

Research Article

Beyond Screen Time: Assessing Recreational Sedentary Behavior among Adolescent Girls

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Most studies of sedentary behavior have focused on television use or screen time. This study aims to examine adolescent girls' participation in a variety of recreational sedentary behaviors (e.g., talking on the phone and hanging around), and their association with physical activity (PA), dietary behaviors, and body mass index. Data were from a sample of 283 adolescent girls. Recreational sedentary behavior, PA, and dietary behaviors were self-reported, and girls' height and weight were measured. Over 95% of girls engaged in at least one recreational sedentary behavior during the recall period. Watching television and hanging around were the most common behaviors. Watching television, using the Internet, and hanging around were associated with less PA; watching television, hanging around, and talking on the phone were associated with less healthful dietary behaviors. No associations were found with body mass index. Interventions may benefit from capitalizing on and intervening upon girls' common recreational sedentary behaviors.

1. Introduction

Physical inactivity among adolescents is believed to play a key role in their risk for obesity. While reducing sedentary behavior is an often-recommended strategy to prevent and treat obesity among adolescents [1, 2], studies aiming to understand associations between sedentary behavior and weight have almost exclusively focused on adolescents' television use [3–7], or the broader concept of screen time, which incorporates other technology-based activities such as computer and video game use [8–10]. This predominant attention to television use and screen time has called into question whether other types of sedentary behavior may displace physical activity (PA) and prompt unhealthful dietary intake, contributing to excess weight gain among adolescents [11].

Adolescent girls are a particularly important population in which to understand the associations between a range of sedentary behaviors and PA and weight as adolescent girls experience a significant decline in PA as they move through the adolescent years [12, 13] and are less likely to participate

in vigorous PA than adolescent boys [14]. While watching television is a common leisure-time activity among adolescents, many adolescent girls report frequently participating in sedentary behaviors that are not screen-based yet still may pose a risk for excess weight gain, such as sitting and hanging around with friends, talking on the phone, and listening to music [11, 15, 16]. Additionally, for a significant proportion of adolescent girls, television, computer, and/or video game use are not their favored sedentary activities, and, therefore, these girls spend little time participating in screen-based activities but a great deal of time engaging in other sedentary behaviors [11, 15].

While there is increasing evidence that adolescent girls engage in a number of different sedentary activities that account for a large proportion of their day, only a small number of studies have utilized a comprehensive view of adolescent girls' sedentary behavior to examine associations between these behaviors and girls' PA, dietary intake, or weight status [17–21], and findings from these studies have been somewhat contradictory. For example, Leatherdale [17] observed that adolescent girls who were physically active

were more likely to engage in “communication time,” including talking on the phone, texting, and instant messaging, as well as frequently watching TV and movies and playing video or computer games. Meanwhile in a study of patterns of sedentary behaviors among adolescents, Gorely et al. [18] observed that girls who spent the majority of their leisure time participating in social activities including talking on the phone, hanging out, and talking with friends tended to watch relatively little television and were unlikely to meet recommendations for daily PA. Additional studies are needed with diverse samples of adolescent girls to better understand girls’ sedentary behavior preferences, as well as whether participation in these behaviors is associated with girls’ risk for obesity.

In light of the need for research examining associations between a wide range of sedentary behaviors and adolescent girls’ weight and weight-related behaviors, the current study aims to describe the frequency and duration of participation in a variety of recreational sedentary behaviors (e.g. watching television, hanging around, talking on the phone, and Internet use) and identify associations between these recreational sedentary behaviors and body mass index (BMI), PA, and dietary behaviors, among a sociodemographically diverse population of overweight, obese, and/or sedentary adolescent girls. Recreational sedentary behaviors were selected as a focus because they characterize girls’ use of their discretionary time as opposed to necessary sedentary pursuits such as doing homework and sleep. Study findings can aid in the identification of behavioral targets for interventions aiming to decrease sedentary time and promote PA and healthful dietary intake among sedentary adolescent girls, who are at risk for obesity and related health outcomes.

2. Methods

2.1. Study Design and Population. Data were drawn from the baseline evaluation of New Moves, a school-based intervention that aimed to prevent obesity and other weight-related problems among adolescent girls [22]. The population included 283 adolescent girls in grades 9 through 12 (mean age = 15.8 years; SD = 1.2). Twelve schools from 1 urban and 6 suburban school districts offered the New Moves program during either the 2007/2008 or 2008/2009 school years. To recruit girls to participate in the study, the New Moves intervention was described in the school course catalogue and on posters located around the school; recruitment materials were designed to appeal to girls who were currently overweight or obese and/or were inactive and not comfortable being physically active, but who had a desire to be healthier. A short screening questionnaire developed for the current study was used to assess girls’ frequency and duration of PA/exercise and their frequency of use of disordered eating behaviors. Four girls were excluded from the intervention because of high levels of PA (≥ 1 hour/day). The study sample was sociodemographically diverse with 28% of girls identifying as African/American black, 28% white, 16% Hispanic, 18% Asian, and 11% of mixed or other race/ethnicity. Approximately, half of the girls were of

normal weight status while 18% were overweight (age- and gender-adjusted BMI percentile between the 85th and 95th percentile), and 28% were obese (BMI percentile ≥ 95 th). Across the 12 schools, between 22 and 92% of students were eligible for free or reduced-price school breakfast and lunch, and in 8 of the 12 schools over 55% of the students were eligible for free or reduced-price school breakfast and lunch. Girls completed baseline data collection during either the end of spring semester or beginning of fall semester preceding their participation in New Moves. Data collection occurred either at the University of Minnesota’s General Clinical Research Center or at the participants’ schools. Trained study staff oversaw all data collection with groups of up to 15 girls at a time. Staff reviewed all survey instruments for clarity and completeness at the time of the data collection. Two staff members edited survey instruments, and the data were entered and double checked for accuracy. The study was approved by the University of Minnesota’s Institutional Review Board and by each participating school district. Participants provided written assent and parent consent.

2.2. Measures

2.2.1. Recreational Sedentary Behavior and Physical Activity. Girls’ recreational sedentary behavior and PA were measured using the 3-Day Physical Activity Recall (3DPAR). The 3DPAR assessed the sedentary behaviors and physical activities that study participants engaged in during each half hour time block between 6 AM and midnight on the three days previous to the day of data collection. Girls completed the 3DPAR on a Monday, Tuesday, or Wednesday in order to capture at least 1 weekday and 1 weekend day. In order to complete the 3DPAR, participants were provided with a list of 65 common sedentary behaviors and physical activities and were asked to select the activity that they participated in for the majority of every 30-minute block. Girls’ participation in recreational sedentary behavior was determined by the average daily number of 30-minute blocks in which girls’ reported participating in the following activities: hanging around; listening to music (sitting); playing video games; surfing the Internet, instant messaging, emailing, shopping online; reading; watching TV or movies; talking on the phone [16, 23, 24].

To assess the frequency of girls’ total PA and moderate-to-vigorous physical activity (MVPA), for each block of PA reported girls noted whether their exertion level while engaging in that activity was light, moderate, hard, or very hard. For every activity at each exertion level, a corresponding metabolic equivalent (MET) value was identified using the Compendium of Physical Activities [25, 26]. Total PA was defined as a per day average number of blocks for which any PA was reported. MVPA was defined as the per day average number of 30-minute blocks for which physical activities with a MET value greater than or equal to 3 were recorded [27, 28]. The 3DPAR has been shown to be a valid measure of MVPA as compared to accelerometry [27] and among adolescent girls had a 2-day test-retest reliability of $r = 0.71$ and $r = 0.77$ for MVPA and vigorous activity, respectively [29].

For recreational sedentary behaviors, total PA, and MVPA, girls' weekend and weekday behavior was weighted to reflect 2 weekend days and 5 weekdays and then divided by 7 to produce a daily average. The Previous-day Physical Activity Recall instrument, which is the same measure as the 3DPAR but collects one day of data regarding both sedentary behaviors and physical activities, has been determined to be a valid measure of screen time when compared to pedometer-measured activity [30].

2.2.2. Body Mass Index (BMI). Trained study staff measured girls' body weight using a Tanita Body Composition Analyzer TBF-300A (Tanita Corporation of America, Arlington Heights, Ill, USA) and height using a portable stadiometer. Girls' weight was measured twice, and both measurements were recorded to the nearest 0.1 kg. If between the two measurements there was a discrepancy of greater than 0.5 kg, the two measurements were repeated. Similarly, girls' height was measured twice, and both measurements were recorded to the nearest 0.1 cm. If there was a discrepancy of greater than 0.5 cm, the two measurements were repeated. The multiple measurements were then averaged to produce a single height and weight for each participant. BMI was calculated using the formula: weight in kilograms divided by height in meters squared, and BMI was transformed to age- and gender-specific z-scores according to the CDC's BMI-for-age and -gender growth charts.

2.2.3. Fruit and Vegetable Intake. Girls' fruit and vegetable intake was assessed using the questions, "Thinking back over the past week, how many servings of fruit did you usually eat on a typical day? A serving would be a medium piece of fruit. Do not include juice." and "Thinking back over the past week, how many servings of vegetables did you usually eat on a typical day? A serving would be 1/2 cup of cooked vegetables or 1 cup of raw vegetables. Do not include potatoes or French fries." Response options for both questions included "None," "Less than 1 serving," "1 serving," "2 servings," "3 servings," "4 servings," and "5 or more servings" [31, 32]. Two-week test-retest correlations for these items were 0.67 for fruit intake and 0.68 for vegetable intake.

2.2.4. Soft Drink Intake. Girls' intake of soft drinks was assessed with the following item: "Over the past month, how often did you drink regular soda pop (not diet)?" Response options included "Never," "Less than once a week," "1-2 times per week," "3-4 times per week," "5-6 times per week," "1 time per day," "2 times per day," "3 times per day," "4 times per day," "5 or more times per day." These response options were adapted from existing beverage intake items in the literature [33]. Two-week test-retest correlation for this item was 0.52.

2.2.5. Fast Food Intake. Girls' weekly intake of fast food was assessed with the question, "In the past week, how often did you eat something from a fast food restaurant (like McDonald's, Burger King, etc.)?" Response options included, "0 times," "1 time," "2 times," "3 times," "4-5 times," "6-7 times,"

"more than 7 times." This survey item was adapted from a previously existing measure [34] and had a 2-week test-retest correlation of $r = 0.81$.

2.3. Data Analysis. Girls who completed a 3DPAR on Monday through Wednesday and, therefore, reported their sedentary behaviors and physical activities for at least one weekday and one weekend day were included in the current study. Girls who completed the 3DPAR on Thursday or Friday were excluded as they did not recall any weekend days. Due to this selection criterion, the analytic sample for the current study represents 79.4% of all girls who participated in the New Moves evaluation trial (283/356). Day of completion of the 3DPAR was determined by the availability of the General Clinical Research Center, not characteristics of the girls, therefore, reducing the potential for selection bias. Descriptive statistics including the percent of girls reporting any participation in each of the recreational sedentary behaviors, and the median blocks of participation in each behavior for both the whole sample and the sample of girls who reported participating in each behavior were calculated for both weekdays and weekend days. To examine cross-sectional associations between girls' participation in each of the recreational sedentary behaviors and BMI z-scores, PA, and dietary habits, three levels of girls' daily participation in each behavior were created: none, low, and high. The low and high categories were created by dichotomizing the sample of girls who participated in each behavior at the median level of participation. To determine the three levels of girls' combined participation in all of the assessed recreational sedentary behaviors (low, moderate, and high), the summary variable was divided into tertiles. ANCOVA was used to calculate the mean level of the outcome variable for each of the three behavior participation levels, adjusted for girls' race/ethnicity and age. School was included as a random effect to account for potential clustering of girls' sedentary behavior by school. The P values presented are based on an F statistic with 2 degrees of freedom and a Tukey-Kramer adjusted P value was used to identify sources of differences between the adjusted means. SAS 9.2 (SAS Institute, Cary, NC, USA) was used for all analyses.

3. Results and Discussion

Watching television, hanging around, talking on the phone, and listening to music were the most common recreational sedentary behaviors reported by study participants (Table 1). Over half of girls reported watching television and/or hanging around on both weekdays and weekend days. Playing video games was the most infrequently reported of the assessed recreational sedentary behaviors with 8% of girls reporting playing video games on weekdays and 10% reporting playing video games on weekend days. Overall, almost all girls reported engaging in at least one of the recreational sedentary behaviors examined in this study on both weekdays and weekend days. Among those who reported participating in any recreational sedentary behavior, the median number of blocks of recreational sedentary behavior was 8.0 blocks on weekdays and 10.8 blocks on weekend days.

TABLE 1: Percentage of girls participating in recreational sedentary behaviors and time spent engaging in behavior on weekdays and weekend days.

| | % (<i>n</i>) reporting behavior | Weekdays | | % (<i>n</i>) reporting behavior | Weekend days | |
|--------------------------------------|-----------------------------------|-------------------------------------|--|-----------------------------------|-------------------------------------|--|
| | | Median (blocks/day) among all girls | Median (blocks/day) among girls reporting behavior | | Median (blocks/day) among all girls | Median (blocks/day) among girls reporting behavior |
| Watching TV | 64.7 (154) | 1.5 | 3.0 | 71.8 (171) | 2.0 | 3.5 |
| Hanging around | 52.5 (125) | 0.5 | 2.0 | 63.9 (152) | 1.5 | 3.8 |
| Talking on phone | 46.6 (111) | 0 | 2.0 | 48.7 (116) | 0 | 2.0 |
| Listening to music | 39.5 (94) | 0 | 1.3 | 47.1 (112) | 0 | 1.5 |
| Internet use | 35.7 (85) | 0 | 2.0 | 40.3 (96) | 0 | 2.0 |
| Reading | 25.6 (61) | 0 | 1.5 | 29.0 (69) | 0 | 1.5 |
| Playing video games | 8.4 (20) | 0 | 1.0 | 9.7 (23) | 0 | 1.5 |
| All recreational sedentary behaviors | 95.0 (226) | 7.0 | 8.0 | 96.6 (230) | 10.3 | 10.8 |

Note: A block represents the majority of a 30-minute period.

Several of the recreational sedentary behaviors were associated with lower PA and MVPA, and less healthful dietary intake, in analyses adjusting for girls' ethnicity/race and age (Table 2). Time spent watching TV was inversely associated with total PA and MVPA ($P = 0.03$ for both). Girls who spent the most time watching TV during the recall period also reported the lowest fruit and vegetable intake (3.8 servings per day) while girls who did not report any TV use reported consuming 5.3 servings of fruits and vegetables per day ($P = 0.02$). High amounts of time spent hanging around, the second most commonly reported activity, were associated with less time spent in total PA ($P = 0.006$), higher soft drink intake ($P = 0.001$), and eating fast food more frequently ($P = 0.006$). For example, girls who reported the greatest amount of time hanging around during the recall period consumed fast food 1 time more per week on average compared to girls who did not report any hanging around. Amount of time spent talking on the phone was positively associated with soft drink intake ($P = 0.03$) but was not inversely associated with PA, whereas Internet use was inversely associated with both total PA and MVPA ($P = 0.03$ and $P = 0.003$, resp.). Reading was the only recreational sedentary behavior associated with healthful dietary behaviors; girls who reported high amounts of reading reported lower soft drink and fast food intake ($P = 0.02$ and 0.04 , resp.). Higher total recreational sedentary behavior time was associated with lower MVPA, PA, and fruit and vegetable intake, as well as higher soft drink intake. Girls' BMI *z*-scores did not significantly differ by their recreational sedentary behavior participation.

Results of this study highlight both the variety of sedentary behaviors in which adolescent girls frequently participate, as well as the potential for many of these behaviors, alone or in combination, to contribute to lower PA levels and less healthful dietary intake. However, no associations were observed between girls' sedentary behavior and BMI. Findings from the current study align with those examining sedentary behavior patterns among adolescent girls [19, 35], especially those of Gorely et al. [15], who found that

watching television and social sedentary activities, such as talking on the phone, were quite common among adolescent girls in the United Kingdom. Meanwhile, video game use and to a lesser extent Internet use was relatively uncommon. These consistent results across two different populations of girls suggest that messages about limiting Internet and video game time may not be highly relevant to the majority of adolescent girls. Interventions may be more successful at reducing sedentary behavior by capitalizing on girls' desire to engage in social activities including talking on the phone and hanging around with friends. Additionally, in the current sample, Internet use may be relatively low due to the lower socioeconomic status of many girls' families. Therefore, if Internet-based activities are an essential component of future interventions with diverse communities, care should be taken to ensure that study participants have consistent access to the Internet.

In the current study, many girls reported spending a large amount of time hanging around, which was associated with low levels of PA and poor dietary intake. A small number of other studies have also observed that many adolescent girls spend a significant amount of their day hanging around [16, 36, 37] although these studies did not examine whether hanging around was associated with other weight-related behaviors. During data collection, girls completing the 3DPAR were encouraged by study staff to not utilize the hanging around code unless they truly were not engaging in any other activity. Therefore, this time likely represents highly unstructured time and provides an opportunity for intervention. Future interventions aiming to increase adolescent girls' PA or improve their dietary intake may benefit from working with girls to substitute unstructured time spent hanging around with other enjoyable social activities that are more physically active or expose girls to healthier food choices. Girls may be especially receptive to this type of intervention activity because it does not emphasize limiting enjoyable sedentary behaviors such as watching television but focuses on finding ways to spend more time during the day with friends participating in enjoyable activities.

TABLE 2: Associations between recreational sedentary behaviors and BMI, physical activity, and dietary behaviors.

| | % | BMI z-score (mean) | MVPA (blocks/day) | Total PA (blocks/day) | Fruit and vegetable intake (servings/day) | Soda intake (times/day) | Fast food intake (times/week) |
|--------------------------------------|------|-----------------------|-------------------------|--------------------------|---|----------------------------|-------------------------------------|
| Watching TV | | | | | | | |
| None | 16.8 | 1.0 | 3.3^{ab} | 5.1^{ab} | 5.3^a | 0.8 | 2.2 |
| Low (0.1–2.7 blocks/day) | 41.2 | 0.8 | 3.5^a | 5.4^a | 4.2^{ab} | 0.9 | 1.9 |
| High (>2.7 blocks/day) | 42.0 | 0.9 | 2.4^b | 4.1^b | 3.8^b | 0.8 | 1.4 |
| $P_{df=2}$ | | 0.46 | 0.03 | 0.03 | 0.02 | 0.70 | 0.10 |
| Hanging around | | | | | | | |
| None | 24.8 | 0.8 | 3.3 | 5.3^a | 4.0 | 0.5^a | 1.4^a |
| Low (0.1–2.0 blocks/day) | 38.7 | 0.9 | 3.4 | 5.4^a | 4.6 | 0.7^a | 1.4^a |
| High (>2.0 blocks/day) | 36.6 | 0.9 | 2.5 | 3.8^b | 3.9 | 1.2^b | 2.3^b |
| $P_{df=2}$ | | 0.78 | 0.09 | 0.006 | 0.25 | 0.001 | 0.006 |
| Talking on the phone | | | | | | | |
| None | 39.9 | 1.1 | 2.9 | 5.0 | 4.1 | 0.5^a | 1.5 |
| Low (0.1–1.6 blocks/day) | 31.1 | 0.7 | 3.5 | 5.3 | 4.2 | 1.0^{ab} | 1.7 |
| High (>1.6 blocks/day) | 29.0 | 0.8 | 2.7 | 3.9 | 4.4 | 1.1^b | 2.0 |
| $P_{df=2}$ | | 0.07 | 0.20 | 0.06 | 0.84 | 0.03 | 0.32 |
| Listening to music | | | | | | | |
| None | 36.6 | 0.9 | 2.8 | 4.3 | 4.3 | 0.9 | 1.9 |
| Low (0.1–0.7 blocks/day) | 33.2 | 0.8 | 3.6 | 5.4 | 4.0 | 0.8 | 1.7 |
| High (>0.7 blocks/day) | 30.3 | 0.8 | 2.6 | 4.6 | 4.2 | 0.8 | 1.5 |
| $P_{df=2}$ | | 0.90 | 0.08 | 0.13 | 0.75 | 0.90 | 0.39 |
| Internet use | | | | | | | |
| None | 46.2 | 0.8 | 3.5^a | 5.5^a | 4.4 | 0.7 | 1.6 |
| Low (0.1–1.2 blocks/day) | 26.9 | 0.9 | 2.9^{ab} | 4.9^{ab} | 3.8 | 0.9 | 1.8 |
| High (>1.2 blocks/day) | 26.9 | 0.9 | 2.3^b | 3.5^b | 4.1 | 1.0 | 1.8 |
| $P_{df=2}$ | | 0.76 | 0.03 | 0.003 | 0.39 | 0.56 | 0.86 |
| Reading | | | | | | | |
| None | 62.6 | 0.9 | 3.2 | 5.0 | 4.1 | 0.9^a | 1.9^a |
| Low (0.1–0.9 blocks/day) | 19.3 | 0.9 | 2.7 | 4.6 | 4.4 | 1.0^a | 1.9^a |
| High (>0.9 blocks/day) | 18.1 | 0.8 | 2.6 | 4.3 | 4.3 | 0.3^b | 1.0^b |
| $P_{df=2}$ | | 0.86 | 0.34 | 0.54 | 0.74 | 0.02 | 0.04 |
| Playing video games | | | | | | | |
| None | 86.1 | 0.8 | 3.0 | 4.8 | 4.1 | 0.8 | 1.7 |
| Low (0.1–0.7 blocks/day) | 8.8 | 0.9 | 3.3 | 5.0 | 4.7 | 1.0 | 2.0 |
| High (>0.7 blocks/day) | 5.0 | 1.4 | 2.6 | 3.9 | 4.9 | 1.0 | 1.4 |
| $P_{df=2}$ | | 0.26 | 0.81 | 0.68 | 0.41 | 0.79 | 0.75 |
| All recreational sedentary behaviors | | | | | | | |
| Low (<6.3 blocks/day) | 32.8 | 0.8 | 4.1^a | 6.4^a | 4.8^a | 0.5^a | 1.4 |
| Moderate (6.3–10.3 blocks/day) | 34.0 | 0.9 | 3.2^a | 5.1^a | 4.1^{ab} | 0.9^{ab} | 1.9 |
| High (>10.3 blocks/day) | 33.2 | 0.8 | 1.7^b | 2.8^b | 3.6^b | 1.1^b | 1.9 |
| $P_{df=2}$ | | 0.64 | <0.0001 | <0.0001 | 0.04 | 0.01 | 0.19 |

Notes: Regression models included girls' race/ethnicity and age.
Significant findings are emboldened.

For associations where the overall F statistic was significant ($P < 0.05$), post hoc comparisons of outcome-specific adjusted means were conducted. Adjusted means with different superscript letters are statistically significantly different using Tukey-Kramer adjusted P value < 0.05 . For example, girls who reported high levels of hanging around reported significantly less total physical activity compared to girls who did not report hanging around or reported low levels of hanging around.

While several of the recreational sedentary behaviors examined in the current study were associated with lower levels of physical activity and less healthful dietary habits, no associations were observed between recreational sedentary behavior and girls' BMI z-score. This finding is consistent with other studies that have observed no association or a small association between participation in sedentary behavior and adolescents' weight status [38, 39]. One potential explanation for the lack of associations observed in the current study and others is that excess weight gain may be due to the accumulation of several less healthful behaviors (e.g., energy-dense diet, inadequate sleep, sedentary lifestyle), and, therefore, only weak associations are observed when examining the role of sedentary behaviors in weight status in isolation of other behaviors. For example, a recent study has observed that obesity risk was higher among adolescents who engaged in both low levels of physical activity and high levels of screen time [8]. Additionally, sedentary behaviors may only be associated with obesity risk among some individuals, such as those with a genetic susceptibility to obesity [40], leading to the observation of null associations between sedentary behavior and weight among the general population. Despite the inconsistency of associations reported in observational studies, sedentary behavior is still an important intervention target, and studies that have aimed to reduce sedentary activity have successfully led to decreases in adolescents' weight status [41–43].

A strength of the current study is its use of a sociodemographically diverse population of adolescent girls who were either currently overweight or obese, or at high risk for overweight due to having a highly sedentary lifestyle. There is a great need to develop relevant and enjoyable programs that encourage greater participation in healthful PA and healthy eating behaviors among this population. However, this focus on a specific, underserved population does limit the generalizability of study findings, and the sedentary behavior patterns of highly physically active adolescent girls may be different than what was observed in this study population. An additional strength of this study is the use of the 3DPAR, which allowed for an understanding of the context of girls' sedentary time. While objective measures of PA and sedentary behavior, such as accelerometry, play an important role in obtaining an unbiased assessment of PA, use of self-report measures that record the specific activities that study participants are engaging in can provide great richness to the understanding of how individuals are spending their time. A limitation of the 3DPAR is that participants are only able to report a single activity that they participate in for the majority of each 30-minute block. Therefore multitasking, which adolescents do frequently when watching television [44], or behaviors that participants engaged in for less than 15 minutes, were not recorded with this instrument. This may result in an underestimation of participation in some behaviors. Additionally, girls completed the 3DPAR using a set list of common activities. Because this list was not comprehensive, activities that may be increasingly common, such as texting, were not captured by the instrument. However, it is important to note that girls rarely asked how to categorize texting during the data collection process, as

they were often texting for short amounts of time throughout the day and not for the majority of a 30-minute time period. Girls who did ask how to code their texting time were told to categorize it with Internet use/instant messaging, which may have inflated the assessment of the amount of time girls spent on the computer. Future studies utilizing the 3DPAR are encouraged to conduct extensive pilot testing of the measure and adapt the activity options provided based on the popular activities among the intended study population.

4. Conclusions

Adolescent girls participate in a number of recreational sedentary behaviors for a significant portion of their free time. Understanding these patterns of behavior, and associations between recreational sedentary behaviors and PA and dietary habits, is informative to the development of interventions aiming to decrease adolescents' risk for overweight and obesity. Findings from the current study suggest that interventions developed to engage adolescent girls may benefit from incorporating messages and behavioral targets that address recreational sedentary behaviors such as hanging around, talking on the phone, and listening to music, in addition to the often-targeted watching television. Future research in this area is also needed to understand whether girls' participation in specific recreational behaviors contributes to decreases in PA and poor dietary intake, or whether the behaviors co-occur and are markers of a less healthful lifestyle in total. Additionally, in light of the lack of associations observed in the current study between recreational sedentary behavior and BMI, and the inconsistent findings between sedentary behavior and weight observed elsewhere in the literature [38, 45], further investigations of the role of television, screen time, and other common recreational sedentary behaviors in adolescents' weight and excess weight gain are a priority.

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