

Eat Lunch First or Play First? Inconsistent Associations with Fruit and Vegetable Consumption in Elementary School



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ARTICLE INFORMATION

Article history:

Accepted 3 October 2014
Available online 6 December 2014

Keywords:

School lunch
Recess
Fruit intake
Vegetable intake
Child

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<http://dx.doi.org/10.1016/j.jand.2014.10.016>

ABSTRACT

Scheduling play before eating lunch has been suggested as a relatively simple environmental strategy to increase fruit and vegetable (FV) intake among elementary school students. However, the few small studies to date have had mixed findings. The primary aim of this observational study was to evaluate the possible relationship between the relative order of play and eating and students' lunch intake of FV. A secondary aim was to examine whether any differences existed in this relationship by student sex, ethnicity, language spoken at home, and school lunch source. A diary-assisted 24-hour recall was collected during the 2011–2012 school year from 2,167 fourth- and fifth-graders attending 31 elementary schools in California. The association of play before eating with FV intake was estimated using Generalized Estimation Equations. Overall, lunch FV intake was not significantly higher for students who had a play-before-eating vs a play-after-eating lunch schedule at school. However, variables included in the model showed significant interaction with play before eating, resulting in the need for separate effect estimates for distinct strata based on sex, ethnicity, language spoken at home, and school lunch source. For 10 of the 16 strata, no significant effect of play before eating was observed on lunch FV intake, while increases in intake were observed in four strata and decreases in two strata. Before rescheduling play before eating for the purpose of improving student FV intake, additional research is recommended.

J Acad Nutr Diet. 2015;115:585–592.

FRUIT AND VEGETABLE (FV) INTAKES ARE INADEQUATE in the United States. In 1999–2002, US children 6 to 11 years old consumed <2 cups FV per day; a majority (74.1% for fruit, 83.8% for vegetables) did not consume recommended amounts.¹ There is evidence that low socioeconomic status has a negative impact on FV intakes.^{1–3} The health benefits associated with consuming more FV⁴ and the tracking of dietary behaviors into adulthood^{5,6} are reasons to increase FV intakes among youth. Most FV interventions targeting children have been school-based, resulting in modest increases in FV intake on the order of 1/6 to 1/2 cup/day.⁷ While multifactorial interventions of at least 1 year in duration that include students, staff, and parents as well as the school food environment have shown the most promise, they also require substantial resources.^{7,8} Relatively simple, inexpensive, and sustainable environmental school strategies are needed to increase student FV intake.

One potential strategy involves reordering the timing of play and eating during the lunch period.⁹ While in 2000, only 5% of US elementary schools scheduled play before eating lunch for all students,¹⁰ many states have recently recommended this practice, and one state requires that elementary schools serve lunch after playtime.¹¹ It has been hypothesized that students who are physically active before eating lunch may consume more because they are hungrier after playing,

are less concerned about the discomfort of playing with a full stomach, or have more time to eat, as lunch lines may be reduced and students are not in such a hurry to get to the playground.^{12–14} Findings to date have been mixed when schools have switched from play after to play before eating lunch, variously showing an increase in FV intake,^{12,15} no change in FV intake,^{14,16} or a decrease in FV intake.¹⁷ However, studies have generally been short-term (measures taken days after a schedule change), involved few schools (only one), not included a control group, and not examined whether impacts vary according to student characteristics.

The primary aim of the current study was to evaluate the relationship between the timing of play (before vs after eating lunch) and the intake of FV at school, using baseline data from an intervention trial. A secondary aim was to examine whether any differences existed in the relationship between order of play and eating time, with FV intake by student sex, ethnicity, language spoken at home, and school lunch source (purchased at school or brought from home).

METHODS

Study Design

Data were collected in 2011–2012 as part of a cluster randomized controlled trial to evaluate the effectiveness of the

California Children's Power Play! Campaign, a school-based educational intervention to promote FV intake and physical activity among fourth- and fifth-grade children in low-resource elementary schools in California (A. Keihner and colleagues, unpublished data, 2014). No changes were made to the school cafeteria or lunch schedule. Inclusion and exclusion criteria were developed, with the goal of obtaining a sample of elementary schools with a diverse student body that would be similar to other low-resource public schools in California. Schools were omitted from recruitment based on the following: not having fourth- or fifth-grade classes; having <30 students per grade; having received the planned or similar intervention in the year prior; district saturated with other wellness activities; district refusal to participate; and having characteristics (location bordering Mexico, being a juvenile detention school) that could limit generalizability of findings. For inclusion, schools needed to have $\geq 50\%$ of the student body qualify for free and reduced-price school meals. From an initial list of 221 elementary schools in San Diego and Imperial counties, the 131 eligible for participation were contacted by e-mail, phone, and a mailed letter to each principal. In some instances, study staff visited the school to meet the principal. The first 45 schools that agreed to participate were included in the study. The intervention study was reviewed and approved by the Institutional Review Board of the Public Health Institute; the present study was deemed exempt by the Committee for the Protection of Human Subjects at the University of California, Berkeley.

Baseline data were collected from students at 45 elementary schools. All fourth- and fifth-grade students in each school were eligible to participate, except in one exceptionally large school, where 6 of 14 fourth- and fifth-grade classrooms were randomly selected to participate. Subsequently, 1 school discontinued participation due to a fire, leaving 44 schools from six school districts. For this analysis, 13 schools were excluded because dietary information was collected on a minimum day. Minimum days do not follow the standard play and eating time structure and, therefore, result in an undefined exposure of interest. The final analytic sample consisted of baseline data collected from 2,167 children in 31 schools from four school districts.

Data Collection

The exposure of interest, the order of play and eating during the lunch period, was determined by querying school foodservice staff. School foodservice staff at each school were asked the following question, with the response recorded by research staff on an environmental inventory tool: For the fourth- and fifth-graders, is their play time before or after they eat lunch? The outcome of interest, student FV intake during school lunch, was computed using a 24-hour diary-assisted recall conducted on a school day and information on school foods collected by interviewing school foodservice staff, as described previously.¹⁸ Student demographic data (sex, ethnicity, language spoken at home) were obtained by student survey. The survey was completed in the classroom with guidance from research staff. Students participated in a training session on how to record their food intake. Methods of recording what, when, and how much was eaten were emphasized. Each child received a set of measuring cups and spoons for portion size measurement. Within 2 days of

completing the food diary, a trained dietary interviewer conducted a recall interview individually with each child using the multiple-pass method.¹⁹ Food models were used to clarify portion sizes and details on forgotten foods were elicited. Foods were coded using the US Department of Agriculture Food and Nutrient Database for Dietary Studies.²⁰

Data Analysis

First, a definition of the outcome of FV consumed at lunch was chosen. For each food or beverage consumed over 24 hours, students reported eating occasion (breakfast, lunch, dinner, or snack), time of day, and location obtained and eaten (home, school, friend's home, fast-food or pizza restaurant, other restaurant, or other). To account for errors in estimation of school lunch times by students, while allowing for the possibility that students took lunch items from the cafeteria to eat during recess or class time, we used the following criteria to define our outcome, lunch FV intake at school: any item reported as lunch and as eaten at school within 15 minutes of the school lunch period.

Second, a range of summary statistics was calculated. Student- and school-level characteristics were compared using appropriate tests (χ^2 test for independence, clustered *t* test, *t* test) to determine whether characteristics differed (unadjusted for any covariates) between play-before-eating vs play-after-eating groups.

Third, estimation of the association of play before eating on lunch FV intake was performed using Generalized Estimating Equations (GEE) with clustering at the school level.²¹ The package *geepack* available in the statistical software R²² was used.²³ Due to clustering at the school level, as well as apparent nonconstant variance, inference was obtained with robust standard errors using the Huber-White (Sandwich) estimator. Based on $\alpha=.05$, a power level of 0.8, and the study sample size, we would be able to detect a difference of $\geq 1/6$ cup FV.

Fourth, variable selection modeling, including identification of possible interaction terms associated with each group (play before vs after eating lunch), was carried out in two stages. The candidate variables included were originally selected based on subject matter expertise. We did not adjust for calorie intake, as our outcome of interest was FV intake, regardless of whether differences in FV intake were related to differences in calorie intake. Adjusting for calorie intake (ie, holding calories constant) would have addressed a different outcome relating to whether FV replaced other sources of calorie intake under our setting of interest. Initially, association of play before eating with student-level characteristics (reported ethnicity, age, sex, spoken language, and whether school lunch items were eaten) was assessed by analysis of variance for a range of nested GEE models. Second, association of FV consumption with the same variables, as well as play before eating, was assessed by sixfold cross validation using mean squared error loss (MSE) for a series of GEE models.²⁴ In the cross-validation procedure, the data were randomly split into six groups containing equal numbers of schools. Then the MSE for each group was obtained using a model fit on the other groups, after which the six MSE values were averaged. The entire process was repeated 100 times for each set of variables to obtain a more stable average. Models included the following: 1) only the exposure of interest, play

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