

## REGULAR ARTICLE

# Food plating preferences of children: the importance of presentation on desire for diversity

Francesca Zampollo<sup>1</sup>, Kevin M Kniffin (kmk276@cornell.edu)<sup>2</sup>, Brian Wansink<sup>2</sup>, Mitsuru Shimizu<sup>2</sup>

1. Sir John Cass Department of Art, Media and Design, London Metropolitan University, London, UK

2. Charles H. Dyson School of Applied Economics and Management, Cornell University, Ithaca, NY, USA

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## Correspondence

KM Kniffin, Dyson School of Applied Economics and Management, Cornell University, Warren Hall 303, Ithaca, NY 14853, USA.  
Tel: 607 255 7827 |  
Fax: 607 255 9984 |  
Email: kmk276@cornell.edu

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## ABSTRACT

**Aim:** Given the importance of food presentation and childhood nutrition, we aimed to test the degree to which adults and children might demonstrate different preferences for various ways in which food can be presented on plates.

**Methods:** Twenty-three pre-teen children and 46 adults were individually presented full-size photos of 48 different combinations of food on plates. The photos varied according to seven dimensions (e.g. number of items, placement of entrée and organization of the food).

**Results:** Contrary to the default assumption that parents and children share preferences for the ways in which food is presented on plates, we find that children have notably different preferences than adults. Most remarkably, we show that children tended to prefer seven different items and six different colours on their ideal plates, while adults tended to prefer three different colours and three different items.

**Conclusion:** The assumption that children prefer food presentations that match adult preferences appears to be unjustified. Future research and interventions that are designed to improve childhood nutrition should test for the impact of diverse presentations on actual food consumption among a variety of populations across institutional settings.

## INTRODUCTION

Researchers studying the impact of age on food preferences have demonstrated patterns of change that start in the womb and continue through adulthood. For example, if breastfeeding mothers consume a diet that regularly includes fruits and vegetables, their infants will be more interested to eat the same healthful foods (1) – in contrast with formula-fed infants – and this effect appears to persist through weaning (2). Among toddlers, there is evidence that the peak years for ‘picky’ and ‘fussy’ eating start at age two (3,4) and continue through age six (5). Among older children and adults, the avoidance of new or unfamiliar foods (i.e. neophobia) is generally recognized to decrease; however, there is certainly variation in the degree to which people are able to access diverse kinds of food, and there is evidence that suggests that older adults develop a stable set of food preferences that is resistant to change (6).

Most generally, the finding that ageing tends to impact the diversity of one’s food preferences clearly makes it vital to encourage the development and maintenance of a broad array of food preferences among infants, toddlers and older children. As Nicklaus (7) advises, ‘parents should be aware that, as soon as complementary foods are introduced to infants, the range of foods they provide their child with will strongly determine their food variety throughout life.’ Indeed, Mennella and Ventura (8) recommend

interventions to maintain a diverse set of food preferences starting before a child’s birth. As they write, ‘pregnant and lactating women should widen their food choices to include as many flavorful and healthy foods as possible [since] these experiences, combined with repeated exposure to nutritious foods and flavor variety during the weaning period’ (8) will provide a critical foundation for lifelong nutritional choices.

Beyond the impacts of ageing, researchers have credited the variation and commonality of people’s food preferences alternately to genetic influences (9,10), parental behaviour (11) and environmental features such as television programming (12) and exposure to sensory education programmes

## Key notes

- We assessed preferences for how food is presented on plates within and between samples of 23 pre-teen children and 46 parent-age adults.
- Compared with adults, children prefer plates with more elements (7) and colours (6), with entrees placed in the front of the plate and with figurative designs.
- Given that adults often prepare plates of food for children to eat, these findings suggest new windows for encouraging diverse childhood nutrition.

that are focused on fruits and vegetables (13). With regard to interventions that such findings support, it is impossible to modify genetic bases and challenging to impact parenting habits; however, there has understandably been significant attention paid to modifying environmental influences of dietary patterns. Shea et al. (12), for example, recommend a reduction in television viewing, while sensory education programmes (13) support the view that exposure (e.g. through school programmes) can significantly expand the willingness of young children to eat a diverse set of foods.

Previous research concerning the introduction and adoption of eating patterns among infants and young children has tended to focus on environmental variables such as (i) the timing when solid foods are introduced as complements to breastmilk (14), (ii) the degree to which the presence of breastfeeding might variably impact eating behaviour for children later in life (15) and (iii) the question of whether caesarean section deliveries might increase the possibility of food allergies (16). While it is perfectly sensible for research designed to assess and improve nutritional diversity among young children to focus on such environmental variables across institutional settings (17), our contribution is to complement previous work by focusing on the finer-grained, microenvironmental subject of whether variable arrangements of food on plates might favourably impact the adoption of more nutritionally diverse diets.

In this paper, we apply research concerning the influence of microenvironmental cues (e.g. plate size) to the subject of diverse food preferences. While much of the research concerning food preferences – among children and adults – focuses on ‘taste, smell and chemical’ aspects (18), we will build on findings that demonstrate that people appear to be significantly influenced by the shape, size and visual appearance of food that is presented to them (19). Towards this end, we examine how the plating preferences of young children differ from the preferences of parent-age adults. The contrast of age groups in our samples permits us to test for age-based preferences for food presentation, and our findings carry implications for supporting dietary variety for young children.

### THE IMPORTANCE OF FOOD PRESENTATION

Food presentation has been broadly demonstrated to have significant impacts on the ways in which adults eat food. In light of the fact that most of the food that people consume in contemporary societies is presented through ‘intermediate containers’ such as plates, cups or bowls (20), microenvironmental cues clearly should be part of any analysis of eating. In this vein, we draw upon a growing body of research that demonstrates a common preference for people to ‘mindlessly’ eat (21–23) if their environment provides them with opportunities to eat beyond their immediate needs for energy.

While studies about the importance of food presentation have tended to focus on preferences among adults to understand overconsumption, the same principles and literature can be applied to understanding preferences among

children in relation to a diverse diet. For example, Kahn and Wansink (24) report a set of studies in which they find that children and adults tend to consume more food (e.g. M&Ms) when there is a greater variety of options (e.g. differently coloured M&Ms). Similar findings of overconsumption have been made for studies where participants are presented with varied sets of yogurt (25) and combinations of different food, such as chocolate brownies with vanilla ice cream as compared with simply chocolate brownies (26). A converse finding generated by these studies is that the desire to overconsume certain foods (e.g. cake) can be reduced if there are fewer options for intake (27).

To complement research concerning the importance of environmental cues and resources on food consumption, it is interesting to consider results reported by Nicklaus et al. (3,4) from their 17 years of observing the lunch choices made at a nursery school designed for 2-year-olds. Specifically, Nicklaus et al. outline a process whereby the 2-year-olds were free to choose several foods at a time from a wide array of lunch options – with the main conditions that they could not refill their plates before eating everything they had served themselves and they could not serve themselves the same food more than three times during a given lunch. Consistent with large-scale studies that have shown that children enjoy eating fried starchy foods (28), Nicklaus et al. (4) report that vegetables tend to be avoided in the self-service lunches while starchy foods and meat tend to be preferred. With regard to variety on the self-served plates, Nicklaus et al. (3) find that even though energy intake increased between ages 2 and 3, there tended to be a decrease in self-served variety at approximately 2 years and 7 months of age that remained stable through age 3.

In the studies that we describe later, we seek to integrate research concerning the importance of food presentation with findings that show age-specific preferences for dietary variety. More specifically, while Nicklaus et al. (3,4) do not discuss the number of different foods that children placed on their self-served plates and do not manipulate the size of the plates that were offered for the lunches, our studies are designed to assess preferences among children and adults for variably organized plates of food. Beyond seeking to test for differences in the preferences of young children and parent-age adults, our studies permit us to measure for preferences that adults do not typically consider (e.g. seven different foods on a single plate).

### SUBJECTS AND METHODS

#### Subjects

We conducted two studies to assess preferences for food presentation among samples of parent-age adults and young children. For Study 1, we recruited a sample of 23 children (15 girls) who were part of a summer camp in Ithaca, NY. With parental permission provided for each participant, our sample includes 10 European-American, nine African-American, two Hispanic and two Asian-American children from the age of 5 through 12 years old. We can also note that the camp offered subsidies for children from

lower-income families to provide diverse socioeconomic access. For Study 2, we recruited a sample of 46 (25 women) students and employees who were 26 years old or older at Cornell University to focus on parent-age adults.

### Procedure

For Study 1, four researchers occupied different corners of a room at the summer camp and each one of them had one or two different groups of pictures. As an example of the ways in which research among young children is different than studies of adults, we conducted Study 1 on three different days to accommodate the children's relatively short attention spans. Across each of the days, we asked participants to rate their most preferred options for each of the picture categories that we presented. We did not make any reference to the categories to avoid external cues that might have been generated; instead, we specifically presented participants with the stimuli described below and asked them to choose 'which is the picture that you like the most?'

For Study 2, participants completed an online survey in which participants were simply asked to rate their most preferred options for each of the picture categories (e.g. using the same pictures as stimuli).

While previous researchers have not tested for variability in preferences for food presentation, nutritionists have long regarded self-reported food preferences as valid measures that reflect actual consumption preferences and patterns (29). For example, a recent study of children's self-reported preferences for apple fries or French fries shows high validity for predicting actual consumption choices (30).

### Stimuli

Building upon the identification of six dimensions along which food presentation tends to vary (31), we showed arrays of different food images to participants in both studies and we asked them to select which options they preferred. In this section, we itemize and describe how we operationalized the six dimensions of food presentation.

#### Number and mixing of colours

Participants were presented a total of four pictures. Through one of the pictures, participants were asked to choose their favourite among a series of round plates that showed between one and six differently coloured vegetables. And, through a complementary picture, participants were asked the same question for a series of round plates that showed between one and six differently coloured fruits.

In addition, we presented participants with a picture that asked them to choose among three differently coloured sets of mixed vegetables and another picture that asked them their favourite among three differently coloured sets of mixed fruits. Through these pictures, we aimed to test whether preferences varied when differently coloured items were mixed on a plate.

#### Number of different components

Participants were presented with two pictures that each showed an array of seven round plates. In one picture,

participants were asked to choose their favourite from among plates with one through seven food elements of a traditional English breakfast (starting with eggs and gradually adding bacon, sausages, toast, tomatoes, mushrooms and beans). In the other picture, participants were asked to choose their favourite from among plates with one through seven elements of another meal, starting with beef and gradually adding bread along with five different pictures.

#### Position of the main component

Participants were presented with six pictures, half of which were on oval plates and half on round plates. We applied a set of three elements to both the oval and round plates and we used Adobe Photoshop to adjust the relative positioning of the three elements. In one pair of round and oval plates, we variably arranged rice, lamb chops and mashed potatoes. In another pair of plates, we variably arranged broccoli, mashed potatoes and a pork chop. And, in a third pair of plates, we variably arranged carrots, lasagna and lettuce. Figure 1 illustrates the nine sectors of a round plate that we used to variably arrange the relative position of each food element.

#### Crowded plate versus empty plate

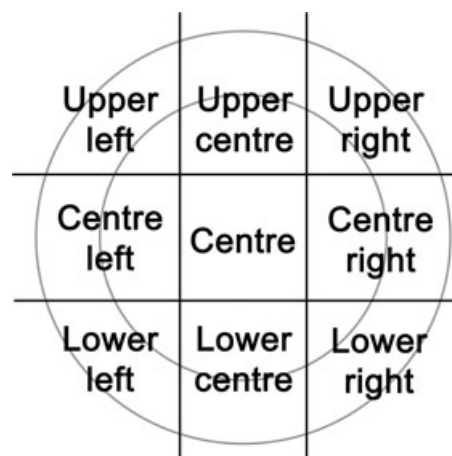
Participants were presented with four pictures that each showed a pairing of the same kind of food. Within each pairing, identical foods were prepared and plated in different ways so that one option provided significantly more 'empty' space than the alternative.

#### Organized versus disorganized

Participants were asked to choose their favourite among four pairs of food arrangements. For each of the four pictures, participants were presented a pair of options that depicted food that was prepared in (i) neat, geometrical patterns or (ii) disorganized, random patterns.

#### Figure design versus casual design

Participants were presented a total of four pictures that each depicted a pair of options comprised by the same food. In



**Figure 1** Different possible entrée positions on round plates.

the 'figure' designs, bacon was arranged as a smile along the lower perimeter of a plate, peas were arranged in a heart shape and cupcakes and cakes were decorated with images. As a contrast to the 'figure' designs, each picture depicting 'casual' designs presented the same foods without any kind of special arrangement.

### Statistical analysis

To analyse our data for the presence of meaningful variation between the two samples (young children and parent-age adults), we conducted chi-square tests to examine whether participants' choices differed significantly from the expected chance distribution. To do this, we first conducted a one-way chi-square test with specific df depending upon the number of choices a participant could select for each variable (e.g. df = 6 for the number of different components on a plate). Then, to see whether a majority of participants significantly preferred one choice over other choices for any given variable, we conducted a one-way chi-square test with 1 df comparing the number of participants who selected the most popular choice with the average number of participants who selected other choices.

Because our first analysis of each variable for each sample produced highly significant differences compared with the expected chance distributions ( $p < 0.001$ ), only results of the second analyses are reported (Table 1). The exception to our approach occurred for the last three variables (e.g. crowded vs. empty plate) for which there were only two choices. In these cases, we simply conducted a one-way chi-square test with 1 df comparing the number of participants who chose the more popular selection with the number of participants who chose the less popular selection.

We rely on this approach to measuring variation between the samples because our approach, which partly tests for consistency within each sample, is more conservative and informative than tests for goodness of fit between the samples. To cite an example from Table 1, we can confidently state that there exists significant variation between the samples for any variable for which we find significant within-sample agreement for different preferences. Likewise, our approach permits us to identify variables where both samples significantly prefer the same values.

## RESULTS

For each of the seven dimensions we examined, Table 1 shows the dominant plating preferences of children and adults. While some preferences are similar, the key differences can be summarized as follows.

### More colours and more components

As indicated in Table 1, our results show that the preferred number of colours on a plate in each of our samples tended to be six for children ( $\chi^2_1 = 40.4$ ,  $p < 0.001$ ) and three for adults ( $\chi^2_1 = 8.18$ ,  $p < 0.01$ ). With regard to the number of elements on a plate, children indicated a significant preference for the maximum number of seven elements ( $\chi^2_1 = 23.0$ ,  $p < 0.001$ ) and adults tended to prefer three items ( $\chi^2_1 = 22.81$ ,  $p < 0.001$ ).

### Entrée in front

With regard to the position of the main component on a round plate, children demonstrated preferences for the lower-right segment on round plates ( $\chi^2_1 = 26.88$ ,  $p < 0.001$ ) and the left portion on oval plates ( $\chi^2_1 = 11.05$ ,  $p < 0.001$ ), while adults rated the central-right segment on round plates ( $\chi^2_1 = 12.51$ ,  $p < 0.001$ ) and the central part of oval plates ( $\chi^2_1 = 28.00$ ,  $p < 0.001$ ) as their top preferences.

### Uncrowded but disorganized

Unlike our first three categories of presentation, we report that children ( $\chi^2_1 = 8.00$ ,  $p < 0.05$ ) and adults ( $\chi^2_1 = 4.89$ ,  $p < 0.05$ ) each tend to prefer plates that include a degree of empty space. Although children ( $\chi^2_1 = 0.94$ ,  $p < 0.05$ ) and adults ( $\chi^2_1 = 17.49$ ,  $p < 0.05$ ) each tend to prefer food presentations that are relatively disorganized, that exception was when the food makes a design. With regard to preferences for 'figure' or 'casual' designs, we report the children demonstrate a preference for 'figure' plates ( $\chi^2_1 = 5.88$ ,  $p < 0.001$ ) and adults register a preference for 'casual' designs ( $\chi^2_1 = 5.619$ ,  $p < 0.001$ ).

## DISCUSSION

The significant differences that we report for presentation preferences within our samples help us appreciate the need

**Table 1** Comparing significant preferences for food presentation between children and adults

	Children's most common preference	$\chi^2_1$	Parent-age adults' most common preference	$\chi^2_1$
Number of different food colours (from 1 to 6)	6	40.4***	3	8.18**
Number of different food components (from 1 to 7)	7	23.0***	3	22.81***
Position of main component of the entrée item (on a round plate)	Lower right	26.88***	Central right	12.51***
Position of main component of the entrée item (on an oval plate)	Left	11.05***	Central	28.00***
Crowded plate vs. empty plate	Empty	8.00*	Empty	4.89*
Organized vs. disorganized presentation	Disorganized	0.94*	Disorganized	17.49***
Figure design vs. casual design	Figure	5.88*	Casual	5.619*

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

for age-appropriate strategies that support healthful eating. Our findings support the view that children are not simply 'little adults'. We instead find that adults should not assume that children share their preferences for food presentation. Most especially, we are struck by the finding that young children appear to prefer plates that feature a wide variety of foods and colours in comparison with adult preferences. In fact, these results should open a window of possibilities for those concerned with childhood nutrition because it would appear as if young children have a preference – to which adults do not typically cater – for very diverse food presentations.

The present studies, of course, have limitations that future research should address. For example, future studies that draw upon larger sample sizes will be able to gain finer-grained assessments of the contrasts that might exist for food preferences within and among smaller age ranges (e.g. comparing infants and toddlers). In light of the self-service studies conducted with 2-year-olds by Nicklaus et al. (3,4), for example, it is worth testing the extent to which neophobic 2-year-olds might differ in their responses to our questions compared with less neophobic 3-year-olds. Similarly, in the light of Dovey et al.'s (5) observation of a decline in food neophobia after age six, it would be worthwhile to focus on that age boundary as well.

With regard to the design of our stimuli, we recognize that our sample of children indicated a preference for the maximum number of elements on a plate and the maximum number of colours on a plate. Consequently, future studies should explore the extent to which there is an upper limit on the variety that children prefer to see on plates. Likewise, with regard to assessing preferences for the position of food on a plate, future studies should control for handedness (e.g. in case right-handed individuals prefer food on the right side of a plate more frequently than left-handed individuals).

More generally, while our studies were designed to control for variables such as smell, taste and participant hunger, future studies need to test the extent to which preferences for food presentation translate to consumption. It is clear from our review of the importance of food presentation among adults that individuals are influenced – mindlessly or not – by their eating environments and tools. Consequently, a field test of our findings would permit us to understand whether or not children's visual preferences correspond with actual eating behaviour when given the chance to consume 'the picture they like the most'.

Given the practical implications that are suggested by our preliminary research, it is clear that further investigations of preferences for food presentation among children are warranted. Specifically, the differences that we find between preferences among adults (i.e. the people who typically provide food for children) and children make it clear that we need a better window into young children's predilections if we are going to align goals of healthy nutrition with age-specific preferences. While there is robust evidence and experience that parents face difficulty introducing new foods (e.g. vegetables) to young children, our studies lend hope that

introducing a wide array of new foods at the same time (i.e. on the same plate) might yield the non-intuitive outcome that nutritional diversity increases. In fact, if nutritional diversity did not increase in any experiment where children were presented with a wide variety of foods, then our finding of a preference for the appearance of diverse food presentations becomes a puzzle and – more practically – the cost of wasting food would become an important factor.

The stakes for future investigations are clearly high because the findings presented in this paper have potential implications for parents, caretakers and paediatricians as well as food service managers for paediatric hospitals, child care centres and schools. Within more specific populations, future studies should also consider the extent to which preferences for diverse food presentations might have importance and special value for addressing the dietary patterns that children with chronic diseases as well as autistic children tend to demonstrate (32). For all of these settings and groups, commercial interests would seem to benefit from consideration of products (e.g. plates) that are aligned with children's preferences (e.g. for as many as eight different elements).

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