

# Interaction between Pre-School Children's Physical Activity and Physical Fitness and Their Parents' Physical Activity

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## ABSTRACT

**Background.** Pre-school age is the period of especially fast growth and physical development, characterized by an intensive growth and development of a child's organism, great changes in the activity of the functional systems, which is affected by increasing physical activeness and fitness (Griniene & Vaitkevičius, 2009; Howells & Sääkslahti, 2019). Previous studies have identified parental influence as a factor that can shape a child's physical self-perception and act as a stimulus for physical activity and fitness (Eddolls, McNarry, Stratton, & Mackintosh, 2016). *The aim* of this study was to indicate physical activity of 5–6-year-old children and to determine the interaction between parents' physical activity and physical fitness data.

**Methods.** The study involved pre-school age children ( $n = 59$ ) from 5 to 6 years old: 31 girls and 21 boys; also, their parents ( $n = 101$ ) were involved: 57 mothers and 44 fathers. Physical activity was measured objectively using the ActiGraph GT3X model. The children performed five physical fitness tests (PFT) according to the Eurofit methodology. Also, parents were asked to fill in questionnaires about their own and their children's physical activity, and also subjective physical fitness.

**Results.** It turned out that there was a significant difference in the time spent in moderate and moderate to vigorous (MVPA) physical activity between 5 to 6-year-old children ( $p < .05$ ). Comparing pre-school children's physical fitness by gender we found that boys were more physically fit than girls when performing long jumps, but girls were more physically fit than boys when performing a sit and reach test ( $p < .05$ ). Subjectively measured PA identified that 72.6% of parents (of both genders) were sufficiently physically active and 27.4% were inadequate physically active.

**Conclusion.** The results revealed that 6-year-old children spent more time in sedentary time than 5-year-olds, who accumulated more time in moderate and total MVPA physical activity per day. No significant relation was found between parents' and children's physical activity and fitness.

**Keywords:** physical activity, physical fitness, pre-school child, health, parents.

## INTRODUCTION

Physical activity (henceforth PA) is defined as any bodily movement produced by skeletal muscles that results in energy expenditure (Rogers, Carter, Williams, & Courneya, 2018; WHO, 2017). PA in pre-school age has an impact on children's emotional health, physical development, and mental fitness (Carson, Tremblay, Chaput,

& Chastin, 2016). Pre-school age is the period of especially fast growth and physical development, characterized by an intensive growth and development of a child's organism, great changes in the activity of the functional systems, and increasing physical activeness and fitness (Griniene & Vaitkevičius, 2009; Howells & Sääkslahti, 2019).

The child has an innate need to move and play. A variety of games, mischief, running, and racing allow children to gain experience in PA and physical fitness. The child's movement and functioning are important manifestations that allow them to become stronger and healthier. It is an important factor of growth and maturation (Fathirezaie et al., 2021). The level of physical activity of children has changed dramatically over the last few decades. Nowadays, children spend more time in passive leisure activities: television, internet, video games, and these activities change children's daily habits (Latomme et al., 2017; Vingras, Grikinienė, Jusienė, & Žilinskaitė, 2018). As we can see in international published scientific information, children are sufficiently physically active for an increasingly short period of time (Konstabel et al., 2014; WHO, 2010), and their physical activity decreases (WHO, 2017). As a result of decreasing PA, children face a variety of health problems from an early age.

Physical fitness (PF) and PA of pre-school children are directly connected to each other. For children, PA and PF are very important as they ensure sustainability and the comprehensive physical and emotional, psychological, and social development (Strukčinskienė, Griškonis, Raistenskis, & Stručinskaitė, 2012; Zumeras & Gurskas, 2012). As a child grows, the most important people in his/her life are parents, on whom the future life of the child depends as well (Kornilavičienė & Bagdonas, 2016). Parents and teachers have the biggest influence on pre-school children's physical activity, since children's patterns of behaviour are adopted at an early age. Studies investigating the correlations of physical activity in children have found that the parents' attitudes, habits, lifestyle, parenting styles and practices have a powerful influence on children's health behaviours (Barkin et al., 2017; Hinkley, Salmon, Okely, Crawford, & Hesketh, 2011). The relationship between parents' and children's physical activity appears to be complex. The child's gender may be important, with some work suggesting that parents affect the physical activity of their sons more than the activity of their daughters (Sterdt et al., 2014). Previous studies have identified parental influence as a factor that can shape a child's physical self-perception and act as a stimulus for physical activity (Eddolls et al., 2016).

Based on the results of earlier studies, we raised the hypothesis that children who had physically active parents were more physically active (Barkin et al., 2017; Jago et al., 2014) and have better

physical fitness results (Rutkauskaitė & Bukauskė, 2016). Therefore, the aim of this study was to indicate physical activity of 5–6-year-old children and to determine the interaction between parents' physical activity and physical fitness.

## METHODS

**Organization of research and participants' data.** The study involved pre-school children ( $n = 59$ ) from 5 to 6 years old: 31 girls and 21 boys, and their parents ( $n = 101$ ): 57 mothers and 44 fathers. The study was conducted in February and March of 2020 in two Kaunas kindergartens. With the written consent of parents, the time and details of the study were negotiated in advance with kindergarten administration. The study was conducted in three phases. The first phase (during February of 2020) included recording of all examined anthropometric data and assessment of physical fitness (flexibility, explosive power, speed, and agility). The second phase (during February and March of 2020) was a survey of pre-school parents, which included questions about their and their children's physical activity and subjective physical fitness. During the third stage (in February and March of 2020) children's physical activity was assessed using the ActiGraph GT3X device, which had to be worn by children on the non-dominant hand for one day.

**Testing physical fitness components.** The children performed five physical fitness tests (PFT). They performed Eurofit (Gruodytė-Račienė, Rutkauskaitė, & Miežienė, 2017) in the following test order: the long jump test to test the explosive power of children's leg muscles; sit and reach test to test flexibility; 5 × 10 m speed shuttle run test to test agility; and a ball throw test to measure explosive power of the hands (Katic et al., 2008) and a 20-m shuttle run test to test the speed. All tasks were related to children's daily activities: jumping, running, and throwing. These five PFT were performed twice (except for 20-m running test) and the best result was recorded.

**Physical activity in an objective manner.** Physical activity was also measured objectively using ActiGraph GT3X. Pre-schoolers were instructed to wear it on the non-dominant wrist for one day from the start of the day. Also, participants were told to take the device off when taking a bath, showering, and swimming in the pool. The device was set to record PA data in a 60-s period. Physical activity during leisure time was assessed by using

record of minutes spent in total (minutes during full wear time) and average (minutes/day) at sedentary, light, moderate, MVPA and vigorous intensities.

Participants filled in a questionnaire (sociodemographic data, parents' and children's subjective PA and PF evaluation). A detailed description of the survey is presented below:

1. The first part consisted of general personal questions, requiring to indicate gender, date of birth and initial letters of name and surname.
2. In the second part, participants were asked to indicate their children's physical activity.
3. Third part included questions about parents' physical activity and physical fitness. First,

parents had to make a subjective PA and PF assessment using the scale from 1 to 10. They were asked how many days during the week they participated in PA, the frequency, duration, and intensity during leisure time (according to WHO recommendations). According to the results on their self-reported physical activity, parents were divided into two groups – sufficiently physically active and inadequate physically active (Table 1, according to Petronytė (2009)). Those who met the requirements for the grey square were considered active, while those who met the requirements for the white square were considered to be passive.

Table 1. Participants' (parents) distribution into two physical activity groups (sufficiently physically active and inadequate physically active)

Frequency (times/week)	Duration (hours/week)					
	7	4-6	2-3	1	0,5	0
Every day						
4-6 times/week						
2-3 times/week						
Once a week						
Once a month						
Less than once a month						
Never						

**Statistical analysis.** All the data received from questionnaires and Actigraphs were analysed using IBM SPSS Statistics 25 for WINDOWS 10. To compare the results between genders, arithmetic mean and standard deviation were calculated (descriptive statistics, objectively and subjectively measured physical activity). Differences between genders and PA were analysed using analysis of variance (ANOVA). Results of the questionnaire were processed using percentile analysis, and the reliability of the answers were tested with chi-square ( $X^2$ ) test. Significance value was evaluated as follows:  $p > .05$  – insignificant;  $p < .05$  – significant. To estimate the relation between objectively measured physical activity and factors measured by questionnaire, Pearson's correlation was used.

## RESULTS

The physical activity of pre-school children were examined as activity throughout the day. The averages for each indicator in terms of gender are shown as percentages (Figure 1). When comparing

the study data within 5–6-year-old groups, the physical activity assessment results slightly differed between ages. The results of 5-year-old children showed a higher result of moderate to vigorous PA of daily MVPA. Time spent in sedentary activities accounted for most time of the day, as the results showed that 5-year-olds spent 57.55% of their time on sedentary activities and 6-year-olds spent 60.02% of all-day time.

When comparing physical fitness of pre-school children by gender (Table 2), we found that boys were more physically fit than girls when performing long jumps, but girls were more physically fit than boys when performing a sit and reach test ( $p < .05$ ). When looking at PFJ at a different age, the results were similar.

Parents were divided into sufficiently physically active and insufficiently physically active according to the answers on the frequency of physical activity (times/week) and its duration (hours/week). After analysing parents' questionnaire data, it was found that 72.6% were sufficiently physically active and 27.4 % were insufficiently physically active. The distribution is also presented in Table 3.

Figure 1. Results of different PA intensity by age subjects

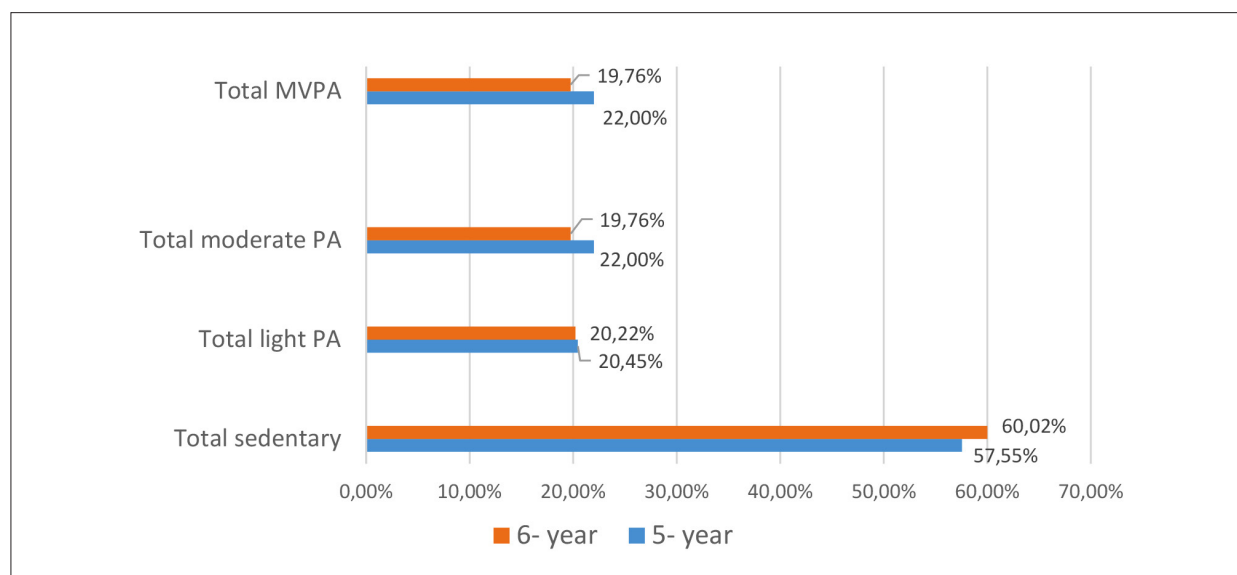


Table 2. Results of physical capacity tests of pre-school children in terms by age

Test titles	5 years	6 years	Mean ( $\pm$ SN)	F-test significance, level of p
Sit and reach (cm)	21.6 $\pm$ 4,5	21.4 $\pm$ 3.4	21.56 $\pm$ 4.0	0.045; p>0.05
Standing long jump (cm)	81.4 $\pm$ 24.2	73 $\pm$ 34.2	78.6 $\pm$ 28.0	1.215; p>0.05
200 g thing throw (m)	3.63 $\pm$ 0.8	4.07 $\pm$ 0.9	3.85 $\pm$ 0.9	3.719; p>0.05
5 $\times$ 10-m speed shuttle run	28.5 $\pm$ 3.9	28.04 $\pm$ 3.6	28.3 $\pm$ 3.8	0.237; p>0.05
20-m shuttle run (s)	5.79 $\pm$ 0.8	5.6 $\pm$ 0.7	5.74 $\pm$ 0.8	0.462; p>0.05

**Note:** x  $\pm$  SN – mean and standard deviation.

Table 3. Relationships between children's physical fitness and their parents' physical activity groups

Tests	Active	Passive	Average ( $\bar{x} \pm$ SN)	F-test significance, level of p
<b>Mother</b>				
Sit and reach (cm)	20.8 $\pm$ 3.9	23.6 $\pm$ 4.0	22.2 $\pm$ 3.9	<b>5.786; p&lt;0.05</b>
Standing long jump (cm)	79.2 $\pm$ 26.8	77.2 $\pm$ 33.0	78.1 $\pm$ 29.9	0.057; p>0.05
200 g thing throw (m)	3.9 $\pm$ 0.8	3.5 $\pm$ 0.9	3.7 $\pm$ 0.9	2.286; p>0.05
5 $\times$ 10 m speed shuttle run	28.8 $\pm$ 3.6	27.5 $\pm$ 4.4	28.2 $\pm$ 4.0	1.197; p>0.05
20 m shuttle run (s)	5.7 $\pm$ 0.6	5.8 $\pm$ 0.9	5.7 $\pm$ 0.8	0.526; p>0.05
<b>Father</b>				
Sit and reach (cm)	21.6 $\pm$ 4.3	23.6 $\pm$ 3.8	22.6 $\pm$ 4.1	1.960; p>0.05
Standing long jump (cm)	78.7 $\pm$ 29.6	81.5 $\pm$ 29.2	80.1 $\pm$ 29.4	0.072; p>0.05
200 g bag throw (m)	3.9 $\pm$ 0.9	3.3 $\pm$ 0.7	3.6 $\pm$ 0.8	<b>4.361; p&lt;0.05</b>
10x5 m speed shuttle run	28.1 $\pm$ 3.3	27.0 $\pm$ 3.9	27.5 $\pm$ 3.6	0.744; p>0.05
20 m shuttle run (s)	5.6 $\pm$ 0.5	5.7 $\pm$ 1.1	5.7 $\pm$ 0.8	0.417; p>0.05

**Note:** x  $\pm$  SN – mean and standard deviation.

To evaluate parents' physical activity and fitness data, respondents were asked to rate physical activity and fitness on a scale from 1 to 10. As we can see in Table 3, both genders of parents rated physical activity similarly, but fathers rated their physical fitness better. In the group of mothers, 3 women (15%) rated their PA with 10 points, while the most common score was 8 with 15 women (58%) choosing it, while 6 men (28.7%) gave the highest score to their PA. However, the most common answer was lower than that of mothers – 7, given by as many as 46.5% of respondents. Comparing physical fitness of both parents, the fathers rated themselves better than the mothers. Only one mother rated herself with the highest score (3%), and the most common answer ranged from 7 to 8 points.

Table 4. Parents' physical activity and physical fitness test scores (means)

	Mother	Father	Mean – (± SD)
Activity (points)	6.47 ± 1.9	6.93 ± 2.1	6.7 ± 1.9
Fitness (points)	6.63 ± 1.7	7.36 ± 1.9	6.96 ± 1.8

Note: x ± SN – mean and standard deviation.

As we analysed parents' physical activity in this study, the data analysed below is related only with physical activity. Foremost, analysis provided the mothers' physical activity data according to gender aspect of the child ( $\chi^2 = 17.1$ ;  $df = 8$ ;  $p < .05$ ) and determined statistically significant differences. Mothers of children aged 5 years and 6 years assessed their own physical activity differently. Mothers of 5-year-old children' physical activity assessed it giving 5 and 7 points, and that was significantly different ( $p < .05$ ) from mothers having 6-year-old children. In addition, mothers whose children aged 6 years rated their activity with higher scores, such as 8, 9, and 10.

## DISCUSSION

Physical activity and healthy lifestyle practice should be developed as early as possible in the child's life (Forinder et al., 2016; Strukčinskienė et al., 2012). The analysis of the performed research suggests that FA has significant benefits for health, physical development, and quality of life (Barkin et al., 2017; Carson et al., 2016; Strukčinskienė et al., 2012; Zumeras & Gurskas, 2012; Zuoženė, Kasperiūnienė, & Zuoza, 2015). If parents encouraged, formed and developed a proper child's

attitude to physical activity in early childhood, a physically active lifestyle is likely to survive stable in the future and for the rest of their lives (Telama et al., 2006; Telama et al., 2014).

The results showed that 5-year-old pre-schoolers spent more time in moderate and moderate to vigorous physical activity. Also, on average, they walked about 2 thousand more steps per day than 6-year-old children. It means that the younger the child by age, the more physically active he/she could be. The *Canadian Fitness and Lifestyle Research Institute* (2017) conducted research including children and young people aged from 5 to 19 years: the results showed that the average number of steps taken per day decreased with age, and those who participated in sports or other PA activities performed 2300 steps more than those who had no physical activity. Assessing children's physical activity in terms of gender, a statistically significant difference was found between PA intensity. The results revealed that girls spent more time engaging in moderate and moderate to high intensity physical activities than boys. Hinkley et al. (2011), in a study with pre-school children, found that boys' physical activity was significantly higher than that of girls. In her systematic review, Tucker (2008) argued that boys were significantly more active and nearly half of the pre-school children did not reach PA recommendations, especially girls. Also, a study conducted by Rutkauskaitė and Bukauskė (2016) concluded that boys were more physically active (42.2%) than girls (25.5%).

The Yao et al. (2015) analysis of parents' relationship with children's physical activity revealed that there was a greater underlying relationship between fathers' and children's physical activity than that of the mothers. On the other hand, other scientific studies showed that mothers were more important, despite the child's physical activity (Jago et al., 2017; Schoeppe et al., 2016). The Maltby, Vanderloo, and Tucker (2018) study showed that the influence of mothers on pre-school children was associated with the intensity of physical activity and less time being sedentary. Also, Jago and colleagues (2017) argued that the influence of mothers' physical activity on a child's PA was stronger than that of fathers. In addition, Schoeppe et al. (2016) demonstrated that the mother's presence of physical activity and walking, rather than that of the father, was a more important indicator of promoting physical activity in children. Jago et al. (2017) showed that children are more likely to follow with PA recommendations by 84%



if parents (or one of them) were following with the adult guidelines and were physical active.

Our study found that physical fitness of 5–6-year-old children was quite similar. However, it was found that flexibility and hand muscle explosive strength was associated with strong correlations with dexterity ( $r = -.3 \pm 0.4$ ,  $p < .05$ ). The more flexible children were, the better they were able to throw the bag further and be more agile. Also, dexterity had a strong correlation with speed ( $r = .4$ ). The more children were agile, the more they were able to run faster the required distance. Klikodujeva (2010) found a very weak correlation between flexibility and other PFT components ( $p > .05$ ). However, the results of this study were statistically significantly associated with leg muscle explosive force (standing long jump), ( $p < .05$ ).

## CONCLUSION

Considering the time spent on moderate and moderate to vigorous (MVPA) physical activity,

there was a significant difference between 5 to 6-year-old children ( $p < 0.05$ ). The results revealed that 6-year-old children spent more time in sedentary time than 5-year-olds, who accumulated more time in moderate and total MVPA physical activity per day. Comparing the pre-school children's physical fitness by gender we found that boys were more physically fit than girls when performing long jumps, but girls were more physically fit than boys when performing a sit and reach test ( $p < .05$ ). Subjectively measured PA identified that 72.6% parents (of both genders) were sufficiently physically active and 27.4% were inadequately physically active. No significant relation was found between parents' and children's physical activity and fitness. Correlation analysis of research results showed a statistically significant direct relationship between fathers' physical activity and children's sedentary time ( $p < .05$ ). Regarding the link between parents' physical activity and children's physical fitness, correlations were statistically significant ( $p < .05$ ).

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