

## THE QUANTITY AND INTENSITY OF PHYSICAL ACTIVITY DURING PHYSICAL EDUCATION IN 3<sup>RD</sup> GRADE PRIMARY SCHOOL CHILDREN\*

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### ABSTRACT

*Introduction:* The purpose of this study was to establish the effective time parameters of physical education (PE) lessons and the amount of time that children spent in moderate to vigorous physical activity (MVPA).

*Methods:* The study involved a total of 189 third-grade pupils (94 boys and 95 girls), aged 8 to 9 years, from five primary schools in the Slovenian coastal region. We used an accelerometer in each school to measure the quantity and intensity of activity during three PE lessons led by the class teacher and / or PE teachers.

*Results:* We found that the average duration of a PE lesson was  $36.6 \pm 7.7$  minutes: lesson preparation time  $14.9 \pm 7.7$  minutes, the main activity  $19.3 \pm 7.1$  minutes and the conclusion  $1.8 \pm 2.4$  minutes. Time spent in MVPA was  $13.2 \pm 4.1$  minutes, with no statistical differences between genders ( $P = 0.338$ ). An average PE lesson carried out on the outside playground lasted an average 7 minutes less than lesson in the gym ( $P = 0.066$ ), and the average PE lesson's effective time was shorter by 1.5 minutes as well ( $P = 0.011$ ). The children led by both teachers together showed, on average, that their MVPA had been shortened by 3.5 minutes. There were no statistical differences between a PE teacher and a classroom teacher. Furthermore, it was revealed that the time spent in MVPA tends to decrease proportionally with the increase in the number of children participating actively in the PE lesson ( $r = -.12$ ;  $P = 0.092$ ).

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*Conclusions: The research only included the time spent in MVPA during PE lessons and not their content. However, it can be concluded that everyday PE lessons could extend the time spent in MVPA by 6 % a week.*

**Keywords:** *physical/sports activity, effective time, children, accelerometer.*

## KOLIČINA IN INTENZIVNOST GIBANJA MED URO ŠPORTA V 3. RAZREDU OSNOVNE ŠOLE

### IZVLEČEK

*Uvod: Cilj prispevka je bil ugotoviti efektivni čas ure Športa in čas, ki so ga otroci preživeli v srednji in visoki intenzivnosti (MVPA).*

*Metode: V celotno raziskavo je bilo vključenih 189 tretješolcev (94 dečkov in 95 deklic), starih 8–9 let iz petih naključno izbranih obalnih osnovnih šol. Na vsaki šoli smo z merilnikom pospeška izmerili količino in intenzivnost gibanja treh ur Športa, ki so jih vodile razredne učiteljice in/ali športni pedagogi.*

*Rezultati: Ugotovili smo, da povprečni čas ure Športa znaša  $36,6 \pm 7,7$  minut, od tega je pripravljalni del  $14,9 \pm 7,7$  minut, glavni del  $19,3 \pm 7,1$  minut in zaključni del  $1,8 \pm 2,4$  minute. Čas v MVPA znaša  $13,2 \pm 4,1$  minut brez razlik med spoloma ( $P = 0.338$ ). Ura Športa, izvedena na zunanjem igrišču, je trajala v povprečju 7 minut manj kot v telovadnici ( $P = 0.066$ ) pa tudi čas MVPA je bil krajši za 1,5 minute ( $P = 0.011$ ). Otroci, ki so jih vodili učitelj in športni pedagog hkrati, so dosegli povprečno 3,5 minut krajši čas MVPA, medtem ko med vodenjem zgolj učitelja in vodenjem zgolj športnega pedagoga ni razlik. Poleg tega smo ugotovili tudi, da je trend časa MVPA krajši z naraščanjem števila aktivno sodelujočih otrok pri uri Športa ( $r = -.12$ ;  $P = 0.092$ ).*

*Zaključki: V raziskavi smo opazovali le čas MVPA pri uri Športa, ne pa tudi njene vsebine. Zaključimo lahko, da bi vsakodnevna ura Športa podaljšala tedenski čas MVPA za 6 %.*

**Ključne besede:** *gibalna/športna aktivnost, efektivni čas, otroci, merilnik pospeška*

## INTRODUCTION

Our modern lifestyle is becoming increasingly sedentary in both adults and children. Children, due to physical inactivity and inadequate nutrition, are now being exposed to an increased risk for the occurrence of various diseases, such as cardiovascular disease, type 2 diabetes, high blood pressure, stroke and other diseases later on life (Cepanec, 2013). Slovenian children, aged 8–5, spend 32–51 minutes on MVPA, depending on gender and age (Volut et al., 2012). Worldwide trends confirm the Slovenian results and suggest that MVPA is decreasing even further, with the children's age (Biddle et al., 2004; Robberts et al., 2004). Therefore, most children do not meet the minimal MPVPA standards.

Such children are under the close supervision of many researchers that are currently trying to develop an adequate method of intervention in order to increase their physical activity levels and diminish their levels of inactivity. Several META analyses of vast scientific data have been performed to identify the most suitable methods of intervention. Interestingly, one of the aims to assure a daily physical education class (Basset et al., 2012). Basset et al. (2012) identified that each PE class could potentially contribute the amount of 23 minutes of MVPA, almost a third of the minimal standards. However, other authors came to different conclusions. Štemberger et al. (2005), performed a study in Slovenian children and found only 9 minutes of MVPA during one PE class.

For some children, PE is the only form of physical/sport activity they receive, as they also choose to do other activities, which are not physical in nature. That is why PE is very important for them. In Slovenia, the first and the second school triad place PE on the school curriculum three times a week and twice in the third. If children choose the optional sports program, carried out by some elementary schools then PE classes are carried out five times a week. Therefore, we still face the challenge of increasing the frequency of PE lessons. However, here we have aimed to measure the quantity and the intensity of MVPA that third graders receive during a PE lesson.

## METHODS

### Children

In total 189 of the 3rd grade children (94 boys; aged 8–9 years) from 5 randomly selected primary schools from the Slovenian coastal region were recruited for the study. We explained all the details to the schools' principals, the physical education teachers and the parents. The motivation for the study was presented in such way that physical education teachers were not motivated to influence the study results. Children's parents gave written consents before the research was conducted onset.

## Research design and instruments

In every school we measured physical activity phenotypes during three physical education classes that were led by educators and/or physical education teachers. Physical activity was monitored by accelerometers (Actigraphy GT1M, Actilife, USA) that were worn on the children's hips for the whole duration of the physical education class. Five minutes prior to and after the classes the accelerometers were attached and removed from the children, respectively. Children, not the teachers, did not know the real purpose of the accelerometers in order to assure a blind study design.

## Data processing and statistics

Accelerometer data were downloaded onto the PC with a 15-second epoch applied. To distinguish between physical activity phenotypes, we took into consideration the threshold values proposed by Mahmutović and Volmut (2012).

- Physical inactivity: < 134 counts per 15 seconds,
- Light physical activity: 135–633 counts per 15 seconds,
- Moderate physical activity: 634–1853 counts per 15 seconds,
- Vigorous physical activity: > 1853 counts per 15 seconds,
- MVPA – the effective time of physical education: the time spent in moderate and vigorous physical activity.

The data were processed with the SPSS statistical package (Chicago IL, USA). After the data normality was confirmed all data were presented with mean standard deviation. We applied a one-sample t-test to check the differences from the expected value: A one-way ANOVA was used to check the differences between teachers (educators, physical education teachers, both). Pearson correlation was used to correlate the effective time with the number of the participating children. All statistical decisions were considered at  $p < 0.05$ .

## Results

We have found out that the time children spent in MVPA during physical education was  $13.2 \pm 4.1$  minutes (Figure 1), in boys  $13.5 \pm 4.3$  minutes, and in girls  $12.9 \pm 4.0$  minutes, with no gender differences ( $P = 0.338$ ). The average time of physical education was  $36.6 \pm 7.7$  minutes, from where the introductory part was  $14.9 \pm 7.7$  minutes, the main part  $19.3 \pm 7.1$  minutes and the final part  $1.8 \pm 2.4$  minutes (Figure 2). When physical education classes were carried out outside, they lasted 7 minutes less than inside ( $P = 0.066$ ) (Figure 3) with MVPA being shorter for 1.5 minute ( $P = 0.011$ ). Interestingly, we also confirmed a significant teacher effect ( $P = 0.001$ ), where the lowest MVPA (-3.5 minutes) was found if both the educator and the teacher conducted the physical education class together ( $P = 0.005$ ). However, there were no differences

between the educator and the physical education teacher. Finally, we detected a trend towards a negative correlation between the time spent in MVPA and the number of children participating in the class ( $r = -0.12$ ,  $P = 0.092$ ).

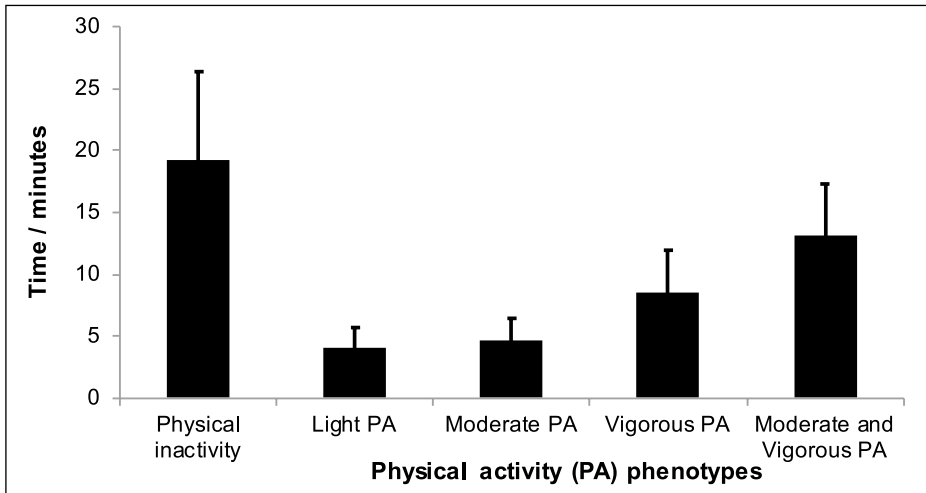


Figure 1: Time spent in physical activity phenotypes during Physical education

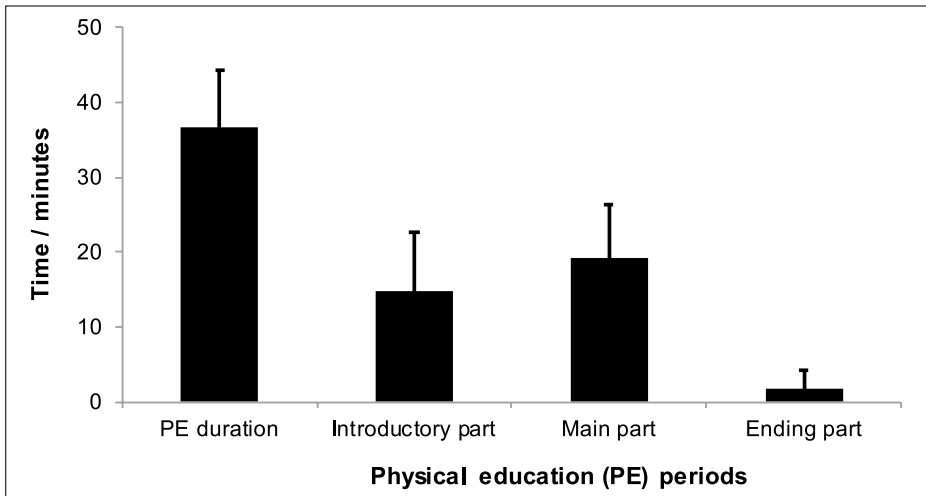


Figure 2: Time spent at Physical education class with the breakup of time spent in different periods of physical education.

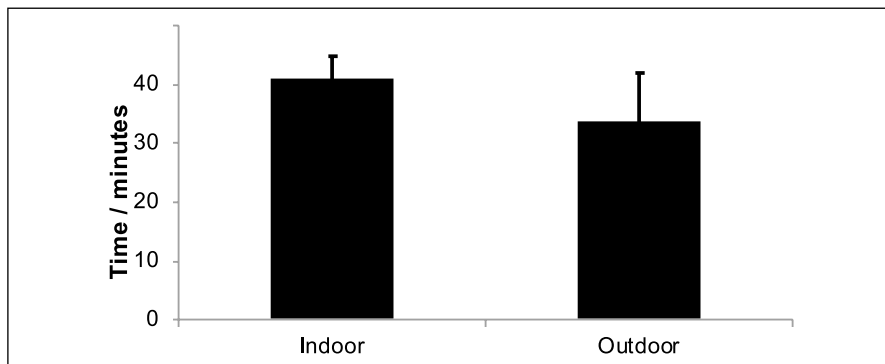


Figure 3: Difference between the time spent at Physical education when performed indoor and outdoor ( $P = 0.066$ )

## Discussion

World Health Organization (2010) recommends at least 420 minutes of MVPA per week. Although Biddle et al. (2004) and Roberts et al. (2004) report that children do not meet the minimal standards from MVPA, the PE class remains an important moment to assure the required physical activity of adequate intensity (Basset et al., 2012; Štemberger et al., 2005).

We have established that PE is currently covering 9.3 % of weekly recommendations. If children had PE five times a week (every day) for one lesson (45 minutes), they would be in an appropriate MVPA for 65 minutes, so MVPA would increase by 6 % on a weekly basis (15.3 % of weekly recommendations). If children had four PE lessons per week placed in two joint PE lessons, which means that PE would occur twice a week for 90 minutes, they would be in a MVPA for 55.8 minutes, so MVPA would increase by 4 % on a weekly basis (13.3 % of weekly recommendations) because in one PE lesson (45 minutes) children spend 14.4 minutes in MVPA and in two joint PE lessons (90 minutes) they spend 27.9 minutes (Wang, Pereira and Mota, 2005). If an average effective time that Fairclough and Stratton state in their study (2006) was up to 50 % of a total PE lesson, then PE would fulfil about 21 % of weekly recommendations. The introduction of two joint PE lessons raises the question of whether the students of class level would be able to participate so long in a MVPA since tiredness and a lack of motivation could lead to injuries or a false learning of motor tasks. Therefore, we believe that it would be unreasonable to increase the number of PE lessons per week.

We have found out that children spend  $13.2 \pm 4.1$  minutes in MVPA during physical education. Štemberger's study (2005) shows that the average MVPA time, measured with a stopwatch, is 9 minutes. Fairclough and Stratton's study (2006) shows that the average time in MVPA of various studies, carried out by direct observation or acceler-

ometers, was  $37.4 \% \pm 15.7 \%$  of a total PE lesson (16.8 minutes on average in one PE lesson), but with measuring effective time with a heart rate monitor this time increased and reached  $49.1 \% \pm 20.5 \%$  of a total PE lesson (which is 22.1 minutes on average in one PE lesson). This means that the result may vary depending on the measurement instrument. In one Texas school children had a lower value because they only spent 3.8 minutes on average for MVPA (Simons-Morton, Taylor, Snider and Huang, 1993).

We have calculated that an average MVPA time for boys was  $13.5 \pm 4.3$  minutes, and for girls  $12.9 \pm 4.0$  minutes. We have found out that there were no gender differences. Štemberger's study (2005) shows that no statistically significant differences between boys and girls were established. Even in Fairclough and Stratton's study (2006) it was confirmed that only four of thirteen examined studies detected statistical difference between genders.

We have noticed that educators or other teachers who had conducted lessons before PE did not want to finish their lessons earlier so that children could start with their sports lesson in time. Many times their lessons were extended by a few minutes. In addition, physical education teachers must finish PE lesson a few minutes earlier so that children have enough time to change and prepare for the next lesson. In this way, educators and PE teachers are left with less time to perform lessons. Thus, an average time of PE in the gymnasium lasts for 36.6 minutes and on the outside playground on average for 7 minutes less. In Štemberger's study (2005) it was measured that an average time of a total PE teaching lesson lasted for 34 minutes.

PE lesson was divided into three parts, namely, the preparatory part, which on average lasted for 14.85 minutes, the main part which on average lasted for 19.3 minutes and the final part, which lasted for only 1.8 minute. In Štemberger's study (2005) it was calculated that the preparatory part on average lasted for 10 minutes, the main part for 20 minutes and the final part for 4 minutes.

In addition, with the increase in the number of actively participating children, the time in MVPA decreases, so it is important that classes do not have too many pupils. Therefore, educators (most of which are independently leading PE lessons and have to control more than 25 children) prioritize the safety of children. In addition, they have to prepare all the tools and props that they need during each lesson. The loss of time due to prop set up could be solved in such a way that students who come first set up the room and students who finish last put the props away. In between the lessons, the educator or physical education teacher would only slightly adjust the training environment and sport props for every age group. Even foreign studies indicate that students in classes with more than 45 pupils are more than 50 % less physically active in sport than students from smaller classes. (Center to Eliminate Health Disparities and Samuels and Associates, 2007; Failing Fitness).

## CONCLUSION

The results of our study indicate the following:

- an average net time of PE in the 3<sup>rd</sup> grade primary school children lasts  $36.6 \pm 7.7$  minutes and on the outside playground on average 7 minutes less,
- children spend only  $13.2 \pm 4.1$  minutes in MVPA during the 45 minutes of physical education, with no gender differences,
- the MVPA achieved during PE covers only 9.3 % of weekly recommendations, which makes the strategies of increasing PE weekly hours doubtful.

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