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A Ballroom Dance Classroom Program Promotes Moderate to Vigorous Physical Activity in Elementary School Children

Abstract

Purpose—To determine if an existing ballroom dance classroom program meets national recommendations to engage children in moderate to vigorous physical activity (MVPA) for > 50% of class time and to determine class effects on body mass index (BMI).

Design—Prospective descriptive study.

Setting—Two New York City public schools.

Subjects—Seventy-nine fourth and fifth grade students.

Measurements—The System for Observing Fitness Instruction Time (SOFIT) and direct heart rate monitoring were used to determine subjects' MVPA levels during class time. Weight and height were measured to calculate BMI.

Analysis—Means were calculated for continuous variables; frequency counts and percentages were calculated for categorical variables. Change in BMI percentiles was assessed using Bhapkar's chi-square test of overall marginal homogeneity.

Results—Data from SOFIT observations showed that a mean of 50.0% and 67.0% of class time in the first and second halves of the program were spent in MVPA. Data from the heart rate monitoring data revealed that 71.1% of students were at ≥25% heart rate reserve, indicating MVPA, for ≥50% of class time. Improvement was seen in BMI percentile ($P=0.051$).

Conclusion—Ballroom dance provides MVPA in elementary school children for ≥50% of class time and has a positive impact on BMI percentiles.

Keywords

Child; Obesity; Physical Activity; Dance Therapy; Research; Descriptive; Quantitative; Behavioral; School; Fitness/Physical Activity; Skill Building/Behavior Change; Youth; Geographic Location

PURPOSE

Childhood obesity is a serious health concern in the United States, affecting children of all races, ethnicities, and income levels with increasing prevalence.¹⁻⁶ The obesity rate has risen from 6.5% in 1980 to 17% in 2006 in 6 to 11 year olds.^{1,2} Modifying physical activity (PA) behaviors in children may have an impact on this phenomenon and on the subsequent morbidity and mortality in adulthood.⁷ Healthy People 2010, a national health promotion and disease prevention initiative, has identified goals for children and adolescents to promote cardio-respiratory fitness. It advocates at least 30 minutes of moderate PA for 5 or more days per week, and vigorous PA for 20 minutes or more for 2 or more days per week. These recommendations also call for daily physical education for all students, as well as maintaining PA for at least 50% of school physical education class time.⁷ In addition, the Expert Committee on the Assessment, Prevention and Treatment of Child and Adolescent Overweight and Obesity, convened by the American Medical Association, the Department of Health and Human Services' Health Resources and Services Administration, and the Centers for Disease Control and Prevention have recommended that to achieve health and

psychological benefit, children should participate in at least 60 minutes of enjoyable moderate to vigorous physical activity (MVPA) accumulated throughout the day, everyday.⁸

School based programs have been used as an opportunity for intervention because they offer access to large populations of children.^{9,10} Prior studies demonstrate that school-level interventions in PA can promote long-term healthy modifications in behavior.^{9,11,12} In addition, PA national recommendations for children have been recently updated to stress the importance of being active in schools.^{7,8} However, school-based programs do not necessarily meet the recommendations of Healthy People 2010 which stipulate maintaining the appropriate level of activity, specifically in the amount of time spent being moderately to vigorously active while in school.^{7,13}

Obesity among elementary school-aged children in New York City is a serious health concern.¹⁴ Hispanic children aged 6 to 11 years have a higher prevalence of overweight and obesity compared to non-Hispanic white children of the same age (42.6% vs. 39.5%). Children in lower income inner city neighborhoods have a higher risk for obesity in addition to having fewer PA-related resources, safe environments, and green space available to them. Most programs developed to increase PA in inner city children have been largely unsuccessful and/or unsustainable. Dance has been identified as a favored activity that could be efficacious in promoting increased PA.^{15,16} A previous study reported that an after school program incorporating dance in conjunction with family-based home intervention activities may exhibit trends toward lowering body mass index (BMI) and decreasing sedentary screen time.¹⁷ Additional studies investigating the use of a dance video game (Dance Dance Revolution) also showed decreased sedentary screen time and increased aerobic fitness among school-aged children.^{18, 19}

The purpose of this study was to examine a current New York City public elementary school classroom-based ballroom dance program to determine whether students taking part in the program could achieve recommendations for PA as defined by Healthy People 2010. These recommendations include engaging children in MVPA for at least 50% of class time. This would allow for greater and more creative options in promoting PA in our nation's public schools. An additional objective was to determine if there was an impact on BMI.

METHODS

Design

The study was a descriptive prospective study that evaluated the activity levels and changes in BMI of elementary school children taking part in an existing New York City classroom ballroom dance program. Of note, during the study period, no structured physical education classes were available to the students in the participating schools. The students were allowed free play during daily recess during this time. Additional options for PA during the school day were limited prior to onset of and during this arts-in-education class.

Sample

Subjects were children, ages 8 through 11, who were enrolled in the fourth or fifth grade in two public elementary schools in New York City. Two schools were chosen among those participating in the dance program and were matched demographically to include similar ethnic make-up and qualification for free lunch. The two schools were invited to participate and permission from school administration was obtained. Inclusion criteria stipulated enrollment in classrooms participating in the dance program. A total of 3 classrooms were eligible in the participating schools. Exclusion criteria included children without parental consent. The ballroom dance program was conducted over a 10-week period that ran from February through June 2006. Dances included ballroom dances such as swing, meringue,

tango, and foxtrot. All subjects took part in the dance program during regular classroom hours as part of an arts-in-education, not physical education, program. The program provided the only structured classroom PA for the students during the study period.

The study was approved by the Weill Cornell Medical College and the New York City Board of Education Institutional Review Boards. Each subject's parent or guardian provided written informed consent, and all subjects provided written assent prior to participation. The consenting process took place at the school prior to the start of the study.

Instruments

Students classified themselves in 1 of 5 race/ethnicity categories: Hispanic/Latino, African American/Black, Asian, Caucasian/White, or other. Date of birth and gender were self-reported. Using a standardized protocol before the start and upon completion of the program, all participants had their weight measured with the same scale (Detecto Scales, Inc, Brooklyn, NY) and their height measured with the same stadiometer (Holtain Limited Stadiometer, Crymych, DYFED) by licensed healthcare professionals at the Clinical and Translational Science Center (CTSC), formerly the General Clinical Research Center (GCRC). Body mass index (BMI) was calculated. BMI's were evaluated into sex and age specific Z scores and percentiles using 2000 CDC growth charts.²⁰

Procedures

The dance instruction was curriculum based and taught by professional ballroom dance teachers under the direction of a dance company. This provided uniform standardized instruction to all classes in that all the dance instructors had similar training and each student had the same lesson taught, regardless of grade or school. Dance steps were taught and then reviewed to reinforce what had been previously learned through practice and repetition. The entire dances were practiced to musical songs. One instructor and one class room teacher was available for each class taught. The number of students in the class ranged between 25 and 30 students. While the dance program was in session, investigators visited the schools during the class period to assess subject's PA using two validated research tools. Observations and measurements were made on random dates throughout the 10-week program in order to monitor changes in level of conditioning as the program progressed.

The System for Observing Fitness Instruction Time (SOFIT) observation method, a validated heart rate (HR) observation system, was used to evaluate activity levels.²¹ During each visit, the PA levels of four randomly selected students were observed per SOFIT protocol. Students were alternated by gender (male, female, male, female). Each student was observed for 20 seconds each, sequentially, and in a cycle (repeating the same four students) until the class time was over. Research staff pre-recorded instructions on an audiotape to indicate 20 second periods comprised of a 10 second interval of observation followed by a 10 second interval of recording physical activity. Five activity codes were used and included lying down, sitting, standing, walking, and very active. As per standard instructions, walking and very active intervals were included in the designation of MVPA. Two observers independently coded students' activity during the SOFIT observation collection sessions in order to assess reliability between raters. Data throughout the 10 week dance program looked at overall performance and consistency of performance during the first 5 weeks (first half) when compared to the second 5 weeks (second half) to determine if there were similar activity levels present. The SOFIT observation method was used to evaluate the class as a whole.

HR monitoring was used to evaluate the participants on an individual level, then data were added together as parts of a whole. During additional randomly selected school visits,

subjects wore a HR monitor (Polar Heart Rate Monitor S610) for entire class sessions as a measure of PA.²² Heart rate monitors were placed on all students participating in the study during the first visit. Interference was found in the data recorded from children being too close together in the partner dancing. Therefore some of the data was unable to be analyzed. In subsequent visits, the monitors were placed on either boys or girls to avoid interference. Additional visits were made so that both boys and girls had an opportunity to wear HR monitors. HR data was obtained from continuous recording of HR in 5-second intervals during the entire class period. We used a level of at least 25% of heart rate reserve (HRR) with an estimated equivalence to at least 3 METS to indicate MVPA.²³⁻²⁵ Using the HR monitor measurements and the Karvonen formula for HRR [(exercise HR – resting HR)/(maximal HR– resting HR)], the amount of time the subjects were in MVPA was calculated. We used a maximal HR of 200 beats per minute to calculate HRR.²³

Data Analysis

Means were calculated for continuous variables; frequency counts and percentages were calculated for categorical variables. Change in BMI risk categories was assessed using Bhapkar's chi-square test of overall marginal homogeneity. The weighted kappa coefficient was used to assess reliability between raters for the SOFIT. Data were analyzed with SAS v8.02 (SAS Institute, Inc., Cary, NC).

RESULTS

Three classrooms consisting of a total of 82 students participated in the study. Seventy-nine (96.3%) of the 82 students were enrolled in the study; 3 were excluded due to parental refusal. Eighty-seven percent were self-identified as Hispanic/Latino, 5% were African-American, 1% was white, 1% was other, and 5% were unknown. The average age was 10.3 years old (range 8.5-11.9). Thirty-five (44.3%) were male; 44 (55.7%) were female.

Eight visits were done for SOFIT observations as described above and 13 for HR monitoring. The visits were divided among the 3 classes throughout the program.

The overall proportion of observed agreement between the two raters for the SOFIT measurements was 58% (551 out of 956 ratings). Reliability between raters as measured by the weighted Kappa statistic was 0.40 (with a 95% confidence interval of 0.35, 0.45). Overall, using the SOFIT activity code categories, rater 1 reported 14.8% walking and 43.5% very active; rater 2 reported 13.3% walking and 43.5% very active. Table 1 represents data taken from SOFIT measurements. Mean class time was 48.2 minutes, with a mean of 50.0% and 67.0% of class time in the first and second halves of the program, respectively, being spent in MVPA. In Table 2 data are shown from the HR monitoring and include HR data at a minimum of 25% HRR. The mean maximal HR was 166. Students spent a mean of 68.6% of the class time with at least a 25% HRR. Overall, 71.1% of students were at a minimum of 25% HRR for >50% of class time. Attendance was not monitored or factored into the analysis for both the SOFIT and HR measurements as subjects were analyzed as parts of a whole.

A total of 71 students (89.9%) had height and weight measurements pre and post the 10 week ballroom dance program. Some students did not have height and weight measured due to their absence on day of measurements. This was due to attendance only. When the baseline BMI percentiles were compared to the post-program BMI percentiles (adjusted for age and sex), 30 (42%) vs. 39 (55%) students were in the normal weight category (<85th percentile), 17 (24%) vs. 11(15%) were in the overweight category (85-<95th percentile), and 24 (34%) vs. 21 (30%) were in the obese category (>95th percentile). Eighty-six percent of the students remained in the same BMI category, 14% improved one or two categories,

and none of the students moved to a category of greater risk. This improvement in BMI category from baseline to completion of program was near statistical significance ($p=0.0511$) (Table 3).

DISCUSSION

The results of this study demonstrate that an existing classroom ballroom dance program for elementary school children offers a novel means for students to be physically active in the classroom. The ballroom dance program used in the study is a preexisting art-in-education program based on a standardized curriculum with the purpose of using ballroom dance as a medium to nurture respect, teamwork, confidence, and joy. This activity occurred outside of a physical education class and allowed almost universal participation among all students in the classroom regardless of athletic ability, body habitus, gender, or physical fitness. Given that the curriculum is a standardized curriculum replicated in many different areas of the country, the music and dances were not specifically tailored to be culturally appealing and instead focused on social dances including rumba, tango, meringue, swing, waltz, and fox trot, which have cross cultural appeal. Results may have been different if culturally adapted music and dance were used; however, this would decrease the ability to replicate the program in different areas and populations.

Students participating in this study were able to achieve levels of PA that are recommended by Healthy People 2010. The ballroom dance program promoted MVPA during at least 50% of the class time in 9 to 11 year old children. The students taking part in the ballroom dance program had a mean time of 30.1 minutes of MVPA per class period, which was consistent with the suggestion of Healthy People 2010 to maintain PA at least 50% of school class period time as well as the recommendation for 30 minutes of MVPA.⁷

Baseline PA levels were not obtained on the students. The CDC conducted a nationally representative survey of children 9 to 13 years of age and reported that 61.9% of these children do not engage in any organized activity in nonschool hours and that 22.6% of them do not engage in any free time physical activity.³ In a New York City audit of 100 elementary and 50 middle schools randomly surveyed in January of 2008, it was found that only 50% of elementary schools offer physical education only once per week. Out of 20 school districts audited from July 2007 to July 2008, 19 of the 20 schools failed to meet requirements of a minimum of 120 minutes of physical education per week.²⁶ Average activity levels, taken during the day including time both in school and out of school, have been previously reported to decrease steeply with age from 9 to 15 years old. This supports addressing physical activity needs as early as possible.²⁷

Data on PA was obtained using two validated methods, both subjectively with the SOFIT observation method to determine entire classroom activity and objectively using direct HR monitoring to determine individual activity. Direct comparison of methods is not available, as the SOFIT observations and the HR measurements were not obtained on the same day. Both methods support that ballroom dance can provide MVPA.

Of note, there was high interindividual variability in the amount of time spent in MVPA while participating in the dance class. In addition, there was interrater variability during SOFIT observations. Some difficulties may have existed in staying in sync during the 20-second intervals and discrepancies in interrater observations may be due to this timing issue. When comparing amount of time observed and recorded in each activity over the course of the class period, percentages were remarkably similar between raters and suggest that the conclusions from the SOFIT instrument would be similar based on either rater's observations.

Measurements were taken throughout the 10-week period. The first half of the program was compared to the second half to see if MVPA was consistent through all 10 weeks of the program. Each half demonstrated a minimum of 50% of class time being spent in MVPA. This shows that ballroom dance is an activity that consistently provides children with an adequate level of MVPA meeting Healthy People 2010 guidelines throughout the 10 weeks.

The levels of overweight and obesity that were encountered were notably higher than those reported in the previous literature (58% vs. 31-43% for BMI $\leq 85\%$ and 34% vs. 18-24% for BMI $\geq 95\%$).^{28,29} Consequently, it is important that daily PA is promoted in schools, considering the number of elementary school-aged children who are overweight. The percentages of overweight and obese decreased and the percentages of normal weight increased from pre-participation to post-participation in the program. These changes were near statistical significance ($p=0.051$).

Ballroom dance provides children an opportunity to participate in MVPA. Dance has been reported as a common and favorite activity regardless of the ethnicity in girls.¹⁶ The skills acquired from dance give children the ability to dance at home or in other social situations, not just in the context of a school program. Basic ballroom steps may form the basis for other dance modalities. The generalizability of these dance skills may contribute to a more active lifestyle change. Further studies using other popular dances or culturally adapted dances would be worthwhile to determine if additional positive changes are present.

Limitations

Numerous limitations to this study exist. The study subjects were predominantly of Latino/Hispanic ethnicity located in an inner city community during the winter and spring seasons. Differences in population (ethnicity), community characteristics (location), and season may have affected the level of activity achieved outside of the dance class. In addition, because of the small sample size from just two schools in one city, the external validity of this study is challenged. Also, data from a control school without dance intervention were not utilized in our analysis of BMI percentiles changes.

Although the curriculum was standardized, there was variability even within classrooms in the same school with the same instructor. Despite this variability, students from all the classrooms were able to maintain PA for at least 50% of class time. Classroom dynamics, peer relationships, student-teacher rapport, and discipline issues may have had an impact, but were not specifically evaluated. It is also possible that while students were being monitored, either with the SOFIT observations or the HR monitoring, that they had an increase in their effort and participation. This was not reported as observed by either the dance instructors or classroom teachers, and was not accounted for and measured. The program may be improved by additional quality control of the instructors and methods of instruction. Given, however, that the primary purpose of this program is an arts-in-education program and is not meant as a means for students to be physically active during class time, we feel it is a creative option offering impressive levels of additional PA for students involved, especially as an adjunct to activity levels in school environments without dedicated physical education classes.

Other contributing factors to changes in BMI may include other activity changes, baseline fitness levels, dietary habits, and measurement error. We did not assess the students' levels of PA outside of the classroom program during, before, or after school hours. We do not know whether students made other changes triggered by this increase in school activity with the dance program.

We are unable to generalize results to all dance programs; however, the results of this study serve to support the current established ballroom dance program as a program for promoting and integrating MVPA in elementary school children.

SO WHAT?

What is already known on this topic?

Childhood obesity is an epidemic and is affecting the health of elementary school children. Existing literature does not include studies on school interventions using dance as a means to provide PA to students.

What does this article add?

The classroom ballroom dance program that we studied meets Healthy People 2010 guidelines by providing an activity besides physical education to elementary school children that engages them in MVPA for 50% of class time. During this study we also found that there may be a possible positive impact on BMI percentiles. Providing activities that engage a large percentage of the class time in MVPA may be one avenue to address the problem of inadequate levels of childhood PA and of increasing rates of childhood overweight.

What are the implications for health promotion practice or research?

Providing ballroom dance through the arts-in-education program will allow children to have another avenue to be physically active during school hours in addition to the physical education classes. This would contribute to helping children meet 60 minutes of MVPA daily and may encourage healthy lifelong activity habits addressing problems with overweight.

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Table 1

Data obtained from the System for Observing Fitness Instruction Time (SOFIT) observations

	First Half	Second Half	Overall
Mean lesson observation length in minutes	44.4	51.1	48.2
Activity by % of class time			
Lying Down	0%	0%	0%
Sitting	9.20%	4.00%	6.20%
Standing	40.90%	29.00%	34.10%
Walking	16.30%	16.80%	16.60%
Very Active	33.70%	50.20%	43.10%
Mean Minutes in moderate vigorous physical activity (MVPA)	22.5	35.7	30.1
Percent of class time in moderate vigorous activity (MVPA)	50.00%	67.00%	59.70%

Table 2

Data obtained from Heart Rate (HR) monitoring

	First Half	Second Half	Overall
Number of students with HR recordings	14	62	76
Mean HR during dance class (beats per minute)	118.2	116.5	116.8
Percent of time at 25% Heart Rate Reserve (HRR)	63.40%	69.70%	68.60%
Number (and percent) of students with 25% HRR for 50% of class time	9 (64.3%)	45 (72.6)	54 (71.1%)

Table 3

Mean Change in Body Mass Index (BMI) Percentiles (Adjusted for Age and Sex)

Variable	n	Mean	Std Dev	Minimum	Maximum
Pre BMI percentiles	71	77.3	23.9	12.5	99.4
Post BMI percentiles	71	74.5*	24.7	6.5	99.5

* p =.0511