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Sampling tomorrow's lunch today: Examining the effect of sampling a vegetable-focused entrée on school lunch participation, a pilot study

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ABSTRACT

School lunch programs are important pillars in the food system, as they impact children's health, local agriculture, and community food security. When offering a new lunch entrée that contains vegetables, schools must consider whether students will choose the new entrée to avoid low participation rates and decreased revenue. Previous research in marketing suggests that sampling (i.e. taste testing) can positively impact consumer choice. In terms of encouraging students to eat school lunch and particularly items that include vegetables, it is often assumed that sampling will help direct food choice to healthier items, but little research has investigated the impact of sampling on food choice in a school lunch environment. The objective of this research was to investigate in a pilot study whether providing samples of a vegetable-focused lunch entrée the day before it appeared on the school lunch menu increased National School Lunch Program (NSLP) participation. The study took place at a Vermont middle school in 2015. Four new vegetable-focused entrées were supplied over three consecutive months. During month two, the entrées were sampled at a middle school the day before they were offered for sale, and NSLP participation, as well as revenue was tracked over three months. Our results suggest that sampling may have a positive impact on NSLP participation rates and food service revenue, but that more research is needed to better assess how sampling can be utilized in the most efficacious way to promote NSLP participation and healthy eating patterns.

1. Introduction

A successful school lunch program is an important contributor to not only children's nutritional status, but also to local agriculture and the broader community. Many schools now feature local produce in their meals especially in the Northeast (Ralston et al., 2017). The inclusion of local produce in school lunch programs has proliferated due to Farm to School programs that highlight the benefits to students, school lunch programs, and farmers of utilizing local fruits and vegetables (Feenstra and Ohmart, 2012). Additionally, school lunch programs have a positive impact on children's food security (Potamites and Gordon, 2010), which illustrates the important role school lunch programs play in community health. Without a school lunch program funded by the government, communities would need additional food pantry and other resources to combat food insecurity. To maintain or even enhance the benefits school lunch programs can have on many aspects of the food system, these programs must maximize their

participation rates to maximize revenue generation.

Balancing school food budgets, the rate of school lunch participation, and the nutrition of school meals creates the school food service “trilemma” (Harvard Pilgrim Public Health, 2010; K. Ralston et al., 2008). Economically sustainable school food programs must maximize student participation to stay financially solvent, an increased challenge with the additional requirements of healthier school lunch regulations (Cohen et al., 2015; Harvard Pilgrim Public Health, 2010; Johns Hopkins University Bloomberg School of Public Health, 2014; US Department of Agriculture Food and Nutrition Service, 2012). In the United States, the federal government reimburses schools per student for serving lunch, allowing some students to receive lunch for free or at a reduced rate. Although National School Lunch Program (NSLP) participation rates have increased for free/reduced price eligible students, they have decreased for full paying students (Food Research and Action Center, 2015). Drops in participation of any group of students make it harder to pay for the production of meals that are both marketable and

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nutritious.

Despite being crucial for school lunch programs, mechanisms for increasing NSLP participation have received limited attention by researchers (Just et al., 2014). The presence of competitive foods, defined as any foods and beverages not part of the federal school lunch program sold during the school day, in most lunch rooms and schools adds a compelling need for evidence-based strategies to increase participation in the NSLP program. Although all foods sold during the school day are now required to meet nutrition standards, competitive foods, such as pizza or other à la carte items, do not provide the same overall nutrition that an NSLP entrée provides. Furthermore, competitive foods cost money, so they are often not an option for those who receive free/reduced price meals creating disparity between students. Schools do not receive reimbursements for competitive foods, so the more competitive foods purchased, the lower NSLP participation may be, and the quality of the NSLP at the school may decrease. Because competitive foods often come with large communication campaigns that reach students outside of school hours, the demand advantage of competitive foods is likely to remain or even increase, despite school food branding nudges (Wansink, Just, & Payne, 2012), further challenging NSLP food budgets.

One potential solution to marketing NSLP meals is offering students samples. Called “taste tests” in the farm-to-school lexicon, the use of sampling is almost ubiquitous in these programs, and their funding has expanded to help increase fruit and vegetable consumption by school children (Gretchen Swanson Center for Nutrition; USDA; USDA FNS, 2016). There is extensive literature on the efficacy of repeated exposure for the changing of taste preferences (Lakkakula et al., 2010; Wardle et al., 2003) from the repeated-exposure paradigm, we know that multiple interactions with a particular stimulus can produce a positive cognitive effect, even when experiences are completely benign (Zajonc, 2001). There is little empirical evidence showing that entrée sampling leads to behavior change, and only one pilot study has investigated the impact of chef-prepared samples specifically on NSLP participation (Just et al., 2014). Sampling has a long history of use in marketing, offering samples in diverse locations from retail establishments to physicians' offices (Adair and Holmgren, 2005; Bawa and Shoemaker, 2004). Allowing customers to try a product before purchase is an enduring practice because it is a behavioral strategy that is effective for increasing purchases (Cuddeford-Jones, 2011; Lammers, 1991). If “sampling tomorrow's school lunch entrée today” is a behavioral intervention that increases NSLP participation by all students, it could ameliorate the trilemma associated with providing healthy and appealing meals while balancing school food budgets.

The research objective of this pilot study was to investigate whether providing samples of a new, vegetable-focused lunch entrée the day before it appeared on the school lunch menu increased NSLP participation. Our hypothesis was that NSLP participation rates would increase, compared to baseline, after sampling.

2. Methods

All study procedures were approved by the University's Institutional Review Board Committee on Human Research in the Behavioral and Social Sciences. The samples were prepared and offered by the school staff as part of their usual cafeteria activities. Only group data was collected, so informed consent was not required.

2.1. Study population and setting

The study took place at a K-8 school in a rural Vermont community of approximately 10,000 people. The town is a Governor's designated “underserved area” based upon school lunch criteria and school testing results and it is committed to providing quality, nutritious meals (Lamdin, 2013). The middle school food service program, for which this study was conducted, typically serves lunch to 381 students in grades 4 through 8, approximately 42% of whom received free or reduced price

lunches. There were 578 fourth-eighth graders who were eligible to participate in the sampling intervention on a given day.

At the school, average school lunch participation was 70.2% for free, 74.6% for reduced, and 51.4% for full-price students, with an overall average of 66% NSLP participation. Each day, students could choose to bring a lunch from home, buy the daily NSLP entrée, or purchase pizza, a sandwich, or salad bar, all of which also meet the NSLP guidelines for reimbursable meals at the study school. Even though at the study school pizza, salad, and sandwiches were not technically competitive foods because they met NSLP meal standards, for the purposes of this study, pizza, sandwiches, and salad bar were considered “alternative entrées” to the NSLP entrées, as the sampling intervention targeted the daily NSLP entrée.

The new entrées were developed and selected for use in the study in consultation with the research team, including two registered dietitians, and were then prepared by the school food service staff. Entrées that featured whole foods were prioritized, to address the study's research question; the participating school's foodservice is committed to providing students appealing and healthy choices. The entrées chosen were Chicken & Broccoli Alfredo (CBA), Root Vegetable Stew (RVS), Savory Turkey Loaf (STL), and Eggplant Parmesan (EP).

2.2. Study intervention and timeline

In September, each entrée was offered with no additional information or sampling. In October, students were invited to taste a sample of the new entrée the day before it was served. In November, no additional samples or information were provided for the entrée. Each month, one new entrée was offered each week.

2.3. Recruitment

All students in grades 4–8 were invited to participate in the study during their lunch period. In October, students were encouraged to walk up to the sampling table, which was located between the lunch line and the compost/trash station in the cafeteria, to indicate that they wanted to participate. Participation was voluntary.

2.4. Measurement/monitoring

2.4.1. NSLP participation rates

Using their computer system, school staff collected data on the number of students who chose each targeted entrée at baseline (September), during the intervention (October), and post-intervention (November) intervention. School staff also collected information on how many students chose to eat school lunch of any kind on the days targeted entrées were served. By subtracting the number of students who chose a targeted entrée from the total number of students participating in the school lunch program, the number of students who chose an alternative entrée (pizza, sandwich, salad) was calculated.

Furthermore, foodservice staff collected information on the percentage of students eligible for free, reduced-price, or full-price meals participating in the lunch program on the days targeted entrées were served. Revenue generated by the foodservice program was also calculated for each day a targeted entrée was served. Lunch revenue was calculated by using the federal reimbursement rate from 2015 to 2016 of \$3.13 for each lunch eligible for a free or reduced price lunch (the state of Vermont subsidizes all reduced eligible lunches at the “free lunch” rate) and \$0.35 for each lunch not eligible for free/reduced price lunch.

2.5. Statistical methods

2.5.1. Sample size calculations

Given the population of 578 fourth-eighth graders and the school lunch participation rate of 66%, a sample of 290 students (grades 4–8)

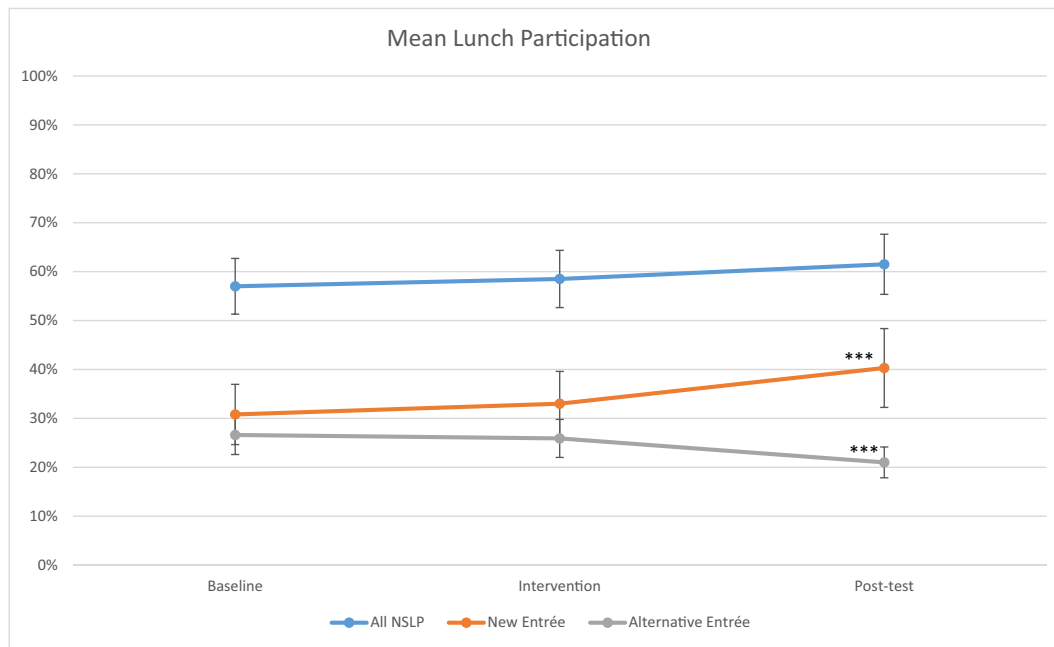


Fig. 1. Mean lunch participation. Percent of students choosing new entrées, alternative entrées, and total NSLP participation over time. Milton Elementary School, Vermont 2015.

*** $p < 0.001$, chi-square comparisons done between baseline and post-test.

allowed detection of a difference of 5% in school lunch participation rates with 95% confidence at 80% power.

2.5.2. Statistical analysis

Significant differences between pre-intervention participation rates and post-intervention participation rates were determined using chi-square analysis. Chi-square was also used to examine differences in selection of the targeted entrées versus alternative entrées at baseline and post-intervention.

3. Results

Fig. 1 compares the selection of new entrées with the selection of the alternative entrées served during the lunch period. The figure shows the percent of students who selected the new entrée at each time point, as well as the percent of students who purchased an alternative entrée. At each time point, the remainder of the school's students brought lunch from home (or ate nothing). Each of the three measurement points is a mean of the four different days that offered one of the new entrées. At baseline, the percent of students who selected the new entrée was slightly higher (31%) than those who purchased an alternative entrée (27%). During the intervention, the percentage of students who selected the new entrée (33%), and the percentage of students purchasing an alternative entrée (26%) both remained about the same. At the post-intervention time point, the percentage selecting the new entrées increased to 40%, while the percentage who selected an alternative entrée decreased to 21%, these were significant changes from baseline ($p < 0.001$). **Fig. 1** also shows that while there is some substituting of the new entrée for existing alternatives, the net effect (total lunches selected) increased, from 57% to 62%, although this increase was not statistically significant. In addition to the overall changes, **Table 1** shows changes in lunch participation for each new entrée separately. **Table 2** compares the percentage of students eligible for free or reduced price lunch who participated in the NSLP on each measurement day, compared with those students not eligible. Free/reduced lunch participation was approximately double that of the ineligible students on any given day, no matter the menu option or the point of measurement. Participation generally increased from the baseline to the post-test

measure, especially among the students eligible for free/reduced lunch. Overall, participation among the free/reduced eligible students increased, from the baseline of 82%, to 92% at the post-test measure ($p < 0.001$). NSLP participation rates of the students not eligible for free/reduced lunch remained the same throughout the course of the study, with the overall rate remaining at 44%.

Revenue was estimated based on federal reimbursement rates and the prices charged at the school. School lunch revenue increased modestly from the baseline to the post-test when three of the four new entrées were served (**Table 3**). Lunch revenue on the Root Vegetable Stew days remained the same for each of the three measurements. In terms of revenue, Chicken Broccoli Alfredo experienced the highest percentage point increase over the three measurements at 13.2% from baseline to post-test. It should be noted that because of a field trip during the lunch hour, the second measurement of Chicken Broccoli Alfredo was estimated based on the actual participation extrapolated to the whole population. Including food, supplies and labor, the total cost of providing the intervention samples was \$3688. Assuming the impact of the samples would last the remainder of the school year (six months) for each menu item, this would result in additional revenue of \$292.53 per month, or \$1755.18 for the six month period (assuming each item was served once per month).

4. Discussion

Results of this study suggest that sampling may have a positive effect on NSLP participation rates especially for those eligible for free/reduced price meals. Aggregate results from all targeted entrées indicate that from baseline to the post-intervention measurement, there was a significant increase in the percentage of students who chose the targeted entrée, and a slight decrease in those who purchased an alternative option, such as pizza or a deli sandwich. The participation trends for both the targeted entrées and alternative options do not all show linear improvement over time, which makes it more difficult to attribute changes in participation to sampling specifically. However, for the targeted entrées, linear improvement in participation over time was found for each entrée other than Root Vegetable Stew, which only showed a 1% decrease in participation from baseline to sampling and

Table 1
Percent of Students who selected the new/target entrée or alternative entrée, N = 587. Milton Elementary School 2015.

	Baseline entrée	Intervention entrée	Post-test entrée	Baseline alternative	Intervention alternative	Post-test alternative
Chicken broccoli alfredo	40.9	42.1	47.7	14.5	13.3	15.2 ^{a,b}
Root vegetable stew	30.7	29.8	39.2 ^a	29.6	31.7	21.3 ^a
Savory turkey loaf	24.7	26.4	31.3 ^{**}	30.5	32.0	27.3 ^{**}
Eggplant parmesan	26.4	33.7	43.4 ^a	31.5	26.6	19.3 ^a
Overall	30.8	33.0	40.25 ^a	26.6	25.9	21.0 ^a

Chi-square test of proportions, $\alpha = 0.05$.

^a $p \leq 0.001$.

^{**} $p < 0.025$.

^a Significance differences calculated between baseline and post-test.

^b Baseline data was collected in September; intervention in October; and post-test in November.

then a large increase from sampling to post-intervention which actually resulted in a significant increase in selection from baseline to post-test. Although, we cannot necessarily say that sampling caused students to shift towards the targeted entrées from the alternative entrées, it certainly seems that as students became more familiar with the new entrées they were more willing to buy them, and sampling added an exposure point.

Overall, there was a slight increase in total NSLP participation from baseline to post-intervention. This suggests that acceptance for the new entrées increased over time, as decreases in the percentages of students choosing the alternative entrées were noted concurrently with increases in the percentages of students choosing the targeted new entrées. Sampling may have contributed positively to this overall increase in participation and certainly did not impact NSLP participation negatively. Therefore, sampling could help address the economic side of the foodservice trilemma by bringing in more revenue for the foodservice operation. Results showed an increase of as much as 13% in revenue after introducing a new entrée with sampling. And, while results did not indicate a significant increase in the participation rate of those students ineligible for free or reduced lunches, there was an increase in the participation rate of students eligible for free/reduced lunches, which contributed to the potential revenue increases and may help address food insecurity concerns.

The rise in participation at the post-test, one month after the samples were offered, may reflect the social aspect of students seeing their peers eat the new entrée for lunch. In an elementary/middle school environment, social contagion might be a powerful force in determining what students eat for lunch. Sampling may have helped create a positive feedback loop between students that is difficult to disentangle, and potentially helpful to lunch programs trying to generate interest in healthy dishes.

Table 2
Comparison of change in free/reduced (F/r) price lunch eligible students' participation with non-eligible students on days the new target entrées were offered. Milton Elementary School 2015.

	Baseline		Intervention		Post-test	
	F/r N = 205	Full price N = 382	F/r N = 205	Full price N = 382	F/r N = 205	Full price N = 382
Chicken broccoli alfredo day	165 80%	160 42%	145 (N = 173) ^a 84%	125 (N = 314) 40%	204 ^{***} 100%	165 43%
Root vegetable stew day	175 85%	179 47%	177 86%	184 48%	188 ^{***} 92%	167 44%
Savory turkey loaf day	163 80%	161 42%	172 84%	171 45%	165 81%	179 47%
Eggplant parmesan day	169 82%	171 45%	166 81%	188 49%	201 ^{***} 98%	167 44%
Overall	82%	44%	80%	44%	92% ^a	44%

One-tailed t-test of correlated samples, $\alpha = 0.05$.

^a 100 students were away from the cafeteria on an all-day field trip on the day of this measure.

^{*} $p = 0.053$.

^{***} $p < 0.001$.

The positive trend in NSLP participation and increased selection of the targeted entrées noted in this study is congruent with previous research on sampling and its effectiveness as a marketing tool to encourage consumers to purchase new items or foods (Bawa and Shoemaker, 2004). The sampling intervention added another opportunity for students to gain exposure with a new food item in a low-stakes environment, and increased the number of interactions students have with a new food, which previous research has shown to be crucial when determining liking (Anzman-Frasca et al., 2012).

As the study did not have a control group, it is possible that the increased NSLP participation observed was due to factors other than the sampling intervention. By the third month each entrée was offered, students may have been more likely to buy them regardless of whether they were allowed to sample the entrées. It is also possible that NSLP participation increases for all entrées as the school year proceeds from September to November, although the decline in purchasing of the alternatives shown in Fig. 1 on the days the new entrées were offered suggests that this is not the case. Future studies could randomize students or schools to sampling or no sampling conditions, to better assess whether sampling on its own can increase entrée selection. Qualitative data assessing why students chose to participate in the NSLP or not, and why they chose the entrée options they did would also be beneficial in future work.

Strengths of the study include a sample size sufficient to produce statistically valid results and longitudinal tracking of the impact of the sampling intervention not just one day later, but one month after the initial sampling opportunity. The study also examines a technique, sampling, that is low cost for schools to implement and although assumed to work, has not heretofore been tested using a scientifically valid methodology in a school cafeteria setting. The intervention samples likely cost somewhat more due to research requirements, but

Table 3
National school lunch program change in revenue over time, Milton Elementary School 2015.

	Baseline			Intervention			Post-test			Net change in estimated revenue from baseline to post-test (\$USD)	Additional revenue for remainder of school year based on net change (\$USD)
	F/r (\$USD)	Full price (\$USD)	Total revenue (\$USD)	F/r (\$USD)	Full price (\$USD)	Total revenue (\$USD)	F/r (\$USD)	Full price (\$USD)	Total revenue change (\$USD)		
	Chicken broccoli alfredo	516.45	536.00	1052.45	453.85 (Estim:538.99)	418.75 (Estim:511.88)	872.6 (Estim:1050.87) ^a	638.52	552.75		
Root vegetable stew	547.75	599.65	1147.4	554.01	616.40	1170.41	588.44	559.45	+1147.89 (+0.04%)	\$0.49	\$2.94
Savory turkey loaf	510.19	539.35	1049.54	538.36	572.85	1111.21	516.45	599.65	+1116.1 (+6.34%)	\$66.46	\$398.76
Eggplant parmesan	528.97	572.85	1101.82	519.58	629.8	1149.38	629.13	559.45	+1188.58 (+7.87%)	\$86.76	\$520.56

^a 100 students were away from the cafeteria on an all-day field trip on the day of this measure, so the revenue was extrapolated based on the percentage of students who selected the entrée and the total number of students.

^b Baseline data was collected in September; intervention in October; and post-test in November.

offering free samples is still an investment for school food service. However, introducing a new menu item to the whole school would be more costly, and if it was not widely adopted as a lunch choice by the students, the revenue loss (and loss of patronage) could be sizable. Furthermore, sampling may be a way to introduce new veggie-focused foods to children that they may not otherwise choose when pizza and sandwiches are the other available options. If sampling helps children become familiar with new entrées, then it may broaden their palates and hopefully contribute to better long-term health.

5. Conclusions

The fact that a significant increase in NSLP participation was not noted for students paying full price may suggest that a sampling intervention needs to be combined with another behavioral intervention for maximum impact. For example, previous research has found that using creative names for foods or placing a targeted food first in a cafeteria line can positively impact the selection of these foods (Wansink and Hanks, 2013; Wansink et al., 2012a, 2012b). It is possible that if Root Vegetable Stew (or any of the entrées) had been given creative names designed by middle school students, they may have been chosen more often, especially if sampling was combined with the customized name.

In terms of impacting the broader food system, attempting to increase vegetable consumption and participation in school lunch programs has wide implications for issues of poverty, diet-related illness, local agriculture, and food waste. Approximately 15 million children—21% of all kids—are living in poverty in the United States (National Center for Children in Poverty), and over 13 million are food insecure (Feeding America, 2017). School lunch programs are poised to be one way of mitigating this issue (Potamites and Gordon, 2010), and some evidence suggests that receiving subsidized lunch can improve health outcomes (Gundersen et al., 2012). Sampling may help NSLP programs contend with competitive food sales to keep the NSLP program viable and able to serve healthy, local options to students of all income levels. Additionally, incorporating local produce into school lunch through farm to school programs has been found to have positive effects on farmers and students, although more controlled studies are needed (Feenstra and Ohmart, 2012). Students must participate in lunch programs, however, for any positive effects to be felt on the individual or community basis. Because research has shown that requiring students to eat more fruits and vegetables at school can result in higher food waste (Amin et al., 2015), a better option seems to be encouraging voluntary participation. Sampling of new, healthy options has the potential to create student buy-in and ultimately change health outcomes.

Sampling can be implemented and combined with other simple cafeteria interventions to encourage students to try new dishes that may contain vegetables that they do not normally eat. Acceptance of the new NSLP entrées increased with each exposure, and sampling is one way to increase the number of exposures without having to serve the new food as the new entrée repeatedly. Sampling is one tool that can contribute to overcoming the school foodservice trilemma.

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Conflict of interest

The authors declare that there is no conflict of interest.

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