

# Comparison of 9th grade students' physical activity levels during recess and regular class periods using objective measurement

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## Abstract:

**Purpose:** to assess and compare secondary school students' physical activity levels during recess and regular class periods using objective measurement. **Material:** The study sample consisted of 26 9th grade school students ( $M = 15.28$  years,  $SD = 0.47$ ) of a German secondary school. They wore the Actiheart the whole school day for one week. All students followed the same school schedule and participated in the same classes. 9th grade school students' physical activity levels during recess and regular class periods were assessed using the physical activity monitoring device Actiheart, which validly and objectively measures physical activity. **Results:** total recess time physical activity levels accounted for  $M = 2.38$  METs, whereas total class period time physical activity levels only reached  $M = 1.58$  METs. This difference could be proven statistically significant. **Conclusions:** Total recess time accounts for significantly higher physical activity levels compared to total class period time and the overall time students spend in school, respectively.

## Keywords:

recess breaks, physical activity, physical activity level, secondary school students, adolescents.

**Крециманн Ролф. Сравнение уровня физической активности учащихся 9-го класса в свободное от занятий время и в период регулярных занятий в классе с использованием объективных измерений. Цель:** оценить и сравнить уровень физической активности учащихся средних школ в свободное от занятий время и в период регулярных занятий в классе с использованием объективных измерений. **Материал:** в исследовании принимали участие 26 учащихся 9 класса школы (возраст - 15,28 лет,  $SD = 0,47$ ) немецкой средней школы. Они носили устройство Actiheart весь школьный день в течение одной недели. Все учащиеся имели одно и то же школьное расписание и были в одних и тех же классах. Уровни физической активности в свободное от занятий время и в период регулярных занятий в классе у учащихся 9 класса школы были оценены с помощью устройства контроля физической активности Actiheart, которое достоверно и объективно измеряет физическую активность. **Результаты:** общий уровень физической активности в свободное время составил  $M = 2,38$  MET (метаболический эквивалент), в то время как уровень физической активности общее время занятий в классе достиг только  $M = 1,58$  MET. Эти различия являются статистически значимыми. **Выводы:** В свободное от занятий время учащиеся имеют достоверно более высокие уровни физической активности по сравнению с общим периодом занятий в классе и общее временем пребывания в школе, соответственно.

**Крециманн Ролф. Порівняння рівня фізичної активності учнів 9-го класу у вільний від занять час і в період регулярних занять в класі з використанням об'єктивних вимірів. Мета:** оцінити і порівняти рівень фізичної активності учнів середніх шкіл у вільний від занять час і в період регулярних занять в класі з використанням об'єктивних вимірів. **Матеріал:** в дослідженні брали участь 26 учнів 9 класу школи (вік - 15,28 років,  $SD = 0,47$ ) німецької середньої школи. Вони носили пристрій Actiheart весь шкільний день протягом одного тижня. Всі учні мали однаковий шкільний розклад і були в одних і тих же класах. Рівні фізичної активності у вільний від занять час і в період регулярних занять в класі в учнів 9 класу школи були оцінені за допомогою пристрою контролю фізичної активності Actiheart, який достовірно і об'єктивно вимірює фізичну активність. **Результати:** загальний рівень фізичної активності у вільний час склав  $M = 2,38$  MET (метаболический еквівалент), в той час як рівень фізичної активності загальний час занять в класі досяг тільки  $M = 1,58$  MET. Ці відмінності є статистично значущими. **Висновки:** У вільний від занять час учні мають достовірно вищі рівні фізичної активності в порівнянні із загальним періодом занять в класі і загальним часом перебування в школі, відповідно.

перерви, фізична активність, рівень фізичної активності, учні середніх шкіл, підлітки.

## Introduction

School as an institution plays an important role in providing physical activity [1, 2]. Besides the fact that students simply spend a great deal of their time at school, school is also relevant because it has the potential of reaching large numbers of children and adolescents [3]. In fact, and due to compulsory education, it should reach nearly all children and adolescents. There is no other setting or institution that can guarantee this high degree of participation, as school participation is conceptually mandatory.

Beyond physical education as a main possible provider of physical activity during the school day at first sight, other factors and areas support overall physical activity of school-aged students over an entire school day, week, and academic year [4]. Physically active school transport (e.g., bicycling) and physical activity during recess significantly add to school students' overall amount of physical activity [1, 3].

Recess may be an underestimated resource to employ to provide and promote physical activity because this "special time" is usually not associated with "serious" learning time in class period settings, as recess is allocated

by school for students to engage in leisure activities and free play [1]. For adolescents, this dimension of "playing" seems definitely less important, but the nature of having a short period of leisure time usually results in the urge to stand up, move around and interact with peers [1].

The major benefits of recess breaks according to empirical evidence are an improvement of students' classroom behavior and attentiveness [5, 6], and most importantly the accumulation of up to 40 percent of school students' total daily physical activity during recess, indeed [7]. Furthermore, recess has a high potential being targeted by interventions aiming at increasing school students' physical activity during the recess timeslot [8].

Overall, school recess provides a major opportunity to increase students' total physical activity, which is backed up by various research outcomes [9]. On the one hand, recess itself serves as a time period students "naturally" and mundanely use for activities that involve certain levels of physical activity. In terms of physical activity levels, recess therefore may be treated as an opposing area compared to common classroom settings that usually enforce students to spend almost the entire class period time sitting. On the other hand, there is plenty of room for developing and implementing school programs that

feature recess as a legitimate physical activity provider [10, 11].

*The purpose of the work* is to compare 9th grade secondary school students' physical activity levels during recess and regular class periods using objective measurement.

*The tasks of the work:*

1) Objective measurement of physical activity levels in 9th grade students during recess;

2) Objective measurement of physical activity levels in 9th grade students during regular class periods (and the overall time students spend in school);

3) Compare physical activity levels in 9th grade students during recess and regular class periods using descriptive and inferential statistics.

**Material and Methods**

*Participant:* The study sample consisted of 26 9th grade school students (M = 15.28 years, SD = 0.47) of a German secondary school [16, 17]. They wore the Actiheart the whole school day for one week. All students followed the same school schedule and participated in the same classes.

*Research Design:* Physical activity was objectively

measured via the physical activity monitoring device Actiheart (Cambridge Neurotechnology Ltd., Papworth, Cambridge, UK), which combines accelerometry and heart rate monitoring. The Actiheart device objectively and validly measures physical activity levels [12] and has been proven to be a feasible instrument in researching children and adolescents [13-17].

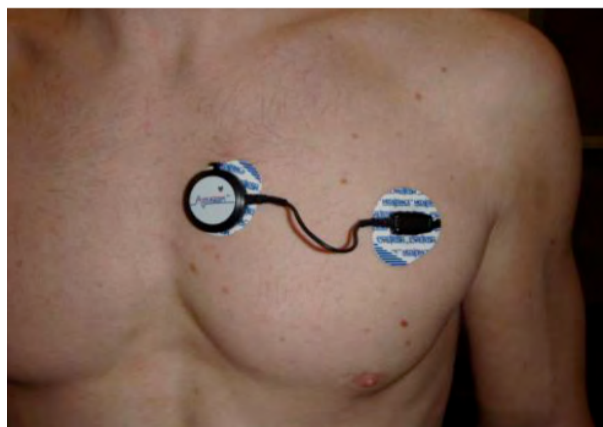
The Actiheart device was attached to participants' chest using two ECG electrodes (Figure 1). The Actiheart setting was adjusted to record heart rate in short-term recording mode continuously over 30-seconds epochs.

*Statistical Analysis:* Actiheart data was analyzed using Actiheart software (Version 4.032, Cambridge Neurotechnology Ltd., Papworth, Cambridge, UK).

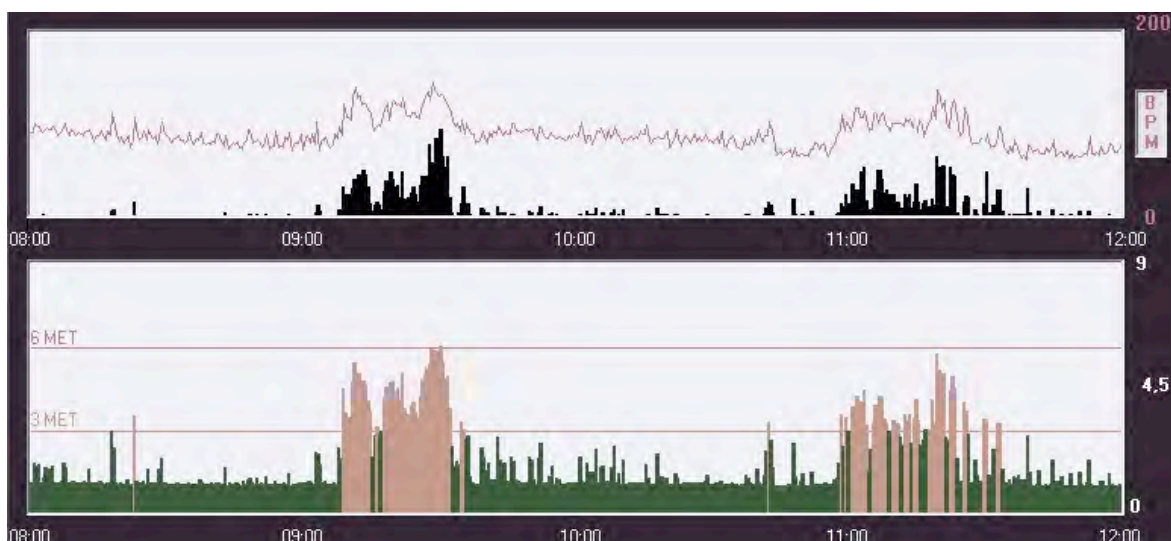
**Results**

The following diagram (Figure 2) has been randomly selected among participants to make it easier to refer to corresponding recess times and gives a first indication that students are at least a little more physically active in breaks than in lesson times.

Recess breaks were regularly scheduled from 9.10 to 9.30 am and from 11.00 to 11.20 am. Before, after and in between the two breaks, students attended regular school



**Figure 1.** Actiheart set-up (18)



**Figure 2.** An average forenoon's physical activity-diagram of an adolescent 9th grade student

subject classes. Table 1 descriptively shows that recess time has higher means for METs than other school times.

An average MET value of 2.4 is roughly equivalent to carrying 7 kg or walking from house to car or bus [19] and indicates that students are definitely more physically active during recess than during mere class period times. To look closer at the actual physical activity levels of the students during recess, it makes sense to compare the METs according to the grouping variable of type of timeframe (i.e. comparing values from recess time to values from class period or school time). Though the variable is normally distributed, its variances are not. Thus, a Mann-Whitney U test has been conducted (see Table 2).

The Mann-Whitney U test shows that there is a highly significant difference (recess vs. total class period time:  $p < 0.001$ , and recess vs. total school time:  $p < 0.001$ ) in both cases. This means that descriptive analysis and the related suggestion of Table 2 indicate that students show statistically significantly higher levels of physical activity during recess time as compared to mere class period time.

To see whether the same holds for amounts of energy expenditure, active energy expenditure (AEE) has been

calculated for single hours, giving the results of Table 3 (inferential statistical analysis). AEE is the amount of calories a person burns over a certain period of time that accounts for physical activity during periods of non-rest [20]. AEE was chosen for display in Table 3 to highlight the realistic MET values for recess, total class period time, and total school time due to physical activity only. Total school time is the accumulated time students spend at school on a given school day.

Again, a Mann-Whitney U test has been conducted to find out about the statistical significance that can be assumed from the obvious descriptive differences that can be seen in Table 4.

As the result of the Mann-Whitney U test shows, the amount of physical activity (AEE) show statistically highly significant differences between recess time and total class period time ( $p < 0.001$ ), and respectively total school time ( $p < 0.001$ ), too. Conclusively, students show higher amounts and levels of physical activity during recess as compared to accumulated mere class period time physical activity levels.

All together, the sample's schedule included 10 major breaks that made up 3 hours and 20 minutes. It could be

**Table 1.** Comparison of physical activity's intensity between recess time (breaks) and other significant periods

	N	Minimum	Maximum	Mean	SD
Total recess time	26	1.88	3.44	2.38	0.36
Total class period time	26	1.25	1.91	1.58	0.17
Total school time	26	1.30	2.14	1.68	0.20

*Note.* Minimum, maximum, and mean values' unit is MET.

**Table 2.** Relationship physical activity level of recess and total class period time/school time (Mann-Whitney U test)

	Recess vs. total class period time	Recess vs. total school time
Mann-Whitney U	2.00	16.00
Wilcoxon W	353.00	367.00
Z	-6.149	-5.839
Asymptotic significance (2-sided)	$p < 0.001$	$p < 0.001$

**Table 3.** Comparison of physical activity amounts between recess time (breaks) and other significant periods

AEE per hour	N	Minimum	Maximum	Mean	SD
Total recess time	26	48.28	143.20	85.75	21.73
Total class period time	26	15.17	75.30	43.56	14.09
Total school time	26	20.06	74.18	48.37	13.14

*Note.* Minimum, maximum, and mean values' unit is kcal.

**Table 4.** Relationship between AEE of recess and total class period time/total school time (Mann-Whitney U test)

	Recess AEE vs. total class period time AEE	Recess AEE vs. total school time AEE
Mann-Whitney U	28.00	39.00
Wilcoxon W	379.00	390.00
Z	-5.673	-5.472
Asymptotic significance (2-sided)	$p < 0.001$	$p < 0.001$

shown that the students use recess times to be physically active to a higher degree than during class periods and overall school time. The statistically highly significant difference between intensities and energy expenditures per average hour, verify that students show higher amounts and levels of physical activity during recess time as compared to mere class period times.

### Discussion

Investigating physical activity behavior of students during recess time can be interesting regarding to find out about the influence school-related physical activity has on overall amounts of physical activity, as well as for legitimization of recess time per se.

The results of this study show that school and recess is an ideal area to promote physical activity in children and adolescents. Unfortunately, efforts by policy makers, and national and regional programs to cut recess and breaks in schools can be seen in various countries, however, with the intention to maximize learning time. To combat these trends, Comprehensive School Physical Activity Programs that center around 1) quality physical education, 2) physical activity before and after school, 3) physical activity during school (both recess and classroom activity), 4) staff involvement, and 5) family and community engagement should be strengthened [21].

In line with developing school (physical activity and health) programs that explicitly cover recess, specific interventions can be developed and applied that may be particularly tackling age ranges and gender appropriateness. For instance, female students seem to be less engaged in physical activity during recess in the school settings compared to male students [22].

The Actiheart device has proven a feasible research method to assess physical activity levels in the target population of school-aged adolescents. The Actiheart can

therefore be applied to any school setting. However, the costs per device may exceed ordinary funding options in most cases. In addition, the proper set-up and attachment to study participants need properly trained personnel and additional clearance to use on students. Nevertheless, in regard to validity and objectivity standards, the Actiheart appears to be the device most accurate to be used in field studies and real-world settings in school.

### Conclusions

Total recess time accounts for significantly higher physical activity levels compared to total class period time. Moreover physical activity levels during recess by itself are also higher than the accumulated physical activity levels for the time students spend in school (school time).

The results indicate that even unaltered “natural” recess provides high amounts of physical activity. Its potential to significantly and evidently add to school students’ overall physical activity legitimized its own existence, defying any effort to cut school recess times short.

Future research may focus on developing and applying interventions to promote and increase physical activity during recess. Particular emphasis may be put on school-aged children and adolescents’ socioeconomic status, race, gender, and/or age [23, 24].

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### Conflict of interests

The author declares that there are no conflicts of interest.

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