

RESEARCH ARTICLE

Does a Higher Incidence of Break Times in Primary Schools Result in Children Being More Physically Active?*

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ABSTRACT

BACKGROUND: Regular physical activity (PA) has multiple benefits to health; however, the majority of schoolchildren do not reach PA guidelines of 60 minutes of moderate to vigorous PA (MVPA) daily. During the school day, break times are often the only opportunity for children to be physically active. This study investigated PA levels during school breaks in German primary school children.

METHODS: PA of 294 children (7.1 ± 0.7 years; 48% boys) was assessed. On the basis of timetables, individual activity times and intensities for daily breaks were determined. Children's weight status was determined on site.

RESULTS: Breaks lasted 30.7 (± 13.8) minutes; length varied significantly between 1 and 2 breaks (21.7 ± 4.1 versus 36.2 ± 14.8 minutes; $p \leq .01$). Children spent 25.3% of their breaks in MVPA, boys being significantly more active (30.8% versus 20.4%; $p \leq .01$). Time spent in MVPA differed significantly between normal weight and overweight/obese children (26.1% versus 18.4%; $p \leq .05$). Children having 2 breaks engaged in significantly more MVPA than those with only 1 (7.4 ± 6.1 versus 5.6 ± 4.7 minutes; $p \leq .02$).

CONCLUSIONS: Children spent 25% of their break in MVPA; having 2 breaks increased time in MVPA significantly, although this is also influenced by weight status. Consequently, more activity breaks should be scheduled during school hours.

Keywords: recess; MVPA; school-aged children; weight status.

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The prevalence of overweight and obese children has dramatically increased during recent years and, consequently, is of public health concern.^{1,2} The underlying reasons for increased weight and obesity are complex and diverse. These may include a combination of genetic, environmental, and psychological influences.^{3,4} Yet, physical activity (PA) is essential for normal growth and development⁵ and plays an important role in the prevention of increased weight and obesity.⁶

Apart from the positive effects on bone density,⁷ psychological well-being,⁸ body composition, and the prevention of obesity,^{9,10} it also has been shown

that PA at a young age is probably to be carried over into adulthood.^{11,12} Nonetheless, research has indicated that children's activity levels have decreased in recent years⁵ and only a small proportion of children engage in sufficient activity to gain health benefits.¹³ Moreover, a substantial number of schoolchildren in Europe¹⁴ and the United States¹⁵ are currently not reaching the international activity guidelines recommending 60 minutes daily of moderate to vigorous physical activity (MVPA).⁶

Opportunities for children to engage in daily PA are dependent on socioeconomic, environmental, and personal factors. Schools have been recognized

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as providing ideal environmental settings for the promotion of health-enhancing PA as they enable all children to avail themselves of the opportunity for PA.¹⁶ During the school day, besides formal physical education, break times are often the only occasion during which children can be regularly physically active. The advantage of break times over formal physical education is that children have the chance to engage in daily PA through play. Additionally, it has been suggested that children are more probably to participate in MVPA during unstructured play rather than in structured activity.¹⁷ Break times are scheduled in most primary schools for 1 period or more per school day and are typically held outside.¹⁸ However, whereas no empirically tested guidelines exist for ideal PA levels during break times, studies indicate that break times can contribute up to 40% of recommended daily PA levels.¹⁹ Therefore, if PA levels could reach 40% and 50% of break time being spent in MVPA, these environments could be considered “health promoting playgrounds.”^{19,20}

In Germany, most primary schools finish at lunchtime and are scheduled to have 1 or 2 break times per morning, which may vary vastly in length. The majority of previous studies have investigated schools in the United States,²¹ United Kingdom,²² Australia,²³ Denmark,²⁴ and other parts of Europe^{25,26} which have a different schooling system to Germany. Some of this research identified that children experience school breaks for 5 hours per week and up to 600 break times a year,¹⁹ offering a large amount of time where children can be physically active. However, these data are based on a 6- to 7-hour school day including 3 break times a day and consequently is only partially applicable.

The main purpose of this study, therefore, is first, to investigate PA levels during school break times in German primary school children. In addition, factors such as length and number of break times were assessed to determine the influence of these on children’s PA levels during those breaks.

METHODS

Participants

Data were collected in respect of 294 primary school children (7.1 ± 0.7 years; 48% boys) in southwest Germany, who were about to take part in the school-based health-promotion program “Join the Healthy Boat.”²⁷ Prior to data collection, parents provided written and informed consent and children their assent to taking part in the study.

Instruments

Trained technicians took anthropometric measurements such as children’s height (cm) and body mass (kg) which were taken to ISAK-standards²⁸ using a

stadiometer and electronic scales (Seca 213 and Seca 862, respectively; Seca Weighing and Measuring Systems, Hamburg, Germany). The children’s body mass index (BMI) was calculated as weight divided by height squared, and converted to BMI percentiles (BMIPCT) using German reference data²⁹ to define their weight status. Cutoff points for overweight children were determined above the 90th percentile; for obese children above the 97th percentile.

Procedure

Children’s PA levels over 6 consecutive days were quantified using a multisensor device (Actiheart®, CamNtech Ltd., Cambridge, UK). Owing to the simultaneous recording of bodily movement and heart rate, this enabled the assessment of both mechanical and physiological strain. Heart rate and body movement counts were recorded every 15 seconds. Energy expenditure was calculated using Actiheart®’s captive software (Version 4.0.73), utilizing age- and sex-specific data in addition to body mass, height, heart rate, and movement counts.

The validity and reliability of this multisensor device have previously been demonstrated when predicting energy expenditure in children during 6 common activities, in free-play situations.³⁰ Energy expenditure was used to determine activity levels, which were classified according to Pate et al³¹ as sedentary (<1.5 metabolic equivalent [MET]), light (1.5-3 MET), moderate (3-6 MET), and vigorous (>6 MET).

Individual break times were identified using timetables provided by the participants’ teachers. For each child, activity times and intensities for their daily break times were determined. Variables such as length and number of breaks, sex and weight status were grouped using median split and yes/no, respectively. Trained staff determined the size of available playground (in m²) during a school visit.

Data Analysis

Statistics were performed using SPSS Statistics 19 (SPSS Inc., Chicago, IL) with a significance level of $p = .05$. Descriptive statistics were calculated (mean values and standard deviations [SD]). Because the Kolmogorov-Smirnov-Tests showed non-normal distributions, Mann-Whitney *U* tests were subsequently used to examine group differences.

RESULTS

Children’s break times varied between 15 and 90 minutes per school morning with an average break time of 30.65 (±13.8) minutes. The data showed that 61.9% of children had 2 breaks in the morning compared to 38.1% who had 1 morning break. Length of break times varied significantly between 1 and 2

Table 1. Participant's Characteristics. Values Displayed in Mean and SD

	Boys	Girls	All
N (%)	140 (47.6)	154 (52.4)	294 (100)
Age (years)	7.2 (0.7)	7.1 (0.7)	7.1 (0.7)
Height (cm)	124.2 (6.5)	123.2 (6.3)	123.7 (6.4)
Body mass (kg)	25.1 (5.3)	24.4 (4.9)	24.7 (5.1)
BMPCT	49.7 (26.9)	47.7 (29.0)	48.6 (28.0)
Overweight/obese (%)	5.7/4.3	5.2/4.6	5.5/4.4

SD, standard deviation; BMPCT, body mass index percentile.

breaks per morning ($F = 13.07$; $p < .01$). Children with just 1 break had an average of $21.70 (\pm 4.1)$ minutes of playtime; children who were scheduled 2 break times had an average of $36.15 (\pm 14.8)$ minutes. Table 1 shows a summary of the participants' anthropometric characteristics. No significant sex differences were found.

The results showed that children, on average, spent their time in light activity (2.59 ± 0.51 MET). In addition, children averaged $6.8 (\pm 5.7)$ minutes of their break time in MVPA. There was a significant sex difference with boys spending virtually one-third more time in MVPA during break times than girls (8.4 ± 6.2 versus 5.3 ± 4.7 minutes, respectively; $F = 13.80$, $p < .01$). Overall, children spent 25.3% of their break times in MVPA (with values ranging from 0.0% to 97.5% of time); boys spent 30.8% and girls 20.4% in MVPA.

The relative time spent in MVPA during break times also differed significantly between normal weight, overweight and/or obese children, with normal weight children spending significantly more time of their break times in MVPA than overweight and/or obese children ($26.11 \pm 21.48\%$ versus $18.36 \pm 13.73\%$, respectively; $F = 4.09$, $p < .05$; Figure 1). Furthermore, there was a difference of relative time spent in MVPA when comparing overweight and obese children; however, this was not significant ($21.14 \pm 13.31\%$ versus $15.97 \pm 14.24\%$, respectively; $F = 1.81$, $p = .17$).

Average energy expenditure during 1 break time compared to 2 break times differed significantly ($p < .01$) with 2.65 ± 0.65 MET for 1 break and 2.56 ± 0.39 MET for 2 break times. Moreover, children who had 2 break times engaged in significantly more MVPA than children who were scheduled 1 break (7.4 ± 6.1 versus 5.6 ± 4.72 minutes, respectively; $F = 13.80$, $p < .02$; Figure 2). In addition, children who had 2 break times a morning spent 23.6% of their break times in MVPA, whereas children who only had 1 break per morning spent 28.2% of their available time in MVPA ($F = 11.39$, $p < .01$).

The size of the available playground (ranging between 200 and 4000 m²) did not influence children's PA or time spent in MVPA during their breaks; however, there was a tendency that schools with

Figure 1. Children's Relative Moderate to Vigorous Physical Activity (MVPA) During Break Times, Divided in Normal Weight, Overweight and Obese Children. Values Are Means and SD. * Represents Significant Difference

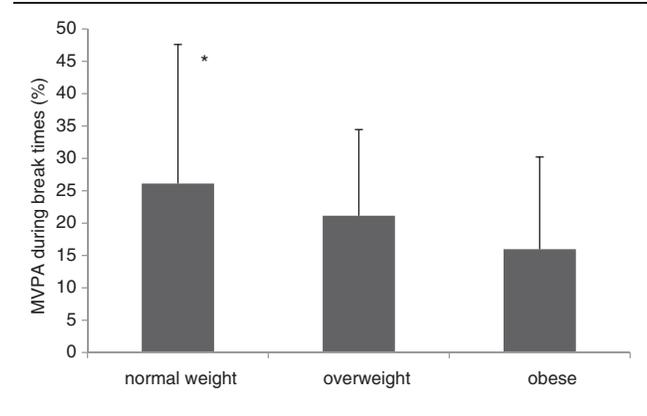
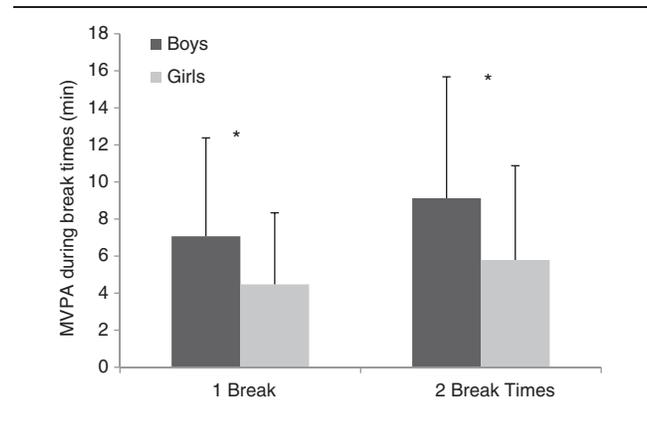


Figure 2. Children's Average Moderate to Vigorous Physical Activity (MVPA) During Break Times in Minutes, Divided in Sex and Children Who Have 1 Break per Morning Compared to 2 Break Times. Values Are Means and SD. * Represents Significant Difference



a larger playground also had longer break times ($F = 55.45$, $p < .01$; $r = 0.6$; $p \leq .32$).

DISCUSSION

This study showed an average energy expenditure of 2.6 MET during break times and activity levels of 25.3% of available time being spent in MVPA. This is broadly comparable to the results of Stratton et al³² who assessed PA levels of 6- to 10-year-olds during school break times, using heart rate monitoring. In this study, normal weight boys and girls spent over one-third and one-fourth of their break time in MVPA, respectively. Furthermore, an observational study showed 27 third-graders (age 8 to 9) spent 23% of their single 30-minute break in MVPA.³³

The results of higher activity levels in boys in this study, 30.8% versus 20.4% girls are also mainly in line with previous findings^{32,34-36} suggesting that boys are the more active sex, not just habitually but also during break times. Consequently, these results add weight to the evidence that sex-specific disparities in PA levels are already apparent at a young age. However, there are also other studies reporting the opposite with the proportion of time spent in MVPA by girls during break times being significantly higher than boys.²⁶

Although an investigation by Stratton et al³² showed boys spending more time in MVPA during their break times than girls, they also reported normal weight boys engaging in more MVPA than overweight boys. In this study, body weight was also a factor influencing PA levels during break time. Normal weight children engaged in a significantly greater proportion of MVPA during their break times than overweight boys and girls.

Whereas there was a tendency for obese children to engage in less MVPA than overweight children, it was not significant ($p = .17$). However, there is a significant relationship between children's weight status and objectively measured habitual MVPA in 5- to 10-year-old children.^{9,37,38} This corresponds with other research on PA during morning break time in primary school children out with Germany,^{39,40} where it has been suggested that these differences can be attributed to discrepancies in fundamental movement skills between overweight and normal weight children.⁴¹

Most notably, the salient finding of this study was that children with only 1 break spent a higher proportion of their available time in MVPA. Having said this, children accumulated more time in MVPA if they had the opportunity to be active for longer (ie, 2 morning breaks). Children with only 1 break per morning had approximately 22 minutes available to produce an average of 2.65 MET and 5.6 minutes in MVPA, which is significantly less than children with the opportunity of 2 break times (2.56 MET in 36 minutes and with 7.4 minutes MVPA). Comparing the relative time spent in MVPA, children with only 1 break spent significantly more time in MVPA than boys and girls who were scheduled 2 break times (28.2% versus 23.6%, respectively).

One explanation for these findings could be the fact that some schools with only 1 break allow children to have their breakfast during the lesson before their break so they can have maximum time to play, whereas schools with 2 break times often ask the children to have their snack within their playtime or may offer an organized breakfast, resulting in less active time.

It has previously been suggested that the duration of playtime available for children to be active is an important factor for children's PA levels.²³ For

example, Ridgers et al²² showed time as a significant negative predictor of vigorous PA in 7- to 9-year-old children during morning break using heart rate monitoring. Increased vigorous PA was associated with increased break time duration. Similarly, 8-year-old boys and girls engaged in significantly more MVPA during break times if their daily break duration was longer.⁴² It was, therefore, suggested that schools provide adequate times during a school day to offer children the opportunity to engage in sufficient PA so it can contribute toward the recommended daily activity guidelines.⁴⁰ This suggestion is supported by the results of this study, which showed children accumulate significantly more MVPA during longer durations of break times. However, it may also be explained by the fact that children have additional time to engage in increased activity opportunities.²³ Moreover, increased duration of break times can provide the opportunity for organizing activities and games whereas decreasing the proportionate impact these exchanges have on PA levels.⁴²

In addition, research indicates that not only break time duration but also playground size influences children's PA levels during break time.⁴³ In this study, playground size was determined and correlated although it did not show any significant influence on children's energy expenditure or activity levels. This corresponds with a Danish study of 417 children (5 to 12 years) which showed that size of school playgrounds had no effect on children's MVPA.⁴³ Conversely, a Belgian study found that increased playground space was associated with more PA during break times in 5-year-olds.³⁵

In this study, PA levels of primary school children were assessed objectively during typical, non-interfered break times. Owing to the relatively large sample size, this offers a representative picture of the intensity and duration of children's PA engagement during break times in the southwest of Germany. Further, the objective assessment of PA over several days allowed an estimation of the different activity levels during children's weekly break times.

Limitations

There are some limitations that should be considered when interpreting these findings. First, because the data are cross-sectional, no causal or longitudinal effects can be derived from this work. Although children's activity levels were observed for 6 days and included 3 to 5 school mornings, direct observation in combination with long-term assessments might have enabled break times to be monitored more thoroughly to receive more in-depth results.

Second, although the study schools are spread throughout the southwest of Germany and included urban and rural settings, monitoring morning breaks

in a wider geographical area might have enabled stronger generalization of the results, especially when considering the low prevalence of overweight and obese children in this study. It may also have revealed how differences in terms of environmental and financial aspects, as well as teacher availability, might have influenced how PA is encouraged during break times and playgrounds are equipped.

Third, it is also likely that children's activities and behaviors were influenced by the fact that they were wearing the multisensor device while their activity was being monitored.

Last, it should be born in mind that measurements were recorded in autumn, which may have influenced children's PA levels and the ability to play outdoors during break times. However, previous studies have found no significant seasonal effect on children's PA levels during break time comparing summer and winter.¹⁹

Future work is required to determine whether the low PA levels such as those found in this study are typical of German primary school children. It may be worthwhile combining objective measurements with direct observation to provide a complete contextual representation of PA levels and patterns during break times.

Conclusions

This study assessed different activity levels in German primary school children during their morning break times. It also investigated whether there were any differences in MVPA if children had the opportunity to play out once or twice in each school morning. Although the activity levels recorded were rather low, the results of this study lend support to previous findings that boys and normal weight children are more active during break times than girls and overweight and/or obese children, respectively.

It also showed that children use the available time during breaks to accumulate more MVPA, with children who have 2 breaks per morning engaging in significantly more MVPA than boys and girls who have only 1 break per morning.

These findings offer the opportunity to put in place suitable interventions that will engage children, especially girls, in additional PA and to question the policies which are advocating less active free time²¹ as children pass through the school system. These findings should also be considered if the introduction of all-day teaching is implemented into German schools.

IMPLICATIONS FOR SCHOOL HEALTH

During the school day, breaks are often the only opportunities for children to be physically active and it has been indicated that break times can contribute

up to 40% of recommended daily PA levels. To our knowledge, this is the first study investigating PA intensity and time spent in MVPA during 1 compared to 2 break times in German primary school children. These findings support a sound understanding of childhood PA during break times that may support future development of effective strategies and health-promoting interventions.

- Children who had 2 break times engaged in significantly more MVPA than children who were scheduled 1 break (7.4 ± 6.1 versus 5.6 ± 4.7 minutes, respectively; $F = 13.8$, $p \leq .02$).
- Boys were significantly more active than girls.
- Weight status influenced relative time spent in MVPA during break times with normal weight children spending significantly more time of their break times in MVPA than overweight and/or obese children ($26.1 \pm 21.5\%$ versus $18.4 \pm 13.7\%$, respectively; $F = 4.1$, $p \leq .05$).
- Size of the available playground did not affect children's PA or time spent in MVPA during their breaks.

These findings show that children use available time during breaks to accumulate more MVPA, which offer the opportunity to put in place suitable interventions which will engage children, especially girls, in additional PA and to question the policies which are advocating less active free time²¹ as children pass through the school system. These findings should also be considered if the introduction of all-day teaching is implemented into German schools.

Human Subjects Approval Statement

The study was approved by the Ministry of Culture and Education as well as the university's ethics committee and is in accordance with the declaration of Helsinki.

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