

## THE EFFECT OF PARENTS' PHYSICAL ACTIVITY AND INACTIVITY ON THEIR CHILDREN'S PHYSICAL ACTIVITY AND SITTING

Erik Sigmund, Kateřina Turoňová, Dagmar Sigmundová, Miroslava Přidalová

Faculty of Physical Culture, Palacký University, Olomouc, Czech Republic

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Next to genetic predispositions, performance of physical activity (PA) in children is influenced by a variety of variables including the parents' PA. The aim of this study is to describe associations between PA and sitting in children aged 8–13 and their parents according to sex and to examine whether their participation in organized PA influences a higher level of total PA.

The level of performed PA, time spent sitting and their participation in organized PA were examined in 193 children (84 girls and 109 boys) and their parents (183 mothers and 157 fathers) using the Czech version of the IPAQ questionnaire.

We have identified positive associations between parents' physical activities, which are the strongest in the duration of walking ( $r_s = 0.48-0.71$ ;  $p < 0.001$ ). A longer duration of total PA in daughters, sons and their fathers and mothers is related to a shorter daily period of time spent sitting ( $r_s = 0.08-0.40$ ). A longer period of time spent daily in sitting in parents is associated ( $r_s = 0.28-0.42$ ;  $p < 0.006$ ) with a longer period of time spent sitting in their children. Children, both daughters and sons, and their mothers, who participate in organized PA twice or more times a week, show a significantly longer period of time spent performing vigorous PA ( $p < 0.02$ ;  $\eta^2 > 0.05$ ) than children whose mothers are without any participation in organized PA.

Based on the associations found between physical activity, sitting and participation in organized PA, we can agree with the statement that "more physically active parents are bringing up more physically active children" (it is more apparent in sons). On the other hand "less physically active parents are bringing up less physically active children" (it is more apparent in daughters). Participation in organized PA in children and mothers positively influences higher levels of PA in total, especially of vigorous PA.

*Keywords: Walking, vigorous and organized physical activity, IPAQ questionnaire, mother, father, daughter, son.*

### INTRODUCTION

Education of children towards the active development and protection of their physical, mental and social health has been a priority in contemporary educational trends at the elementary schooling level (Jeřábek & Tupý, 2007). In kinanthropology, we attempt to establish a healthy and physically active lifestyle in children and youth. This includes monitoring of physical activity (PA) and the environment regarding the relations between "school-family-leisure time" with an aim of emphasizing the determiners that are either enhancing or limiting physical activity and to create PA recommendations and programs. PA performance in children is, next to genetic predispositions, conditioned and influenced by a range of variables that include parents' PA.

The influence of parents' behavior on physical activity in children and adolescents has been frequently analyzed in literature (Bois, Sarrazin, Brustad, Trouilloud, & Cury, 2005; Gustafson & Rhodes, 2006; Kalakanis, Goldfield, Paluch, & Epstein, 2001; Medeková, Zaple-

talová, & Havlíček, 2000; Prochaska, Rodgers, & Sallis, 2002; Sallis, Prochaska, Taylor, Hill, & Geraci, 1999; Sallis, Taylor, Dowda, Freedson, & Pate, 2002; Voss, Hosking, Metcalf, Jeffery, & Wilkin, 2008), but due to the variety of methods applied, the findings are often contradictory or limited (Prochaska, Rodgers, & Sallis, 2002; Welk, Wood, & Morss, 2003). Less frequently, the associations between parents' PA and children's PA are studied according to sex – mothers  $\approx$  daughters (or sons); fathers  $\approx$  sons (or daughters) (Bois et al., 2005; Medeková, Zapletalová, & Havlíček, 2000) or the type or intensity of PA performed (Andersen & Wold, 1992; Sallis et al., 2002).

Gustafson and Rhodes (2006) argue, on the basis of the results of 34 American and European cross sectional and longitudinal studies concerning the relation of parents' PA and children's PA over the last 20 years, that positive support from parents predicts higher PA in their children. By the parents' support, they understand motivating children, providing physical activity and sports equipment and their own involvement in PA

and leading PA. It has been shown that this positive influence is more apparent in younger children (Sallis et al., 1992) and in vigorous PA (Andersen & Wold, 1992; Sallis et al., 2002).

Frequently, the support of PA in children is associated with the socioeconomic status of the family; however, the results are often contradictory. Monitoring weekly PA in 214 children aged 7–8 using the ActiGraph accelerometer, Voss et al. (2008) found out that children from families with a lower financial income participate less in organized PA but their total weekly PA is independent of their parents' income. On the other hand, a higher parents' socioeconomic status is positively associated with higher PA at weekends ( $r = 0.34$ ) in their 8–10 year old children (Ziviani, MacDonald, Ward, Jenkins, & Rodger, 2008). Similarly, Sallis and Owen (1999) suggest that children of parents' having a higher education or from families with higher financial incomes, have better conditions in order to perform PA and at the same time, they are more physically active than the children of parents' who have a lower education level or lower financial incomes.

In a study carried out in 9 year old children ( $n = 297$ ) and their parents, Sallis et al. (1992) found out that boys from incomplete families showed higher PA than boys from families with both parents. "Boys from incomplete families are perhaps more active since they are not so attended to by parents and they have to rely more on themselves in terms of transportation such as walking or cycling than boys from complete families" (Sallis et al., 1992, 1387).

The relationship between the physical activity of children and their parents is not clearly unequivocal; it is likely conditioned by various psychological variables (the temperament, type and preference of leisure time activities), social ones (completeness of the family, number and sex of siblings and friends), environmental ones (location and type of housing, the availability and safety of sports facilities and other areas for PA), somatic ones (weight, health) and other variables that need to be emphasized when creating effective health and physical activity enhancing programs. Our study's purpose is to describe the relations between different kinds of physical activity (walking, moderate and vigorous PA), time spent sitting and time spent performing organized PA in parents and their children according to sex – mother  $\approx$  daughter (or son), father  $\approx$  son (or daughter).

## AIM

The aim of the study is to assess whether "more physically active parents bring up more physically active children" applying the analysis of the associations

between PA and sitting in 8–13 year old children and their parents according to sex. A further goal is to assess whether the participation of children and their parents in organized physical activity influences higher PA in total.

## METHODS

### Selection of methods and surveys

The analysis of the association between PA of parents and their children was a part of a broader research effort aimed at the assessment of the somatic state of children aged 8–13 regarding the determinants of overweight (Turoňová, 2008). In three directly selected elementary schools in Olomouc that agreed to participate in our research, 138 girls and 154 boys aged 8–13 were addressed to participate in the study. Upon the explanation of the aims of the study, the children obtained the IPAQ questionnaire. Along with the questionnaire, the children and their parents received a form of consent regarding participation in the study.

Out of the total of the addressed participants, 70% of the children (88 girls and 117 boys) and 63% of the parents (191 women and 177 men) gave written consent to participation in the study. Of IPAQ questionnaires from children, 6.3% and from parents, 7.6% were not fully or correctly completed. In the end, data from 192 children (84 boys and 109 girls) and 340 parents (183 mothers and 157 fathers) were included into the analysis of the associations between PA and sitting.

The children's and parents' participation in the study was voluntary and no incentives were paid to them. The study was approved by the ethics committee of the Faculty of Physical Culture at Palacký University in Olomouc.

### IPAQ questionnaire

The level of weekly PA of the participants was estimated using the Czech version of the IPAQ short version questionnaire on physical activity (Frömel, Bauman et al., 2006). The Czech short version of the questionnaire was translated and standardized from the English standardized original "International Physical Activity Questionnaire" (Craig et al., 2003). The first page of the short administrative IPAQ questionnaire includes one question on the duration and weekly frequency of vigorous PA, moderate PA and walking.

Vigorous PA is reflected in faster breathing and an apparent increase in heart rate. It includes physically demanding PA such as running, aerobics, fast cycling or digging or lifting heavy loads (Frömel et al., 2006; Haskell et al., 2007). Moderate PA involves medium exertion, when one breathes faster than when resting and

the heart rate noticeably increases. Walking is a general example of this type of activity.

The second page of the administrative version of the IPAQ questionnaire asks about demographic characteristics of the respondent (sex, age, education, employment, size of residence), one additional question concerning the time spent sitting on working days, and other personal characteristics (weight, height, nationality, type of housing, smoking, material background and regular participation in organized PA) (Frömel, Bauman et al., 2006). Organized PA is understood to be intentional, planned and targeted PA controlled by a teacher, an instructor, or a trainer, aimed at meeting a physical activity goal, and very often at maintaining or improving one's fitness and health at the same time (Frömel, Novosad, & Svozil, 1999).

The final score obtained from the IPAQ questionnaire is based on the daily or weekly duration of total PA or its individual types (minutes/week), or its level (METmin/week). The number of METminutes of vigorous PA = 6 × duration of vigorous PA (minutes/week). The number of METminutes of moderate PA = 4 × duration of moderate PA (minutes/week) and the number of METminutes of walking = 3.3 × duration of walking (minutes/week). The values of multiples 6.4 and 3.3 are equivalents of PA intensity which were set when standardizing the IPAQ questionnaire.

### Statistical processing and data interpretation

Data were analyzed using the STATISTICA 6 (Statsoft ČR, 2002) software. The associations between participation in organized PA, duration of individual types of PA and sitting in parents and their children were quantified using the Spearman's coefficient of ordinal correlation  $r_s$ . The degree of association expressed by the absolute values of the  $r_s$  coefficient (0.1–0.3; or 0.3–0.7; 0.7–1) can be interpreted as being small, medium or large (Hendl, 2004). To identify the statistical significance of differences between the duration of PA and sitting in groups of children and their parents, we divided the groups according to their participation in organized PA (none :  $1 \times$  :  $\geq 2 \times$  week), using the Kruskal-Wallis non parametric test. To assess the logical significance of the tested differences, we used the "effect size"  $\eta^2$  coefficient. The most common interpretation of the values of the  $\eta^2$  coefficient is 0.01 – small effect, 0.06 – medium effect and 0.14 – large effect (Morse, 1999).

## RESULTS

The closest associations between PA in parents and their children are found in walking and total PA (TABLE 1). This finding is moreover enhanced by the

identification of the inverse relationship between the time spent performing PA by children and time their parents spent sitting. Physical inactivity in parents, represented by sitting, is closely associated with a longer period of time spent sitting in children. The analysis of the relationships between PA and sitting in parents and their children has not shown any apparent differences in values of correlation coefficients  $r_s$  when taking into consideration the age of daughters and sons. Positive relations between PA in parents and their children or inverse relations between time spent performing PA in children and sitting in their parents are independent of the children's age.

The results point at closer relationships between mothers' PA and that of their children rather than fathers' PA (TABLE 1); the differences are not however statistically or logically significant. Fathers have a closer relationship to their sons' PA than to their daughters' PA.

More frequent participation in organized PA is positively reflected in a higher level of weekly PA (METmin) especially in mothers and their children (both sons and daughters) and in vigorous PA (TABLE 2). When testing statistically the differences in PA between groups of parents and their children, categorized according to their weekly participation in organized PA, we have found out that children (both sons and daughters) and mothers participating in organized PA show a significantly higher level of vigorous PA (METmin/week) than children and mothers without participation in organized PA [daughters:  $H(2, n = 84) = 7.84, p = 0.02, \eta^2 = 0.10$ ; sons:  $H(2, n = 109) = 17.63, p = 0.0001, \eta^2 = 0.16$ ; mothers:  $H(2, n = 183) = 22.28, p = 0.0001, \eta^2 = 0.12$ ].

A higher degree of participation in vigorous PA in children and mothers with more frequent participation in organized PA was not reflected in a lesser performance of moderate PA or walking.

The level of total weekly PA and its individual types in children and parents, depending on their participation in organized PA, is shown in Fig. 1 and 2. Fig. 1 shows that an increase in vigorous PA in children participating once or twice a week in an organized PA session is significantly reflected in higher weekly PA in total than in children without any participation in any organized PA while keeping approximately the same levels of walking and moderate PA in both groups.

In children participating twice or more times a week in organized PA, we observe a positive finding of less time spent sitting than in children without participation in an organized PA. The results apply to both girls and boys where we do not find any differences between them in terms of PA and sitting.

In comparison to children, already one instance of participation in an organized PA a week in parents is positively reflected in their total PA (Fig. 2). Along with

**TABLE 1**

Relationships ( $r_s$ ) between time spent walking, moderate PA and vigorous PA and sitting in parents and their children.

$r_s$		MOTHERS					FATHERS				
		Overall PA	Walking	Moderate PA	Vigorous PA	Sitting	Overall PA	Walking	Moderate PA	Vigorous PA	Sitting
<b>D A U G H T E R S</b>	Overall PA	<b>0.50</b>	<b>0.63</b>	0.20	0.05	-0.22	0.24	<b>0.41</b>	0.11	0.02	-0.01
	Walking	<b>0.48</b>	<b>0.71</b>	0.06	0.01	-0.05	0.23	<b>0.48</b>	0.03	0.01	-0.12
	Moderate PA	<i>0.28</i>	<i>0.30</i>	0.19	0.04	-0.23	0.15	0.16	0.25	0.07	-0.15
	Vigorous PA	0.27	0.22	0.24	0.11	-0.25	0.10	0.10	0.10	0.02	-0.07
	Sitting	-0.04	0.06	-0.17	-0.11	<b>0.40</b>	-0.09	-0.11	-0.10	0.02	<b>0.42</b>
<b>S O N S</b>	Overall PA	<b>0.53</b>	<b>0.44</b>	<b>0.46</b>	0.21	-0.28	<b>0.46</b>	<b>0.39</b>	<i>0.33</i>	0.23	-0.30
	Walking	<b>0.54</b>	<b>0.54</b>	<b>0.44</b>	0.10	-0.32	<b>0.43</b>	<b>0.48</b>	0.20	0.19	-0.36
	Moderate PA	<i>0.30</i>	0.19	<b>0.34</b>	0.13	-0.11	<b>0.39</b>	0.25	<b>0.39</b>	0.15	-0.20
	Vigorous PA	0.17	0.06	0.11	<i>0.28</i>	-0.10	0.08	0.04	0.10	0.13	0.01
	Sitting	0.05	0.09	-0.03	0.03	<i>0.28</i>	0.01	0.01	-0.05	0.09	<i>0.29</i>

Legend:

$r_s$  – Spearman's coefficient of ordinal correlation,

PA – physical activity,

Statistical significance – *italics*  $p \leq 0.01$ ,

**bold**  $p \leq 0.001$ .

**TABLE 2**

Relationships ( $r_s$ ) between the level of walking, moderate PA and vigorous PA (METmin/week) in parents and their children regarding organized PA ( $0 \times$  week,  $1 \times$  week  $\geq 2 \times$  week)

$r_s$	Daughters	Sons	Mothers	Fathers
<b>Overall PA</b>	<i>0.29</i>	<i>0.29</i>	0.13	0.04
<b>Walking</b>	0.13	0.06	0.04	0.11
<b>Moderate PA</b>	<i>0.27</i>	0.14	0.05	0.04
<b>Vigorous PA</b>	0.25	<b>0.36</b>	<b>0.31</b>	0.03

Legend:

$r_s$  – Spearman's coefficient of ordinal correlation,

PA – physical activity,

Statistical significance – *italics*  $p \leq 0.01$ ,

**bold**  $p \leq 0.001$ .

more frequent participation by parents in organized PA, we can observe an increase in vigorous PA (Fig. 2). Neither in children nor in parents, is the more frequent

participation in an organized PA accompanied by less walking nor by an increase in sitting (Fig. 1, 2).

## DISCUSSION

The aim of the study was to assess whether “more physically active parents bring up more physically active children” by applying the analysis of the associations between PA and sitting in 8–13 year old children and their parents according to sex.

Similarly to international studies (Medeková, Zapletalová, & Havlíček, 2000; Gustafson & Rhodes, 2006; Sallis, Taylor, Dowda, Freedson, & Pate, 2002; Welk, Wood, & Morss, 2003) analyzing larger samples of participants, we have found positive relations between parents' PA and their children's PA. Yet, the associations we have found are higher than in the mentioned studies. Among the reasons we can find the homogeneity of the observed sample of children (3 geographically related schools, with the same programs and similar facilities,

Fig. 1

The comparison of medians of individual types of PA (METmin/week) and sitting (MIN/week) in children divided according to their participation in organized PA

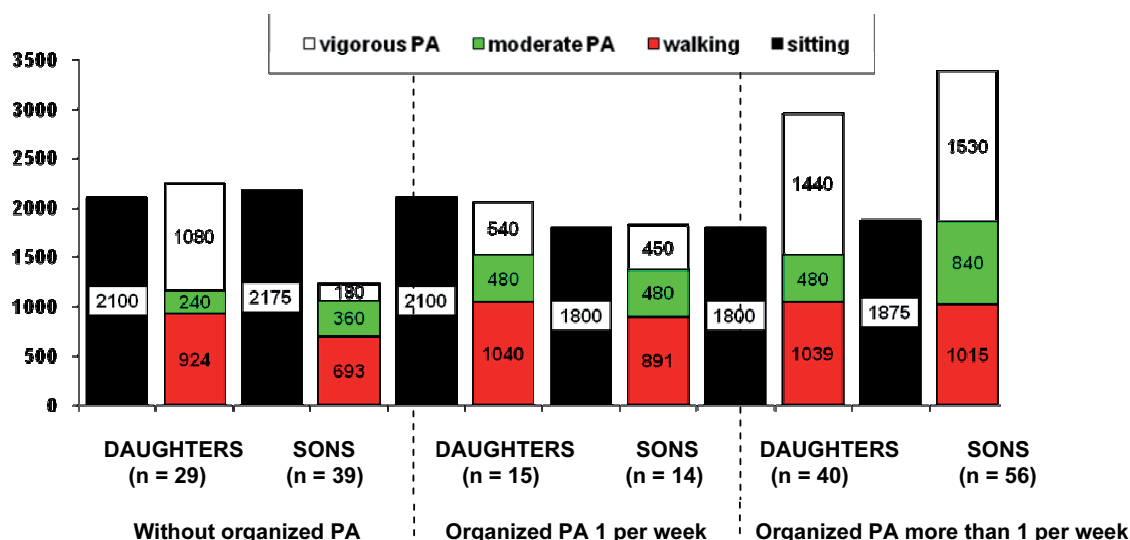
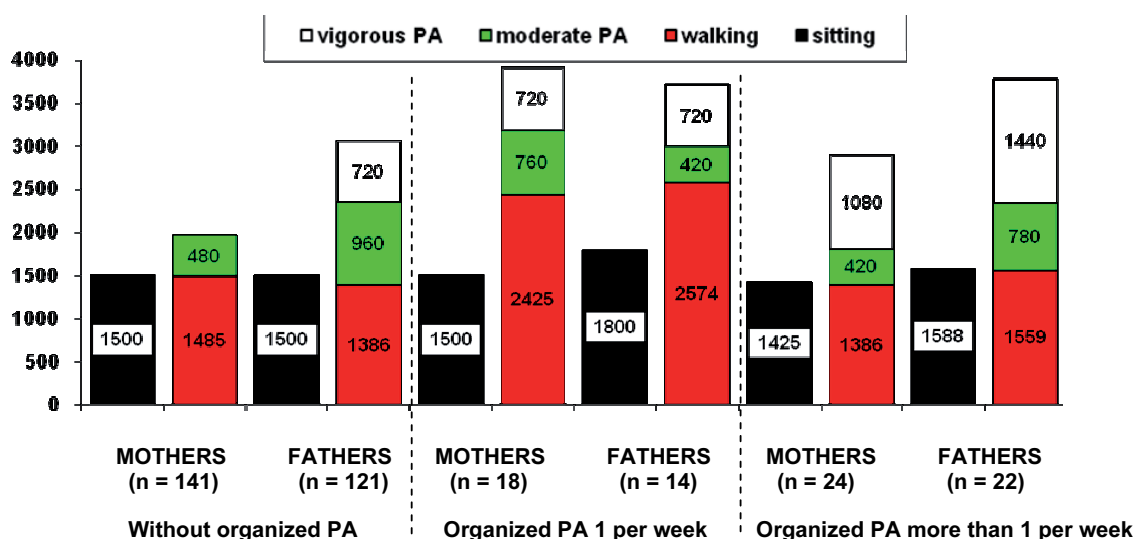


Fig. 2

The comparison of medians of individual types of PA (METmin/week) and sitting (MIN/week) in parents divided according to their participation in organized PA



the same place of residence) and parents (similar higher education and similar socioeconomic status) and moreover also a good organization of this single time survey. The fact that we can be still considered a “walking” society is proved by the closest associations between PA in parents and children found in walking, which is a dominant type of weekly PA performed.

Similarly to Medeková, Zapletalová and Havlíček (2000) in 6–9 year olds or Welk, Wood and Morss (2003) in children aged 8–11, we argue that “more physically active parents bring up more physically active children”. Yet, only Medeková, Zapletalová and Havlíček (2000) have not confirmed a stronger influence of fathers on their children’s PA than mothers; un-



like Sallis et al. (2002) in 9–17 year old children. In our study, mothers are showing a slightly closer relationship to their children's PA (both sons and daughters) than fathers, who tend to devote themselves more to their sons' PA than to their daughters'. We can assume that mothers do not tend to prefer either sons or daughters, unlike fathers, who tend to support more their sons' ambitions in PA.

Another goal of the study was to identify whether parents' and children's participation in organized PA is reflected in a higher level of total PA. This secondary goal may seem to be tautological, yet it is not. Based on previous studies of adolescents, it was found that vigorous PA performed in the form of organized PA was often "compensated for" by longer periods of physical inactivity (sitting, lying, watching TV or using a computer) and by shorter length of time spent walking in leisure time in comparison to non participation in an organized PA which could be associated with longer periods of time spent walking or performing leisure PA (Frömel, Novosad, & Svozil, 1999).

Participation in organized PA is a significantly positive correlate of PA in daughters, sons and mothers, which is apparent mainly in an increase in vigorous PA. While in children participation twice or more times a week in organized PA becomes apparent in a higher weekly rate of PA in total, in mothers already the participation once a week in organized PA influences a higher weekly rate of PA in total. Moreover, we have observed that more frequent participation in organized PA is associated with less time spent sitting and at the same time there is not less walking observed.

More than the influence of actual parents' PA on their children's PA, the parents' support of their children towards PA has been discussed (Gustafson & Rhodes, 2006; Sallis et al., 1992; 1999; 2002). The transportation of children to sport facilities, paying of fees and buying of certified sports equipment are becoming more important due to the decrease of the availability of a natural environment for PA, the overall decline of PA in children, the increase of more technical sport activities and the emphasis on safety and health aspects of PA performance.

Monitoring of the relationships between parents' PA and their children's PA is also important due to, for example, the creation of effective physical activity programs. Not only their support, but the parents' actual participation in PA helps to increase their children's PA. In a study describing PA in 8–12 year old obese children, Kalakanis, Goldfield, Paluch and Epstein (2001) found that PA in their parents is a good predictor of the children's PA intensity. Therefore, they recommend physical activity intervention programs in obese children to include also their parents' participation in PA.

## LIMITS AND RECOMMENDATIONS OF THE STUDY

The application of the standardized questionnaire to assess the level of weekly PA and the relationship between parents and children is considered to be the major limit of the study, which does not allow for an overall generalization of the findings. Despite that fact that Sallis et al. (2002) found similarity between the results obtained from the questionnaire and more objective PA monitoring using CSA accelerometer concerning the relationship between PA in parents and their children. In questions concerning the volume of PA, the participants tend to overestimate its real volume, in general. To reduce the number of incorrect or incomplete IPAQ questionnaires, a trained university student was involved in the study to assist the participants with questionnaire completing in both children and parents.

In further studies, we recommend assessing the relationships between PA in siblings, schoolmates or friends who can also play a vital role in motivation them to participate in PA (Sallis et al., 1999; 2002). An analysis of children's PA in the school, out of school and family environments can be important, as well as the assessment of PA stability in relationship to parents' PA. A school environment motivating children to participate in PA along with providing safe and qualified instructors can be a significant stimulus influencing children aged 12–14 to participate in PA (Sallis, Conway, Prochaska, McKenzie, Marshall, & Brown, 2001).

## CONCLUSIONS

- Regardless of sex and age, the relationships between physical activity in 8–13 year olds and their parents are positive. The closest relationship between children's PA and their parents PA are found in the daily time spent walking, then in total weekly PA and moderate PA. We can conclude that "more physically active parents (both mothers and fathers) bring up more physically active children" (it is more apparent in sons).
- A longer period of time spent performing PA in both sons and daughters and mothers and fathers is related to a shorter daily period of time spent sitting. Overall, we can argue that "less physically active mothers and fathers bring up less physically active children" (it is more apparent in daughters).
- Children (both sons and daughters) and their mothers, who participate twice or more times a week in organized PA show significantly ( $p < 0.02$ ) longer periods of time performing vigorous PA than children and mothers without participation in organized

PA. Participation in organized PA is thus positively reflected in a higher level of weekly PA in total.

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# VLIV POHYBOVÉ AKTIVITY A INAKTIVITY RODIČŮ NA POHYBOVOU AKTIVITU A SEZENÍ JEJICH DĚTÍ (Souhrn anglického textu)

Provádění pohybové aktivity (PA) dětí je vedle genetických predispozic podmíněno a ovlivněno řadou proměnných, mezi něž patří také PA rodičů. Cílem této studie je s ohledem na pohlaví popsat vztahy mezi PA a sezením u 8–13letých dětí a jejich rodičů a zjistit, zda se účast v organizované PA podílí na celkově vyšší úrovni realizované PA.

Úroveň realizované PA, doba sezení a účast v organizované PA byla u 193 dětí (84 děvčat a 109 chlapců) a jejich rodičů (183 matek a 157 otců) zjišťována prostřednictvím české standardizované verze dotazníku IPAQ.

Mezi pohybovou aktivitou rodičů a dětí nacházíme pozitivní vztahy, které jsou nejtěsnější u doby trvání chůze ( $r_s = 0,48-0,71$ ;  $p < 0,001$ ). Delší doba realizace celkové PA se u dcer i synů a jejich matek i otců vztahuje ke kratší době každodenního sezení ( $r_s = 0,08-0,40$ ). Delší doba každodenního sezení rodičů je asociovaná ( $r_s = 0,28-0,42$ ;  $p < 0,006$ ) s delší dobou sezení jejich dětí. Děti, dcery i synové, a jejich matky, které se dva a vícekrát týdně účastní organizované PA, vykazují signifikantně delší dobu provádění intenzivní PA ( $p < 0,02$ ;  $\eta^2 > 0,05$ ) než děti a jejich matky bez účasti v organizované PA.

Na základě zjištěných vztahů mezi pohybovou aktivitou, sezením a účastí v organizované PA lze souhlasit s tvrzením, že „pohybově aktivnější rodiče vychovávají pohybově aktivnější děti“ (zřetelněji u synů). A naopak „pohybově méně aktivní rodiče vychovávají pohybově méně aktivní děti“ (zřetelněji u dcer). Účast v organizované PA se u dětí a matek příznivě podílí na celkově vyšší úrovni realizované PA, zvláště pak u intenzivní PA.

**Klíčová slova:** chůze, intenzivní a organizovaná pohybová aktivita, sezení, dotazník IPAQ, matka, otec, dcera, syn.

## Erik Sigmund, Ph.D.



Palacký University  
Faculty of Physical Culture  
tř. Míru 115  
771 11 Olomouc  
Czech Republic

### Education and previous work experience

He is a researcher and academic worker of Center for Kinanthropology Research at Faculty of Physical Culture in Palacký University, Olomouc. Graduated in Mathematics and Physical Education high school teacher from Palacký University (Czech Republic) and obtained his Mgr. in 1997. He obtained Ph.D. in the field of Kinanthropology in 2000 (Faculty of Physical Culture, Palacký University, Olomouc). His scientific interests are in the areas of physical activity and life style of children and data analysis, especially formal concept analysis. He is a member of the American College of Sports Medicine (ACSM), member of the European Public Health Association (EUPHA) and member of the Czech Kinanthropology Society.

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