

CHILD AND PARENTAL PHYSICAL ACTIVITY: IS THERE AN ASSOCIATION WITH YOUNG CHILDREN ACTIVITY?

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SUMMARY

Objectives: The aim of the study is to examine the physical activity (PA) of young children and their parents on weekdays and at the weekend, as well as possible associations between them.

Methods: Fifty-eight children (29 boys), aged 5–8 years (mean age = 6.53 years) and the parent who spent more time with them (25 fathers, 33 mothers, mean age 40.67 years) wore Omron HJ-720IT pedometers for seven consecutive days. Two ANOVAs for repeated measures were applied to examine PA differences between genders and week phases (weekdays vs. weekend days) in children and parents. Moreover, one sample t-tests were used to compare participants' PA to the recommended PA, while linear regression analyses were utilized to examine whether parental PA in each week phase was associated with children's PA.

Results: Children accumulated more steps on weekdays than at the weekend ($F_{1,56} = 18.58, p < 0.001, \eta^2 = 0.27$), while boys presented higher PA than girls ($F_{1,56} = 12.42, p = 0.001, \eta^2 = 0.20$), and accomplished the recommended daily PA, in contrast to girls. Mothers and fathers presented similar PA ($p = 0.67, \eta^2 = 0.004$), with more steps on weekdays than at the weekend ($F_{1,56} = 9.22, p = 0.004, \eta^2 = 0.16$). However, their PA was significantly lower than the recommended. Finally, there were no statistically significant associations between parents' and boys' ambulatory activity either on weekdays ($p = 0.938$) or at the weekend ($p = 0.095$). On the contrary, parents' PA explained 47% of girls' PA on weekdays ($R = 0.68, F_{1,28} = 22.81, p < 0.001$) and 23% at the weekend ($R = 0.48, F_{1,28} = 6.40, p = 0.02$).

Conclusions: Boys appear to be more physically active than girls in Greece, whereas mothers and fathers present similar ambulatory activity. Moreover, parents' PA is related to that of their daughters and not to that of their sons. Taking into account that both girls and parents did not meet PA recommendations, family-based interventions are needed for both children and parents benefit.

Key words: ambulatory activity, family, pedometers, steps, health

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<https://doi.org/10.21101/cejph.a5043>

INTRODUCTION

Several studies have revealed that nowadays young children present low levels of physical activity (PA) (1, 2). Children's inactivity constitutes a threat to public health, as it is now well documented that participation in PA is positively associated with the enhancement of many health parameters (3, 4). That is why many scientific organizations have published PA recommendations according to which young children should daily accumulate at least 60 minutes of moderate to vigorous PA (5). The pedometer PA that corresponds to the aforementioned guideline is 10,000–14,000 steps/day (6).

The imperative need for the enhancement of young children's PA has led several researchers to investigate the factors that can affect children's participation in PA (7–9, 11–14). Their results highlighted the important role of both the socioeconomic context of child rearing (7) and the school environment (8). Another significant factor seems to be the parents (9), as according to the Social Cognitive Theory (10), they are among the vital contributors to children's socialization. Parents shape their offspring's health-

related behaviours, such as PA, serving both as potential “gate-keepers” to PA and role models (11). Regarding their supporting role, parents can enhance children's PA levels through behaviours such as providing them with opportunities for active play at home and/or outdoor (9); watching them take part in PA, praising them, encouraging the participation in sports or recreational movement activities; transporting them to athletic clubs or other PA places; paying the fees for their child participation (11, 12).

As far as the potential influence of parents' PA on that of their children is concerned, it is believed that it is indicative of the support for PA that parents offer to their offspring (13). Especially in the early years, when parent-child coactivity is common, parenting PA modelling plays a significant role in the establishment of a social norm regarding activity/inactivity (11). This role weakens as the child matures (12). That is why several researchers state that parents' PA (11, 14) and family-based coactivity (12) should be among the main aims of policies attempting to increase young children's PA.

If the role of parents' PA on that of their children is to be investigated, the accurate PA recording would significantly contribute to

this investigation. PA recording methods, such as questionnaires, diaries, etc., have been used in several studies (15). Nevertheless, it is now well known that for gathering objective information, motion sensors, like pedometers and accelerometers, had to be utilized for PA recording (16). Among the aforementioned objective methods for PA assessment, the use of pedometers is supported by several researchers due to the fact that the information they provide is understandable by the general public (17). However, there are very few studies that have examined the association between parents' and children's PA with the use of pedometers. To our knowledge, there is only one study focusing on preschool age (18), a second one using data of 9–12 years old children (19), and a third one with a sample of a wider age range (20). Those studies have revealed that children's PA is associated with that of their parents (18–20).

Active parents appear to be more supportive of their young children's PA (11), especially at weekends, when family members share their free time, children of more active parents present higher PA levels than their peers of less active parents (18, 19). The aforesaid studies provide evidence on the importance of the role of parents' PA to the enhancement of children's PA, however, this evidence is limited. If sound conclusions on whether parents' PA assists children to accomplish PA recommendations are to be drawn further research is needed. The aim of the present study was to examine weekdays/weekend PA of parents' and their young children and to investigate possible associations between them.

MATERIALS AND METHODS

Participants

Two kindergartens and two elementary schools in Athens, Greece, were randomly selected and an invitation letter was sent to the parents of students aged 5–8 years, informing them about the purpose of the study and inviting the parent who spent more time with their child to participate. Sixty-five families (69.9% of the invited families) volunteered to participate. A written consent was obtained for the parent and child participation in this study that was approved by the Ethics Committee of the School of Physical Education and Sport Sciences, National and Kapodistrian University of Athens Institutional Review Board.

Among the participants, seven children had incomplete pedometer data (i.e. their pedometers recorded data for less than three weekdays and one weekend day) and they were not included in the analyses. Therefore, the final sample consisted of 58 children (29 girls and 29 boys), aged 5–8 years (mean age = 6.53 years, SD = 0.93) and of one of their parents (25 fathers, 33 mothers, mean age = 40.67 years, SD = 4.56).

Measures

Anthropometry

In order to have a better profile of the participants, their anthropometric characteristics were also measured. Body weight of children was measured with a Seca Beam Balance (710) to the nearest 0.1 kg, whereas their height was measured with a Seca Stadiometer (208) to the nearest 0.5 cm. Children's BMI was calculated as weight/height² and their weight status was estimated

according to the Obesity Task Force cut-off criteria (21). Parents reported their body mass and height and their BMI was classified according to the World Health Organization (underweight: BMI < 18.5, normal weight: 18.5 < BMI < 24.99, overweight: 25 < BMI < 29.99, obese: BMI > 30.0) (22).

Physical Activity

The Omron HJ-720IT pedometers were used to monitor both children's and parents' PA. The Omron HJ-720IT has two piezo-electric sensors that use multi-position measurement technology. They can record steps when they are placed horizontal, vertical or even upside down, a characteristic that makes their use more practical for children. The HJ-720 shows on screen the data of the last seven days, while they can store data that is accessible up to 41 days.

Regarding the validity of the HJ-720 pedometer, there is sufficient research evidence supporting it. Specifically, this particular device has been found to satisfactorily record the ambulatory activity in Greek young children (23).

Procedure

This study was conducted between March and May 2015. Once the written consent of parents for involving themselves and their children in the study was received, a meeting between the first two authors and parents was arranged, in which parents were given a questionnaire regarding their age and age of their children. Moreover, they were fully informed about pedometer operation and they were given two pedometers (one for themselves and one for their child). Pedometers were placed on the right hip of participants, who wore them for a typical week (7 consecutive days) of spring, all day long, except the hours of sleep, the bath time and activities in the water. This week started one day after the meeting with the parents; the pedometer data of the meeting day were not included in statistical analyses to deal with potential reactivity (18, 19). For each day step counts, pedometer records lower than 1,000 or higher than 30,000 steps were considered as outliers and were not taken into account. Pedometer counts were calculated for two time periods, weekday: average step counts for at least three weekdays data; weekend: average step count for at least one weekend day data.

Data Analyses

Descriptive statistics were calculated for all variables. Two ANOVAs for repeated measures (one for children and one for parents) with gender as the fixed factor and the step counts of week phases (weekdays vs. weekend days) as the repeated factor were utilized with alpha set at 0.05. Moreover, effect size with η^2 was also examined for data interpretation, according to Cohen's (24) guidelines ($\eta^2 < 0.06$ = small; $\eta^2 < 0.13$ = medium; $\eta^2 > 0.14$ = large).

Differences between weekdays/weekend steps and the step count recommendations were tested using one sample t-tests, separately for parents, boys and girls. The ambulatory activity recommendations of Tudor-Locke et al. for adults (25) and young children (6) were used as test values. For parents this value was 10,000 steps, while for children the lowest limit (10,000 steps) of the recommended step range (10,000–14,000) was used as test value. For data interpretation, apart from p-values, effect size, us-

ing Cohen's *d*, was examined (*d*=0.20 small effect size; *d* = 0.50 medium effect size; *d* = 0.80 large effect size) (24).

Moreover, linear regression analyses were utilized to examine whether parental ambulatory activity in each week phase (weekdays, weekend days) was associated with children's ambulatory activity in the same phase (one analysis for each week phase). Due to the significant gender differences found in children's steps, the aforementioned regression analyses were computed separately for boys and girls. The significance level was set at *p*<0.05.

RESULTS

Sample characteristics are presented in Table 1. A high prevalence of overweight and obesity was revealed for both children (29.2% for boys, 23.1% for girls) and parents (26.3% for fathers, 27.8 for mothers), with almost one in four children or parents being found to have excess weight.

Children's and their parents' step counts per day in each week phase are presented in Table 2.

The ANOVA with repeated measures showed that children accumulated significantly more steps on weekdays than at the weekend ($F_{1,56} = 18.58, p < 0.001, \eta^2 = 0.27$), whereas boys presented higher ambulatory activity than girls ($F_{1,56} = 12.42, p < 0.001, \eta^2 = 0.20$), with η^2 values suggesting a large practical significance in both cases. On the other hand, there was no interaction between gender and week phase ($F_{1,56} = 0.01, p = 0.910, \eta^2 = 0.000$).

Regarding step count recommendations (6), 31% of boys did not accumulate 10,000 steps on weekdays, whereas at the weekend this percentage was higher (70.4%). However, the one sample *t*-test utilized in boys' data showed that their ambulatory activity was not statistically different from the lowest limit of step count recommendations either on weekdays (*p*=0.058, *d*=0.37) or at the weekend (*p*=0.66, *d*=0.086). In girls, the percentage

of those who did not meet step recommendations was 72.4% on weekdays and 88.5% at the weekend. Moreover, the one sample *t*-test revealed that they accumulated statistically less steps than those recommended both on weekdays ($t_{28} = 3.23, p = 0.003, d = 0.60$) and at the weekend ($t_{28} = 5.71, p < 0.001, d = 1.13$) and these differences were of moderate (for weekdays) to large (for weekend) significance.

As far as parents' ambulatory activity is concerned, they had significantly more steps on weekdays than at the weekend ($F_{1,56} = 9.22, p = 0.004, \eta^2 = 0.16$), while there were neither gender differences (*p*=0.67, $\eta^2 = 0.004$) nor interaction between gender and week phase (*p*=0.23, $\eta^2 = 0.031$). Only 22.8% of parents met the ambulatory activity guidelines of Tudor-Locke et al. (25) on weekdays and 14.3% at the weekend. According to the one sample *t*-test that was utilized, parents' steps/day were significantly lower than the ambulatory activity guidelines, both on weekdays ($t_{57} = 5.46, p < 0.001, d = 0.72$) and at the weekend ($t_{57} = 7.62, p < 0.001, d = 1.09$), with Cohen's *d* values suggesting a moderate to large practical significance.

Furthermore, the linear regression analyses showed that parents' PA was significantly associated with girls' PA but not with boys' PA. Specifically, with regard to girls, parents' ambulatory activity explained 47% of girls' PA on the weekdays ($R = 0.68, F_{1,28} = 22.81, p < 0.001$) and 23% at the weekend ($R = 0.48, F_{1,28} = 6.40, p = 0.020$). On the contrary, there were no statistically significant associations between parents' and boys' ambulatory activity either on weekdays (*p*=0.938) or at the weekend (*p*=0.095).

DISCUSSION

The aim of the present study was to examine weekdays/week-end PA of parents' and their young children, as well as to inves-

Table 1. Sample characteristics (means and standard deviations or percentages)

		Children		Parents	
		Boys (n=29)	Girls (n=29)	Fathers (n=25)	Mothers (n=33)
Age		6.64 ± 0.98	6.40 ± 0.94	43.08 ± 4.98	39.22 ± 3.91
BMI (Kg/m ²)		16.69 ± 2.00	16.47 ± 2.44	28.31 ± 6.05	21.95 ± 3.65
BMI categories	% normal weight	70.8	76.9	73.7	72.2
	% overweight	25.0	7.7	10.5	27.8
	% obese	4.2	15.4	15.8	0

Table 2. Pedometer determined physical activity values of children and their parents (means and standard deviations)

		Weekday PA (steps/day)	Weekend PA (steps/day)
Children	Boys	11,247.78 ± 3,054.70	8,756.67 ± 4,375.35
	Girls	8,473.00 ± 2,728.77	6,108.85 ± 3,471.84
	Total	9,886.57 ± 3,194.78	7,457.74 ± 4,141.58
Parents	Fathers	8,028.50 ± 3,495.74	6,041.58 ± 3,705.68
	Mothers	7,805.16 ± 3,129.01	6,958.64 ± 2,643.03
	Total	7,914.55 ± 3,280.79	6,509.47 ± 3,207.38

tigate potential associations between them. The results revealed that children were significantly more active on weekdays than at the weekend, a finding that is confirmed in several previous studies (2, 19, 26). In Greece, only one study (2) focusing on preschoolers' ambulatory activity had been conducted before this one, in which children accumulated 9,191 steps/day on weekdays and 7,913 steps/day at the weekend. According to the relevant literature, among the factors that potentially account for PA differences between weekdays and weekend days in children are the socio-cultural context in which they live (27), the PA of children's family (8), and the school settings (8, 27). One could suppose that the higher PA levels on school days are a result of physical education lessons or other PA activities organized at schools, but according to previous studies (28), school settings in Greece seem not to contribute to the enhancement of young students' PA, as school time is a "sedentary time". The higher ambulatory activity on weekdays found in the present study can be attributed to the participation of children in after school movement/sport activities. Although there is no published research regarding the number of children that participate in after school activities, or the types of those activities, it is known that children in Greece take part in at least one organized movement programme, such as football, basketball, dance, or gymnastics.

Regarding gender PA differences, previous research findings are conflicting, with some researchers reporting similar ambulatory activity for both genders (1, 2) and others revealing that boys are more active than girls (19, 20, 29). In the present study, boys were found to have higher ambulatory activity than girls, however, both presented low levels of PA, a finding that is in line with the study of Kambas et al. (2). It is impressive that a very high rate of girls who participated in this study did not meet step recommendations either at the weekend or on weekdays that were found to be the more "active" part of the week. Also, a high percentage of boys did not gather 10,000 steps/day at the weekend, however, boys' ambulatory activity was comparable to the lowest limit of the daily steps recommendations of Tudor-Locke et al. (6), whereas girls did not manage to accomplish the above step count guideline. According to the literature, boys' and girls' PA differences can be attributed to the type of play they choose, with boys preferring outside competitive games and girls preferring quiet games involving more fine than gross motor skills (30). Taking into account the aforementioned as well as that the data in the present study were collected during spring, a season with good weather conditions in Greece, boys' higher PA levels are not surprising.

Regarding potential gender differences in parents' week PA patterns, in a previous study mothers were found to be more active on weekdays than at the weekend, while in fathers' activity no significant differences were revealed between weekdays and weekend (18). However, in the present study, fathers and mothers showed similar ambulatory activity, accumulating significantly more steps on weekdays than at the weekend, a finding that is confirmed by several previous studies (19, 20). It seems that at the weekend, when parents have more free time than on weekdays, they prefer sedentary activities. Moreover, Greek parents' PA was found to be significantly lower than the recommended PA (25), both on weekdays and at the weekend, with a high percentage of the participants failing to reach PA guidelines.

Concerning the association between parents' and children's PA, several research findings support that parental PA is associated with that of their children, regardless the method used for PA recording: accelerometers (29), questionnaires (15) or pedometers (19). In the present study, the results revealed that this association was not consistent in sons and daughters. Parents' ambulatory activity was significantly associated to girls' activity, both on weekdays and at the weekend, but not to that of boys' PA. The different strength of the parental-child PA association in daughters and sons is reported in several previous studies with different patterns. Specifically, according to Craig et al. (20), only boys' PA, and not girls' PA, was related to their parents'. Similarly, Cantell et al. (14) found that daughters' PA was independent of their parents', while sons' PA was correlated with that of their fathers' PA but only at the weekend. Moreover, in other studies a gender-specific PA tendency was found, with mothers' PA correlating with daughters' PA, and fathers' PA with sons' PA (29). The present study provides another perspective of this parent-child association; although its small sample does not allow its results generalization, its findings are interesting since girls' PA appears to be less positively affected by environmental factors at individual, family and community level (31). In the present study, both parents and daughters presented low PA levels, so concerns have arisen about the impact of the parent-daughter association on girls' health-related behaviours. It can be assumed that the parents participating in this study who were "inactive" had a negative influence on their daughters' PA behaviour, and that should be taken into account if girls' PA is to be enhanced.

Taking into consideration that social variables, such as parenting role, may be among the most significant modifiable factors for children's PA (11), policies aiming at PA enhancement should focus on family activities, especially at weekends. The Greek State authorities should take into consideration the importance of PA for public health and provide the Greek families with the opportunities and motivation to be physically active. Informing parents about both their role on children's PA and the importance of equally encouraging their sons and daughters to participate in PA, as well as offering free organized PA programmes for families in municipal parks might be an important step towards a more active population.

The present study has some limitations that should be discussed. First of all, the small sample size, as well as the fact that all participants were citizens of Athens, impede the generalization of the current findings. Moreover, the use of pedometers for PA recording should be taken into account when these results are to be interpreted, as these devices do not provide information about the type and intensity of PA. However, this study is among a few objectively examining the association between parents' and their children's PA, and the first one conducted in Greece. Through such studies light will be shed on the role parents can play in their offsprings' PA and effective interventions can be planned and implemented. Further research on this topic gathering information on variables such as family socioeconomic status or family size in a larger sample is needed, so this important side of children's PA can be fully understood.

Conflict of Interests

None declared

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Received January 18, 2017

Accepted in revised form February 5, 2018