



## Differences in preschool-age children's dietary intake between meals consumed at childcare and at home

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### ABSTRACT

Preschool children need optimal nutrition, including a variety of nutrient-dense foods, for growth and development. The purpose of this study was to determine differences in foods and nutrients consumed at childcare and home environments. Children ages 3-to-5 years ( $n = 90$ ,  $3.8 \pm 0.7$  years; 56% female) from 16 childcare centers participated in this cross-sectional study from 2011 to 2014. Lunches at childcare were observed for two days; three days of dinners at home were reported by caregivers. Nutrient-dense and energy-dense foods were counted and nutrient content of meals was determined using FoodWorks®. More servings of fruit ( $0.92 \pm 0.82$  vs.  $0.15 \pm 0.26$ ;  $p \leq 0.0001$ ), vegetables ( $1.47 \pm 1.43$  vs.  $0.62 \pm 0.60$ ;  $p \leq 0.0001$ ), and low-fat dairy ( $0.83 \pm 0.32$  vs.  $0.07 \pm 0.19$ ;  $p \leq 0.0001$ ) were consumed at childcare than at home. More servings of high-fat, high-sugar foods ( $0.08 \pm 0.18$  vs.  $0.43 \pm 0.39$ ,  $p \leq 0.0001$ ) and sugary drinks ( $0.22 \pm 0.41$  vs.  $0.39 \pm 0.35$ ,  $p \leq 0.001$ ) were consumed at home than at childcare. There were no differences between environments in whole-grains, high-fat meats, or high-fat high-sugar condiments consumed. On average, children consumed  $333.0 \pm 180.3$  kcal at childcare and  $454.7 \pm 175.3$  at home ( $p \leq 0.0001$ ). There were no differences in macronutrient profiles or in iron, zinc, folate, or vitamin B6 intake. More calcium ( $86.2 \pm 44.6$  vs.  $44.6 \pm 22.2$  mg/kcal,  $p \leq 0.0001$ ) and vitamin A/kcal ( $56.1 \pm 36.9$  vs.  $26.5 \pm 24.2$  RAE/kcal,  $p \leq 0.0001$ ) were consumed at childcare than at home. Preschool children are consuming more nutrient-dense foods and a more servings of fruit and vegetables at childcare during lunch than at home during dinner. Childcare and parents should work together to provide early and consistent exposure to nutrient-rich foods to ensure optimal nutrition for developing children.

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### 1. Introduction

Dietary habits developed in early childhood serve as a foundation for future preferences and intake (Savage et al., 2007), and are difficult to modify as children age (Birch, 1999). Familiar eating environments, such as the home and childcare, influence the formation of children's dietary habits (Ziegler et al., 2006). The home food environment and feeding practices affect dietary quality and, ultimately, the child's health (Couch et al., 2014; Skouteris et al., 2011; Jones et al., 2014). While parents undeniably have great impact on children's eating habits, 11 million young children attend childcare daily (Child Care in America, 2014) and are influenced by the childcare food environment (Kharofa et al., 2015). In the U.S., childcare centers are required to meet dietary quality standards (United States Department of Agriculture, 2015; Oklahoma Department of Human Services, 2016), while meals served

at home are not subject to regulation. Dietary quality standards vary based on participation in the Child and Adult Care Food Program (CACFP) and state licensure requirements, if a center does not participate in the CACFP. Researchers report that children in childcare over-consume foods high in fats and sugar (Benjamin Neelon et al., 2012), while under-consuming fruit, vegetables, grains, and fiber (Briley et al., 1999; Gubbels et al., 2014).

Studies contrasting dietary intake of young children at home and childcare are limited (Ziegler et al., 2006; Briley et al., 1999; Gubbels et al., 2014; Bernardi et al., 2010; Bruening et al., 1999; Sepp et al., 2001; Worobey et al., 2005). Half were conducted outside the U.S. (Gubbels et al., 2014; Bernardi et al., 2010; Sepp et al., 2001), and those in the U.S. were published at least 10 years ago (Ziegler et al., 2006; Briley et al., 1999; Bruening et al., 1999; Worobey et al., 2005). Additionally, of those studies conducted in the U.S., only one indicated whether or not childcare centers participated in the CACFP (Bruening et al., 1999) and another included Head Start Centers which necessitates participation in CACFP since they serve a low-income population (Worobey et al., 2005). Discrepancies among the dietary intake findings in infant, toddler, and preschool-age children could be attributed to the

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global reach of the locations and the outdated time frame. However, findings are inconsistent. Higher fats and sweets were generally consumed at home (Briley et al., 1999; Bruening et al., 1999; Sepp et al., 2001), although one study reported more sweet snacks consumed at childcare (Gubbels et al., 2014). Two studies found that more vegetables were consumed at home (Briley et al., 1999; Gubbels et al., 2014), while another observed that more vegetables were consumed at childcare (Bruening et al., 1999). Energy intake was equivalent between environments (Ziegler et al., 2006; Gubbels et al., 2014; Bernardi et al., 2010), or higher at home (Sepp et al., 2001; Worobey et al., 2005). Researchers reported that either macronutrient profiles (percent carbohydrate, fat, protein) were the same in both environments (Ziegler et al., 2006; Worobey et al., 2005), more fat and protein was consumed at home (Gubbels et al., 2014; Bernardi et al., 2010), or more fat was consumed at childcare (Sepp et al., 2001). Some reported that more micronutrients were consumed at childcare than at home (Ziegler et al., 2006; Bruening et al., 1999), while others noted equivalent micronutrient consumption in both environments (Briley et al., 1999; Sepp et al., 2001). Regarding those findings that could discern between CACFP-participating centers and homes, the centers provided lower fat (Bruening et al., 1999), more vegetables (Bruening et al., 1999), lower energy (Worobey et al., 2005), and more micronutrients (Bruening et al., 1999) compared to homes. Of the study conducted in the U.S. that reported higher vegetable intake at home, CACFP participation was not indicated (Briley et al., 1999). Given the inconsistency across studies and need for a current understanding of dietary patterns among young children in the U.S., the purpose of the present study was to determine differences in foods and nutrient intake between meals consumed by preschool-age children at childcare and at home. We hypothesized that more nutrient-dense meals would be consumed at childcare than at home.

## 2. Methods

### 2.1. Study design

This cross-sectional study involved 3-to-5-year-old children and their parents from 16 childcare centers across Oklahoma. Data collection occurred from 2011 through 2014. All study procedures were approved by the University Institutional Review Board.

### 2.2. Recruitment

Licensed childcare centers that provided full-time care and a lunch meal to preschool children were eligible. Participation in CACFP was not a requirement and was not recorded as part of data collection. Oklahoma state licensure requirements for childcare state that centers must provide meals consistent with the CACFP (Oklahoma Department of Human Services, 2016). Centers were contacted via phone to determine interest and eligibility. Thirty-three centers were contacted; 13 were not eligible, eight had scheduling conflicts, and 16 participated. Three-to-five-year-old children enrolled at participating centers were eligible. Caregivers completed a consent form and reported demographics, including the child's age, sex, and race. Socio-economic status of the families was not reported. Although, in Oklahoma, 23% of families with children < 5 years are living below the poverty threshold (United States Census Bureau, 2016). Approximately 1/3 of residents live in rural areas, and 18% are uninsured (United States Census Bureau, 2016). Of 508 eligible children, 252 consented to observation at childcare, and 90 agreed to participate in phone interviews.

### 2.3. Dietary intake at childcare

Plate waste was observed using the Dietary Observation for Child Care (DOCC) (Ball et al., 2007) tool to assess all foods and beverages consumed during lunch at childcare. Trained researchers received plate waste proficiency via training and passed a plate waste practical

exam. There was high reliability between observers across foods (ICC = 0.968,  $p < 0.001$ ) before observations in the field. Each researcher observed foods served, traded, spilled, and additional servings, and subtracted food remaining, for up to three children during one lunch meal (Ball et al., 2007). Food and recipe details were obtained. Researchers aimed to conduct two observations for each child which would be averaged for analyses; however, 21 children had a single observation. Using a dependent *t*-test, there was not a significant difference for intake during day one and day two; therefore, day one values were imputed for day two for those 21 children. Day one and day two values were then averaged for data analyses.

### 2.4. Dietary intake at home

Information about dinner at home was collected from caregivers during a telephone interview using the 3-Dinner Dietary Recall (3DDR) form that was developed for this study. Researchers were trained on standard recall interview techniques and procedures (Thompson and Byers, 1994) and engaged in ample practice before participating in data collection with caregivers. Trained researchers asked caregivers to recall foods the child consumed during the previous three dinner meals. Parents were prompted to recall easily forgotten foods, such as condiments, and probed for food preparation methods and brands. Interviewers used a guide to help caregivers visualize volumes of foods using common household goods (i.e., ping-pong ball equals two tablespoons). Researchers aimed to obtain three days of dinner recall for each child which would be averaged for analyses; however, 11 children had only two days. For those children with three dinner recalls, using a repeated measures Analysis of Variance, there was not a statistically significant difference across days. Similarly, there was no significant difference for dietary intake between weekdays and weekend days using a dependent *t*-test. Therefore, for those 11 children with two recalls, an average of day one and day two was imputed for day three. Day one, two, and three values were then averaged for analyses.

### 2.5. Dietary intake data processing

Foods consumed (fruit, vegetables, low-fat dairy, whole-grains, high-fat meats, high-fat high-sugar foods, high-fat high-sugar condiments, and sugary drinks) were counted. The criterion for each category is in Table 1. Each food was counted as one serving rather than using actual volumetric serving size. This approach errs in favor of the caregiver who provides a variety of fruits and vegetables, although each independently may not constitute a complete serving. For example, if a mixed vegetable recipe was served, each vegetable included was counted separately as one serving. Energy (kilocalories), macronutrients (carbohydrate, protein, fat), and micronutrients (calcium, iron, zinc, vitamin A, folate, vitamin B6) were determined using FoodWorks® (The Nutrition Co., Long Valley N.J.) and the United States Department of Agriculture food database. Macro- and micronutrients were examined relative to energy consumed, so that differences in the energy content of the meal were attenuated.

### 2.6. Analysis

Descriptive characteristics (mean  $\pm$  SD and frequency) were calculated. Dependent *t*-tests were conducted to determine the differences in foods and nutrients consumed during meals at childcare and at home. There were 19 dependent variables examined; thus, the alpha was adjusted, using the Bonferroni method for significance ( $p < 0.003$ ). Data were analyzed using SPSS Statistical Analysis Software (IBM Corporation, Somers, NY).

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