



## Research report

# Timing of serving dessert but not portion size affects young children's intake at lunchtime <sup>☆,☆☆</sup>



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## ABSTRACT

The purpose of this repeated exposure, randomized, cross-over quasi-experimental study was to determine the individual and combined impact of (a) the timing of serving dessert and (b) portion size of main course in 2–5 year old children ( $n = 23$ ) on energy intake at lunch in a childcare setting. Children were served two study lunches (fish or pasta, each with dessert) twice a week for 12 weeks that differed in the timing of dessert (served with or after the main course) and portion size of the main course (reference portion or 50% larger portion). Analyses of variance revealed that serving dessert after the meal resulted in higher energy intakes from both the main course and from dessert, and therefore greater total intake at the meal. Portion size of the main course did not influence total energy intake at the meal. Results indicate that the timing of serving dessert affects children's energy intake regardless of the portion size of the main course. Specifically, serving dessert with the meal reduces total energy intake regardless of the main course portion size. This suggests that offering dessert with the main course may be an effective strategy for decreasing total energy intake at meals in preschool-aged children.

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## Introduction

It has been established that American children 2–5 years of age consume excess amounts of solid fats and added sugars (SoFAS) (Ball, Benjamin, & Ward, 2008). Desserts are a standard part of Western cuisine and contribute to SoFAS in children's diets. In 2–18 year olds, grain desserts (cakes, cookies, donuts, pies, crisps, cobbles, and granola bars) are the top source of energy (138 kcal/day), the second major source of solid fats (43 kcal/day from solid fat), and the third major source of added sugars (40 kcal/day from added sugars) with dairy desserts being the fourth major source of added sugars (29 kcal/day from added sugars) (Reedy & Krebs-Smith, 2010). Within any given day, about 85% of children 2–3 years of age consume some type of sweetened beverage, dessert, sweet, or salty snack (Fox, Condon, Briefel, Reidy, & Deming, 2010). The question of how dessert influences children's total energy consumed at meals has not been adequately examined.

Between the ages of 2 and 5 years old food intake is correlated with food preferences, which are established by the age of four (Kuhl, Clifford, & Stark, 2012). Innately, young children prefer sweet tastes, which likely contributes to their preference for and intake of a wide variety of desserts (Kuhl et al., 2012). Children also readily form preferences for high fat foods, which are commonly served as dessert (Birch, 1992; Cooke & Wardle, 2005). Since these types of foods may have high reward properties to stimulate eating even in the absence of hunger, modifying the timing of serving dessert might be particularly powerful in preschool aged children who have demonstrated a strong preference for high-fat and high-sugar foods commonly served as dessert (Birch, 1992; Cooke & Wardle, 2005; Kuhl et al., 2012). To determine if modifying when dessert is served would have an impact on children's total energy consumed at meals, the portion size of the meal must be increased to determine if children will increase intake at a meal.

Secular trends reveal increases in the average portion size of foods consumed by children over time (Briefel & Johnson, 2004; Fisher & Kral, 2008). However, being exposed to ever-increasing portion sizes may have contributed to what is now perceived as age-appropriate portion sizes for children in schools (Howell Davies et al., 2008) as well as at home (Crocker, Sweetman, & Cooke, 2009). Experimental evidence supports the idea that large portions promote excessive energy intake at meals. In single meal studies, researchers have shown that increasing the portion size of an entrée increased children's total energy intake at the meal by 13–39% (Fisher, 2007; Fisher, Arreola, Birch, & Rolls, 2007; Fisher, Liu, Birch,

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& Rolls, 2007; Fisher, Rolls, & Birch, 2003; Rolls, Engell, & Birch, 2000; Savage, Fisher, Marini, & Birch, 2012). Research has also shown that increases in portion size at a meal either increased total daily energy intake (Cecil et al., 2005; Fisher, Arreola, et al., 2007) or showed that children are able to self-regulate total daily energy intake throughout a given day (Lown et al., 2011). However, the influence of dessert being served with the main course on children's intake of the main course has been understudied to date.

This research systematically compared serving dessert with versus after the main course and evaluated whether the effects differed based on the portion size of the main course. To determine if the timing of serving dessert would alter a child's intake, the size of the large portion was anticipated to be sufficient enough to avoid experimentally induced restriction of intake (50% larger than reference portion) (Fisher, Liu, et al., 2007). We hypothesized that total energy intake would decrease if dessert were served with the main course. If a larger portion of the main course were served at lunchtime, then intake of the main course and total energy intake would increase (Fisher, 2007; Fisher, Arreola, et al., 2007; Fisher, Liu, et al., 2007; Fisher et al., 2003; Rolls et al., 2000; Savage et al., 2012) especially when dessert were served after the main course.

## Methods

### Participants

Participants were recruited through flyers that were given to parents of children attending the Ben and Maxine Miller Child Development Laboratory School, a childcare center for children at Purdue University (West Lafayette, Indiana). Eligibility was restricted to children between the ages of 2–5 years old who attended childcare for the full day. Exclusion criteria included the presence of food restrictions, food allergies, or digestive diseases, such as Crohn's Disease or Cystic Fibrosis. Twenty-three children (17 boys and 6 girls) from four different classrooms were consented into the study. Each parent provided information on his or her child's demographic background (see Table 1).

### Design

A randomized, repeated exposure, crossover, quasi-experimental design study with three within-subject factors (meal, timing of serving dessert and portion size) was employed. Each participant in each classroom received each of the four treatments four times (8-week intervention  $\times$  2 days/week = 16 intervention days/4 treatments = 4 times). The researchers randomly assigned the

**Table 1**  
Sociodemographic characteristics of total sample population of 2- to 5-year-olds ( $n = 23$ ).

Sociodemographic variables	<i>n</i>	%
<i>Sex (n = 23)</i>		
Boys	17	73.9
Girls	6	26.1
<i>Age<sup>a</sup> (n = 23)</i>		
2	6	26.1
3	7	30.4
4	5	21.7
5	5	21.7
<i>Race (n = 23)</i>		
Asian	7	30.4
Caucasian	13	56.5
Other	3	13.1

<sup>a</sup> No statistically significant associations were found between sex or race and age (Fisher exact test,  $P > 0.25$  for both).

classrooms to one of the four possible combinations of portion size and timing of dessert (reference portion, dessert with lunch; reference portion, dessert after lunch; large portion, dessert with lunch; or large portion, dessert after lunch) on each day. In one given day, the children in one classroom were undergoing the same treatment. For 12 weeks (4 week baseline and 8 week intervention), the children received fish on Thursdays and pasta on Fridays. Randomization was not conducted for all weeks of the study to assure that each classroom had equal amounts of repeated exposures. Mondays to Wednesdays remained as the regular 4-week menu rotation as these days and foods were not part of the study. The first 4 weeks of the study period acclimated children to the researchers and the activities involved in plate-waste measurement. Thus, data were based on weeks 5–12 of the study, which represented two 4-week menu rotations.

### Experimental meals

The two lunches chosen were baked freshwater fish (Thursdays) and pasta (Fridays) based on lunches teachers observed to be most liked by the children, which foods parents knew to be liked and disliked by the children, and which foods foodservice staff could most easily increase the reference portion size by 50% (Tables 2 and 3 and Fig. 1). Although fish is not usually considered a meal preference by children, many children that attended the childcare center were of Asian descent and were accustomed to eating fish.

The study lunches were already part of the childcare's 4-week menu rotation. The study lunches were not served on non-study days during the experiment. The 4-week menu rotation was modified so the study lunches were served every week for the duration of the study (12 weeks). The reference portions of the childcare meals were based on the United States Department of Agriculture Food and Nutrition Service Child and Adult Care Food Program Child Meal Pattern for Lunch for 1–2 year olds and 3–5 year olds, respectively (Foland & Graves, 2008). The reference portions of

**Table 2**  
Child meal pattern for "Fish Thursday" reference portion versus large portion.

Meal component	2 Years		3–5 Years	
	Reference	Large	Reference	Large
2% Milk <sup>a</sup>	½ Cup	½ Cup	¾ Cup	¾ Cup
Mixed vegetables	¼ Cup	½ Cup	½ Cup	¾ Cup
Orange	¼ Cup	½ Cup	½ Cup	¾ Cup
Rice	¼ Cup	½ Cup	¼ Cup	½ Cup
Fish	1 oz	1½ oz	1½ oz	2¼ oz
Chocolate chip cookie <sup>a</sup>	1 Cookie	1 Cookie	1 Cookie	1 Cookie
Total energy (kcal)	325	488	400	600

<sup>a</sup> 2% Milk and chocolate chip cookie were not increased by 50% for the larger portion size.

**Table 3**  
Child meal pattern for "Pasta Friday" reference portion versus large portion.

Meal component	2 Years		3–5 Years	
	Reference	Large	Reference	Large
2% Milk <sup>a</sup>	½ Cup	½ Cup	¾ Cup	¾ Cup
Mixed vegetables	¼ Cup	½ Cup	½ Cup	¾ Cup
Mixed fruit	¼ Cup	½ Cup	½ Cup	¾ Cup
Pasta	¼ Cup	½ Cup	¼ Cup	½ Cup
Meat sauce	1 oz	1½ oz	1½ oz	2¼ oz
Chocolate chip cookie <sup>a</sup>	1 Cookie	1 Cookie	1 Cookie	1 Cookie
Total energy (kcal)	330	495	400	600

<sup>a</sup> 2% Milk and chocolate chip cookie were not increased by 50% for the larger portion size.

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