SUPPLEMENT

Dietary and Physical Activity/Inactivity Factors Associated with Obesity in School-Aged Children[1–3]

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ABSTRACT

Diet and physical activity (PA) are essential components of nutritional status. Adequate nutrition and an active lifestyle are key factors during childhood, because food habits track into adulthood. Children spend more time in school than in any other environment away from home. Studying the diet factors and patterns of PA that affect obesity risk in children during school hours and the complete school day can help identify opportunities to lower this risk. We directly measured the time children spent performing moderate to vigorous PA (MVPA) at school, compared the amount and intensity of PA during school hours with after-school hours, and tried to determine if diet behaviors and PA or inactivity were associated with excess weight and body fat. This cross-sectional study included 143 normal-weight (NLW) and 48 obese children aged 8–10 y. Diet data were obtained from two 24-h recalls. Body composition was measured by bioimpedance. Screen time and sports participation data were self-reported. NLW children drank/ate more dairy servings than the obese children, who consumed more fruit-flavored water than the NLW group. Consumption of soft drinks, sugar-added juices, and fresh juices was low in both groups. Children were less active during school hours than after school. MVPA was lower during school hours in the obese group than in the NLW group. Schools, parents, and authorities should be more involved in promoting strategies to improve the dietary habits and PA levels of school-aged children, because this group is not achieving the recommended level of daily MVPA. *Adv. Nutr. 3: 622S–628S, 2012.*

Introduction

In Mexico, obesity affects 10.8 and 9% of school-aged boys and girls, respectively. The prevalence is higher in Mexico City, at 13% (1). Chronic illnesses associated with obesity, such as type 2 diabetes and cardiovascular disease, are reported to begin in childhood. Excess body fat hastens development of these diseases, increases the risks of complications, and, if persistent, reduces life expectancy (2).

Diet and physical activity (PA)[7] are essential components of nutritional status and energy balance (1). Adequate nutrition is a key factor during childhood, because food habits track into adulthood (3). Sedentary behaviors influence the change in BMI between adolescence and adulthood; an active lifestyle, such as participating in sports at a young age, appears to have a beneficial impact on BMI later in life (4).

Children spend more time in school than in any other environment away from home. Schools, therefore, are a key setting for public health strategies to prevent overweight and obesity or reduce their prevalence. Schools, by themselves, cannot overcome the childhood obesity epidemic (5). Opportunities to be active during school hours are

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[7] Abbreviations used: FV, fruits and vegetables; MVPA, moderate to vigorous physical activity; NLW, normal weight; PA, physical activity; PC/VG, personal computer/video games.

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scarce (6) and, often, little importance is paid to PA and physical education, although there is evidence that PA can be added to the school curriculum by taking time from other subjects without interfering with students' academic performance (7). Schools and the community have a shared responsibility to provide all students with more opportunities to be active and with food and nutrition education to help them make healthy choices. This paper discusses some of the factors, such as diet and PA during the school day, that are needed to maintain a healthy weight. Studying diet factors and PA patterns that increase the risk of obesity in children is necessary to identify ways to lower their risk of excess weight gain.

The aims of the present study were as follows: *1*) to directly measure the amount of time children spent performing moderate to vigorous PA (MVPA) at school, including the hour prior to school, during recess, and the hour after class dismissal; *2*) to compare the amount and intensity of PA during school hours vs. after-school hours; and *3*) to determine the association of diet behaviors and PA or inactivity to excess weight and body fat.

Methods

Design and participants

In this cross-sectional study, anthropometric and body composition measurements were taken, and PA and diet data for school days were collected from 198 normal-weight (NLW) and 69 obese children aged 8–10 y from 5 public and 5 private schools in Mexico City. The study was approved by the National Institute of Genomic Medicine research and ethics committee, and informed consent was obtained from the children's parents before enrollment in the study.

Children were categorized as obese (>95th percentile) and NLW (<85th percentile and >5th percentile) using age and sex BMI-specific percentiles (8). Anthropometric and body composition measurements (i.e., weight, height, bioimpedance analysis) were obtained by trained personnel. Diet factors and diet-related behaviors were analyzed from two 24-h recalls. The amount of time the children spent watching television, using personal computer/video games (PC/VG), and participating in sports outside of school was obtained from a questionnaire. PA was directly measured with accelerometers.

Measurements

Height was measured without shoes to the nearest 0.1 cm using a SECA portable stadiometer. Body weight was measured to the nearest 0.1 kg using a SECA electronic scale, with participants wearing only school pants/skirt and a shirt. Both measurements were taken twice, and the mean value was reported. BMI was calculated as kg/m^2.

Estimates of body composition were obtained by bioimpedance analysis using the Quantum III Body Composition Analyzer System (RJL Systems). With the participant lying supine, bipolar electrodes were placed on the middle finger of the right hand and the lateral aspect of the right ankle. The equation used to estimate body composition was developed by Sun et al. (9).

Trained personnel obtained food intake data with two 24-h recalls using the multiple-pass technique (10), which provides valid information on energy intake in groups of children (11). Mean portions of dairy products, fruit, vegetables, juice, sugar-sweetened beverages, and candy were determined. Type of milk consumed, number of meals consumed, and eating breakfast and dinner were also determined from the recalls. Dietitians converted intake into grams of food or milliliters of beverage portions using a database compiled from different sources (12–15). Fruit portions were based on the USDA definitions (13) and on the Sistema Mexicano de Alimentos Equivalentes (14); e.g., 1 serving of fruit equals 1 medium apple, one-half a banana, or 1 cup of cut fruit. Dairy products included whole and skim milk and yogurt. Beverage standard portion, including soda, fresh fruit juice, and fruit-flavored drinks, was 240 mL. Commercially produced juice included reconstituted bottled and packaged juice. To estimate candy consumption, a portion size was considered equivalent to 20 g of sugar.

The questionnaire about time spent watching television, PC/VG use, and participation in sports outside school hours contained open questions. Children were asked to record the amount of time spent doing those activities from Monday through Friday and whether they played any sports after school. Questionnaires were completed by the children with the help of their parents.

To measure PA, an accelerometer (Actigraph GT3×) was placed at the right hip and tied to an elastic belt. Children were asked to wear it for 7 continuous days during waking hours and to remove it only for water activities like showering or swimming and at bedtime. For the present analysis, only data from school days are presented. Accelerometers were programmed to take measurements every 5 s and then reintegrated to 60 s for comparison with other studies. Data reduction was made with Meterplus software (SanTech). At least 3 weekdays, with 10 h of use each day, were required to be considered a valid measurement. Threshold counts for sedentary time were <800 counts; for light PA, 800–3199 counts; and for MVPA, ≥ 3200 counts (16). Of the 2 groups, 55 NLW and 21 obese children did not fulfill the minimal wearing time; therefore, results are presented for only the 143 NLW and 48 obese children who had valid measurements.

The time points included in the assessment were the following: time before school entrance, the 30-min class recess, the hour after school dismissal, school hours (0800–1459), and after-school hours (1500–2300). The first 3 time points were chosen, because they have been reported as the 3 main peaks of activity in children attending school (17).

Statistical analysis

Data were analyzed using SPSS (version 17.0) software. For all statistical tests, $P < 0.05$ was taken as the significance level. To determine differences between NLW and obese children, *t* tests for independent samples were used. Pearson correlation coefficients were calculated to determine the association between variables. CI and OR were calculated with a spreadsheet created by the Physiotherapy Evidence Database from the George Institute for Global Health (18).

Results

The anthropometric characteristics of participants are shown in **Table 1**. A wide range of weight and body fat composition was evident in both groups. Children in the obese group were taller than NLW children, regardless of age ($P < 0.05$). Sedentary behaviors and factors related to diet quality are shown in **Table 2**. The 2 groups did not differ in reported time spent watching television ($P = 0.19$) or in PC/VG use ($P = 0.41$). Both groups had a mean daily intake of 4.7 meals, but eating 5 meals/d was more common among NLW than obese children (19.9 vs. 2.1%; $P < 0.001$) and was associated with a lower risk of obesity [OR = 0.09 (95% CI:...)] 0.01–0.70). Although not shown in Table 2, information about sports participation outside school was collected. NLW children tended

Table 1 Anthropometric and body composition characteristics of NLW and obese children[1]

Characteristic	NLW (*n* = 143)	Obese (*n* = 48)
Weight, *kg*	32.6 ± 6.2 (22–48.8)	51.7 ± 8.8* (38.5–83.8)
Height, *cm*	136.6 ± 7.1 (112.4–154.8)	141.6 ± 6.6* (127–155.1)
BMI	17.2 ± 1.7 (13.6–20.6)	25.7 ± 2.9 (21.6–35.5)
Body fat, %	19.4 ± 5.2 (7.8–30.2)	36 ± 4.5 (27.5–48.3)

[1] Values are means ± SD (minimum–maximum). *Different from NLW, *$P < 0.05$. BMI = weight (kg)/height^2 (m). NLW, normal weight.

Table 2 Comparison of mean daily sedentary and diet related behaviors between NLW and obese children[1]

	NLW (n = 143)	Obese (n = 48)
Television viewing, *h*	2.1 ± 1.4 (0–8)	2.5 ± 2.3 (0–12)
Computer/videogames use, *h*	0.9 ± 0.9 (0–4)	0.7 ± 0.8 (0–4)
Number of meals	4.7 ± 1.1 (2–8)	4.7 ± 1 (2.5–7)
Fruits	1.1 ± 1.2 (0–7.3)	1.1 ± 1.1 (0–4.5)
Vegetables	0.7 ± 0.9 (0–4)	0.8 ± 0.8 (0–3)
Dairy products	1.8 ± 1 (0–4.8)	1.7 ± 0.8 (0–3.1)
Soda[2]	0.4 ± 0.7 (0–4.4)	0.2 ± 0.5 (0–2.8)
Fresh juice	0.1 ± 0.3 (0–2)	0.1 ± 0.3 (0–2)
Commercially produced juice[2]	0.4 ± 0.7 (0–4)	0.2 ± 0.5 (0–2)
Natural fruit-flavored water	0.6 ± 0.9 (0–5)	0.9 ± 1 (0–3.5)
Other sugar-sweetened beverages	0.1 ± 0.4 (0–2.5)	0.1 ± 0.4 (0–2)
Candy	1 ± 1.2 (0–8)	0.9 ± 1 (0–4)

[1] Values are means ± SD (minimum–maximum). All diet data are presented in portions. NLW, normal weight.
[2] Significant differences between groups were found for soda and commercially produced juice intake.

to participate in sports more than obese children (63 vs. 48%) (P = 0.08).

Mean fruit consumption was 1.1 servings/d for both groups, and vegetable consumption was 0.7 and 0.8 portions for NLW and obese children, respectively. The recommendation of eating ≥5 servings of fruits and vegetables (FV) per day was reached by only 6.3% of the NLW children and none of the obese children ($P < 0.05$). Mean consumption of dairy products was 1.8 and 1.7 servings/d by NLW and obese children, respectively; the proportion of children consuming ≥3 servings of dairy products was higher ($P < 0.01$) among the NLW children (18.3%) than among the obese children (6.4%). Drinking ≥3 dairy portions tended to lower the risk of obesity (OR = 0.34; 95%CI: 0.11–1.03). Mean daily consumption of soda was significantly higher among NLW participants, but the proportion of children drinking ≥1 glass of soda daily did not differ between the 2 groups. Only 9 children consumed fresh juice, with a mean intake/d of 0.1 servings; 5.6% of NLW children and 2.1% of obese children consumed ≥1 glass of fresh juice ($P < 0.05$). More commercially produced juice was consumed by NLW children ($P < 0.05$), but the mean intake was less than one-half a serving; 23.3% of the NLW group and 10.6% of the obese group consumed ≥1 glass of fresh juice ($P < 0.05$). Natural, fruit-flavored water, which is a common beverage in Mexico made by mixing plain water with sugar and different kinds of fruits or fresh juice, was equally consumed by both groups; however, the proportion of children drinking ≥2 glasses/d was higher in the obese group [34.4 vs. 9.8%; $P < 0.05$; OR = 4.29 (95%CI: 1.7–10.6)]. Other sugar-sweetened beverages were consumed similarly among all children. Candy consumption did not differ significantly between groups. Only 1.4 and 2.1% of NLW and obese children, respectively, skipped breakfast and/or dinner.

The amount and intensity of activity at selected time points are shown in **Table 3**. Significant differences between the NLW and obese groups were found for only MVPA during school hours. Activity before school began (i.e., when children were in transit to school) was primarily sedentary, with mean MVPA duration of less than 2 min. A similar situation was observed during the hour after school dismissal; the mean MVPA was 1.7 ± 2.7 min for NLW children and 1.0 ± 1.7 min for obese children. Recess time presents a good opportunity for children to move; nonetheless, 73% of this time was spent on sedentary activities, ∼7 min were spent doing light-intensity activities such as walking, and <1 min was spent doing MVPA.

Correlation coefficients between obesity-related measurements and PA and dietary behaviors are shown in **Table 4**. None of the 3 activity intensities during the hour after or before school was associated with any of the obesity-related measurements. The amount of sedentary time during recess was directly associated with percent body fat and BMI, whereas light-intensity activity was inversely associated with these 2 measurements. MVPA was not associated with any of the obesity-related measures. Associations were found between television viewing and sedentary time ($r = -0.25$), light activity in the afternoon (r = 0.24), and moderate activity in the afternoon (r = 0.16) ($P < 0.001$).

Correlations between dietary-related factors and obesity-related measurements are shown in Table 4. Neither fruit nor vegetable consumption was associated with obesity measurements. Dairy consumption was significantly and inversely associated with percent body fat. Among beverages, only natural fruit-flavored water was associated with obesity; consumption of soda, fresh juice, commercially produced juice, and other sugar-sweetened beverages was not associated with any obesity-related variables. Candy consumption was not associated with obesity measurements. The frequency of meals was directly associated with percent body fat.

Table 3 Comparison of time spent on sedentary, light, and MVPA at different time points during the school day between NLW and obese children[1]

Intensity of PA	NLW (n = 143)	Obese (n = 48)
Before school (60-min period), *min*		
Sedentary time	49.1 ± 7.1	48.6 ± 6.4
Light	9.1 ± 5.1	8.7 ± 4.3
MVPA	1.5 ± 2.6	1.2 ± 2.4
Recess (30-min period), *min*		
Sedentary time	21.9 ± 4.6	22.4 ± 4.8
Light	7 ± 3.6	7 ± 3.9
MVPA	0.7 ± 1.3	0.5 ± 0.8
After school (60-min period), *min*		
Sedentary time	44.7 ± 8.5	45.4 ± 8.9
Light	13.6 ± 6.9	13.5 ± 8
MVPA	1.7 ± 2.7	1 ± 1.7
School hours (7-h period), *min*		
Sedentary time	344.1 ± 26.6	344.1 ± 25.2
Light	57.5 ± 22.8	54.6 ± 14
MVPA	5.8 ± 5.5*	3.7 ± 4.2*
After-school hours (8-h period), *min*		
Sedentary time	339.6 ± 42.1	351.7 ± 51.8
Light	84.7 ± 37.9	68.6 ± 35.3
MVPA	10.5 ± 10	7.6 ± 7.9

[1] Values are means ± SD. *$P < 0.05$. MVPA, moderate to vigorous physical activity; NLW, normal weight; PA, physical activity.

Table 4 Pearson correlation coefficients (*r*) for obesity-related measures and PA-related factors/dietary behaviors[1]

	Body fat	Weight status[2]	BMI
	%		
Sedentary time BS	0.04	0.002	0.04
Light activity BS	−0.01	−0.05	−0.12
MVPA BS	−0.13	−0.12	−0.15
Sedentary time recess	0.19*	0.09	0.22**
Light activity recess	−0.14*	−0.06	−0.16*
MVPA recess	−0.12	−0.06	−0.12
Sedentary time AS	0.003	0.06	−0.01
Light activity AS	0.02	−0.04	0.03
MVPA AS	−0.04	−0.08	−0.05
Sedentary time SH	0.03	−0.02	0.03
Light activity SH	−0.06	0.03	−0.05
MVPA SH	−0.13	−0.07	−0.13
Sedentary time ASH	0.02	0.10	0.11
Light activity ASH	−0.03	−0.16	−0.08
MVPA ASH	−0.07	−0.07	−0.07
TV viewing	0.11	0.07	0.07
PC/VG use	−0.06	−0.05	−0.04
Sports[3]	−0.03	−0.05	−0.07
Fruit	0.06	0.01	0.00
Vegetables	0.02	0.04	0.03
Dairy products	−0.17*	−0.9	−0.13
Soda	−0.6	−0.12	−0.09
Fresh juice	0.03	−0.03	0.19
Commercially produced juice	−0.12	−0.11	−0.12
Natural fruit-flavored water	0.12	0.15*	0.10
Other sugar-sweetened beverages	0.01	0.09	−0.18
Candy	0.06	−0.03	0.01
Number of meals	0.17*	0.01	0.08

[1] *$P < 0.05$, **$P < 0.01$. Recess was a 30-min period. AS, after school 1-h period; ASH, after school hours from 1500 to 2300 h; BS, before school 1-h period; MVPA, moderate to vigorous physical activity; NWL, normal weight; PA, physical activity; PC/VG, personal computer/video games; SH, school hours from 0800 to 1459 h.
[2] NWL or obese.
[3] Performing ≥1 sport besides those practiced at school.

Discussion

Dietary behaviors

There is controversy about the protective role of separating daily food intake into >3 meals. In our study, the number of daily meals was positively associated with percent body fat, 3 or 4 meals a day were a risk factor for higher body fat. Ezendam et al. (19), however, found a protective role of ≥3 meals/d, and Barba et al. (20) reported that daily eating frequency was inversely associated with the degree of total adiposity and central fat deposition. Our study data showed that eating 5 meals/d was a protective factor against obesity, which is in agreement with Toschke et al., who reported an OR of 0.51 (95%CI: 0.29–0.89) when 5 daily meals were consumed (21). There is no standardized definition of a "meal" in terms of minimum or maximum energy content or amount of food eaten. It has been proposed that analyzing the amount of energy in every meal and number of meals consumed might lead to a more sensitive outcome (19).

Greater amounts of FV consumption are important because of their protective effect on chronic disease risk, mainly against cancer and cardiovascular disorders (22). In the present study, FV intake was low, according to data on school-aged children in Mexico (1) and Latino children living in the United States (23). It has been reported that mean intake of FV by school-aged children in Mexico is 103.1 g/d, which is lower than the adult mean daily intake of 122.6 g (24). Aranceta Bartrina et al. (25) reported low FV intake (<5 servings/d) by 83% of Spanish children in their study, and Dennison et al. (26) reported that most children in their sample consumed <5 FV servings/d. Our finding that only 6.8% of NLW children in our study ate ≥5 servings of FV/d is similar to that of Basch et al. (23). A possible concern is that none of the obese children achieved the recommended 5 daily servings of FV (27).

FV intake has been proposed to have a protective effect against obesity. In a systematic review by Ledoux et al. (28), increased FV intake, in conjunction with other behaviors, contributed to reduced adiposity among overweight or obese adults. They also mentioned a weak inverse relationship between FV intake and adiposity among overweight adults. In children, this relationship remains unclear (28). We were not able to show any association between FV consumption and lower body fat, BMI, or obesity risk. More research is needed to clarify the nature and mechanisms of the effects of FV intake on adiposity (28).

In the last decade, it has been hypothesized that dairy intake may have a beneficial effect on the regulation of body weight, possibly through calcium intake and its effect on adipocyte metabolism by inhibiting lipogenesis and stimulating lipolysis (29–31). According to te Velde et al. (32), dairy intake may help prevent overweight. Our data showed an inverse association between dairy intake and body fat; other studies have reported that higher diary food intake, as a percentage of total energy, was associated with a decrease in BMI (33).

Soft drinks currently constitute the leading source of added sugars in the diet, and, according to a study performed by Harrington (34), the OR of a child becoming obese increases 1.6 times for each additional can or glass of sugar-sweetened drink consumed beyond the usual daily beverage intake. We observed that the mean consumption of sugar-sweetened drinks, like soft drinks or commercially produced juices, was low, and we did not see an association between these beverages and adiposity or weight status, with the exception of fruit-flavored water. The low intake observed possibly may be because schools in Mexico are not currently allowed to sell soft drinks or any drink with a high amount of sugar, and the government constantly sends messages to the population about increasing plain water intake. These actions might make parents more aware of the beverages their children drink. The only beverage that was associated with obesity in our study was fruit-flavored water. This is a very important finding, because although people tend to think that drinking fruit-flavored water is very healthy (perhaps because of the words "fruit" and "water" in the name), these beverages also contain added sugar. A study conducted by Barquera et al. (35) reported that from 1999 to 2006, fruit-flavored water consumption by school-aged children increased. It is important to alert the population that fruit-flavored water, like any other sugar-sweetened beverage, adds energy and sugar to their diet.

PA and sedentary behaviors

Participants in this study exceeded the 2-h limit of "screen time" recommended by the American Academy of Pediatrics

(35–37). Generally, few children achieve this recommendation. In 2 other studies, time spent watching television was reported to be 3.28 h (38) and 2.7 h (39). Long periods of screen exposure may have deleterious effects on children's health. A study conducted in 7-y-old children showed that each hour per day spent on PC/VG was associated with a significant increase in diastolic blood pressure (40). According to Hamer et al. (41), higher levels of screen time and low PA levels interact to increase psychological distress in young children. We reported that watching television was negatively associated with sedentary time in the afternoon and positively related to light and moderate activity, which is the opposite of what we would expect. A possible explanation is that children may have underreported the number of hours they spent watching television.

One of the main factors contributing to increased adiposity is lower energy expenditure caused by decreased PA (42). The amount of PA is tightly correlated with body fat accumulation and obesity (43,44). The intensity of activities also plays an important role in obesity prevention; vigorous PA may have a greater effect on preventing obesity than does lower-intensity PA. Nonetheless, both average and at least moderate PA levels may have an impact on total and central body fat in youth (45). It has been reported that obese children are less physically active (46) and spend less time in MVPA than their nonobese peers (47). In this study, we were able to confirm that obese children perform less MVPA than NLW children during school hours. Rivera et al. (48) found physical inactivity present in 93.5% of children and adolescents, but they did not find any relationship between this variable and excess weight or body fat. The only association between these factors found in this study was a correlation between sedentary activity during school recess and percent body fat and BMI. However, it is important to make efforts to reduce physical inactivity. Mitchell et al. (49) reported a 1.32-fold increase in the risk of obesity for every hour spent in sedentary behavior.

During the hour prior to class beginning and the hour after school dismissal (i.e., transit time), most activity was sedentary, suggesting that transport options to and from school involved little walking and more car or bus riding. Jauregui et al. (17) reported a mean MVPA of 2.23 min in second-grade students, which is slightly higher than our observation.

Very little MVPA is performed during recess at school, although, presumably, this is a good opportunity for children to move around. Children in our study spent ~73% of their recess time in sedentary activities and <1 min in MVPA. On the contrary, Jauregui et al. (17) reported a mean 6.69 min of MVPA. The difference is most likely due to the threshold used to define MVPA: Jauregui et al. (17) used a threshold proposed by Rowland (50), whereas we used the threshold proposed by Puyau et al. (16). There is controversy about which threshold is better to determine MVPA. Some authors have compared different cutoff points (51,52), but there is no consensus about a single cutoff point to define MVPA. Jennings et al. (6) presented some reasons why children do not get enough MVPA during school recess. They observed that in elementary schools in Mexico, children spent recess time purchasing and consuming food; there was a lack of PA organized by the school, and, due to overcrowding and safety issues, sports equipment, running, and playing were not allowed. In our study, obese children performed less MVPA than NLW children during recess, although this was not significantly different. Sedentary time was significantly negatively associated with BMI and percent body fat, whereas light-intensity activity was positively associated with these 2 measurements.

An association between inactivity and adiposity was previously reported by Maffeis et al. (53). Sports participation may have a protective role against obesity; a decrease in childhood obesity has been reported with an increase in sports participation (19). Haerens et al. (47) observed that overweight children engage in less PA during their leisure time than NLW children. Although sports participation outside school in our study did not differ between NLW and obese children and sports participation was not associated with obesity or obesity-related measurements, a higher proportion of NLW children engaged in sports than did obese children. One possible explanation for why no association was found between obesity and playing sports may be the low total MVPA observed in this sample, which indicates little or no sports participation.

Both obese and NLW children are more active after school than during school hours. Schools could play an important role in children's activity levels. Strategies to provide schools with alternatives to promote more intense PA among students are needed to take full advantage of the potential benefits that schools can provide. One idea is that schools, along with parents, could organize PA before class begins, during recess, and after school dismissal, which would increase the chance for children to meet the PA recommendation of 60 min of MVPA every day. One way to do that is to have children summoned 10 min before their habitual arrival time and picked up 10 min after their habitual departure time, so they can perform organized activities.

Dietary behaviors that may lower children's risk of obesity are eating/drinking 3 servings of dairy products/d and having 5 meals/d. Families should be advised that fruit-flavored water is a major source of sugar in their diet and that the low FV intake reported by many children needs to be increased. Special attention should be paid to reducing children's screen time. Schools, parents, and authorities should be more involved in promoting PA whenever possible, because the daily MVPA recommendation for school-aged children is not being met.

Acknowledgments

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