Preventive Medicine Reports 2 (2015) 478–482

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: http://ees.elsevier.com/pmedr

Physical activity levels and obesity status of Oregon Rural Elementary School children

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ARTICLE INFO

Available online 26 April 2015

Keywords:
Rural school settings
Childhood overweight and obesity
Physical activity

ABSTRACT

Objective. To evaluate the relationship between physical activity (PA, min/school-day) at school and body mass index (BMI, kg/m^2) among rural elementary-aged children.

Methods. Height (cm), weight (kg), and PA were measured for 1767 children (5–12 years) enrolled in six rural Oregon elementary schools in fall, 2013. PA at school was measured over four days using Walk4Life pedometers. Children with ≥3 valid monitoring days (n = 1482) were included in analyses. Means (min/d) were calculated for wear time, total PA (TPA: combined light, moderate, vigorous PA), and moderate to vigorous PA (MVPA: step count > 120/min). BMI z-scores were calculated and regression models were run to examine the relationship between PA and BMI z-scores, adjusting for wear time, sex, and grade.

Results. Overweight (38.1%: BMI ≥ 85th percentile for age and sex) and obesity (19.4%: BMI ≥ 95th percentile) prevalence was similar for boys (n = 782) and girls (n = 700). More MVPA was associated with lower BMI (P < 0.001), independent of sex, wear time or grade. Mean MVPA was 18.9 +/− 8 min/d, versus 15.2 +/− 6.7 min/d for healthy-weight and obese children, respectively.

Conclusions. Children are not meeting minimum MVPA recommendations (60 min/d) during school hours. Efforts to promote PA for obesity prevention in rural elementary schools should focus on increasing opportunities for MVPA.

Introduction

The prevalence of overweight and obesity has climbed steadily among children ages 6–11 over the last three decades, rising from 6.5% in 1976–1980 to 18% by 2009–2010 (Fryar et al., 2012). The most current available data indicate that the rates for overweight (34.2%; CI 30.1–38.5) and obesity (17.7%; CI 14.5–21.4) among children ages 6–11 years (Ogden et al., 2014) remain high with obesity rates 10% above the Healthy People 2020 goal of 15.7% (U.S. Department of Health and Human Services and Office of Disease Prevention and Health Promotion, 2014). Longitudinal studies show that obese children are more likely to become obese adolescents (Cunningham et al., 2014), and eventually obese adults (Freedman et al., 2005; Guo and Chumlea, 1999) putting them at greater risk for heart disease, type 2 diabetes, stroke, cancer, osteoarthritis and early mortality (National Heart Lung and Blood Institute (NHLBI), 2012). The ripple effects of childhood overweight and obesity will be economically crippling in the U.S. if we cannot stem the tide.

Genetic predisposition for a high body mass index (BMI, kg/m^2) is between 25% and 40% (Bouchard et al., 1997) suggesting ample potential for environmental influences, including physical activity (PA) exposure, on the development of obesity. For children, who do not generally have volitional control over the environments where they live, learn and play, increasing PA at school has been proposed as one of the best options for accelerating progress in obesity prevention (National Physical Activity Plan, 2010; White House Task Force on Childhood Obesity, 2010; IOM (Institute of Medicine)., 2012).

Physical education (PE) programming has historically served as the primary mechanism for providing child PA time during the school day. Currently, a majority of schools are challenged with budget cuts or pressure to achieve academic standards that detrimentally impact habitual PE programming. Among schools providing PE, few meet the nationally recommended minimum of 150 min/week of moderate to vigorous physical activity (MVPA) at the elementary level (National Association for Sport and Physical Education, American Heart Association, 2012). Even when schools have robust PE programs, it is rare that children spend the recommended 50% of PE class time in MVPA (UCLA Center to Eliminate Health Disparities, Samuels and Associates, 2007). Thus, relying on PE programming to ensure that children are sufficiently active during the school day may be short sighted. Bassett et al. (2013) found

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http://dx.doi.org/10.1016/j.pmedr.2015.04.014

that optimizing certain policies and practices may significantly influence the habitual dose of PA children experience while at school. Classroom activity breaks, active transportation, and on-site before/after-school programs are among the strategies suggested. However, in rural school districts, children often live far from home and have long bus commutes, making participation in before/after school programs or active transportation efforts challenging or inaccessible. In these rural environments, the 6–7-hour school day may present the best opportunity for many children to meet the recommended 60-min/d minimum of MVPA. As such, statewide surveillance data on PA during school hours has potential as an important health behavior indicator in rural areas.

In Oregon, and nationwide, there is a dearth of data assessing the amount of time spent engaged in PA among children attending rural schools and no data relating PA at school to health indicators such as BMI. This makes it challenging to advocate school policies and resources to promote PA as critical among rural children. Thus, the purpose of this study was to measure PA levels during the school day among children attending elementary schools in rural Oregon, and to determine the relationship of PA behaviors at school to BMI.

Methods

Participants and settings

This study was in collaboration with Oregon State University Health Extension (OSUHE) faculty on campus and in the field. OSUHE provides programming in approximately 200 elementary schools throughout Oregon. Participating schools were selected based on the following criteria: 1.) Located in a community designated as a rural place by the US Census (U.S. Department of Agriculture (USDA), 2012), 2.) ≥50% of school families eligible for free and reduced meals, 3.) OSUHE county faculty were available to participate. Three OSUHE faculty members serving three geographically diverse Oregon counties were available and agreed to participate. OSUHE faculty served as liaisons to schools and helped research staff collect data. Researchers trained all staff on assessment protocols. Table 1 presents the characteristics of participating schools. School families were informed of the school-based assessments through school initiated communications and provided the chance to opt-out. Data were collected in fall 2013 over a 5-week period. The study was approved by the OSU Institutional Review Board.

Assessment of body mass index (BMI)

Height and weight were measured over 2-days at each school by the same team of trained research assistants. Height was measured to the nearest 1 mm using a portable stadiometer; weight was measured to the nearest 0.1 kg using a portable digital scale and data were used to calculate BMI (kg/m^2). BMI raw data were transformed to BMI z-scores based on the Centers for Disease Control and Prevention (CDC) growth charts (Vidmar et al., 2013). Children were classified as "overweight" or "obese" using the age- and sex-specific 85th and 95th percentiles from the CDC growth charts (Centers for Disease Control and Prevention, 2014).

Assessment of physical activity (PA)

Physical activity was measured on four consecutive school days during the hours children were attending school. Classroom teachers were trained to distribute pedometers, log non-compliance, daily wear time (min/d), and school attendance, and assist children with putting the devices on at the start of each school day and removing them at the end of the school day (approximately 6.5 h). We used Walk4Life MVP pedometers (Walk4Life Inc.; Oswego, IL); a validated device that records all activity and can differentiate activity minutes at or above a pre-specified step rate (Beets et al., 2011). Children wore the pedometers on their right hip, attached by an elastic belt. PA data collection coincided with height and weight assessments.

Statistical analyses

Cumulative averages over the 4-day sampling period were calculated for wear time (min/d at school), total PA (TPA; combined light, moderate, vigorous PA), and MVPA (step count > 120/min). Children with ≥3 valid monitoring days were included in the final analyses. While there were no differences in TPA or MVPA between children with 2, 3, or 4-days of valid PA data, only children with ≥3 days of PA monitoring were included in analyses.

T-tests were used to compare means of PA variables (TPA, and MVPA), by sex (boys vs. girls) and by grade (grade 1 vs. grade 2–6). Proportional tests were used to compare proportions of overweight/obese and obese children by sex and by grade.

BMI z-scores were calculated for use in regression models. Any children with z-scores > 4 SD above or below age and sex matched reference data were identified as outliers and excluded from analyses. Regression models were run to examine the relationships between PA variables (TPA and MVPA) and BMI z-scores, adjusting for wear time, sex, and grade. A p-value < 0.05 was used to identify a statistically significant relationship. All analyses were conducted in Stata/IC 13.1.

Results

Within the six rural schools, we measured 1767 of 1852 enrolled 1^{st}–6^{th} graders (95.4%). The final sample included 1482 children (83.8% of measured children; 782 boys; 700 girls) with valid PA and BMI measurements (BMI z-scores data < 4 SD for sex and age and >3 days of pedometer measured PA data). The combined overweight/obesity prevalence was 36.8% for girls and 39.3% for boys; obesity prevalence was 17.8% and 20.8% for girls and boys, respectively (Table 2). Overall, there were no differences between boys and girls for prevalence of overweight/ obesity; however, a greater proportion of 4^{th} grade boys compared to girls were classified as obese (P = 0.004; Table 2).

Table 1
Characteristics of participating rural elementary schools.

Grade levels	County 1		County 2		County 3	
	School 1 K–6	School 2 K–5	School 3 K–6	School 4 K–6	School 5 K–6	School 6 K–6
Student enrollment (n)	571	442	495	347	166	191
Participation in National School Lunch and Breakfast Program (yes/no)	Yes	Yes	Yes	Yes	Yes	Yes
Students eligible for free/reduced school meals—n (%)	321 (56.2)	289 (65.4)	297 (60.0)	215 (62.0)	156 (94.0)	151 (79.1)
Race/ethnicity—n (%)						
White	461 (80.7)	260 (58.8)	438 (88.5)	287 (82.7)	64 (38.6)	132 (69.1)
Hispanic	66 (11.6)	160 (36.2)	22 (4.4)	20 (5.8)	11 (6.6)	39 (20.4)
Other	44 (7.7)	22 (5.0)	35 (7.1)	40 (11.5)	91 (54.8)	20 (10.5)

Data source: Oregon Department of Education http://www.ode.state.or.us/data/reports/toc.aspx#students. Data reflect 2013–2014 enrollment information.