



# Can providing a morning healthy snack help to reduce hunger during school time? Experimental evidence from an elementary school in Connecticut



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## ABSTRACT

While children may be naturally inclined to regulate their hunger, they are also guided by adults and influenced by environmental constraints regarding when and how much to eat. As such, the timing and availability of meals could alter a child's natural eating habits. This could impact the nutritional quality of what they eat as well. We conducted a field experiment with three fourth grade classes at a public elementary school in Eastern Connecticut to analyze if providing a nutritious snack one hour prior to lunch effects a child's level of hunger and consequently their lunch-time consumption. We found students shift their caloric and nutrient intake from lunch to snack time. In addition, we found a significant reduction in student hunger. Our results highlight the importance in considering the timing and quality of meals provided during school time. In our sample, current snack and lunch schedule may not be optimal and changing it can have an impact on the wellbeing of students. Providing healthful options for snack could be an effective way to improve student diets while preserving their ability to make their own choices.

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## 1. Introduction

Childhood obesity is becoming a public health issue in most developed countries. Obese and overweight children are more likely to stay obese in adulthood and more likely to incur non-communicable diseases like diabetes and cardiovascular disease as adults (WHO, 2012). As a result, numerous obesity prevention studies seek to find appropriate policy interventions to alleviate behavioral and environmental factors positively related to obesity.

As school-age children spend a large share of their day in school, adapting the school food environment may be an ideal way to help promote healthful behavior such as selecting healthful food choices. To this end, the federal government has taken several steps over recent years to help improve the school food environment. In 2010, the Healthy, Hunger-Free Kids Act was implemented. Among other things, the act directed the US Department of Agriculture

(USDA) to update nutrition standards for all foods and beverages sold in schools. There are concerns, however, that such nutritional standards are not enough (The Pew Charitable Trusts, 2012).

The nutritional quality of the food a child eats at school may have important effects on their health and academic performance. For instance, food insufficiency has been found to be associated with significantly poorer cognitive functioning, academic achievement and school attendance (Taras, 2005). Kleinman et al. (1998) found food deprivation to be related to psychosocial dysfunctions among poor children. Beyond academic performance, lower eating frequency is associated with higher body weight status in children and adolescents, especially in boys (Kaisari, Yannakoulia, & Panagiotakos, 2013). This is particularly relevant in the US given alarming rates of childhood obesity. Hunger has clear and important implications for the health and school performance of children. Yet, in a survey of public schoolteachers, 80 percent declared students come to school hungry one or more times each week and most of them rely on school meals as their primary source of nutrition (No Kid Hungry Share our Strength, 2012).

Before the school day starts, children have the opportunity to eat breakfast at home, although some do not do so or eat an

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insufficient breakfast. At public schools, children also have the opportunity (but not the obligation) to eat breakfast at school, with some children receiving free or subsidized breakfasts. Then children have lunch where they obtain their meals from two primary sources: from the school or from their own home. In most schools, it is not the school's responsibility to provide a snack between breakfast and lunch. As a result, some students may not eat their first meal until lunch time if they fail to bring a snack. Further, the quality and quantity of food a child brings is determined by their parents and might not be sufficient. Even if children are provided access to more healthful foods, such as through the National School Lunch Program (NSLP), they may still be hungry by the time it is provided and make poor food choices as a result.

Children demonstrate a natural ability to self-regulate food intake in response to caloric density cues (Birch, McPhee, Shoba, Steinberg, & Krehbiel, 1987). At the same time, however, adult verbal communication may override response to such cues (Birch & Fisher, 2000; Ramsay et al., 2010). Consequently, the eating schedule and food availability in schools might also affect children's natural response to hunger.

The main objective of this study is to analyze what effect a child's level of hunger has on their lunch-time choices. Previous research on school lunch programs has suggested that changing the food environment can have an impact on what children choose to eat (Hanks, Just, & Wansink, 2013; Wansink, 2011). As such, we also examine if providing children a healthful, nutritious snack prior to lunch has an influence on their lunch-time consumption. We expect that providing a snack might reduce students' hunger level. In turn, this may help students to control for possible hunger driven consumption behavior during lunch time. In particular, students may consume more healthful food items while at school.

## 2. Materials and methods

We observed students over two school weeks (10 days) at a public elementary school in Eastern Connecticut in the Fall of 2012. Given limited resources, we were able to work with three fourth grade classes. A primary concern was that the students needed to be independent readers so that they could participate in the survey without assistance. Another concern was the maturity level of the participating students given the added distraction of the experiment. School administrators helped select these classes based on their ability to participate in the experiment with respect to time constraints and academic ability. The institutional review board (IRB) approval for our study was issued by the University of Connecticut in the summer of 2012. We obtained parental permission to observe and interact with 24 students (10 boys and 14 girls) prior to implementing our experiment. In addition, we "passively" observed with no direct interaction, the remaining students who did not provide parental permission. In the end, we had a total of 44 students.

Over the entire study period, we observed the children during snack and lunch time and used nametags to track participating students. Each day prior to snack, all the children were provided with a brief survey asking whether they ate breakfast that day. In the morning before snack and after snack, the children were asked to rate their level of hunger using a simple 5-point rating scale (Fig. 1). The responses are used to control for child hunger levels from day to day.

Each day, we visually recorded what the children brought for snack and estimated what they ate by taking a digital picture before and after they consumed their snack. Snack time was roughly 2 h after the children arrived at school and 1 h prior to lunch. During lunch, we also observed what the children brought from home or bought at school and what they ate. Children who buy lunch at

school are able to choose among a hot lunch served at the lunch line or an alternative such as cereal lunch, peanut butter and jelly sandwich lunch, or salad lunch. For children who bought a school lunch, we took a picture of the items they selected in the lunch line and a picture of how much of their lunch they ate and specifically what they ate. For children who brought their lunch, we recorded what they brought and measured how much they ate and what they ate of their homemade lunch.

During the second week of the study, we provided Classes 1 and 2 with a snack around one hour prior to their lunch time during their normal snack time. The snack came in a snack bag and consisted of pre-sliced apple (58 g), a snack bag of carrots (45 g), a cheese stick and half pint of 1 percent low fat milk. Children continued to bring in their own snack if they wanted and were not required to eat the snack we provided. We continued to measure what the children brought and ate for snack and lunch using the same procedures. We continued to track the control class that did not receive the snack during the second week.

After the two week period, we used the digital pictures we collected to build a dataset identifying the nutritional content (calories fat, carbohydrates, fiber, sugar and proteins) of the foods students brought and ate during snack and lunch time for each of the subjects over the two weeks. Some students were absent from school or left after snack and prior to lunch. If the student left early, we eliminate their entire day observation.

To determine nutritional content of food items brought from home we use various online databases and product websites. Many of the foods students brought were in product packaging so it was relatively simple to identify nutritional content. For non-packaged items, we relied on the USDA's National Nutrient Database which provides nutritional information for over 8 thousand foods. In some cases, it was difficult to determine the content of homemade food items such as sandwiches. In that case, we would compile the nutritional content based on the observed product characteristics. For example, for a peanut butter sandwich, we would include the nutritional content of two pieces of white (or wheat) bread and a serving of peanut butter.

The school provided us the standard size of the portions served for the school lunches. We would then determine the nutritional content using online sources and referencing the nutrition labels in the kitchen. While there is clearly room for measurement error, we attempt to be as consistent as possible. In some cases, students often brought repeat meals, e.g. a peanut butter sandwich every day. To some extent, this helps to minimize the effect of measurement error for a specific student.

To estimate how much each student eats during lunch and snack, we used the digital pictures to estimate the percentage of each item eaten. We then calculate the amount of nutrients and calories eaten by each subject during a given meal and day by multiplying the total nutritional content of each food item by the percentage eaten. For consistency, we estimate the percentage of food eaten using multiples of 5 between 0 and 100. We show an example of before and after pictures taken during the experiment (Fig. 2).

Our final dataset is an unbalanced panel containing nutrients and calories consumed over ten school days by the 24 students during snack and lunch time for a total of 458 observations after removing missing observations. For each student, we also have survey response data before and after the snack each day.

### 2.1. Data analysis

Given the numerous ways to examine consumption by students, we explore the effect of the snack treatment on several different dependent variables (Table 1). For model 1, we examine if the

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