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Eating and Activity Habits of Overweight Children on Weekdays and Weekends

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Abstract

Objective—To determine whether eating, sedentary, and physical activity behaviors differ on weekdays and weekends in a sample of children who are overweight and obese.

Methods—Eighty-one children 6–9 years old who were overweight or obese and enrolled in a weight management program completed 3-day food diaries and 3-day Previous Day Physical Activity Recalls (PDPARs) for two weekdays and one weekend day. All data were obtained at baseline prior to intervention delivery.

Results—Children consumed a greater percentage of calories from fat ($t = 2.15$, $p = .04$) and fewer fruits ($t = 6.83$, $p < .001$), vegetables ($t = 2.91$, $p=.002$), non-nutrient dense (NND) snack foods ($t = 5.58$, $p < .001$), and sweetened drinks ($t = 2.91$, $p = .005$) on weekends. Children watched more television ($t= 5.25$, $p < .001$), expended more energy ($t = 4.37$, $p < .001$), and spent a greater percentage of time in moderate-to-vigorous physical activity ($p < .001$) on weekends compared to weekdays.

Conclusions—Findings demonstrate a number of differences in children's eating and activity habits on weekends and weekdays. They also suggest that attending to differences in food intake and activity habits separately on weekdays and weekends may help to identify periods of high risk, which could be modified with effective intervention approaches.

Trial Registration Numbers—NCT00259324, NCT00200265.

Key Words or Phrases

eating habits; physical activity; sedentary activity; weekdays; weekends

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Introduction

Data from the National Health and Nutrition Examination Survey (NHANES) indicate that 32% of U.S. children 2–19 years old are overweight or obese (BMI ≥ 85th percentile for age and gender) (1). Given that this represents almost 1/3 of the pediatric population, it is important to identify factors associated with increased adiposity in an effort to enhance current intervention approaches. A number of investigations have identified unhealthy eating and activity habits that are associated with obesity risk, and hence targeted during standard behavioral treatment for weight control. For example, there is evidence that, as a whole, children do not eat the recommended number of fruits and vegetables (2), while desserts and soda are among the top sources of energy intake for children 2–18 years old (3). Additional evidence suggests that decreased intake of fruits and vegetables as well as increased intake of sugar sweetened beverages, in particular, are associated with an increased likelihood of being overweight or obese during childhood (4). In addition to energy intake, data from NHANES also suggests that children are not engaging in enough active play and engage in too many sedentary activities such as television viewing, computer time, video and computer games, with obese children being at particular risk for these behaviors (5). For all of these reasons, standard behavioral treatment for pediatric obesity has focused on increasing nutrient-dense foods such as fruits and vegetables and promoting increases in physical activity while decreasing energy-dense foods and beverages as well as sedentary activities (4). Although much attention has been paid to identification of the above-noted unhealthy eating and activity behaviors associated with obesity, less research has focused on *when* children are more likely to engage in unhealthy eating and activity behaviors. Identification of specific situations or periods of time of increased risk could help to enhance current treatment approaches.

Research with both children and adults document that periods of time marked by less structure and/or increased access to food and sedentary activities such as summer vacation or holiday periods are associated with increases in weight status (6–10). For example, the Early Childhood Longitudinal Study, a large prospective study, found that the summer months rather than the months when children are in school (between kindergarten and first grade) were marked by faster and more variable BMI growth (9). Two additional studies found that children who are overweight and obese may be at particular risk for increased summer weight gain (7–8). In the first study, which was conducted with school age children (in grades 1–6) in Japan, 68% of obese children evidenced summer weight gain compared to only 9% of non-obese children (7). Similarly, in a sample of Native American school-aged children (in grades 3–8), increases in BMI were evidenced over the summer months for overweight and obese children, but not their normal weight peers (8). However, in this study, no changes were observed in BMI z-scores over this time period. Paralleling these findings regarding changes in children's BMI are two additional studies documenting negative effects of the summer months on physical fitness (11–12). In one study, gains in physical fitness evidenced during the school year for overweight middle school children (mean age = 12.0 ± 0.5 years) were essentially reversed over the summer months (11) while in the second study of school-age children (mean age = 8.0 + 1.4 years at baseline) in Greece (12), changes in fitness plateaued during this time period.

Similar to summer vacation from school, weekends are also marked by less structure and increased access to food and sedentary activities in the home environment, which may result in the adoption of less healthy eating and activity behaviors. Research largely supports this in terms of sedentary and physical activity (13–14). Using accelerometry, Rowlands at al. (13) found that both the frequency and duration of physical activity was greater during the weekdays than on weekends in a sample of children 9–11 years old. Similarly, the Trial of Activity in Adolescent Girls found that girls (mean age = 11.9 ± 0.5 years) were more likely to engage in moderate-to-vigorous physical activities during weekdays (14). However, they also spent a greater percentage of time in sedentary activites during weekdays, which may be due at least in part to time in school. Additional studies with adolescents have shown that weekends are marked by greater time spent in sedentary activities, including television viewing (15–16).

There is also some evidence that eating habits on weekends are less healthy than on weekdays. Results from the Continuing Survey of Food Intake by Individuals suggest that children and adults consume more energy and fat on weekends compared to weekdays (17). However, these differences in intake were more pronounced in adults, particularly 19–50 years old. A second investigation of children in 4^{th} through 6^{th} grade found that children consumed a higher percent of energy from fat and used more high fat food preparation methods on weekends than on weekdays (18). However, children reported less energy intake on weekends as well. In contrast to these two studies, a study of children 5–17 years old found no differences in total energy or in the percentage of energy from fat, saturated fatty acids, or non-milk extrinsic sugar on weekdays versus the weekend (19). They did find differences in the number of eating events, largely due to greater variation in eating events during weekdays.

To our knowledge, none of the previous studies have focused solely on the eating and activity habits of overweight and obese children (BMI ≥ 85^{th} percentile for their age and gender) on weekends and weekdays. Yet, given evidence that overweight and obese children are at increased risk for unhealthy eating and activity habits (4) as well as weight gain during times marked by less structure (i.e., summer vacation) (7–8), they may also be at greater risk for engaging in these behaviors during these times. Furthermore, the identification of time periods of increased risk for less healthy eating and activity behaviors could help to enhance current intervention approaches. Thus, it may be particularly important to assess these behaviors in children presenting for weight control treatment. The purpose of the present study was to determine whether, in a sample of overweight children presenting for behavioral weight control treatment, eating and activity habits are less healthy on weekends compared to weekdays. The present paper focuses on younger school-age children, 6–9 years old, given the importance of reducing obesity rates in this population to prevent future obesity risk and associated comorbidities. It also focused on foods and activities commonly targeted in weight control treatment given the focus on a treatment seeking sample. It was hypothesized that children would consume more calories, percent calories from fat, sweetened drinks, and non-nutrient dense (NND) snack foods; and fewer fruits and vegetables on weekends than during weekdays. It was also hypothesized that children would spend more time watching television, expend less energy, and spend a decreased percentage of time in moderate to vigorous physical activities on weekends compared to weekdays.

Methods

Participants

Participants included in the present analyses were studied prior to commencing one of two weight loss trials: Child HELP (N = 39) or Kids CAN (N = 42) (NCT00259324, NCT00200265) (20). Children from Southeastern New England were enrolled year round into the two studies from November 2005 to September 2007. Both studies delivered a family-based intervention for weight control to participating parents of children 4–9 years old who were overweight or obese (i.e., ≥ 85th percentile BMI for their given age and gender). Parents attended eight, one-hour sessions over six months. To be eligible, children needed to be 4–9 years old with a BMI ≥ 85th percentile for their age and gender. They could not have any dietary or physical activity restrictions, and could not have a major psychiatric diagnosis. Children also had to fail to meet at least one dietary or activity recommendation targeted in the trials (i.e., amount of physical activity; number of servings of fruits, vegetables, or dairy; amount of television viewing; number of sweetened drinks consumed; or number of sweet and salty NND snack foods consumed). Of note, although criteria were set for eligibility based on these above-noted eating and activity behaviors, no participant was excluded from either trial based on these criteria. Parents needed to be willing to attend the eight treatment sessions delivered over the 6 month intervention. Families also needed to be English speaking, and not participating in another pediatric weight control program. Child participants across the two studies did not differ on age (t = 0.15, NS), sex (χ^2 = 0.90, NS), or zBMI (t = 1.73, NS). Thus samples from both studies were combined for the present paper.

Across both studies, a total of 549 children were screened for eligibility. Of these children, 367 (67%) were excluded because they did not meet inclusion criteria (N=195), declined to participate (N=107), did not show at their assessment appointment (N=61), or for other reasons (N=4). This left N=182 children who completed baseline assessments. In order to assess differences in weekdays and weekends, the present sample was limited to children 6–9 years old (i.e., who would be enrolled in school) who completed 3-day food diaries during the school year (and not including school holidays) rather than during the summer months (i.e., when weekday and weekend habits may not differ). This resulted in N = 81 children for the present sample. Of these 81 children, 62% were female. Eighty-eight percent were identified as White, 11% as African American/Black, and 1% as mixed race. Fifteen percent were identified as Hispanic/Latino. Mean age was 7.84 (SD =1.00) years, and mean BMI percentile was 96.40 (1.70); mean z-BMI was 2.25 (0.42); 90% were obese. Parents of children were primarily female (93.8%), and overweight/obese (85%); mean age of parents was 38.41 (5.29) years.

Procedures

The present study was approved by the Institutional Review Board at The Miriam Hospital. Written informed consent was obtained from all participating parents, and assent was obtained from children 8 years and older. Families completed questionnaires as part of the baseline assessment prior to randomization and beginning treatment. Food diaries and Previous Day Physical Activity Recalls were completed on the same weekdays and weekend

days. Trained research staff obtained measures of height and weight for both the child and participating parent.

Measures

Demographics—Basic demographic information were collected from families, including child and parent age, gender, and race/ethnicity.

Anthropometrics—All measurements were taken for parents and children while they were dressed in light clothes and without shoes using standard procedures (21). Weight was measured on a calibrated electronic scale to the nearest 0.1 kg. Height was measured using a wall-mounted stadiometer to the nearest 0.3 cm. For parents, measurements were converted into body mass index (BMI; kg/m^2). For children, BMI percentiles and z-BMI were calculated with reference to CDC norms for a child's age and gender (22).

Child Food Intake—Children (together with their parents) completed 3-day food diaries (2 weekdays and 1 weekend day) to assess children's food intake. Although subject to under-reporting, self report of food intake has demonstrated reliability and validity when compared to the doubly labeled water method, particularly when at least 3 days are collected and parents and children report together (23). Families (i.e., the parent and child together) were instructed to write down all foods consumed on each of the three days, including a brief description of the food, preparation method, and amount consumed. Trained staff reviewed food diaries with families at the baseline assessment to ensure accuracy and completion of reported food intake. Each food diary was entered into the Nutrition Data System for Research (NDS-R) software developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, Minnesota. The following macronutrients were calculated separately for weekdays and the weekend day: total calories, and percent calories from fat. In addition, because we were interested in a treatment-seeking sample of children who are overweight/obese, food commonly targeted in standard behavioral treatment were also assessed (4). Thus servings of fruits, vegetables, and non-nutrient dense (NND) snack foods were computed for each day. Servings of fruits and vegetables were limited to whole fresh, frozen or canned fruits and vegetables (because whole foods are targeted during SBT); juices and fried potatoes were not included. The following food items from the identified food groups were defined as NND snack foods: a) in the bread, cereal, rice, pasta food group (i.e., baked goods such as cakes, cookies, doughnuts, muffins, pastries, pies, scones, and sweet rolls and biscuits; granola/snack bars; high-fat crackers; and flavored popcorn); b) in the milk, yogurt, and cheese food group (i.e., frozen dairy-based desserts, frozen yogurt, ice cream, ice milk, and pudding); and c) in the fats, oils, and sweets (i.e., candy, chips and salty snacks, chocolate, frozen desserts, gelatin desserts, and sherbet). Sweetened drinks included all sugar-sweetened beverages other than 100% fruit juice. For analyses, the two weekdays were averaged and compared to the weekend day.

Physical and Sedentary Activities—Three-day (2 weekdays and 1 weekend day) Previous Day Physical Activity Recall (PDPAR) were used to assess children's activities on weekdays and weekends (24). Families documented children's activities (both sedentary and physical activities) in 30-minute increments, and categorized activities into different

intensities (i.e., very light, light, medium, and hard). For the present study, families reported on activities from 6:00am–11:30pm. Because this study was conducted within the context of a weight loss trial, we focused analyses on engagement in voluntary activities. As such, engagement in mandatory physical activity such as participation in gym class was excluded from analysis. This provided the opportunity to evaluate activity choices made by the child (which could then be targeted and intervened upon in future studies). PDPARs were reviewed with families by trained research staff to ensure that activity codes were compatible with designated intensities. For analysis, MET values were computed for each 30-minute block with reference to a specialized grid based on the activity code and intensity level (24), and the Compendium of Physical Activities (25). The PDPAR has interrater reliability of .98, and correlates significantly with accelerometer and heart rate estimates of physical activity (24). Variables of interest included average MET value, percent time spent in moderate to vigorous physical activity (≥ 3 METs), and number of hours watching television. As with the dietary variables, mean weekday values were compared to the weekend value.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences version 18.0 (SPSS 18.0). Basic descriptive statistics were run to describe the study sample. Paired t-tests were run to compare child eating and activity behaviors on weekends and weekdays. For all analyses, statistical significance was defined as $p < 0.05$.

Results

Differences in Dietary Intake for Weekdays and the Weekend Day

Table 1 shows comparisons of children's reported food intake on weekdays and weekends. As can be seen in the table, consistent with study hypotheses, children consumed a greater percentage of calories from fat on weekends compared to weekdays, $t(1,80) = 2.15$, $p < .05$. Also consistent with study hypotheses, children reported consuming significantly fewer servings of fruit on weekends compared to weekdays, $t(1, 80) = 1.47$, $p < .001$. They also consumed significantly fewer vegetables, $t(1, 80) = 2.91$, $p = .005$. Contrary to study hypotheses, servings of NND snack foods, $t(1, 80) = 5.58$, $p < .001$, and sweetened drinks, $t(1, 80) = 2.91$, $p = .005$, also decreased on weekends compared to weekdays.

Differences in Sedentary and Physical Activities for Weekdays and the Weekend Day

Table 2 shows comparisons of children's reported sedentary and physical activities on weekdays and weekends. Consistent with hypotheses, on average, children watched 1.43 (1.11) hrs/day of TV compared to almost twice as much (2.62 ±2.23 hrs/day) on the weekend, $t(1, 80) = 5.25$, $p < .001$. However, contrary to study hypotheses, children reported higher mean MET values during their free time on weekends, $t(1, 80) = 4.37$, $p < .001$, and a greater percentage of time in moderate to vigorous physical activities on weekends compared to weekdays, $t(1, 80) = 3.96$, $p < .001$.

Discussion

Study findings suggest that, in a sample of overweight and obese children 6–9 years of age, weekdays and weekends represent distinct periods of increased risk for different eating and activity behaviors. Consistent with study hypotheses, on weekends, children reported consuming a higher percentage of calories from fat, and fewer fruits and vegetables than on weekdays. They also reported watching more television on weekends. These findings are consistent with previous research, which have generally documented poorer eating habits (17–18), and increased time spent in sedentary activities (15–16) on weekends. For example, in a sample of students in 4^{th} – 6^{th} grade, Cullen and colleagues (18) found that despite a reported decrease in caloric intake, weekends were a time of increased risk for intake of a higher percentage of energy from fat and use of food preparation methods that were higher in fat. The present findings extend previous research by documenting these consistent findings in a younger, overweight/obese sample.

When considered in light of recent policy that has focused on changing children's weekday food environment, particularly in schools, results regarding intake of fat, fruits, and vegetables as well as television viewing are interesting. Many studies that have focused on the weekday school food and activity environment have found minimal changes in children's BMI status over time (26), which have led to recommendations to enhance these programs through increased involvement of parents and modification to the home environment as well (27). Our findings suggest that in addition to weekdays when children are in school, attention should be paid specifically to weekends when children report watching more television, consuming more fat, and eating fewer fruits and vegetables. The decreased structure and increased access to television may place children at particular risk of being more sedentary and consuming a higher fat diet. However, it is important to note that reported percentage of calories from fat across weekdays and weekends fall within recommended guidelines. In contrast, children exceeded current recommendations for television viewing by the American Academy of Pediatrics (i.e., no more than 2 hours/day) on weekends (28). Thus intervention approaches for pediatric obesity may benefit from targeted strategies that help to problem-solve with families regarding modifying the weekend food and activity environment.

Contrary to study hypotheses, weekdays represented a time of increased risk for different obesogenic behaviors, including consuming more NND snack foods and sweetened drinks, and spending less time in moderate to vigorous physical activities. We are unaware of studies that have assessed differences in NND snack food and sweetened drink consumption on weekdays and weekends. It is possible that increased intake during the week could be due to families' busier schedules, decreased time to prepare meals, and ease of consuming readily available NND snack foods during the week. However, this interpretation is speculative. Additional research is needed to replicate the present findings and to determine whether weekdays truly represent a time of increased risk for higher intake of NND snack foods and sweetened drinks.

Findings regarding physical activity diverge from previous research conducted with community based samples of older children and adolescents who were both overweight/

obese and of healthy weight (13–14). The present sample was a younger, treatment-seeking sample of children who were overweight and obese. Thus, differences in study findings may simply reflect differences in physical activity habits among the populations sampled. They may also be due to methodological differences such as the use of self-report of physical activity with the 3-day PDPAR in the present study compared to the use of accelerometers in previous studies (13–14). For example, in previous studies using accelerometers (13–14), bouts of MVPA were captured at 30 second to one minute intervals. Thus, even small bursts of MVPA were captured. In contrast, engagement in MVPA was captured in 30 minute intervals using the PDPAR in the present study. Thus larger bouts of MVPA were measured, which may account for the present study's finding of greater engagement in MVPA on weekends (when more time is available for engagement in larger bouts of MVPA).

Beyond differences observed on weekdays and the weekend day, more general findings in terms of eating and activity behaviors in this overweight sample are also of interest. Most self-reported eating and activity behaviors in the present study were less than ideal. For example, children consumed a significant number of NND snack foods and sweetened beverages on both weekdays (approximately 6 servings/day) and weekends (approximately 3 servings/day), which would likely place children above the discretionary calories recommended for this age group (29). Furthermore, although significantly different on weekdays and weekends, it is important to note that the average MET value on weekends was 1.76 (0.46) compared to 1.52 (0.29) METs on weekdays. MET values within this range are comparable to sedentary play such as playing with dolls/action figures or sitting/standing while doing arts and crafts (30). Thus, regardless of whether it was a weekday or the weekend day, children in the present sample were still spending their time primarily in light activities. Although some of these findings may be due to eligibility criteria for study enrollment (i.e., to enroll children needed to improve their eating and/or activity habits in at least one of these areas), it should be noted that no child was excluded from either trial based on criteria for needing to improve eating and/or activity habits. Thus, findings likely generalize to a treatment seeking sample of overweight and obese children. Furthermore, the scope and clustering of unhealthy eating and activity habits is nonetheless of interest.

Findings from the present study should be considered in light of some limitations. First, the present study was conducted with overweight and obese children who presented for a weight management intervention. Thus findings may not generalize to non-obese, non-treatment-seeking children as well. Second, findings were demonstrated in a relatively small sample. Future studies would benefit from larger, more representative samples of children, which would allow for more detailed analysis of factors associated with differences in energy intake and expenditure on weekdays and weekends. Furthermore, 3-day food diaries and 3-day PDPARs were used to assess food intake and physical activity, respectively. Although trained staff reviewed all measures with families for determination of accuracy in completion, self-reported assessment of food intake and energy expenditure can be subject to reporter bias, and are less accurate than objective measures. Furthermore, there is evidence suggesting that overweight/obese children may be at particular risk for reporter bias in terms of both food intake (23) and physical activity (31). Finally, differences between weekdays and weekends may be affected by the greater presence of parents on weekends (e.g., they

could not observe their child's intake at school) and hence their ability to more accurately observe and recall children's eating and activity behaviors.

In conclusion, findings suggest that weekdays and weekends each represent periods of increased risk for less healthy eating and activity behaviors. Careful examination of eating and activity habits on weekdays and weekends separately may uncover unique challenges to adherence to standard behavioral treatment recommendations for weight control. For example, weekends may represent a time when families consume meals that are higher in fat and deficient in fruits and vegetables. Problem-solving with families regarding these potential challenges that they face on weekends could represent a targeted treatment approach for enhancing adherence. Furthermore, children also have increased free time on weekends for television viewing. Thus, guiding children away from television viewing on weekends towards even light activities can promote benefits in terms of energy balance. Taken together, findings suggest that capitalizing on targeted strategies that focus on time periods of increased risk for less healthy eating, sedentary, and physical activity behaviors may prove useful for enhancing our current behavioral approaches for pediatric obesity.

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Table 1

Weekday versus Weekend Eating Habits in 6–9-year-old Children (N = 81).

	Weekday Mean (SD)	Weekend Mean (SD)
Total Calories	1730.79 (409.71)	1859.44 (722.73)
Percent Calories from Fat	31.37 (5.66)	33.60 (8.62) *
Servings of Fruit	1.75 (1.68)	0.62 (1.17) ***
Servings of Vegetables	2.09 (1.77)	1.45 (1.748) **
Servings of NND snack foods	4.50 (3.58)	2.10 (2.57) ***
Servings of Sugar Sweetened Drinks	1.49 (1.80)	0.98 (1.31) **

* $p < .05$;

** $p < .01$;

*** $p < .001$

Table 2

Weekday versus Weekend Sedentary and Physical Activity Habits in 6–9-year-old Children (N = 81).

	Weekday Mean (SD)	Weekend Mean (SD)
Television Viewing (hours/day)	1.43 (1.11)	2.62 (2.23)***
Average MET value	1.52 (0.29)	1.76 (0.46)***
Percentage of Time in MVPA	8.62 (7.35)	14.12 (11.72)***

* $p < .05$;

** $p < .01$;

*** $p < .001$