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Original Research Article

Are Preschoolers Meeting the Mark? Comparing the Dietary, Activity, and Sleep Behaviors of Preschoolers With Obesity to National Recommendations

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Abstract

Objective National health organizations and expert committees have issued recommendations for health behaviors related to obesity risk. Behavioral and family-based weight management interventions for preschoolers often target improving adherence to these recommendations, but it is unknown how the health behaviors of preschoolers with obesity enrolled in weight control treatments (WCTs) compare with these guidelines. In this study, the dietary intake, activity, and sleep behaviors of preschoolers with obesity enrolled in a family-based behavioral WCT are described and compared with national health behavior recommendations. **Methods** Health behaviors of 151 preschoolers with obesity (M age = 4.60, SD = 0.93) enrolled in a clinical trial of a weight management program were measured at baseline through caregiver-report questionnaires, three 24-hr dietary recalls, and accelerometers. **Results** In total, 70% of the sample exceeded daily caloric recommendations, only 10 and 5% met recommendations for fruit and vegetable intake, respectively, and only 30% met the recommendation of consuming no sugar-sweetened beverages. The majority of the sample met the daily recommendations for 60 min of moderate-to-vigorous activity (80%), < 2 hr of screen time (68%), and sleep duration (70%). **Conclusions** Behavioral weight management interventions for preschoolers with obesity should target the health behaviors where children are not meeting recommendations.

Key words: children; health behavior; obesity.

Introduction

Approximately 9% of children 2–5 years meet criteria for obesity with a body mass index (BMI) ≥ 95th percentile for their age and gender (Ogden, Carroll, Kit, & Flegal, 2014; Skinner, Perrin, & Skelton, 2016), and children who are obese in early childhood are at significantly greater risk for obesity in later childhood (Skinner, Bounds, Carruth, Morris, & Ziegler, 2004) and adulthood (Guo, Wu, Chumlea, & Roche, 2002). Diet, activity, and sleep behaviors are related to obesity risk in early childhood (Hawkins & Law, 2006; Kuhl et al., 2014; Kuhl, Clifford, & Stark, 2012; Monasta et al., 2010). National health organizations, such as the American Heart Association [AHA; (Gidding et al., 2005)] and an expert committee regarding prevention and treatment of obesity (Barlow & Expert Committee, 2007), provide recommendations on these health behaviors for children to promote healthy habits early in life and prevent the development of obesity.

Dietary Behaviors

A number of dietary behaviors have been implicated in weight management. Obesity has been conceptualized as an imbalance between energy intake and energy expenditure (Butte, Christiansen, & Sorensen, 2007; Swinburn, Jolley, Kremer, Salbe, & Ravussin, 2006), making excess caloric intake a risk factor for obesity. The AHA recommends between 1,000 and 1,400 calories per day for preschoolers with low levels of activity depending on age and sex (Gidding et al., 2005). In contrast to these recommendations, data from the National Health and Nutrition Examination Survey 2005–2006 found average calorie consumption to be 1,471 kcal for children 2–3 years and 1,802 kcal for children 4–8 years (Reedy & Krebs-Smith, 2010). Increased consumption of sugar-sweetened beverages (SSBs) has also consistently been associated with increased obesity risk in preschoolers (Kuhl et al., 2012). The expert committee guidelines for obesity prevention and treatment [hereafter referred to as Expert Guidelines; (Barlow & Expert Committee, 2007)] recommend eliminating SSB from preschoolers' diets, but the majority (70%) of preschoolers have been found to consume SSB (Wang, Bleich, & Gortmaker, 2008). Although the relationship between consumption of fruits and vegetables and child weight status has been inconsistent (Janssen et al., 2005), it is recommended that preschoolers consume 1–1.5 cups of fruit and 1–1.5 cups of vegetables per day, depending on their age and sex, to achieve quality nutrition (Gidding et al., 2005). Prior research has found that preschoolers at any weight status consume fewer daily servings of fruits and vegetables than recommended, and a large portion of their fruit consumption comes from 100% fruit juice (Dennison, Rockwell, & Baker, 1998; Lorson, Melgar-Quinonez, & Taylor, 2009). Using a nationally representative data set, Lorson et al. (2009) found that only 50% of preschoolers currently meet fruit intake recommendations and even fewer (22%) meet recommendations for vegetable intake.

Activity Behaviors

Physical and sedentary activities are often considered key factors related to weight management (Hill, 2006), despite inconsistent findings regarding the relationship between physical activity and weight status in preschoolers (Collings et al., 2013; Prentice-Dunn & Prentice-Dunn, 2012). The Expert Guidelines (Barlow & Expert Committee, 2007) recommend that children achieve 60 min of moderate-to-vigorous physical activity (MVPA) each day. Vale et al. (2010) found that on average both healthy weight and overweight/obese preschoolers engaged in ∼90 min of MVPA per day. However, preschoolers have been demonstrated to engage in low levels of MVPA and high levels of sedentary behavior while in child care centers (Reilly, 2010), where many preschoolers spend a significant portion of their day. Regarding sedentary behaviors, >2 hr of daily television (TV) viewing has been related to child overweight (Janssen et al., 2005; Lumeng, Rahnama, Appugliese, Kaciroti, & Bradley, 2006), and children with obesity have been found to be more likely to have a TV in their bedroom than their healthy weight peers (Boles, Scharf, Filigno, Saelens, & Stark, 2013). The Expert Guidelines (Barlow & Expert Committee, 2007) recommend no >2 hr of screen time per day for preschoolers and that TVs not be placed in children's bedrooms. Prior research has found that most preschoolers engage in <2 hr of screen time per day, despite the fact that more than one third of preschoolers have a TV in their bedroom (Vandewater et al., 2007).

Sleep

Sleep duration has been associated with increased prevalence of obesity among young children (Jiang et al., 2009; von Kries, Toschke, Wurmser, Sauerwald, & Koletzko, 2002). For example, preschoolers receiving <9 hr of sleep per night were found to have an almost five times greater likelihood of obesity compared with peers receiving ≥11 hr of sleep per night (Jiang et al., 2009). Further, von Kries et al. (2002) found that among 5–6-year-old children duration of sleep was inversely related to prevalence of obesity, including when controlling for other

potentially confounding sociodemographic and lifestyle factors (e.g., early weight gain; parent education; parent weight; child birth weight; sedentary activity). Further, parent-reported bedtime after 9 p.m. at 4.5 years of age has been longitudinally associated with greater risk for obesity in adolescence (Anderson, Andridge, & Whitaker, 2016). However, the relationship between obesity and sleep has not always been supported among young children; Klingenberg et al. (2013) found both parent-reported sleep and accelerometry-measured sleep at age 3 years were not related to adiposity. In fact, research has suggested that sleep duration and obesity may not be related until children reach 6–7 years old (Hiscock, Scalzo, Canterford, & Wake, 2011; Klingenberg et al., 2013). The National Sleep Foundation (NSF) recommends 11–14 and 10–13 hr of sleep per day for 2- and 3–5-year-olds, respectively (Hirshkowitz et al., 2015). Nationally, preschoolers average ~9.5 hr of sleep per night and an additional 1.5 hr of sleep during naps, meeting recommendations for this age group (NSF, 2004).

Health Behaviors of Children With Overweight and Obesity Enrolled in Treatments

Preschoolers in the overall population appear to meet recommendations for activity and sleep while falling short of dietary recommendations. However, less research has examined health behaviors of preschool children with obesity enrolled in a weight control treatment program (WCT), and research to date has yet to compare the behaviors of these children with Expert Committee guidelines and national recommendations. One study did report baseline characteristics of children 2–8 years with overweight or obesity enrolled in a clinical trial of a motivational interviewing intervention at primary care clinics (Resnicow et al., 2012). Although the study did not present the number of children meeting each recommendation, children in this sample on average exceeded recommendations for screen time ($M = 2.5$ hr) and SSB consumption ($M = 1.0$ cans daily) and were below recommendations for fruit ($M = 2.1$ servings) and vegetable ($M = 1.7$ servings) servings per day. Similarly, Hare, Coday, Williams, Richey, Tylavsky, & Bush (2012) reported baseline characteristics of children enrolled in a clinical trial of a family-based behavioral WCT (Hare et al., 2012). Participants were children 4–7 years old with overweight or obesity, primarily African-American, and primarily living in an urban environment. At baseline, children, on average, were not meeting fruit and vegetable or physical activity recommendations, consuming an average of 1.7 servings of fruit and 1.1 servings of vegetables per day and engaging in only an average of 18 min of MVPA per day. However, as in the Resnicow et al. study (Resnicow et al., 2012), only the overall sample descriptive statistics were presented, and no information about the number of individual children meeting recommendations was provided. Further, while all participants in both studies were young children (2–8 years of age), they were not limited to the preschool years (2–5 years of age).

Current Study

In summary, research exploring rates of adherence to the health behavior recommendations among preschoolers with obesity before treatment are lacking. However, behavioral WCTs, a common and effective treatment for pediatric obesity (Whitlock, O'Connor, Williams, Beil, & Lutz, 2010), frequently focus on these recommendations. Knowledge of preschoolers' health behaviors at their time of enrollment in treatment would allow tailoring of treatments to target the health behaviors, where these preschoolers are currently not meeting recommendations. While supporting children and their families to maintain satisfactory adherence to health recommendations that they have already been achieving is important, it is likely WCTs could have a larger impact on reducing BMI percentile if new health behaviors that have not been adopted are promoted. The current study is a secondary analysis describing the baseline diet, activity, and sleep behaviors of a sample of preschoolers with obesity enrolled in a randomized clinical trial (RCT) comparing a behavioral, family-based weight management program (LAUNCH) to a motivational interviewing intervention and standard care (Stark et al., 2017). Results are interpreted within the context of national recommendations for health behaviors related to weight [i.e., Expert Guidelines (Barlow & Expert Committee, 2007), AHA (Gidding et al., 2005), NSF (Hirshkowitz et al., 2015)], and rates of adherence to recommendations in the sample are calculated.

Methods

Participants

Participants were 151 preschoolers with obesity enrolled in an RCT of a family-based behavioral WCT tailored specifically for this age group (Stark et al., 2017). Children were identified through medical chart reviews from 27 independent pediatric practices ($n = 149$) and referrals from 7 practices in one unified health system ($n = 2$). Inclusion criteria were: (1) ages 2 years through 5 years; (2) BMI percentile for age and sex $\geq$ 95th but no >100% above the median BMI for age and sex; (3) medical clearance from their pediatrician; (4) active patient with anthropometric measurements within the previous year present in the medical chart (These inclusion criteria were confirmed again during the baseline assessment visit with study

obtained anthropometric data.); and (5) living within 50 miles of the medical center. Exclusion criteria included (1) medical conditions known to promote obesity or preclude full participation in the program; (2) concurrent enrollment in another WCT; (3) taking weight-affecting medications; and (4) either parent or child were not fluent English speakers. Once qualifying children were given medical clearance by their pediatrician, families were mailed a letter with a brief overview of the study and a self-addressed and stamped postcard to return if they did not want to be contacted with additional information about the study. Families not returning postcards within 10 days of mailing were contacted by research staff via phone to provide additional information about the study, answer questions, and schedule baseline study assessments, where inclusion and exclusion criteria were verified, for families interested in participation. After completion of baseline study visits, participants were randomized to participate in either standard of care, an 18-session (4 in person visits, 14 phone sessions) motivational interviewing intervention (targeting caregiver-driven behavioral changes to child and family health habits and including education material from the Let's Go 5-2-1-0 program), or the LAUNCH family-based clinic and home behavioral weight management program. LAUNCH consisted of 10 group clinic-based visits and 8 home visits focused on dietary information, physical activity education, behavioral parenting strategies, and behavioral strategies for weight management (e.g., goal setting; self-monitoring). Additional details regarding study recruitment (McCullough et al., 2017; Robson, Bolling, McCullough, Stough, & Stark, 2016) and procedures of the larger RCT from which this secondary analysis was completed have been provided elsewhere (Stark et al., 2017).

Measures

Demographics

Caregivers completed a self-report questionnaire regarding family, caregiver, and child demographics.

Anthropometrics

Child weight and height were measured using a standardized procedure described previously. BMI was standardized for age and sex using the Centers for Disease Control and Prevention (CDC) growth charts (Kuczmarski et al., 2000) and the SAS program made available by the CDC (available at: https://www.cdc.gov/nccdphp/dnpao/growthcharts/resources/sas.htm).

Child Diet

Three 24-hr recalls (2 weekdays and 1 weekend day) using the multiple-pass method were completed (Guenther, DeMaio, Ingwersen, & Berline, 1995). Recalls were analyzed using Nutrition Data Systems for Research (NDS-R) software (versions 2012–2016, Nutrition Coordinating Center, University of Minnesota) to obtain average daily consumption of calories, SSB, servings of fruits (excluding fruit juices, fried fruits, and fruit-based savory snacks), and servings of vegetables (excluding fried vegetables and French fries). Fruit and vegetable consumption is reported in cup equivalents.

Child Physical and Sedentary Activity

ActiGraph accelerometers (Model GT3X+) were worn by children on their right hip for 7 days with a minimum of 3 valid days [defined as a minimum of 5 hr of wear time (Cliff, Reilly, & Okely, 2009)] required for analysis. Children were asked to wear the accelerometer for 7 consecutive days (5 weekdays, 2 weekend days). Participants wore the accelerometer for an average of 4.66 weekdays (range 2–5) and 1.80 weekend days (range 0–2), and 65% of participants ($n = 96$) with accelerometry data wore the accelerometer for the requested 5 weekdays and 2 weekends. Nonwear time was defined at ≥ 60 min of consecutive zero counts with ≤ 2 min of activity. Data were analyzed using Actilife software (Pensacola, Florida) with preschool-aged intensity-based cut points (Pate, Almeida, McIver, Pfeiffer, & Dowda, 2006) used to calculate time spent in sedentary, moderate, and vigorous physical activity. In total, 15-s intervals (epochs) were used for accelerometer collection, and the following cutoff points were used: moderate physical activity—420 counts/15 and vigorous physical activity—842 counts/15 s. Pate et al. (2006) previously cross-validated these cutoff points using 15-s intervals in 3–5-year-old children using oxygen consumption (Vo_2 ml/kg per min), while children completed laboratory-based structured activities with an accelerometer on their hip.

Caregivers also reported the number of hours their child engaged in various sedentary activities on an activity checklist. Caregivers were given a list of sedentary activities (defined as "those they do while seated") and asked to report the number of days their child engaged in each of these activities in the past 7 days and to estimate the number of minutes their child engaged in each activity per day. This was then converted to daily minutes and used to calculate the total weekly minutes of both sedentary activity and screen time. The list of sedentary activities included: (1) computer/Internet; (2) video games; (3) coloring, drawing, and painting pictures; (4) being read to or reading; (5) sitting and playing quiet games; (6) listening to music; (7) making crafts; (8) TV or video watching; and (9) the option for caregivers to specify

"other" sedentary activities in which their child engaged. Screen time was calculated as the sum of average daily minutes of parent-reported time spent on the computer/Internet, video games, and TV/video watching.

Child Sleep Diary Questionnaire

Average daily hours of sleep (nighttime sleep and naps) and average bedtime were calculated using caregiver-reported child sleep times on the *Sleep and Meal Time Diary Questionnaire* created for this study. For 7 days, caregivers recorded daily on the sleep diary questionnaire answers to the following questions: "What time did your child wake up?"; "Did your child take a nap? If yes, please indicate the total number of minutes your child napped."; "What time did your child get into bed?"; "What time was time was lights out/child tried to fall asleep?"; "How many minutes did it take your child to fall asleep after lights out?" Daily sleep was calculated as the total number of minutes between when the child fell asleep at night and awoke in the morning plus the number of minutes spent napping. This calculation was then converted to daily hours of sleep. If caregivers reported >7 days, the first 5 weekdays and 2 weekend days were used. Total average hours of sleep and bedtime were reported across all days, weekdays, and weekend days. During baseline home assessment visits, presence of a TV in the child's bedroom was assessed by direct observation by research staff. Reliability was assessed for 25% of observations and found to be 100%.

Procedures

The study protocol was approved by the institutional review board of the children's hospital where data collection took place. Written informed consent was obtained from caregivers before data collection. All measures were completed at clinic and home baseline assessment visits occurring within a 3-week assessment window and before study condition randomization (Stark et al., 2017). Anthropometrics and the first 24-hr dietary recall were conducted during the clinic assessment, and the last two dietary recalls were conducted by telephone with a dietitian. All self-report questionnaires and the home observation were conducted during the home assessment, while physical activity monitors and sleep logs were provided to caregivers at their first visit either in the home or in clinic. Families received $50 for completing the baseline assessment with families living >20 miles from the hospital also receiving travel reimbursement (Stark et al., 2017). Descriptive statistics and frequency counts were computed for all study variables using SAS Version 9.3 (Cary, NC).

Results

Participant Description

Participants (M age = 4.60, SD = 0.93; M BMI percentile = 98.57, SD = 1.28) were predominantly non-Hispanic (94%) and White (76%). Children participated with one designated caregiver, predominately mothers (90%) married (72%), obese (BMI $\geq$ 30 kg/m^2; 67%), and had some college (35%) or an undergraduate college degree (36%). See Table I for complete participant demographics.

Health Behaviors

Complete health behavior data and the number of children meeting recommended values can be found in Tables II and III. Results are separated by age and sex when indicated by recommendations.

Dietary Intake

Caloric Intake. The average daily caloric intake for all age and sex groups was greater than recommended with 70% (n = 105) of the sample exceeding recommendations. Average daily caloric intake for each group ranged from 1,264 to 1,423 calories, and children on average were ~185 calories over the recommended daily value for their age and sex.

Fruit and Vegetable Intake. The majority of children (90%) did not meet the recommended daily value for fruit consumption with average consumption for each age and sex group ranging from 0.54 to 0.77 cup-equivalents per day. The percentage of children meeting recommendations was highest for 2–3-year-old girls (40%). Most children also did not meet recommended values for vegetable consumption (95%) with average daily values ranging from 0.33 to 0.48 cup-equivalents per day for each age and sex group. Adherence to vegetable intake recommendations was low across all age and sex groups (ranging from 0 to 11%).

SSB Consumption. Approximately 70% of the sample (n = 105) exceeded the recommendation of no consumption of SSB. Average daily SSB consumption was 4.62 fl oz (SD = 5.23). The most commonly consumed SSB was sweetened fruit drinks (M = 3.30, SD = 4.63).

Physical and Sedentary Activity

Average valid accelerometer wear time was 12.84 hr (SD = 2.21) per day. In total, 80% of preschoolers met the recommended 60 min of daily MVPA (M = 92.63 min; SD = 31.73) with most of this time spent engaged in moderate activity (M = 67.37 min; SD = 21.33). Preschoolers engaged in ~10 hr of sedentary activity per day while awake (M = 9 hr, 48 min; SD = 1 hr, 57 min). The average amount of screen time per day, as reported by caregivers, did not exceed the 2-hr maximum recommendation (M = 1.68 hr; SD = 1.18), and 72 children (47.68%) had a TV in

Table I. *Baseline Child, Family, and Parent Demographics*

	Mean (*SD*)	Frequency (%)
Child demographics		
Age (years)	4.60 (0.93)	
BMI	20.85 (2.47)	
BMI *Z*-score	2.44 (0.60)	
BMI percentile	98.57 (1.28)	
Average percent children were over 50th percentile BMI[a]	35.36 (16.66)	
Sex		
Male		65 (43.05)
Female		86 (56.95)
Ethnicity		
Hispanic or Latino		9 (5.96)
Non-Hispanic		142 (94.04)
Race		
Black or African-American		14 (9.27)
White		115 (76.16)
More than one race/other		22 (14.57)
Day care or school attendance		
Attends		109 (72.19)
Does not attend		42 (27.81)
Family demographics		
Children living in the household[b]	2.31 (0.99)	
Hollingshead	43.03 (11.68)	
Family income		
<$30k		16 (10.60)
$30k–49.9k		23 (15.23)
$50k–99.9k		77 (50.99)
$≤100k		34 (22.52)
Not reported		1 (0.66)
Parent demographics		
Age	35.42 (6.55)	
Relationship to child		
Mother		136 (90.07)
Father		11 (7.28)
Grandparent		3 (1.99)
Other		1 (0.66)
Gender		
Male		11 (7.28)
Female		140 (92.72)
Ethnicity		
Hispanic or Latino		4 (2.65)
Non-Hispanic		147 (97.35)
Race		
Black or African-American		15 (9.93)
White		130 (86.09)
More than one race/other		6 (3.98)
Marital status		
Single		31 (20.53)
Married		108 (71.52)
Divorced		6 (3.97)
Separated		3 (1.99)
Widowed		1 (0.66)
Cohabit, not married		2 (1.32)
Education level		
Less than high school degree		2 (1.32)
High school degree/GED		16 (10.60)
Some college/specialized training		53 (35.10)
College degree		55 (36.42)
Graduate degree		25 (16.56)
Weight status		
Healthy weight (BMI < 25)		19 (12.58)
Overweight (BMI 25 to < 30)		25 (16.56)
Obese (BMI > 30)		101 (66.89)[c]
Pregnant (excluded)		6 (3.97)

[a]Calculated as (actual BMI—BMI at the 50th percentile for age and gender)/(BMI at the 50th percentile for age and gender * 100).

[b]Defined as all household members ≤ 18 years of age, including the target child enrolled in the current study.

[c]Including $n = 4$ who received bariatric surgery during the treatment or assessment period and therefore were excluded as part of the larger RCT.

BMI = body mass index; RCT = randomized clinical trial; GED = General Education Development.

their bedroom, while 78 children (51.66%) did not (data missing for one child).

Sleep

On average, caregivers reported children slept 10 hr and 27 min ($SD = 46$ min) per day. The majority of children (70%) met the minimum recommendation for sleep duration for their age group. Children went to bed at an average caregiver-reported bedtime of 9:31 p.m. ($SD = 44$ min). Children with a TV in their bedroom averaged 10 hr and 20 min ($SD = 46$ min) per day based on caregiver-report, and children without a TV in their bedroom averaged 10 hr and 35 min ($SD = 45$ min).

Discussion

This article describes dietary, activity, and sleep behaviors commonly identified as key risk factors for obesity in a sample of preschoolers with obesity enrolled in a family-based behavioral WCT and builds on past research by examining rates of adherence to health behavior recommendations in this population. A description of weight-related health behaviors in preschoolers with obesity is necessary for identifying the most salient risk factors in this population and could be used to identify key components to target in behavioral WCTs. Adherence to specific health behavior recommendations ranged from 0 to 80%, suggesting significant individual variability across preschoolers and the potential importance of tailoring treatment targets for each family.

The majority of children in the current sample exceeded dietary recommendations for caloric intake and SSBs and fell short of specific food group recommendations. Children in the current sample exceeded the recommendation for daily caloric intake by an average of 185 calories per day. As parents often underestimate actual calorie consumption, the caregiver-reported dietary intake may underestimate

Table II. *Description of Average Daily Dietary Values for Calories, Fruits, Vegetables, and SSBs at Baseline Compared With Daily Recommended Intake*

Behavior	Recommendation	% (*n*) meeting recommendation	*M* (*SD*)
Calories (kcals)			
Total sample (n = 151)		30 (*n* = 46)	1,398.05 (314.56)
2–3-year-old girls (n = 15)	1,000	27 (*n* = 4)	1,264.32 (315.16)
2–3-year-old boys (n = 20)	1,000	15 (*n* = 3)	1,302.92 (278.88)
4–5-year-old girls (n = 71)	1,200	18 (*n* = 13)	1,437.14 (323.28)
4–5-year-old boys (n = 45)	1,400	58 (*n* = 26)	1,423.22 (304.22)
Fruit (cups)			
Total sample (n = 151)		10 (*n* = 15)	0.59 (0.48)
2–3-year-old girls (n = 15)	1	40 (*n* = 6)	0.77 (0.64)
2–3-year-old boys (n = 20)	1	20 (*n* = 4)	0.65 (0.52)
4–5-year-old girls (n = 71)	1.5	3 (*n* = 2)	0.58 (0.38)
4–5-year-old boys (n = 45)	1.5	7 (*n* = 3)	0.54 (0.55)
Vegetables (cups)			
Total sample (n = 151)		5 (*n* = 8)	0.43 (0.32)
2–3-year-old girls (n = 15)	1	0 (*n* = 0)	0.37 (0.19)
2–3-year-old boys (n = 20)	1	0 (*n* = 0)	0.33 (0.27)
4–5-year-old girls (n = 71)	1	11 (*n* = 8)	0.48 (0.35)
4–5-year-old boys (n = 45)	1.5	0 (*n* = 0)	0.40 (0.31)
Total SSBs (fl oz)			
Total sample (n = 151)	0	30 (*n* = 46)	4.62 (5.23)
Sugar-sweetened fruit drinks (fl oz)			3.30 (4.63)
Sugar-sweetened soft drinks (fl oz)			1.08 (2.30)
Sugar-sweetened tea (fl oz)			0.16 (0.78)
Sugar-sweetened water (fl oz)			0.09 (0.71)

SSB = sugar-sweetened beverage.

actual intake in the current study. Interestingly among 5-year-olds, 58% of boys were meeting recommendations for caloric intake, compared with only 18% of girls. It is possible that the recommended intake value for 5-year-old boys is high enough (≤ 1,400 calories/day) that even children meeting this recommendation may still be consuming excess energy, given that all participants were currently obese. Additionally, most children were not meeting recommendations for daily consumption of fruits and vegetables, consistent with findings of previous studies with preschoolers at any weight status and among preschoolers with overweight and obesity enrolled in clinical trials (Hare et al., 2012; Lorson et al., 2009; Resnicow et al., 2012). The lower rates of fruit and vegetable consumption in the current sample could be because of the fact that only children with obesity were included, and these children may exhibit less healthy eating patterns than the general population of preschool-aged children, and children were younger in age than in previous studies describing clinical samples at treatment baseline (Hare et al., 2012; Resnicow et al., 2012). Additionally, sociodemographic factors have been demonstrated to influence the diet quality of preschoolers (North & Emmett, 2000), and the overrepresentation of higher income, White, two-parent families in the current study may mean that current study results are not generalizable to other sociodemographic populations.

Our finding that most children were consuming SSBs is consistent with other research that has identified consumption of SSBs as a risk factor for obesity in preschoolers (Kuhl et al., 2012). Interestingly, the percentage of preschoolers in the current sample consuming SSB was identical to that in a nationally representative sample of preschoolers including children of any weight status (Wang et al., 2008). In the current sample, fruit-flavored drinks were the primary contributor to exceeding the recommended level of SSBs. Average daily SSB consumption in our sample was ~4.5 ounces, which corresponds to ~50 additional calories per day; hence, SSB consumption may be a contributor to excess caloric consumption. Sugar intake among preschoolers has been related to sociodemographic factors (Kranz & Siega-Riz, 2002), and therefore, it is important to consider the characteristics of our sample. For example, Hispanic children, who were underrepresented in the current study, have been demonstrated to consume less added sugar in comparison with their non-Hispanic peers (Kranz & Siega-Riz, 2002).

These findings confirm that dietary behaviors are an important target for WCTs. Parents can exert significant influence on a preschooler's diet through control over foods available in the home and monitoring of child eating behavior. In fact, change in parent motivation during engagement in a WCT has been related to change in dietary behaviors and BMI outcomes in preschoolers (Van Allen et al., 2014). Therefore, changes to dietary behaviors may be more easily influenced at this family level than other health behaviors,

Table III. *Description of Average Time Spent in Physical Activity, Screen Time, and Sleep at Baseline Compared With Recommendations*

Behavior	Recommendation	% (*n*) meeting recommendation	*M* (*SD*)
Physical activity			
Daily moderate activity (minutes)			
Total sample (n = 148)			67.37 (21.33)
Daily vigorous activity (minutes)			
Total Sample (n = 148)			25.25 (12.37)
Daily MVPA (minutes)			
Total sample (n = 148)	60 min	80 (*n* = 119)	92.63 (31.73)
Minute per hour in MVPA			
Total sample (n = 148)			6.56 (2.07)
Sedentary activity			
Daily sedentary activity			
Total sample (n = 148)			9 hr, 48 min (1 hr, 57 min)
Daily screen time (hours)			
Total sample (n = 148)	< 2 hr	68 (*n* = 103)	1.68 (1.18)
Sleep			
Daily sleep duration			
Total sample (n = 148)		70 (*n* = 104)	10 hr 27 min (46 min)
2-year-olds (n = 11)	11–14 hr	73 (*n* = 8)	11 hr 33 min (49 min)
3–5-year-olds (n = 137)	10–13 hr	70 (*n* = 96)	10 hr 22 min (42 min)
Weekday sleep duration			
Total sample (n = 148)		70% (*n* = 103)	10 hr 26 min (54 min)
2-year-olds (n = 11)		73% (*n* = 8)	11 hr 38 min (53 min)
3–5-year-olds (n = 137)		69 (*n* = 95)	10 hr 21 min (49 min)
Weekend sleep duration			
Total sample (n = 148)		64 (*n* = 94)	10 hr 30 min (62 min)
2-year-olds (n = 11)		55 (*n* = 6)	11 hr 23 min (61 min)
3–5-year-olds (n = 137)		64 (*n* = 88)	10 hr 25 min (61 min)
Bed time			
Average bed time			
Total sample (n = 148)	9:00 p.m.[a]	24 (*n* = 35)	9:1 p.m. (44 min)
Weekday bed time			9:22 p.m. (47 min)
Weekend bed time			9:54 p.m. (53 min)

[a]Child bedtime was compared with the 9:00 p.m. cutoff identified as a risk factor for obesity in previous research (Anderson et al., 2016).
MVPA = moderate-to-vigorous physical activity.

such as physical activity, which may require more systemic changes, such as modification of day care schedules or outdoor available play spaces. Additionally, primarily addressing dietary behaviors may have the biggest influence on the energy intake and expenditure balance necessary for weight management. Indeed, a previous study found reduction in caloric intake to be the greatest predictor of weight change in a sample of preschoolers in a WCT (Kuhl et al., 2014). Preschoolers in the current study exceeded calorie recommendations by an average of ~185 calories per day, which can be altered through changes in dietary intake. However, to expend these 185 extra calories per day, a preschooler would need to engage in MVPA for an extended period of time such as 105 min of dancing, 103 min of walking, or 63 min of running in place (Puyau et al., 2016), which may not be feasible, given the need for adult supervision of preschoolers during outside physical activity.

Preschoolers in our sample were achieving the recommended 60 min of daily MVPA, which is consistent with some prior research that found average preschooler engagement in MVPA to be above recommendations (Vale et al., 2010). In fact, estimates of MVPA in the current sample (~90 min) were similar to those of both healthy weight (96 min) and overweight/obese children (93 min) in a previous sample of children 4–6 years (Vale et al., 2010). MVPA in the current sample was found to be much greater than that of preschoolers enrolled in a prior behavioral WCT (Hare et al., 2012). This prior study enrolled participants from a primarily urban and African-American population, while the current study enrolled a higher percentage of suburban, White, and higher SES families, and these socioeconomic differences are related to variations in physical activity among children (Molnar, Gortmaker, Bull, & Buka, 2004; Sallis, Prochaska, & Taylor, 2000). It may be that 60 min of MVPA is not a sufficient physical activity goal to prevent obesity among preschoolers, given children in the current sample met criteria for obesity while still engaging in this high level of activity, or to offset the excess caloric intake found in our sample.

Despite meeting MVPA recommendations, our sample was spending an average of almost 10 hr per day in sedentary behavior while awake, which is

consistent with past research demonstrating high levels of sedentary activities among preschoolers (Reilly, 2010). The current study defined sedentary activity as time spent in an activity completed while sitting, and this included screen time, reading, coloring, drawing, crafts, playing games (not involving a screen), or listening to music. Decreasing sedentary activity and increasing MVPA may be difficult in preschoolers because of the need for adult supervision when young children are engaged in active play outdoors and because most indoor space for preschoolers may not be set up for safe active play. Further, many developmentally appropriate leisure activities for preschoolers are sedentary in nature (e.g., coloring; reading). It was also noteworthy that caregivers reported <2 hr a day of screen time for their children, even though the objective measurement showed high amounts of sedentary time. This may be a function of bias in self-report (e.g., social acceptability; lack of parent awareness) or it could be that children spend significant time engaged in other developmentally appropriate leisure activities that are also sedentary in nature.

Almost half of the children in the present study had a TV in their bedroom (48%), which is slightly higher than rates found in the general population of preschoolers [43% of 3–4-year-olds and 37% of 5–6-year-olds (Vandewater et al., 2007)] and higher than rates found in a previous study examining baseline behaviors of children with overweight or obesity enrolled in a WCT (Resnicow et al., 2012). However, most of the children (70%) were meeting the minimum recommendation for sleep duration, and the average sleep duration was similar to findings of a national study by the NSF (2004). The average bedtime in the current study (9:32 p.m.) is later than the national average bedtime for preschoolers of 8:55 p.m. (NSF, 2004), and later bedtimes have been associated with obesity (Anderson et al., 2016). Research should determine whether sleep duration or bedtime plays a role in weight management for preschoolers.

Limitations

Results of this study should be interpreted in the context of study limitations. First, the preschoolers in the sample were treatment-seeking for weight management and may not represent other families in terms of their interest in nutrition and weight-related health. Second, the preschoolers in the present sample were in the upper range of obesity with an average BMI-percentile-for-age and -sex ≥ 98th. Therefore, the sample may not be representative of preschoolers who are within the 95th–98th percentile obesity range. Additionally, our sample overrepresented high-income, two-parent, White families, and children at the upper end of the preschool age range. Therefore, our study results may not generalize to younger children or more ethnically or economically diverse samples. In addition, while dietary recalls may represent a valid method for assessing group-level estimates of energy intake in preschoolers, there may be error in dietary report at the individual level. It is also important to note that methodological variations in interpreting physical activity data (e.g., cut points used for analyzing accelerometry data) can significantly impact the number of children considered to be meeting physical activity recommendations (Beets, Bornstein, Dowda, & Pate, 2011). Finally, the measures for TV/screen time and sleep behaviors were caregiver-report, and our sleep diary questionnaire was not previously validated. Parents may have a bias recall of the amount of time their children engage in screen time, may be unaware of the amount of time their child spends in screen time, or may not consider indirect exposure to screen time (e.g., if children are present when adults are engaging in screen time). Additionally, while sleep diaries may represent an accurate way for reporting sleep start and end times, they may misestimate total sleep duration because of an inability to account for nocturnal awakenings (Werner, Molinari, Guyer, & Jenni, 2008). Future research should use objective measures for assessing these constructs.

Conclusions

In the current sample, most of the preschool children enrolled in a weight management study did not meet the dietary recommendations of the Expert Guidelines (Barlow & Expert Committee, 2007) and national health organizations (e.g., AHA) but did meet activity and sleep recommendations. However, for all health behaviors at least 20% of the sample was not achieving recommended values, suggesting significant individual variability in baseline health behaviors. WCTs may increase their potential impact by focusing on the health behaviors, where children are currently furthest from recommended values. For most children in our sample, that would include focusing on reducing caloric intake and increasing fruit and vegetable consumption. Pediatric psychologists' expertise in behavioral strategies (e.g., self-monitoring, rewards, contingency management) can facilitate making these dietary changes (e.g., reducing calories; increasing fruit and vegetable consumption), positioning them to be an integral part of weight management treatment teams. Study findings also have implications for treatment of obesity in preschoolers within primary care settings with integrated behavioral health practitioners. Pediatric psychologists working in primary care settings have a limited amount of time with families, and therefore, guidance around weight management would need to focus on the most salient risk factors to maximize efficiency and impact.

Given the variability in health behaviors among the current sample, it is important that providers in these settings tailor recommendations to focus on those behaviors most salient for each child.

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