

ABSTRACT

Background. Breakfast skipping has been associated with obesity. Schools have adopted breakfast policies to increase breakfast participation. Recently there have been concerns that students in schools where breakfast is served in the classroom may be eating two breakfasts - one at home and one at school - thereby increasing their risk of excessive energy intake and weight gain.

Objective. The study objective was to compare the prevalence of not eating breakfast, eating breakfast at home or school only, and eating double breakfasts (home and school) by students in schools with distinct breakfast policies and evaluate the relationship of breakfast policy to energy intake and diet quality.

Design. Baseline data were collected in 2011-2012 as part of a cluster randomized, controlled trial to evaluate the effectiveness of a school-based intervention to promote fruit and vegetable intake and physical activity in low-resource elementary schools in California.

Participants/setting. Participants were 3,944 fourth and fifth graders from 43 schools, 20 served breakfast in the cafeteria before school, 17 served breakfast in the classroom at the start of school, and 6 served 'second chance' breakfast (in the cafeteria before school and again at first recess).

Statistical analysis. As part of a secondary data analysis, differences in school and individual characteristics by school breakfast policy were assessed by chi-square test of independence or ANOVA. Associations between school breakfast policy and breakfast eating patterns were assessed. Outcomes included calorie intake at breakfast, total daily calorie intake, and diet quality as measured by the Healthy Eating Index-2010. Control variables included student race/ethnicity, grade, and language spoken at home, and clustering of students by school.

Results. Breakfast in the classroom was associated with fewer students not eating breakfast ($p<0.001$), but more eating breakfast at both home and school ($p<0.001$). Students in the breakfast in the classroom group did not have higher average energy intakes from breakfast or higher daily energy intakes that were higher than other breakfast policy groups. The breakfast in the classroom group had higher overall diet quality ($p=0.01$).

Conclusions. No evidence was found to support discontinuation of breakfast in the classroom policy on the basis of concerns that children will eat excess calories.

School Breakfast Policy is Associated with Dietary Intake of Fourth and Fifth Grade Students

INTRODUCTION

Breakfast eating among children has been related to numerous positive short-term and long-term outcomes. Benefits of breakfast eating include improved cognitive function and academic performance in school,¹⁻⁸ improved school attendance,^{7,8} micronutrient profile,⁹⁻¹¹ and reduced body mass index.^{12,13} A 2008 review also cited additional behavioral and psychosocial benefits from eating breakfast including improvements in psychosocial wellbeing, discipline, and social behavior, and less aggression and fewer suspensions.¹⁴ Despite these benefits, on any given day up to one-third of children in the U.S. do not eat breakfast.⁹

The federal School Breakfast Program is an important source of breakfast for children. The US Department of Agriculture's School Breakfast Program was established in 1966 as a pilot and then officially authorized in 1975 to provide breakfast at no cost to students living below 130% of the federal poverty level.¹⁵ School districts receive a federally funded, per-meal reimbursement for every breakfast served with the highest reimbursement provided for meals served to the lowest income students. Students in households with incomes between 130% and 185% of the federal poverty level are eligible for a reduced price breakfast costing no more than 30 cents per meal. Most (77%) school breakfasts are served to students eligible for free meals; 8% are served to students eligible for reduced-price meals; and the remaining are served to students eligible for full-priced meals.¹⁶ The School Breakfast Program is the third largest federal nutrition assistance program in the country in terms of number of participants. In fiscal year 2013, over 13 million students participated on each school day.¹⁶

However, the School Breakfast Program does not reach all students who are eligible for free or reduced-price meals. While the number of schools participating in the School Breakfast Program has grown since the program's inception to nearly the number of schools participating in the National School Lunch Program, fewer than half as many students eat school breakfast compared to school lunch.¹⁶ Given that there is a large body of research linking participation in the school breakfast program and favorable dietary, health,¹⁷⁻²⁰ and educational²¹⁻²³ outcomes in children, increasing the utilization of the School Breakfast Program is a worthy goal.

Schools have adopted several types of breakfast policy to increase breakfast participation. When the School Breakfast Program was first introduced, schools typically served breakfast in the cafeteria before school began. One disadvantage to this policy is that students must arrive at school early to eat breakfast. Bus schedules, transportation time, and other factors can make early arrival a challenge for students. Several studies have shown that it is possible to increase breakfast participation by making breakfast free to all students, so-called ‘universal’ breakfast.^{24,25} Others have reported that while providing universal breakfast offers nutritional advantages because school breakfasts tend to be more nutrient-dense than breakfasts eaten at home, universal breakfast before school does not necessarily reduce breakfast skipping.^{25,26}

In an attempt to increase student participation, some schools have moved the service of universal breakfast from the cafeteria prior to the start of school to the classroom after school begins.²⁷ Other schools have adopted alternative breakfast policies including grab ‘n’ go breakfast, breakfast on the bus, and ‘second chance’ breakfast.²⁷ With grab ‘n’ go breakfasts all the components of school breakfast are conveniently packaged so students can grab a reimbursable meal quickly, either from the cafeteria line or from carts on school grounds. Students can eat in the cafeteria, the classroom or the playground. In some districts where students have lengthy bus commutes, schools serve breakfast on the bus ride to school. ‘Second chance’ involves serving breakfast in the cafeteria prior to the start of school as well as serving it again later in the morning to students who missed the first offering.²⁷ Some schools offer “second chance” breakfast during the first recess, while other schools offer it during a “nutrition break” or between class periods. Although all of these strategies are designed to increase breakfast participation, few studies have compared the dietary impacts of these varying breakfast policies.

Recently there have been concerns about whether the potential harms of breakfast in the classroom outweigh the benefits.²⁸ Results from a few studies suggest that moving breakfast into the classroom may lead to an increased percentage of students eating two breakfasts (one at home prior to the one at school), increased breakfast energy intake, and ultimately the potential for excessive weight gain.^{29,30} Given that over a third of children aged 6 to 19 years old in the U.S. are overweight or obese,³¹ identifying the most effective school breakfast policy that does not contribute to obesity is a national priority.

The objectives of the study were twofold: 1) to compare the prevalence of not eating breakfast, eating breakfast at home or school only, and eating breakfast at home and school among elementary school students attending schools with one of three distinct breakfast policies: breakfast in the cafeteria prior to the start of school, breakfast in the classroom at the start of the school day, and ‘second chance’ breakfast; and 2) to evaluate the relationship of breakfast policy to daily energy intake and diet quality of students.

METHODS

Study Design and Setting

Data were collected in 2011-2012 at baseline of a cluster randomized, controlled trial to evaluate the effectiveness of a school-based intervention to promote fruit and vegetable intake and physical activity among fourth and fifth grade students in low-resource elementary schools in San Diego and Imperial Counties in California.³² No changes were made to the school breakfast schedule or food offerings. All study protocols were reviewed and approved by the IRB at the Public Health Institute, an independent nonprofit organization focusing on health promotion, which spearheaded the original study. Parents were sent an information letter about the study and an opt-out consent form. Students were read a verbal assent by research staff before the food diary was completed.

Participants

Participants are 3,944 4th and 5th grade students from 43 elementary schools in five school districts. Schools were excluded based on having: 1) no fourth or fifth grade classes; 2) fewer than 30 students per grade; 3) fewer than 50% of the student body qualifying for free or reduced price meals; 4) received the planned intervention or a similar intervention or other strong wellness activities in the year prior; and 5) characteristics that would limit the generalizability of findings (e.g., location bordering Mexico or being a juvenile detention school). From an initial list of 221 elementary schools, 131 were eligible for participation based on these criteria and 45 were recruited by research staff. Recruitment was discontinued once the desired sample size of schools was achieved. Subsequently one school dropped out of the study due to a campus fire. For this study, one school was excluded because it differed from all other schools in that it did not provide school breakfast. A student participation rate of 78.2% was achieved in the intervention study.

Procedure

The exposure of interest, breakfast service policy, was determined by research staff querying school foodservice staff. School level characteristics that might impact a student's breakfast participation were also queried by research staff and included: percent of students eligible for free or reduced-price meals, and whether or not a school had Provision 2 status. Provision 2 status allows a school to provide meals at no cost to all students regardless of family income.³³ Federal reimbursement is based on the number of children served free or reduced-price meals in the first year of Provision 2 implementation.³³ To make this model economically viable, schools with Provision 2 status tend to have higher rates of children eligible for free or reduced-price meals compared to schools without Provision 2 status.³³ Data on Provision 2 status were obtained from school office staff. Percent of students eligible for free or reduced price meals for the 2011-12 school year were obtained from the California Department of Education Dataquest website.

The outcomes of interest, number and location of breakfast (none, one at school, one at home, two – at home and school), and calorie intake at breakfast and for an entire day, were computed by research staff using a 24-hour diary-assisted recall collected on a school day. Prior to recording intake in their food diary, students received classroom training from research staff. Methods of recording what, when, and how much was eaten were emphasized. Each child received a set of measuring cups and spoons and two-dimensional pictures for portion size measurement. Within two days of completing the food diary, trained research staff conducted a 24-hour recall interview individually with each child using the multiple-pass method.³⁴ Food models were used to clarify portion sizes and details on forgotten foods were elicited. Where each food and beverage was obtained and consumed was also queried and recorded by interviewers so that for each item consumed students were asked whether it was obtained and consumed at school or elsewhere. Information on foods and beverages collected from students was supplemented with information on school foods and beverages collected by interviewing school foodservice staff, as described previously in a national evaluation of the Fresh Fruit and Vegetable Program.³⁵ Foods and beverages were coded by research staff using the U.S. Department of Agriculture's Food and Nutrient Database for Dietary Studies (version 3.0, 2008, U.S. Department of Agriculture, Agricultural Research Service, Food Surveys Research Group), and MyPyramid equivalents were

used to determine food group intakes (MyPyramid Equivalents Database, version 2.0, 2003-2004, U.S. Department of Agriculture, Agricultural Research Service, Food Surveys Research Group).

Daily diet quality was quantified using the Healthy Eating Index-2010 (HEI-2010).³⁶ The HEI-2010 is a measure of conformance to the 2010 Dietary Guidelines for Americans.³⁷ A total of 12 components (total fruit which includes 100% juice, whole fruit which excludes juices, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, fatty acids, refined grains, sodium, and empty calories) are scored separately and then summed for a maximum score of 100 signifying the highest quality diet. The standards used for scoring are expressed as a percent of calories or per 1000 calories allowing for diet quality comparisons across a wide range of energy intakes.

Student demographic data (sex, race/ethnicity, language spoken at home) were obtained by written survey. The survey was completed by students in the classroom with assistance from research staff to answer any student questions.

Breakfast was defined as anything consumed (food or caloric beverage) between 4:00 am and up to half an hour before the school lunch start time, with items reported as lunch items excluded. This may include some items for which the time was inaccurately recorded (e.g., 7:00 am instead of 7:00 pm). However, instances of seemingly aberrant times (e.g., between 1:00 am and 4:00 am) were hand checked with the diaries and any obvious errors were corrected. Students not eating breakfast were defined as those who recorded zero intake of calories as breakfast. Breakfast eaters recorded any intake of calories at breakfast (range was 3 to 3400 kcal for breakfast and 189-6263 kcal for total daily intake). All items recorded as eaten in the defined period were included as 'breakfast,' with the understanding that some students were over-reporting and others under-reporting consumption. This definition was used instead of other less inclusive ones that have been used in past studies,^{38,39} in order to maximize detection of any items that could be considered 'second' breakfast. For the purposes of this analysis, any breakfast item reported by students as being obtained from the school was classified as school breakfast; all other breakfast items were classified as being from home, although items may have been obtained from elsewhere (e.g., a restaurant). Items consumed at home, even if separated in time (e.g., ate something at 6:00 am and then again at 7:00 am), were categorized as one breakfast from home.

Data Analysis

Association of school and individual student characteristics with school breakfast policy were assessed by a chi-square test of independence or ANOVA. School characteristics assessed included Provision 2 status, and the proportion of students eligible for free or reduced price meals. Individual student characteristics assessed included sex, race/ethnicity (Hispanic, non-Hispanic white, etc.), language spoken at home (English, Spanish, or other), grade level (fourth or fifth), and age.

Associations between breakfast eating patterns and school breakfast policy were assessed by chi-square test of independence. Breakfast eating patterns included no breakfast, breakfast at home (or elsewhere) only, breakfast at school only, and double breakfast (home and school). Associations of nutritional outcomes including breakfast calorie intake, total daily calorie intake, and HEI-2010 scores with school breakfast policy were assessed using GEE models to adjust for race/ethnicity, grade, language spoken at home, and school level clustering. Student race/ethnicity, grade and language spoken at home were included in the models since they differed between breakfast groups and outcomes of interest could differ according to these characteristics. Adjustment to account for cluster design effects was done. An adjusted P value below 0.05 was considered significant. Next, for those outcomes found to have significant differences by GEE, a post-hoc multiple comparison test using GEE methodology was carried out to determine which groups had significantly different means. For these tests p-values were adjusted by the Bonferroni-Holm method based on the number of comparisons and an adjusted p-value below 0.05 was considered significant. All analyses were conducted using SAS version 9.3 (2011, SAS Institute, Inc).

RESULTS

Sample Characteristics

Of the 43 elementary schools included in the study, 17 served breakfast in the classroom at the start of school, and 26 served breakfast in the cafeteria prior to the start of school. Additionally, six of the schools that offered breakfast in the cafeteria also had a “second chance” breakfast.

Therefore we examined three groups according to the breakfast service policy: breakfast in the cafeteria only before the start of school (20 schools, 1825 students), breakfast in the classroom (17

schools, 1530 students), and second chance breakfast (6 schools, 589 students) (**Table 1**). Schools that offered breakfast in the classroom differed from those that offered breakfast in the cafeteria and second chance breakfast on several characteristics. Breakfast in the classroom schools had a higher percentage of students eligible for free or reduced price meals and a higher number of schools with Provision 2 status. Students at breakfast in the classroom schools were more likely to be Hispanic and speak Spanish at home than students in the other two breakfast policy groups. The breakfast in the classroom group also had a slightly, but significantly higher, proportion of students in the fourth grade rather than the fifth grade; however, age, which averaged 9.75 ± 0.68 (SD) for the total sample, did not differ between groups (data not shown). Approximately half (49.3%) of the total sample were male.

Prevalence of Breakfast Eating

On the day of the dietary data collection, among all policy groups combined, approximately one in 10 students did not eat breakfast while half ate a breakfast at home only, nearly one-quarter ate a breakfast at school only, and 14% ate breakfast at both home and school (**Table 1**). The schools with breakfast in the cafeteria policy had the highest proportion (13.1%) of students not eating breakfast, while the breakfast in the classroom group had the lowest proportion (8.4%) of students not eating breakfast. The breakfast in the classroom group had the lowest proportion of students who ate a breakfast at home only and the highest proportion of students who ate breakfast at school only. The breakfast in the classroom group also had the highest proportion of students, nearly one-fourth, who ate breakfast at both home and school, compared to 5.6% of the breakfast in the cafeteria group and 15.3% in the second chance breakfast group. A higher proportion of students in the breakfast in the classroom group (63.0%) and the second chance breakfast group (69.1%) ate school lunch on the day that food intake was recorded, compared to students in the breakfast in the cafeteria (54.5%) ($P = 0.028$, adjusted for multiple comparisons).

Relationship of Breakfast Policy to Dietary Intake

Average calorie intake at breakfast tended to be highest in the second chance breakfast group, although not significantly so using the post-hoc multiple comparison test (**Table 2**). There were no significant differences in mean daily calorie intake between breakfast policy groups. The breakfast in the classroom group had the highest total HEI-2010 score across the entire sample as well as for the subset of all breakfast eaters and those that ate no breakfast. The components of the HEI-2010

score that were significantly higher for students in the breakfast in the classroom group included: total fruit (indicating higher intake), whole fruit (indicating higher intake), and empty calories (indicating lower intake). The subscore for greens and beans was significantly higher for the breakfast in the cafeteria group; however, this subscore was relatively low (mean of 0.42 out of a maximum score of 5) for all breakfast policy groups.

DISCUSSION

In this study involving nearly 4,000 fourth and fifth grade students from 43 elementary schools in southern California we found that breakfast in the classroom policy was associated with a reduced prevalence of not eating breakfast, a larger proportion of students eating breakfast at school, and a higher prevalence of eating breakfast at home and again at school. Given that breakfast in the classroom policy involves providing the opportunity for all children to eat breakfast at school, these findings are not unexpected. Breakfast in the cafeteria policy can present logistical challenges for students as well as potentially exacerbate stigma associated with students' participation in school meals. Students in the study sample attending schools with a second chance breakfast must either arrive early to school or miss the first recess in order to get breakfast. Both breakfast in the cafeteria and second chance breakfast options appear to present barriers to students consuming the school breakfast.

Students in the breakfast in the classroom group did not have higher average energy intakes from breakfast or higher daily energy intakes that were higher than the other breakfast policy groups. Further, the breakfast in the classroom group had a higher overall dietary quality as measured by HEI-2010. Although the HEI-2010 scores and some of the subgroup HEI-2010 scores were statistically significant between breakfast policy groups, these differences may not be attributable solely to breakfast, given it is only one meal in the entire 24-hour period. The higher HEI-2010 scores for students at schools with breakfast in the classroom may be due to that fact that more students at these schools ate the school breakfast *and* the school lunch compared to students attending schools that offered breakfast in the cafeteria. Others have shown that school meals tend to be of higher quality than food brought from home.^{40,41}

A higher proportion of students in breakfast in the classroom schools qualified for free or reduced-price meals, attended Provision 2 schools, were Hispanic, and spoke primarily Spanish at home compared to the other breakfast policy groups. This is not surprising, given that breakfast in the classroom and Provision 2 are most likely to be fiscally feasible in schools where a substantial proportion of students are eligible for free or reduced-price meals due to the fact that the federally funded, per-meal reimbursement is highest for breakfasts served to low-income students. Though adjustment was made for clustering of students by school, the degree to which differences in student characteristics may have contributed to the findings is unknown. Others have shown that lower income and minority children tend to have lower quality diets⁴² and higher body mass index⁴³ than higher income children. Therefore the presumably lower-income Hispanic students in the breakfast in the classroom schools would be expected to have lower diet quality and higher energy intakes, opposite to study findings. On the other hand, less acculturated Hispanic families tend to eat a higher quality diet than their more acculturated peers.⁴⁴

It is not clear why second chance breakfast policy might result in increased breakfast calorie intake. According to the schools in the sample that served second chance breakfast, students eating breakfast in the cafeteria before school starts were not allowed to eat a second breakfast at recess. While it may be that this rule is not always enforced, we found that only 7.5% (44 of 589) students in the second chance breakfast group ate items at school at two different times during the morning (data not shown). Another explanation could be that students who ate at home early in the morning were hungry by mid-morning at school and took advantage of a second chance to eat another breakfast.

The few other studies that have examined the relationship between breakfast in the classroom policy and student dietary intakes have found similar results on the prevalence of not eating breakfast and eating breakfast both at home and at school. In a cross-sectional study involving elementary schools in New York City, Van Wye found that compared to students at schools with breakfast in the cafeteria (n=1245), students at schools with breakfast in the classroom (n=1044) were less likely to skip breakfast (8.7% vs. 15.0%), and more likely to eat more than one breakfast (51% vs 30%).³⁰ In another study of 465 fourth grade children, a larger proportion of students from breakfast in the classroom schools ate more than one breakfast than students at breakfast in the cafeteria schools.²⁹ In the School Breakfast Program Pilot evaluation of universal

free breakfast offered either in the classroom (17 schools) or in the cafeteria (61 schools), elementary school students offered breakfast in the classroom were twice as likely to eat two or more breakfasts compared to students offered breakfast in the cafeteria (20% vs. 10% of students, respectively, with a total sample size of over 5000 students).⁴⁵

However, studies are conflicting about differences in calories consumed at breakfast according to school breakfast policy. In the present study, students eating breakfast in the classroom tended to have the lowest average calorie intake at the defined breakfast time period of the three school breakfast policy groups (22 kcals less than students in the breakfast in the cafeteria group and 87 kcals less than students in the second chance breakfast group), although the differences did not remain significant using the more conservative post-hoc comparison test. In contrast, in the New York City study, breakfast in the classroom students consumed an average of 95 kcals more at breakfast than students not offered breakfast in the classroom.³⁰ It is important to note, however, that in the New York City study intakes were estimated from a food checklist completed by students, with typical portion sizes imputed. This method of dietary assessment is less accurate than the 24-hour recall method.⁴⁶ Baxter estimated breakfast calorie intake by observation by research staff and also found that breakfast in the classroom students (no breakfast skippers included) ate significantly more calories at breakfast (by 26 kcals on average) than students eating breakfast in the cafeteria.²⁹ However, in the School Breakfast Program Pilot, which used a 24-hour recall to measure intakes similar to the method used in the present study, total calories did not differ among students eating breakfast at school between breakfast in the classroom versus breakfast in the cafeteria.⁴⁵

Study strengths include a large sample size of students and schools, inclusion of schools with three different breakfast policies, and use of a diary-assisted 24-hour recall method to assess dietary intakes. The diary-assisted 24-hour recall is a blending of two dietary assessment methods that maximizes the strengths of both the food record and the 24-hour recall. Although additional days of recall are recommended to maximize accuracy of dietary data collected from young school-age children,⁴⁷ the dietary record method has the potential for providing more accurate information than a recall alone by recording foods as they are consumed and the 24-hour recall is the method used in the only nationally representative dietary survey in the U.S.⁴⁶ Further, the diary-assisted

method was enhanced by obtaining nutritional information about school foods and beverages from school foodservice staff.

However, there are also study limitations. We did not assess body mass index; and we were unable to adjust for student's physical activity level, which can influence energy intake, nor household socioeconomic status. Further, self-report of dietary intake by children is less accurate than methods involving direct measurement and a wide range of energy intakes was documented.⁴⁶ Dietary intakes are based on only one day of recall per child. Further, this is an observational study; students were not randomly assigned to groups and therefore there may be inherent group differences that impacted the dietary outcomes measured. For example, differences in HEI scores observed among students not eating breakfast by breakfast policy group may be related to participation in the school lunch program. We also cannot rule out that there may have been differences in the school foods that were served to students in the three groups. The majority of the sampled schools (34 out of 43 with 55% serving breakfast in the cafeteria and 45% serving breakfast in the classroom) were from a single very large school district operated by a single school foodservice authority. Still, we did not standardize menus across schools and did not quantify the quality or amounts of breakfast items served. In addition, we did not observe breakfast at each school, so we cannot account for differences in the way the breakfast policies may have been implemented in schools or in individual classrooms.

CONCLUSION

Among elementary school students attending low-resource schools, breakfast in the classroom policy, compared to other breakfast policies, was associated with fewer students not eating breakfast and an increase in overall dietary quality without increasing calorie intake at breakfast time or over the course of the day. While additional longitudinal studies are warranted, no evidence was found to support discontinuation of breakfast in the classroom policy on the basis of concern about children eating excessive breakfast calories.

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Table 1. School and student characteristics by school breakfast policy at baseline as part of a cluster, randomized, controlled school-based intervention trial conducted in 2011-2012 in California.

Characteristic	School Breakfast Policy			Total	P Value ^a
	In the Cafeteria	In the Classroom	Second Chance		
Elementary Schools (n=43)					
Schools (n)	20	17	6	43	--
Provision 2 schools (n) ^b	0	14	0	14	--
Student body eligible for free or reduced price meals (% (SD))	64.0 (8.0)	85.8 (4.7)	59.9 (10.6)	72.1 (13.4)	<0.001
Fourth and Fifth Grade Students (n=3944)					
Students (n)	1825	1530	589	3944	--
Age (mean years, SD)	9.77 (0.69)	9.74 (0.67)	9.72 (0.65)	9.75 (0.68)	0.37
Male (%)	48.8	50.8	47.2	49.3	0.27
Race/ethnicity (%) ^c					
Hispanic	39.9	60.1	52.9	49.2	<0.001
Non-Hispanic White	15.7	5.5	21.0	12.5	<0.001
Non-Hispanic Black	8.7	10.8	6.4	9.1	0.004
Asian	10.7	9.0	1.0	8.5	<0.001
American Indian/Alaskan Native	1.6	1.0	1.8	1.4	0.131
Native Hawaiian/Pacific Islander	2.9	0.5	1.5	1.7	<0.001
Other ^c	20.4	13.1	15.5	16.7	<0.001
Language spoken at home (%)					
English	58.2	34.0	58.3	48.8	<0.001
Spanish	30.8	56.0	38.7	41.7	<0.001
Other	11.0	10.1	3.1	9.5	<0.001
Fourth grade (%)	47.3	52.5	48.6	49.5	0.009
Breakfast location (%) ^d					
No breakfast	13.1 ^x	8.4 ^y	10.4 ^y	10.8	<0.001
Breakfast at home only	69.3 ^x	23.4 ^y	62.6 ^x	50.6	<0.001
Breakfast at school only	12.1 ^x	44.2 ^y	11.7 ^x	24.4	<0.001
Breakfast at home and school	5.6 ^x	24.0 ^z	15.3 ^y	14.1	<0.001

^a Chi-square test was used for unadjusted comparisons.

^b Provision 2 is an option in the federal School Breakfast Program and National School Lunch Program for schools to reduce the paperwork and simplify the logistics of operating school meals programs.

Percentages may not add up to 100% down a column due to rounding.

^c 'Other' for race includes students who selected more than one.

^d 'Home' signifies that breakfast was obtained from a student's home or from anywhere else that does not include school.

^{xyz} Different superscripts indicate statistical differences between groups using a post-hoc Bonferroni-Holm multiple comparison test.

Table 2. Dietary characteristics by school breakfast policy at baseline as part of a cluster, randomized, controlled school-based intervention trial conducted in 2011-2012 in California.

Characteristic	School Breakfast Policy			Total	P Value ^a
	In the Cafeteria (n=1825)	In the Classroom (n=1530)	Second Chance (n=589)		
	Mean (SD)				
Breakfast Energy Intake (kcal/day)					
Breakfast eater (n=3515)	392 (273) ^x	370 (284) ^x	457 (321) ^x	393 (286)	0.002
Energy Intake (kcal/day)					
No breakfast eaten (n=429)	1423 (703)	1311 (626)	1430 (655)	1391 (674)	0.24
Breakfast eater (n=3515)	1764 (709)	1664 (711)	1780 (710)	1726 (711)	0.89
All combined (n=3944)	1719 (716)	1633 (712)	1744 (709)	1689 (714)	0.054
HEI-2010 Score					
No breakfast eaten (n=429)	44.7 (11.2) ^x	48.9 (13.1) ^y	42.9 (11.0) ^x	45.7 (12.0)	0.04
Breakfast eater (n=3515)	47.4 (11.8) ^y	50.4 (11.1) ^z	46.3 (11.0) ^x	48.4 (11.5)	0.02
All combined (n=3944)	47.0 (11.8) ^y	50.3 (11.3) ^z	46.0 (11.0) ^x	48.1 (11.6)	0.01
HEI-2010 Component Scores for All Study Participants Combined (n=3944) ^b					
Component (maximum score)					
Adequacy					
Total fruit (5)	2.76 (2.01) ^x	3.35 (1.90) ^y	2.61 (2.07) ^x	2.96 (2.00)	<0.001
Whole fruit (5)	2.67 (2.26) ^y	3.46 (2.09) ^z	2.26 (2.25) ^x	2.91 (2.24)	0.0003
Total vegetables (5)	2.14 (1.64)	2.00 (1.65)	2.10 (1.67)	2.08 (1.65)	0.09
Greens and beans (5)	0.49 (1.25) ^y	0.37 (1.12) ^x	0.32 (1.00) ^x	0.42 (1.17)	0.02
Whole grains (10)	2.46 (2.75)	2.52 (2.73)	2.44 (2.70)	2.48 (2.73)	0.72

Dairy (10)	7.18 (3.13)	7.48 (3.09)	7.64 (3.06)	7.37 (3.11)	0.20
Total protein foods (5)	3.67 (1.56)	3.61 (1.59)	3.69 (1.50)	3.65 (1.56)	0.78
Seafood and plant proteins (5)	1.43 (2.01)	1.19 (1.89)	1.18 (1.89)	1.30 (1.95)	0.06
Fatty acids (10)	4.02 (3.33)	4.49 (3.44)	3.87 (3.34)	4.18 (3.38)	0.06
Moderation					
Refined grains (10)	3.99 (3.52)	4.14 (3.51)	4.43 (3.51)	4.11 (3.52)	0.34
Sodium (10)	3.85 (3.20)	4.39 (3.34)	4.20 (3.31)	4.11 (3.28)	0.10
Empty calories (20)	12.4 (5.35) ^y	13.3 (5.43) ^z	11.2 (5.28) ^x	12.6 (5.42)	0.01

^a Based on GEE models adjusted for student race/ethnicity, grade, and language spoken at home, and school cluster design. Occasionally a P value is significant based on the initial adjusted GEE model, but the more conservative post-hoc Bonferroni-Holm multiple comparison test finds no significant difference between individual means (e.g., for breakfast energy intake among breakfast eaters).

^b HEI-2010 component scores range from 0 to 5 (for total fruit, whole fruit, total vegetables, greens and beans, total protein, seafood and plant proteins), or 0 to 10 (for whole grains, dairy, fatty acids, refined grains, sodium), or 0 to 20 (for empty calories).

^{xyz} Different superscripts indicate statistical differences between groups using a post-hoc Bonferroni-Holm multiple comparison test.