

Do children eat less at meals when allowed to serve themselves?^{1–4}

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ABSTRACT

Background: The effect of self-serving on young children's energy intake is not well understood.

Objective: The objective was to examine individual differences in the effects of plated and self-served entrée portions on children's energy intake.

Design: Two within-subjects experiments were used to examine ad libitum intake at meals in 63 children aged 3–5 y when 400 g of a pasta entrée was either plated or available for children to self-serve. Child age, sex, BMI, and responsiveness to increasing portion size (defined as individual slope estimates relating ad libitum intake of the entrée across a range of entrée portions) were evaluated as predictors of self-served portions.

Results: Children's entrée and meal intakes did not differ between the self-served and plated conditions for the total sample or by child weight status. However, larger self-served entrée portions were associated with greater entrée and meal intakes. Children who served themselves larger entrée portions tended to be overweight and more responsive to portion size (ie, greater increases in entrée intake as plated portion size increased). Last, self-served portion predicted both entrée and meal intake over and above BMI *z* score and responsiveness to portion.

Conclusions: Contrary to our hypothesis, relative to plated portions, allowing children to self-serve the entrée portion did not reduce energy intake. Children who were more responsive to portion-size effects were likely to self-serve and eat larger entrée portions. Self-serving is not a one-size-fits-all approach; some children may need guidance and rules to learn how to self-select appropriate portion sizes. *Am J Clin Nutr* 2012;96:36–43.

INTRODUCTION

Family-style meals, which allow children to serve themselves from communal dishes, are widely endorsed (1) by the USDA (2), Head Start Programs (3), the American Public Health Association, and the American Academy of Pediatrics (1). The rationale is that allowing children to serve themselves helps to promote autonomy and self-regulation in eating by allowing them to make food choices while providing opportunities for them to develop motor and social skills related to eating (4–6). Childcare providers are also more likely to talk to children about nutrition and model tasting of new foods when children are allowed to serve themselves (4).

The effect of allowing young children to serve themselves on their self-selected portion sizes and intake at meals is not well understood. One study in 44 preschool-aged children found that mean midmorning and afternoon snack intakes were significantly greater when children were allowed to self-serve than when served

fixed preportioned amounts (5). Another study found that children aged 3–6 y consumed 25% less of an entrée when they served themselves than when served a large entrée portion (7). This finding suggested that allowing children to self-serve might help prevent excessive energy intake at meals when exposed to large portions (8). A subsequent study failed to fully replicate those findings (6): only children who increased their intake in response to increased portion (ie, ate more when served larger portions) consumed less of the entrée when allowed to serve themselves than when served preportioned plated meals.

Individual differences in self-serving on children's intake at meals have received limited attention. One study found that children who consumed greater energy from palatable foods after a meal, in the absence of hunger, also showed greater increases in entrée and meal intake when served a large entrée portion relative to when an age-appropriate entrée portion was served (6). Numerous studies have also observed associations between child weight and eating behaviors in children (9–11). Taken together, these findings suggest that the effects of self-served portions on intake may be moderated by differences in children's responsiveness to food cues or by child weight status.

This research compared children's entrée and meal intakes at lunches during which they were allowed to self-serve an entrée with intakes at lunches during which large, 400-g, preplated portions of the same entrées were served. This comparison was chosen because prior research has shown that serving children large portions of energy-dense foods can significantly increase energy intake at meals (12–14). In addition, 400 g is representative of macaroni and cheese intake that corresponds to the 95th percentile among 2- to 5-y-old children participating in the Continuing Survey of Food Intakes of Individuals Survey (15).

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On the basis of previous research (7), children were expected to eat less when allowed to self-serve than when large entrée portions were served to them. Individual differences in the size of children's self-served entrée portions were examined in relation to child age, sex, and weight status and a measure of children's responsiveness to portion size at meals. Greater self-served entrée portion sizes were expected to be seen in children who were overweight and more responsive to portion size (ie, greater increases in intake as portion size increases).

SUBJECTS AND METHODS

Design

Self-serving and its effects on young children's intake at a meal were assessed as part of 2 within-subjects experimental studies of food portion size. Both experiments used similar designs and procedures. Experiment 1 was conducted in an experimental laboratory setting adjacent to a university childcare facility. Experiment 2 was conducted within the normal daily routine in classrooms of a commercial childcare facility. Self-serve was the policy at both facilities. Thus, children were accustomed to "family style" meals, in which they could determine the portion sizes of foods offered by serving themselves from communal dishes, typically placed at the center of each lunch table. In the present study, children served themselves from individual serving bowls rather than common, communal bowls as practiced with family-style service to accurately estimate intake. During the experimental lunches, children's ad libitum food and energy intakes were assessed by weighed methods. To assess the effects of self-serving, either 400 g of a palatable pasta entrée was served to children as part of the plated meal or they were allowed to serve themselves from a dish holding 400 g of the same entrée. Fixed portions of milk and other foods (ie, green beans with butter, whole-wheat roll, and unsweetened applesauce) were served at each meal in both experiments. Children's weight status was assessed by using measured heights and weights.

Subjects

The Pennsylvania State University Institutional Review Board approved all study procedures, and parents provided written consent for their family's participation in the study before the initiation of data collection. Initial recruitment of subjects for this study began in September 2007.

Experiment 1 involved 3- to 5-y-old children attending a full-day childcare program adjacent to the research laboratory in which the experimental lunches were served. Parental consent was obtained for 21 children who met initial participation criteria of being an English speaker and without food intolerances to study foods or chronic illness affecting food intake. Furthermore, children who indicated that the manipulated entrée food was "yucky" were excluded. Data are reported for 16 of the 21 children (6 boys, 10 girls). Data from 4 children were excluded from analyses because they failed to meet additional exclusion criteria that were assessed after data collection began: consumption of <10% of the smallest entrée portion or dislike of the main entrée. In addition, one child was absent when children's self-served portion sizes were assessed.

Experiment 2 involved 3- to 5-y-old children seen at lunch in their preschool and kindergarten classrooms. Parental consent

was obtained for 66 children who met the initial participation criteria used in experiment 1. Data are reported for 47 children (20 boys, 27 girls); the data on 17 children were excluded from analyses on the basis of the additional exclusion criteria applied after data collection began, as described in experiment 1. In addition, 2 children were absent on the day children's self-served portion sizes were assessed.

Procedures

In both experiments, children ate lunch with other classmates at normally scheduled times. In experiment 1, children were served lunch in an adjacent laboratory dining room, separate from their classroom. Children were seated at tables with 2 or 3 other children for a 20-min timed meal; research assistants were present as observers but did not eat with the children. Experiment 2 took place in the more naturalistic context of the children's childcare classroom setting. There were 5–7 children at a table, and they ate lunch with their teachers, who were instructed to try to avoid food-related discussions. If children finished eating before the 20-min period, they were allowed to excuse themselves from the table and leave the dining area, a rule consistent with usual classroom procedures.

In both experiments, across portion-size conditions children were served identically arranged trays containing the entrée and the other standard menu items, with uniform containers used at each meal. The size of the serving bowl and spoon were standardized such that in both experiments children served themselves from a 669-mL (2.9-cup) bowl containing 400 g of the entrée by using the same serving spoon. The following general instructions were given to children before each meal: 1) scoop up as much as they wanted to eat, 2) eat as much or little as they wanted, 3) serve themselves more than once if desired, and 4) do not share food with others, and 5) notice of the time remaining would be given 5 min before the end of the meal. Research assistants were present to record spillage. When children finished lunch, spilled or dropped foods were returned to the correct dish and lunch items were cleared. Spilled milk was cleaned up with preweighed paper towels, and milk intake was corrected by subtracting the weight of the dry towels from the weight of the wet towels.

At self-served lunches in both experiments, an individual serving dish containing 400 g of the entrée and a large serving spoon were placed adjacent to each child's lunch tray. Children were instructed to serve themselves as much or as little of the entrée as they wanted from the 400-g portion in their serving dish. Fixed portions of other menu items were served on the plate or in individual containers.

Experimental menu

A macaroni-and-cheese entrée (Stouffer's) with an energy density of 1.52 kcal/g (6.36 kJ/g) was offered in both experiments. Macaroni and cheese was selected for its familiarity and acceptability and for comparison with prior studies that examined entrée portion size in young children (7, 14). During lunches when children were allowed to self-select entrée portion size, 400 g of the entrée was provided in a serving bowl for each child, corresponding to the 95th percentile for intake among 2- to 5-y-olds participating in the Continuing Survey of Food Intakes by

Individuals 1994–1996 (15). The portion sizes of other foods served at lunch were generous and did not vary across lunches: green beans (85 g) with whipped butter (5 g), unsweetened applesauce (250 g), a whole-wheat roll (35 g), and a fixed serving of 2% milk (236 mL) or soy milk for one child at the request of a parent (244 g), providing a total of 373 kcal. The portions of the side items and milk were selected so that for the 100-g entrée, the meal would provide one-third of the 1600-kcal requirement for moderately active 3- to 5-y-olds (16, 17).

Children's self-served entrée portions were calculated by adding the entrée consumed to the amount of the entrée remaining on the plate and serving spoon. Food and milk weights were recorded before and after consumption to the nearest 0.1 g by using digital scales (Mettler-Toledo PR5001 and Mettler-Toledo XS4001S; Mettler-Toledo Inc). The amount of each food item consumed (g) was determined by subtracting postmeal weights from premeal weights. Energy intake (kcal) was calculated by multiplying consumption in grams by energy content from the manufacturers' nutrition information. Energy density (kcal/g) was calculated from the energy content of all foods divided by the weight of food consumed, excluding milk, for each individual. For energy density calculations, milk was excluded on the basis of previous findings indicating that the inclusion of beverages may diminish associations with outcome variables due to the increased day-to-day variance within individual respondents (18).

Measures

Background characteristics

One parent, usually the mother, completed a questionnaire to obtain information on family background characteristics including family income, mothers' and fathers' years of education, and the race-ethnicity of mother, father, and child.

Preference assessment

Children's familiarity with and liking of the entrée were assessed before data collection by using a tasting procedure developed by Birch (19). Children were asked whether they had eaten macaroni and cheese previously; they then tasted the food and categorized it as "yummy," "just okay," or "yucky."

Child weight status

A trained staff member measured children's heights and weights following standard procedures described by Lohman et al (20) the first week of data collection. Height was measured in duplicate to the nearest 0.1 cm by using a portable stadiometer (Shorr Productions), and weight was measured in duplicate to the nearest 0.1 kg by using an electronic scale (Seca). Age- and sex-specific BMI z scores (kg/m^2) were calculated by using an SAS macro supplied by the CDC. Overweight was defined as a BMI of ≥ 85 th percentile on the basis of standardized reference criteria (21).

Responsiveness to food portion size

Children's responsiveness to increasing food portion size was described by using measurements of each child's ad libitum energy intake across a series of lunches at which the portion size of a plated entrée was systematically increased. Macaroni-and-cheese entrée portions, ranging from 100 to 400 g, were served to children at lunch once a week in a randomly assigned order along

with fixed portions of other foods. One portion-size order was used to serve the 2 classrooms in experiment 1 (ie, 100, 160, 220, 280, 320, and 400 g); whereas, in experiment 2, 6 classrooms were randomly assigned to receive the portion-size conditions in 1 of 2 random orders. Responsiveness to portion size was characterized by individual regression estimates (slopes) that were calculated for each child by regressing entrée intake as the dependent variable onto entrée portion size (in g) (22). A complete description of the methods can be found elsewhere (22).

Statistical analyses

Descriptive statistical analyses were performed on all variables of interest. Data are shown as means \pm SEs. The main dependent variables of interest were self-served entrée portion size and intake as well as total energy consumed at lunches. The normality of these variables was assessed by using Shapiro-Wilk test and verified for all analyzed variables. To assess whether allowing children to serve themselves influenced intake at meals, 1-factor ANOVA was used to compare children's entrée and total lunch intake during the 400-g self-served condition with their intakes at a lunch during which a 400-g portion of the entrée was plated and served directly to them. BMI z scores were used to examine the role of individual differences in children's weight status as it affects the amount of the entrée self-served and eaten. An ANCOVA was also used to determine whether child weight status [ie, overweight (BMI ≥ 85 th percentile) compared with normal weight] interacted with serving type on amount of entrée consumed. Pearson's correlation was used to examine the relation between the amount of food served during the self-serve lunch and the amount of the entrée consumed. A series of independent regression analyses were conducted to examine separately the contribution of individual differences in age, sex, BMI z scores, responsiveness to portion, and self-served portion on self-served intake. Next, hierarchical regression analyses were conducted to determine the factors that contribute to or predict self-served portion (in g) and intake. For the model predicting self-served portion, we examined the impact of portion-size susceptibility (block 2) on self-served portion, over and above BMI z score (block 1). For the model predicting self-selected intake, we examined the impact of self-served portion on self-selected intake (block 3), over and above self-selected portion (block 2), with adjustment for BMI z score (block 1). Previous evidence suggests that a child's weight status and intake are significantly related (22), and we hypothesized that the amount children served themselves might predict subsequent intake. A similar pattern of results emerged for experiments 1 and 2 (data not shown); therefore, data from experiments 1 and 2 were combined and analyzed and are presented below ($n = 63$). Data were analyzed by using SAS software (version 9.2, 2001; SAS Institute).

RESULTS

Descriptive statistics

There were no significant differences between experiments 1 and 2 in demographic or background characteristics. Children were, on average, ~ 4 y of age and weighed 18 kg. A total of 31% and 26% of the children were of normal weight in

experiments 1 and 2, respectively, on the basis of CDC guidelines. Parents tended to be highly educated, currently employed, and married. Most of the families (64%) reported combined family incomes of $> \$50,000$ in experiment 1, and 56.8% reported combined family incomes of $\geq \$80,000$ in experiment 2. At self-served lunches, children served themselves an average (\pm SD) of 276.9 ± 96.5 g and 264.6 ± 103.8 of the entrée ($\sim 69\%$ and 66% of the large 400-g portion) in experiments 1 and 2, respectively, which was not significantly different.

Comparison of children's self-served entrée portions and intake with the 400-g plated portions

The mean (\pm SD) amounts of the entrée children consumed at lunch in the self-served condition (193.2 ± 92.3 g) did not differ from their entrée intake at a lunch during which a 400-g portion of the entrée was plated and served to children (201.3 ± 92.3 g). The effect of entrée serving type (self-served compared with plated) on entrée intake did not differ by weight status. In other words, overweight children did not tend to eat more or less during the self-served meal than during the 400-g plated meal compared with nonoverweight children. Furthermore, total energy intake at lunch did not differ between the self-served and plated conditions.

As shown in **Figure 1**, there was a positive association between children's self-served portion sizes and their entrée intakes (in g; $r = 0.68$, $P < 0.0001$), total lunch intakes (in g; $r = 0.42$, $P = 0.0007$), and total energy (in kcal) consumed at the lunch ($r = 0.60$, $P < 0.0001$). Children who served themselves more of the entrée consumed more energy from the entrée and also consumed more total energy at lunch than did children who self-served smaller portions of the entrée. Children's self-served portion sizes were not associated with their intake of other foods served during lunch ($r = 0.02$, $P = 0.90$). In other words, the amount of the entrée that children served themselves did not influence the amount of fruit, vegetables, or milk they consumed.

Association of children's weight status with self-served entrée portion and responsiveness to portion size

At lunches during which children were allowed to self-serve, significant positive associations of children's BMI z score with energy intake from the entrée ($r = 0.27$, $P < 0.05$) and total energy intake at lunch ($r = 0.43$, $P < 0.001$) were observed. Although the association between children's BMI z score and the amount of the entrée that children served themselves ($r = 0.24$, $P = 0.06$) was not significant, overweight children self-selected significantly larger entrée portions (mean \pm SE: 325 ± 21 compared with 244 ± 14 g; $P < 0.01$) and consumed significantly more of the self-selected entrée (383 ± 40 compared with 261 ± 17 kcal, $P < 0.01$) and total energy at the meal (549 ± 42 compared with 394 ± 18 kcal, $P < 0.01$) compared with nonoverweight children. Responsiveness to increasing portion was not associated with children's BMI z scores ($r = 0.19$, $P = 0.12$).

Predictors of self-selected entrée portion

As shown in **Figure 2**, children who showed greater responsiveness to increases in the portion size of a plated entrée

(ie, greater individual slope estimates) were also observed to serve themselves larger entree portions (**Figure 2A**; $r = 0.40$, $P < 0.001$) and had greater entrée (**Figure 2B**; $r = 0.46$, $P = 0.0001$) and total energy intakes at the self-served lunches ($r = 0.42$, $P < 0.001$); these associations did not differ by child weight status. Linear regression results showed that BMI z score and responsiveness to increasing portion were independent predictors of self-selected portion; age and sex were not significant predictors and thus were excluded from all other models (see **Table 1**). Hierarchical regression results are presented in **Table 2** and show that responsiveness to portion size predicted 13% of the variance for self-selected portion size above and beyond BMI z score ($F = 6.98$, $P < 0.001$). Together, responsiveness to portion and BMI z score predicted 19% of the variance for self-selected portion size.

Predictors of self-served entrée and total meal intake

Hierarchical regression analyses were conducted to predict self-served entrée and total meal intake (see **Table 3**). As shown in **Table 1**, BMI z score, self-served entrée portion, and responsiveness to portion size were independent predictors of self-served entrée intake and total meal intake. For self-selected energy intake (block 2), responsiveness to portion was a significant predictor of intake and explained 17% of the total variance over and above BMI z score. However, when self-selected portion was added to the model, responsiveness to portion was no longer a significant predictor of intake. In block 3, self-served portion emerged as the only significant predictor and explained 27% of the total 25% of variance for entrée intake.

For total meal intake, a similar pattern emerged such that when self-served portion was added to the model, an additional 17% of the variance was explained and responsiveness to portion size was no longer a significant predictor of meal intake. Unlike the results observed for entrée intake, BMI z score remained a significant predictor of total meal intake and explained $\sim 18\%$ of the variance. Last, there was no interaction between responsiveness to portion size and BMI z score on self-served entrée or total meal intake (data not shown).

DISCUSSION

Serving children large portion sizes has been shown to promote food and energy intakes at meals (7, 9, 12). Alternatively, allowing children to serve themselves at meals is considered to offer developmental benefits, although research on outcomes involving intake has been limited. This research was conducted to evaluate whether children would eat less when allowed to self-serve an energy-dense entrée than when served a large preplated portion and whether individual differences (eg, child age, weight status, and responsiveness to increasing portion) would affect self-served entrée portions. When offered a serving dish containing 400 g, children served themselves approximately two-thirds the amount of the large preplated entrée. Contrary to expectations, total energy consumed at the meal did not differ on the basis of whether children served themselves or were served a large plated entrée. Results showed that although children's responsiveness to increasing portion significantly predicted the amount children self-served, the variability in children's self-served portion sizes was substantial and the strongest predictor of

entrée and meal intake. Taken together, these findings suggest that allowing children to serve themselves does not necessarily result in lower meal intakes than when children are served large portions, but that the effects of self-serving may result in greater entrée and meal intakes for some children. Allowing children to self-serve portions could be used as a screening procedure to identify children who may be likely to serve themselves large portions while providing an opportunity to teach them about age-appropriate portion sizes. These findings show that the influence of self-serving on children's energy intakes at meals differs across children (6–8).

Our findings are consistent with another experimental study in which children aged 2–9 y consumed similar amounts of an entrée when served a large portion of an energy-dense entrée or

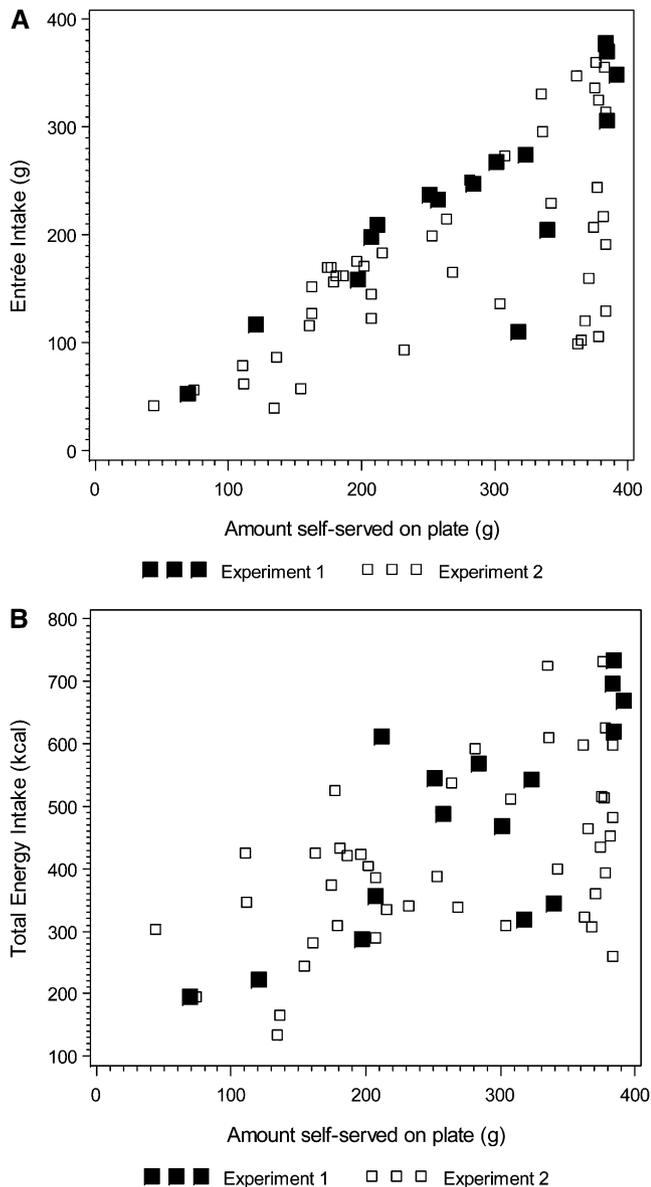


FIGURE 1. Amount of entrée self-served and entrée intake (A) and meal energy intake (B) for experiments 1 ($n = 16$) and 2 ($n = 47$). Pearson's correlation showed a positive association between the self-served entrée portion and entrée intake ($r = 0.68$, $P < 0.0001$) and total lunch intake ($r = 0.42$, $P = 0.0007$).

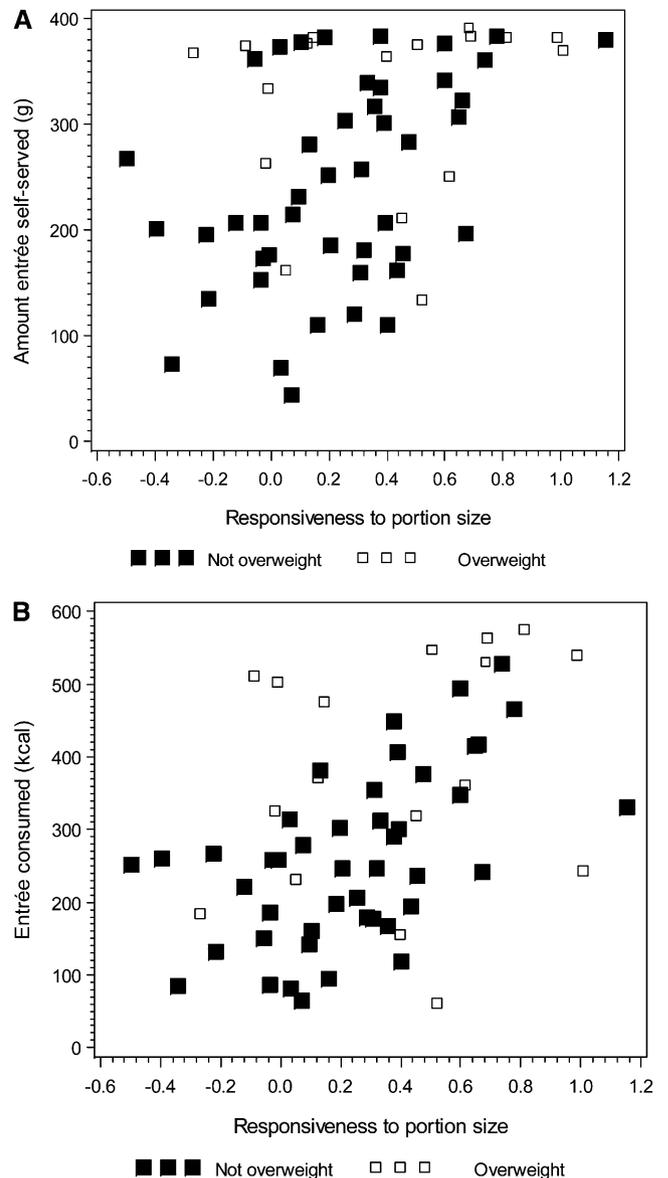


FIGURE 2. Responsiveness to portion size and self-served portion (A) and entrée energy intake (B) by child weight status ($n = 63$). Greater responsiveness to increases in the portion size of a plated entrée (ie, greater individual slope estimates) was associated with larger self-served portions (A; $r = 0.40$, $P < 0.001$) and greater entrée energy intakes (B; $r = 0.46$, $P = 0.0001$), but these associations did not differ by child weight status. Responsiveness to portion size was defined as individual slope estimates relating ad libitum intake of the entrée across a range of entrée portions. Overweight was defined as a BMI ≥ 85 th percentile.

allowed to self-serve from an individual serving bowl holding the same large entrée portion (6). However, other research has shown that children who were responsive to increasing portion sizes ate less when allowed to serve themselves compared with when preplated portions were served to them (5, 7). The present findings suggest that the reasons for differences across studies are unclear but may include differences in sample characteristics such as BMI or responsiveness to portion size. In addition, differences in types of foods and portion sizes served, or differences in setting and procedures, may explain the impact of self-serving on intake. It is important to note the current study evaluated only individual differences in children's self-serving

TABLE 1

Child age, sex, BMI z score, and responsiveness to portion size independently predicted self-served entrée portion, entrée intake, and total meal intake¹

Predictors	Self-served portion (g)			Entrée intake (g)			Total meal intake (kcal)		
	R ²	SE β	P	R ²	SE β	P	R ²	SE β	P
Age	0.00	-0.12	NS	0.00	0.04	NS	0.02	-0.02	NS
Sex	0.01	-0.10	NS	0.02	0.01	NS	0.01	-0.09	NS
BMI z score	0.06	0.24	<0.06	0.08	0.28	<0.05	0.17	0.43	<0.001
Responsiveness to portion size ²	0.15	0.40	<0.001	0.20	0.16	<0.0001	0.17	0.42	<0.001
Self-served entrée portion				0.46	0.68	<0.0001	0.36	0.60	<0.0001

¹ SE β, standardized estimate of regression coefficient.

² Responsiveness to portion size was defined as individual slope estimates relating ad libitum intake of the entrée across a range of entrée portions.

behaviors and intake at a single meal when children were allowed to self-serve the entrée. Additional research across multiple days, varying the palatability of foods across meals and snacks, is needed to understand how children’s serving behaviors and intake patterns change with experience related to self-serving, including participation in family-style meals when children self-serve either the entrée or a combination of foods served with the meal.

In the present study, children’s energy intake of the entrée or meal, on average, was not influenced by self-serving, but results provide evidence of individual differences in children’s serving behaviors and intake. Self-selected portion sizes were not associated with weight status. However, children who were more responsive to increasing portion sizes, defined by individual slope estimates relating ad libitum intake of the entrée across a range of entrée portions, selected larger entrée portions and consumed more energy when given the opportunity to self-serve the entrée. Similarly, previous studies have documented individual differences in appetite and their association with child weight. For instance, poorer compensation for a first-course preload, lower levels of satiety responsiveness, higher amounts of eating in the absence of hunger, and higher levels of food responsiveness have been shown to be related to adiposity in children (10, 23–25). The findings of the present study suggest that individual differences in children’s response to increasing portion size also influence the amount of food they select and consume when allowed to freely select portion size at meals. Children who were more responsive

to portion size tended to respond differently to self-serving than did other children. The children who were more responsive to portion size may require more structure and/or guidance than others to acquire self-serving behaviors that are consistent with current dietary guidance. In this research, children were encouraged to serve themselves as much or as little as they desired in the interest of observing variation in self-served portion sizes. Adult support, instruction, and scaffolding are likely critical to the development of children’s self-serving behaviors (26). Rudimentary self-feeding skills are apparent beginning in the first year of life, for instance, as children reach for the breast or take a cracker held out by the caregiver. By the time children reach preschool, self-feeding is well established; children are able to drink independently from cups and use utensils to feed themselves. Allowing children to serve themselves as part of family-style meals involves a range of social and motor skills that are relatively advanced, including the rules of “how much” to take, passing bowls around the table, and saying “please” and “thank you.” Evidence suggests that adults, including childcare providers, can affect preschool-aged children’s eating behaviors and food intake (27, 28); thus, those individuals may also be instrumental in coaching children how to select and eat appropriate portion sizes. Thus, additional research is warranted to examine the impact of childcare providers and parents providing guidance to help children to acquire “rules” for participating in meals that are served family-style, which include selection of age-appropriate portions.

In general, sensitivity to children’s skill levels is critical to effective scaffolding, in which adults match directives to the child’s current capabilities (26, 29). In helping children learn how to serve themselves appropriate amounts, caregivers can give physical assistance to children as needed, to scoop foods or hold bowls, while also providing verbal instruction and prompts (30). For instance, verbal instruction related to self-serving may include instructions regarding how much to initially serve (eg, “Take one scoop now and you may have another if you are still hungry”), verbal prompts might include asking children to indicate “when” they have enough while an adult is serving a portion of food for the child or to “listen to their tummies” to decide how much to eat. The present findings suggest that policies and education related to family-style meals should address adults’ role in supporting the development of self-serving behaviors, including the need for greater structure for children who have greater responsiveness to large portion sizes.

TABLE 2

Hierarchical regression analyses predicting self-served portion size¹

Predictors	Entrée intake (g)				
	R ² change	β	SE β	β ¹	β ²
Block 1	0.06				
BMI z score		23.11	11.92	0.24	0.17
Block 2	0.13				
Responsiveness to portion size ²		105.58	33.94		0.37**

¹ **P < 0.01. β, regression coefficient; β¹ and β², standardized parameter estimates for blocks 1 and 2, respectively; SE β, standardized estimate of regression coefficient.

² Responsiveness to portion size was defined as individual slope estimates relating ad libitum intake of the entrée across a range of entrée portions.

TABLE 3
Hierarchical regression analyses predicting entrée intake and total meal intake¹

Predictors	Entrée intake (kcal)						Total meal intake (kcal)					
	R ² change	β	SE β	β^1	β^2	β^3	R ² change	β	SE β	β^1	β^2	β^3
Block 1	0.08						0.18					
BMI z score		37.2	16.5	0.28	0.20	0.10		60.3	16.6	0.43***	0.36**	0.27**
Block 2	0.17						0.12					
Responsiveness to portion size ²		170.4	45.6		0.42***	0.21		148.8	47.0		0.35**	0.19
Block 3	0.27						0.17					
Self-served portion		0.80	0.14			0.58****		0.68	0.16			0.46****

¹ There was no significant interaction between BMI z score and responsiveness to portion size on entrée or total meal intake. The effect of children who were more responsive to increasing portion, consuming more energy, was not influenced by child weight. ** $P < 0.01$, *** $P < 0.001$, **** $P < 0.0001$. β , regression coefficient; β^1 , β^2 , and β^3 , standardized parameter estimates for blocks 1, 2, and 3, respectively; SE β , standardized estimate of regression coefficient.

² Responsiveness to portion size was defined as individual slope estimates relating ad libitum intake of the entrée across a range of entrée portions.

A number of limitations qualify these interpretations. Because the sample was relatively homogenous in terms of child ethnicity-race and socioeconomic status, findings cannot be generalized to children of differing sociodemographic backgrounds or to contexts outside of the laboratory or childcare setting. Future studies should investigate factors that affect self-serve eating behaviors as well as responsiveness to portion size within a family home setting, or potentially over multiple daily meals. In addition, research could examine optimal ways to instruct children in self-serving, especially for children predisposed to self-serve large portions. Also, other individual difference factors that identify children as potentially needing more guidance when self-serving should be examined.

In conclusion, the findings of this study did not support the hypothesis that children would consume less energy when allowed to self-select entrée portions than when served large preplated entrée portions. In fact, allowing children to self-serve without explicit guidance resulted in larger portions and intakes among those children who were especially responsive to portion size as a determinant of intake. Self-serving should be promoted as a means of encouraging children's active participation in making decisions about foods selected and eaten. In turn, this skill may support autonomy, allowing preschool children to refine motor skills, and provide an opportunity to start making connections between the amount selected and feelings of hunger and satiety (4–6). Like other aspects of children's development, encouraging self-serving requires structured support from caregivers to physically assist the child and encourage appropriate, but small, first portions. Furthermore, research should examine how individual differences in weight status and responsiveness to portion sizes and self-serving influence intake across foods served at meals and snacks differing in palatability and energy density.

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