ABSTRACT

BACKGROUND: Little is known about adolescents' food purchasing behaviors in rural areas.

This study examined whether purchasing food at stores/restaurants around schools was related to adolescents' participation in school breakfast programs and overall diet in rural Minnesota.

METHODS: Breakfast-skippers enrolled in a group-randomized intervention in 2014-2015 (N = 404 from 8 schools), completed 24h dietary recalls and pre/post surveys assessing food establishment purchase frequency. Healthy Eating Index Scores (HEI-2010) were calculated for each student. Student-level school breakfast participation (SBP) was obtained from school food service records. Mixed-effects regression models estimated: (1) whether SBP was associated with store/restaurant use at baseline, (2) whether an increase in SBP was associated with a decrease in store/restaurant use, and (3) whether stores/restaurant use was associated with HEI-2010 scores at baseline.

RESULTS: Students with increased SBP were more likely to decrease fast food restaurant purchases on the way home from school (OR 1.017, 95% CI 1.005, 1.029), but were less likely to decrease purchases at food stores for breakfast (OR 0.979, 95% CI 0.959, 0.999). Food establishment use was associated with lower HEI-2010 dairy component scores ($p = .017$).

CONCLUSIONS: Increasing participation in school breakfast may result in modest changes in purchases at food establishments.

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The community food retail environment is a key determinant of diet and weight outcomes among youth.¹⁻⁹ A considerable amount of research has examined the role of food establishments like small food stores around schools in urban areas.^{2,10-14} Among youth, visits to small food stores often occur daily or multiple times a week,^{10,15,16} resulting in regular purchases of food and beverages with poor nutritional quality and high ratio of calories-per-dollar.¹⁰ Students also visit fast food outlets on their way to and from school,¹⁷ and may be more likely to do so when fast food is located nearby schools.¹⁸ The presence of an abundance of stores and restaurants around urban schools has been associated with overall poorer youth dietary behaviors,¹⁸⁻²⁰ though across studies the reported association with weight outcomes has been mixed.^{21,22}

Rural community food environments have consistently demonstrated a dearth of healthy, high-quality foods, and rural youth face an increased risk of obesity compared with their urban counterparts.²³⁻²⁵ Despite evidence of these disparities, little research has examined the role of the community food environment surrounding schools outside of urban areas. At the same time, schools in rural areas may have practices that encourage the purchase of low-nutrient, energy dense snacks.²⁶ For instance, rural schools in Minnesota are more likely to have foods that “compete” with school meal program, such as vending machines and school stores, and are more likely to sell sports drinks and salty snacks compared with urban schools.²⁷ Food exposures from stores and restaurants near the school may have a joint impact on youth dietary choices along with opportunities to purchase food inside school.²⁸

Given a choice between eating meals in school and out of school, there is some evidence that local food establishments may draw students away from eating at school, particularly during lunchtime. In one national study, low-income high-school students were estimated to be 4.2% less likely to participate in the National School Lunch Program (NSLP) for each fast food restaurant in the school's zip code.²⁹ School policies like maintaining an open-campus environment in which students are allowed to leave during lunchtime have been associated with increased fast-food consumption at lunchtime in another study in suburban Minnesota.³⁰ Yet, from these cross-sectional studies, it is not possible to discern whether promoting school meal programs has the potential to reduce student purchases at outside establishments.

Furthermore, while these studies suggest a possible substitution of school lunches with fast-food lunches, the role of the National School Breakfast Program in influencing student food purchasing patterns outside of school is a neglected area of research. Participation in the school breakfast program is associated with lower body mass index (BMI).³¹ It is possible that habitual participation in the school breakfast program could influence food purchasing outside of school by reducing hunger among students early in the day.

The purpose of this study is to address the gap in research on the relationship between school breakfast participation (SBP) and use of the food environment around schools in a sample of high-school students who self-identify as breakfast skippers in rural Minnesota. Specifically, the study aims are to describe the frequency of food environment use among rural high-school students, and to test whether: (1): the frequency of eating school breakfast is associated with the

use of food stores and restaurants around schools; (2) an increase in school breakfast participation over time leads to a decrease in use of stores and restaurants around schools; and (3) the use of food stores and restaurants around schools is associated with student diet quality.

METHODS

Participants

This analysis was conducted as part of Project BreakFAST, a group-randomized trial aimed at increasing school breakfast participation through school policy and environmental changes in 16 rural Minnesota high schools.³² The intervention and pre/post assessments took place in 2 waves: Wave 1, which occurred between 2012 and 2014, and Wave 2, which occurred between 2013 and 2015. Each wave included 4 control schools and 4 intervention schools. Students were eligible to participate in the study if they were in grade 9 or 10, proficient in English, had access to a telephone, were scheduled to be at school at the beginning of the school day, and were breakfast skippers, defined as those who reported eating breakfast 3 or fewer times per week. Eligibility was determined by a pre-baseline screening that included all students in the 9th and 10th grade who were present at school on the day of the screening (N = 5767). A total of 2512 students were eligible to participate in the study. At each school, 50-75 eligible students were randomly selected and invited to participate in the study; racial and ethnic minority students were oversampled. A total of 904 students enrolled in the study, 732 of which completed both a baseline and follow-up survey.

Because 6 out of the 8 questions pertaining to food establishment purchases were added to the survey after the Wave 1 baseline assessment time point, only students in Wave 2 were asked the full set of questions about food establishment use at 2 time points, and it is only among these students that it was possible to construct the logical dichotomous outcome measure “any use of food establishments” versus “no use of food establishments.” Therefore, the current study includes the 404 students in Wave 2 who completed the baseline survey food environment questions. As the goal of the study was to understand the association between school breakfast changes at the individual level and use of the surrounding food environment, students were analyzed as part of a single cohort rather than comparing intervention and control groups, though the intervention status of each student’s school was included as a control variable. This approach recognized that individuals in both the intervention and control school may have increased or decreased their school breakfast participation regardless of school intervention status.

Measures

BreakFAST study surveys were fielded using an online form and independently completed by students in the school computer lab or at home. Survey questions addressed factors related to student breakfast patterns, social norms about school breakfast, use of the food environment during the school day, transportation to and from the school, other self-reported health behaviors, and student demographics, including age and race, categorized as white/non-white.

Questions about students' use of food establishments around the school were included in the online survey. Students were asked, during a normal school week, how many days per week they: (1) got breakfast at a fast food restaurant; (2) got breakfast at another restaurant; (3) got breakfast at a convenience store or gas-station; (4) got breakfast at another small food store; (5) got lunch at a fast food restaurant or another restaurant; (6) got lunch at a convenience store, gas-station, or other small food store; (7) got food or beverages at a fast food restaurant or another restaurant on the way home from school; and (8) got food or beverages at a convenience store, gas-station, or other small food store on the way home from school. Response ranged from 0 to 5.

To measure "any" food environment use, food environment questions were dichotomized into "any" (if a student answered e 1 for any of the above questions) or "none," (if a student answered 0 to all of the above questions.) To measure purchases at different times of the day, questions relating to each time of day were combined into 4 questions for breakfast, 2 questions for lunch, and 2 questions for after school. For example, students were categorized as having used the food environment for breakfast if they answered e 1 for any of the breakfast questions. For the longitudinal component of this study, the analysis separately examined pre/post change in the number of days per week each type of food retail was used at different times of the day to provide more detailed information about the impact of school breakfast.

Schools provided administrative data on school breakfast participation, gender, and free/reduced price meal participation for Wave 2 students at the end of the 2013-2014 school

year, which was before the Project BreakFAST intervention was implemented. The same data were again provided at the end of the 2014-2015 school year, which was after one school year of the intervention. The rate of school breakfast participation was measured at the student level as the proportion of days that each student purchased a fully-reimbursable school breakfast, the denominator being the number of days that student attended school during the whole school year. Change in school breakfast participation was measured as the change in the proportion of days that each student purchased school breakfast between the 2 years of data.

Unannounced 24-hour dietary recalls were administered before and after the intervention, in the spring of 2014 and again in the spring of 2015. Recalls were conducted by research staff over the phone using Nutrition Data Systems for Research (NDSR).³³ Three dietary recalls were attempted at each time point, including 2 weekdays and 1 weekend day. NDSR is a computer-based software that uses a multiple-pass interview technique to prompt for complete food recall and descriptions. Respondents consult a Food Amounts Booklet to estimate the amount and type of foods and beverages they consumed from midnight to midnight the previous day.

A Healthy Eating Index 2010 (HEI-2010) score was created by combining the 24-hour recalls for each participant to assess overall diet quality. The HEI-2010 is a United States Department of Agriculture (USDA) measure of diet quality that assesses how well a set of foods aligns with the Dietary Guidelines for Americans (DGA).³⁴ Higher scores (range 0-100) indicate better alignment. The HEI-2010 also assesses 12 subcomponents of a healthy diet that contribute to the score. Subcomponents include vegetables (range: 0-5), greens and beans (range: 0-5), total

fruit (range: 0-5) whole fruit (range: 0-5), whole grains (range: 0-10), dairy (range: 0-10), total protein (range: 0-5), seafood and plant protein (range: 0-5), fatty acids (range: 0-10), sodium (range: 0-10), refined grains (range: 0-10), and empty calories (range: 0-20). Sodium, refined grains and empty calorie scores are reverse coded so that higher scores contribute to a higher HEI score.

Data Analysis

Student baseline characteristics were summarized using descriptive statistics and were compared between students who made food establishment purchases at least once a week versus those who did not using 2-sample t-test for continuous variables and chi-square test for categorical variables. The association between school breakfast participation, which was a continuous measure, and food establishment purchases at baseline was examined using generalized linear mixed models (PROC GLIMMIX in SAS). Models included random effect of school and fixed effects of school breakfast participation, age, sex, free and reduced priced meal eligibility, and race. The association between HEI 2010 scores and food establishment purchases at baseline were examined in a similar fashion. Change in food establishment purchases from baseline to follow-up were categorized as 'decrease' or 'no change or increase'. The association between change in school breakfast participation, which was a continuous measure, and change in food establishment purchases were evaluated using generalized linear mixed models with the same covariates included. Odds ratios and their 95% CI were reported.

All analyses were conducted using SAS version 9.3 (SAS Institute Inc., Cary, NC). A 2-tailed p-value less than .05 was considered statistically significant.

RESULTS

At baseline, half of the students reported that they usually visited a food establishment outside of school at least once a week. The proportion of students reporting that they usually made a food or beverage purchase at a food establishment outside of school at least once a week was 37% for after school, 27% for lunch, and 18% for breakfast.

Student baseline characteristics are presented in Table 1. In students from the 8 schools, 51% were in grade 9 and 49% were in grade 10, 54% were female, and 67% were white. About one-third (35%) of the students were eligible for free/reduced price meal programs. Most students drove to school in a car (63%); fewer took the bus (41%) or used another mode of transportation (3%). At baseline, the average student participated in school breakfast on 14% of the days that they attended school. Student characteristics were similar for students who reported using the food environment at least once a week and those who did not.

Table 2 presents the association at baseline between school breakfast participation and purchasing food outside of the school for breakfast, lunch, and on the way home from school, adjusted for school and student characteristics. School breakfast participation was positively associated with making purchases at a food establishment outside of the school for breakfast ($p =$

.04), but not during lunch or after school. Students with 1% higher SBP at baseline had 1.4% greater odds of making a purchase outside of school for breakfast.

Table 3 presents the percent of students who reported a decrease in the frequency with which they made a purchase at food establishments outside of school between baseline and follow-up. Between baseline and follow-up, students were most likely to report a decrease by at least one visit per week in the frequency of making purchases at convenience stores, gas stations, or other small food store on the way home from school (22%). They were least likely to report a decrease in the frequency of making purchases at other small food stores and non-fast food restaurants for breakfast (5%).

Table 3 also describes how a 1% increase in school breakfast participation (SBP) was associated with reduced use of the food environment between baseline and follow-up. In adjusted models, students with increased SBP were more likely to decrease their fast food restaurant purchases on the way home from school (OR 1.017, 95% CI 1.005, 1.029) and less likely to decrease their visits to small food stores for breakfast (OR 0.979, 95% CI 0.959, 0.999). An increase in SBP was not associated with reduced use of the food environment during the school lunch period. Including a variable to control for school intervention status (intervention vs. control) did not meaningfully alter the results, and it was not included in the final models presented here. However, because the final models do not control for school intervention status, in interpreting the results, one cannot rule out that the association between SBP and food environment usage may have been affected by school intervention status.

Table 4 presents the association between making purchases at food establishments outside of school and student overall diet at baseline of the intervention, measured by Healthy Eating Index scores (HEI-2010), including the 12 HEI-2010 subcomponents. Whereas there was no difference in overall HEI-2010 scores between students who reported making a purchase at food establishments outside of school at least once a week and students who did not, food establishment purchases were associated with lower subcomponent scores for dairy ($p = .017$). Food establishment purchases demonstrated marginally statistically significant associations with lower whole fruit and lower total protein scores ($p = .05$).

DISCUSSION

In this sample of rural high-school students who reported they often skip breakfast, making purchases at food establishments outside of the school was common. This was particularly the case after school, when more than one-third of students reported making a food or beverage purchase at a store or restaurant at least once a week. Participation in the school breakfast program was associated with modest differences in food establishment use among these students. Over time, students with increased participation in the school breakfast program were slightly more likely to maintain or increase their use convenience stores and gas-stations outside the school for breakfast, rather than decrease their use. In other words, participation in school breakfast did not appear to replace breakfast purchases at stores outside of school; rather, increasing breakfast use may have occurred concurrently in and outside of school. It is possible

that students who became accustomed to eating breakfast more habitually may have sought out breakfast and found either source of breakfast (from school or from a store or restaurant) acceptable.

While SBP did not replace breakfast purchasing behavior outside of school, eating school breakfast was associated with changes in food purchases later in the day. Results showed that increasing SBP was associated with a decrease in purchases at fast food restaurants after school. Students who ate school breakfast may have been less hungry for subsequent meals later in the day. Whereas current research generally does not support the notion that breakfast-skipping leads to caloric overcompensation at later meals,³⁵ a number of studies with adult, adolescent, and child participants report that people experience more hunger later in the day after they skip breakfast.^{36–38} In the current study, caloric intake remained unchanged throughout the intervention, even though school breakfast participation increased. It's possible that students in the current study who consumed school breakfast may have been less likely to seek out an after-school meal than those that skipped breakfast. Alternatively, it's also possible that the association between change in breakfast participation and after school food environment use is due to unmeasured confounding – for example, an increased participation in after school sports teams or other activities.

In the current study, the use of the food environment around school was associated with indicators of poorer quality diet among student participants, namely lower dairy consumption and marginally lower fruit and total protein consumption. School breakfast must adhere to the

Dietary Guidelines for Americans, which emphasizes dairy, fruits and vegetables, and items high in whole grains and low in sodium, whereas breakfast purchased outside has no such standards. Fast-food restaurant visits among youth have been associated with a number of indicators of poor diet,³⁹ most notably sugar-sweetened beverage consumption.^{40,41}

This study contributes to the sparse literature on the food environment in rural areas, which present unique food access challenges compared with urban ones.¹⁴ Even though store density in rural school areas is less than in urban areas,⁴² rural schools in Minnesota may not be particularly isolated from food establishments. Previous research conducted in the study area, in which a complete list of food retail options was compiled during site visits to 3 BreakFAST study schools, suggests that students likely had a number of fast-food, convenience store, and other food establishment options to visit within 3-5 miles of their school.⁴³ This study also moves beyond other studies that have assessed the cross-sectional relationship between food environment composition around schools and student meal patterns,^{20,29} which have not been able to deduce the directionality of the relationship. Results from the current intervention study support the notion that changes in school meal programming can contribute to behavior changes in use of the community food environment over time. This is important, as addressing fast-food exposure may be a difficult point for intervention. Another strength of this study was that data on SBP were collected at the student level by school administrative processes that accounted for student absences and measured participation across the whole year, and was therefore not subject to self-reporting bias. This is particularly noteworthy because intervention students would have

been aware that a school breakfast intervention was taking place at their school, and might have otherwise been more likely to over-report breakfast participation.

This study had several limitations. Although we tested longitudinal change in both SBP and food environment use, it is not possible to say whether SBP was the direct cause of the observed changes. Changes in adolescent meal patterns over the course of a year are likely complex, and relevant unmeasured factors such as changes in activity spaces, peer influences, and after-school commitments were absent in our models. Another limitation of this study is that data on food environment use were self-reported, and did not capture the specific food establishments that students were exposed to, or the nutritional quality of the purchases they made. Furthermore, our interpretation that students became more habitual breakfast eaters, alternating school breakfast with breakfast outside the school, may not be correct. This study cannot rule out the possibility that some students ate multiple breakfasts in a single day.⁴⁴ Whereas potentially worrisome, one study among younger students has suggested that school breakfast programs can improve diet quality and do not contribute to excess calories even despite the fact that some students ate multiple breakfasts.⁴⁵ Indeed, other analyses in the Project BreakFAST study, students did not increase their caloric intake from baseline to follow-up.⁴⁶

Conclusions

The results of this study indicate the importance of research on adolescent food purchasing patterns in rural settings. Findings demonstrate that, among rural high-school

breakfast-skippers, purchasing foods and beverages at stores and restaurants is common, and those who use the food environment around school are likely to demonstrate some indicators of poorer diet, as compared with those who do not use food establishments around the school. Increasing participation in school breakfast may result in changing patterns of purchases at food establishments. Additional research is needed to rule out other causes of changing meal patterns among high-school students over time. This study demonstrates that school breakfast participation may have a modest impact on student purchases outside of school, yet the cumulative impact of school meal programs along with other obesity-prevention and health promotion policies and practices at the school should be more closely examined.⁴⁶

IMPLICATIONS FOR SCHOOL HEALTH

Our findings, taken in context with other studies, have several implications for school nutrition programs, policies, and practices. School breakfast programs often have low participation rates due to real and perceived barriers to participation by students.^{47,48}

Increasing school breakfast participation may require active promotion strategies,³² such as marketing strategies to make breakfast appealing. For example, promotional posters and videos featuring students can be used to encourage school breakfast. Our results indicate that schools may also need to specifically promote the advantages of school breakfast over breakfast purchased at an outside food establishment. For example, existing promotional resources⁴⁹ can be reframed to promote school meals as low-cost, tasty, and energy-sustaining choices compared

with those available outside of school. To optimize the nutritional impact of school breakfast programming, schools might consider implementing complementary practices and policies that discourage students from purchasing low-nutrient, energy dense foods, such as closed-campus policies or limiting competitive food options.

In implementing school breakfast programs, schools should also be aware that such programming could influence food establishment purchases and, particularly in sparsely populated town and rural areas, could affect relationships with local businesses. On one hand, high-school students might provide welcome foot traffic for nearby stores; on the other hand, students may be perceived as a nuisance to other regular customers.¹² Anecdotally, an interview with a school food director in the current study revealed that after the school breakfast program was implemented, a local restaurant called the school pleased that they had fewer students eating at the restaurant for lunch, as it allowed them to serve more of the local workers. Thus, the promotion of school meals may be perceived positively by the local community.

Finally, schools should recognize that there may be benefits of school breakfast that stretch beyond its potential impact on out-of-school food purchases. As a critical part of the federal meals program, the program reaches students in more than 89,000 US schools every day.⁵⁰ Moreover, meal program expansion and promotion within schools can reduce the stigma of participation for low-income youth and students experiencing food insecurity, who may reap the greatest benefits from school meal programs.^{51–53} Taken in context with other studies, our

results support local and national school efforts to expand school breakfast programming and increase program participation among high-school students.

Human Subjects Approval Statement

The University of Minnesota Institutional Review Board approved study procedures (IRB Code Number 1111S06384).

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Table 1. Student Characteristics and Reporting Food Establishment Purchases at Least Once a Week

	Frequency N (%) (N = 404)	No food establishment purchases (N = 201)	Food establishment purchase ≥1 time a week (N = 203)	p-value (Chi-square Test)
Grade level				
9	205 (51%)	103 (50%)	102 (50%)	p = .84
10	199 (49%)	98 (49%)	101 (51%)	
Sex				
Female	219 (54%)	109 (50%)	110 (50%)	p = .99
Male	185 (46%)	92 (50%)	93 (50%)	
Race				
White	268 (67%)	131 (49%)	137 (51%)	p = .72
Non-white	130 (33%)	66 (51%)	64 (49%)	
Free/reduced price meal eligibility				
Full priced	263 (65%)	133 (51%)	130 (49%)	p = .65
Free/reduced	141 (35%)	68 (48%)	73 (52%)	
Transportation to school				
Car				
Yes	255 (63%)	120 (47%)	135 (53%)	p = .16
No	149 (37%)	81 (54%)	68 (46%)	
Bus				
Yes	165 (41%)	90 (55%)	75 (45%)	p = .11
No	239 (59%)	111 (46%)	128 (54%)	
Other				
Yes	13 (3%)	4 (31%)	9 (69%)	p = .26*
No	391 (97%)	197 (50%)	194 (50%)	
Make purchase at food establishments				
For breakfast	71 (18%)	0	71	-
For lunch	107 (27%)	0	107	-
On the way home from school	149 (37%)	0	149	-

	Mean (SD)			p-value (t-test)
% school breakfast participation (SBP)§	14.0 (20.6)	13.3 (19.5)	14.8 (21.5)	p = .47

*Fisher’s Exact test

§ (number of days student ate school breakfast / number of days student attended school during the school year) *100

Table 2. **Association between School Breakfast Participation (SBP) and Food Establishment Purchases for Breakfast, Lunch, and after School (N = 404)**

	Adjusted odds ratio (95% CI) of % SBP*	p-value
Any food establishment purchase, yes vs. no	1.001 (0.990, 1.013)	p = .85
Food establishment purchase for breakfast, yes vs. no	1.014 (1.000, 1.028)	p = .04
Food establishment purchase for lunch, yes vs. no	0.996 (0.983, 1.009)	p = .53
Food establishment purchase on the way home from school, yes vs. no	0.995 (0.983, 1.007)	p = .40

*Generalized linear mixed models, including a random effect of school and fixed effects of % SBP (continuous), age, gender, free/ reduced priced meal eligibility, and race.

Table 3. **The Association between Increase in School Breakfast Participation and Decrease in Purchases at Food Establishments outside of School**

Change in ...	N	N (%) who decreased purchases	Adjusted odds ratio (95% CI) of change in % SBP*	p-value
Getting breakfast at a fast food restaurant, less vs. no change or more	356	27 (8%)	0.994 (0.976, 1.013)	.54
Getting breakfast at another restaurant, less vs. no change or more	354	17 (5%)	0.985 (0.962, 1.008)	.19
Getting breakfast at a gas station or convenience store, less vs. no change or more	356	32 (9%)	0.979 (0.959, 0.999)	.04
Getting breakfast at another small food store, less vs. no change or more	355	17 (5%)	0.983 (0.957, 1.009)	.19
Getting lunch at a fast food restaurant or other restaurant, less vs. no change or more	354	56 (16%)	1.009 (0.997, 1.020)	.15
Getting lunch at a convenience store, gas station or other small food store, less vs. no change or more	357	45 (13%)	0.997 (0.982, 1.011)	.63
Getting food or beverages at a fast food restaurant or other restaurant on the way home from school, less vs. no change or more	359	57 (16%)	1.017 (1.005, 1.029)	.004
Getting food or beverages at a convenience store, gas station, or other small food store on the way home from school, less vs. no change or more	354	79 (22%)	1.003 (0.992, 1.015)	.59

*Generalized linear mixed models, including a random effect of school and fixed effects of change in % SBP (continuous), age, sex, free/reduced priced meal eligibility, and race.

Table 4. **Association* between Making Purchases at Food Establishments Outside of School and Healthy Eating Index Scores (HEI-2010) (N = 354)**

	Any food environment use (N = 174) Mean (SD)	No food environment use (N = 180) Mean (SD)	p-value
Total HEI-2010 score (0-100)	49.1 (11.8)	50.8 (11.2)	.22
Total Vegetables Score (0-5)	2.1 (1.2)	2.1 (1.3)	.73
Greens and Beans Score (0-5)	0.7 (1.5)	0.7 (1.5)	.54
Total Fruit Score (0-5)	2.1 (1.9)	2.1 (1.7)	.76
Whole Fruit Score (0-5)	1.7 (1.9)	2.2 (1.8)	.05
Whole Grains Score (0-10)	3.5 (3.2)	3.6 (3.3)	.76
Dairy Score (0-10)	7.8 (2.7)	8.4 (2.3)	.02
Total Protein Foods Score (0-5)	3.9 (1.4)	4.2 (1.1)	.05
Seafood and Plant Proteins Score (0-5)	1.3 (1.9)	1.3 (1.9)	.97
Fatty Acids Score (0-10)	3.6 (3.0)	3.2 (2.9)	.28
Sodium Score (0-10)	4.2 (3.1)	4.4 (3.1)	.64
Refined Grains Score (0-10)	5.0 (3.2)	5.3 (3.0)	.29
Empty Calories Score (0-20)	13.3 (4.8)	13.2 (4.4)	.66

*Linear mixed models, including a random effect of school and fixed effects of food environment use, age, sex, free/ reduced priced meal eligibility, and race.

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01/03/2013

Susie Nanney
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RE: "Improving High School Breakfast Environments"
IRB Code Number: **111S06384**

Dear Dr. Nanney

The Institutional Review Board (IRB) received your response to its stipulations. Since this information satisfies the federal criteria for approval at 45CFR46.111 and the requirements set by the IRB, final approval for the project is noted in our files. Upon receipt of this letter, you may begin your research.

IRB approval of this study includes the letter to parents dated December 3, 2012 and the assent form received January 3, 2013.

The IRB would like to stress that subjects who go through the consent process are considered enrolled participants and are counted toward the total number of subjects, even if they have no further participation in the study. Please keep this in mind when calculating the number of subjects you request. This study is currently approved for 1,200 subjects. If you desire an increase in the number of approved subjects, you will need to make a formal request to the IRB.

For your records and for grant certification purposes, the approval date for the referenced project is December 27, 2012 and the Assurance of Compliance number is FWA00000312 (Fairview Health Systems Research FWA00000325, Gillette Children's Specialty Healthcare FWA00004003). Research projects are subject to continuing review and renewal; approval will expire one year from that date. You will receive a report form two months before the expiration date. If you would like us to send certification of approval to a funding agency, please tell us the name and address of your contact person at the agency.

As Principal Investigator of this project, you are required by federal regulations to inform the IRB of any proposed changes in your research that will affect human subjects. Changes should not be initiated until written IRB approval is received. Unanticipated problems or serious unexpected adverse events should be reported to the IRB as they occur.

The IRB wishes you success with this research. If you have questions, please call the IRB office at 612-626-5654.

Sincerely,

Christina Dobrovolny, CIP
Research Compliance Supervisor
CD/ks

CC: Sara Coulter, Lisa Harnack, Mary Hearst, Kara Johnson, Martha Kubik, Robert Leduc, Sue Lowry, Qi Wang, Katherine Young

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Title:

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