

Exercise Level and Energy Expenditure in the TAKE 10![®] In-Class Physical Activity Program

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ABSTRACT: *This study evaluated the effectiveness of an innovative, classroom-based physical activity prevention program designed to integrate academic curriculum elements along with a physical activity program in providing moderate-to-vigorous intensity physical activity. A convenience sample of three public school classrooms (one first, third, and fifth grade class) was observed implementing the TAKE 10! program while monitored by either CSA accelerometers or digital pedometers. Pedometer step counts and CSA data were recorded for each student and activity. As calculated from CSA data, average MET levels during the activities were 5.72-7.05 (first grade), 5.51-6.77 (third grade), and 4.98-7.19 (fifth grade), and levels were not different between grades ($p > 0.05$). Average caloric expenditure (Kcal) per 10-minute session was 25.6-27.8 (first grade), 27.6-33.9 (third grade), and 29.7-42.9 (fifth grade). Measured pedometer step counts per session ranged from 644-931 in first grade, 659-1,376 in third grade, and 1,002-1,041 in fifth grade. TAKE 10! sessions for all three grades produced exercise levels in the moderate intensity range throughout full duration of the session. Classroom-based physical activity promotion provides a useful strategy to promote meaningful physical activity among school children. (J Sch Health. 2004;74(10):397-400)*

Obesity among US children has reached epidemic proportions. The percent of overweight children and adolescents more than doubled since the early 1970s.^{1,2} Today, approximately 9 million young people are considered overweight.³ Obesity in children increases their risk for becoming obese adults, and for developing diabetes, hypertension, coronary heart disease, osteoarthritis, and some cancers.^{4,6} While causes of childhood obesity remain unclear, improper diet and inadequate physical activity are considered primary contributors to the problem.^{7,8}

Children must learn early how to incorporate activity into their everyday lives, because research suggests active children become active adults.⁹ Schools provide ideal sites to intervene with children due to classroom teachers acting as health and physical activity role models for children and amount of time children spend at school.^{10,11} Paradoxically, school structure also introduces barriers to physical activity promotion. Policies at the state and national levels that call for improvement in standardized test scores are often achieved, in part, by increased time in core academic subjects. Those policies frequently lead to competition for the number of minutes allocated for non-core subjects, such as physical education.^{12,13}

Emphasis on improvement of standardized test scores in a variety of academic disciplines caused many schools to decrease physical education and recess programs for elementary school children, thus diminishing opportunities for physical activity. Only 8% of elementary schools provide daily or the weekly equivalent of 150 minutes of physical activity.¹⁴ Furthermore, studies suggest children who are inactive in school do not compensate for it with increased physical activity outside of school.^{7,8}

Innovative approaches have been suggested to increase activity levels of children during the regular school day.

One study examined physical activity patterns of children in structured physical activity breaks versus traditional recess breaks. The structured physical activity breaks provided students with moderate-to-vigorous physical activity. Students were more active during structured physical activity breaks than traditional (unstructured) recess periods.¹⁵ This finding suggests that changes, which fit within the current public school systems, can increase physical activity. Likewise, any factor that increases habitual daily energy expenditure, even by a small amount, may have a positive impact on maintenance of healthy body weight.¹⁶

To address the need for increased physical activity among school-aged children, the International Life Sciences Institute Center for Health Promotion (ILSI CHP) developed the TAKE 10![®] program, a classroom-based, physical activity promotion program that integrates activity into the elementary school academic curriculum.¹⁷ The program provides teachers with grade-specific activities linked to core curriculum objectives in mathematics, science, social studies, language arts, and character education. The program provides physical activity that reinforces academic concepts and skills. Ten-minute physical activity sessions implemented during regular class time substitute for a seated activity. Teachers conduct one or more 10-minute session per day in addition to any physical education or recess periods provided for students. This study evaluated exercise intensity level and estimated energy expenditure achieved by elementary school students participating in TAKE 10!.

METHODS

A convenience sample of three classrooms in DeKalb County, Ga., was selected at an elementary school already implementing TAKE 10! during spring semester 2001. School enrollment included 88% African American, 7% Hispanic, and 5% Caucasian students. Sixty-four percent of the school population qualified for free/reduced lunch. Classrooms were selected based on teacher willingness to participate in data collection and school administrator support. One class each of first, third, and fifth grade was recruited for a total of three classrooms and 71 students. Age and grade demographic variables were collected to ascertain energy expenditure at the classroom level. Each

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class was evaluated for five days, which included eight to nine activity sessions per class.

Teachers attended a two-hour training session, conducted by ILSI CHP staff (a certified teacher), that included information on curriculum integration, link between health and academic learning, and the proper teaching mechanics of TAKE 10!. Proper teaching mechanics included frequency, intensity, and duration of TAKE 10! activities. Teachers modeled the lessons to ensure they understood the recommended implementation techniques and strategies.

During each activity, five students wore CSA accelerometers (Computer Science Applications, Inc., Shalimar, Fla.) placed at mid hip.¹⁸⁻²⁰ The remaining students wore electronic pedometers (Walk4Life, Plainfield, Ill.) also placed at mid hip. Accelerometers were rotated among the students so all students had equal opportunity to wear them.

Teachers recorded the frequency of each activity implemented over the study period as well as step counts from the pedometers after each activity session. CSA data were downloaded into a computer at the end of the week with results carefully recorded for each student and each session. Mean duration per activity was determined by dividing the activity specific cumulative duration by number of times implemented (frequency). In addition, total minutes per activity was calculated as the sum of activity specific CSA counts. CSA minute-by-minute counts were entered into the age-specific, child-compatible CSA formula for determining energy intensity (MET levels).²¹

Using criteria supplied by CSA, this procedure allowed for identification of light (< 3 METs), moderate (3-6

METs) and vigorous (> 6 METs), exercise intensity levels during each minute of every activity session. To estimate caloric expenditure per session, MET levels were applied to mean body weights as supplied by NHANES for ages six (first grade), eight (third grade), and 10 (fifth grade). Grade specific CSA minute-by-minute counts were compared using an analysis of variance (ANOVA). Informed consent was obtained from all study participants and from a parent or guardian. The study was approved by the Institutional Review Board of Georgia State University.

RESULTS

Table 1 contains the number, name, and duration of TAKE 10! sessions implemented during the study week. The three grades reported a similar number of sessions (eight - nine) during the study week. Mean session durations were also similar across grades, ranging from approximately 10 to 11 minutes per session. Total time spent in TAKE 10! sessions during the study week for the three classrooms was 86.1 (fifth grade), 88.9 (first grade), and 91 (third grade).

Table 2 contains step counts and the estimated energy expenditure level of children for each grade and activity type. CSA counts increased with grade level, averaging 2,931, 3,443, and 3,872 counts for first, third, and fifth grades, respectively. However, after adjusting for estimated mean body weights, MET values were similar across grades, ranging from 6.16 to 6.42 METs. All sessions were associated with MET values in the moderate to vigorous range of energy expenditure. Energy expenditure expressed in Kilocalories (Kcal) averaged from approximately 25 to

Table 1
Summary of TAKE 10! Activities by Grade

Grade	Number of Sessions	Activity Name*	Mean Duration (Min./Session)	Total Time per Week (Minutes)
1st Grade	3	1. Sums in motion	11	33
	3	2. Aim for fitness	11.3	33.9
	2	3. Knee deep in snow	11	22
	Total	8		88.9
3rd Grade	2	1. Math on the run	11	22
	1	2. Safety cheer	10	10
	2	3. Aim for fitness	9.5	19
	1	4. Knee deep in snow	10	10
	3	5. Stories in space	10	30
Total	9		91	
5th Grade	3	1. Aim for fitness	10.7	32.1
	3	2. Math on the run	11	33
	2	3. Stories in space	10.5	21
	Total	8		86.1

* Name given to a specific activity depicting the physical activity and academic content. Each activity is grade specific, and although some activity names are the same for multiple grades, the academic content is based on the national curriculum standards for the specific grade.

37 Kcal, and increased with grade. Kcal expenditure was significantly different when comparing first and fifth grades. Pedometer step counts, which averaged from 743 to 1,022 counts, also increased with grade.

DISCUSSION

This study confirmed that a classroom-based physical activity program, integrated with the academic curriculum, can promote meaningful energy expenditure among first-, third-, and fifth-grade children. Participants achieved exercise intensities in the moderate to vigorous range and maintained these levels throughout the activity sessions. This finding also supports the premise that classroom teachers can incorporate in-class structured physical activity, which may provide more intensive physical activity than unstructured activities.¹⁵ Teachers participating in the study indicated the program was easy to implement, and required minimum preparation time, and their students enjoyed the activities.

A comparison group was not used because the study measured energy expenditure achieved during selected TAKE 10! activities. Staff assumed students who participated in TAKE 10! activities experienced the measured increase in energy expenditure from the intervention. Students who did not participate in the activities did not experience an increase.

Exercise intensity varied by activity within grade levels with some activities producing exercise intensities as much as 44% higher than others. Activities that produced the highest intensity levels varied from grade to grade, possibly indicating classes performed the activities somewhat differently. MET levels were not different among grade levels.

Development, testing, and revision of TAKE 10! began in 1999. During 2000-2001, pilot testing of program imple-

mentation patterns, energy expenditure, teacher attitudes and behavior, and attraction to physical activity was completed. Additional format (no content) changes were completed in October 2002.

Participants in individual sessions burned a modest number of Kcal, ranging from approximately 25 to 37 Kcal per 10-minute session. Caloric expenditure, while not significantly different between adjacent grades, was different between grades one and five, perhaps because of the higher body weights of fifth-grade students. Although a relatively small number of Kcal were used per session, students who perform 5 to 10 sessions per week conceivably could be expected to burn 150-300 Kcal per week through TAKE 10! sessions. This accumulated energy expenditure may create a long-term impact on developing overweight and obesity.¹⁶ Moreover, multiple 10-minute periods of moderate to vigorous physical activity can accumulate through sessions like TAKE 10!, helping children achieve the recommended 60 total minutes per day and discouraging extended periods of physical inactivity in the classroom.²²

The program seeks to complement existing curricula in the classroom and physical education, therefore not detracting from classroom instruction time or physical activity meant for physical education. While helping students achieve the recommended level of physical activity, the activities also contribute to balancing energy intake and energy expenditure. These physical activities, even by a small amount, may create a positive impact on maintaining healthy body weight.

Limitations of the study included use of a convenience sample of three classrooms from one school. In addition, the evaluation represented a small percentage of the more than 30 activities that could be implemented in the classroom.

Table 2
Step Counts and Estimated Energy Expenditure by Grade and TAKE 10! Activity

Grade	n	Activity Name	CSA Counts*	METs*	Kcal*	Pedometer Step Counts*
1st Grade	3	1. Sums in motion	3797.37 ± 659	7.05 ± .84	27.82 ± 3.31	931 ± 307
	3	2. Aim for fitness	2244.55 ± 433	6.50 ± .55	25.64 ± 2.17	653 ± 259
	2	3. Knee deep in snow	2751.39 ± 169	5.72 ± .68	22.57 ± 2.68	644 ± 152
Mean			2931	6.42	25	743
3rd Grade	2	1. Math on the run	3956.52 ± 548	6.77 ± .66	33.89 ± 3.28	1376 ± 284
	1	2. Safety cheer	3941.38 ± 690	6.75 ± .83	33.80 ± 4.13	1089 ± 242
	2	3. Knee deep in snow	3498.68 ± 489	6.22 ± 1.31	31.15 ± 6.55	711 ± 184
	1	4. Aim for fitness	2914.55 ± 700	5.53 ± .84	27.66 ± 4.19	896 ± 283
	3	5. Stories in space	2902.22 ± 429	5.51 ± .51	27.58 ± 2.57	659 ± 209
Mean			3443	6.16	31	946
5th Grade	3	1. Math on the run	4760.19 ± 619	7.19 ± .99	42.92 ± 5.91	1023 ± 177
	3	2. Stories in space	4075.13 ± 827	6.43 ± .93	38.34 ± 5.53	1002 ± 169
	2	3. Aim for fitness	2781.70 ± 311	4.98 ± .50	29.70 ± 2.97	1041 ± 192
Mean			3872	6.2	37	1022

* Values are mean ± SD

CONCLUSIONS

TAKE 10! provided participants with physical activity of moderate to vigorous intensity during the 10-minute activity sessions. The brief bouts of physical activity performed in the classroom, when accumulated over multiple sessions may play an important role in energy expenditure and may help contribute to maintaining energy balance.

TAKE 10! offers an effective means of increasing student physical activity through academically linked activities. The program fits within the public school system without requiring additional staff or extensive training, and program content appeals to multiple learning styles. Future studies should test effectiveness of the intervention regarding energy expenditure, teacher attitudes, and implementation characteristics using comparison schools or classrooms. ■

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