Comparison of School vs Home Breakfast Consumption with Cardiometabolic and Dietary Parameters in Low-Income, Multiracial/Ethnic Elementary School-Aged Children

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ABSTRACT

Background Breakfast consumption is often associated with improving cardiometabolic parameters and diet quality. However, literature evaluating breakfast consumption with these outcomes between the school and home environments is limited.

Objective This study examined relationships between breakfast consumption locations (school vs home) and cardiometabolic parameters, breakfast dietary intake, and daily dietary intake.

Design This cross-sectional study used baseline data from TX Sprouts, a 1-year school-based gardening, nutrition, and cooking cluster-randomized trial, implemented in 16 elementary schools in Austin, TX, during 2016 to 2019.

Participants/setting Analyses included 383 low-income, multiracial/ethnic elementary school-aged children (mean age = 9.2 years; 60.6% Hispanic; 70.5% free/reduced lunch; 58.5% home breakfast consumers).

Main outcome measures Cardiometabolic parameters were obtained via fasting blood draws, and dietary intake was assessed using one 24-hour dietary recall conducted on a random, unannounced weekday. Cardiometabolic and dietary parameters (ie, energy intake, macronutrients, and food group servings) for breakfast and for the day were evaluated.

Statistical analyses performed Multivariate analysis of covariance was performed to examine cardiometabolic parameters and dietary intake between school and home breakfasts.

Results School breakfast consumers (SBC) had lower fasting triglyceride levels than home breakfast consumers (HBC) (89.0 mg/dL vs 95.7 mg/dL; $P = 0.03$) (to convert to mmol/L, multiply by 0.0113). SBC had lower total fat for the day ($P = 0.02$) and lower total and saturated fat, sodium, and refined grains at breakfast ($P \leq 0.01$) than HBC. However, SBC had lower protein at breakfast ($P = 0.01$) and higher carbohydrates, total sugar, and added sugar for the day and at breakfast ($P \leq 0.03$) than HBC.

Conclusions SBC compared with HBC had lower fat intake, which may have contributed to the lower triglyceride level observed in SBC, but also had lower protein intake at breakfast and higher added sugar intake for the day and at breakfast. These results suggest dietary intake differed between HBC and SBC; that is, the home and school environments, but more research is needed to evaluate if such differences are due to School Breakfast Program guidelines.
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BREAKFAST CONSUMPTION IS POSITED TO PLAY A prominent role in weight management and diet quality.[1-3] Many studies support that regular breakfast consumption predicts and protects against overweight and obesity incidence and improves indexes of weight management in children and adolescents.[2,4-13]

Several metabolic benefits have been associated with breakfast consumption, such as improved lipid profiles and blood pressure, decreased fasting insulin, and reduced risk for dyslipidemia and metabolic syndrome in children.[7,14-18] Non-Hispanic Black and Hispanic children are at higher risk for obesity and high blood pressure compared with non-

Hispanic White counterparts.[19,20] In addition, Hispanic children have higher prevalence of dyslipidemia than non-Hispanic children, and non-Hispanic Black children are disproportionately affected by type 2 diabetes compared with children of other races/ethnicities.[20-22] Research examining breakfast consumption in a multiracial/ethnic population is warranted. There are many aspects of breakfast consumption to consider when examining weight outcomes in children. These include frequency of breakfast consumption, the types of foods consumed at breakfast, and the location where breakfast is prepared and consumed.[9,23,24] Despite the benefits aforementioned, null and positive associations between breakfast consumption and obesity prevalence in children and adolescents have also been observed.[25-30]

Few studies have examined breakfast location, such as home vs school, with adiposity, metabolic, and dietary parameters in children, especially in a high-risk multiracial/ethnic population.[31] Consumption location could influence these outcomes as low-income populations rely on federal school meal programs to provide as much as half of daily dietary intake.[32] The US Department of Agriculture School Breakfast Program (SBP) was established in 1966 and served an average of 14.7 million US children each day during 2019.[33] Non-Hispanic Black and Hispanic children have higher prevalence of food insecurity than non-Hispanic White children.[34,35] Hispanic children with access to the SBP reported lower food insecurity rates compared with Hispanic children without access to the SBP (16% vs 25%, respectively).[34,35] Given that Hispanic and non-Hispanic Black children are more likely to be food insecure, the SBP serves as a means to provide adequate nutrition and reduce risk of marginal food insecurity in those who have access and/or participate.[36-38]

Quality of foods consumed at breakfast has been associated with quality of foods consumed throughout the day.[39] The current SBP guidelines include only three nutrition component requirements. For those in kindergarten through grade 5, the SBP daily requirements are 1 c dairy, 1 c fruit, and 1 oz-eq grains.[40] Schools must offer at least four food items to fulfill these three components. However, offer vs serve (OVS) systems allow students to decline certain food items. Students must select at least three food items for breakfast, including a 1/2 c fruits or vegetables that can be increased to a full serving per the student's request. Meat and meat alternatives for OVS may substitute grains, but this is not a requirement. Each component of the SBP has potential shortfalls. The dairy requirement can be fulfilled via flavored milk, up to 50% of fruit consumption can be fulfilled via fruit juice, and only 50% of grains must be whole grains.[40] Although breakfast is considered to be an important eating occasion, especially for children, there are fewer requirements and specifications for the SBP compared with the National School Lunch Program.[40] Even so, both programs lack guidelines for protein and added sugar intake, which have been shown to have favorable and unfavorable relationships, respectively, on adiposity and metabolic outcomes in children.[41-47]

Due to the potential influence of the breakfast meal on dietary intake throughout the day,[39] examining breakfast quality between home and school environments could aid in predicting health and dietary outcomes. School meal participants consume more milk and less saturated fat and sodium than nonparticipants.[48] The SBP has been associated with positive nutrition outcomes, such as increased fruit and vegetable intake in multiracial/ethnic, low-income children.[49-51] Polonsky and colleagues[31] showed that school breakfast consumers were more likely to consume fruits and vegetables and less likely to consume foods high in saturated fats and added sugars compared with home breakfast consumers. In children aged 6 to 13 years, longitudinal analyses have shown breakfast at home to have favorable changes in body mass index (BMI), total cholesterol, low-density lipoprotein (LDL) cholesterol, and fasting glucose levels and higher increase in high-density lipoprotein (HDL) cholesterol levels over 1 year.[52] Results reported by Baxter and colleagues[53] complemented this, showing school energy intake to be positively associated with BMI and BMI category. A previous study examining this particular sample reported null associations between breakfast consumption and cardiometabolic parameters.[30] The goal of this study was to evaluate the relationship between breakfast location, school vs home, with cardiometabolic parameters, total daily dietary intake, and dietary intake at breakfast in multiracial/ethnic, low-income elementary school-aged children. We hypothesized that school breakfast consumers would have higher cardiometabolic risks and less healthy dietary behaviors, both for daily intake and breakfast, compared with home breakfast consumers, due to the high carbohydrate and added sugar consumption previously observed in this population and high proportion of students receiving free and reduced lunch (FRL) at school.[30]

RESEARCH SNAPSHOT

Research Question: Are there differences in cardiometabolic parameters, daily dietary intake, and breakfast dietary intake between locations of breakfast consumption (home vs school)?

Key Findings: In this cross-sectional study that included 383 low-income, multiracial/ethnic elementary school-aged children, school breakfast consumption was linked to lower fasting triglyceride levels and lower consumption of dietary fat, saturated fats, and refined grains at breakfast, compared with home breakfast consumption. However, school breakfast consumption was associated with higher added sugar and sugar-sweetened beverage (including flavored milk) consumption for the day and at breakfast, and lower protein consumption at breakfast, compared with home breakfast consumption.

MATERIALS AND METHODS

Study Design

This cross-sectional study utilized baseline data from TX Sprouts, a school-based cluster randomized controlled nutrition, gardening, and cooking intervention. The study design and main outcomes for the TX Sprouts intervention has been described in detail elsewhere.[54,55] TX Sprouts recruited third through fifth grade students and their parents from 16 elementary schools in five school districts in the Greater Austin, TX, area and took place during 2016 to 2019. All schools had to meet the following inclusion criteria: >

50% Hispanic children, > 50% of children enrolled in the FRL program, location within 60 miles of the University of Texas at Austin campus, and no preexisting school garden or gardening program. The first 16 schools that met the study criteria and agreed to participate were randomly assigned to receive the intervention (n = 8 schools) or delayed intervention (n = 8 schools), serving as the control group. Data were collected in three waves, each of which lasted for one school year. This trial was registered at ClinicalTrials.gov (NCT02668744).

Study Population

Figure 1 provides a detailed diagram showing the participant flow through the study. All third- through fifth-grade students in each school were recruited for the study (N = 4,239). Both student assent and parental consent were obtained for 3,302 students to participate in the TX Sprouts intervention. Of those, clinical data were collected on 3,135 students. Sixteen students (eight boys and eight girls) were randomly selected from each grade level at each school to be contacted for dietary recalls (n = 48/school). If any of the 16 originally selected students were unavailable or did not want to participate in recalls, then additional students were randomly selected to take their place. The intervention's protocol required two 24-hour dietary recalls that were collected on a subsample of 760 children, of which 39 had recalls conducted only on weekend days and were omitted. Students were excluded from analyses for missing

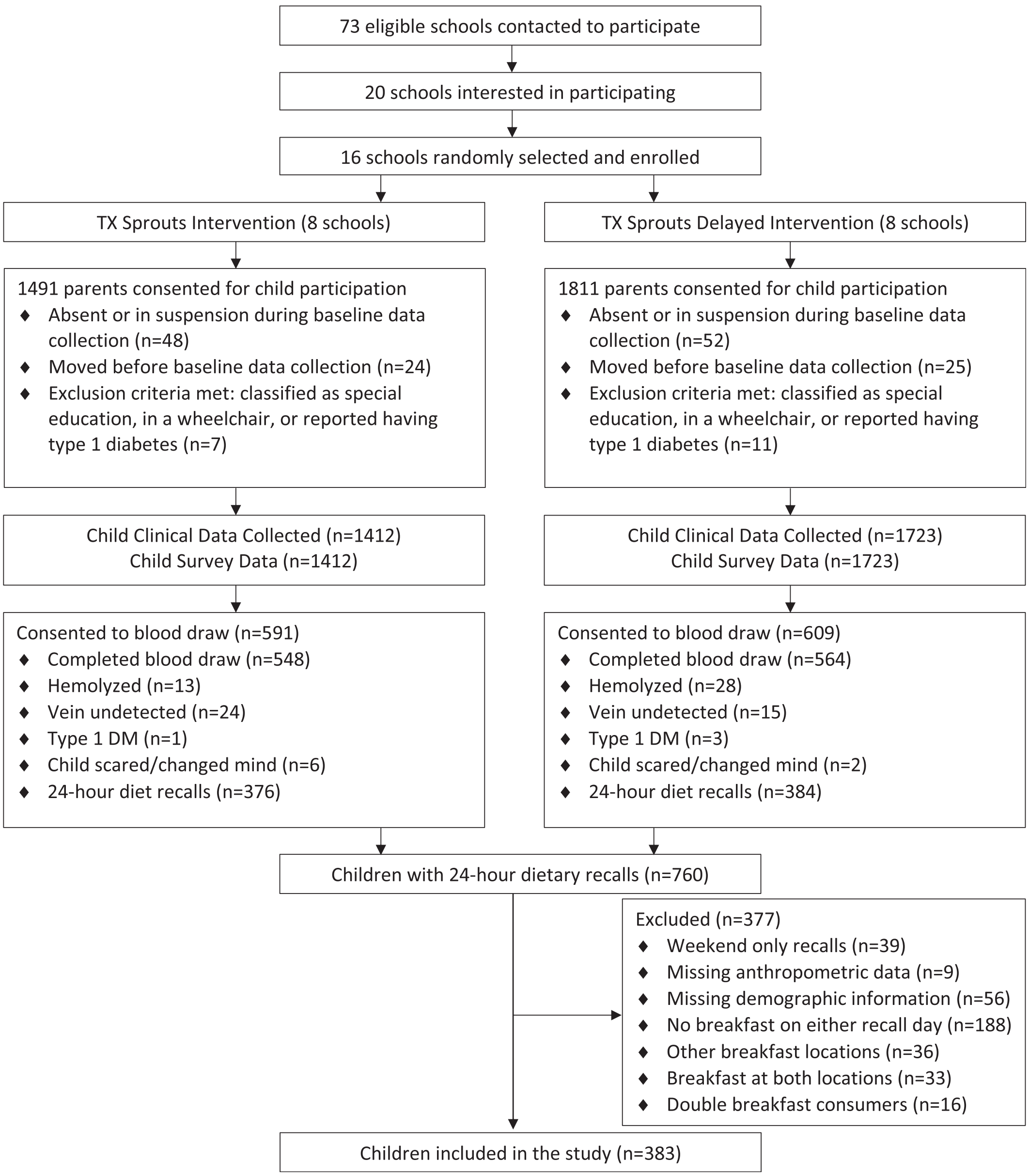

Figure. Consort diagram of TX Sprouts baseline sample of low-income elementary school-aged children by breakfast consumption location at home or school from Austin, TX, 2016-2019, for examining breakfast consumption location with cardiometabolic and dietary parameters.

Table 1. Characteristics of low-income elementary school-aged children by breakfast consumption location at home or school from TX Sprouts in Austin, TX, 2016-2019 (n = 383)

Variable	Total	Home	School
	←——— *n* ———→		
Sample size	383	224	159
	←——— *n (%)* ———→		
Male sex	201 (52.5)	120 (53.6)	81 (50.9)
	←——— *mean ± standard deviation* ———→		
Age (y)	9.2 ± 0.9	9.2 ± 0.9	9.3 ± 0.9
	←——— *n (%)* ———→		
Race/ethnicity			
Hispanic	232 (60.6)	135 (60.3)	97 (61.0)
Non-Hispanic White	83 (21.7)	53 (23.7)	30 (18.9)
Non-Hispanic Black	41 (10.7)	24 (10.7)	17 (10.7)
Other[a]	27 (7.0)	12 (5.3)	15 (9.4)
Free/reduced lunch	270 (70.5)	144 (64.3)	126 (79.3)
	←——— *mean ± standard deviation* ———→		
Height (cm)	138.1 ± 8.9	137.6 ± 8.8	138.7 ± 9.0
Weight (kg)	38.9 ± 11.6	38.1 ± 11.7	40.0 ± 11.5
BMI[b] *z* score	0.8 ± 1.1	0.7 ± 1.2	0.9 ± 1.1
	←——— *n (%)* ———→		
BMI categories[c]			
Underweight	10 (2.6)	7 (3.1)	3 (1.9)
Normal	188 (49.1)	114 (50.9)	74 (46.5)
Overweight	75 (19.6)	39 (17.4)	36 (22.6)
Obese	110 (28.7)	64 (28.6)	46 (28.9)

[a]Native American/American Indian, Asian/Pacific Islander, other, and more than one race
[b]BMI = body mass index.
[c]BMI categories were based on BMI percentiles using Centers for Disease Control and Prevention age- and sex-specific values. Underweight was classified as < 5th percentile, normal weight was classified as 5th percentile to < 85th percentile, overweight was classified as 85th percentile to < 95th percentile, and obese was classified as ≥ 95th percentile.

anthropometric data (n = 9), missing demographic data (n = 56), not having consumed breakfast on either recall day (n = 188), having consumed breakfast at a location other than home or school (n = 36), having consumed breakfast at school on one recall day and home on the other (n = 33), and having consumed two breakfasts in at least one recall day (n = 16). The total analytical sample included 383 students and is representative of the total TX Sprouts population in terms of geographic location and demographic, household, and physical characteristics outlined in Table 1. Characteristics of the total TX Sprouts population have been published elsewhere.[54]

Recruitment

All third- through fifth-grade students and parents of the recruited schools were contacted to participate via information tables at "Back to School" and "Meet the Teacher" events, flyers sent home with students, and classroom announcements made by teachers. Recruitment materials were available in both English and Spanish. Both parental consent and student assent were required for inclusion in the study. The study was conducted in accordance with the Declaration of Helsinki, and all procedures pertaining to human subjects were approved by the Institutional Review Boards of The University of Texas at Austin and all associated school district review boards.

Demographic Characteristics

Age and sex were collected via self-administered surveys, and staff members were available in the room to help students with questions throughout the process. Each student's race/ethnicity and FRL status were obtained via self-administered surveys from a parent/guardian.

Cardiometabolic Parameters

Participants were asked to remove all footwear to obtain height, measured using a free-standing stadiometer to the nearest 0.1 cm (Seca). In addition to footwear, participants were asked to remove heavy and/or layered clothing to obtain body weight and bioelectrical impedance, which were assessed with a Tanita Body Fat Analyzer (model TBF 300; Tanita Corporation of America Inc). In a private screening area, participants were asked to gather clothing above the waist so that waist circumference could be measured over skin using the National Health and Nutrition Examination Survey protocol.[56] BMI *z* scores were determined using Centers for Disease Control and Prevention age- and sex-specific values.[57] Blood pressure was measured via an automated monitor (Omron) with a child cuff or, in some cases, an adult cuff, which was used when the child cuff did not properly fit to provide an accurate reading. All anthropometric measures were taken once by trained staff.

Optional fasting blood draws were collected before the school day between 6:30 AM and 8:00 AM on a subsample of students at baseline, resulting in a smaller sample with metabolic measurements in this study ($n = 188$). Those who opted to not participate in the blood draw were still able to participate in all other TX Sprouts evaluations and activities. Eligible students and their families received flyers and text message reminders about the optional blood draws and were instructed to come fasting, having nothing to eat or drink other than water after midnight. Blood samples were collected by certified phlebotomists or nurses with experience drawing blood in children with obesity and were conducted in a private room at the schools. Students received a $20 incentive for participation in the blood draw, and parents were incentivized to have their children participate in the blood collection by receiving a free diabetes screening. Parents were given their child's fasting plasma glucose and glycated hemoglobin (HbA1c) values within 2 weeks.

Directly following collection, whole blood was placed on ice and transferred to the laboratory on the University of Texas at Austin campus, where Clinical Laboratory Improvement Amendments waived glucose was measured using a HemoCue Glucose 201 analyzer (HemoCue America). Due to a larger-than-expected proportion of students having prediabetes, based on the American Diabetes Association definition[58] (fasting plasma glucose = 100 to 125 mg/dL [to convert to mmol/L, multiply by 0.0555]), an HbA1c measurement was added in the last two waves, explaining the lower number of samples observed for HbA1c in this study ($n = 126$). HbA1c assays using DCA Vantage Analyzer (Siemens Medical Solutions) were performed on whole blood. The remaining blood was centrifuged, aliquoted, and stored at −80°C. Samples were transported on dry ice to Baylor College of Medicine for assessment of insulin, cholesterol, and triglyceride levels. Insulin level was evaluated using an automated enzyme immunoassay system analyzer (Tosoh Bioscience, Inc). Total cholesterol, HDL cholesterol, and triglyceride levels were measured using Vitros chemistry DT slides (Ortho Clinical Diagnostics Inc); LDL cholesterol level was calculated using the Friedwald equation.[59]

Dietary Parameters

Dietary intake was collected using a validated 24-hour dietary recall method on a random subsample of children.[60] The recall period only included dietary intake from the full day before collection. Per the intervention protocol, two 24-hour dietary recalls were collected via telephone by trained staff and supervised by a registered dietitian nutritionist using the Nutrition Data System for Research (2016 version), a computer-based software application that facilitates the collection of recalls in a standardized fashion.[61-63]

Nutrition Data System for Research generated nutrient and food/beverage servings per the 2000 Dietary Guidelines for Americans.[64,65] Fruit servings were defined as one medium apple, banana, orange or pear, $^1/_2$ c chopped, cooked, or canned fruit, or 1/4 c dried fruit. Vegetable servings were defined as 1 c raw leafy vegetables or $^1/_2$ c other cooked or raw vegetables. Grain servings were defined as 1 slice of bread (16 g flour); 1 oz ready-to-eat-cereal; and $^1/_2$ c cooked cereal, rice, or pasta. Food and Drug Administration (FDA) serving sizes were used for other food items in grams when needed.[64] Dairy servings were defined as approximately 1 c milk or yogurt, $1^1/_2$ oz natural cheese, and 2 oz processed cheese. Protein sources were generally defined in terms of 1 oz-eq. One ounce was used for cooked meat, fish, or poultry. Other 1 oz-eq include 1 egg, 1 T peanut butter, and $^1/_2$ oz nuts or seeds. FDA serving sizes were used for other food items when needed.[64] Beverage servings are based on FDA serving sizes, which defined a serving of soft drink, fruit drink, coffee, tea, or meal replacement as 8 fl-oz.[64]

Dietary intake data were governed by a multiple-pass interview approach.[66] Before the dietary recalls, Food Amounts Booklets, developed by the Nutrition Coordinating Center at the University of Minnesota, were distributed to and sent home with the students to mitigate under- and overreporting of foods consumed. The booklets were provided in both English and Spanish and contained pictures of portion sizes to assist students in estimating portion sizes of foods and beverages reported during the dietary recall. Parents and/or guardians were requested to assist with information regarding food items, portion sizes, and cooking methods, and this methodology has been validated for children of this age.[67] A follow-up was scheduled to ensure the parent was present in the case that the child was having issues recalling information. Those who reported relatively low or high total energy had a follow-up with a parent and/or guardian to confirm recall information. Students received a $10 incentive upon completion of both 24-hour dietary recalls. Quality assurance was conducted on all dietary recall data by additional trained research staff. The protocol was designed to obtain two dietary recalls on nonconsecutive days, resulting in two main options: 1 weekday and 1 weekend day or 2 weekdays. On rare occasions, 2 weekend days were collected. For the purpose of this study, all weekend day recalls were excluded because school meals were not an option. Only 1 recall day for each participant was included due to the examination of cardiometabolic parameters, which could not be interpreted in the case that a participant had breakfast at home on 1 recall day and school on the other. Those having consumed breakfast on only 1 weekday recall had that recall included in the analyses by default. Those having consumed breakfast on both weekday recalls ($n = 93$) were randomized to have only 1 recall day included in the analyses.

Breakfast Parameters

During the 24-hour dietary recall, students were asked to name each eating occasion (EO) and the location where the EO occurred. Response options included: breakfast, brunch, lunch, dinner/supper, snack, beverage only, school lunch, or other for the EO names, and school or home for the EO locations. Students were classified as breakfast consumers in the case that they referred to an EO as "breakfast" and the energy intake was at least 15% of total daily energy and consumption occurred before 10:00 AM. These criteria have been shown as an appropriate method for defining a breakfast meal.[68-71]

The energy requirement of 15% was determined to exclude meals low in energy. For some students, breakfast may be a granola bar or a single apple. The recommended amount of energy to be consumed at breakfast is dependent on the number of daily eating occasions.[69] Hispanic compared to non-Hispanic children (aged 6 to 11 years) have fewer eating occasions; thus, the lower end of 15% daily energy proved appropriate for the breakfast definition in this study and has served as the recommended minimum requirement previously.[69,72] It has been recommended to have a maximum energy requirement of 25%.[69] However, Hispanic children (aged 6 to 11 years) consume an average of 23% daily energy at breakfast,[73] so an upper limit of 25% did not seem appropriate.

Students confirmed where each breakfast occasion occurred during the 24-hour dietary recall and were stratified into two groups: home breakfast consumers, having consumed the breakfast meal at home (HOME); or school breakfast consumers, having consumed the breakfast meal at school (SCHOOL).

Statistical Analysis

Descriptive statistics were calculated for the total sample. Continuous variables were reported as mean ± standard deviation, and categorical variables were reported as percentages. Multivariate analyses of covariance (MANCOVA) were performed to examine the group effect of anthropometric and metabolic parameters, daily dietary intake, and breakfast dietary intake by breakfast location. The model with anthropometric outcomes was adjusted for age, sex, race/ethnicity, and FRL status. The model with metabolic outcomes was adjusted for age, sex, race/ethnicity, FRL status, and BMI *z* score. Demographic characteristics were included as covariates due to heterogeneity in the sample. BMI *z* score was included due to linear relationships observed between dietary intake and obesity prevalence.[74] Energy was included as a covariate because failure to account for energy can make associations with nutrients ambiguous, particularly in epidemiologic studies.[75] Breakfast location could influence energy intake, so analyses were conducted without adjusting for energy and the results remained. As a result, energy remained in the models to reduce extraneous variation as macronutrient and micronutrient intake were correlated with energy intake. Models with daily dietary outcomes were adjusted for age, sex, race/ethnicity, FRL lunch status, BMI *z* score, and daily energy. Models with breakfast dietary outcomes were adjusted for age, sex, race/ethnicity, FRL status, BMI *z* score, and subsequent daily energy. Pearson correlations were performed to correlate triglyceride levels with dietary components, such as breakfast fat, breakfast saturated fat, and breakfast added sugar.

Data were examined for normality, and transformations were made in the case that data deviated from normality. All values reported are untransformed values, and *P* values were obtained from models after adjusting for covariates. Analyses were performed using Stata version 16.1,[76] and the significance was set at $P < 0.05$.

RESULTS

Demographic and Physical Characteristics of the Study Sample

The study population had a total of 383 children that were 52.5% boys and had an average age of 9.2 years. The largest race/ethnic group was Hispanic (60.6%), followed by non-Hispanic White (21.7%), non-Hispanic Black (10.7%), and other (7.0%), which included Native American, American Indian, Asian, and Pacific Islander. Approximately 70.5% of children received FRL at school. There were more children who consumed breakfast at home (58.5%) than at school (41.5%). Nearly half of the population had overweight (19.6%) or obesity (28.7%). Because blood draws were optional, there was a subsample of 188 children. This subsample was 52.1% boys with an average age of 9.3 years. Hispanic children also made up the largest race/ethnic group at 64.4%, followed by non-Hispanic White (17.6%), non-Hispanic Black (10.1%), and other (7.9%). Approximately 71.3% of children in this subsample received FRL at school. more than half of the subsample had overweight (21.3%) or obesity (31.9%). The subsample is representative of the study sample based on these characteristics.

Relationships between Breakfast Location and Anthropometric and Metabolic Parameters

The relationships between breakfast location, anthropometrics, and metabolic parameters are presented in Table 2. No significant group effects were observed in the MANCOVA models between anthropometric parameters by breakfast location ($F[5, 365] = 0.86$; $P = 0.51$) and metabolic parameters by breakfast location ($F[7, 168] = 1.88$; $P < 0.08$). None of the anthropometric parameters (waist circumference, body fat percentage, BMI *z* score, and blood pressure) had independent relationships with breakfast location. Of the metabolic parameters (fasting plasma glucose, insulin, total cholesterol, HDL cholesterol, non-HDL cholesterol, LDL cholesterol, triglyceride levels, and HbA1c value), triglycerides had an independent relationship with breakfast location. Fasting triglyceride levels were higher in HOME than SCHOOL ($P = 0.03$).

Relationships Between Breakfast Location and Intake

The relationships between breakfast location and intake are presented in Table 3. There was no significant relationship observed between breakfast location and breakfast energy. The MANCOVA including breakfast macronutrients revealed a significant group effect by breakfast location ($F[10, 358] = 6.37$; $P < 0.001$). Protein and fat consumption at breakfast were higher in HOME compared with SCHOOL ($P \leq 0.01$), but carbohydrate consumption at breakfast was lower in HOME compared with SCHOOL ($P < 0.001$). HOME had higher saturated fat consumption at breakfast compared with SCHOOL ($P = 0.002$). Sodium consumption at breakfast was higher in HOME than SCHOOL ($P = 0.01$), but total sugar and added sugar at breakfast were lower in HOME than SCHOOL

Table 2. Multivariate analysis of covariance models examining anthropometric and metabolic parameters in low-income elementary school-aged children by breakfast consumption location at home or school from TX Sprouts in Austin, TX, 2016-2019 (n = 383)

Variable	Total	Home	School	*P* value[a]
Anthropometric parameter[b]				
	←——— *n* ———→			
Sample size	383	224	159	
	←——— *mean ± standard deviation* ———→			
Waist circumference (cm)	71.1 ± 12.0	70.2 ± 12.0	72.3 ± 11.9	0.44
Total body fat (%)	26.1 ± 8.9	25.7 ± 8.9	26.8 ± 9.0	0.56
BMI[c] ***z* score**	0.8 ± 1.1	0.7 ± 1.2	0.9 ± 1.1	0.23
Systolic blood pressure (mm Hg)	102.5 ± 11.3	102.3 ± 11.2	102.9 ± 11.5	0.86
Diastolic blood pressure (mm Hg)	67.2 ± 8.8	67.3 ± 8.8	67.0 ± 8.7	0.35
Metabolic parameter[d]				
	←——— *n* ———→			
Sample size	188	93	95	
	←——— *mean ± standard deviation* ———→			
Fasting glucose (mg/dL)[e]	90.9 ± 9.9	90.6 ± 10.2	91.3 ± 9.8	0.98
Insulin (μIU/mL)[f]	15.6 ± 13.0	15.8 ± 14.2	15.4 ± 11.8	0.39
Cholesterol (mg/dL)[g]	153.5 ± 24.1	151.9 ± 23.8	155.0 ± 24.4	0.43
HDL[h] (mg/dL)	47.8 ± 9.9	47.7 ± 10.3	47.9 ± 9.5	0.50
Non-HDL (mg/dL)	105.7 ± 22.7	104.3 ± 22.3	107.1 ± 23.1	0.56
LDL[i] (mg/dL)	87.3 ± 20.5	85.2 ± 20.7	89.4 ± 20.2	0.23
Triglycerides (mg/dL)[j]	92.3 ± 42.8	95.7 ± 38.7	89.0 ± 46.5	**0.03**
	←——— *n* ———→			
Sample size	126	69	57	
	←——— *mean ± standard deviation* ———→			
Glycated hemoglobin (%)[k]	5.2 ± 0.3	5.2 ± 0.3	5.3 ± 0.3	0.99

[a]Significant at $P < 0.05$. All significant values are in bold.
[b]Multivariate analysis of covariance model included all anthropometric parameters and adjusted for age, sex, race/ethnicity, and free/reduced lunch status.
[c]BMI = body mass index.
[d]Multivariate analysis of covariance model included all metabolic parameters, excluding glycated hemoglobin, and adjusted for age, sex, race/ethnicity, free/reduced lunch status, and BMI *z* score.
[e]To convert mg/dL glucose to mmol/L, multiply mg/dL by 0.0555.
[f]To convert μIU/mL insulin to pmol/L, multiply μIU/mL by 6.945.
[g]To convert mg/dL cholesterol to mmol/L, multiply mg/dL by 0.0259.
[h]HDL = high-density lipoprotein.
[i]LDL = low-density lipoprotein.
[j]To convert mg/dL triglyceride to mmol/L, multiply mg/dL by 0.0113.
[k]Glycated hemoglobin was only included in the last two waves of the intervention and thus had a lower sample size; a separate multivariate analysis of covariance model examined all metabolic parameters, including glycated hemoglobin, and adjusted for age, sex, race/ethnicity, free/reduced lunch status, BMI *z*-score, and energy.

($P < 0.001$). The MANCOVA including servings per day for total vegetables, total vegetables (excluding 100% juice), total vegetables (excluding 100% juice and potatoes), total fruits, total fruits (excluding 100% juice), dairy, dairy (excluding flavored milk), sugar-sweetened beverages (SSBs), SSBs (excluding flavored milk), whole grains, refined grains, total meats, and total legumes in the breakfast meal also showed a significant group effect ($F[13, 355] = 9.51$; $P < 0.001$). HOME had higher intake of vegetables, vegetables (excluding 100% juice), and vegetables (excluding 100% juice and potatoes) at breakfast compared with SCHOOL ($P \leq 0.003$). SCHOOL had higher intake of fruits (including 100% juice) at breakfast compared with HOME ($P < 0.001$). HOME had higher dairy intake at breakfast than SCHOOL when flavored milk was excluded ($P < 0.001$). In addition, SCHOOL had higher SSB intake at breakfast than HOME when flavored milk was included ($P < 0.001$). Breakfast refined grain intake was higher at HOME than SCHOOL ($P < 0.001$), and breakfast

Table 3. Multivariate analysis of covariance models of breakfast dietary consumption and composition in low-income elementary school-aged children by breakfast consumption location at home or school from TX Sprouts in Austin, TX, 2016-2019 (n = 383)

Variable	Total	Home	School	*P* value[a]
	←———————— *n* ————————→			
Sample size	383	224	159	
	←——— *unadjusted mean ± standard deviation* ———→			
Breakfast total energy (kcal)[b]	348 ± 164	347 ± 177	348 ± 143	0.57
Breakfast protein (% kcal)[c]	12.8 ± 5.2	13.5 ± 5.7	11.9 ± 4.2	**0.01**
Breakfast carbohydrate (% kcal)[c]	64.4 ± 18.4	61.3 ± 19.3	68.9 ± 16.2	< **0.001**
Breakfast fat (% kcal)[c]	24.9 ± 14.8	27.2 ± 15.4	21.6 ± 13.4	< **0.001**
Breakfast saturated fat	9.8 ± 6.3	10.6 ± 6.5	8.6 ± 5.8	**0.002**
Breakfast total fiber (g)[c]	3.0 ± 2.4	2.9 ± 2.6	3.1 ± 2.0	0.06
Breakfast soluble fiber	1.1 ± 0.9	1.0 ± 0.9	1.1 ± 1.0	0.13
Breakfast insoluble fiber	1.9 ± 1.7	1.9 ± 2.0	2.0 ± 1.4	0.17
Breakfast total sugar (% kcal)[c]	34.7 ± 16.5	30.0 ± 16.2	41.2 ± 14.6	< **0.001**
Breakfast added sugar	15.3 ± 12.1	13.6 ± 11.9	17.6 ± 11.9	< **0.001**
Breakfast sodium (mg)[c]	460.8 ± 361.4	503.6 ± 422.9	400.5 ± 239.1	**0.01**
Breakfast total vegetables (servings)[cd]	0.1 ± 0.4	0.1 ± 0.5	0.01 ± 0.06	**0.001**
Excluding 100% juice	0.1 ± 0.4	0.1 ± 0.5	0.01 ± 0.06	**0.002**
Excluding 100% juice and potatoes	0.1 ± 0.3	0.1 ± 0.4	0.01 ± 0.06	**0.003**
Breakfast total fruits (servings)[c]	0.6 ± 0.9	0.4 ± 0.9	0.9 ± 0.9	< **0.001**
Excluding 100% juice	0.2 ± 0.6	0.2 ±0.6	0.2 ±0.5	0.58
Breakfast dairy (servings)[c]	0.8 ± 1.0	0.8 ± 1.2	0.7 ± 0.5	0.90
Excluding flavored milk	0.6 ± 1.0	0.7 ± 1.2	0.5 ± 0.5	< **0.001**
Breakfast sugar-sweetened beverages (servings)[c]	0.2 ± 0.4	0.1 ± 0.3	0.3 ± 0.5	< **0.001**
Excluding flavored milk	0.1 ± 0.3	0.1 ± 0.3	0.1 ± 0.2	0.88
Breakfast whole grains (servings)[c]	0.5 ± 0.7	0.5 ± 0.8	0.6 ± 0.6	**0.02**
Breakfast refined grains (servings)[c]	1.1 ± 1.2	1.2 ± 1.2	0.8 ± 1.1	< **0.001**
Breakfast meat (servings)[c]	0.2 ± 0.6	0.2 ± 0.6	0.2 ± 0.6	0.83
Breakfast legumes (servings)[c]	0.01 ± 0.2	0.03 ± 0.2	0.0 ± 0.0	**0.04**

[a]Significant at $P < 0.05$. All significant values are in bold.
[b]Independent analysis of covariance model was conducted for breakfast energy and adjusted for age, sex, race/ethnicity, free/reduced lunch status, and BMI *z*-score.
[c]Separate multivariate analysis of covariance models that adjusted for age, sex, race/ethnicity, free/reduced lunch status, BMI *z*-score, and energy.
[d]Serving sizes were assigned to each Nutrient Data System for Research food based on the recommendations made by the 2000 Dietary Guidelines for Americans when available. For foods not included in the recommendations, the Food and Drug Administration serving sizes were used.

whole grain intake was higher at SCHOOL than HOME ($P = 0.02$). Lastly, HOME had higher legume intake at breakfast compared to SCHOOL ($P = 0.04$).

Relationships Between Breakfast Location and Daily Intake

The relationships between breakfast location and daily dietary intake are presented in Table 4. There were no significant relationships between breakfast locations and daily eating occasions and daily energy. The MANCOVA including macronutrients revealed a significant group effect by breakfast location ($F[10, 358] = 3.11$; $P < 0.001$). HOME had lower daily carbohydrate consumption and higher daily fat consumption than SCHOOL ($P \leq 0.03$). Both total and added sugar intake for the day were lower in HOME than SCHOOL ($P \leq 0.003$). The MANCOVA including servings per day for total vegetables, total vegetables (excluding 100% juice), total vegetables (excluding 100% juice and potatoes), total fruits, total fruits (excluding 100% juice), total dairy, dairy (excluding flavored milk), SSBs, SSBs (excluding flavored milk), whole grains, refined grains, total meats, and total legumes also showed a significant group effect by breakfast location ($F[13, 355] = 6.53$; $P < 0.001$). Daily fruit (including 100% juice), dairy (including flavored milk), and SSB (including flavored milk) consumption were lower in HOME

Table 4. Multivariate analysis of covariance models examining daily dietary consumption and composition in low-income elementary school-aged children by breakfast consumption location at home or school from TX Sprouts in Austin, TX, 2016-2019 (n = 383)

Variable	Total	Home	School	*P* value[a]
	←— *n* —→			
Sample size	383	224	159	
	←— *unadjusted mean ± standard deviation* —→			
Eating occasions per day[b]	3.7 ± 0.8	3.6 ± 0.8	3.7 ± 0.8	0.28
Total energy (kcal)[b]	1,374 ± 484	1,370 ± 514	1,380 ± 441	0.57
Carbohydrate (% kcal)[c]	53.3 ± 10.9	52.4 ± 10.7	54.5 ± 11.0	**0.03**
Protein (% kcal)[c]	16.4 ± 5.0	16.5 ± 5.1	16.3 ± 4.9	0.57
Fat (% kcal)[c]	31.8 ± 8.6	32.5 ± 8.5	30.7 ± 8.6	**0.02**
Saturated fat	11.0 ± 3.6	11.1 ± 3.5	11.0 ± 3.8	0.63
Total fiber (g)[c]	12.6 ± 6.9	12.7 ± 7.6	12.5 ± 5.7	0.69
Soluble fiber	4.1 ± 2.3	4.0 ± 2.4	4.1 ± 2.2	0.37
Insoluble fiber	8.4 ± 5.2	8.6 ± 5.9	8.2 ± 4.0	0.98
Total sugar (% kcal)[c]	23.9 ± 9.1	22.0 ± 8.8	26.5 ± 9.1	< **0.001**
Added sugar	10.5 ± 6.8	9.8 ± 6.9	11.5 ± 6.5	**0.003**
Total sodium (mg)[c]	2,313.6 ± 979.0	2,370.1 ± 1047.5	2234.1 ± 870.6	0.23
Total vegetables (servings)[cd]	1.8 ± 1.6	1.8 ± 1.7	1.7 ± 1.5	0.80
Excluding 100% juice	1.8 ± 1.6	1.8 ± 1.7	1.7 ± 1.5	0.81
Excluding 100% juice and potatoes	1.5 ± 1.6	1.5 ± 1.7	1.4 ± 1.4	0.84
Total fruits (servings)[c]	1.8 ± 1.9	1.6 ± 2.0	2.0 ± 1.8	**0.005**
Excluding 100% juice	1.1 ± 1.6	1.2 ± 1.8	1.0 ± 1.2	0.32
Dairy (servings)[c]	1.8 ± 1.3	1.7 ±1.1	2.1 ± 1.5	**0.007**
Excluding flavored milk	1.4 ± 1.2	1.5 ± 1.1	1.4 ± 1.4	0.21
Sugar-sweetened beverages (servings)[c]	0.8 ± 1.0	0.6 ± 0.9	1.1 ± 1.2	< **0.001**
Excluding flavored milk	0.4 ± 0.7	0.4 ± 0.8	0.5 ± 0.7	0.59
Whole grains (servings)[c]	1.1 ± 1.3	1.1 ± 1.3	1.1 ± 1.2	0.47
Refined grains (servings)[c]	4.3 ± 2.6	4.7 ± 2.7	3.8 ± 2.4	< **0.001**
Meat (servings)[c]	3.2 ± 2.5	3.2 ± 2.6	3.2 ± 2.2	0.25
Legumes (servings)[c]	0.2 ± 0.5	0.2 ± 0.5	0.2 ± 0.4	0.39

[a]Significant at $P < 0.05$. All significant values are in bold.
[b]Independent analysis of covariance models were conducted for eating occasions and total energy and adjusted for age, sex, race/ethnicity, free/reduced lunch status, BMI *z*-score, and energy (for eating occasions as outcome).
[c]Separate multivariate analysis of covariance models that adjusted for age, sex, race/ethnicity, free/reduced lunch status, BMI *z*-score, and energy.
[d]Serving sizes were assigned to each Nutrition Data System for Research food based on the recommendations made by the 2000 Dietary Guidelines for Americans when available. For foods not included in the recommendations, the Food and Drug Administration serving sizes were used.

than SCHOOL ($P \leq 0.007$). The relationship with fruit was attenuated when excluding fruit juice, and the relationships with dairy and SSBs were attenuated when excluding flavored milk. Daily consumption of refined grains was higher in HOME than SCHOOL ($P < 0.001$). No other differences were detected.

DISCUSSION

This study sought to examine relationships between breakfast location and cardiometabolic parameters, breakfast dietary intake, and daily dietary intake. No differences were observed in anthropometric measures by breakfast location, but lower fasting triglyceride levels were found in children who consumed breakfast at SCHOOL compared to HOME. Literature has supported high dietary intake of fat and added sugars to be associated with high triglyceride levels.[77,78] Elevated triglyceride levels have been linked to insulin resistance, glucose impairment, and ultimately, metabolic syndrome in children.[79] SCHOOL breakfasts compared with HOME breakfasts were lower in fat and saturated fat in this study, which may have contributed to the lower triglyceride levels. Lending support for this conclusion, weak positive correlations between triglyceride levels and breakfast fat intake ($r = 0.2$; $P = 0.06$) and breakfast saturated fat intake ($r = 0.2$; $P < 0.04$) were observed in HOME. SCHOOL breakfasts compared with HOME breakfasts were higher in added sugar, and no correlation was observed between triglyceride levels and breakfast added sugar in school breakfast consumers ($r = -0.1$; $P = 0.60$). This is contrary to the literature and could be due to the race/ethnicity composition of the study sample. School-aged Hispanic children have higher triglyceride levels than other racial/ethnic groups, despite non-Hispanic White and non-Hispanic Black children having higher saturated fat intakes above the recommended levels.[80] However, non-Hispanic Black and Hispanic children aged 6 to 11 years consume higher total sugars at breakfast than their non-Hispanic White counterparts.[81] Differences in sugar and fat consumption by race/ethnic groups, both at breakfast and subsequently, could influence triglyceride levels to varying degrees.

There have been several other studies that support dietary fat consumption to be associated with triglyceride levels. A cross-sectional study conducted in Mexican school-aged children found positive associations between triglyceride concentrations and intake of added fats, but no relationships between added sugars and refined carbohydrates on triglycerides were observed.[78] Cross-sectional studies in Spanish children reported low fat consumption and meeting the American Heart Association recommendations for dietary fat intake was associated with low triglyceride levels.[82,83] Gulesserian and Widhalm[84] showed that substitution of saturated fats with rapeseed oil, which is low in saturated fat, decreased serum triglyceride levels over a 5-month period in children and adolescents with familial hypercholesterolemia, but this study only had 17 participants with extreme values of serum lipids.[84] The SBP guidelines require saturated fat intake at breakfast to be < 10% of total breakfast energy.[40] The present study showed that the SBP supports beneficial dietary intake, with school breakfast consumers having an average of 8.6% of breakfast energy consumed as saturated fats, but there was no difference in daily saturated fat intake between groups. Additional research examining breakfast and subsequent meals between home and school environments is needed to explain total daily intake and to elucidate relationships with cardiometabolic parameters.

SCHOOL had lower fat, saturated fat, and sodium consumption at breakfast compared with HOME. Nishi and colleagues[85] reported that dietary intake at home contributed to majority of saturated fat and sodium consumption throughout the day. Hispanic and non-Hispanic Black children have less availability and accessibility to healthy foods, compared with non-Hispanic white counterparts.[86] The SBP requirements address energy (350 to 500 kcal), sodium (≤ 540 mg), and saturated fat (< 10% kcal) for breakfast meals over the course of a 5-day week in the school environment.[40] Sodium and saturated fat consumed at breakfast were lower in SCHOOL compared with HOME and were within the limits of the SBP guidelines. However, the SBP has no current guidelines for added sugar consumption and allows flavored milk and fruit juice to fulfill the dairy and fruit requirements, respectively.[40] SCHOOL compared with HOME had higher breakfast and daily intake of added sugars. HOME remained below the daily recommendation of less than 10% of energy from added sugars, on average, but SCHOOL overconsumed added sugar per the recommendations, making up 11.5% of total energy, on average.[87] In addition, HOME breakfasts were composed of 13.6% (11.7 g) added sugar compared with the 17.6% (15.3 g) added sugar observed in school breakfasts, already accounting for nearly 5% of daily energy for this age group. The breakfast meal contributed to a large proportion of the daily added sugar in both locations but more so in the school environment. Guidelines regarding added sugar content of school breakfast meals could be a target in reducing added sugar consumption in this population.

Afeiche and colleagues[39] noted six discernable breakfast patterns in Mexican children, and all patterns contained SSBs, which was the most frequently reported food group consumed at breakfast followed by milk. Although not location-specific, other studies have found breakfast consumption in children to be associated with high intake of sugars, notably from consumption of fruit, milk, carbohydrates, and nonmilk extrinsic sugars (i.e., sugars not within the cellular structure of a food, excluding lactose in milk products), relative to daily intake.[88,89] In this study, popular breakfast food items for HOME and SCHOOL were the same: milk, ready-to-eat cereal, juice, and fresh fruit. Although the same food items were top contributors for breakfast in both locations, 7.8% of milk consumed at home was flavored milk, whereas 34.5% of milk consumed at school was flavored milk. Sugar intake at breakfast has been associated with sugar intake throughout the day.[39] The present study supports this observation as it showed SCHOOL compared with HOME had higher total sugar, added sugar and SSB (including flavored milk) intake at breakfast and higher daily consumption of total sugar, added sugar, fruit servings (including 100% juice), dairy (including flavored milk), and SSBs (including flavored milk). The relationships observed for daily fruit, dairy, and SSBs and breakfast fruit and SSBs were attenuated when excluding 100% juice and flavored milk. Vinke and colleagues[90] investigated timing and frequency of SSB consumption in children and reported that the largest difference between low SSB consumers and high SSB consumers was at breakfast (31% vs 98%). SCHOOL nearly doubled the daily intake of SSBs (including flavored milk) when compared with HOME (1.1 servings vs 0.6 serving). Flavored milk consumption was a primary food item that influenced the SSB and dairy results observed in SCHOOL and likely contributed to the higher added sugar consumption compared with HOME.

The SBP mandates that breakfast must contain 1 oz-eq grains, with at least 50% as whole grains.[40] There was lower daily refined-grain and breakfast refined-grain consumption in SCHOOL compared with HOME, supporting the benefits of consuming breakfast in the regulated school environment. However, SCHOOL had 1.4 servings of total grains at breakfast, on average, with a 0.6 serving as whole grains (42.9%), suggesting inadequate consumption of whole grains per the SBP requirements. There was little difference in breakfast whole-grain intake observed between breakfast locations, despite the SBP mandate. A previous study reported no differences in whole-grain intake between race/ethnic groups but that Mexican-American children had higher refined-grain intake compared with non-Hispanic Black children.[91] Refined grains composed 77.6% of total grains in SCHOOL and 81.0% of total grains in HOME. Substituting refined-grain ingredients with whole-grain ingredients has been shown to increase whole-grain intake in children and adolescents.[91] The breakfast meal provided 54.5% of daily whole-grain intake in SCHOOL and 45.5% of daily whole-grain intake in HOME, serving as a primary source of whole grains in both locations. However, refined-grain intake exceeded whole-grain intake at breakfast in both locations. Most children met recommendations for total grains, but whole-grain composition remained below recommended intake.[92] Because whole-grain intake has been inversely associated with blood pressure, waist circumference, and overweight/obesity prevalence in children, breakfast could serve as a target to decrease refined-grain and increase whole-grain consumption, regardless of location.[92,93]

Protein intake between SCHOOL and HOME differed at breakfast. HOME had higher protein intake at breakfast compared with SCHOOL (13.5% vs 11.9%). High protein intake at breakfast has been associated with health benefits, such as weight management, glucose control, and satiety and appetite control throughout the day.[41,94-96] However, these studies showed that protein elicits these positive responses only with high intake (i.e., 35 g or 40% of breakfast energy) that does not normally include processed meats and/or protein sources high in saturated fat. The literature is limited in comparing different environments for protein intake in children. The current protein intake recommendation for this population is 10% to 30% of daily energy.[97] Daily protein intake for both school and home breakfast consumers was approximately 16% of energy. HOME had higher protein intake at breakfast than SCHOOL. Specifically, HOME breakfasts had 11.7 g protein whereas SCHOOL breakfasts had 10.2 g protein, on average. Due to the number of dairy servings observed in HOME and SCHOOL breakfasts (0.8 servings and 0.7 servings, respectively), the majority of protein consumption is likely from dairy sources. Neither location had a protein source other than milk as a common breakfast food item, so an additional protein serving at breakfast might reduce intake of added sugars and total carbohydrates consumed at breakfast, particularly in the school environment. As aforementioned, the OVS system allows students to substitute grains with meat and meat alternatives in school breakfasts, but this is not a requirement. All positive dietary outcomes observed for SCHOOL could be attributed to the SBP, and the results presented suggest that additional regulations on sugar and protein in breakfast meals in this low-income, high-risk population might be beneficial.

Limitations

The present study has several limitations. First, the study was confined to one geographical area, and thus, results may not be representative of the general population nor the SBP, although analyses included five school districts. Non-Hispanic Black and Hispanic youth are disproportionately affected by obesity,[19] and this study examined relationships between breakfast location with cardiometabolic parameters and dietary behaviors in a predominately high-risk population. Therefore, the results may not be reflective of other race/ethnic groups. Another limitation is that the analyses were cross-sectional in nature and therefore cannot infer causality. Nearly half (48.3%) of the population had overweight or obesity, which complicated discussion of potential mechanisms regarding cardiometabolic parameters, particularly the triglyceride levels finding in this study. In addition, the survey included measures on physical activity and screen time, but total energy expenditure was not assessed and, therefore, was not included in the study. The use of one dietary recall may not be indicative of daily intake nor established dietary patterns, so results are subject to attenuation bias. However, the use of dietary recalls has been shown to be a valid and reliable measure of children's (aged 9 to 11 years) dietary intake of breakfast in randomized controlled trials of school-based interventions.[98] In addition, dietary recall data permitted more detailed measures of dietary intake as opposed to survey or food frequency data, which have been used in previous studies examining breakfast location. Students unwilling to complete dietary recalls were randomly replaced, but the risk of nonresponse bias should be considered as the number of those replaced is not available. The sample sizes by location were too small to examine interactions by race/ethnicity and overweight/obesity status. Whereas studies have shown increased breakfast consumption and SBP participation when offered in the classroom, consumption of a second breakfast has resulted in unintended outcomes, such as increased overweight and obesity prevalence.[29,53,99-101] However, these analyses could not be performed due to a low sample of double breakfast consumers ($n = 16$). Another limitation is that there is no standard definition of breakfast, so these results can only be interpreted given the breakfast definition used in the study. Self-reported dietary intake in children may not be the most reliable, but parental assistance was requested and materials such as portion booklets were provided to improve accuracy. Although there are potential outside factors that may influence where the student chose to consume breakfast, data were not collected to examine such reasons, and future studies should include appropriate psychosocial variables. All data were collected from a randomized controlled trial and future analyses will examine interventional effects of breakfast consumption locations on cardiometabolic parameters, daily dietary intake, and breakfast composition in this population.

CONCLUSIONS

SCHOOL had lower triglyceride levels and lower intake of total fat, saturated fat, sodium, and refined grains at breakfast compared with HOME. These results suggest that the SBP guidelines for fat and sodium were successful at keeping fat and sodium intake within limits, possibly contributing to the healthier lipid profiles. However, dietary intake of added sugars and protein by breakfast location remain to be elucidated. SCHOOL had higher daily intake of total sugar, added sugar, dairy (including flavored milk), and SSBs (including flavored milk); higher intake of carbohydrates, total sugar, and added sugar at breakfast; and lower intake of dairy (excluding flavored milk) and protein at breakfast compared to HOME. These results raise the question whether or not SBP guidelines on sugar and protein intake could lead to healthier dietary intake, as was suggested for sodium and saturated fats. Future studies are needed to examine relationships of the SBP on sugar and protein consumption in school breakfasts and associations with weight status and other cardiometabolic parameters in low-income, multiracial/ethnic elementary school-aged children.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

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AUTHOR CONTRIBUTIONS

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