

# DIFFERENCES IN PHYSICAL ACTIVITY LEVEL BETWEEN 3<sup>RD</sup> AND 4<sup>TH</sup> GRADE PUPILS OF ELEMENTARY SCHOOL

IVANA KLARIČIĆ<sup>1</sup>, TIHOMIR VIDRANSKI<sup>2</sup>, MATEA CVITANOVIĆ<sup>3</sup>

<sup>1</sup>Faculty of Kinesiology in Osijek, Croatia, <sup>2</sup>University of Slavonski Brod, Croatia, <sup>3</sup>Faculty of Education in Osijek, Croatia

## Correspondence:

Ivana Klaričić, Faculty of Kinesiology in Osijek, Croatia  
ivanak@kifis.hr

**Abstract:** The aim of this research was to determine differences in physical activity (PA) level between 3rd grade pupils (3 lessons of PE per week) and 4th grade (2 lessons of PE per week) pupils of elementary school. Partial aims were referring to determine gender differences. The set of entities included 400 3rd and 4th grade pupils of elementary school. In the 3rd grade participated 200 pupils, 93 girls and 107 boys and in the 4th grade 200 pupils participated in the research, of which 102 girls and 98 boys. PA level was estimated by the croatian version of PAQ - C (Physical Activity Questionnaire for Children) which estimates overall weekly PA by summarising nine partial parameters of PA and PA occurring during PE lesson is one of them. Differences in level of overall PA between 3rd grade pupils and 4th grade pupils of elementary school were not determined. Also gender differences in level of overall PA (3rd or 4th grade pupils) were not determined. Only determined gender differences were the ones in some partial parameters of PA. According to the pupil's average result during PE (4,60), conclusion is that pupils were active often or every time, whereby the purpose of the PE lesson is in large scale fulfilled. The future research need to upgrade questionnaires for estimation of physical activity level based on self-evaluation, also need to determine reasons of pupil's insufficient levels of PA in some partial parameters of PA in order to raise level of overall PA.

**Key words:** physical activity, questionnaire, young school age, gender differences, Physical Education.

## INTRODUCTION

The term physical activity may not be identified with the term exercise which is just its subcategory. Physical activity includes exercise, but also playing, work, active transportation, home activities, recreation etc. (World Health Organization). Importance of physical activity, especially at the age of growth and development, is manifested by its multiple positive influence on immediate and indirect indicators of a good health status.

Considering the global health interest in monitoring physical activity of the world population, scientific researches are carried out with different purposes. Jurakić and Andrijašević (2008) state four aims for measuring physical activity: 1. determining and monitoring a level of physical activity of a particular population (e.g. population of one country), 2. understanding the correlation between a level of physical activity and physical and/or mental health (epidemiological research), 3. understanding the determinants (patterns) of physical activity within certain groups, 4. determining the effects of intervention programs for improving health. Results of such scientific research are the appropriate starting point for various forms of intervention by health, school and other institutions with a purpose to improve present condition.

There are different ways of measuring and evaluating physical activity. Jurakić and Andrijašević (2008) distinguish three groups of measurements: laboratory methods, methods based on the use of electronic devices and instruments, and methods based on self - assessment of physical activity of the examinees themselves. Measuring and evaluating methods can be either direct or indirect. Direct methods include: calorimetry, a physical activity questionnaire taken by a researcher or an interviewer and electronic motion detectors recently developed in the form of pedometers, body motion recorders, cameras, etc. Indirect methods are: energy input determination techniques, energy consumption determination techniques such as measuring pulse, muscular strength, etc. (Mišigoj - Duraković and Duraković, 2006). The questionnaire is one of the most practical (and economical) method of assessing physical activity because it can be applied on a large sample of entities and it is quick (Jurakić and Andrijašević, 2008).

The PAQ - C questionnaire estimates level of overall physical activity of younger school children aged 8 to 14 (Crocker et al., 1997). According to the available research, the PAQ - C questionnaire has a croatian version and its reliability was tested on an appropriate sample (according to the age) (Vidaković - Samardžija and Mišigoj

- Duraković, 2013). Reliability was determined by a test - retest method ( $r = 0.78$ ). The authors concluded that the PAQ - C questionnaire could be applied in future researches with the purpose of determining level of overall physical activity of children and youth in Croatia.

Considering the determined multiple benefits of physical activity, the problem is set, how to increase its overall level to all members of society, especially children and young people. In Republic of Croatia, Physical education lessons are the only form of physical exercise that is compulsory for all pupils (both elementary and secondary education), and there for is the most important form of Physical education in school. There are all sorts of extracurricular physical activities provided by school (sports, hiking, field trips etc.) but only PE lessons are mandatory. PE provides an impact on kinanthropological status of all children and youth aged 6/7 to 18/19. Racette et al. (2015) determined in 7-day follow-up of pupils' physical activity by cardiac monitor that pupils spent on average 30,6 minutes in moderate to high-level physical activity (HR = 140 bpm) on days without a PE lesson and 44,4 minutes on days with a PE lesson, which is almost 50% more. Authors recommend schools to introduce PE lessons on every school day so pupils can reach recommended 60 minutes of moderate to high-level physical activity per day.

In Republic of Croatia Curriculum of Physical Education enacts 2 lessons of PE per week for compulsory education. But it also enacts 3 lessons per week for 1<sup>st</sup> to 3<sup>rd</sup> grade of elementary school. The reason are specific needs of children in this period of development (increased need for motion, application of moderate intensity activity etc.).

As these studies need to be carried out on a large number of subjects, objective measurement methods become over demanding to the resources. The method of estimation by questionnaire in such research would be much more economically acceptable.

The main aim of this research is to determine differences in overall physical activity level between 3<sup>rd</sup> and 4<sup>th</sup> grade pupils of elementary school. Partial aims are related to determining differences in partial indicators of physical activity, determining gender differences (3<sup>rd</sup> and 4<sup>th</sup> grades separately), and determining which gender contributes to the differences between 3<sup>rd</sup> and 4<sup>th</sup> grade pupils.

## MATERIAL & METHODS

### *Participants*

400 pupils of elementary school participated in the study. 200 pupils attended 3<sup>rd</sup> grade, 93 girls and 107 boys, and 200 pupils attended 4<sup>th</sup> grade, 102 girls and 98 boys. Pupils were given permission for participating by principal, teacher and parents/guardians.

The questionnaire was completed in in the classroom during the school attendance. At the beginning of the study the pupils were given a detailed explanation of the questionnaire and its purpose, and they could ask any question if something was unclear. The questionnaire was anonymous. It took 10 to 20 minutes to complete it. Question number 10 showed that 18% of pupils were ill or had been prevented for some other reason from performing their usual physical activity. In the 3<sup>rd</sup> grade, 38 pupils were ill or prevented, 19 boys and 19 girls, and in the 4<sup>th</sup> grade 36, 16 boys and 20 girls. The most common reasons were health problems, and in the small number of times it was boredom or lessons pupils attended in the other shift. According to the instructions of the author of the questionnaire, absent pupils were excluded from the research.

### *Procedure*

Physical activity was evaluated by the Croatian version of the questionnaire PAQ - C, a questionnaire for evaluating the level of overall physical activity of children and youth aged 6 to 14 (Vidaković Samaržija and Mišigoj-Duraković, 2013). The questionnaire is composed of 10 questions, the first 9 questions relate to self - assessment of physical activity over the past seven days, and the purpose of the last question is to determine if a pupil was prevented from his/her usual physical activity. The level of physical activity was evaluated at the Likert scale of 5 degrees (result 1 - insufficiently active, 5 - highly active). The variables are: 1. overall physical activity, 2. physical activity during leisure time, 3. physical activity during PE lesson, 4. physical activity during 5 min school recess, 5. physical activity during 15 min school recess, 6. physical activity after school, 7. physical activity in the evening, 8. physical activity on weekend, 9. physical activity on school days, 10. Total weekly physical activity. Variables 2 - 10 represent partial indicators of overall physical activity. The overall physical activity was calculated as the arithmetic mean of 9 partial indicators of physical activity according to the questionnaire instructions.

**Statistical analysis**

Arithmetic mean (AM) and standard deviation (SD) are presented for each group of participants separately. Shapiro-Wilk W test was used to determine normality of distribution. Correlation between variables was analyzed by Spearman’s rank correlation. Differences between groups in variable overall physical activity were analyzed by a t - test for independent samples, and differences in other variables were analyzed by the Mann-Whitney U test. The data were analyzed by the computer program Statistica for Windows 12.0.

**RESULTS**

For the purpose of this research, all participants are divided into groups according to two criteria: a) grade (3<sup>rd</sup> or 4<sup>th</sup>) and b) gender (male or female). In this way the pupils are divided first into 2 groups, 3<sup>rd</sup> grade (3G) and 4<sup>th</sup> grade (4G) and then into 4 groups, 3<sup>rd</sup> grade girls (3F), 3<sup>rd</sup> grade boys (3M), 4<sup>th</sup> grade girls (4F), 4<sup>th</sup> grade boys (4M).

*Table 1. Descriptive parameters of 3th and 4th grade pupils*

Variables	AM	SD	AM	SD	AM	SD	AM	SD	AM	SD	AM	SD
	3G(n=162)		4G (n=164)		3M(n=88)		3F (n=74)		4M (n=82)		4F (n=82)	
PA – leisure time	1.61	0.49	1.70	0,48	1.61	0,48	1.61	0.50	1.67	0.50	1.74	0.46
PA – PE lesson	4.64	0.55	4.59	0,68	4.59	0,60	4.69	0.49	4.60	0.70	4.57	0.67
PA – 5 min recess	2.77	1.28	2.82	1.29	2.89	1,29	2.64	1.26	3.05	1.31	2.60	1.23
PA – 15 min recess	3.05	1.23	3.15	1.26	3.17	1.25	2.91	1.18	3.35	1.26	2.94	1.23
PA – after school	3.28	1.46	3.29	1.29	3.48	1.50	3.04	1.38	3.16	1.36	3.43	1.22
PA - evenings	3.15	1.41	3.18	1.22	3.19	1.48	3.09	1.33	3.21	1.27	3.15	1.17
PA – weekend	3.48	1.29	3.65	1.16	3.67	1.30	3.24	1.25	3.60	1.23	3.70	1.10
PA – school days	3.12	1.29	3.02	1.25	3.16	1.36	3.07	1.20	2.99	1.36	3.05	1.14
Total wekly PA	3.18	1.11	3.18	0.97	3.15	1.19	3.21	1.02	3.13	1.02	3.24	0.92
Overall PA	3.14	0.66	3.18	0.65	3.21	0.71	3.05	0.59	3.19	0.72	3.16	0.57

Normality of distribution of all variables was determined by the Shapiro - Wilk W test. Normal distribution was determined only in the variable Overall physical activity (table 2). Therefore, the differences in the variable Overall physical activity will be analyzed by a t-test for independent samples, and the differences in other variables will be analyzed by the Mann-Whitney U test.

*Table 2. Results of Shapiro – Wilk W test*

	PA – lei- sure time	PA –PE lesson	PA- 5 min recess	PA – 15 min re- cess	PA –after school	TA – eve- nings	TA - wee- kend	PA-school days	Total weekly PA	Overall PA
W	0.894	0.636	0.886	0.899	0.881	0.899	0.878	0.889	0.977	0.991
p	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00	p=0.054

Since the variables describing partial physical activity indicators do not have normal distribution, the correlation between variables was analyzed by Spearman’s rank correlation and the results are presented in table 3.

**Table 3.** The matrix of correlations between variables (questionnaire's items) (Spearman's rank)

Variables	PA – leisure time	PA – PE lesson	PA- 5 min recess	PA – 15 min recess	PA –after school	TA – evenings	TA – weekend	PA-scho-ol days	Total weekly PA	Overall PA
PA – leisure time	1.00									
PA – PE lesson	0.16*	1.00								
PA – 5 min recess	0.02	-0.02	1.00							
PA– 15 min recess	0.10	0.09	0.49*	1.00						
PA – after school	0.29*	0.24*	0.13*	0.16*	1.00					
PA - evenings	0.29*	0.22*	0.23*	0.20*	0.49*	1.00				
PA – weekend	0.31*	0.20*	0.14*	0.15*	0.48*	0.44*	1.00			
PA – school days	0.22*	0.17*	0.19*	0.25*	0.33*	0.38*	0.34*	1.00		
Total wekly PA	0.25*	0.29*	0.12*	0.17*	0.34*	0.33*	0.34*	0.38*	1.00	
Overall PA	0.40*	0.36*	0.47*	0.51*	0.68*	0.71*	0.67*	0.63*	0.59*	1.00

In table 3, it is shown that all coefficients of correlation of Overall PA with its partial indicators are statistically significant, meaning that every single question is estimating well the construct for which the questionnaire was constructed.

As mentioned above for the partial aims of this research, all participants are divided into four groups: 3<sup>rd</sup> grade girls (3F), 3<sup>rd</sup> grade boys (3M), 4<sup>th</sup> grade girls (4F), 4<sup>th</sup> grade boys (4M). Out of six possible paired comparisons for four group, selected were the ones relevant to the aim of this research. The results of the analysis for determining differences between groups are presented in Table 4.

**Table 4.** Results of Mann – Whitney U test and t – test for independent samples

Variables	3G – 4G	3F - 3M	4F – 4M	3F – 4F	3M – 4M
PA – leisure time	0.019*	0.870	0.208	0.021*	0.329
PA – PE lesson	0.923	0.433	0.716	0.509	0.633
PA – 5 min break	0.700	0.239	0.028*	0.851	0.372
PA – 15 min break	0.428	0.197	0.031*	0.876	0.283
PA – after school	0.943	0.056	0.256	0.072	0.132
PA - evenings	0.914	0.644	0.662	0.879	0.979
PA – weekend	0.268	0.032*	0.698	0.025*	0.652
PA – school days	0.522	0.811	0.711	0.845	0.429
Total wekly PA	0.892	0.758	0.288	0.701	0.907
Overall PA	0.631	0.131	0.710	0.276	0.868

The results in table 4 show that statistically significant differences in variable Overall PA were not determined in any comparison. Statistically significant differences were determined in some partial indicator of PA in several pairs of comparison.

## DISCUSSION

As aforementioned, all coefficients of correlation of Overall PA with its partial indicators in table 3 are statistically significant, meaning that every single question is estimating well the construct for which the questionnaire was constructed. The lowest correlation of the variable Overall PA is with PA during PE lesson (0.36) and low correlation is also with PA - leisure time (0.40). The highest correlation but still moderate has PA - evenings (0.71), PA - after school (0.68) and PA - weekend (0.67). Correlation with other partial indicators (PA – school days, Total weekly PA, PA – 15 min recess and PA – 5 min recess) ranges from 0.47 to 0.63. A statistically significant correlation was not determined between variables PA – 5 min recess and PA – 15 min recess (both) and variables TA – PE lesson and PA – leisure time (both). The average correlation between items is 0.249, which represents a good agreement of the questions, and at the same time indicates that each one measures another construct. In comparison, Vidaković - Samaržija and Mišigoj - Duraković (2013) determined an average correlation between the particles 0.172.

The results presented in table 4 show that statistically significant differences in variable Overall PA were not determined in any comparison. The cause of such an occurrence can be interpreted in a way that only a year difference at the chronological age of 9 to 10 years is not large enough to achieve significant differences in pupils' behavior and habits of physical activity, and one lesson more of Physical Education per week doesn't have an influence big enough on overall physical activity next to its eight other partial indicators. The results also demonstrate that gender differences between pupils in overall physical activity have not been determined. As noted earlier, the researches so far have confirmed gender differences between girls and boys. Le Mura et al. (2000) come to the same conclusion, by evaluating physical activity of 4<sup>th</sup> grade pupils by accelerometer, that girls are less active. Their research has highlighted the need for additional motivation for girls to increase their physical activity. However, it is important to emphasize that gender differences are increasing with chronological age, the main cause being the biological age, puberty, to be exact. Nader et al. (2008) come to the conclusion that boys are more active but also that their activity decreases with age (about 15 years) as same as girls' activity does (about 13 years). But on the other hand, Thomson et al. (2003) determined that the differences within girls and boys of same chronological age almost disappear when they are grouped according to biological age. Chronological age of 9 and 10 years in this research is the age in which both girls and boys are still almost equal to biological age, so it is not surprising that there are no differences.

The difference analysis in partial indicators of overall physical activity showed statistically significant differences in four out of nine partial indicators. The first variable is PA - leisure time, between 3<sup>rd</sup> and 4<sup>th</sup> grade (both genders together) (4G = 1.70; 3G = 1.61) and between 3<sup>rd</sup> grade girls (1.61) and 4<sup>th</sup> grade girls (1.74). Considering that there are no differences in the PA - leisure time between the 3<sup>rd</sup> and 4<sup>th</sup> grade boys, it can be concluded that the greater activity of the 4<sup>th</sup> grade girls in leisure time contributes to the greater activity in leisure time of the 4<sup>th</sup> grade compared to the 3<sup>rd</sup> grade.

Second and third partial indicator in which the differences are determined are PA – 5 min recess and PA – 15 min recess, between boys and girls in 4<sup>th</sup> grade in both variables, and in both cases the girls have a lower result. Considering that differences between 3<sup>rd</sup> grade boys and girls in same variables have not been determined, it can be concluded that gender differences are still greater in one year of older pupils. This might be attributed to a possible change of habits and type of activity of girls in pre-puberty, in terms of reducing activity during 5 and 15 min recesses. Verstraete et al. (2006) in their research of the effects of providing physical activity games during morning recess and lunch break in elementary schools, have come to conclusion that play during recess is effective in increasing children's physical activity and can increase daily level of physical activity. Correlation coefficient between PA – 5 min recess (0.47) and PA – 15 min recess (0.51) with overall physical activity in this research suggest the same. Fourth statistically significant differences were determined in PA - weekend in two pairs of comparisons, 3<sup>rd</sup> grade girls achieved lower results compared to 3<sup>rd</sup> grade boys and 4<sup>th</sup> grade girls.

By examining the arithmetic means of all groups of participants in table 1, other occurrences may be noted, but with the emphasis of non-existence of statistical significance. 3<sup>rd</sup> grade pupils (both genders) have scores lower than 4<sup>th</sup> grade pupils at 6 out of 9 partial overall physical activity indicators. The overall score of 3<sup>rd</sup> grade girls (3.05) was lower than the other groups (3.16, 3.19, 3.21) and even in 7 out of 9 partial indicators lower than boys of the same grade (3<sup>rd</sup>) and one year older girls (4<sup>th</sup> grade). 3<sup>rd</sup> grade girls contribute to the difference between the 3<sup>rd</sup> and 4<sup>th</sup> grade (both gender together) because the group of boys (3<sup>th</sup> grade) has the highest overall physical activity level and higher scores in 6 of the 9 partial indicators. Gender differences observed in 4<sup>th</sup> grade, they are slightly smaller than the ones in the 3<sup>rd</sup> grade (both not significant) ( $p = 0.131$  :  $p = 0.631$ ). Đokić (2014) determined in his research that boys are more active than girls during the PE lesson and sports activities, in leisure time boys are more engaged in sports while girls are walking. Also, Vidranski and Pejanić (2015) in their research confirm that boys are more active than girls. Furthermore, Jandrić (2010) in his research on Differences between Boys and Girls in Physical Activity has come to the same knowledge, boys are more active and spend more time in playing.

The highest level pupils achieved in partial physical activity indicators was during the PE lesson (4.60), ie all groups were "often" or "every time" active during the PE lesson. Therefore, it is of great importance to emphasize that the pupils' response to organized physical activity that is mandatory to attend is their high activity during them, thus the purpose of these activities is mostly fulfilled. Despite the fact that reported results suggest high activity during PE lessons, pupils' overall physical activity score is to a lesser extent dependent on their activity during PE, which is evident from the correlation between PA – PE lesson and Overall PA. Coefficient of correlation is 0,36 and is the lowest of all partial indicators of physical activity.

## CONCLUSIONS

The main purpose of this research is to determine differences in overall physical activity between 3<sup>rd</sup> and 4<sup>th</sup> grade pupils of elementary school. The assumption was that the age difference between them and difference in number of Physical Education lessons per week between 3<sup>rd</sup> and 4<sup>th</sup> grade (3<sup>rd</sup> - 3 lessons/week; 4<sup>th</sup> - 2 lessons/week) will cause differences in level of overall physical activity. It was also assumed that gender differences could also cause differences between boys and girls of the same grade. The level of physical activity is estimated by questionnaire as the questionnaire is a practical and cost-effective tool for assessing a large sample of participants. The questionnaire selected for this research is Croatian version of PAQ-C questionnaire, a questionnaire of appropriate validity and reliability, according to his authors.

No statistically significant difference in overall physical activity level ( $p = 0.631$ ) was determined between 3<sup>rd</sup> and 4<sup>th</sup> grade (both gender together). Gender differences were not determined either. Gender differences were identified in some partial indicators of physical activity, boys achieve higher scores than girls.

An average pupils' score in overall physical activity is 3.14 (3<sup>rd</sup> grade) and 3.18 (4<sup>th</sup> grade), which is consistent with the survey results (10 years old participants) (3.08 – 1. measurement; 3.04 – 2. measurement) (Vidaković-Samaržija and Mišigoj-Duraković, 2013). Also, pupils' physical activity during PE lesson (4.60) is similar in values to the survey (4.55 – 1. measurement; 4.63 – 2. measurement).

The future research need to upgrade questionnaires for estimation of physical activity level based on self-evaluation, also need to determine reasons of pupil's insufficient levels of PA in some partial parameters of PA. It is a recommendation that pupils should be encouraged to further increase of their physical activity in all of its extracurricular forms, and especially to maintain high levels of physical activity during PE lessons that is satisfactory to the results obtained. From the results of this research it can be concluded that both 3<sup>rd</sup> and 4<sup>th</sup> grade both boys and girls are highly active in mandatory physical activity (PE), while on the other hand the pupils participate differently in other arbitrary forms of physical activity. There is a need and also an obligation to increase physical activity of pupils who have reduced interest in non-mandatory physical activities.

### Announcemet

We announce that the authors have equally contributed to this paper.

### Conflict of interests

There is no conflict of interests among the authors themselves.

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