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The influence of club football on children's daily physical activity

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Studies on the effects of organized club sports on children's total amount of physical activity (PA) show varying results. This may be partly due to different sports having different activity levels, but also different possibilities for being played outside club settings. This study investigates how playing football as a club sport is associated to the total amount of daily PA among children and how increased school recess activity impacts on this. Using accelerometers, the average daily amount of children's PA as well the activity levels in specific contexts, such as during club-sports and school recess, was measured on a sample of 518 Danish children aged 9–10. The study found that children playing club football had higher total daily amounts of PA than both children taking part in other club-sports and children not taking part in club-sports at all. About half of the difference in total PA could be explained by higher activity levels during school recess. The association between club football and total PA, and the mediating effect of school recess PA, can be interpreted as the result of two main factors: the high activity levels during club football, and that Danish school grounds have football facilities which allow able and interested children to play football for many hours each week during school recess. On a more general level, the results indicate that the influence leisure-time club sport participation has on PA may differ due to how well the sport can be transferred to and played in other daily contexts for children's self-organized PA, such as school recess.

Introduction

Physical activity (PA) in children has been shown to decrease the level of cardiovascular disease risk factors and increase bone density.[1] This has made children's overall PA a fundamental part of health promotion policies in many countries.[2] One strategy that is often used in Denmark and other Scandinavian countries is to try to increase the number of children participating in leisure-time club sport.[3] However, studies on the effects of organized club sports on children's total amount of PA show varying results.[4] One study found that participating in club-organized sports did not strongly influence 6–10 year old children's total amount of daily PA, but that activity levels during school recess and other contexts for self-organized play did as children spend many more hours each week in such contexts than they do participating in club sports.[5] It is likely that different sports have different effects and influences on the total amount PA. The influence of club sports on children's total amount of PA may vary due to the differing PA levels involved in different types of sports, but

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perhaps also due to differences in how well the sport can be transferred to other contexts important for children's self-organized physically active play, such as school recess.

Surveys show that football is a very common leisure-time sport among Danish children, especially for boys.[6,7] Football has been shown to produce high activity levels especially when played in small teams.[8] Studies have also shown that football is a common activity in school recess among boys, and that this activity and its facilities occupy large proportions of Danish school grounds during recess, creating good opportunities for large amounts of daily PA for those children (most often boys) who are able and interested to play.[9] This study tests the hypothesis that football will have a stronger influence on children's daily amount of PA than other types of leisure-time club sports, due partly to the high activity levels when playing football in the club, but especially to increased school recess activity for those children playing the sport. This is done by firstly testing the association between leisure-time club football participation and total amount of daily PA in a large sample of third-grade children, and secondly testing the mediating effect of school break activity levels on this association.

Methods

Participants

Two Danish suburban municipalities – Taarnby and Ballerup – were invited and agreed to participate in a large multidisciplinary study of children's PA called COSCIS. All 18 schools in these two municipalities agreed to participate. The 1024 children attending third grade in the 18 schools were invited to participate in the study. Seven hundred and four consented to take part. From these 704 participants, questionnaire data combined with sufficient measures of PA[10] were obtained from 518 children when the children were in third grade (9–10 years old). This sample is broadly representative of the general Danish population in terms of social parameters such as the distribution of rental and self-owned accommodation, socio-economic position and the proportion from ethnic minorities.[11]

Measurements of PA

The children's habitual PA was measured using the uniaxial MTI 7164 accelerometers (Actigraph, Fort Walton Beach, Florida, USA). The MTI 7164 accelerometers have been well validated in children against gold standard measures of PA[12] and have been shown to compare favourably with other similar objective measuring instruments.[13] The monitors record body movement as a combined function of the frequency and intensity of the movement allowing detection of normal human motion and rejecting high-frequency vibrations encountered in activities such as car or bus transport. In order to best reflect the distribution of school days and school-free days (weekends and holidays) in school children's lives, both school days and weekend days were included in the measuring period. The four days of recording included 1–2 weekend-days (mean = 1.68). Due to variation in sleeping patterns in children, accelerometer data were analysed for each child from 7 am to 11 pm. To further ensure that the accelerometer measures of daily PA were not corrupted by including data from periods when the accelerometers were not being worn, a

program was used to automatically delete missing data (defined as continuous sequences of zeros longer than 10 min which could only be caused by the accelerometer not being worn). This technique has been recommended as an important part of ensuring the reliability of accelerometer data.[14] To reduce the bias from some children not wearing their monitors for the total measuring period, each child's daily minutes of PA were calculated by multiplying the defined daily measuring period for all children (960 min) with the percentage time for which each child was active during their individual total measuring period. To minimize any bias from the novelty of wearing an activity monitor, the MTI monitors were worn by the children for one day before recording. Data were included in the final data-set only if the monitor had recorded more than eight hours of valid recordings a day for at least three days (4 days $n = 379$, 3 days $n = 139$).[15]

Determining the contexts of the activity measurements and identifying club sports participation

The children's class timetables were collected together with self-reported leisure-time activities in order to identify the contexts for the above-described activity measures. The children's class timetables for the days of measuring were used to classify PA measures as activity during school recess, during school in general and during time outside school. A standardized activity self-report questionnaire jointly filled in by parents and children every day during measurement was used to gain information about the time periods for the children's daily leisure-time activities including the exact time they participated in club-organized sport and what kind of sport they participated in during that time. Children who reported having done sports in institutional settings such as sports clubs, dance or riding schools were categorized as participating in club-organized sports and exercise. Children who reported having played football in a club were categorized as playing club football.

Data transformation to PA variables

To obtain information on the activity levels of the children in more specific daily contexts, data were analysed for Total Time (7 am to 11 pm on all the measured days), and for School Time (defined by the schedule of the class, typically weekdays from 8 am to 2 pm). These time periods were then subdivided into more specific contexts for PA such as school recess and leisure-time club sports using the time table of each child's school class and self-reported activities from questionnaire diaries filled out during the days of accelerometer measurements. Time spent in activity of at least moderate intensity (4–6 METS or 2500–5000 counts per minute reflecting medium exertion in an upright position e.g. walking approximately 5.2 km/h) and vigorous intensity (>6 METS or >5000 counts per minute reflecting a high level of exertion in an upright position e.g. running faster than 6.4 km/h) were calculated. The percentage time spent at these activity levels was calculated by dividing the minutes of each measure by the total minutes of recording. The selection of the counts/min cut-off points identifying moderate and vigorous PA was based on a compromise of the recommendations of five different validation studies of accelerometer measures of PA in children.[16]

Defining and categorizing children as being physically active was based on current health-related PA recommendations[17] of one hour a day of activity of at least a

moderate level recommended by many health organizations and authorities (including the Danish National Board of Health).

Statistical analysis

All data were analysed using the statistical software program SPSS 22.0. Differences between children participating in club-organized football, children participating in other club-organized sports and children not participating in organized sports measured in continuous variables such as the amount of PA in total in different contexts were tested using ANOVA. Chi-squared tests were used to test differences between groups in categorical data. The analyses of mediators and moderators of differences in PA between those children participating in club football and those who did not were conducted using general linear models or logistic regression, depending on the nature of the dependent PA variables. The 95% confidence intervals for the associations are reported. p-Values less than 0.05 were considered statistically significant and only associations at this minimum level of statistical significance are reported.

Results

Table 1 describes the study sample in terms of number of participants, gender, age, total daily amount of PA, participation in club football and other leisure-time club-organized sports during the period the activity was measured. It shows that 30% of children in the study participated in some type of organized leisure-time club-sports other than football during the period their activity levels were measured. Fourteen per cent of the boys had participated in club football but only 2% of the girls ($p < 0.001$). Boys had a 10% higher daily amount of PA ($p < 0.001$) than girls.

Daily PA among children participating in club football, participating in other club-sports and children not participating in any club-sports

Table 2 outlines the activity levels in different contexts of children who participated in club football, children who participated in other club-sports and children who did not participate in any club-sports during the days their activity levels were measured. ANOVA showed that these categories of club-sports participation were associated with all the measures of total daily amounts of PA and all the measures of PA during school time.

Table 1. Characteristics of the study population.

	Boys	Girls
N	268	249
Mean age (SD)	9.57 (0.37)	9.46 (0.37)
Participated in club sports	29.48%	30.52%
Played club football***	13.81%	2.01%
Participated in other club sports than football***	15.67%	28.51%
Mean daily minutes of MVPA (SD)***	87.19 (28.49)	75.38 (26.81)

***Gender difference significant at $p < 0.001$.

Table 2. Daily amounts of PA among children: who played club football, participated in other club sports and undertook no leisure-time club sports.

	Played club football	Participated in other club sports	No club sports participation
Total			
Activity (min/day)[aa]	101.46 (26.63)[bbb]	82.89 (29.23)	78.75 (27.27)
Moderate activity (min/day)[aa]	70.20 (17.87)[bbb]	58.33 (16.67)	57.19 (17.61)
Vigorous activity (min/day)[aa]	31.26 (12.03)[bb]	24.55 (15.47)[c]	21.56 (11.83)
Active >1 h daily[aa]	97.6%[bb]	81.4%	72.9%
Vigorously active >1.5 h per week[aa]	92.9%	85.0%[c]	75.7%
School time			
Activity (min/day)[aaa]	43.11 (17.31)[bbb]	31.51 (17.03)	30.56 (14.71)
Moderate activity (min/day)[aaa]	27.62 (10.58)[bbb]	20.69 (8.79)	20.43 (8.85)
Vigorous activity (min/day)[aaa]	15.49 (8.87)[bb]	10.82 (9.42)	10.13 (7.12)

Note: Data are presented as mean (SD) except from % being active >1 h/day and % vigorously active >1.5 h/week.
[aa]Difference between the three groups significant at $p < 0.01$.
[aaa]Difference between the three groups significant at $p < 0.001$.
[bb]Difference between children who played football and children doing other sports significant at $p < 0.01$.
[bbb]Difference between children who played football and children doing other sports significant at $p < 0.001$.
[c]Difference between children who participated in club sports other than football and children who didn't participate in any club sport significant at $p < 0.05$.

Children who had participated in club football had a 22% higher total daily amount of PA ($p < 0.001$) and a 27% higher daily amount of vigorous activity ($p = 0.003$) than children who had participated in other club-sports. Only 2% of children playing club football did not reach the recommended 1 h of daily activity; this is significantly less than the 19% of children doing other sports and the 27% of the children not doing any sports. When adjusting for gender, children playing club football had 10.89 higher odds of being physically active more than an hour daily (95% CI: 1.47–80.69, $p = 0.019$).

Children playing football did not only have higher total amounts of daily PA, but also had higher amounts of PA during school time. During school time, children playing club football in their leisure time had 36% higher daily amount of PA and 43% higher PA at a vigorous level (both $p < 0.001$) than children participating in other club-sports.

The difference in amounts of PA between children playing football as their club sport and children doing other sport is larger during school time than total time. This may indicate that the higher activity levels among children playing club football is not only (or even mainly) due to high activity levels when participating in this leisure-time club activity, but also due to their higher levels of activity during school hours.

Compared to children not participating in club-sports, children doing other sports had higher daily amounts of vigorous activity ($p < 0.05$) but had neither significantly higher total daily minutes of moderate activity, nor higher likelihood of being active for an hour each day, nor higher amounts of activity during school time.

Activity levels during leisure-time club sports and school recess

Table 3 describes the activity levels during leisure-time club sports and during school recess. Children participating in club football did not have higher amounts of total or vigorous activity during the hours of their club-sports participation than children doing other types of club-sports, but did have higher amounts of moderate activity (28%, $p = 0.02$). However, during school breaks, children playing leisure-time club football had higher amounts of activity (46%, $p < 0.001$), (moderate (43%, $p < 0.001$) and vigorous (50%, $p = 0.004$)) than children doing other club-sports whereas children doing other club-sports did not have higher activity levels than children not doing any clubs sports.

Associations between playing club-football and daily PA when adjusted for gender

Since children's gender affects both their activity levels and the likelihood of playing club football, the above-described associations between club football participation and daily PA needs to be adjusted for gender. This was done using General Linear model. The results are described in Table 4. It can be seen that there is a gender-independent association between playing club football and the amount of PA in

Table 3. Activity levels of children: who played club football, participated in other club sports and undertook no leisure-time club sports.

	Played club football	Participated in other club sports	No club sports participation
Activity level during club sport			
% of time physically active	33.86 (18.32)	29.09 (13.44)	
% of time moderately active	18.93(10.64)[b]	14.77 (6.99)	
% of time vigorously active	14.94 (10.15)	14.32 (10.44)	
Activity level during school recess			
% of time physically active[aaa]	29.78 (11.37)[bbb]	20.44 (13.11)	19.87 (12.26)
% of time moderately active[aaa]	18.53 (6.31)[bbb]	12.95 (6.59)	13.31 (7.44)
% of time vigorously active[aaa]	11.25 (7.3)[bb]	7.48 (7.09)	6.56 (6.25)

Note: Data are presented as mean (SD).
[aaa]Difference between the three groups (ANOVA) is significant at $p < 0.001$.
[b]Difference between children who played football and children other sports significant at $p < 0.05$.
[bb]Difference between children who played football and children doing other sports significant at $p < 0.01$.
[bbb]Difference between children who played football and children doing other sports significant at $p < 0.001$.

Table 4. Associations between playing club football or not and measures of daily PA adjusted for gender.

		95% CI		
	B	Lower	Upper	*p*
Total activity (minutes of activity per day)	17.89	9.05	26.74	<0.001
School time activity (minutes of activity per day)	9.58	4.71	14.46	<0.001
Activity level during club sports (% of time physically active)	7.10%	1.23%	12.90%	0.018
Activity level during school recess (% of time physically active)	7.70%	3.78%	11.63%	<0.001

total, during school time, during clubs sports and during school recess. The interaction term of gender and playing football was not significantly associated to any of the PA measures, implying that the association between playing football and PA is not different for the two genders. This interaction term was therefore not included in any of the final models presented.

It is interesting to note that playing club football in free time has a strong association not only with total activity and activity levels during the sports time itself, but also with activity levels in school and school recess indicating that being more active during school recess is one of the main reasons children playing leisure-time club football are more active in total. To further support this hypotheses, Table 5 describes the association between playing club football and the total daily amount of activity when adjusted for activity levels during recess. It can be seen that adjusting for children's activity levels during recess decreases the higher amount of daily activity among club football players from $B = 17.89$ min/day to $B = 9.22$ min/day. This roughly indicates that almost half of club football's association to total daily activity stems from higher activity during school recess.

Discussion

According to modern sociological action theory,[18] human agency and hence children's physical activities can be regarded as a product of the interplay between local, social, cultural and material resources and the acting agent's (the child's) individual

Table 5. The association between playing club football and the daily amount of activity, when adjusting for gender and for activity levels during recess.

		95% CI		
	B	Low	High	*p*
Model 1: crude				
Playing football unadjusted (crude)	21.72	12.97	30.48	<0.001
Model 2: adjusting for gender				
Playing football	17.89	9.05	26.74	<0.001
Gender	9.70	4.87	14.54	<0.001
Model 3: adjusting for gender and recess PA level				
Playing football	9.22	1.44	16.99	0.020
Gender	3.61	−0.68	7.90	0.099
PA level during recess	112.68	95.74	129.61	<0.001

interests and abilities. Based on this understanding of PA as social practice, it can be hypothesized that in order to increase PA, the children's knowledge, skills and interest in a particular PA is crucial, but so too are the necessary material resources (sport and play facilities), social resources (others to play with) and cultural resources (rules, norms and values determining which activities are acceptable/'normal' for girls and boys to do in these settings).

In this study, children (most often boys) participating in club football during their leisure time had higher amounts of total daily PA resulting in a very high likelihood of being active more than the minimum recommended hour per day. This is in line with other more experimental studies which have shown very high activity levels when children play football.[19] However, an important contribution from this study is the observation that children participating in leisure-time club football were not only more active during this activity but also during school time in general, and school breaks in particular, than children doing other club-sports or no club-sports in their leisure time. This suggests that club football not only affects daily PA through the activity it creates in itself but is also an indicator of an interest in and an ability to play football which other studies have shown to be helpful resources for being active during recess in Danish schools.[20] In other words children's interest in and ability to play football affects their activities in other everyday contexts where there are opportunities to play this game. This is especially the case during school recess. As school recesses take up many weekly hours of children's lives, these abilities and interests have a great influence on the total amount of their activity.

On a more general level, the results suggest that the influence leisure-time club sport participation has on PA may differ as a result of the different PA levels of different sports, but also of how well the sport can be transferred to and played in other daily contexts for children's PA.

It might seem counterintuitive that the group of children participating in other leisure-time club sports than football did not have higher amounts of daily physical activity than the children not doing any club sports in their leisure time. It has been previously shown that[21] Danish children at the age 9–10 often have high activity levels in their daily contexts for self-organized outdoor play in which they spend many more hours each week and than the few hours per week typically spent participating in organized sport. In other words, at this age clubs sports participation per se is not a vital determinant of children's PA as those children who do not participate in sports[22] are often active elsewhere in other more self-organized ways. However, a club-football background seems to be an especially enabling resource for being physically active in these contexts.

Practical perspectives

The described association between football and the total daily amount of PA through high recess activity raises new questions about how best to use this knowledge to increase children's daily PA. In practice, trying to increase children's PA is often complex, as some of the patterns of inequality and stratification in PA practices are reflections of broader stratification mechanisms not easily changed by local PA initiatives alone.

Therefore, it remains hard to determine whether the solution to increase levels of PA lies in trying to make football a game for all during recess (for example by increasing the amount of playground space and facilities allocated to football and by

trying to increase children's abilities and interest in playing football) or in trying to promote other easily self-organized physical activities in school recess and other informal play settings for children (for example by providing better facilities for these). Because the shaping of a child's interest in playing football rely on a wide range of socializing agents (families, peers, pedagogues, coaches, TV networks, etc.), it is not easily changed and considering also that children are different (not only across genders) with regard to their tastes, values, habits and skills, the last approach might be most effective from a public health intervention point of view and, importantly, more all-inclusive/democratic.

Limitations

A main limitation of this study is that it does not measure whether children are playing football during recess. However, other studies have shown how the football games at recess are dominated by 'football boys' who are very skilled and knowledgeable about football and who also play in clubs during their leisure time after school.[23]

As the data analysed is cross-sectional, it is hard to determine whether club football participation leads to high activity levels or whether children who are somehow disposed to be very physically active are more likely to choose this game as their club sport and school-ground activity. However, as sporting tastes are dependent on many social structural factors (such as the sporting interests of parents, friends, available sports-facilities in neighbourhood, etc.), the latter does not seem likely as a main explanation. Based on other studies of children's PA in Danish school grounds,[24] we interpret the association between club football and total PA and the mediating effect of school recess PA to be the result of football as a game that results in high activity levels when played and that Danish school grounds provide good facilities for football.

Conclusion

In the suburban Danish setting of this study, children playing club football as leisure-time club sport had higher total daily amounts of PA of both moderate and vigorous intensity than children doing other club-sports and children not doing club-sports. About half of the difference in total PA could be explained by higher activity levels during school recess alone.

The association between club football and total PA and the mediating effect of school recess PA can be interpreted to be the result of club football having high activity levels and of Danish school grounds offering good facilities for those who are able and interested to play football during the many hours of school recess each week.

On a more general level, the results indicate that the influence leisure-time club sport participation has on PA may differ according to different PA levels of different sports and also to how well the sport can be transferred to and played in other daily contexts for children's PA.

Disclosure statement

No potential conflict of interest was reported by the authors.

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