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Home-Schooled Children are thinner, leaner, and report better diets relative to traditionally-schooled children

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Abstract

Objective—To examine and compare the relationships among diet, physical activity, and adiposity between home-schooled children (HSC) and traditionally-schooled children (TSC).

Design and Methods—Subjects were HSC (n=47) and TSC (n=48) aged 7 to 12 years old. Dietary intakes were determined via two 24-hour recalls and physical activity was assessed with 7 days of accelerometry. Fat mass (FM), trunk fat, and percent body fat (%BF) were measured by dual-energy x-ray absorptiometry (DXA).

Results—Relative to HSC, TSC demonstrated significantly higher BMI percentiles, FM, trunk fat, and %BF; consumed 120 total kilocalories more per day; and reported increased intakes of *trans* fats, total sugar, added sugars, calcium, and lower intakes of fiber, fruits, and vegetables (p<0.05). At lunch, TSC consumed significantly more calories, sugar, sodium, potassium, and calcium compared to HSC (p<0.05). Physical activity did not differ between groups. Traditional schooling was associated with increased consumption of *trans* fat, sugar, calcium (p<.05); lower intakes of fiber, and fruits and vegetables (p<.05); and higher FM, %BF, and trunk fat (p<0.01), after adjustment for covariates.

Conclusions—These data suggest HSC may consume diets that differ in energy and nutrient density relative to TSC, potentially contributing to differences in weight and adiposity.

Keywords

obesity; adiposity; youth; nutrition; physical activity; diet quality

Introduction

The prevalence of childhood obesity has increased over the last thirty years (1) and research demonstrates obese children are more likely to become obese adults (2). Pediatric obesity that tracks into adulthood may have detrimental implications for long term health and contributes to the development of chronic health complications (2–4). Studies characterizing modifiable factors associated with the development of pediatric obesity are essential to establish guidelines for minimizing obesity risk.

Though the substantial rise in the prevalence of pediatric obesity has been linked, in part, to a confluence of genetic, behavioral, and environmental factors (5–7), a growing body of literature has investigated the school environment as a potential contributor. Despite the popular view that traditional school environments promote obesity with increased availability of energy-dense foods and decreased physical education classes (8–13), some data suggest otherwise (14, 15). Rather, food eaten at home has been shown to provide more energy from low-nutrient, energy-dense foods than food eaten at school or other locations (16), suggesting that children who spend more time at home may be at risk for excessive weight gain. Limited research has explored the relationship between diet, physical activity, and adiposity in children who spend a greater than average amount of time at home, such as the case in home-schooled children (HSC).

The proportion of children in the United States who are home-schooled has increased substantially during the last 40 years (17), coincident with a substantial rise in childhood obesity rates (1). The facts above invite speculation that home-schooling may be one of a multitude of factors associated with greater obesity rates in children, particularly because it has been noted that HSC demonstrate lower physical fitness levels and decreased step counts relative to TSC (18, 19). Though aspects of HSC and families (i.e. parental motivations to home-school, determinants of student achievement, and physical activity and fitness levels) have been studied (18–20), there has been limited investigation of obesity-related parameters in HSC compared to traditionally-schooled children (TSC).

Therefore, we examined whether HSC are at increased risk for excess adiposity and compare postulated modifiable determinants of child weight status (e.g. dietary factors, physical activity) between HSC and TSC. The objectives of this study were to: 1) to quantitatively measure and compare energy intakes, diet quality, physical activity, and adiposity in HSC and TSC, and 2) to evaluate the relationship between energy intakes, diet quality, physical activity, and adiposity in HSC and TSC. We hypothesized HSC would have higher adiposity, increased energy intakes, poor diet quality, and less physical activity relative to TSC.

Methods and Procedures

Subjects

This paper utilizes data from a cross-sectional study evaluating genetic and environmental factors underlying pediatric racial/ethnic differences in body composition and insulin-related outcomes. Participants were 95 children aged 7–12 years, self-identified as non-Hispanic white (NHW) who were recruited in Birmingham, Alabama from 2005–2009. Recruitment was conducted at schools, churches, health fairs, and through newspapers, parent magazines, radio, and participant referrals. We did not employ recruitment strategies specifically designed to over-sample home-schooled children, and the majority of these children were recruited via participant referrals. Given that some families had multiple children in this age range, we had families with more than one child enrolled in both the HSC group (n=13) and TSC group (n=8). Parents of the participants reported school status [home-schooled; n=47 vs. traditionally-schooled; n=48] for each child, though in the case of HSC we were unable to collect any information regarding the amount of time the child had been home-schooled or if they had ever been exposed to the traditional school environment. The children were peripubertal (pubertal stage ≤3 as assessed by a pediatrician according to the criteria of Marshall and Tanner) (21, 22), and were not taking any medications contraindicated for study participation (i.e. medication known to affect body composition, metabolism, cardiac function). Children and parents provided informed assent and consent, respectively, to the protocol, which was approved by the Institutional Review Board at the University of Alabama at Birmingham. All measurements were collected by trained staff in the Nutrition Obesity Research Center and Department of Nutrition Sciences at University of Alabama at Birmingham.

Anthropometric measures

Anthropometric measurements for all participants were obtained by the same registered dietitian. Participants were weighed (Scale-tronix 6702W) to the nearest 0.1 kg (in minimal clothing without shoes) and height was recorded to the nearest 0.1 cm without shoes using a digital stadiometer (Heightronic 235; Measurement Concepts, Snoqualmie, WA). Children's BMI-for-sex-and-age percentiles (BMI %) were calculated according to the 2000 Center for Disease Control and Prevention growth charts (23).

Adiposity

Adiposity was measured by dual-energy x-ray absorptiometry (DXA) using a GE Lunar Prodigy densitometer (GE LUNAR Radiation Corp., Madison, WI) with pediatric software encore 2002 version 6.10.029, while participants wore light clothing and laid flat on their backs with arms at their sides. Measured variables included total fat mass (FM), trunk fat, and percent body fat (%BF).

Socioeconomic Status

Socioeconomic status (SES) was measured with the Hollingshead 4-factor index of social class (24), which combines the educational attainment and occupational prestige for working parents in the child's family. Scores range from 8 to 66, with higher scores indicating higher SES. Given that SES has been shown to be associated with body composition in children (6), SES was used as a covariate in all models related to child adiposity. The SES measure may not address qualification of free/reduced price meals for the National School Lunch Program (NSLP), which may impact diet (16). Thus, regardless of current child schooling status, parents also reported if their child qualified to receive a free/reduced lunch (0=No; 1=Yes). In models evaluating school status on dietary intakes and diet quality, we adjusted for NSLP eligibility.

Dietary Assessment

Dietary composition for each participant was assessed using an average of two weekday 24-hour dietary recalls (24HR). Each 24HR was performed in the presence of the child's parent and the "multiple pass" method was used, providing a cup and bowl size to help estimate portion sizes (25). Children and parents were asked the location of all meals the children consumed (i.e. home, school, a restaurant) and where each meal was prepared and/or purchased. All TSC had eaten a school lunch for their lunchtime meal (which included anything that was purchased at school, including NSLP meals, competitive foods, and a la carte items). All HSC had consumed a lunchtime meal that was prepared and eaten at home. Therefore, we refer to the lunchtime meal as one that was prepared and consumed at home for HSC participants and prepared and consumed at school for TSC participants (whether purchased or given to the child for those who qualified for free/reduced lunch from the NSLP). 24HR data for all children were coded by a registered dietitian and entered into Nutrition Data System for Research version 2006 (Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN), a dietary analysis program designed for the collection and analysis of 24-hour dietary recalls. The outcome variables analyzed include energy intakes, macronutrient intakes, and micronutrient intakes. It is important to note that we are aware of the non-trivial errors associated with self-reported estimates of energy intake and some authors in this paper believe it is an inadequate measure for the basis of scientific conclusion (26). With the aim of completeness, however, we included this variable and do not use it as a basis for scientific conclusion, rather as a means to explore the differences between TSC and HSC and identify areas for further research.

Physical Activity Assessment

Children wore an MTI ActiGraph accelerometer (GT1M, ActiGraph Health Services, Pensacola, FL) on their waist over the right hip for 7 days to objectively measure physical activity levels (and removal was limited to times when the child was sleeping, bathing, or swimming). Epoch length was set at one minute and physical activity data were expressed as counts per minute (counts min^{-1}). As previously described, the daily counts per minute >1952 counts per minute were summed and analyzed as the average time children spent in moderate and vigorous physical activity (MVPA) (27).

Statistical Analysis

Normality assumptions were evaluated and non-normal variables were log-transformed, meeting normality assumptions. Differences in means between HSC and TSC were explored with independent samples *t*-tests. Analysis of covariance (ANCOVA) was used to evaluate differences in dietary, physical activity, and adiposity variables between HSC and TSC and controlled for age, sex, pubertal stage, and SES.

Multivariate linear regression analyses examined the relationship between school status, dietary intakes, physical activity, and adiposity variables. The school variable was coded in all analyses as 0=HSC and 1=TSC. We also evaluated whether qualifying for free/reduced lunch from the NSLP was associated with diet or physical activity variables; with children who did not qualify for free/reduced lunch as the reference group. All models adjusted for child's age and sex, with male as the referent category. Multivariate linear regression models investigating adiposity variables also adjusted for energy intakes, physical activity, pubertal status, and SES. We also tested for both an interaction between school group and sex and for the effect of siblings on all adiposity/obesity-related behaviors. All analyses were conducted using SAS Version 9.3 (SAS Institute Inc, Cary, NC).

Results

Demographics and Body Composition

Descriptive statistics comparing HSC and TSC are reported in Table 1. Though not statistically significant, the percentage of females was slightly higher in TSC than HSC (56.25% vs. 42.55%). No significant differences were observed regarding child age, pubertal stage, SES, or percent of children who qualify for free/reduced lunch between the two groups. Evaluation of body composition indicated HSC had significantly lower BMI%, FM, %BF, and trunk fat relative to TSC.

Dietary Intakes and Physical Activity

Comparisons of dietary intakes and physical activity are reported in Table 2. Based on the daily energy need requirements outlined in Dietary Guidelines for Americans (28), both TSC and HSC were consuming excess calories. TSC reported greater consumption of excess calories (420 kcals/day) relative to daily overconsumption by HSC (300 kcals/day). When evaluating total daily energy intakes, TSC report consuming approximately 120 kcals more per day than HSC (1951 kcal vs. 1830 kcal); significantly higher intakes of *trans* fat, total sugar, added sugars, calcium; and lower consumption of fiber, and fruits and vegetables relative to HSC. Evaluation of the lunchtime meals indicated similar trends, with TSC consuming significantly more calories, sugar, sodium, potassium, and calcium at lunch when compared to HSC. When comparing non-lunchtime dietary intakes, TSC consume significantly less potassium and fiber than HSC. No significant differences were detected between TSC and HSC with respect to the amount of time spent engaged in daily moderate to vigorous physical activity.

Diet, Physical Activity, Adiposity, and School Status

Multivariate linear regression analysis tested for associations between diet, physical activity, adiposity, and school status (TSC as the reference category), after adjustment for covariates in Table 3. The relationship between school status, physical activity, and dietary patterns is assessed after accounting for qualification of free/reduced lunch status, age, and child sex. Traditional school status was associated with increased reported intake of *trans* fat (p=0.0136), total sugar (p=0.0342), added sugars (p=0.0164), calcium (p=0.0109), and decreased consumption of fiber (p=0.0408), and fruits and vegetables (p=0.0005). Being traditionally schooled was also nearly significantly associated with increased energy intake (p=0.0584). Regardless of current school status, qualifying for a free/reduced lunch program was associated with significantly greater percent of calories from fat (p=0.0223), and was nearly significantly associated with increased percent of calories from carbohydrate (p=0.0560), increased *trans* fat (p=0.0548), and less fiber (p=0.0670) and fruit and vegetable intakes (p=0.0832).

The relationship between school status and adiposity was assessed after accounting for energy intake, physical activity, SES, age, pubertal stage, and sex. TSC status was significantly associated with higher FM (p=0.0014), %BF (p=0.0012), and trunk fat (p=0.0015). Regardless of school status, SES was not associated with any adiposity measure. Though sample size limitations precluded us from stratifying by sex, we tested for an interaction between school group and sex but this was not significant in any adiposity/obesity-related behavior outcomes (data not shown). Additionally, we evaluated the effect of siblings on all models and found there was no contribution of this effect to any adiposity or obesity-related behavior outcomes in this study (data not shown).

Discussion

Herein, we compared associations of diet, physical activity, and adiposity in home-schooling and traditional-schooling. Contrary to our hypotheses, TSC reported significantly higher energy intakes (both daily and at lunchtime meals), poorer diet quality, and higher levels of adiposity when compared to HSC, despite no differences in physical activity between the groups. Our findings suggest that HSC and TSC differ in regards to diet and adiposity parameters, but do not differ in time spent engaged in moderate to vigorous physical activity.

Marked differences in adiposity between TSC and HSC were observed. Relative to their HSC counterparts, TSC demonstrated greater FM, %BF, trunk fat, and BMI%. Given that time spent engaged in physical activity did not differ between the two groups, the increased adiposity observed in TSC may be due to an excess consumption of calories. In contrast to a previous report finding no difference in dietary intakes in a small sample of HSC and TSC (19), our data indicated that TSC consumed approximately 120 kcals more per day than HSC. Relative to TSC, HSC ate 118 kcals less during their lunchtime meal, leading us to believe that the difference in total energy intake between the two groups is derived from a caloric disparity at the lunchtime meal. This is supported by our observation that non-lunchtime meal energy intakes did not differ between groups. Additionally, TSC reported consuming significantly more sugar and sodium during school lunchtime meals though no differences were observed between groups during non-lunchtime dietary intakes in these variables. This suggests that the lunchtime meals children consume at school may be higher in calories, sugar, and sodium than the lunchtime meals consumed at home, differing from other studies indicating foods from home are more likely to be low-nutrient, energy-dense foods (16, 29). This disparity may be due to the cohorts in those studies being drawn from diverse groups of children attending traditional schools only or due to the measurement error often associated with energy intakes (26). The mixed results outlined above highlight the need for further research to be conducted in a large longitudinal sample of HSC and TSC that investigates the relationship between a robust measure of energy intakes, such as doubly labeled water, and adiposity over time (26). In addition to differing in energy intake, there were clear discrepancies in diet quality between TSC and HSC, even after accounting for age, sex, and qualification for free/reduced lunch. Specifically, being traditionally schooled was associated with increased consumption of *trans* fat, total sugar, added sugars, calcium, and lower intakes of fruits and vegetables, and fiber. Given that a positive association between *trans* fat and sugar and cardiovascular disease has been shown (30, 31), it is concerning that the traditional school environment was related to higher consumption of these nutrients. Fruit, vegetable, and fiber consumption has been inversely related to weight gain (32, 33), suggesting decreased intakes may negatively impact weight status in TSC over time. Higher intakes of calcium in the traditional school group, however, are beneficial and could be protective against the development of obesity (34), though neither group is reaching current recommendations for daily calcium intakes (28). With the exception of TSC consuming more calcium relative to HSC, to the extent that study variables describe diet quality, it appears TSC report poorer diet quality relative to HSC. One possible reason for this observation may be due to the school food environment. The diet quality of school lunches in the United States has been reported to fall below recommended Dietary Guidelines (10, 35) and several studies have found diet quality to be inversely associated with adiposity (36, 37). Additionally, relative to HSC, TSC may have increased access to low-nutrient, energy dense foods in vending machines in or near the cafeteria or at school stores, factors which have been speculated to influence and in some studies associated with a higher BMI in TSC children (38, 39). Other potential and plausible explanations are differential reporting bias or that dissimilarities outside the scope of this study exist in home-schooled populations, which may contribute to differences in adiposity, energy intake, and diet quality, independent of physical activity.

Robust measures of physical activity for 7 days indicated that there were no differences in time spent engaged in moderate to physical activity between HSC and TSC. This is consistent with research demonstrating physical activity did not differ between groups over 3 days, despite lower physical fitness in HSC relative to TSC (18). Previously it has also been shown that TSC had increased step counts in comparison to HSC, but measures were assessed by an activity monitor, a less robust measure of physical activity (19). Thus, physical activity was not observed to differ significantly between groups and does not appear to play a significant role in the observed disparity in obesity-related variables among HSC and TSC in our cohort.

The strengths of this study are the use of robust measures used to determine body composition and objective physical activity. Variables which independently may contribute to body composition including SES, sex, age, race/ethnicity, qualification for free/reduced lunch, or pubertal status did not differ among TSC and HSC. Additionally, we accounted for where lunch time meals were purchased and/or consumed which allowed for evaluating the relationship between lunch time meals and adiposity. To our knowledge, this is also the first study to characterize body composition and obesity risk in HSC, a growing population that has been largely unexplored in the obesity literature.

The limitations of this study include the use of 24-hour recalls and a relatively small convenience sample recruited from a specific geographic region introducing the possibility of selection bias; therefore limiting the generalizability of these results to all children. The homogenous sample of NHW children is furthermore a limitation, though overall demographics for HSC indicate this is typical for homeschooled families nationally (40). The inclusion of multiple children from the same family also had the potential for bias; however, we tested the effect of siblings in all models and found no significant contribution of this effect to any outcome variable. We acknowledge that all TSC consumed a school lunch, rather than bringing their lunch from home, and that these results presented herein may not be reflective of children who bring their lunch from home. We also recognize that the use of HSC as a comparison group to TSC may bring about confounders such as a potential reporting bias regarding dietary intakes due to the HSC parent's ability to confirm or report a more accurate account of the child's intake throughout the school day. Other potential confounders not studied herein may be worth investigating in future research, such as parental feeding practices; values and beliefs regarding nutrition, or ability to monitor children's dietary intakes. Despite these limitations, our data demonstrated that TSC and HSC were homogenous with regards to SES, qualification for free/reduced lunch, pubertal stage, race/ethnicity, and sex giving us confidence that our cohort of HSC was an appropriate comparison group for the purposes of this study.

In summary, given the large portion of time children spend at school; educational environments have the potential to impact nutritional intakes and physical activity levels.

Though physical activity did not differ between groups, our data suggests that HSC are thinner, leaner, and report better diets compared to TSC. Large, longitudinal research studies are needed to further identify the etiology of the observed disparities in obesity-related variables between HSC and TSC.

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What is already known about this subject?

- In children, food eaten at home may provide more energy from low-nutrient, energy-dense foods than food eaten at school or other locations.
- The proportion of children in the United States who are home-schooled has increased substantially during the last 40 years, coincident with a substantial rise in childhood obesity rates.
- Home-schooled children have significantly lower physical fitness levels than traditionally-schooled children.

What this study adds

- Relative to home-schooled children, traditionally-schooled children have significantly higher BMI percentiles and greater adiposity.
- Relative to home-schooled children, traditionally-schooled children report consuming significantly more calories, *trans* fats, total sugar, added sugars, calcium, and lower intakes of fiber, fruits, and vegetables daily.
- There were no differences between home-schooled and traditionally-school children in moderate to vigorous physical activity measured by 7 days of accelerometers.

Table 1

Comparisons of demographics and body composition between home-schooled children and traditionally-schooled children.

	Home-Schooled Children (n=47)	Traditionally-Schooled Children (n=48)
Variable	Mean ± SD	Mean ± SD
Demographics		
Sex (% female)	42.55	56.25
Age (yrs)	9.54±1.68	9.61±0.1.69
Pubertal stage (Tanner)	1.32±0.63	1.31±0.59
Socioeconomic status	48.66±10.67	49.38±9.06
% Free Lunch	9.76	16.67
Body Composition[a]		
BMI percentile (%)	**54.55±27.52**	**63.33±25.72**[*]
Total fat mass (kg)	**6.75±3.54**	**8.41±4.92**[*]
Percent Body Fat (%)	**20.26±7.39**	**22.76±8.79**[*]
Trunk fat mass (kg)	**2.57±1.61**	**3.36±2.38**[*]

[*] indicate differences between groups, $p<0.05$

[a] Analysis of covariance (ANCOVA) was used to evaluate the difference in body composition variables between HSC and TSC and controlled for age, sex, pubertal stage, and SES

% Free Lunch=Percentage of the children whose parents report that qualify for a free/reduced National School Lunch Program Lunch; BMI percentile= BMI-for-sex-and-age percentiles;

Table 2

Comparisons of dietary intakes and physical activity between home-schooled children and traditionally-schooled children.

Total Daily Dietary Intakes and Physical Activity[a, b]	**Home-Schooled Children (n=47)**	**Traditionally-Schooled Children (n=48)**	**Lunchtime Dietary Variables**[a, c]	**Home-Schooled Children (n=47)**	**Traditionally-Schooled Children (n=48)**	**Non-Lunchtime Dietary Variables**[a, d]	**Home-Schooled Children (n=47)**	**Traditionally-Schooled Children (n=48)**
Daily Estimated Energy Requirement (kcal)	1533.33±235.51	1529.17±216.31	-	-	-	-	-	-
Energy Intake (kcal)	1830.25±412.19	1950.80±409.37*	Energy Intake (kcal)	533.01±244.46	650.72±302.27*	Energy Intake (kcal)	1321.71±388.20	1305.53±353.46
% Calories from carbohydrate	52.23±7.07	51.89±6.47	% Calories from carbohydrate	51.67±13.49	52.07±11.99	% Calories from carbohydrate	52.79±6.03	51.71±5.87
% Calories from protein	14.20±3.59	13.96±2.78	% Calories from protein	15.24±5.38	14.03±5.10	% Calories from protein	13.16±3.77	13.89±3.61
% Calories from fat	33.47±5.74	34.12±5.24	% Calories from fat	32.95±9.62	33.85±10.59	% Calories from fat	33.99±6.29	34.39±7.01
% Calories from saturated fat	12.15±3.00	12.70±2.38	% Calories from saturated fat	10.27±4.82	11.70±4.00	% Calories from saturated fat	14.03±3.81	13.7±3.34
Trans fat (g)	5.43±2.33	6.75 ±2.83*	*Trans* fat (g)	1.73±1.19	2.09±1.30	*Trans* fat (g)	3.83±2.15	4.63±2.35
Total sugar (g)	113.34±35.68	127.23±40.53*	Total sugar (g)	51.11±38.97	63.05±40.49*	Total sugar (g)	77.88±31.76	91.11±40.04
Added sugars (g)	75.52±37.46	95.18±38.95*	Added sugars (g)	20.92±19.45	25.74±20.74	Added sugars (g)	55.75±29.96	67.81±31.69
Sodium (mg)	2964.11±861.91	3157.78±857.37	Sodium (mg)	937.68±528.60	1085.13±581.26*	Sodium (mg)	2079.14±658.43	2119.59±718.35
Potassium (mg)	2079.86±682.79	2107.65±573.05	Potassium (mg)	548.82±291.57	818.29±492.74*	Potassium (mg)	1551.49±662.70*	1291.40±448.76
Calcium (mg)	804.58±354.91	947.94±279.82*	Calcium (mg)	183.67±117.98	321.65±206.97*	Calcium (mg)	627.88±304.34	616.35±212.17
Fiber (g)	14.77±5.84*	12.83±4.67	Fiber (g)	4.41±2.85	5.19±3.61	Fiber (g)	10.65±5.07*	7.81±4.01
Daily Fruit and Vegetable servings	4.98±2.64*	2.59±1.81	-	-	-	-	-	-
Daily Physical activity (min/d)	55.79±30.94	61.65±31.73	-	-	-	-	-	-

* indicate differences between groups, p<0.05a

[a] Analysis of covariance (ANCOVA) was used to evaluate the difference in dietary and physical activity variables between HSC and TSC and controlled for age and sex

[b] According to recommendations from Dietary Guidelines for Americans

[c] In traditionally-schooled children, lunch time meal was a school lunch that was purchased/provided and consumed at school; In home-schooled children, lunch time meal was prepared and consumed at home

[d]Includes dietary intakes consumed outside of the lunchtime meal Physical activity=Total min/day spent in moderate to vigorous physical activity

Table 3

Multivariate linear regression analysis investigating the relationship between school status (traditional-schooled vs. home-schooled), daily dietary intakes, daily physical activity, and adiposity among home-schooled and traditionally-schooled children[a].

	Total Energy (kcal)		Carbohydrate (%)[b]		Protein (%)[b]		Dietary Fat (%)[b]		Saturated Fat[b]		*Trans* Fat ((g))		Total Sugar (g)	
Variable	**β±SE**	***p*-value**	**β±SE**	***p*-value**	**β±SE**	***p*-value**	**β±SE**	***p*-value**	**β±SE**	***p*-value**	**β±SE**	***p*-value**	**β±SE**	***p*-value**
TSC[e]	158.48±82.58	0.0584[†]	−1.25±1.44	0.3895	−0.38±0.70	0.5845	1.12±1.12	0.3193	0.74±0.55	0.1852	**1.41±0.56**	**0.0136**[*]	**34.64±−16.09**	**0.0342**[*]
Free[f]	18.11±18.31	0.3257	−0.62±0.32	0.0560[†]	−0.04±0.15	0.8156	**0.58±0.25**	**0.0223**[*]	0.12±0.12	0.3212	0.24±0.12	0.0548[†]	−2.85±3.57	0.4266
	Added Sugars (g)		**Sodium (mg)**		**Potassium (mg)**		**Calcium (mg)**		**Fiber (g)**		**Fruit and Veg[c]**		**Physical Activity[d]**	
Variable	**β±SE**	***p*-value**	**β±SE**	***p*-value**	**β±SE**	***p*-value**	**β±SE**	***p*-value**	**β±SE**	***p*-value**	**β±SE**	***p*-value**	**β±SE**	***p*-value**
TSC[e]	**20.44±8.34**	**0.0164**[*]	289.73±177.62	0.1066	−16.19±137.42	0.9065	**160.02±61.44**	**0.0109**[*]	**−2.37±1.14**	**0.0408**[*]	**−2.51±0.66**	**0.0005**[*]	3.50±6.24	0.5763
Free[f]	−1.50±1.85	0.4200	38.48±39.39	0.3314	−13.52±30.48	0.6583	5.91±13.63	0.6657	−0.47±0.25	0.0670[†]	−0.26±0.14	0.0832[†]	0.54±1.39	0.6942
	BMI Percentile[g]		***Log* Total Fat Mass[g]**		**Percent Body Fat[g]**		***Log* Trunk Fat[g]**							
Variable	**β±SE**	***p*-value**	**β±SE**	***p*-value**	**β±SE**	***p*-value**	**β±SE**	***p*-value**						
TSC[e]	12.21±6.46	0.0631[†]	**0.35±0.11**	**0.0014**[*]	**5.56±1.64**	**0.0012**[*]	**0.41±0.12**	**0.0015**[*]						
SES[h]	0.07±0.32	0.8127	−0.01±0.01	0.2172	−0.11±0.08	0.1800	−0.01±0.01	0.2954						

[*] Superscripts and bolded indicates a significant association with a cutoff at p<0.05

[†] Superscripts indicates a trend toward significant with a cutoff at p<0.10

[a] All models adjusted by age and sex

[b] Percentage of total calories

[c] Daily fruit and vegetable servings

[d] Physical Activity=Minutes per day spent in moderate to Vigorous Physical Activity

[e] TSC=Traditional Schooled Children's group

[f] Free=Qualification for Free/reduced National School Lunch Program

[g] Models adjusted for physical activity, energy intakes, and pubertal stage

[h] SES=socioeconomic status