

Parental Education and Physical Activity in Pre-School Children

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Background: The purpose of this study was to objectively assess preschool children's total physical activity (TPA) patterns and compliance with guidelines and to examine differences relative to parental education.

Methods: The sample consisted on 509 healthy preschool children, aged 3 to 6 years recruited from kindergartens located in the metropolitan area of Porto, Portugal. The PA was assessed for 7 consecutive days by accelerometry. For TPA, we followed the guidelines of the National Association for Sport and Physical Education (2009) (children who spent at least >120 min per day in active play). For moderate-to-vigorous physical activity (MVPA), we calculated the proportion of children who spent at least >60 min per day in active play based on Tremblay *et al* (2012). Parental Education was analyzed according to the Portuguese education system.

Results: Children with parents in the highest education level were less active than children from low and middle education level ($p \leq 0.001$) in all patterns of PA (week and weekend). Regarding TPA during the week we found that the majority of children from low and middle parental education meet the NASPE guidelines. On the other hand, more than half the children from high parental education did not meet these recommendations ($p \leq 0.001$) and MVPA recommendations ($p \leq 0.05$). In both recommendations, children from low parental education were twice more likely to meet the recommendations compared with children belonging to high parental education.

Conclusion: Parent education was negatively associated with children's daily physical activity patterns and compliance with guidelines.

Keywords: physical activity, accelerometers, guidelines, parental education

Social changes over time, from rural to industrial, to modern, have resulted in drastically changed lifestyle (Eaton 2003). Decreases in physical work, increases in education, the improvement of the quality of life and more time for leisure activities have all effected physical activity (PA) patterns in high and middle income countries (Sallis and Owen 1999). The result has been an increase in physical inactivity and sedentary behaviour, which has had an impact on health level, quality of life and the functional autonomy of populations, which is now one of the major public health problems of the Twenty-First century (Blair 2009).

Current health-related physical activity guidelines suggest that preschool children should accumulate at least 120 min of PA per day (60 min daily of structured and 60 min daily of unstructured PA) for a healthy lifestyle (NASPE 2009). More recently, an expert panel recommended that children should participate in at least 60 min of moderate-to-vigorous PA (MVPA) per day (Tremblay *et al*, 2012).

While these recommendations highlight the need for a daily PA engagement, it does not always occur and it does not remain constant throughout the week.

There is some evidence that PA declines on the weekend (Vale *et al*. 2010, Treuth *et al*. 2007). PA has important health outcomes throughout the life-span (WHO 2010, Strong *et al*. 2005), therefore, it is imperative for children to remain active into adulthood (Nelson and Gordon-Larsen 2006). Hence, it is important to identify, as best as possible, the factors that influence PA in children. One factor that has been systematically referenced in literature as a contributing factor to PA is parental education (Santos *et al*. 2004, Ball *et al*. 2009). Although different studies point-out that youth from low parental education families have a higher risk for an unhealthy lifestyle and cardiovascular disease compared to those from higher PE (House 2002, Huurre *et al*. 2003, Pollitt *et al*. 2007), there is inconsistent evidence concerning the association between PA and parental education background in children and adolescents (La Torre *et al*.

2006, Kaluski *et al.* 2009, Walters *et al.* 2009, Drenowatz *et al.* 2010, McMurray *et al.* 2000, Kristensen *et al.* 2008, Whitt-Glover *et al.* 2009, Johnston *et al.* 2007, Bratteby *et al.* 2005). To the best of our knowledge, only one study of preschoolers has analyzed the differences between patterns of PA and socioeconomic status (SES) (Kelly *et al.* 2006) and none have analysed results according to PA recommendations.

Thus, the purpose of this study was to objectively assess preschool children's physical activity (TPA) patterns and compliance with guidelines of total physical activity (TPA) and moderate to vigorous physical activity (MVPA) and to examine differences relative to parent's education.

Material and Methods

Participants and setting

The “*Prestyle Project*” was designed as a cluster-randomised controlled trial. The unit of randomisation is public school class (pre-school class and kindergartens). The schools were located in Matosinhos City, which belongs to Porto District, Portugal. There were 30 schools with pre-school classes in the municipality. Accordingly, 25 school classes from different school settings were selected and a random sample of 1160 children, aged 2–6 year, was recruited, however a total of 625 children were evaluated per year. The present study only included children aged 3.5–6.0 years, who wore an accelerometer for 7 consecutive days and had information about parental education. Thus, final sample of the present study included 509 healthy preschool children (48.5% girls; 5.2±0.8 years; height 1.12±0.78 m; body mass 21.4±4.2 kg). Informed written consent was obtained from the children's parents or guardians and the school principal.

Study procedures were approved by the Portuguese Foundation for Science and Technology and by the Ethics Committee of Physical Activity and Health PhD program hosted by the Faculty of Sport at Porto University.

Physical activity assessment

Daily physical activity was measured by an Actigraph accelerometer, model GTM1 (Pensacola, FL 32502, USA) a small, lightweight, uniaxial device. This accelerometer produces “raw” output as activity counts per minute, which provides information about the total amount of physical activity (Janz 1994). Alternatively, accelerometer output can be interpreted using specific cut-points, which describe different intensities of physical activity. Data reduction, cleaning, and analyses of accelerometer data were performed using a specially written program (MAHUFFe; available in www.mrc-epid.cam.ac.uk), described and used previously (Purslow *et al.* 2008; Sardinha *et al.* 2008). For the purpose of this study, the epoch duration or sampling period was set to 5 s, which is better and more accurate for the spontaneous and intermittent activities of children as used previously with a similar sample (Vale *et al.* 2009, Oliver *et al.* 2009).

Data were analysed using specific pediatric cut-points, which have been validated for young children: <1100 counts per minute for sedentary time recommended by Reilly *et al.* (Reilly *et al.* 2003), >1100 counts per minute for active time recommended by Reilly *et al.* (Reilly *et al.* 2003), >1680 counts per minute for moderate physical activity, and >3360 counts per minute for vigorous physical activity per minute suggested by Pate and colleagues (Pate *et al.* 2006).

For total activity, we followed the guidelines of the National Association for Sport and Physical Education (NASPE 2009), calculating the proportion of children who spent at least >120 min per day active. For moderate-to-vigorous physical activity, we calculated the proportion of children who spent at least >60 min per day active based on Strong *et al.* (2005).

Parental Education

Parents' education was used as a proxy measure of socio economic status. It has been previously done in the Portuguese context (Mota and Silva 1999), since it is known that education is positively associated with more health-related knowledge (Tur *et al.* 2005) and a higher capacity to put it into practice (Ball and Crawford 2006). The family parental education considered the highest level of education from mother or father, respectively. In mono-parental (single-parent) families the parental education was based on the children's principal guardian. The parental education was scored based upon Portuguese Educational system with 9 years' education or less - sub secondary level (scored as 1), 10-12 years' education-secondary level (scored as 2), and higher education (scored as 3). Levels 1, 2, and 3 were considered as low, middle, and high parental education (Mota and Silva 1999).

Protocol

The study was conducted on 7 consecutive days (Monday to Sunday) between March 2009 and November 2010 to account for seasonal variation. A minimum of 10 hours of data per day was required for analysis. Parents were instructed to attach the accelerometer when the child woke and to remove it when they went to bed. The accelerometer was firmly adjusted at the child's right hip by an elastic waist belt under their school clothing. A data sheet was given to the children's teachers, who were instructed to record the time when each child arrived at and left school. Activities were not prescribed or directed by the teachers and researchers. Children participated in normal activities with their classmates.

Statistical analysis

Means and standard deviations were calculated to describe children's characteristics by different PA patterns during week and weekend days. The time spent each day in MVPA was calculated by summing the minutes of MPA and VPA for each day. To examine the patterns of PA, data were separated into weekdays and weekend days. Sex differences in TPA and MVPA between weekdays and weekend days were tested with an independent samples t-test (Table 1). A general linear model (GLM) with repeated measures was used to examine differences in TPA and MVPA between weekdays and weekend days within each sex and the interaction between sexes. (*data not shown*). Differences by parental education for TPA and MVPA between weekdays and weekend days were assessed by analysis of covariance (ANCOVA), controlling for sex (Table 2). A chi-square test was used to determine differences between the parental education in the proportion of children complying with PA guidelines (Figure 1). Following bivariate correlation analysis we conducted logistic regression to examine the association between parental education and complying with PA guidelines (Table 3). All statistical were performed using SPSS 17.0 for Windows, and Statistical significance was set at <0.05 .

Results

Table 1 summarizes physical activity patterns during weekdays and weekend days. On average, boys spent significantly more time in TPA than girls ($p<0.001$) on weekdays ($p<0.001$) and on weekend days ($p<0.001$). Furthermore, regardless of sex, preschool children engaged significantly more in TPA and MVPA on weekdays than on weekend days ($p<0.001$ in all of patterns). There was no significant sex interaction between the sexes for all patterns of PA therefore parental education was analyzed taking into consideration the whole sample.

Table 1 – Sex differences in TPA and MVPA between weekdays and weekend days were tested with an independent samples t-test

Characteristics	Total (n=473)	Girls (n=247)	Boys (n=262)	<i>p</i>
Total activity – week (min/day)	141,8±36,3	133,0±32,1	150,0±38,1	≤0,001
Total activity – weekend (min/day)	124,3±40,3	116,1±33,7	131,4±44,5	≤0,001
Moderate to Vigorous activity – week (min/day)	101,6±27,9	94,4±25,5	108,4±28,6	≤0,001
Moderate to Vigorous activity – weekend (min/day)	88,1±31,0	81,9±26,4	94,0±33,7	≤0,001

Table 2 shows that, children of parents with high education were less active than children from low and middle parental education. This was shown in all patterns of PA (total and moderate to vigorous) during the weekdays ($p\leq0.001$). At weekends the minutes spent in TPA and MVPA were similar in all categories of parental education ($p>0.05$).

Table 2 – Parental Education differences in TPA and MVPA between weekdays and weekend days were assessed by analysis of covariance (ANCOVA), controlling for sex

Characteristics	Low PE (n=252)	Middle PE (n=132)	High PE (n=76)	p
Total activity – week (min/day)	145,5±34,1	144,9±42,5	128,3±31,9	≤0,001
Total activity – weekend (min/day)	123,3±39,3	125,3±44,9	123,1±35,7	0.887
Moderate to Vigorous activity – week (min/day)	105,0±27,9	102,9±29,2	92,0±25,9	0.002
Moderate to Vigorous activity – weekend (min/day)	87,8±31,6	87,8±30,6	88,4±29,8	0.989

Controlling for sex

The majority of children with low and middle parental education met the total PA recommendations (59% and 58%, respectively). However, less than half the children with high parental education (38%) met these recommendations ($p=0.008$). The same tendency was observed with MVPA recommendations although the prevalence with was different ($p = 0.035$). (Figure 1)

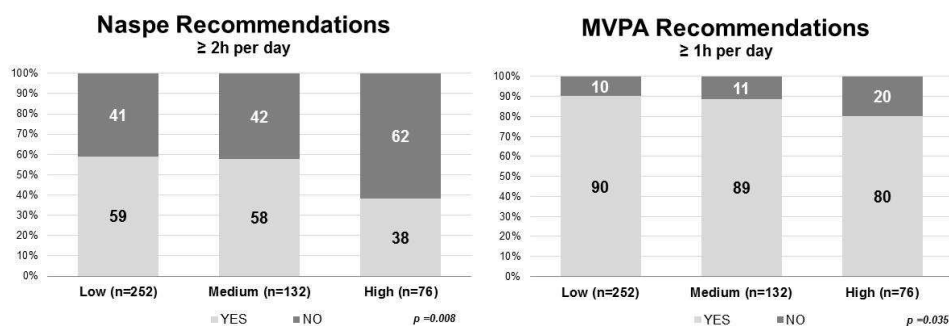


Figure 1 – Prevalence of children met the total and moderate to vigorous physical activity recommendations according to parental education.

Logistic regression analysis (Table 3) showed that in both recommendations children from low parental education were more than twice as likely ($OR= 2.4$; $p\leq 0.05$) to met the recommendations compared with children from high parental education, after adjustment for sex.

Table 3 – Multivariable Logistic Regressions with outcome “complying with recommendations”

	NASPE Recommendations		MVPA Recommendations	
	Multivariable (odds ratio (95% CI))	P value	Multivariable (odds ratio (95% CI))	P value
High PE - REF				
Middle PE	1.0 (0.7-1.6)	0.893	1.2 (0.6-2.4)	0.596
Low PE	2.4 (1.4-4.2)	≤0,001	2.4 (1.2-4.9)	0.015

REF – reference; PE – parental education * Adjusted for sex

Discussion

The present study aimed to assess participation of preschool children in total physical activity (TPA) and moderate-to-vigorous physical activity (MVPA) on weekday and weekend days according to their parental education. Additionally, we assessed compliance with recommendations for TPA (NASPE 2009) and for MVPA (Tremblay *et al.* 2012) according to their parental education.

The results of the present study suggested that boys engaged in more ($p\leq 0.05$) time in TPA and MVPA than girls, which has been shown in other studies of preschool children (Hinkley *et al.* 2008). Our results also showed that, irrespective of sex, children were significantly more active

(TPA and MVPA) on weekdays than weekend days. These findings are similar to those previously reported in 266 Australian pre-school children (Okely *et al.* 2009) as well as in elementary school children assessed by accelerometer (Moller *et al.* 2009).

The most important finding of this study was that parental education was significant and negatively associated with children's PA level. Indeed, children assigned as low parental education are the most active, regardless of the PA intensity assessed. Even though the relationships between parental education and PA has been addressed in youth, to the best of our knowledge only one other study objectively assessed the relationship of socio economic status and PA in this same age group (Kelly *et al.* 2006). In general, data reporting associations between SES and PA are controversial. Some recent studies in youngsters showed a positive association (La Torre *et al.* 2006, Kaluski *et al.* 2009, Walters *et al.* 2009, Drenowatz *et al.* 2010), while others described a negative association (McMurray *et al.* 2000, Kristensen *et al.* 2008) and still others didn't find any relationship between them (Whitt-Glover *et al.* 2009, Johnston *et al.* 2007, Bratteby *et al.* 2005).

Regarding compliance with PA recommendations, to the best of our knowledge, no study with pre-school children addressing the association with children's parental education. Guidelines state that preschool children should accumulate at least 120 min of PA per day (60 min daily of structured and at least 60 min daily of unstructured of physical activity) (NASPE 2009) and participate in at least 60 min of MVPA per day (Strong *et al.* 2005). Our findings showed that on weekdays around 72% and 95% of the children met the NASPE and MVPA recommendations, respectively. When parental education, was taken into account, we found that during the week that the majority of children from low parental education (77% week; 51,1% weekend) met the TPA recommendations and the same applied to about $\frac{2}{3}$ of children from middle parental education. However, more than half the children (46,6% week; 39,71% weekend) in high parental education did not meet these recommendations. To best of our knowledge, no study has attempted to analyze PE according to PA recommendations, and thus we haven't any comparable information.

In our study we considered parental education level as a measure of SES, as it has been previously done in the Portuguese context (Mota and Silva 1999), because it is known that education is positively associated with more health-related knowledge (Tur *et al.* 2005) and a higher capacity to put it into practice (Ball and Crawford 2006). Although Kelly *et al.* (2006) categorized SES through the combination of different factors (material goods, housing conditions, professional situation, etc.) and not only parents' education, as the present study did.

On the other hand it was verified by Voorhees *et al.* (2009), in 6 grade girls, even though there is no objective association between SES and PA there is between PA type and location: girls with low SES engage in more informal, spontaneous and moderate to vigorous activities at home than higher SES girls.

PA location seems to be relevant. Telama *et al.* (2009) concluded that children of parents with higher SES had more access to physical and sportive practices over 28 years (from 1977 to 2005). Although, there was not such evidence when comparing organized PA in the school environment and comparing children's spontaneous PA.

Adolescents in families with higher SES may have easier access to physical activities and sports paid by their parents, but this may not be as relevant to pre-schoolers as their physical activity may be in more informal situations that do not require payment (Ferreira *et al.* 2006).

Dregval and Petrauskiene (2009) found that Lithuanian children of low parental education as well as the ones that lived outside the urban centres, spent more time in open aired activities and less time in sedentary activities (e.g., playing computer), compared with higher SES children or urban children. These authors suggested that families with low SES have limited access to computers which might contribute to more time spent in PA away from home.

Another important factor is the parents' perception of safety and security of living areas that is associated with more frequent open air activities (Stalsberg and Pedersen 2010). However the relationship between people and their environments varies across-culture. People from different cultures are brought up in different environments with different values, norms and practices. Thus, it is often difficult to make comparisons.

Hence, it is important to recognize the factors that influence PA in children and to be able to document what amount of the population is obtaining the health benefits of PA and what sections need to be targeted to increase their levels of PA (Baranowski *et al.* 1992). Therefore, the determination of evidence-based PA guidelines to inform public health professionals, health policy, educators and for knowledge translation to the general public is crucial.

The strengths of this study were the objective assessment of PA in pre-school children based on their parental education. Thus, our findings raised some novel data about this age group and added some new insights to the literature in this field. However, some limitations should also be recognized. The study included preschool children from only one metropolitan area, which makes it difficult to generalize the findings and it is not possible to infer causal relationships using such a cross-sectional design. However, cross-sectional studies might be useful to describe the risk factor profile in a population, providing information of the relationship between different variables. Nevertheless, this study focused on the assessment of PA levels in a preschool sample using an objective measure, which enhanced the confidence of our findings because it was suggested that objective measures such as accelerometers provided more valid PA assessment in children (Pate *et al.* 2006).

In summary, parental education was negatively associated with daily patterns of PA and guidelines compliance.

Key Messages:

- There has been a decrease in physical activity, which has had an impact on health level and quality of life of populations.
- On weekdays around 72% and 95% of the children met the NASPE guidelines and moderate to vigorous PA recommendations, respectively.
- Children with parents in the lowest education group were the most active, regardless of the PA intensity assessed.
- This study found that parental education was negatively associated with daily patterns of physical activity and guidelines compliance in preschool children.
- It is important to recognize the factors that influence physical activity in children and to be able to document what amount of the population is obtaining the health benefits of physical activity.

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