"Bizzy Break! The Effect of a Classroom-Based Activity Break on in-School Physical Activity Levels of Primary School Children" by Murtagh EM, Mulvihill M, Markey O
Pediatric Exercise Science
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Section: Article

Article Title: Bizzy Break! The Effect of a Classroom-Based Activity Break on in-School Physical Activity Levels of Primary School Children

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Running Head: Effect of a classroom physical activity break

Journal: *Pediatric Exercise Science*

Acceptance Date: January 9, 2013

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ABSTRACT

The school has been identified as a key setting to promote physical activity. The purpose of this study was to evaluate the effect of a classroom-based activity break on in-school step counts of primary school children. Data for 90 children (49 boys, 41 girls, 9.3 ± 1.4 years) from three Irish primary schools is presented. In each school one class was randomly assigned as the intervention group and another as controls. Children's step counts were measured for five consecutive days during school hours at baseline and follow-up. Teachers of the intervention classes led a 10 minute activity break in the classroom each day (Bizzy Break!). Mean daily in-school steps for the intervention at baseline and follow-up were 5351 and 5054. Corresponding values for the control group were 5469 and 4246. There was a significant difference in the change in daily steps from baseline to follow-up between groups ($P<0.05$). There was no evidence that girls and boys responded differently to the intervention ($P>0.05$). Children participating in a daily 10 minute classroom-based activity break undertake more physical activity during school hours than controls.

Key words: physical activity, classroom break, primary school

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There is overwhelming evidence that regular physical activity (PA) impacts positively on health (21). Children who are physically active have lower rates of obesity, diabetes, hypertension, hypercholesterolemia and depression than their inactive peers (11-12). Activity in childhood is also thought to reduce the development of chronic diseases in adulthood (2). Despite this evidence high proportions of children in Europe (22) and the US (4) do not meet recommended guidelines of 60 minutes moderate to vigorous PA per day (29). While objective data on the PA levels of Irish children is scarce (1, 18, 31), it echoes trends in other western societies and highlights the need for intervention.

The school has been identified as an ideal setting in which to promote PA (20) as it gives access to children regardless of age, ethnicity, gender and socio-economic class. A review of 26 studies found that school-based PA interventions have positive effects for duration of PA, television viewing time, cardiorespiratory fitness and blood cholesterol levels.(7) It has been suggested that 30 minutes of moderate to vigorous PA should be accumulated within the school day (20). To meet this goal opportunities need to be provided outside traditional occasions, such as break time and physical education class, for children to be active. Incorporating short bouts of activity throughout the school day could help children accumulate the required amount of PA.

While intuitively schools should facilitate children's PA, many schools are primarily of place of learning through traditional sedentary methods where covering curriculum content and academic concepts are the priority. Because of budgetary constraints and growing pressure on administrators and teachers to increase academic achievement scores, opportunities for PA are being reduced or eliminated (17). An effective environmental approach to increase physical activity has been to incorporate activity breaks into the primary school classroom (19). Several researchers have attempted to make the integration of PA into the school day more palatable to teachers by incorporating physically active methodologies

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with academic concepts (15). However these approaches have an associated need for resources and/or training which may not be attainable in this time of budget-cuts and austerity (8). Recently a low-cost, teacher-directed classroom intervention was shown to increase PA levels of children compared to controls (8). However as teachers in the study received training from two experts in the area of classroom-based PA, this has a resource and personnel implication which may limit the scope to replicate the programme on a large scale basis.

Thus public health professionals who wish to encourage schools to adopt physically active practices are faced with the challenge of providing a programme which is low-cost, does not require formal training and can be delivered by teachers with minimal investment in time. A classroom PA break which is supported by attractive resources, such as a student poster, teacher notes and music CD, was designed to meet these requirements. The purpose of the present study was to evaluate the effect of this classroom-based activity break on in-school step counts of primary school children. A secondary aim was to augment the limited data on objectively measured PA level of Irish schoolchildren.

METHODS

Participants

Participants attended four rural primary schools. The grade level of these children was 2^{nd} – 6^{th} class. Two classes in each school at consecutive class levels were assigned to an intervention group or a control group in a randomised parallel design. Written informed consent was obtained from the parent/guardian of each child. Consent to participate in the study was granted by the parents of 165 children. The study received approval from the institutional research ethics committee.

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Instruments

Participants wore a pedometer (Yamax Digiwalker SW-200) during the school day. Pedometers show acceptable accuracy, reliability and validity (25, 28) and the Yamax has been designated as a 'research grade' instrument (26).

Procedure

Height and weight of each child was recorded according to standard procedures (16). In order to determine baseline in-school PA levels, subjects in both the intervention and control groups were asked to wear a pedometer for five consecutive days during the school day. As the study sought to examine the impact of an activity break on in-school steps, out-of-school physical activity was not measured. Children were shown how to attach the pedometer to the waistband of their clothing (at the right hip, in line with the knee) (18) and asked to put it on as soon as possible after arriving at school and remove it at the end of the school day. Each child was given a record sheet and under supervision of the teacher noted the time the pedometer was put on and taken off, and the total step count at the end of the school day. Children were advised to go about their normal daily routine and not to open the pedometer case during the day.

In each school one class was randomly assigned as the intervention group and one class assigned as the control group. Teachers of the intervention classes were asked to lead a 10 minute activity break (Bizzy Break!) in the classroom each day for five consecutive days (10) and otherwise undergo the usual school day routine. The activity break included a series of mobility, stretching and pulse-raising exercises performed to music. Children participated in the space beside their desks. Prior to the intervention a member of the research team met with the teachers of intervention classes to provide a poster (summarising the activities), teacher notes (with detailed information on the activities) and a music CD (10). Teachers

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noted the time that the activity break was performed each day. Control classes underwent their normal daily routine during the intervention week. Daily in-school step counts for intervention and control classes were recorded using the same procedure as the baseline week. In all schools the intervention week immediately followed the baseline week. Data was collected between November 2010 and January 2011.

Data analysis

14 participants mislaid their step-count record sheets and were excluded from the study. Data was screened for outliers using the method of Kang & Brinthaupt (2009) who considered step counts during the school day (14). Daily step counts below 500 or above 15,000 were deleted. Seventy six data points (concerning 39 subjects) were excluded due to this criterion.

The wear-time noted by children on the record sheets was then inspected. If a subject did not wear the pedometer for a minimum of 5 hours per day the step-count for that day was deleted. This occurred for 246 data points (concerning 89 subjects). After screening for outliers and daily wear time, subjects missing 3 or more days of data per week were excluded (n=61). In total, 75 participants were excluded. All the children from one school were excluded as they did not meet the wear time criteria (n=38).

The mean imputation method based on an individual information-centered approach, proposed by Kang et al (13) and employed by Kang & Brinthaupt (14), was used to replace missing data. Therefore, if a subject had no more than two missing variables per week the mean of the other days were used to replace the missing variable. This occurred for 17 data points (14 subjects). After replacing missing data, 90 subjects from three schools had complete data sets (9.3 ± 1.4 years; 49 boys, 41 girls).

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Descriptive statistics were used to summarise subject characteristics and step counts. Data screening and manipulation were conducted in Microsoft Excel 2007 (Microsoft Corporation, Redmond, WA) and statistical analysis was performed using the SPSS statistics package (Version 19, SPSS, Woking, UK). Baseline difference between boys and girls were examined using t-tests. A mixed ANOVA was conducted to determine the effects of the programme on the intervention and control group, with one between subject factor (group) and one within subject factor (time). To examine the effect of the intervention on boys and girls, a mixed ANOVA was employed with two between subject factors (group and gender) and one within subject factor (time). Statistical significance was established at $P < 0.05$. Values are presented as mean ± standard deviation.

RESULTS

Data is presented for 90 participants from three primary schools. Subject characteristics are shown in Table 1. There was a significant difference between groups for age and weight. There was no significant difference between groups for BMI. Mean daily in-school steps for the entire sample at baseline and follow-up were 5418 ± 1864 and 4596 ± 2120 respectively. Boys took significant more in-school steps than girls (mean daily in-schools step at baseline: 5922 ± 1700 vs 4815 ± 1892, $P < 0.05$). Mean daily in-school step counts for the intervention and control group are presented in Table 2. The time x group interaction for mean daily steps was significant, suggesting that the intervention group and the control group responded differently to the intervention ($P<0.05$). No significant differences were found for the time x group x gender interaction, suggesting that boys and girls responded similarly to the intervention ($P > 0.05$). Sixty percent of the activity breaks took place between lunch and the end of the school day, 15% were conducted in the morning and 25% between the morning break (recess) and lunch.

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DISCUSSION

The findings of this study indicate that a 10 minute PA break has a significant effect on the in-school PA levels of children. This is encouraging as the intervention required no special skills or facilities, was implemented in limited space in classrooms and teachers received no training. At a time when schools are increasingly being looked at as sites for PA promotion and teachers are expected to take responsibility for improving the PA levels of the children in their care, this study provides support for an initiative that teachers can easily incorporate into their every day routines.

The finding that both the intervention and the control group demonstrated a reduction in steps between baseline and follow-up is difficult to explain. Data is presented from three different schools, during different weeks so the finding is not likely due to events at a school level. Anecdotally some teachers reported poor weather conditions which impacted on opportunities for outdoor play during break (recess) and lunch times. Variation in weather has previously been shown to impact on PA (24), however as weather conditions were not recorded in the present study this remains speculative. When using unsealed pedometers, it has been suggested that children will increase steps above their normal levels during the initial testing period, for example by jumping up and down or walking and running more than usual, to see the effect on the step-count display (23). Data collection in the present study was preceded by a familiarisation day where the children wore the pedometers; however it is possible that this was not sufficient length of time for children to become unreceptive to the presence of the pedometer. Ultimately as both the intervention and control groups were exposed to equal conditions, it is the difference between groups that demonstrates the positive impact of the Bizzy Break! programme.

Girls have been identified as being particularly at risk of inactivity (6) and previous research has demonstrated that low active girls do not increase their activity during leisure-

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time once the constraints of school were removed (9). In the present study there was no significant difference in the effect of the activity breaks between boys and girls. Therefore the Bizzy Break! programme may be attractive as an intervention that can impact positively on both girls and boys equally in the same classroom.

There is only one other Irish study that recorded in-school steps counts with which to compare our findings (1). An examination of the PA levels of 6 – 9 year old children noted in-school step counts of 3950 per day. The in-school step-count of children in the present study is considerably greater (5418 at baseline) and may reflect the fact that Belton's study included a wider age group and therefore younger children who typically exhibit lower daily step counts that their immediately older peers (27). Based on the findings of three studies, expected values for in-school steps have been proposed as 6700 – 7600 for boys and 4900 – 6100 for girls (27). The mean in-school steps for boys and girls in the present study (5922 and 4815 respectively) fall below the proposed range. Even lower values were reported for boys and girls children in 4th and 5th grade in the US (5042 and 4124 respectively) (3). The disparity in findings may represent not only different age ranges but also differing social and environmental factors between countries, and highlights the needs for further research to establish country-, gender- and age-specific norms (18).

Previous research examining physical activity levels during the entire day has found boys to be more active than girls (18, 30). However findings are equivocal when examining the duration of the day when primary school children are at school. As in the present study, Belton et al (1) and Brusseau et al (3) found that boys accumulated more PA than girls during school hours. Whereas Cox et al (5) and Hardman et al (9) found no interactive effect of gender among steps taken at school. Further investigation of in-school PA is warranted before firm conclusions can be drawn with regard to role of the school in promoting or hindering PA opportunities for a particular gender.

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Limitations

Limitations include the short duration of the intervention; therefore the long-term sustainability of the Bizzy Break! programme was not assessed. As discussed above, as the pedometers were not sealed reactivity may have occurred, particularly during the first week of data collection. Children from within the same school are not independent as they are likely to be influenced by factors such as school ethos, schools facilities and the distance of school from residential areas (18). Finally, we measured PA during the duration of the school day only; therefore it is unknown whether children adjusted their out-of-school PA when a Bizzy Break! was added to their daily routine. The use of an objective measure of PA, a control group and five days of monitoring are strengths of the study.

Conclusions

Children participating in a daily 10 minute classroom-based activity break undertake more PA during school hours than controls. The fact that the programme can be completed in the available space beside a child's desk, requires no special training for the teacher and is supported only by teacher notes, a poster and music CD may make it attractive to schools that are over-burdened and under-resourced. The activity break impacted on the PA levels of both girls and boys to the same degree. The use of a PA break should ideally be used as just one part of a school-wide policy to promote children's daily activity, as "active school" approaches that enhance physical education, provide activity breaks throughout the school day, integrate curricula that target sustained behaviour change and sedentary behaviours and connect with family and the community may offer the most promise for children (19). Future work should examine the intensity of the PA breaks using accelerometer or heart rate monitoring to detect the contribution to daily moderate to vigorous PA.

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Table 1: Subject characteristics. Mean (SD)

	Intervention (21 girls, 18 boys)	**Control** (20 girls, 31 boys)	**All** (41 girls, 49 boys)
Age (years)	9.9 (1.8) *	8.9 (0.7) *	9.3 (1.4)
Weight (kg)	40.7 (15.0) *	34.1 (7.3) *	37.0 (11.8)
BMI (kg/m^2)	19.7 (4.7)	18.3 (3.0)	19.0 (3.9)

*$P < 0.05$

Table 2: Mean daily in-school step count for the intervention and control groups at baseline and follow-up. N=90. Mean (SD)

	Baseline	Follow-up	Change
Intervention group	5351 (1862)	5054 (2199)	-297 *
Control group	5469 (1882)	4246 (2008)	-1222 *

* Significant difference in the change in step counts between the intervention group and the control group from baseline to follow-up ($P<0.05$)