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Characterization of Childhood Obesity and Behavioral Factors

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Abstract

Introduction: Childhood obesity is a major public health threat in the United States. Recent data indicate that 34.2% of children ages 6 to 11 years are overweight or obese. The purpose of this study is to describe childhood obesity levels and identify risk behaviors in two school-based health centers in Michigan, one urban and one rural.

Methods: This study is a secondary data analysis from a multicenter comparative effectiveness trial. Multiple logistic regression was used to examine behavioral factors associated with overweight/obesity in children.

Results: In this sample ($n = 105$), 41.9% were obese and 16.2% were overweight. The duration of sleep per night ($p = .04$) and the frequency of eating breakfast ($p = .04$) were significant predictors of being overweight/obese.

Discussion: Health care providers in school-based health centers must be comfortable assessing, preventing, and treating childhood obesity in this high-risk group of patients. Interventions should encourage children to eat breakfast daily and to get adequate sleep.

Keywords

Obesity; overweight; pediatric; breakfast; sleep

Childhood obesity is a major public health threat in the United States. The National Health and Nutrition Examination Survey (NHANES) 2011–2012 data indicate that 17.7% of children ages 6 through 11 years are obese, as defined by a body mass index (BMI) at or

above the sex-specific 95th percentile on the Centers for Disease Control and Prevention (CDC) BMI-for-age growth charts (Ogden, Carroll, Kit, & Flegal, 2014). The NHANES survey results also identified 16.5% as being overweight (BMI ≥ 85th percentile, but < 95th percentile; Ogden et al., 2014). The NHANES findings demonstrate that there is both an alarming and sustained prevalence of obesity among the youth of the United States.

An obese child is at risk for many adverse health consequences throughout his or her life span. Obesity in childhood is an established risk factor for type 2 diabetes mellitus (McGown, Bircerdinc, & Younossi, 2014), non-alcoholic fatty liver disease (Feldstein, Patton-Ku, & Boutelle, 2014), dyslipidemia (Cook & Kavey, 2011), musculoskeletal disorders (Krul, van der Wouden, Schellevis, van Suijlekom-Smit, & Koes, 2009), asthma (Black, Zhou, Takayanagi, Jacobsen, & Koebnick, 2013), and psychological disorders (Vander Wal & Mitchell, 2011). Pediatric obesity often leads to overweight or obese status in adulthood (Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007; Singh, Mulder, Twisk, van Mechelen, & Chinapaw, 2008) and is correlated with increased morbidity and premature mortality (Reilly & Kelly, 2011). As pediatric obesity gains the national spotlight, researchers are turning their attention to the behavioral factors associated with obesity in children, including sleep duration, physical activity, screen time, and nutritional habits.

Energy balance is an established model for understanding obesity. In this model, the energy from food and drink must equal the energy expended through physical activity for a person to maintain a certain weight (National Heart, Lung, and Blood Institute [NHLBI], 2013). A simple equation can be used: energy intake – energy expenditure = change in body stores of energy in the form of fat, glycogen, and protein (Schoeller, 2009). If the amount of energy taken in is greater than the amount of energy expended, the extra energy will be stored by the body and weight gain will occur. If the amount of energy taken in is less than that expended, the body's energy stores will be used to make up the difference, and weight loss results (Hill, Wyatt, & Peters, 2012). Sleep duration, physical activity, screen time, and nutritional habits all affect the energy balance equation, although not all factors are well understood.

Guidelines for addressing pediatric obesity incorporate both energy intake and energy expenditure components. Expert panel guidelines have been developed for preventing, assessing, and treating childhood overweight and obesity (Barlow, 2007; National Association of Pediatric Nurse Practitioners [NAPNAP], 2006), as well as for addressing risk factors for cardiovascular disease in children and adolescents (NHLBI, 2011). These recommendations for clinicians include how to educate patients and families about physical activity, screen time, and nutrition.

The U.S. Department of Health and Human Services recommends that school-age children participate in at least 60 minutes of physical activity per day (Office of Disease Prevention and Health Promotion, 2008). The expert guidelines echo this recommendation, suggesting that clinicians counsel families to prioritize 60 minutes of daily moderate to vigorous physical activity for children (Barlow, 2007; NAPNAP, 2006; NHLBI, 2011). Several studies have demonstrated that increased physical activity is associated with decreased levels of obesity in children (Ekelund, Luan, Sherar, Esliger, Griew, & Cooper, 2012; Janz et al.,

2009). An international systematic review by Jiménez-Pavón, Kelly, and Reilly (2010) revealed that decreased physical activity was consistently associated with increased adiposity in children.

The term “screen time” is defined as time spent using an electronic screen, such as a television, computer, or mobile device. Screen time is often used as a proxy for the synonymous terms “physical inactivity” and “sedentary behavior.” It is unclear whether there is an association between screen time and pediatric obesity (Ekelund et al., 2012; Fröberg, 2015). Expert guidelines suggest that screen time should be limited to less than 2 hours per day for children (Barlow, 2007; NAPNAP, 2006; NHLBI, 2011).

The relationship between nutritional habits and pediatric obesity is complex, as reflected by the varied nutritional recommendations included in the expert guidelines (Barlow, 2007; NAPNAP, 2006; NHLBI, 2011). To help children and families obtain adequate nutrition, ongoing nutrition counseling is recommended, and access to fruits and vegetables should be increased. Consumption of sugar-sweetened beverages should be decreased or eliminated, and naturally sweetened juice consumption should be limited. Guidelines recognize that nutrition recommendations must be individualized to each child and family (Barlow, 2007; NAPNAP, 2006; NHLBI, 2011). In a study of national energy intake versus national weight gain, Swinburn, Sacks, and Ravussin (2009) found that the added energy intake of the U.S. population from 1970 to 2000 was more than sufficient to describe the weight gain of both the children and the adults of the United States during this time. The percentage of dietary intake consisting of fat is strongly associated with increased body fat in adolescents (Labayen et al., 2014).

The expert guidelines recommend that clinicians encourage pediatric patients to eat breakfast daily (Barlow, 2007; NAPNAP, 2006; NHLBI, 2011). The medical literature suggests that consuming breakfast daily may help to reduce the risk of pediatric obesity. In a study of school-aged children, daily breakfast consumption was found to be associated with lower rates of obesity, improved lipid profiles, and increased physical activity (Papoutsou et al., 2014). Alexander and colleagues (2009) found that omitting breakfast is associated with increased levels of intra-abdominal adipose tissue but is not associated with other measures of adiposity or with insulin indicators in 10- to 17-year-old Latino youth. Freitas Júnior and colleagues (2012) found that sedentary obese children and adolescents in Brazil who ate breakfast had lower levels of fasting blood glucose, triglycerides, and very low-density lipoprotein cholesterol. The impact of breakfast consumption on the energy balance equation is complex and not yet well understood.

Although sleep duration is not addressed in the expert guidelines (Barlow, 2007; NAPNAP, 2006; NHLBI, 2011), researchers have found a relationship among sleep duration, dietary quality, and pediatric obesity (Franckle et al., 2015; Mendelson et al., 2015; Taveras, Gillman, Peña, Redline, & Rifas-Shiman, 2014). The NHLBI (2012) recommends at least 10 hours of sleep per night for school-aged children and 9 to 10 hours for teenagers. Previous research in school-aged children (Liu, Zhang, & Li, 2012) demonstrated a bidirectional relationship between sleep and obesity. Liu and colleagues (2012) conducted a review of 25 studies from 2006–2011 covering a range of pediatric populations ages 0–19 years around

the world. All studies suggested that short sleep duration is associated with childhood obesity as early as 6 months of age and throughout childhood. The authors suggest that getting less sleep than is developmentally appropriate causes hormonal and metabolic changes that may increase obesity risk, while obesity increases the risk of sleep disorders such as obstructive sleep apnea (Liu et al., 2012). The increase in childhood obesity levels in the United States has paralleled an increase in short sleep duration in the children of the United States (Tauman, 2013). Although there is growing evidence that short sleep duration plays a role in the development of obesity in children and adults (Cappuccio et al., 2008), the role of sleep on behavioral and metabolic processes that may affect energy intake and expenditure is unclear. Evidence suggests that food intake increases during periods of restricted sleep and energy expenditure is affected by sleep through mechanisms related to sleeping metabolic rate, thermic effect of food, and physical activity (St-Onge, 2013). The impact of sleep duration on energy expenditure and obesity is complex and poorly understood, particularly in children.

PEDIATRIC OBESITY IN MICHIGAN

Obesity rates for children in Michigan are similar to the national average, but they continue to rise. In 2013, 33% of children ages 10 to 17 years in Michigan were overweight or obese, an increase from 29% in 2003 (KIDS COUNT and Annie E. Casey Foundation, 2014). Nationally, 34.2% of children ages 6 to 11 years were over-weight or obese in 2011–2012, with no significant change since 1999–2000 (Ogden et al., 2014). As national obesity rates stabilize, it is important to determine why rates of overweight and obesity continue to rise for children in Michigan.

The overall purpose of this study was to determine the strongest predictors of obesity in this high-risk population. Two research questions were addressed. First, what is the prevalence of overweight and obesity in children seen in school-based health centers (SBHCs) in urban and rural Michigan? Second, which health behaviors are most closely associated with pediatric obesity in this group of children? The health behaviors we examined were divided into four subgroups: sleep duration, physical activity, screen time, and nutritional habits. Based on the literature and the energy balance model, we hypothesized that nutritional habits and amount of physical activity would have the greatest association with pediatric obesity in this population of children in urban and rural Michigan.

METHODS

This study utilizes secondary data analysis to determine predictors of childhood obesity in a population of children seen in SBHCs in urban and rural Michigan. Urban/rural location, sleep, physical activity, screen time, and nutritional habits were assessed. Human subject approval was obtained from each of the SBHCs, and informed consent was obtained from each provider prior to the initiation of the original study (Gance-Cleveland, Dandreaux, Aldrich, & Kamal, 2015). Secondary data analysis was determined to be exempt by the Institutional Review Board at the authors' academic institution. Participant consent was waived for this secondary data analysis because only de-identified data were collected.

Setting and Participants

SBHCs are located on school campuses and provide health care to students and their families through partnerships between schools and local community health organizations (Heuer, 2007; Council on School Health, 2012). Underserved and minority families use SBHCs for treatment of chronic conditions including obesity (The Center for Health and Health Care in Schools, 2003; Council on School Health, 2012).

Data were gathered from 109 children seen in two Michigan SBHCs. BMI data were missing for four of the urban children, so they were excluded from analysis, and as a result, data for 105 children were available for analysis. Data were collected over a 6-month period in 2012. Based on chart audit results, the population at the urban site was predominately non-Hispanic Black, and the population at the rural site was predominately non-Hispanic White.

Data Collection Procedure

In the original study, researchers gathered data to assess the impact of participation in a virtual collaborative and decision-support technology to help providers in SBHCs implement obesity guidelines (Gance-Cleveland, Gilbert, Gilbert, Dandreaux, & Russell, 2014). The data used in this secondary analysis were gathered after providers at the SBHCs were trained via a virtual collaborative and decision-support technology that was provided to the SBHCs. HeartSmartKids (HSK) is an English-Spanish bilingual electronic decision-support technology designed to help providers identify, assess, and counsel on weight status of children. The original study involved gathering data about the health habits of the children seen at SBHCs using HSK. Prior to seeing a provider at the SBHC, the child and his or her parent, if present, were given an iPad on which to complete the HSK lifestyle survey. The survey took 5 to 7 minutes, and each question required an answer before the next question could be viewed. All children who were seen in the SBHCs for sports physicals or well-child visits were eligible to participate in the original study. Most of these children did participate, with some exceptions based on clinician workflow and time constraints. When the survey was complete, children's height and weight were measured by the provider or an assistant, and this information was entered into the HSK database by the provider or provider's assistant. No intervention or treatment was provided to the children prior to completing the HSK survey. Responses to the HSK survey questions were used in this secondary data analysis.

Measures

Overweight and obese were defined as previously described per CDC criteria. After measured height and weight were entered, the technology calculated a BMI percentile for the child and plotted it on the gender- and age-specific growth chart. During the visit, the chief clinical complaint, as well as the child's weight status and cardiovascular risk factors, were addressed by the provider in a normal manner. During the visit, each child and family was given a HeartPrint in the language in which they completed the survey, which contained a summary of the child's risk factors and suggestions to reduce risk of obesity or to begin to lose weight (Gance-Cleveland, Gilbert, Kopanos & Gilbert, 2010).

The questions included on the HSK questionnaire were established using the evidence-based guidelines for the prevention and treatment of childhood obesity. The instrument has established test-retest reliability and concurrent validity in a similar population of children ages 9 to 14 years (Gance-Cleveland, Schmiede, Aldrich, Stevens, & Scheller, n.d.). HSK questions used in this study are listed in Table 1 and include the following topics: sleep duration (two questions), physical activity (one question), screen time (one question), and nutritional habits (five questions). The number of hours of nocturnal sleep was determined by calculating the difference between reported normal bedtime and normal wake-up time. Physical activity was measured as hours of active play per day reported on the HSK survey. Screen time was measured as reported hours per day spent “watching TV, using the computer, playing video games, or on the telephone.” Several questions addressed nutritional habits, measuring the number of times per week the participants ate breakfast and ate at restaurants, the number of times per day participants drank sweetened beverages and ate junk snacks, and how many fruits and vegetables the participants ate daily.

Statistical Analysis

All analyses were conducted using SPSS version 22 (IBM Corp., Armonk, NY). Descriptive analyses were performed on all variables. Prior to analysis, a new outcome variable was created; those who were overweight or obese were grouped and given a value of one, and those who were of a healthy weight were given a value of zero. Only youth with a BMI percentile-based category of healthy weight, overweight, or obese were included in the final sample for descriptive analyses and regression models ($n = 102$; three youth were underweight). Differences by over-weight or obese compared with healthy weight status were evaluated with independent samples t -tests (not assuming equal variances) or Pearson's χ^2 tests, depending on the level of the data. To determine variables to include in the final model, univariate logistic regression analyses were conducted. Being overweight or obese was regressed on the following factors: urban/rural grouping; age; gender; nocturnal hours of sleep; daily hours of active play, screen time, junk snacks, sweet beverages, and fruits and vegetables; and weekly breakfast consumed and meals eaten out. Factors in univariate analyses significant at $p < .10$ in addition to precision variables (i.e., age and gender) were included in the multiple logistic regression model. A multiple logistic regression model was used to examine the research questions of interest, and results were evaluated using a significance level of .05. The final multiple logistic regression model included variables significantly related to being overweight or obese in the univariate models. Model diagnostics were examined to ensure that none of the assumptions of multiple logistic regression were violated.

RESULTS

Demographics

Sample demographic and outcome variables are shown in Table 2. Slightly more than half the participants were female (51.4%), and the children had an average age of 10.8 years (range, 3.0–16.7 years). Weight categorization via BMI percentile indicated that 41.9% of youth were obese, 16.2% were overweight, 39.0% were a healthy weight, and 2.9% were

considered to be under-weight. Children averaged 9.3 nocturnal hours of sleep, and the majority of youth (55.2%) were from the urban location.

BMI Differences

As shown in Table 3, youth differed significantly in overweight or obese status compared with healthy weight status by location ($p = .05$), whereby more over-weight or obese youth were from the urban location and more healthy weight youth were from the rural location. Healthy weight youth had higher average nocturnal hours of sleep ($p < .01$), consumed breakfast more frequently each week ($p < .01$), and had more daily hours of average play ($p = .05$) than did over-weight or obese youth. No significant differences were found in gender, age, average daily hours of screen time, meals eaten out weekly, junk snacks consumed or sweet beverages consumed daily, or fruits and vegetables consumed daily by overweight or obese status compared with healthy weight status.

Predictors of Obesity

On univariate analysis, urban/rural grouping (odds ratio [OR] = 0.44, $p = .05$), nocturnal hours of sleep (OR = 0.63, $p < .01$), and frequency of breakfast consumed weekly (OR = 0.66, $p < .01$) were significant predictors of being overweight or obese. Additionally, daily hours of active play marginally predicted being overweight or obese (OR = 0.67, $p = .06$). The multiple logistic regression model included the following variables: gender, age, urban/rural grouping, nocturnal hours of sleep, daily hours of active play, and frequency of breakfast consumption.

Results from the multiple logistic regression model are shown in Table 4. Multicollinearity diagnostics indicated no issues with collinearity among predictors in the model. Nocturnal hours of sleep significantly predicted being overweight or obese when adjusting for the other covariates in the model, such that on average, for every 1-hour increase in nocturnal sleep, the odds of being overweight or obese decreased by 35.9% ($p = .04$). Frequency of breakfast consumed weekly significantly predicted being overweight or obese when adjusting for the other covariates in the model, such that on average, for every 1 day increase in eating breakfast weekly, the odds of being overweight or obese decreased by 30.1% ($p = .04$). Urban/rural status, gender, age, and daily hours of active play were not significant predictors of being overweight or obese in the multiple logistic regression model.

DISCUSSION

This sample of children seen at SBHCs in urban and rural Michigan has a much higher rate of overweight/obesity than in the state of Michigan or in the United States. In this sample, 41.9% of youth were obese compared with 17.7% in the most recent national sample (Ogden et al., 2014). Overweight and obese children totaled 58.2% of the sample, compared with 33% in Michigan (KIDS COUNT and Annie E. Casey Foundation, 2014) and 34.2% nationally (Ogden et al., 2014).

Socioeconomic disadvantage has been strongly linked to increased rates of childhood obesity (Jo, 2014). The population studied is of low socioeconomic status compared with the United States as a whole. The rural county in this study had an unemployment rate of 12%

and a median household income of \$37,443 in 2012 (KIDS COUNT and Annie E. Casey Foundation, 2014). The urban county in this study had an unemployment rate of 10.5% and a median household income of \$39,461 in 2012 (KIDS COUNT and Annie E. Casey Foundation, 2014). The U.S. overall unemployment rate was 7%, with a median household income of \$60,700 at this time (KIDS COUNT and Annie E. Casey Foundation, 2014). Income and employment data were not collected for the study participants, but SBHCs primarily serve populations of lower socioeconomic status, so the population surveyed likely had lower income and higher unemployment rates than those reported for the counties as a whole.

Children in the healthy weight group have longer nocturnal sleep duration, eat breakfast more days per week, report more physical activity per day, and are more likely to be from the rural location than are children in the overweight/obese weight category. The average number of hours of sleep per night reported by participants was 9.30. Sleeping less than 10 hours per night was significantly associated with obesity. This finding agrees with the current literature in the area of sleep and childhood obesity (Cappuccio et al., 2008; Liu et al., 2012; Tauman, 2013). In this sample, the frequency with which a child eats breakfast was inversely associated with his or her obesity status. Previous studies demonstrated similar results and point to potential physiologic reasons for this negative correlation (Alexander et al., 2009; Freitas Júnior et al., 2012). The rate of physical activity approached significance in its relationship with pediatric obesity. This is in agreement with previous research, which revealed an inverse relationship between the amount of physical activity and the BMI of the child (Ekelund et al., 2012; Janz et al., 2009; Jiménez-Pavón et al., 2010).

It is especially important to understand the factors contributing to childhood obesity in vulnerable populations such as this one so that clinicians can adequately assess, treat, and prevent childhood obesity in such high-risk populations. SBHCs are ideal sites for interventions related to childhood obesity, because clinicians in SBHCs see children and families of lower socioeconomic status in an environment conducive to long-term follow-up.

Current expert guidelines for clinicians (Barlow, 2007; NAPNAP, 2006; NHLBI, 2011) address breakfast consumption but not nocturnal sleep duration, which were the significant factors contributing to overweight/obese status in this population. Based on this study, the clinician guidelines may need to place greater emphasis on the importance of nocturnal sleep duration and daily breakfast consumption.

The energy balance model of obesity states that energy in minus energy out equals change in weight, suggesting that dietary factors and physical activity will be the largest predictors of childhood obesity. As the science of childhood obesity expands, more complex models of childhood obesity will likely evolve to account for the various influences on abnormal growth patterns including metabolic contributions and social determinants of health. These new models should acknowledge that predictors of obesity are complex, with hormonal and metabolic factors, such as sleep duration, playing a role. In addition, the contribution of breakfast needs to be further explored.

Strengths and Limitations

Strengths of the current study included measurement of height and weight rather than reported height and weight, and BMI percentiles were programmed in the HSK technology to eliminate human error. Limitations include the small geographic area, small sample size, nonrandom sample selection, and lack of race/ethnicity data for each HSK respondent. HSK questions are based on self-reported sleep duration, physical activity, screen time, and nutritional habits. Some scales used for the self-reported answer choices were quite broad—for example, whole hour options for sleep times—which could have affected the results. The study design was correlational, and therefore causation cannot be assumed.

Further investigation is warranted to characterize childhood obesity in the United States both nationally and regionally so that targeted interventions can be implemented. This research should be replicated in a larger geographical area to improve generalizability of the findings. Another important avenue of investigation is to elucidate the biological and behavioral mechanisms of various predictors of childhood obesity. It would be ideal to form an overarching theoretical framework that incorporates constructs of pediatric obesity development, because the commonly accepted energy balance model appears to leave out significant factors.

Results suggest that the problem of childhood obesity permeates various populations despite differences in rural/urban status, lifestyle, and age. Although the population studied was small and geographically localized, results regarding the modifiable risk factors of childhood obesity are consistent with previous studies. SBHCs serve disadvantaged youth who are most at risk for obesity. Education to combat obesity in SBHCs should include encouragement to eat breakfast, sleep the recommended number of hours per night, and participate in physical activity each day.

Nurse practitioners can assess and provide guidance on developmentally appropriate sleep requirements, emphasizing that longer sleep duration is recommended for younger children. Families should receive information about sleep hygiene interventions to promote adequate sleep such as bedtime routine and a quiet, electronic-free environment for sleep. Clinicians should be aware of how to assess for sleep apnea and refer patients for treatment when necessary.

Nurses can also assess the frequency of breakfast consumption, encourage regular breakfast consumption, and problem-solve with families on healthy breakfast ideas that fit into their busy routine. Planning ahead to have healthy breakfast foods that are easy to prepare can save money, time, and help children get off to a good start in the morning. For example, a yogurt parfait (made with low-fat granola, fruit, and yogurt) or whole wheat toast with peanut butter and banana slices can be eaten at home or on the go. Helpful resources and ideas can be found at www.choosemyplate.gov. Providers should continue to encourage daily moderate to vigorous physical activity for all children.

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TABLE 1.

HeartSmartKids questions and possible responses

Category	Questions	Possible responses
Sleep ^a	“What is your child’s normal bedtime?”	7 PM, 8 PM, 9 PM, 10 PM, 11 PM
	“When does your child normally wake up?”	5 AM, 6 AM, 7 AM, 8 AM, 9 AM
Physical activity	“How many hours of active play or sports does your child do each day?”	0, 30 min, 1 hr, 2 hr, 3+ hr
Screen time	“How many hours per day does your child spend watching TV, using the computer, playing video games, or on the telephone?”	0, 1 hr, 2 hr, 3 hr, 4+ hr
Nutrition	“Each WEEK, about how many times does your child eat breakfast?”	0, 1, 2, 3, 4, 5, 6, 7
	“Each WEEK, about how many times does your child eat at restaurants?”	0, 1, 2, 3, 4, 5+
	“Each DAY, about how many times does your child eat snacks like French fries, chips, cookies, or candy bars?”	0, 1, 2, 3, 4+
	“Each DAY, about how many times does your child drink soda, juice, or other sweet beverages?” (Do not count “diet” beverages)	0, 1, 2, 3, 4+
	“Each DAY, about how many fruits and vegetables does your child eat?”	0, 1, 2, 3, 4, 5, 6+

^aThe number of hours between these times was calculated to determine hours of sleep per night for each child.

TABLE 2.Participant characteristics and health behaviors ($n = 105$)

Characteristic	No. (%)	Mean (SD)
Sex, female	54 (51.4)	
Age, year		10.79 (2.99)
BMI ^a		
Underweight	3 (2.9)	
Healthy weight	41 (39.0)	
Overweight	17 (16.2)	
Obese	44 (41.9)	
Youth location		
Rural	47 (44.8)	
Urban	58 (55.2)	
Nocturnal hours of sleep		9.30 (1.32)
Daily hours of active play ^b		1.82 (1.04)
Daily hours of screen time ^c		2.23 (1.06)
Breakfast consumed weekly ^d		5.93 (1.61)
Meals eaten out weekly ^e		1.24 (1.17)
Junk snacks daily ^f		1.82 (1.18)
Sweet beverage consumption daily ^f		1.82 (1.25)
Fruits and vegetables consumed daily ^g		2.86 (1.47)

Note. BMI = body mass index; SD = standard deviation.

^aUnderweight (< 5th percentile), healthy weight (5th to < 85th percentile), overweight (85th to < 95th percentile), obese (≥ 95th percentile).^bMeasured from 0 to 3+ hours per day.^cMeasured from 0 to 4+ hours per day.^dMeasured from 0 to 7 days per week.^eMeasured from 0 to 5+ times per week.^fMeasured from 0 to 4+ times per day.^gMeasured from 0 to 6+ times per day.

TABLE 3.

Participant characteristics and health behaviors by healthy weight and overweight/obese ($n = 102$)^a

Characteristic	Healthy weight		Overweight + obese		Test statistic (t value or Pearson χ^2)	p Value
	No. (%)	Mean (SD)	No. (%)	Mean (SD)		
<i>n</i>	41 (40.2)		61 (59.8)			
Sex, female	19 (46.3)		34 (55.7)		$\chi^2(1, N = 102) = 0.87$	.35
Age, year		10.29 (3.36)		11.24 (2.61)	$t(71.34) = -1.51$	.14
Location (% urban)	18 (43.9)		39 (63.9)		$\chi^2(1, N = 102) = 3.99$	.05
Nocturnal hours of sleep		9.76 (1.41)		9.00 (1.20)	$t(76.21) = 2.82$	< .01
Daily hours of active play ^b		2.07 (0.99)		1.67 (1.03)	$t(88.09) = 1.97$	.05
Daily hours of screen time ^c		2.07 (0.91)		2.33 (1.15)	$t(97.44) = -1.25$	.22
Breakfast consumed weekly ^d		6.46 (1.21)		5.56 (1.78)	$t(99.98) = 3.07$	< .01
Meals eaten out weekly ^e		1.24 (1.28)		1.26 (1.21)	$t(78.19) = -0.08$	.94
Junk snacks daily ^f		1.68 (1.25)		1.90 (1.12)	$t(79.28) = -0.90$	.37
Sweet beverage consumption daily ^f		1.83 (1.12)		1.84 (1.37)	$t(96.21) = -0.03$	.98
Fruits and vegetables consumed daily ^g		2.78 (1.57)		2.90 (1.45)	$t(80.91) = -0.39$	.70

Note. SD = standard deviation.

^aExcludes underweight youth ($n = 3$).^bMeasured from 0 to 3+ hours per day.^cMeasured from 0 to 4+ hours per day.^dMeasured from 0 to 7 days per week.^eMeasured from 0 to 5+ times per week.^fMeasured from 0 to 4+ times per day.^gMeasured from 0 to 6+ times per day.

TABLE 4.

Multiple logistic regression model of the factors associated with overweight/obese youth ($n = 102$)^a

Factor	β	Standard error	Odds ratio	95% CI	Wald χ^2	p Value
Urban	0.005	0.520	1.005	0.363, 2.784	0.000	.992
Sex, male	-0.293	0.443	0.746	0.313, 1.776	0.439	.508
Age	-0.049	0.095	0.952	0.791, 1.146	0.268	.605
Nocturnal hours of sleep	-0.445	0.218	0.641	0.418, 0.981	4.188	.041
Daily hours of active play	-0.340	0.224	0.712	0.459, 1.104	2.306	.129
Breakfast consumed weekly	-0.359	0.176	0.699	0.495, 0.986	4.174	.041

Note. *CI = confidence interval.*

^aExcludes underweight youth ($n = 3$).