ALIGNING ACTION FOR HEALTH®

Healthy School Food Collaborative Phase IV Report

February 2020

Contents

Executive Summary

The purpose of Healthy School Food Collaborative (HSFC) Phase IV is to gain additional insight as to how lunch culture, primarily timing of recess and social vs. silent lunches affects school food consumption. Phase III findings indicated that there is a correlation between silent lunch and school food consumption. However, there was not sufficient control of confounding variables to assert a causal relationship based on the data and design. Phase III demonstrated that there can be a disconnect between a schools' stated policy and the implementation of said policy. Specifically, schools' official policy is that silent lunches are not used, but in practice they are which was confirmed via cafeteria environmental scans. Based upon the findings of Phases II & III, Phase IV sought to address the following research questions:

1. *Does the timing of recess affect the amount of food that students consume during lunch?*

2. *Do the food vendors at participating schools serve food that meet or exceed USDA and HSFC standards?*

Three schools participated in the intervention, with a total of 45 days of plate waste data collection. Two of the schools used the same food vendor and one school contracted with a different food vendor. All three of the schools had similar demographics with most students qualifying for the National School Lunch Program with free and reduced lunches. The plate waste data collection occurred pre and post policy change at the school. The pre-test period occurred when lunch was held prior to recess. The post-test period occurred when lunch was held after recess. Data collection took place over fall and winter 2018 and 2019, respectively.

Two of the three schools had a significant increase in lunch consumption from the pre to post test period. The third school had a slight increase in food consumption from the pre to post test period but was not statistically significant. Phase IV results indicate replicability of Phase III findings: *the scheduling of lunch directly following recess results in increased student food consumption.*

Meet the Team

Healthy School Food Collaborative

The Healthy School Food Collaborative (HSFC) developed by Propeller: A Force for Social Innovation and funded by the W.K. Kellogg Foundation is a School Food Authority for charter schools in New Orleans. A School Food Authority oversees the operations of a school feeding program by ensuring eligibility requirements are met for school food, in addition to receiving federal meal reimbursements. HSFC was created in response to the national obesity epidemic with a shared belief among partners that Louisiana schools have a unique position to institutionalize healthy lifestyles through nutritional standards, nutritional education, and increased access to fresh and healthy food in schools. The HSFC holds school vendors accountable to raised nutritional standards and food quality standards.

Propeller: A Force for Social Innovation

Propeller: A Force for Social Innovation is a New Orleans hub for collaboration and innovative change. As a New Orleans-based nonprofit organization founded in 2009, Propeller seeks to create social, environmental, and economic impact in New Orleans by incubating ventures that have the potential to solve our city's most pressing issues – including the ongoing obesity epidemic within Louisiana. The HSFC was created by a Propeller initiative.

Louisiana Public Health Institute

Over the past six years, LPHI has provided programming and evaluation support to the HSFC. The investment has served to further LPHI's mission of promoting healthy school communities so that children and youth can reach their full potential. LPHI works in schools throughout the Greater New Orleans area to support nutrition education programming, increase healthy eating and physical activity among school students and staff, and expand health services. A key component of LPHI's work is supporting changes in school nutritional services, with a goal of increasing consumption of healthy foods and decreasing the child and adolescent obesity trend. In 2013, LPHI entered into a partnership with the HSFC to evaluate the initiative's impact in New Orleans public schools.

Healthy School Food Collaborative Phases I, II, and III

LPHI, in partnership with the HSFC, collaborated to evaluate the impact of the HSFC on student consumption of healthy School Lunches. Phase I and II of the HSFC evaluation were conducted in 2013 and 2014 respectively. Phase I was a pilot phase that was designed to test the feasibility of using the plate waste method in local schools and compared different school food authority menus for nutritional content. Phase I included grades K-5 at eight schools and measured the food consumption at a single lunch-period per school. Phase II of the HSFC evaluation collected plate waste data at eight schools on 40 consecutive school days to enhance the reliability of the data. Instead of including all grades, Phase II only looked at students in grades 4th and 5th. Satisfaction surveys were also administered to students twice during the data collection period at each school and collected information about environmental characteristics of the cafeteria. Both Phase I and Phase II included schools across a variety of food vendors in New Orleans. The most critical finding that Phase I and II discovered was that students throughout the eight schools were consuming around 50% of the 550-650 calories that the USDA recommends for children in that age range. There were slight differences between what was being consumed across food vendors, such as students from one vendor consuming more vegetables and milk and another vendor

consuming more of their entrée and fruit; however, all students (regardless of vendor) were consuming significantly less food than recommended.

Phase III of the HSFC evaluation was conducted in fall of 2015 and spring of 2016. Phase III built from Phases I and II and included three charter schools that all used the same food vendor, all of which were members of the HSFC. The interventions in Phase III were developed on the premise that by positively changing several small factors like timing of recess, perceptions of the cafeteria environment, and type of lunch, one can create a significant effect on consumption. The most important finding from Phase III is that having recess before lunch had a significant positive effect on student consumption. Despite the increased consumption, students still were not consuming the 550-650 calories per lunch recommended by the USDA.

Project Overview & Hypotheses

Phase IV of the HSFC research built on previous phases of this project by seeking to further explore whether the timing of recess has an impact on the amount of food that elementary school students consume. The hypotheses that Phase IV of this project sought to answer are:

1. *Does the timing of recess affect the amount of food that students consume during lunch?*

2. *Do the food vendors at participating schools serve food that meets or exceeds USDA standards and meets HSFC standards?*

Methodology

Participating Schools & Data Collection Overview

We provide an overview of the schools that participated in Phase IV of the HSFC research project in **TABLE 1** below. Three schools participated in the plate waste portion of this project during fall 2018 and spring 2019: School 1, School 2, and School 3. Six schools participated in policy change with corresponding lunch time observations. School 1 and School 2 shared the same food vendor. School 3 used a different food vendor. Two types of data were collected each day: plate waste analysis and the lunchtime monitoring tool. The plate waste data collection methodologies are described below. The lunchtime monitoring tool was completed each day by a research assistant and used to record the cleanliness of the cafeteria and kitchen, lunch menu postings, visual quality of the food, silent vs. social lunches[1], teachers eating lunch in the cafeteria, if recess was held as planned, and if students were given competitive food as a reward. "Competitive food" is the term used for any food present in the cafeteria that is not part of the provided meal.

[1] Silent lunch refers to any lunch period where students are punished by being forced to eat in silence for a portion or all of the lunch period. Social lunches are those where this does not occur.

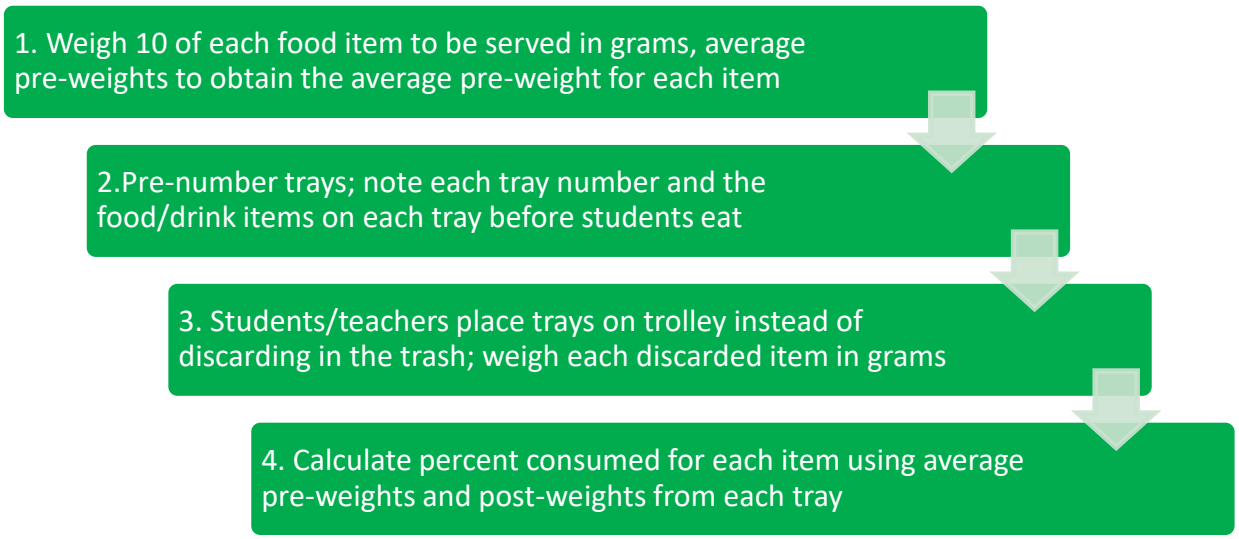
TABLE 1. INTERVENTION INFORMATION

School Name	Charter Management Organization	Intervention Type	Vendor	Pre	Post	Total
School 1	CMO 1	Plate Waste	Vendor 1	7	8	15
School 2	CMO 1	Plate Waste	Vendor 1	10	11	21
School 3	CMO 2	Plate Waste	Vendor 2	6	6	12
School 4	CMO 3	Observation	-	10	8	18
School 5	CMO 3	Observation	-	5	5	10
School 6	CMO 4	Observation	-	2	8	10
School 7	CMO 5	Observation	-	8	8	16
School 8	CMO 6	Observation	-	5	5	10
School 9	CMO 7	Observation	-	5	5	10
Total Observations				**58**	**64**	**122**

Plate Waste Methodology

Below in Figure 1, we provide a visual overview of the plate waste methodology used to establish the amount of food consumed by students during lunchtime.

FIGURE 1. PLATE WASTE METHODOLOGY: STEPS TO DETERMINE STUDENT CONSUMPTION.



Menu Analysis

LPHI requested food menus including nutritional values for all meals served during the plate waste data collection period from food vendors. The averages of all food components from the different vendors were compared to the USDA requirements for the National School Lunch Program. USDA requirements provide suggested ranges for calorie, sodium, fat, and saturated fat, requires vegetables to be fresh or frozen, mandates all fruit must be fresh, and requires reduced sugar in milk and inclusion of 1% and non-fat options. Menu items for each meal component were placed in a frequency chart, located in Appendix A, and Student consumption across meal components were analyzed using t-tests in Stata. Analysis looked at average nutritional values for salt, fat, saturated fat, sugar, and calories.

Qualitative Research Methodology

Lunchtime Monitoring Tool

A lunchtime monitoring tool was utilized during plate waste data collection to observe student behavior during lunch and track fidelity of the policy change.

Observations

LPHI developed an observation tool designed to observe student behavior before and after the policy change. The observation tool monitors the grade at lunch, the duration of lunch, when recess was held in respect to lunch, and the duration of recess. The monitoring tool also has sections for notes on the following: student behavior during recess activity, interpersonal interactions, student behavior at lunch, and student behavior during time of transition (recess to lunch or vice versa, and recess or lunch to class.

In-Depth Key Informant Interviews

Key informant interviews with school administrators and principals were held following data collection or observation at the respective schools with school administrators. LPHI developed the interview guide with the intention of better understanding the cafeteria environment from the perspective of school administrators, lunchtime norms, experiences in policy change implementation, and observed impact of the policy change.

Phase IV Results

Consumption

FIGURE 2. PRE VS. POST POLICY CHANGE: AVERAGE CALORIES CONSUMED BY SCHOOL

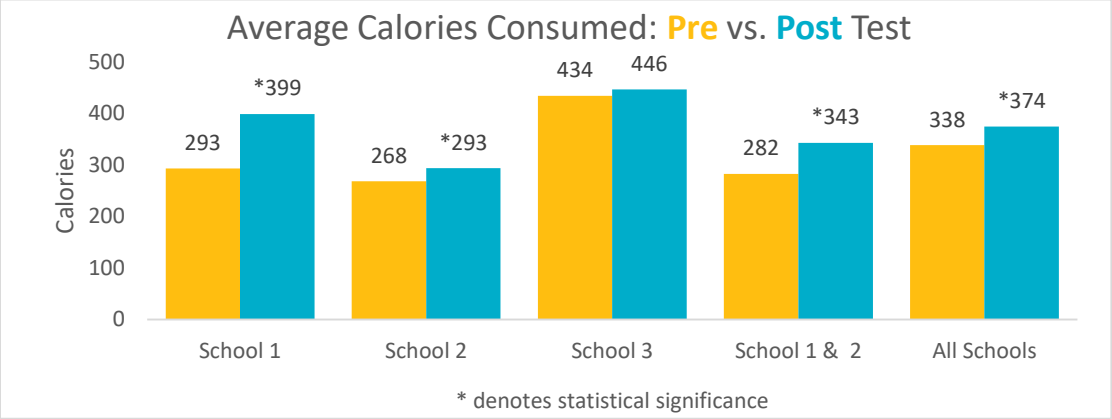
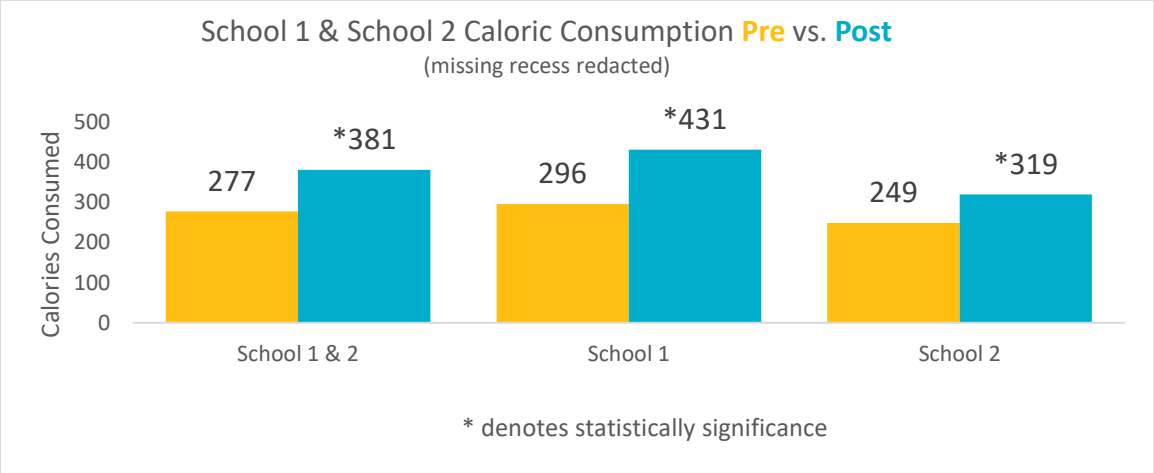


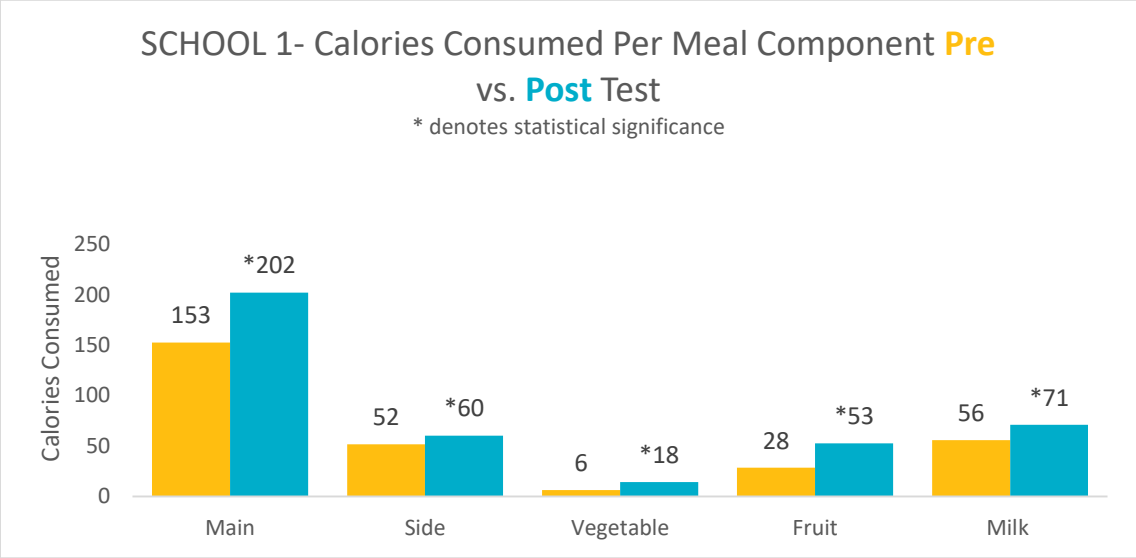
Figure 2 describes the average calories consumed by students from pre to post test. School 1, School 2, and the aggregate of all three schools saw a statistically significant increase in consumption from pre to post test. School 3 consumed the most amount of calories and had a slight increase in consumption from pre to post test, but it was not statistically significant.

FIGURE 3. PRE VS. POST POLICY CHANGE: AVERAGE CALORIES CONSUMED SCHOOL 1 AND SCHOOL 2.



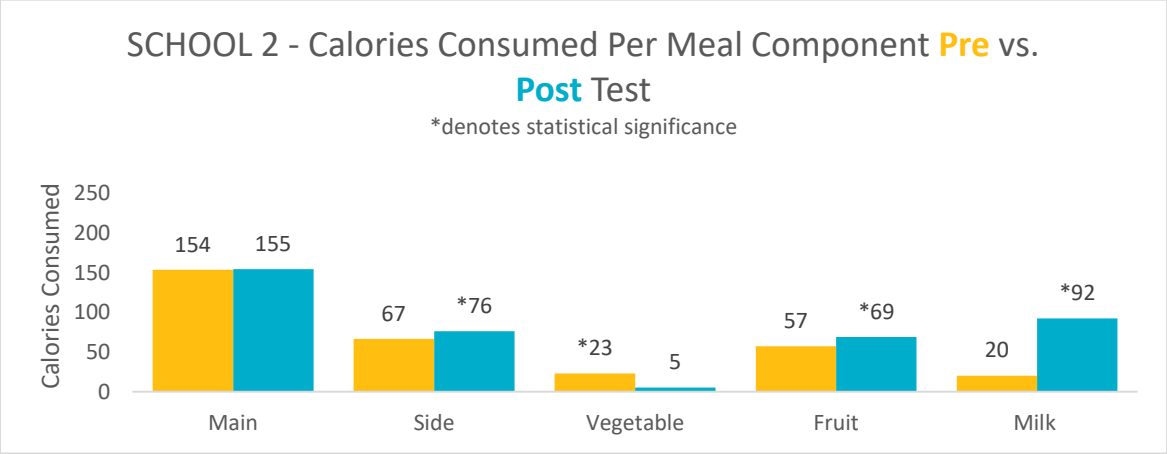
For some days at School 1 and School 2, recess did not occur as planned, often due to inclement weather or student behavior. Figure 3 showcases consumption data when recess occurred as planned (meaning that recess took place before lunch for those days when it was supposed to take place before lunch, and vice versa). When we analyze School 1 and School 2's calorie consumption data only for those days when recess took place as scheduled, the increase in calorie consumption is still statistically significant, and the size of the increase is even larger.

FIGURE 4. CALORIES CONSUMED BY MEAL COMPONENT PRE VS. POST POLICY CHANGE: SCHOOL 1



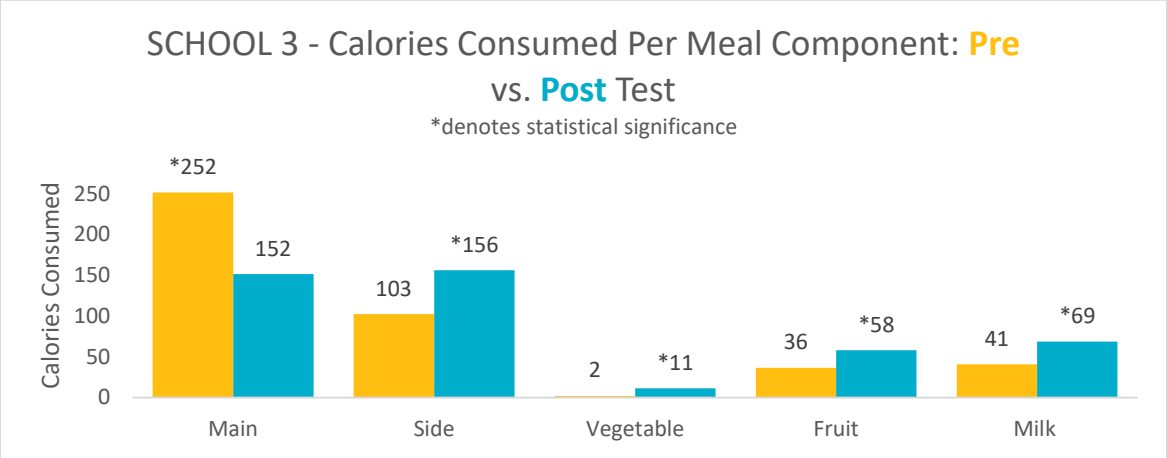
School 1 reported a statistically significant increase in consumption from pre to post test in all meal components.

FIGURE 5. CALORIES CONSUMED BY MEAL COMPONENT PRE VS. POST POLICY CHANGE: SCHOOL 2



School 2 reported a statistically significant increase in consumption from pre to post test in sides, fruit, and milk. There was a slight increase in consumption for mains, but it was not statistically significant. There was a statistically significant decrease in vegetable consumption from pre to post test.

FIGURE 6. CALORIES CONSUMED BY MEAL COMPONENT PRE VS. POST POLICY CHANGE: SCHOOL 3

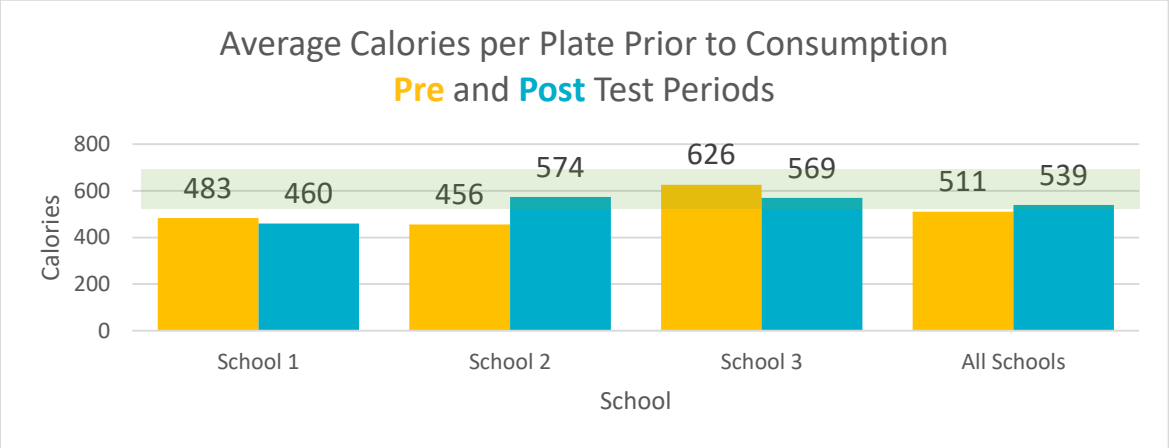


School 3 reported a statistically significant increase in consumption from pre to post test in all meal components other than the main. School 3 saw a statistically significant decrease in consumption from pre to post test for the main component of the meal.

USDA Standards

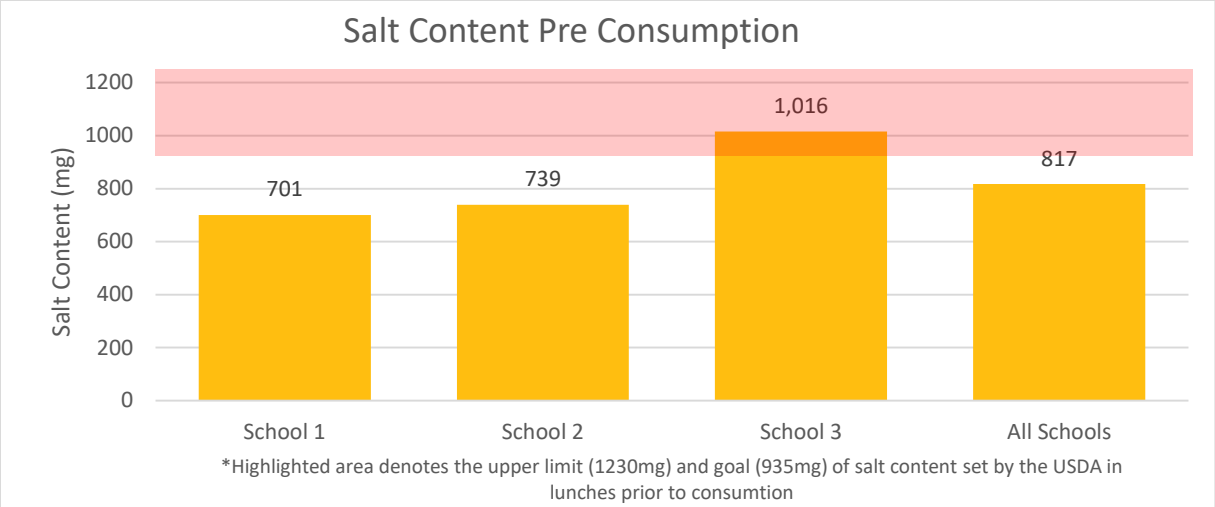
Calories: USDA standards suggest that all school lunches contain between 550 and 650 calories. As seen in Figure 7, during the pre-test period School 1 and School 2 provided student lunches with fewer calories than suggested by the USDA. Over the post-test period, School 1 provided lunches that met the lower threshold of caloric contents. School 2, over the post-test period did not meet USDA caloric minimums. School 3 served lunches over the pre and post test periods that fell within the USDA range of suggested caloric content.

FIGURE 7. AVERAGE CALORIES OF SCHOOL LUNCHES



Sodium: As seen in Figure 7, all three intervention schools (School 1, School 2, and School 3) met USDA guidelines by having less than 1230mg in all lunches prior to student consumption. The USDA goal for all school lunches is to have fewer than 935mg of sodium. School 1 and School 2 had fewer mgs of sodium than the USDA sodium goal, while School 3 did not with an average of 1,016mg of sodium per meal.

FIGURE 8. AVERAGE SALT CONTENT ON PLATE



Unhealthy Fats: The data collected in HSFC Phase IV cannot determine if the unhealthy fats in meals meet the USDA restrictions.

Low and Fat Free Milk: All three schools abide by USDA standards by providing low and fat free milk options for each student.

Fruit: All three schools meet the USDA standards by providing fresh fruit with every lunch. There is no frozen fruit served at School 1, School 2, or School 3.

Vegetables: All three schools meet the USDA standards by providing fresh or frozen vegetables. There are no canned vegetables served at School 1, School 2, or School 3.

Average Nutritional Value of Meals by Vendor

Table 2 displays the average nutrition components per plate by vendor. Vendor 1's average sodium content on the plate is fewer than the USDA goal. Vendor 2 sodium content was above the USDA goal, but fell within USDA guidelines. On average, Vendor 1's meals contained more fat, saturated fat, and sugar than Vendor 2. Vendor 2 on average had more calories per plate than Vendor 1. Vendor 1's meals does not meet the USDA suggestion of 550-650 minimum calories per plate. Vendor 2 is within USDA's suggested caloric range.

TABLE 2. AVERAGE NUTRITION COMPONENTS PER PLATE BY VENDOR

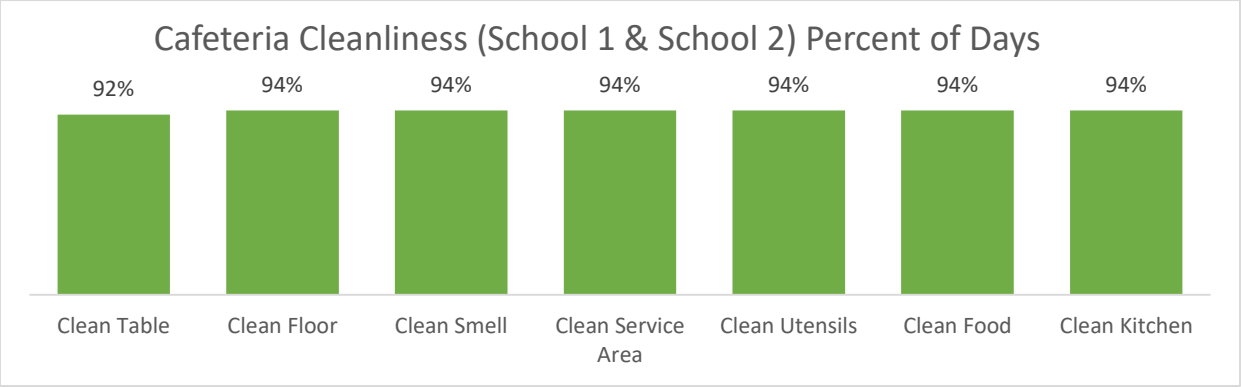
Vendor	Avg Sodium (mg)	Avg Fat (g)	Avg Saturated Fat (g)	Avg Sugar (g)	Avg Calories
Chartwells	718.72	80.27	88.69	264.65	489.28
VOA	1016.58	70.38	59.79	75.41	599.84

Qualitative Results

Lunchtime Monitoring Tool

The lunchtime monitoring tool was completed for School 1 and School 2 for all plate waste data collection, but it was not completed for School 3. The cafeteria environments were perceived positively by RAs. Ninety-four percent (94%) of days, the RAs documented the cafeteria to be clean.

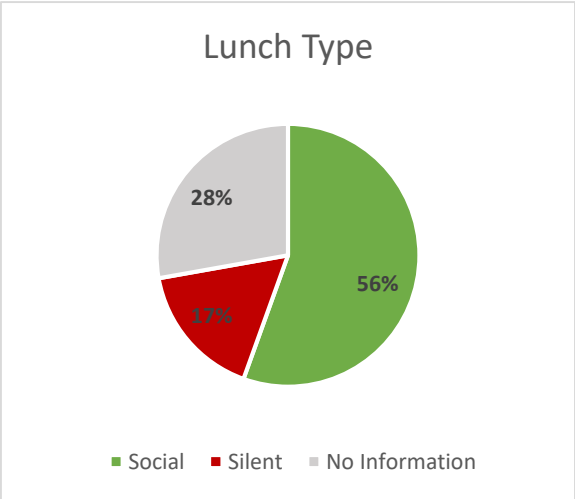
FIGURE 9: CAFETERIA ENVIRONMENT



As showcased in Figure 10, the RAs perceived the food quality to be "good" 83% of days and "fair" 11% of observation days at School 1 and School 2. As seen in Figure 11, Fifty-six percent (56%) of days held a social lunch, 17% of days were a punitive silent lunch, and there was no data recorded for 28% of the plate waste collection days at School 1 and School 2.

FIGURE 10: PERCEPTION OF QUALITY

FIGURE 11: LUNCH TYPE



Observations

Six schools participated in the policy change. LPHI conducted at least 10 observations at each of the schools to assure that the schools were compliant with the policy change and observe student behavior. Upon conclusion of the lunch time observations, key informant interviews were conducted with school administrators who directly observed the policy change.

Key themes from the lunch time observations and listed below:

Recess

Across all observation schools, students were very active at recess and generally seemed happy to be engaging in free play. Most students were interacting with groups of other students and engaging in games like basketball, football, tag, or dancing. Four of the six observation schools had playsets. At the schools with playsets, about half of the students were engaging with the respective structures. On average, one to three students were not engaging with other students, by their own choice. In addition, two of the observation schools had punitive recess activities. These activities consisted of students being isolated during recess and not allowed to play. On occasion, students would have recess indoors due to weather related reasons. Indoor recesses that were observed consisted of playing in the gym, going to the computer lab, or engaging with the online platform “GoNoodle”. The observations did not provide enough information to note if there were behavior changes from pre to post test periods.

Lunch

Across all observation schools, students had moderate to loud noise levels during lunch. The students interacted with others and seemed to be happy. Half of the observation schools engaged in punitive lunch policies. The respective punishment consisted of the students sitting in isolation for the duration of lunch. Some schools also had short periods of punitive silent lunches, if students were too loud or not responding to administrators. The lunchtime observations did not provide enough evidence for observers to come to conclusions surrounding food consumption or behavior differences from pre policy change to post policy change. School administrators who witnessed the policy change were able to provide more information in the key informant interviews.

Transition Periods

Across all observation schools, students were generally on their best behavior and very quiet during transition periods. The observations did not provide enough evidence to report a change in food consumption from the pre/post policy change period. School administrators who witnessed the policy change were able to provide more information in the key informant interviews.

Key Informant Interviews

HSFC Phase IV includes a qualitative component consisting of key informant interviews from participating schools (plate waste schools & policy change observation schools). Key informant interviews were conducted with school administrators who directly observed the policy changes.

The themes from the key informant interviews are as follows:

Consumption

Two thirds of the administrators interviewed noted that students seem to be consuming more food when recess is held immediately before lunch. Administrators noted that students seem to be more excited when coming into the lunchroom after recess and are ready to eat. One administrator noted that they observed students drinking more milk and eating more fruit following the policy change. One of the administrators who did not notice a change in food consumption stated that the students do not like the new food vendor because the lunch options are not familiar to the students.

> *"I am really happy to see the students consume more food because it increases their energy, ability to focus, and don't have to worry about kids being hungry. If it weren't for the project, we never would have thought about making the change. Glad they did. This will have a large impact on the kids."*
>
> *– Administrator of Observation School*

Behavior

Five of the administrators noted that there was an observed positive impact on student behavior in accordance with the policy change. The administrators noted that students were calmer at lunch and had smoother transitions from lunch to class. One administrator noted that there were fewer behavioral infractions over the policy change period. The remaining four administrators did not notice a significant change in student behavior. There were no negative behavior changes that were noted in relation to the study.

> *"[students who have recess before lunch] seem to be calmer, have gotten out a lot of their energy, and seems like more students mention they are hungry…They are calmer when they go back upstairs when they have recess and then lunch because lunch has provided a calming down time…this is significant because for teachers, transitions are some of the most stressful times of the day."*
>
> - *Administrator of Plate Waste Data Collection School*

Scheduling

All of the administrators noted that there were no negative impacts of participating in the study. The greatest challenge that was noted was adjusting the scheduling to allow for recess immediately before lunch. The administrators noted that changing the schedules for the participating grade(s) was not a significant challenge, but implementing the policy change across all grades at the school would be complicated. Two of the administrators mentioned that they have considered placing physical education before lunch for the grade levels where it would not be feasible to have recess before lunch.

> *"Originally, I thought that the policy change would be a stretch because I thought it was going to be a major breakdown in scheduling, it was not. 4th grade did not have recess scheduled, so this policy change actually added recess to their schedule…with this [change], fewer students have been sent to reflection and suspension."*
>
> *– Administrator of Observation School*

Future of the Policy Change

All the administrators noted that they would like to continue the policy change for the participating grade levels. The administrators noted that they would like to expand the policy change for all grades where scheduling allows. One of the schools is planning to increase participation in the policy change for the 2021 school year for half of the grades and have all grades participating by 2022. The administrators had overwhelmingly positive perceptions of the policy change because it had a positive impact on the students, at zero cost.

> *"To have one teacher feel like there was a positive impact was a huge thing. This anecdotal evidence is huge. If there is some positive effect and no negatives, then it is a very good change. This one teacher proved that to be true."*
>
> *– Administrator of Plate Waste Data Collection School*

Discussion

Schools that participated in HSFC Phase IV plate waste data collection met or exceeded the USDA standards for sodium, fresh fruit, fresh or frozen vegetables, and milk selection. The percent of unhealthy fats within the meals could not be calculated based on the HSFC data collected and available data sources. School 3 Elementary met the USDA standards for calories on the plate prior to consumption. School 1 did not meet the USDA standards for calories on the plate prior to consumption during the pre-policy change data collection period but did meet USDA standards for the post-policy change data collection period. School 2 did not meet the USDA standards for calories on the plate prior to consumption. When the data was aggregated for all schools, the USDA standards for calories on the plate prior to consumption were not met. Students are not provided with lunch meals that have enough calories to sustain themselves throughout the day.

Findings from the plate waste study indicate that the policy change of holding recess prior to lunch had positive impacts on student food consumption, confirming findings from HSFC Phase III. The aggregated data for all three intervention schools saw a statistically significant increase in food consumption when recess was held prior to lunch. Individually, School 1 and School 2 saw a statistically significant increase in food consumption when recess was held prior to lunch. The consumption for School 1 and School 2 increased more when data was removed for lunches that did not occur as planned. These results strengthen the conclusion that activity prior to lunch will result in increased consumption. Although School 3 did not have a statistically significant increase in food consumption following the policy change, students at School 3 on average consumed more food than their counterparts at School 1 and School 2. It is possible that the study did not observe a significant increase in consumption at School 3 due to the fact that students already had higher levels of consumption. Findings from the qualitative interviews and observations suggest that having recess before lunch not only increases food consumption but creates better temperament during the lunch period and smoother transition periods in the afternoon.

Limitations

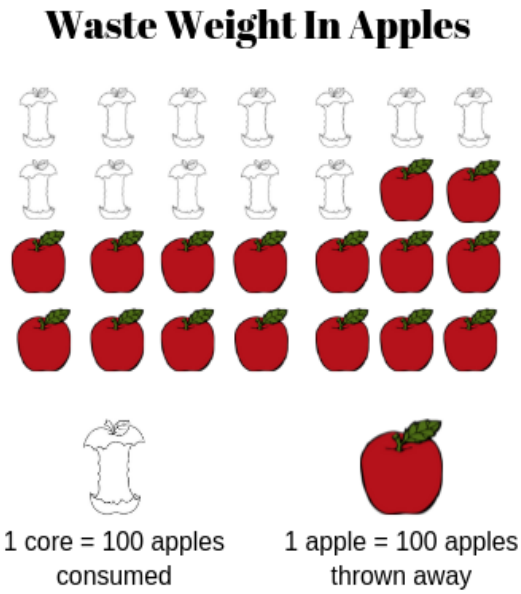
There are limitations to consider when interpreting the results from HSFC Phase IV. First, during the data collection period, there was turnover within the LPHI staff. Due to the turnover, there were discrepancies in data collection methodology – most notably, there was not a lunchtime monitoring tool completed for data collection at School 3 Elementary. Additionally, there were discrepancies in the post weight measurement of fruit. For data collection at School 1 and School 2, fruits with cores or peels (oranges, apples, bananas, pears) where the flesh was consumed were recorded as consumed, with a post weight of zero grams. At School 3, the actual weight of the peel or core was recorded as the post weight.

Additional factors that could have increased the scientific rigor of the study are as follows: inclusion of a control group, have the same meals in the pre and post test periods, include a data collection system that would allow for matching on an individual level, and have the same food vendor across all schools enrolled in the study. Due to school regulations, recruitment of schools, and the decentralized charter school system in New Orleans, these additional measures were not realistic for phase IV.

Moving Forward: *Waste*

LPHI collected 45 days of plate waste data at three elementary schools where 90% of children are enrolled in the free and reduced national school lunch program. Below are estimated waste metrics and visualizations.

- Over the data collection period, LPHI recorded that just over ONE TON of food waste was thrown into the trash (2,111 lbs.)
- Between 200-300 lbs. of food waste is thrown in the trash per day per school
- Over the course of a year, it is estimated a single school will throw away 50,000-60,000 lbs. of food waste – nearly 30 TONS
- Meal compositions by overall plate weight:
  - Main = 21% of plate weight
  - Side = 5% of plate weight
  - Veggies = 11% of plate weight
  - Fruit = 21% of plate weight
  - Milk = 42% of plate weight



Landscape Analysis: *Food Waste in America*

Demonstrating the impact of school food and nutrition on health, educational and economic outcomes is a global challenge (Nelson & Breda, 2013). In the United States, nearly half of all edible food served in schools is not consumed, and instead thrown away (Schupp, 2018; Byker, Farris, Marcenelle, Davis, & Serrano, 2014; Cohen et al., 2013). The waste sent to landfills or composting facilities results in loss of nutrients from the food supply, damage to the environment, and influences on school expenditures (Schupp, 2018). The landscape of public-school systems has the capacity to influence various industries on micro (e.g. individual, school, community) and macro (e.g. local, national, global) scales. When looking at the scope of food in schools, as was the focus of the HSFC work, the process and outcomes of waste are of concern when considering impacts on environmental, social, economic, and political sustainability, and overall climate change. Some school related factors that attribute to food sustainability efforts include assessing, measuring, and evaluating plate waste and consumption levels of students, as well as food related policy.

Making adjustments to in-school lunchroom related policies, such as timing of lunch, has influenced the level of food consumption and plate waste. When recess is held before lunch, the nutritional intake and social benefits has warranted policy change consideration (Chapman et al., 2017, Bergman et al., 2004; Price & Just, 2014; Hunsberger et al., 2014; Chapman et al., 2019). The earlier lunch is held has also been linked to the highest plate waste (Chapman et al., 2017). Studies suggest that environment and physical activity play a critical role in student food intake and dietary composition and outcomes (Mathieu et al., 2018; Micha et al., 2018). School age children are vulnerable to nutritional imbalance (Derqui, Fernandez, & Fayo, 2018). A balanced diet requires appropriate portion sizes and nourishing food choices to be served. The National School Lunch Program (NSLP) set standard minimum and maximum levels of nutrient intake to be met by students in schools, which further supports the need for evidence-based strategies to increase nutrition program effectiveness, while also monitoring and meeting students' dietary needs and reducing waste (Smith & Cunningham-Sabo, 2014; Nelson & Breda, 2013, Byker et al., 2014).

Food Waste Reduction & Sustainability Innovations

Schools provide an unparalleled opportunity to reach a majority of children and have the potential to positively influence their behaviors and attitudes towards living a healthy lifestyle and consuming healthier foods. Healthy school meals have been proven to contribute to the improvement of children's wellbeing and educational outcomes (Balzaretti et al., 2018). Existing research has evaluated school food to address student weight concerns, food consumption levels and nutritional intake, largely through plate waste studies. To expand upon research, interventions, and policies related to food served and measured plate waste in schools, focus has gradually increased around food waste reduction and overall sustainability. Nelson and Breda (2013) conducted a cost-benefit analysis of investment in school and nutrition programs which resulted in substantial change and gains around school food management. Food waste shifts attention especially to governmental resources along with costs associated with the NSLP, which sets dietary standards for school food service to students. Added costs to the program, as well as the overall environment include disposal costs, over-purchasing of food, and labor; inefficient resource use to grow and transport food, greenhouse gas emissions, and sanitation (Byker et al., 2014).

Interventions have shown integration of food sustainability literacy and educational activities into school curricula to be an effective and central approach, to not only increase awareness of students, school staff, and communities, but also to prevent overweight and obesity issues (Oostindjer et al., 2017; Jones et al.,

2012; Balzaretti et al., 2018). Fidelity and multisystem change requires an interdisciplinary approach and involvement from a range of stakeholders within and outside of the school environment (Derqui et al., 2018; Rojas et al., 2011; Jones et al., 2012). The quality of food served, from the way it tastes to aesthetics, influence students' motivation and perceptions around food consumption. A focus on increased food quality and palatability of school meals, school meal consumption and nutrient intake has shown to improve and the costs associated with food waste decrease (Cohen et al., 2013). Higher quality food in schools does require additional funding and requires lunchroom staff to be trained to produce more palatable meals (Cohen et al., 2013).

Food curricula

Fritjof Capra (as cited in Stone, 2007) writes about the importance of nutritional literacy and uses the Edible School Garden model as an example of how children will usually choose to eat better when they know what they grow. There is emphasis on the need for consistency across nutritional education programs and what food is actually available and accessible to students. Food interwoven into education teaches how and where food comes from, and the systems involved in breaking down and disposing of the food (Stone, 2007). A rural Californian school district and county level Department of Public Works, Solid Waste Planning & Recycling created a model of waste reduction and sustainability (Flammer, 2015). The program includes source reduction methods, onsite composting, food donation, and food scrap diversion to animal feed. The program provides experiential learning and training to students who are the eventual designated leaders. The opportunity to lead the program allows the students to retain the skills and information they learn, as well as make connections related to community issues like food insecurity (Flammer, 2015).

A recent formative study of three elementary schools developed aims to increase vegetable consumption, which was shown to be the largest proportion of lunch food waste, and overall reduce food waste. A pilot intervention will be a nutrition promotion program utilizing mindfulness focused food system education (Schachtner-Appel & Song, 2019). In Washington State School Districts, an evaluation of current food rescue programs shows that in addition to NSLP nutrition standards contributing to improvement of fruit and vegetable consumption and waste reduction, educational programs like Smarter Lunchroom further promote consumption of produce. Studies also show that increased time to consume foods, increased food choices, and smaller portion sizes are also attributable to better consumption and less food waste (Schupp, 2018).

Appendix A: *Menu Comparison*

	Vendor 1		Vendor 2	
Main Meal	**Pre**	**Post**	**Pre**	**Post**
Baked Potato	1	1	0	0
BBQ chicken	2	1	0	0
Calzone	0	0	0	1
Cheese Pizza	2	3	0	0
Cheese Sandwich	1	5	0	0
Cheeseburger	1	0	0	0
Chicken Nuggets	1	0	0	0
Chicken Sandwich	0	1	0	0
Chicken Taco	0	1	0	0
Chicken Tenders	0	0	1	0
Chili Mac	2	1	0	0
Fish Sandwich	2	1	0	0
Frito Pie	0	0	1	0
Gumbo	1	1	0	0
Herb Chicken and Rice	0	1	0	1
Hot Dog	0	1	0	0
Lasagna	0	0	0	1
Mac and Cheese	3	1	0	0
Mashed Potatoes	0	0	0	1
Meatball Sub	1	1	0	0
Pepperoni Pizza	1	3	0	0
Pizza	0	0	1	0
Pork Chop	1	1	0	0
Pork Sandwich	0	0	1	0
Salad	3	4	0	0
Salisbury Steak	1	1	1	1
Sausage Pizza	1	0	0	0
Spaghetti	0	1	0	0
Taco Salad	1	1	0	0
Turkey Nachos	1	0	0	0
Turkey Sloppy Joe	0	1	0	1
Veggie Pizza	2	0	0	0
Yogurt and Crackers	0	1	0	0

	Vendor 1		Vendor 2	
Sides	**Pre**	**Post**	**Pre**	**Post**
Beans	4	4	2	0
Biscuit	0	0	1	0
Breadstick	0	0	0	1
Cheese	0	4	0	0
Cookie	0	0	1	0
Cornbread	1	0	1	0
Crackers	1	0	0	0
Crackers	0	2	0	0
Dinner Roll	6	6	0	1
French Fries	2	1	0	1
Garlic Bread	2	2	0	0
Italian	0	1	0	0
Ketchup	4	2	2	1
Marinara Sauce	0	0	0	1
Mashed Potatoes	0	1	0	0
Mayo	1	1	0	0
Potato Salad	1	0	0	0
Potato Wedges	0	0	1	0
Potatoes	0	0	1	0
Ranch	0	3	0	0
Rice	3	4	1	0
Salsa	0	0	1	0
Sweet Potato Fries	0	1	0	0
Sweet Potato Tots	0	1	0	0
Tater Tots	1	0	1	0

	Vendor 1		Vendor 2	
Veggies	**Pre**	**Post**	**Pre**	**Post**
Broccoli	2	2	1	1
Cabbage	0	1	0	0
Carrots	4	2	0	0
Collard Greens	3	1	0	0
Corn	3	4	1	2
Green Beans	1	4	1	0
Italian Veggies	1	2	0	0
Lettuce	0	0	1	0
Peas	1	1	0	0
Roasted Veggies	0	1	0	0
Salad	0	0	0	1
Zucchini	1	0	0	0

	Vendor 1		Vendor 2	
Fruit	**Pre**	**Post**	**Pre**	**Post**
Apple	17	16	0	0
Banana	6	5	3	2
Cantaloupe	0	0	2	0
Clementine	0	2	0	0
Grapes	3	2	0	0
Kiwi	1	0	0	0
Nectarine	1	0	0	0
Orange	9	9	2	2
Pear	8	7	0	0
Pineapple	0	0	2	2
Plum	3	10	0	0
Strawberries	1	0	0	0