Lunch, Recess and Nutrition:
Responding to Time Incentives in the Cafeteria

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Highlights:

- Switching recess to before lunch in schools increases fruit and vegetable consumption.
- It also decreases waste.
- Limited studies and pilot projects have suggested this.
- We utilize a natural experimental setting and non-intrusive methods to further test this
- Our large dataset supports switching recess positively affects nutritional outcomes..

ABSTRACT

Objectives

In this study, we evaluate if moving recess before lunch has an effect on the amount of fruits and vegetables elementary school students eat as part of their school-provided lunch.

Methods

Participants were 1st-6th grade students from three schools that switched recess from after to before lunch and four similar schools that continued to hold recess after lunch. We collected data for an average of 14 days at each school (4 days during spring 2011, May 3 through June 1, 2011 and 9 days during fall 2011, occurred September 19 through November 11, 2011. All of the schools were in Orem, UT. Data was collected for all students receiving a school lunch and was based on observational plate waste data.

Results

We find that moving recess before lunch increased consumption of fruits and vegetables by 0.16 servings per child (a 54% increase) and increased the fraction of children eating at least one serving of fruits or vegetables by 10 percentage points (a 45% increase).

Conclusions

Our results show the benefits of holding recess before lunch and suggest that if more schools implement this policy, there would be significant increases in fruit and vegetable consumption among students who eat school lunch as part of the National School Lunch Program.

Key Words: Recess, lunch, fruits and vegetables, National School Lunch Program

INTRODUCTION

There is a growing effort in the United States to encourage healthy eating among children, one that is increasingly targeted at elementary schools. This effort is largely being led by the U.S. Department of Agriculture (USDA), which under the Healthy, Hunger-Free Kids Act of 2010, was granted increased authority over the National School Lunch Program. The USDA initially set new nutrition standards for all food sold as part of the National School Lunch Program. Additional initiatives under the bill included protein and calorie requirements and targets for use of whole grain products.

Beginning in the fall of 2014, the Healthy, Hunger-Free Kids Act required that all students purchasing a national school lunch to take either a serving of fruit or vegetables with their lunch. These approaches have met with varying degrees of success, and in some cases result in substantial costs to the school (Just, Price 2013) . Stocking vending machines with healthier options or adding healthy foods outside of the regular lunch program costs money, although one recent study found that lowering the price on healthy options in school vending machines increased healthy food intake without significantly affecting the profits of the machines (French 2003) . A recent study indicated that schools who complied with the current requirements for serving certain types of fruits and vegetables spend on average an additional fourteen cents per meal than those who do not (Kleinman et al. 2002) . With over 31.7 million meals being served daily, this adds up to roughly $800 million per year in extra food costs.

Given the current policy regime, another alternative approach to increasing fruit and vegetable consumption that costs nothing in terms of extra labor or food expenses and that has been relatively underutilized is having recess occur just prior to lunch. In our study, we find that moving recess to before lunch is significantly more effective at encouraging fruit and vegetable consumption than simply requiring students to take a fruit or vegetable with their lunch.

When lunch occurs directly before recess, students are often allowed to leave for recess as soon as they are done eating; this scheduling can create an incentive for students who place a high value on recess time to eat their food—or rather, be "done" with lunch—as quickly as possible. This desire to minimize eating time can decrease the percentage of children that consume the recommended amounts of fruits and vegetables, thus leaving children feeling hungry for the rest of the day. This lagging hunger after lunch can decrease academic

performance (Kleinman et al. 2002, Florence, Asbridge & Veugelers 2008) and lead to excessive and unhealthy snacking when children return home from school (CULLEN et al. 2000) .

Previous studies have documented administrator, teacher, and parent concerns surrounding this change in schedules. Popular concerns are logistics of supervision, hand washing, cold weather clothing, tradition, scheduling, exercise, communication, nutrition beliefs, academic priorities, and resistance by another party (Rainville, Wolf & Carr 2006) . In a study conducted in Hawaii some teachers and administrators were skeptical before the implementation of the recess before lunch program, but afterwards reported highly positive experiences (Tanaka et al. 2005) . An evaluation of the program in Montana found that moving recess before lunch resulted in many benefits, including more food being eaten, a calmer lunchroom atmosphere, and a dramatic decrease in disciplinary problems (Robinson 2003) .

Studies have also shown benefits from moving recess to before lunch, including less food wasted at lunch and better behavior during lunch, at recess and in the classroom (Ramstetter, Murray & Garner 2010) . Bergman *et al* (2004) compared plate waste data for 1117 students at two schools, one with recess before lunch and one with recess after lunch and found that the school with recess before lunch had higher levels of consumption of many macro and micro nutrients including iron, calcium, and vitamin A, and lower levels of plate waste (Bergman 2003) . Getlinger *et al* (1996) compared plate waste data for the 67 students before and after a change that moved recess to occur before lunch and found that the change in recess times reduced plate waste from 34.0% down to 24.3% and increased vegetable consumption from 19 to 30 grams (Getlinger et al. 1996) . Our study combines the strengths of these two studies. We combine the large sample approach used by Bergman *et al* with the comparison of the same set of students before and after the change in recess used by Getlinger *et al*.

METHODS

Data were collected at seven elementary schools, all from the same school district in Utah. Three of these schools moved their recess to occur before lunch at the start of the 2011-2012 school year. The other four schools, which we used as our control group, continued to have recess occur after lunch. We collected data for an average of four days at each school in the spring of the 2010-2011 school year and an average of nine days at the same set of schools in the fall of the 2011-2012 school year after the recess policy had changed at the three treatment

schools. Our data includes all children receiving a school lunch and our data is recorded each day at the child-level. Students' confidentiality was maintained throughout this study as we did not record their name or student identification number. Instead individual students were recorded based on just their grade and gender.

Our data collection approach was developed by Just and Price (2013) and involved observers standing by the trash cans throughout the lunch period recording the number of servings of fruits and vegetables that each student consumed or threw away using a specially designed iPhone application. Specifically, our researchers examined each tray as it was thrown away by students as they were leaving the lunch room and determined based on its contents how many servings of fruits or vegetables the student had taken and how many servings the student had eaten. All of this data was recorded in real time using the app. The fruits or vegetables offered from the cafeteria were served in pre-portioned cups or as whole fresh fruit items. This allows us to accurately determine the number of servings taken and actually eaten by observing the empty cups or the remains of the fresh fruit or vegetable (such as an apple core). This method has been validated and found to be both reliable and relatively precise (Hanks, Wansink & Just 2014) .

Our analysis was based solely on students receiving a school provided lunch for two reasons. First, our data collection approach was based on a visual inspection of each student's tray and was designed to not create any significant disruption to the normal flow of traffic at the end of lunch or any verbal interaction with the students. Recording data on sack lunches would have required opening each bag and asking the student which fruit and vegetables had been included in their lunch. Second, we were able to measure the number of servings that each child ate because these items came in pre-portioned cups. This level of pre-portioned servings would not have been the case for items in sack lunches for any items packaged in baggies, including the most commonly included vegetables like baby carrots and celery. Since we only recorded the data at the end of lunch, we would have had no way of knowing how many of these items the student started the lunch with.

As part of our data collection, we did not count potatoes, corn, or fruit juices as fruits or vegetables. While these are considered to be in the fruit and vegetable category under USDA regulations, corn and potatoes are technically neither a fruit nor vegetable. While they do have nutritional value, corn is considered a grain and potatoes are classified as a starchy food by many

nutritionists. Moreover, many potato sides are served in the form of French fries or other processed foods. Therefore we found the average nutritional gap between these foods and fruits and vegetables to warrant excluding them in the study. The same logic applies to fruit juices: many fruit juices served in schools are artificially sweetened, and while the juice does provide nutrients, research has shown that such sugar-sweetened beverages can lead to weight gain and increased risk of type 2 diabetes (Schulze et al. 2004, Wang, Bleich & Gortmaker 2008, Dennison, Rockwell & Baker 1997) .

We used two measures of fruit and vegetable consumption for our analysis. First, we measured the number of servings of fruits or vegetables that each student ate (measured in increments of half a serving). Second, we measured whether each student ate at least one serving of fruits or vegetables. While it is likely that our measure of the number of servings that a student ate is measured with some error (since we made a conscious tradeoff between accuracy and the number of observations), measures of whether the student ate at least one serving are likely to be more accurate (an empty container is easily identified).

We used multivariate regression to estimate the impact of the change in the timing of when recess occurs. We regressed each of our measures on a "Post-period" variable, indicating that the date the observation was made was after any policy changes were implemented. We ran these regressions separately for the treatment and control schools. For our analysis, we used the student-day as the unit observation but clustered all of our standard errors at the school-day level. We included controls for the student's gender and grade as well as school and day of the week fixed effects.

The inclusion of school fixed effects was designed to capture any fixed characteristics of the school across the two school years that we included in our analysis. These characteristics might include the layout of the cafeteria, the demographics of the student body, and possibly even less quantifiable aspects of the lunch room such as the personality of the lunch-room workers. The day of the week fixed effects are similarly designed to control for any differences across days of the week that might have affected student consumption patterns during lunch.

In order to test whether the change in fruit and vegetable consumption differed between the treatment and control schools, we also pooled the data from the seven schools together and ran a regression in which we added in an interaction term between the post treatment variable and whether or not the school was in the treatment group. This approach provided a difference-

in-difference estimate of the relative change between the treatment and control schools that allowed us to determine whether the change in behavior at the treatment schools is statistically significantly different from the change at the control schools.

RESULTS

Altogether, our data collection yielded information on 22,939 student-day observations (8,167 at the treatment schools and 14,772 at the control schools). While the group of students that ate a school lunch varied from day to day, we had at least 2,477 unique participants in our study (based on summing the maximum number of students we observe across each day and each school).

In Table 1, we used data from the Common Core of Data along with our baseline data collected in the spring to compare the characteristics of our three treatment schools and four control schools. The results in this table show that our two groups of schools are very similar along all of these measures. Most importantly for our study, the average baseline consumption rates at the groups of schools are nearly identical with the children eating 0.3 servings of fruits and vegetables each day and 22% of children eating at least one serving of fruits and vegetables. In addition, since all of the schools are in the same school district, they share a number of other characteristics in common including the same menus and recipes for the items being served.

Table 2 displays the results of a regression-based test of the change in servings of fruits and vegetables being consumed (panel A) as well as the percentage of children eating at least one serving (panel B). We estimate results for the treatment and control schools separately. The final column provides a measure of the relative change between the treatment and control schools and whether the difference in the change between the two groups is statistically significant.

The results in Table 2 show that the treatment schools experienced a 0.157 serving increase in fruit and vegetable consumption (a 54% increase relative to the baseline rates at these schools) and 10.1 percentage point increase in the percentage of children eating at least one serving of fruits and vegetables (a 45% increase). In contrast, during this same time period, the control schools experienced a decrease in the amount of fruits and vegetables being consumed.

If we assume that the pattern we observed at the control schools provides an accurate estimate of what would have happened at the treatment schools if they had not moved recess before lunch, then our interaction effect suggest that moving recess before lunch increases fruit

and vegetable consumption by 0.195 servings (a 65% increase) and increases the percentage of children eating fruits and vegetables by 15.6 percentage points (a 69% increase). As such, the policy of moving recess to occur before lunch provides possibly one of the most cost-effective ways that schools can use to increase the consumption of fruits and vegetables during school.

DISCUSSION

It is important to place these results in the context of current policy efforts. The recent government policy changes included a requirement that students purchasing a national school lunch take either a serving of fruit or vegetables with their lunch. Just and Price (2013) used methods that are identical to those employed in this study to measure the impacts of such a requirement (Just, Price 2013) . Comparing these results, the impact of changing the timing of recess is much more effective at increasing the percentage of students consuming a serving of fruits or vegetables than the policy that was recently implemented, and is likely to require much lower costs for schools to implement. The effects we observe in this paper are also similar to those of other recess-before-lunch programs that have successfully increased fruit and vegetable consumption in schools (Robinson 2003, Getlinger et al. 1996) .

Some limitations of our study encourage further research to analyze the role lunch and recess times have on classroom behavior and overall health. First, the nature of our data collection methods limits our data to lunchtime consumption of only students eating school lunch. Second, our sample is limited to only seven elementary schools, all of which are located in Utah, though the schools in our sample have socio-economic and demographic characteristics that are similar to the national average. The schools in our sample have a higher fraction of students receiving free or reduced price lunch relative to the national average (54% vs. 48%) but a smaller fraction of non-white students (32% vs. 48%). Finally, as we cannot track individual students or get their health information, we cannot make overall health conclusions such as the impact on BMI. It should also be noted that at larger schools with over 1,000 students and lunch blocks that last 2-3 hours, it may be impractical to schedule recess before lunch for all students, but in these cases it still should not be unreasonably difficult to schedule recess before lunch for a large majority of the students

Switching recess to before lunch in elementary schools could work as a useful tool in the national effort of encouraging greater consumption of fruits and vegetables during lunch. This

effect is likely to operate by making children hungrier when they return from recess and also allowing them to relax during lunch and take more time to eat their fill of nutritious food instead of anxiously rushing through lunch to get more playing time. Increased fruit and vegetable consumption in young children can have positive long term health effects. Additionally, decreasing the waste of fruits and vegetables is significant for schools and districts that are faced with the higher costs of offering healthier food choices. The policy changes implemented in this study are feasible, although some resistance may be met due to complications in rescheduling. Overall the results demonstrate that when recess is scheduled immediately before lunch, the percentage of children eating at least one serving of fruit or vegetables increases significantly.

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Contributor's Statement

Dr. Price was involved in the conception and design of the studies, acquisition of data, data analysis, and drafting/revising of the manuscript. Dr. Just was involved in the conception and design of the study and the drafting/revising of the manuscript. All authors approved of the manuscript in its final form

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Table 1. *Summary Statistics*

Characteristic:	Moved recess to occur before lunch (3 schools)	Recess continued to occur after lunch (4 schools)
School size	602.3	566.3
Fraction male	50.2%	50.9%
Ethnicity		
White	68.7%	67.5%
Hispanic	24.5%	26.0%
Other	6.81%	6.54%
Fraction free/reduced price lunch	52.9%	55.6%
Spring 2011 (before change):		
Servings of FV consumed	0.291	0.309
Ate at least one serving of FV	22.0%	22.8%
Fall 2011 (after change):		
Servings of FV consumed	0.462	0.266
Ate at least one serving of FV	33.3%	17.7%

Notes: The sample includes 7 elementary schools, 3 of which moved their recess to occur before lunch. All three schools changed the recess policy immediately prior to the start of the 2011-2012 school year.

The Spring Study occurred May 3 through June 1, 2011 and the Fall Study occurred September 19 through November 11, 2011. All of the schools were in Orem, UT.

Table 2. *Change in the percentage of children eating at least one serving of fruits or vegetables*

	Moved recess to occur before lunch	Recess continued to occur after lunch	Difference-in-difference estimate
A. Servings of FV consumed:			
Post period	0.157**	-0.047	0.195**
	(0.070 – 0.243)	(-.0121 – 0.026)	(0.088 – 0.301)
	[0.001]	[0.20]	[< 0.001]
B. Ate at least one serving of FV:			
Post period	0.101**	-0.055	0.156**
	(0.033 – 0.170)	(-0.112 – 0.003)	(0.073 – 0.239)
	[0.005]	[0.06]	[< 0.001]
N	8,167	14,772	22,939

Notes: Each of the results in the table above are based on a separate regression. The post period variable is an indicator for whether the observation occurs during the second year of the study (when 3 schools moved recess to occur before lunch). Each regression includes controls for the child's grade and gender as well as school and day of week fixed effects. Confidence intervals have been clustered at the school-day level are provided in parentheses; P-values are provided below in brackets; ** and * denote statistical significance at the .01 and .05 levels, respectively.

The Spring Study occurred May 3 through June 1, 2011 and the Fall Study occurred September 19 through November 11, 2011. All of the schools were in Orem, UT.