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The Assessment of Physical Activity and Nutrition in Home Schooled Versus Public Schooled Children

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The purpose of this study was to descriptively compare the physical activity and dietary intake of public school (PSC) versus home schooled children (HSC). Potential parental and home influences were also examined. Thirty six matched pairs of public school-home school children aged 7–11 years participated in this study. Each participant wore an activity monitor and recorded their dietary intake concurrently for seven consecutive days. PSC had significantly more total and weekday steps, and spent more time in moderate-to-vigorous physical activity compared with HSC. There were no differences in dietary intake between the two groups. These results suggest differences in physical activity between PSC and HSC and encourage further study of public and home school environments, in relation to the obesity epidemic.

Over the past 25 years, there has been an alarming and exponential increase in childhood obesity (BMI for age and sex > 95th percentile), increasing from 5% to 17% since 1980 (35). This is cause for great concern because an estimated 77% of obese children remain obese throughout their adult life (18). In addition, obesity during childhood can be a significant risk factor for adult morbidity and mortality (13,16,30,44). This is due to the numerous health consequences and medical complications related to obesity including heart disease, hypertension, and many metabolic derangements including type 2 diabetes, hyperlipidemia, and hypercholesterolemia (7,14,20,44).

A variety of factors have been identified as possible contributors to the increasing incidence of obesity. These factors include but are not limited to, behavioral, environmental, socioeconomical, metabolic, and genetic influences (47). Two of the primary factors are poor nutrition and physical inactivity.

It has been well recognized that the school environment may have a significant impact on the physical activity levels and dietary intake of children because they spend more than half of their waking hours in this setting. In the first national

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study conducted to assess dietary intake in students, it was reported that even though school lunches met a variety of nutrition goals, they were comprised of approximately 38% fat and exceeded the recommendations for saturated fat (6,11). Alarmingly, this study also showed that only one percent of schools met national recommendations for fat relative to total energy intake (6). The follow up to this study reported that schools have made substantial improvements in the nutritional value of their lunches, with a trend toward significantly lower levels of total fat and saturated fat, now reaching levels of 33–35% in most elementary and secondary schools (17). This is consistent with a more recent report stating that students consume 36% of total energy from fat with only 13% of students meeting current U.S. dietary guidelines for fat consumption (10).

There is also much concern, because children today lack physical activity in schools. Reasons for this include limited opportunities for recess and less time for physical education classes. A recent national survey reported that children have less than 30 min for recess during lunch and receive physical education an average of 2.4 times per week (33). Thus, the average total physical activity time available to students within most schools is approximately 200 min per week (33). This would drastically impact the chances of children meeting the recommended 300 min of moderate to vigorous physical activity (MVPA) over a five day school week as recommended by the National Association for Sport and Physical Education (32). Recently, it was reported that only 3.8% of elementary schools provide daily physical education and only 68% provide daily recess for students (26). Due to the lack of physical education classes, lunchtime physical activity may now be the largest contributor (16%) to total daily physical activity for children (45). It has further been reported that that the actual time spent engaging in physical activity during physical education class and recess is very minimal. For instance, students in physical education classes may only engage 40% of their time in MVPA, while others have found this to be as low as 9% of the time spent in physical education class (28,43). Furthermore, children may engage in as little as 45% of their time in physical activity during recess (28,29,43). Therefore, while most states have adopted a 150 min per week school based physical activity requirement, children may not be obtaining the intended amount.

Homeschooling has become an increasingly popular alternative for many families. In 2003, it was estimated that 1,096,000 U.S. children were instructed at home, a 29% increase over the previous four years (39). Limited reports on physical activity in home schooled children (HSC) suggest that HSC may be more interested in physical activity as they age and may have greater opportunities to engage in physical activity because of the characteristics, involvement, and support of their parents (40,49). These characteristics include significantly higher formal education, greater socioeconomic status, and positive attitudes about physical fitness (12,40). Unfortunately, objective measures of physical activity levels in HSC have been understudied. Presently, there has only been one published study comparing physical activity and fitness levels between children attending public schools versus those being schooled at home (49). Nutritional practices among HSC and between HSC and public school children (PSC) have not been previously reported.

The home environment may also have an impact on healthy lifestyle behaviors in children. It has been reported that children's dietary intakes, food preferences, and physical activity levels are significantly influenced by their parents (2,25,36,41).

Homeschooled children typically spend fewer hours per day engaged in formal instruction, and therefore they may have a greater opportunity to be physically active. Furthermore, parents providing home school instruction may have greater input and control over the dietary intake (both quantity and quality) of their children.

Thus, the purpose of this study was to compare the physical activity levels and dietary intakes of HSC to children attending public schools and examine potential parental involvement and home influences to explain any differences found. We hypothesized that HSC would have significantly greater physical activity levels and significantly healthier dietary intakes compared with children attending public schools.

Methods

Subject Population

The study sample included a total of 113 children aged 7–11 years and 76 parents. This included 68 HSC and 45 PSC. Using youth BMI for age and sex classifications, 56, 8, and 4 of the HSC, and 30, 9 and 6 of the PSC were, healthy weight, at risk for overweight, and overweight, respectively (24). One parent for each child was designated as the primary caretaker, defined as spending the most time with the child, or HSP. This parent was asked to participate in the study and included 44 parents of the recruited HSC, and 32 parents of the recruited PSC. Using adult BMI classifications; 22, 12, and 10 of the HSP, and 16, 10, and 6 of the PSP were healthy weight, overweight and obese, respectively (34). Subjects were studied between February and May of 2007 and were recruited from local home school association groups and cooperatives, and from local public elementary school physical education teachers using study flyers and presentations. Everyone who was willing to participate was included. No one was denied participation, thus reducing sampling bias. Home school children and PSC were matched after the study had concluded based on age (within one year), sex, reported ethnicity, and BMI relative to age and sex category (healthy, at risk for overweight, and overweight) to minimize bias between the groups. This resulted in 36 matched pairs of children and the designated 29 HSP and 30 PSP. Subjects did not have any physical activity limitations and were not home schooled for any medical reasons. All subjects provided informed consent (parents) and assent (child) in accordance with the Medical Institutional Review Board of the University of Kentucky.

Anthropometry

Standing height and body weight were determined using a wall-fixed stadiometer (Seca Model 216; Seca North American West, Ontario, CA) and a calibrated electronic scale (Tanita Corporation Model BWB-627A; Arlington Heights, IL), respectively. All subjects were measured in light-weight clothing containing no metal and without shoes.

Body Composition

Body composition was assessed for all subjects using total body dual-energy x-ray absorptiometry (DXA) scans. All DXA scans were performed by a single trained investigator using a Lunar DPX-IQ (GE/Lunar Inc., Madison, WI) with the scan mode selection based on sagittal diameter, and analyzed using software version 4.7 for total body fat mass (FM; kg), percent fat, and fat-free mass (FFM; kg).

Physical Activity Assessment

All subjects were asked to wear a New Lifestyles-1000 (NL; LeesTown, MO) medical grade activity monitor for seven consecutive days. This monitor was chosen for its simplicity, durability, low cost, seven day memory capability, accuracy, reliability, and ability to assess time spent in MVPA (42). Subjects were instructed to place the activity monitor on their waistband at the anterior midline of the thigh, on the right side of the body, according to manufacturer's recommendations. Subjects placed the monitor on their waistband when they woke up in the morning and were instructed to take it off when they went to bed at night, unless they were to come into contact with water (e.g., bathing and swimming). To avoid reactivity, all activity monitors were sealed using different colored stickers after stride length, time of day, and intensity threshold were internally programmed. Stride length was determined by instructing each subject to take 20 steps down a corridor at their normal walking speed, described to the subject as "how you normally walk from place to place." The distance traveled over 20 steps was then measured using a calibrated 400 series Rolatape measuring wheel (Rolatape Corporation; Watseka, IL) and divided by the 20 steps taken. Stride length was calculated as the average of two 20-step trials. The researchers set the NL activity monitor MVPA threshold at activity setting #4 for children and #3 for adults, based on recommendations from the manufacturer. Outcome variables of interest were total steps (over all seven days), total MVPA time, average weekday steps and MVPA time, and average weekend steps and MVPA time. Days were excluded for incomplete data resulting from various reasons such as forgetting to wear the activity monitor for more than one hour, the children not wearing the monitor during sporting events, opening or tampering with the activity monitor, and water damage. Therefore, total steps and total MVPA time were analyzed only for those subjects that did not have any missing data for the entire seven day period. For average weekday and weekend steps, and MVPA time, a minimum of three weekdays and both weekend days were required to be included in the analyses.

Nutrition

Subjects were asked to record all dietary intake for seven consecutive days (concurrently while wearing the activity monitor) using a provided food journal. This included all types and amounts of food and drink consumed. Each subject received training using food models, measuring cups, and sports balls to accurately categorize the type and amount of food and drink consumed. All food journals were reviewed for accuracy and completion upon return and subjects were asked to provide further details when necessary. The journals were subsequently analyzed for both macronutrients and micronutrients by a single registered dietitian using the Nutrition Data System for Research (NDSR (2006); Nutrition Coordinating Center; Minneapolis, MN). Nutrient variables of interest included total energy (kcals), total fat, total carbohydrate, total protein, percent of energy from fat, carbohydrate, and protein, saturated fat, cholesterol, sugars, dietary fiber, and sodium. The number of days that the children ate breakfast and lunch, at school and at home, during weekdays were also examined.

Child and Parental Questionnaires

Child Questionnaire. All child subjects were asked to complete the Physical Activity Questionnaire for Older Children (PAQ-C) as previously described (9). The PAQ-C has demonstrated sufficient levels of validity and reliability for boys and girls in grades 4–8 (8,22).

Parent Questionnaire. A questionnaire specifically designed for this study was completed by the parents to provide additional demographic information as well as practices, attitudes, and beliefs about physical activity and nutrition. Although unvalidated, similar questions as those included in other validated PA questionnaires were used. Parental demographics included marital status, highest level of education completed, and socioeconomic status (SES). Physical activity and dietary habits were evaluated by questions about food consumed away from home, child participation in housework and meal preparation, encouragement of the child to engage in physical activity, participation with the child in physical activity and dietary practices, transportation of the child to paid lessons or organized sports, and discussions with the child that physical activity was good for their health. Television viewing by their child and safety of their neighborhood were additional questionnaire items included. Questions relating to attitudes and beliefs included conversations with their child about the importance of physical activity and nutrition, personal opinions on their child obtaining the recommended amount of physical activity and dietary intake, and their personal enjoyment of physical activity. The number of minutes of physical activity the parents felt that a child should get and the number of times their child ate school prepared meals were also quantified.

Statistical Analysis

Subject characteristics were compared between child groups (HSC vs. PSC) and between parent groups (HSP vs. PSP) using paired samples t tests. Within group comparisons for weekday versus weekend physical activity measures (step counts and time in MVPA) were analyzed using paired samples t tests of the matched pairs with significance determined as $p < .05$. Because some of the families in both groups enrolled more than one child in the study, linear mixed models were used to compare physical activity measures and dietary intakes between the children and their parents to account for the correlation of the data of more than one child per parent. This intrafamily correlation was determined from Pearson's correlation coefficient after the clustering effect of the family had been taken into consideration (by applying family id and subject group subheadings to compare main effects with tests for covariance parameters). Questionnaire data were analyzed using the frequency of responses between the child and parent groups with significance ($p < .05$) detected by applying Fisher's exact test. Data were analyzed using SAS version 9.1 for Windows (SAS Institute Inc., Cary, NC).

Results

Subject Characteristics

Demographic and descriptive characteristics for the subjects are presented in Table 1. Although the parents of the HSC and PSC were not matched, they were similar for most of the assessed demographic variables. There were no significant differences observed within any of the child or parent groups for age, height, weight, or body composition measures.

Physical Activity Analyses

For physical activity measures, data were not obtained for one subject within the HSC group and three subjects in the PSC group due to sickness, failure to return the activity monitor, and failure of one of the activity monitors to record data. Therefore, physical activity data were obtained from 67 HSC, 42 PSC, and all participating parents from both groups. Of these subjects, 14, 23, 9, and 11 days were excluded from physical activity data (from reasons described in the methods) in the HSC, PSC, HSP, and PSP groups, respectively. Thus, the activity monitor was worn for the entire day 97% (455 of 469 and 306 of 315 days) of the time in the HSC and HSP groups, 92% of the time (271 of 294 days) within the PSC group, and 95% of the time (213 of 224 days) within the PSP group. As a consequence, total steps and MVPA data could not be analyzed for 13 HSC, 16 PSC, 8 HSP, and 6 PSP, whereas average weekday and weekend steps and MVPA data could not be analyzed for 4 HSC, 7 PSC, 3 HSP, and 1 PSP. Therefore, a lower number of matched pairs were used for data analysis and are shown in Table 2. Table 2 displays the physical activity levels of HSC, PSC, HSP, and PSP.

Child Versus Child. When the child groups were compared, PSC accumulated significantly more total steps and more weekday steps than did the HSC. However, weekend steps were not significantly different between the groups. Similarly, PSC had significantly greater total time spent in MVPA and weekday MVPA time compared with the HSC. Weekend MVPA time was not significantly different between the groups of children.

Activity Patterns. Activity patterns were different between public and home schooled children. Group mean weekday steps were significantly greater than weekend steps for PSC. In contrast, the group of HSC had greater (although not significantly different) mean weekend step counts. The MVPA weekday and weekend patterns were similar within the groups. Thus, the public school children tended to be more active on the weekdays than weekends whereas the home school group appeared to have a more consistent pattern of activity on weekdays and weekends. Child groups appeared to follow parent activity patterns.

Nutritional Analyses

Nutritional analysis was completed for all but 2 HSC, 2 PSC, and 2 PSP for reasons such as sickness and failure to complete or return the food journal.

Table 1 Descriptive Characteristics of Study Participants

	Matched HSC (n = 36)	Matched PSC (n = 36)	Matched HSP (n = 29)	Matched PSP (n = 30)
Age (yr)	9.46 ± 1.40	9.52 ± 1.37	40.43 ± 6.22	40.12 ± 4.25
Height (cm)	137.41 ± 10.55	135.73 ± 10.87	166.81 ± 6.93	167.28 ± 7.85
Weight (kg)	33.17 ± 9.38	33.43 ± 13.05	71.65 ± 15.27	73.60 ± 20.09
BMI (kg/m2)	17.2 ± 2.6	17.6 ± 4.0	25.8 ± 5.9	26.1 ± 5.77
BMI category	28	28	15	15
Normal weight (n)	6	6	9	9
Overweight (n)	2	2	5	6
Obese (n)				
FFM (kg)	26.45 ± 4.62	26.47 ± 6.90	26.99 ± 7.01	27.97 ± 14.48
Total Body FM (kg)	6.72 ± 5.35	6.96 ± 6.70	25.50 ± 10.44	23.29 ± 8.74
% Fat	17.99 ± 9.27	17.69 ± 9.89	34.40 ± 7.57	31.33 ± 7.91
Sex (n)	10 F, 26 M	10 F, 26 M	28 F, 1 M	24 F, 6 M
Ethnicity	35	35	29	30
Caucasian (n)	1	1	0	0
Asian (n)	0	0	0	0
African American (n)				
# yrs home schooled	3.89 ± 1.70	0.0 ± 0.0	N/A	N/A

Note. HSC = Home schooled children; PSC = Public schooled children; HSP = Home school parents; PSP = Public school parents; M = Male; F = Female

Table 2 Physical Activity Levels of Home School and Public School Children and Their Parents

	HSC	PSC
Weekday	*n* = 36	*n* = 36
Steps	10,790 ± 3,572 cp	13,406 ± 3,258 c,cp
MVPA (min)	31.40 ± 14.08	47.29 ± 14.80 c
Weekend	*n* = 35	*n* = 30
Steps	11,397 ± 3,848 cp	11,471 ± 3,838 cp
MVPA (min)	35.57 ± 16.45 cp	37.09 ± 16.34
Total	*n* = 33	*n* = 25
Steps	76,410 ± 24,018 cp	86,789 ± 19,976 c,cp
MVPA (min)	218.67 ± 96.88 cp	308.72 ± 102.26 c
	HSP	**PSP**
Weekday	*n* = 29	*n* = 30
Steps	7,446 ± 2,867	10,766 ± 2,858 p
MVPA (min)	27.89 ± 15.91	45.36 ± 14.54 p
Weekend	*n* = 27	*n* = 29
Steps	7,271 ± 3,341	9,344 ± 3,797
MVPA (min)	27.48 ± 18.19	36.93 ± 18.54
Total	*n* = 25	*n* = 25
Steps	52,143 ± 20,678	73,752 ± 18,364 p
MVPA (min)	196.19 ± 113.52	311.41 ± 101.67 p

Note. Values are means ± SD;
n = number of participants
HSC = Home schooled children; PSC = Public schooled children; HSP = Home school parents; PSP = Public school parents; Weekdays represent at least 3 days of data collection
Weekends represent both Saturday and Sunday
c denotes significant differences between child pairs, p denotes differences between parent groups, and cp denotes differences between child/parent ($P < .05$)

Nutritional intake measures for the children and parent groups are presented in Table 3.

There were no significant differences in total energy intake between any of the child, child/parent, or parent group comparisons. The mean caloric intakes were 1712 kcal, 1612 kcal, 1731 kcal, and 1668 kcal with 33%, 32%, 37%, and 34% of total intake coming from fat in the HSC, PSC, HSP, and PSP, respectively.

Child Versus Child. There were no significant group mean differences for any nutrient variables between HSC and PSC. Home school children did, however, show a trend toward greater cholesterol intake compared with PSC.

Nutritional Patterns. The HSC ate breakfast on a regular basis with 34 out of the 36 children eating at least something for breakfast on all five weekdays. The other two HSC missed breakfast only one weekday which resulted in HSC eating break-

Table 3 Dietary Intake of Home Schooled Versus Public School Children and Their Parents

NDSR	HSC (*n* = 36)	PSC (*n* = 35)	HSP (*n* = 29)	PSP (*n* = 28)
Energy Kcal (Avg 7 days)	1,712 ± 276	1,612 ± 396	1,731 ± 453	1,668 ± 358
Fat Kcal	571 ± 121	510 ± 139	639 ± 208	575 ± 173
Total Fat (g)	63 ± 13	57 ± 15	71 ± 23 cp	64 ± 19 cp
% Fat	33 ± 4	32 ± 3	37 ± 6 cp	34 ± 7
Saturated Fat (g)	23 ± 6	21 ± 7	24 ± 8	22 ± 7
Cholesterol (mg)	192 ± 86	154 ± 71	220 ± 104	193 ± 80
Sodium (mg)	2,674 ± 652	2,464 ± 584	2,959 ± 776	2,560 ± 594
Total Carb (g)	228 ± 41	225 ± 61	211 ± 58	205 ± 60
Carb kcal	914 ± 166	900 ± 246	845 ± 233	821 ± 239
% Carb	53 ± 5 cp	56 ± 5 cp	49 ± 7	49 ± 9
Dietary Fiber (g)	13 ± 4	12 ± 5	16 ± 6 cp	16 ± 6 cp
Sugars (g)	105 ± 31 cp	105 ± 36 cp	87 ± 32	86 ± 33
Protein (g)	63 ± 13	57 ± 14	67 ± 19	68 ± 11 cp
Protein Kcal	252 ± 52	229 ± 54	267 ± 77	272 ± 46
% Protein	15 ± 2	14 ± 2	16 ± 2	17 ± 4 cp

Note. All values are mean ± SD; n:number of participants

NDSR = Nutrition Data System for Research; Carb = Carbohydrate

HSC = Home schooled children; PSC = Public schooled children; HSP = Home school parents; PSP = Public school parents

c denotes significant differences between child pairs, p denotes differences between parent groups, and cp denotes differences between child/parent

fast 99% of the time during the weekdays. The PSC ate something for breakfast 95% of the time on weekdays. However, most of these meals were eaten at home with the parents reporting that their child ate breakfast at school on average one time per week. The PSC also ate an average of 2.4 lunch meals at school per week. Weekdays versus weekend eating patterns were not examined as part of this study.

Children and Parental Questionnaire

For questionnaire data, 2 HSC, 8 PSC, and 2 PSP failed to return or complete their questionnaire. Of those who did return the questionnaires, there was a 99% overall response rate for all items included. Results showed that there were significant differences in responses between HSC and PSC for questions concerning physical activity during physical education class, recess, and lunch. PSC reported higher scores (indicating more activity) more frequently for engaging in physical activity during scheduled physical education ($p < .001$) and recess time ($p < .05$), whereas HSC had a significantly greater number of responses reporting increased activity during lunch ($p < .05$). There were no significant differences in the frequency of responses for physical activity time spent immediately after school (following formal school instruction for the day), in the evenings, on the weekends, or during free time. Results from the parental questionnaire revealed that HSP reported that their children participated more frequently in meal preparation (grocery shopping, cooking, etc.) each week ($p < .01$) and, on average, engaged more frequently in housework or chores ($p < .01$). In contrast, PSP reported participating in physical activity more frequently ($p < .05$) with their children, and reported that their children spent significantly greater amounts of time viewing television before 4:00 p.m. on weekends ($p < .05$). There were no reported parental group differences for any other questionnaire items, including whether participating parents thought their children ate within the recommended ranges, the amount of physical activity they believed a child should receive per day (PSP: 97 ± 8 vs. HSP: 90 ± 13 min x d^{-1}), SES, and education level.

Discussion

The results of this study provide comparisons of step counts, MVPA, and dietary intake information from home school versus public school children; as well as information pertaining to parental and home influences that could provide potential explanations for these findings. To date, there has been one published study comparing the physical activity and physical fitness levels between home schooled and public school youth aged 9–16 years (49). Welk and colleagues (2004) found that only older male HSC had lower fitness scores than did the PSC and there was no difference in physical activity (defined as accelerometer activity counts) between these two groups. They did note, however, that there was a trend for homeschoolers to be less active over all three days that were monitored. Our results differ in that PSC had significantly higher step counts, time spent in MVPA on the weekdays, and in total over a period of one week than did matched HSC. The different findings of our study may be explained in part by the younger age of our children, the longer duration of activity monitoring, the type of activity monitor employed, the physical activity output measured, our larger sample size, and the subject matching process. However, numerous factors may keep these findings from becoming generalizable as our sample was still relatively small, some families had multiple children participate, few public schools were represented by the PSC, and most of the children in the study had a BMI for age and sex categorized as healthy weight and had favorable body composition measures.

The lower weekday physical activity levels of HSC, without differences in weekend activity levels, may suggest that the lack of scheduled physical education classes, recess, or after school physical activity programs in home school curricula play a role in lower activity levels. Beighle and colleagues (2006) found that children were physically active greater than 60% of the time during recess, whereas outside of school these same children only spent 20% of their time participating in physical activity, suggesting a need for increased play time and recess during the school day (3). Furthermore, Tudor-Locke and colleagues (2006) found that lunchtime physical activity provided the greatest source of daily physical activity obtained during school hours (15–16%), whereas recess and physical education class contributed 8–9% and 8–11% respectively (45). This study also found that almost half of children's steps came from after school activities demonstrating the importance of extracurricular activities and outside playtime. Thus, HSC could potentially lose up to 20% of their opportunity to engage in physical activity by not having recess or physical education classes. The present study supports these findings because the HSC were 24% less active than PSC on the weekdays when public school occurred. The questionnaire data further support this with PSC reporting more physical activity during their scheduled physical education classes and recess. A better understanding of the physical activity patterns that occur during a typical school day for a home school student may help to further explain these differences. Thus, our findings lend support to the inclusion of physical education classes, recess time, and the integration of physical activity into academic content. This is especially important as PSC in the county this study was conducted receive 1–2 days of supervised physical education per week. This finding supports the continuation and perhaps inclusion of additional physical activity, rather than the current trend of reducing or eliminating opportunities for physical activity from the public school environment.

The school environment may not be able to entirely explain the differences in PA between the child groups. Parental, social, and external aspects must also be considered. This may include the safety and proximity of the neighborhood to playgrounds or recreational areas, parental activity levels, as well as family structure. We attempted to identify these possibilities. We found that there were no differences between the parents' perception of the safety of their neighborhoods, that only one public school child reported walking to and from school in our sample, and very few reported walking to a school bus in the morning. Conversely, very few HSC reported playtime in a park or going to a playground. Thus, we do not believe that these factors played a significant role in the differences of physical activity levels observed in this study. The most important factor may be that the PSC were more active simply because their parents were more active, as PSP reported greater participation in physical activity with their child. Future studies should examine the effect of family structure (i.e., number of siblings and friends) on physical activity levels. That is, there may be greater opportunities for PSC to play with friends or be in larger groups during the week, whereas, HSC may have more opportunities to engage in PA with friends on the weekend. Collectively, these findings may explain why PSC were more active during the weekdays and HSC were more active on the weekend.

The present study was also the first to examine dietary intake in HSC, and the first to examine physical activity and dietary intake concurrently in PSC. Since the school environment provides opportunities for children to eat 1–2 meals per day and have access to vending, soda machines, and snack bars, it can be either healthy or detrimental to a child's eating behavior. Research has repeatedly shown that the quality of school meals is suboptimal (10,11,17,51). Devaney and colleagues (1995) used a large nationally representative sample of school children in grades 3–12 and reported that food consumed at school contained more total energy, protein, total fat, saturated fat, and sodium than is recommended for good health (11). This is particularly apparent in elementary students with as much as 36% of total energy coming from fat (10). Consequently, PSC may be at a great disadvantage for greater intakes of fat as it has been reported that students often consume about 30–35% of their total daily energy while in school (1,6,21) and eat on average 3.4 school lunches per week (5). However, in the current study, we did not find any differences in total kilocalories, carbohydrate, fat, protein, saturated fat, cholesterol, or sugars in our comparison of HSC and PSC. One possible reason may include that the average number of school prepared meals eaten in our sample of PSC was considerably lower than the national average with only 2.4 meals eaten during school lunch per week. This may have diminished any possible advantage of HSP having greater control over the quantity and quality of meals prepared at home.

As the school environment may not have had a significant impact on the dietary intakes of the PSC in this study, we studied potential parental and home influences that could explain the study findings. For instance, previous studies have investigated the effects of parental demographics as well as nutritional knowledge and attitudes toward nutrition revealing that higher education, household income, and parental knowledge and attitude toward a healthy lifestyle were positively associated with a child's diet including increased consumption of vegetables and fruits, and a decreased intake of dietary fat (5,19). Our matched sample data did not support reports that HSP often have characteristics, such as higher education (4) and socioeconomic status (40), which have been shown to predict healthier dietary habits and intakes in children (5). The dietary intake findings in the current study may then be explained, in part, by the fact that we found no significant differences in combined annual household income or education levels in our groups of parents. We also found that the HSP and PSP responded similarly to questions concerning attitudes and beliefs about physical activity and nutrition. We did find, however, that HSC participated more frequently in meal preparation practices with their parents. More research concerning participation in meal preparation on dietary intakes is needed. The impact of television viewing in the home on the fat and energy intakes has also been the focus of many studies (27,50). Wiecha and colleagues (2006) showed that for each additional hour of television watched, energy consumption increased by 167 kcal with more consumption of foods commonly occurring during commercials (50). Conversely, Matheson and colleagues (2004) reported that there were no differences in the fat content of foods consumed during television viewing (27). The present study indicated that there were no significant differences in the reported amount of time spent watching television or playing video games, except before 4:00 p.m. on the weekends, when PSC spent significantly more time engaged in these activities. This might suggest that, although there were no overall differences in dietary intakes over one full week, weekend consumption between HSC and PSC may be different since their physical activity patterns changed. Unfortunately, weekday and weekend patterns of dietary intake were not determined separately for this study. Collectively, without differences in parental demographics or attitudes and with very little differences in reported television viewing, our similar total energy and fat intakes of HSC and PSC seem plausible. More research is warranted to study the practices of overweight and obese children, home school versus public school population samples, and the frequency of meals consumed in public schools.

It is also important to note that, on average, neither child group met the current guidelines and recommendations for nutrition and physical activity. The American Dietetic Association (ADA) recommendations for children aged 2–11 years include consuming 25–35% of energy from fat (1), whereas other recommendations call for a reduction to less than 30% of energy from fat (23,48). This should be coupled with 60 min of MVPA on most, if not all, days of the week (31). We found that HSC actually consumed more energy from fat (33% vs. 32%) and on average, were less active (34 min vs. 42 min MVPA) than their matched public school counterparts. It has also been proposed that children should accrue more than the recommended 10,000 step·day^{-1} recommended for adults (38). Using BMI standards to predict step count recommendations in children, Tudor-Locke and colleagues (2004) suggested that boys should accumulate 15,000 step·day^{-1}, whereas girls should accumulate 12,000 step·day^{-1} (46). This is slightly higher than the recommendations of the President's Council for Physical Activity of 13,000 and 11,000 step·day^{-1} for boys and girls, respectively (38). We found that only 8 HSC and 9 PSC accumulated over 90,000 steps for the week which would meet the lower of these recommendations since our sample consisted of a majority of boys. Thus, we estimate that over 50% of the children in our sample are not meeting step accumulation recommendations.

We attempted to identify further explanations for our findings. We studied our subjects in the months of February through May. Initially, the HSC were recruited, then matched PSC were identified which consequently, may have caused a seasonality effect on physical activity measures because more HSC were studied during the earlier colder months. It has been reported that there is a significant effect of season on moderate and recommended physical activity levels in both children and adults (15,37). However, Fisher and colleagues (2005) stated that seasonality may only play a limited role in the physical activity of young children (15). We conscientiously recorded the weather each day of this study and found that the HSC participated slightly less in physical activity when the temperature was colder. Thus, PSC may have an advantage by having access to inside play areas such as gymnasiums during inclement weather. Future research should examine HSC activity patterns in summer months as compared with PSC and also examine other outside influences in HSC such as birth order and family size. Finally, dietary intake data were self-reported and despite our instructions not to alter food and drink intake during the recording time, error and reactivity influences may have occurred.

Summary

We found that PSC obtained significantly more steps and time spent in MVPA over a period of one week with significantly more steps and MVPA occurring on weekdays than HSC. This may be partially explained by increased physical activity during the school day with PSC having greater opportunities to engage in activity during recess and physical education classes. Therefore, the inclusion and maintenance of physical education classes, rather than the reduction, in school curriculums should be of the utmost importance to help children meet physical activity recommendations. Nutritionally, we did not find any significant differences between the child groups. This may be explained by the nonsignificant differences in parental SES, parental educational level, or TV viewing time by the groups of children. While physical activity measures were lower than recommended for most children, total energy intakes in our child samples were also lower than national averages. The BMI categorized matched child cohorts included in this study included an over representation of healthy weight children compared with local, state and national demographic reports, thus reducing the generalizability of our findings. Additional factors not examined in this study may have contributed to these unexpected findings. Future research should include a greater number of both overweight and obese children.

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