Beal, 1992; Casey & Rozin, 1989), it is important to understand whether preparing foods directly influences children's food intake and if there are minimal forms of preparation that might elicit such an influence. Such information could be used to maximize the value of the time and resources of parents, caregivers, and schools that engage children in food preparation activities.

Second, prior research has focused on healthy foods that might be less familiar or desirable to school-age children. This is not surprising, given the goal of increasing children's intake of healthy foods that might be unfamiliar or less desirable to children at this age. Nonetheless, these recommendations could be interpreted as a broad suggestion that might expand at home to include desserts and other popular foods, rather than a specific tool to encourage children to eat foods they might otherwise avoid. Popular literature supports this possibility. For instance, a 2015 *New York Times* article entitled, "Cooking With Kids: 5

Reasons You Should Be Doing It," describes potential health benefits of cooking with children at home, yet features dessert recipes and a photograph of children making ice cream (Dell'Antonia & Laskey, 2015). To provide another example, a recent instructional pamphlet developed for parents to address picky eating advises including children in food preparation activities to encourage children to try new foods, but many of the cooking skills listed for young children are especially relevant for baking, such as leveling dry measurements, beating/whisking, scraping the sides of a bowl, and using electric beaters, in addition to skills that are used to prepare healthy meals, such as washing ingredients and knife safety (Mafteiu, 2017). Though these are anecdotal examples, they highlight a potential disconnect between pediatric recommendations and real home activities. In light of findings that adults drank more of a high-calorie milkshake if they prepared it themselves (Dohle, Rall, & Siegrist, 2014), it is plausible that children would also consume more dessert if they prepared it themselves. Therefore, the present study includes salad and dessert preparation conditions to examine whether the impact of food preparation on intake would differ depending on the type of food that children prepared.

The Present Study

This study presents 5- to 7-year-old children with a food preparation task in a laboratory setting and assesses their intake and evaluation of two foods: One food that children prepared themselves and another food that someone else prepared using the same ingredients and mirroring the amounts of those ingredients that children included. Participants were offered both foods simultaneously and could choose for themselves how much of each food they wanted to eat. Children prepared and ate either salads or desserts.

We selected this design for several reasons. First, the primary goal of this study was to isolate the effect of food preparation by providing children with otherwise identical foods.

Therefore, this method differs from previous studies of food preparation by removing potential differences in the ingredients included in the foods (i.e., the foods children prepared and were served contained different ingredients; Allirot et al., 2016), by eliminating social influences from peers or parents (e.g., Allirot et al., 2016; van der Horst et al., 2014), and by focusing on food preparation, rather than including multiple intervention components (e.g., Davis et al., 2011). Many studies of children's food preferences have presented children with two foods that were identical except for one feature or context to isolate the influence of that feature (e.g., brand labels and licensed characters; Roberto et al., 2010; Robinson et al., 2007) or context (e.g., social messages or information about contamination; DeJesus, Shutts, & Kinzler, 2015; DeJesus et al., 2018). This controlled experimental design allows us to examine children's food intake of foods they prepared and foods they did not prepare in a context in which all foods contained the same ingredients. Second, the foods that children prepared reflected their own decisions – they could decide how much of each ingredient to use. Therefore, it would be critical to compare children's intake of foods they prepared themselves to their intake of another food with the same ingredients in the amounts they preferred but prepared by someone else. By customizing the served food based on children's own choices, we could insure that we were examining food preparation directly, rather than inadvertently comparing children's intake of a food with ingredients they liked to a food with ingredients they did not like. Third, many factors could contribute to children's food choices, such as their pre-existing preferences or experience with food preparation. By simultaneously presenting children with the food they made and an identical food they did not make, we were able to control for those preferences and experiences, keeping them constant across the two foods. Finally, each child was presented with only one type of food (either salad or dessert). Had children received two sets of food, their eating behavior in the second food task would have been difficult to interpret, given that they would have been less hungry.

We hypothesized that children would eat more of a food they prepared themselves, even when compared to a very similar food prepared by someone else. This preference for self-prepared foods, if obtained, could take on any of three different patterns. First, children could eat more of the food they prepared themselves, regardless of the type of food (salad or dessert). This would suggest a general effect of preparation on children's food intake, even in the absence of the social input and nutrition education included in prior food preparation interventions. Second, children could eat more of the salad they made themselves, but demonstrate no effect when eating desserts, suggesting that food preparation might encourage children to try foods they might be less willing to eat otherwise, whereas they may be equally interested in eating dessert no matter who made it. Third, children could eat more of the dessert they made themselves but demonstrate no effect when eating salads, suggesting that food preparation might especially enhance children's enthusiasm for eating foods that they already like, which previous interventions were not designed to test. From a public health perspective, this is important to study to more thoroughly understand the impact of involving children in food preparation and to design more specific recommendations for parents and educators about children's participation in food preparation activities.

Method

This study recruited 5- to 7-year-old children to participate in a food preparation activity in a laboratory setting. Children were assigned to prepare either a salad or a dessert and were able to choose the amount of each ingredient they used to prepare their food. Unbeknownst to the child, an experimenter mirrored the child's selections to make a comparable food. Children then were presented with two foods simultaneously: The food they prepared and a highly similar food they did not prepare. Children were explicitly told they could eat either or both foods if they desired to do so. Children's food intake and ratings of each food were measured. In addition to the food task, children also completed an analogous toy preparation task to validate our general method (see Supplemental Materials). Children's parents provided demographics and information about children's food preferences and habits. Importantly, children were not provided with additional information (e.g., nutrition education) and participated on their own (i.e., without help or influence from peers or parents).

Participants

Inclusion criteria were that children had to be fluent English speakers and 5-7 years old. This age range was selected based on previous studies of children's reasoning about object history, creative activities, and value (e.g., Frazier & Gelman, 2009; Gelman & Davidson, 2016; Gelman, Frazier, Noles, Manczak, & Stilwell, 2015; Hood & Bloom, 2008; Li, Shaw, & Olson, 2013; Marsh, Kanngiesser, & Hood, 2018), as well as past research on the influence of contextual information on children's food intake and evaluations (DeJesus et al., 2015; DeJesus et al., 2018; Lumeng et al., 2008; Roberto et al., 2010). In addition, children at this age already have some knowledge about which foods are healthy and which are not: In a study that examined 3- to 7-year-old children's food categorizations, all age groups were significantly better than chance at classifying foods as "healthy" or "junky" (though significant improvement with age was also observed; Nguyen, 2007). Similarly, when asked to put together a "healthy" plate using realistic plastic foods, preschool-aged children's plates were lower in estimated calories, fat, and sugar and higher in fiber than children's preferred meals (Harrison, Peralta, Jacobsohn, & Grider, 2016). Taken together, these findings suggest that children in our target age range consider contextual information when choosing foods and already have some knowledge of health categories.

Children were excluded from recruitment or inclusion in the final dataset if the child had any food allergies (even if those foods were not involved in the study to avoid potential cross-reactions) or if the parent reported any developmental delays.

Our recruitment goal for this study was 64 five- to seven-year-old children. Overall, 74 children came to the lab and completed a version of the study. Ten children completed the study but were excluded from the final dataset because of experimenter error during the study (n = 3), because their parents reported developmental disabilities during the study (n = 2), or because of changes to the study procedure as we refined the method (n = 5, the first five children recruited). After these exclusions, 64 children completed the final version of the procedure (M = 5.99 years, SE = 0.07, range = 5.01 – 7.06 years; 32 F, 32 M). During the study, 5 children incorrectly identified which food they prepared themselves, therefore the final analyses were run on the remaining 59 children (we also report a secondary analysis including all 64 children who completed the same procedure).

Participants were recruited from a volunteer database of families interested in participating in research studies at a university town in the Midwestern United States. See Table 1 for participant demographics by food type (salad vs. dessert, a between-subjects condition). Children's race/ethnicity were as follows: 49 non-Hispanic White children, 2 Hispanic White children, and 12 children who were non-Hispanic and of more than one race; one parent did not report their child's race/ethnicity. Parents reported their family's gross income as one of nine ranges: (1) less than $15,000; (2) $15,000 to $19,999; (3) $20,000 to $24,999; (4) $25,000 to $34,999; (5) $35,000 to $49,999; (6) $50,000 to $74,999; (7) $75,000 to $99,999; (8) $100,000 to $149,000; or (9) $150,000 or more. The modal reported gross family income range in this study was $100,000 to $149,000 (see Table 1).

-- Table 1 --

Table 1

Participant demographics by food type (salad vs. dessert), as reported by parents (n = 59; excludes the 5 participants who incorrectly reported which food they prepared). Independent-samples t-tests or chi-square tests compared children in the salad and dessert conditions.

Child characteristics	**Salad (*n* = 30) Mean (SE); *n***	**Dessert (*n* = 29) Mean (SE); *n***	**Test stat (*p*-value)**
Age (years)	6.03 (0.11)	6.03 (0.09)	$t(57) = 0.02$ (.98)
Gender			$\chi^2(1) = 0.16$ (.69)
Female	15	13	
Male	15	16	
Race/ethnicity			$\chi^2(3) = 1.41$ (.70)
Non-Hispanic White	23	21	
Biracial	5	7	
Hispanic White	1	1	
Did not report	1	0	
Income category			$\chi^2(6) = 8.52$ (.20)
Less than $15,000	0	0	
$15,000 to $19,999	0	1	
$20,000 to $24,999	0	0	
$25,000 to $34,999	3	0	
$35,000 to $49,999	0	1	
$50,000 to $74,999	4	2	
$75,000 to $99,999	4	7	
$100,000 to $149,000	11	7	
$150,000 or more	5	9	
Did not report	3	2	

-- Table 1 --

The study was described to parents as being about children's reasoning about food, but food preparation and creative activities were not mentioned during recruitment so that families would not inadvertently engage in different activities than they typically would prior to the study.

Materials and Procedure

Children were tested individually in an on-campus, child-friendly lab in 2016-2017. We requested that children not eat for at least one hour before the test session. Parents were also asked to report the time that children last ate when they arrived at the lab. Children were randomly assigned to prepare either salad or dessert and their assignment to food type occurred prior to their arrival in the lab. The procedures for the salad condition and dessert condition were identical, with the exception of the ingredients offered to the child, the utensils children were given (fork for salad, spoon for dessert), and that the food was referred to as a "salad" in the salad condition and as a "dessert" in the dessert condition. See Table 2 for a description of salad and dessert ingredients and Figure 1 for photographs of the components and finished products in each task. Parents provided written informed consent and children provided verbal assent. All procedures were approved by the university's institutional review board ("Child Food Preparation," HUM00111360). A data file is available on the Open Science Framework: https://osf.io/z53sx/

--- Table 2 ---

Table 2

Target amount of each ingredient provided per food item. Ingredients were measured to be within one gram of the target amount.

Ingredient	**Amount provided**
Salad	
Chopped romaine lettuce	50 g
Shredded carrots	20 g
Peas	20 g
Croutons	10
Hidden Valley Ranch Dressing	20 g
Total estimated calories	115 calories
Dessert	
Hunt's Snack Pack Vanilla Pudding	1 pudding cup (3.25 oz)

Nabisco 100 Calorie Oreo Thin Crisps	6 g
Nabisco 100 Calorie Chips Ahoy!	6 g
GFS Rainbow Sprinkles	6 g
Hershey Chocolate Syrup	25 g
Total estimated calories	218 calories

-- Table 2 --

-- Figure 1 --

Figure 1

Figure 1. Salad and dessert ingredients and examples of completed foods.

-- Figure 1 --

Children washed their hands and were brought into the testing room by the main experimenter (E1). Children were offered a snack of two Saltine crackers to ensure that no child was unusually hungry before starting the task (see Epstein, Leddy, Temple, & Faith, 2007; Temple, Legierski, Giacomelli, Salvy, & Epstein, 2008). After the child finished the snack, a first experimenter (E1) said, "Today, you are going to make a [salad/dessert]. Everything you need to make a [salad/dessert] is right here. I will help by reading you the instructions." E1 helped the child put on an apron and verbally labeled the ingredients available to make the food.

If the child did not wish to add an ingredient, E1 would first respond, “That’s what the instructions say,” and if the child still did not wish to add an ingredient, E1 would move on to the next ingredient. If children asked E1 any questions about the task outside of the script, such as if children were putting the food together correctly or if they were using the right amount of an ingredient, E1 said, “Whatever you think is right,” but did not give any additional instructions. These preparation actions were selected because we expected that children of this age would easily be able to complete them without assistance, as the goal of the study was to examine whether actually assembling foods was associated with children’s food intake (rather than the social aspects of food preparation activities, a topic we return to in the discussion).

When the child finished making the food, the experimenter said, “Good job, you made a [salad/dessert].” We anticipated that the composition and appearance of the foods would vary across participants. Thus, this feedback was included so that all children would feel that they performed the task correctly, regardless of the appearance of what they prepared.

While the child made the food, another experimenter (E2) used the same ingredients to prepare a matching food from the other side of a one-way mirror. Therefore, E2 could see which ingredients and approximately how much of each ingredient children added to their food and could prepare a food as identical as possible to the child’s creation, varying only in bowl color (i.e., if the child’s food was in a red bowl, E2’s food was in a blue bowl).

After the child finished preparing the food, E2 brought the matching food into the testing room and said, “I have another [salad/dessert] for [child’s name].” E2 helped the child set the table with two white placemats, two napkins, two utensils, and a bell, while E1 surreptitiously weighed and photographed both foods. E2 then left the room. Children were presented with both foods simultaneously: E1 put each food on a placemat and said, “Now you get to eat some [salad/dessert]! Here's the [salad/dessert] you made and here's another [salad/dessert]. You can eat your [salad/dessert], you can eat the other [salad/dessert], or you can eat both of them. I have some work to do over here, so just ring this bell when you are done eating." E1 faced away from the child so that the child would not feel pressured to eat a particular food or to eat at all.

Children could use the bell to signal to E1 that they were finished eating. If children did not ring the bell after 5 minutes, E1 asked if they were ready to move on to the next part of the task. E1 then sat next to the child and asked the child to rate their liking for each food by asking if the food was "yummy, yucky, or in the middle." If the child answered "yummy" or "yucky," E1 asked if the food was "really" or "a little bit" yummy or yucky. This procedure generated a liking scale of: 0 = really yucky, 1 = a little bit yucky, 2 = in the middle, 3 = a little bit yummy, 4 = really yummy. As a manipulation check, children were then asked to report which food they prepared themselves.

At the very end of the protocol, after both the food and the toy tasks were completed, a subset of participants (n = 23) was asked to directly compare the foods. Children were first asked to identify which of the two foods they made themselves (versus the food that was served to them). Children who completed the toy task first and the food task second had just answered this question (the manipulation check); children who completed the food task first were asked to identify which food they made themselves for a second time to confirm their memory (after they also completed the toy task). At this point, 4 out of 23 participants inaccurately reported which food they prepared (2 salad, 2 dessert). Children were then asked to identify which of the two foods was "more yummy" (the food they made themselves vs. the food served to them).

Design

Several additional features of these tasks were counterbalanced across participants: Whether children completed the food or the toy task first; whether children prepared the food in a red or blue bowl (if the child prepared the food in the blue bowl, E2 would prepare the food in the red bowl, and then the child would prepare a red toy and E2 would prepare a blue toy); the order in which liking ratings were obtained (for the item they prepared vs. the item they were served, both between and across participants); and whether the child-prepared item was placed on the left or right side of the table (from the child's perspective). Based on this counterbalancing, 8 protocol scripts were generated. A randomized list of scripts was created to evenly distribute scripts by food (salad vs. dessert) and child age/gender (i.e., 5-year-old boys, 5-year-old girls, etc.) prior to the start of data collection. Children were assigned to a study sequence (i.e., script and food type) based on their age, gender, and the date and time of their appointment. Food availability was a constraint to true random assignment: Fresh vegetables for the salad preparation task were purchased the day of the study from a local salad bar. Occasionally the salad bar did not have all of the necessary ingredients, so rather than cancel the scheduled appointment, we assigned children to the dessert condition when this occurred.

Measurement and coding

Completed salads and desserts were weighed before children started eating and again after the test session using a calibrated Ohaus SP202 Scout Pro Portable Balance (leftover or omitted ingredients did not count towards this weight). Because the dessert weighed more than salad, we calculated the proportion eaten by subtracting the post-test weight from the pre-test weight of the food and dividing by the pre-test weight so that we could directly compare children's food intake across foods.

Parents completed questionnaires including demographic variables, questions about their children's food experiences (how often their child typically participates in food preparation activities, how often their child eats salads and desserts, how much their child likes salad and dessert) and at what time their child last ate prior to the test session. For frequency questions (how often children participate in food preparation activities, how often children eat salad/dessert), parents rated their children's behavior on a scale from 1 (never) to 7 (daily), with 4 marked as "occasionally". For liking questions (how much children like salad/dessert), parents rated their children's liking on a scale from 1 (hates salad/dessert) to 7 (loves salad/dessert), with 4 marked as "neutral towards salad/dessert". Parents answered all food questions, regardless of their child's food assignment (see Table 3).

-- Table 3 --

Table 3

Participant characteristics by food type (salad vs. dessert), as reported by parents (excluding participants who incorrectly reported which food they prepared). Higher scores indicate more frequent eating and more liking. Independent-samples *t*-tests compared children in the salad and dessert conditions. Asterisks mark significant differences.

Child characteristics	**Salad (*n* = 30) Mean (SE); n**	**Dessert (*n* = 29) Mean (SE); n**	**Test stat (*p*-value)**
Food prep frequency (1-7)	4.20 (0.32)	4.00 (0.31)	*t*(57) = 0.45 (.65)
Salad intake frequency (1-7)	3.73 (0.30)	3.21 (0.36)	*t*(57) = 1.14 (.26)
Salad liking (1-7)	3.73 (0.31)	3.71 (0.41)	*t*(57) = 0.05 (.96)
Dessert intake frequency (1-7)	4.90 (0.21)	4.69 (0.27)	*t*(57) = 0.62 (.54)
Dessert liking (1-7)	6.55 (0.16)	6.48 (0.19)	*t*(56) = 0.28 (.78)
Time since last eaten (min)	102.60 (11.10)	150.72 (15.82)	*t*(57) = 2.51 (.02)*

-- Table 3 --

Test sessions were video recorded for later coding. The food (self-prepared vs. served) the child ate first (if any) was coded from video. Bites were coded from video by two independent coders who were blind to which food children prepared. Coders coded an overlapping set of 13 participants (26 foods) and had excellent agreement, ICC = .997 (*CI* = .992, .998; model: two-way mixed, absolute agreement). Disagreements were resolved by a third coder. The coders then independently coded the remaining videos.

Statistical analysis

To examine whether children who prepared salads vs. desserts systematically differed, we compared children by condition on each item reported by parents (see Table 1, Table 3). We observed a significant difference across conditions for only one variable: The amount of time since children had last eaten. Children in the salad condition (M = 102.6 minutes, SE = 11.1) had eaten more recently than children in the dessert condition (M = 150.7 minutes, SE = 15.8), $t(57) = 2.51$, $p = .02$, $d = 0.66$. Therefore, we included the amount of time since children had last eaten (z-scored, as the data were positively skewed) as a covariate in our analyses of children's food intake and evaluations. Five children incorrectly reported which food they prepared and therefore were excluded from the analyses of their food intake and evaluations ($n = 5$; 2 salad, 3 dessert).

To test the hypothesis that children would eat more of the food they prepared themselves than the food they were served, we performed a repeated-measures ANOVA on the proportion of each food children ate, with preparation (prepared vs. served) as a within-subject factor, food type (salad vs. dessert) as a between-subjects factor, and z-scored time since children had last eaten as a covariate. To test the hypothesis that children would rate the food they prepared themselves more positively than the food they were served, we performed an ordinal logistic regression on children's evaluations of each food (given the limited scale used to measure children's evaluations), with preparation (prepared vs. served) as a within-subject factor, food type (salad vs. dessert) as a between-subjects factor (and the interaction between preparation and food type), and time since children had last eaten (z-scored) as a covariate.

Additionally, we performed a binomial test to examine if children differed in the food they ate first and a chi-square test to examine whether this differed across foods (salad vs. dessert). Children's direct comparison between the self-prepared vs. served food (obtained from a subset of participants at the very end of the protocol) was compared using a binomial test as an exploratory analysis.

Results

Food intake

We found a significant effect of preparation (self-prepared vs. served) on children's food intake, $F(1, 56) = 16.07$, $p < .001$, $\eta_p^2 = .22$ (see Figure 2 for a graph of children's food intake by food type). Children ate more of the self-prepared food (proportion of food eaten: $M = 0.34$, $SE = 0.04$) than the served food ($M = 0.18$, $SE = 0.04$). We also found a significant effect of food type, $F(1, 56) = 10.76$, $p = .002$, $\eta_p^2 = .16$. Children ate more dessert ($M = 0.37$, $SE = 0.05$) than salad ($M = 0.16$, $SE = 0.04$). No significant interaction between food preparation and food type was observed, $F(1, 56) = 0.18$, $p = .68$, $\eta_p^2 = .003$. There was no significant effect of the amount of time since children last ate, $F(1, 56) = 2.54$, $p = .12$, $\eta_p^2 = .04$.

-- Figure 2 --

Figure 2

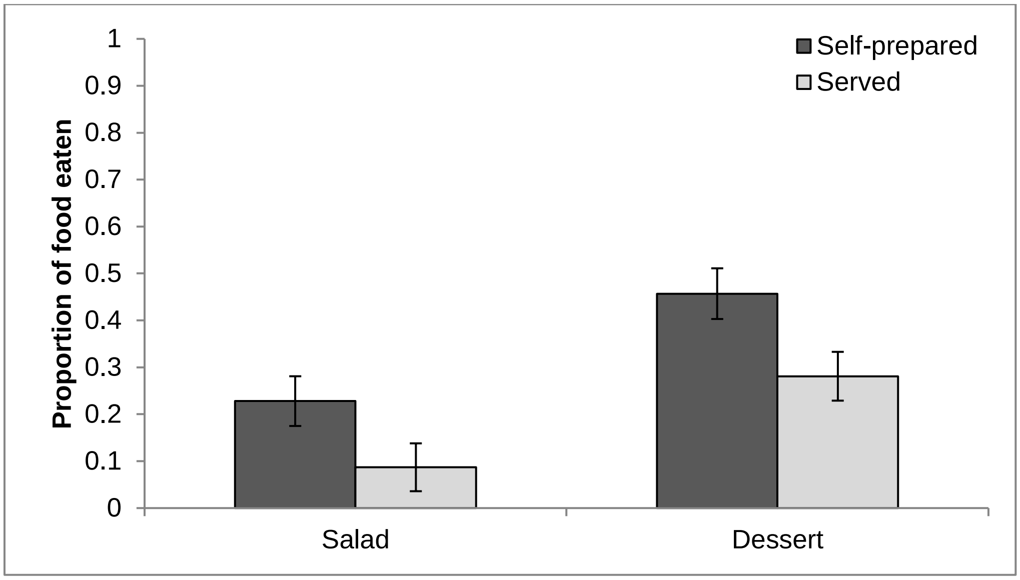

Figure 2. Child food intake by preparation (self-prepared vs. served) and food (salad vs. dessert), controlling for the amount of time since children last ate. Error bars represent ±1 SE.

-- Figure 2 --

We repeated these analyses including all participants (even those who inaccurately remembered which food they made) and found the same effects (prepared > served: ($F(1, 61) = 12.41$, $p = .001$, $\eta_p^2 = .17$; dessert > salad: $F(1, 61) = 14.88$, $p < .001$, $\eta_p^2 = .20$; interaction: $F(1, 61) = 0.42$, $p = .52$, $\eta_p^2 = .007$; time: $F(1, 61) = 1.94$, $p = .17$, $\eta_p^2 = .03$). An additional analysis of the grams eaten of each food (rather than the proportion) also revealed the same results (prepared > served; $F(1, 56) = 14.8$, $p < .001$, $\eta_p^2 = .21$; dessert > salad; $F(1, 56) = 14.39$, $p < .001$, $\eta_p^2 = .20$; interaction, $F(1, 56) = 0.94$, $p = .34$, $\eta_p^2 = .02$; time: $F(1, 56) = 2.32$, $p = .13$, $\eta_p^2 = .04$).

Overall, 26 children ate some amount of both foods (implying that many children were willing to switch between the foods), 24 children ate only the food they prepared, 2 children ate only the food they were served, and 7 children ate neither food. Eating all of one portion of food was rare – out of the 59 children who correctly remembered which food they prepared, only 12 ate 80% or more of at least one food (excluding those children, a preparation effect is still observed: $F(1, 44) = 18.27$, $p < .001$, $\eta_p^2 = 0.29$). Children's first bite was more likely to be of the food they prepared than the food they were served ($p < .0001$): 42 took their first bite from the food they prepared, whereas 9 took the first bite from the food they were served (7 did not eat; 1 did not have an available video to code the child's first bite). This pattern did not differ by food type, $\chi^2(1) = 0.19$, $p = .67$.

Food liking ratings

We observed no significant effect of food preparation, Wald χ^2 (1) = 1.48, $p = .224$, food type, Wald χ^2 (1) = 1.47, $p = .226$, or their interaction, Wald χ^2 (1) = 2.11, $p = .147$, on children's liking ratings of each food. The amount of time since children last ate (z-scored) was a significant predictor of children's liking ratings, Wald χ^2 (1) = 10.01, $p = .002$. Averaging across foods, children who had eaten less recently (i.e., they had a positive z-score) rated foods more positively ($M = 3.47$, $SE = 0.12$) than children who had eaten more recently (i.e., they had a negative z-score; $M = 2.41$, $SE = 0.18$), $t(54) = 4.05$, $p < .001$, $d = 1.10$.

For the subset of participants who were asked to directly compare the self-prepared vs. served food (i.e., which food was "more yummy") at the very end of the protocol and remembered which food they prepared at that point ($n = 19$), 13 reported preferring the self-prepared over the served food whereas 3 preferred the served food, $p = .02$, binomial test. An additional 3 children reported the foods tasted the same or they did not know which tasted better.

Discussion

These results suggest that children eat more of the salad or dessert they prepared themselves, compared to a highly similar food that someone else made. These findings reveal that participating in food preparation activities influences children's eating behaviors, even when controlling for an indirect measure of child hunger (i.e., the amount of time since children last ate) and when removing potential social influences and additional intervention components (e.g., Allirot et al., 2016; Davis et al., 2011; van der Horst et al., 2014). These findings are important because public health initiatives and pediatric recommendations promote including children in food preparation activities, yet in reality many families may be preparing desserts and other unhealthy foods. These findings suggest that recommendations to include children in food preparation should more clearly communicate the consequences of involving children in preparing unhealthy foods: Though it may be a fun activity, children might also eat more of those foods. In addition to eating more of foods that are unfamiliar or not well-liked (such as vegetables), children also eat more familiar, well-liked, unhealthy foods (such as desserts).

Why children eat more food when they prepare it themselves is an important open question from these findings. We outline three possibilities here, which may operate independently or have additive effects on children's food choices. First, food preparation often takes places in a social context, particularly for young children. Children are highly sensitive to social information in food contexts – they learn what is appropriate to eat from their community (e.g., Rozin & Schiller, 1980), track patterns of social affiliation and eating behavior in infancy (e.g., Liberman, Woodward, Sullivan, & Kinzler, 2016), eat foods that have been endorsed by their peers (e.g., Birch, 1980; DeJesus et al., 2018), and eat more food in social contexts (e.g., Salvy, De La Haye, Bowker, & Hermans, 2012). Preparing foods with other people may be socially rewarding, and consequently may further increase children's food intake and ratings.

Although the present study was designed specifically to remove social influence, it is possible that children's previous experiences preparing foods with other people could shape their general attitudes toward food preparation and that preparing foods along with other people would enhance the effects observed in the present study. Second, preparing foods may increase children's exposure to those ingredients. It can take several exposures for children to like a food (e.g., Birch & Marlin, 1982), but interacting with or directly selecting ingredients could count as an additional exposure to those foods, even before children actually eat them. However, it may be critical for children to know that they are preparing a food, rather than just interacting with ingredients – children who assembled a peacock out of vegetables were no more likely to eat vegetables as a snack than children who assembled a peacock out of non-food objects (Sanne, Ellen, & Emely, 2017). Third, the preparation effect could operate through the opportunity to customize or directly assemble foods. In this study, children had both opportunities – they could select how much of each ingredient to use and took action themselves to assemble the food. Future research is needed to directly compare these effects and examine the extent to which children demonstrate individual differences in each area. For instance, some children may be especially interested in customization, whereas others might find the social experience of preparing foods with other people to be especially rewarding, regardless of the food's composition or their familiarity with the ingredients.

Despite these effects on behavior, we did not observe a consistent effect of preparation on children's evaluations. Several factors may have contributed to this lack of effect. First, the foods were purposely designed to be as similar as possible in order to isolate the effect of preparation, and children rated each food close together in time (rather than at the beginning and end of the study). Therefore, children may have (accurately) perceived the items to be highly similar and consequently evaluated them similarly. Indeed, 31 children gave the same evaluation for both foods. Second, our scale might not have been sensitive enough to detect differences in children's ratings based on preparation. "Yucky" is included as a response option based on other studies that ask children to rate foods and provide negative options (e.g., Birch, 1980) and we expected that children might rate salads negatively. However, children rarely used this option (14 out of 125 food ratings). It is possible that children might view "yucky" as an impolite option, particularly when rating a food someone else made. Asking children to directly compare the foods may be a more sensitive measure: The subset of children directly compared the foods reported that the food they made was better than the food that someone else made. However, we are cautious in interpreting this finding, as it was an exploratory measure completed by a subset of our sample at the very end of the protocol. Finally, children's behavior may show differences more quickly than their evaluations. Given that repeated exposure increases children's liking for foods (Birch & Marlin, 1982; Sullivan & Birch, 1990), a similar process may operate here. Preparing a food may initially increase children's intake of that food, which over time may result in an increase in their preference, rather than an immediate change in their preference. Future studies would be useful to tease apart these possibilities.

This study provides experimental evidence that involving children in preparation activities is related to their food intake in the moment. However, this study has several limitations to be addressed by future research. First, we varied food preparation within participants (rather than having one group of children prepare a food and one group of children be served a food) to directly compare children's intake of highly similar foods, varying only in whether children prepared the food or not. However, a between-subjects design would more closely mirror children's daily experiences (i.e., they are served some foods and might help to prepare others) and provide an opportunity to examine whether children not only eat relatively more of the food they prepared, but also eat more in absolute terms when preparing their own food. The latter pattern, if obtained, could have direct implications for factors that might contribute to childhood obesity. Second, this study examines a narrow age range (5- to 7-year-old children). Recruiting a wider range of ages is important to understand the developmental trajectory of these effects. Past research studying eating behavior (e.g., Sanne et al., 2017) and object preferences (e.g., Norton, Mochon, & Ariely, 2012) suggests that preparation effects persist through adulthood, yet preparing foods may have different consequences or underlying mechanisms at different ages. Third, it is important to consider the individual differences that might influence the impact of food preparation, as well as the feasibility of including children in food preparation activities. This study included a relatively homogenous sample that was primarily White and high income. We have no specific reason to believe that these effects would differ among children from different sociocultural backgrounds, but this is an important concern in psychological research more generally and research on eating behavior specifically (Daniel, 2016; Henrich, Heine, & Norenzayan, 2010; Nielsen, Haun, Kärtner, & Legare, 2017). We also did not measure children's height and weight during the study, so we cannot examine whether these effects differed based on child BMI or weight category. We do not have a specific directional prediction regarding whether children who are higher or lower in BMI would be more likely to show a preparation effect, but this would be an important question for future study. Finally, the study was designed to reduce social pressure to eat (in general, or a particular food). However, it is possible that other aspects of the setting (e.g., eating food in a laboratory context) provide a somewhat unusual experience that could affect children's eating behavior. Future research that examines why food preparation is a compelling activity should consider how different contexts influence children's food choices.

We end by noting that participating in food preparation could have many social and cognitive benefits that are beyond the scope of this study (e.g., planning, measurement, positive social interaction, feelings of accomplishment), especially in light of evidence that conversations during mealtimes can serve as learning opportunities across domains (e.g., math skills; Susperreguy & Davis-Kean, 2016). Many children seem to value the experience of preparing foods: One child in this study rated the food they prepared as "really yummy" and went on to explain, "Because I'm the best chef and I made it." Studies of adults have found that spending time on creative activities (e.g., coming up with novel or original ideas, expressing oneself in an original and useful way, or spending time doing artistic activities) is associated with improved mood (Conner, DeYoung, & Silvia, 2016). Though we were especially interested in the potential health consequences of involving children in food preparation in this study, this experience may have implications beyond health. At the same time, understanding the potential health consequences of involving children in food preparation is critical as families, schools, and other childcare settings consider whether and how to invest time and resources into this endeavor.

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Supplemental Materials

Toy task rationale

In addition to the food preparation task, children in this study also participated in an analogous toy preparation task, in which they assembled a toy airplane. The primary purpose of this task was to validate our general method. Previous research has found that 5- and 6-year-old children prefer toys that they assembled themselves to toys that they did not assemble (Marsh, Kanngiesser, & Hood, 2018), and that they consider whether someone created an object or originated an idea when deciding who owns the final product (Kanngiesser, Gjersoe, & Hood, 2010; Kanngiesser & Hood, 2014; Kanngiesser, Itakura, & Hood, 2014; Li, Shaw, & Olson, 2013), so we hypothesized that children would interact more with toys they assembled themselves than toys they did not assemble. This is an important comparison to include: If we were to obtain no effect of preparation on the food task, this would allow us to determine if the issue was the domain of food per se or if the issue was the task we developed.

Toy task procedure

The toy task was designed to be analogous to the food task. An experimenter (E1) said, "Today, you are going to make an airplane. Everything you need to make an airplane is right here. I will help by reading you the instructions." As in the food task, children wore an apron while assembling the toy and E1 pointed out and labeled the toy components – the airplane body, the front wings, the back wings, and a clear plastic nose (see Figure S1 for images of the materials). The airplane body and wings were made of precut red or blue foam (color counterbalanced across participants). Similar to the food task, if children asked the experimenter if they were assembling the toy correctly, E1 repeated the instructions for that step or said, "Whatever you think is right," but did not provide any additional instructions or assistance.

-- Figure S1 --

Supplemental Figure 1

Figure S1. Toy components (left) and an example of a completed toy (right).

-- Figure S1 --

While the child assembled the toy, another experimenter (E2) used the same components to prepare a toy from the other side of a one-way mirror that was as similar as possible to the child's creation (e.g., putting the wings in the same orientation) so that the two toys varied only in color (i.e., if the child's toy was red, E2's toy was blue). After the child finished making the toy, E2 brought the toy into the testing room and said, "I have another airplane for [child's name]." E2 helped the child set the table with two white placemats and a bell while E1 surreptitiously photographed both toys. After E1 photographed the toys, E2 left the room. Children were presented with both toys simultaneously: E1 put each toy on a placemat and said, "Now you get to play with these airplanes! Here's the airplane you made and here's another airplane. You can play with your airplane, you can play with the other airplane, or you can play with both of them. I have some work to do over here, so just ring this bell when you are done playing." E1 faced away from the child so that the child would not feel pressured to play with a particular toy or to play at all.

Children could use the bell to signal to E1 that they were finished playing with the toys. If children did not ring the bell after 5 minutes, E1 asked if they were ready to move on to the next part of the task. E1 then asked the child to evaluate each toy as "good, bad, or in the middle." If the child answered "good" or "bad," E1 asked if the toy was "really" or "a little bit" good or bad. This procedure generated a liking scale of: 0 = really bad, 1 = a little bit bad, 2 = in the middle, 3 = a little bit good, 4 = really good. Children were then asked to report which toy they prepared themselves as a manipulation check.

At the very end of the protocol, after both the food and the toy tasks were completed, a subset of participants ($n = 25$) was asked to directly compare the toys. Children were first asked to identify for which of the two toys they made themselves (versus the toy they were given). Children who completed the toy task second had just answered this question (the manipulation check); children who completed the toy task first were asked to identify which toy they made themselves for a second time to confirm their memory. At this point, 1 out of 25 participants inaccurately reported which toy they made. Children were then asked to identify which of the two toys was "better" (the toy they made themselves vs. the toy they were given).

Toy task coding and analyses

The amount of time children spent touching each toy (in seconds), as well as which toy they touched first, was coded from video by two independent coders who were blind to which toy children prepared. Coders coded an overlapping set of 13 participants (26 toys) and had excellent agreement, ICC = .99 (*CI* = .99, 1.0; model: two-way mixed, absolute agreement). Values from the reliability set were averaged across coders. The coders then independently coded the remaining videos.

To test the hypothesis that children would interact more with a toy they prepared than the toy they were given, a paired-samples *t*-test was used to compare the amount of time children spent touching each toy. All participants correctly remembered which toy they made. However, a video of the toy task was not available for 4 participants, so those participants were excluded from toy behavioral coding.

To test the hypothesis that children would prefer the toy they prepared over the toy they were given, a Wilcoxin signed-rank test was used to compare children's ratings of each toy. Children's direct comparison of the two toys (obtained from a subset of participants at the very end of the protocol) was compared using a binomial test as an exploratory analysis.

Toy task results

Amount of time spent touching each toy. Children played longer with the toy they prepared themselves (M = 87.76 s, SE = 9.33) compared to the toy they were given (M = 63.37 s, SE = 7.46), $t(59) = 4.21$, $p < .001$, d = 0.54, and were more likely to touch the toy they prepared first, p = .03, binomial test. Excluding 5 children who first touched both planes simultaneously, 36 first touched the toy they prepared, whereas 19 first touched the toy they were given.

Toy liking ratings. We observed no difference in children's ratings of the toy they assembled themselves and the toy they were served, Z = 1.19, p = .236. Children frequently provided the same rating for both toys (n = 22). Among the subset of children who were asked to directly compare the toys at the very end of the protocol, 24 children accurately identified which toy they made themselves. Of those 24 children, 10 children reported that the toy they prepared was better, whereas 8 children reported that the toy they were given was better, p = .81, binomial test (an additional 6 children reported the toys were the same or they did not know which was better).

Toy task discussion

Consistent with the results of the food task, children interacted longer with the toy they made themselves, compared to a highly similar toy that someone else made. We also did not observe a difference in children's evaluations of the two toys. We hypothesize that a similar set of issues are at play in children's ratings of these toys – we designed the toys to be highly similar (indeed, 22/64 children used the same rating for both toys), children rarely used the "bad" response option (6 out of 126 toy ratings), and evaluation could follow behavior (i.e., after more experiences playing more with toys they made themselves, children might demonstrate a preference for the toy they made). Future studies should consider how these factors might influence children's responses.

Supplemental References

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