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## Original Research

# Correlates of habitual physical activity and organized sports in German primary school children



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## ABSTRACT

**Objectives:** The increased prevalence of childhood obesity has also been attributed to low physical activity (PA) levels. Understanding factors affecting child PA levels is especially important considering the benefits PA offers to youth.

**Study design:** This study therefore examined different correlates affecting habitual PA and sports participation in primary school children.

**Methods:** Height and weight were measured during a school visit in 1714 children ( $7.1 \pm .6$  years). PA and behavioural correlates were assessed by parental questionnaire. The effect of various correlates on PA as well as participation in organized sports was assessed using logistic regression analysis.

**Results:** Significant correlates of PA and sports participation were engagement in sporting activities outside of clubs and children's weight status. Playing outdoors for more than 60 min/day was significant for PA, having well educated parents and being male. Participation in sports was influenced by children's media consumption, active travel to school and having active parents. No influence was found for migration, income, parental weight status and health consciousness.

**Conclusion:** In this study, a multiplicity of independent correlates of PA and sports participation, which require a broad approach to promote an active lifestyle, have been considered. Understanding these factors might support the development of effective health-promoting interventions.

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## Introduction

The increasing prevalence of childhood obesity is a rising concern in Western countries<sup>1</sup> and has metabolic and genetics factors which have been attributed to a decrease in physical activity (PA) levels and increased energy intake.<sup>2</sup> A major long-term consequence of obesity in childhood is the risk of adult obesity and its associated comorbidities, such as hypertension, metabolic diseases and Type 2 diabetes.<sup>3</sup> Both comorbidities and the risk of adult obesity have been well documented.<sup>4</sup> Increasing PA is one important factor in addressing the problems associated with growing childhood obesity. PA is not only important for weight management but also contributes to healthy growth and overall development in childhood.<sup>5</sup> The World Health Organization (WHO) identified insufficient physical activity as one of the four leading modifiable risk factors for non-communicable disease and attributes annually around 3.2 million deaths to physical inactivity.<sup>6</sup> Further, PA is beneficial for some lipid measurements, musculoskeletal health and cardiovascular health.<sup>7</sup> One way to increase PA levels is regular participation in organized sports, especially in Germany where a well-established framework of sports clubs is in place and roughly 4.5 million 7- to 14-year old children regularly engage in organized sports.<sup>8</sup> Understanding factors which influence childhood PA and/or sports engagement is especially important considering the multitude of benefits PA offers to youth.<sup>9</sup>

Understanding correlates of PA and sport will also support the development of effective interventions to promote an active lifestyle, which is thought to facilitate a carryover of healthy habits into adulthood.<sup>10</sup> There have been several studies and reviews on correlates of youth PA<sup>11–15</sup> highlighting a relationship of childhood PA and gender, body mass index, parental PA, school sports participation, time spent outside, family influences and socio-economic status.<sup>16</sup> However, most of the previous research focussed on PA only and was conducted in North America (US and Canada), UK, Scandinavia and Australia, which have a different school system, as well as different structures regarding sports participation. There is a lack of research on primary school children in Germany, who spend significantly less time at school and therefore, have to organize their PA in the afternoons and evenings themselves. The aim of the present study was to identify factors associated with children's PA and sports participation in Germany.

## Methods

### Participants

Baseline measurements of 1714 primary school children ( $7.1 \pm .6$  years; 50% male) who participate in a school-based health-promotion programme<sup>17,18</sup> in south-west Germany were used for analysis. Children were randomly recruited from participating schools; data collection took place prior to any intervention. Parents written, informed consent as well as verbal child assent were obtained prior to data collection. The study was approved by the Ministry of Culture and Education

as well as the University's ethics committee and is in accordance with the declaration of Helsinki.

### Anthropometric measures

Children's height (cm) and body mass (kg) were taken in vest, shorts and bare feet by trained technicians during a school visit according to standard procedures. Standing height was measured to the nearest .1cm using a stadiometer (Seca 213, Seca Weighing and Measuring Systems, Hamburg, Germany) and body mass was measured with electronic scales (Seca 862, Seca Weighing and Measuring Systems, Hamburg, Germany) to the nearest .05kg. Subsequently body mass index (BMI) was calculated and converted to BMI percentiles (BMIPCT) using German reference data.<sup>19</sup> Overweight and obesity was determined above 90th and 97th percentile (BMIPCT), respectively. Parental weight status (BMI) was calculated based on self-reported height and weight.

### Physical activity and sports participation

Children's weekly participation in habitual PA and organized sports was assessed via a standardized questionnaire, completed by their parents since most first grade children were unable write or read at the time of data collection. Parents were asked to specify the number of times and minutes per week their child engages regularly in organized sports and the number of days per week their child engages in more than 60 min of moderate to vigorous PA (MVPA). These questions were based on the KiGGS survey, which assessed health behaviour in 18000 German children and adolescents<sup>20</sup>; an additional validation against accelerometer data in a subsample showed that this is a valid and reliable instrument.<sup>21</sup>

### Behavioural correlates

Behavioural correlates derived from parental responses were divided in child- and family/environmental-related correlates. Child-related correlates include gender, daily time spent playing outdoors, engagement in sporting activities outside of sports clubs, active travel to school, children's weight status, their screen media consumption and migration status. Family-related correlates are based on regular parental PA, parental health consciousness, maternal and paternal weight status, and education level, their net household income, size of their flat or house, access to a garden as well as whether the child is raised by a single parent.

According to German reference data,<sup>19</sup> children's body weight was dichotomized by overweight/obesity (above the 90th BMI percentile) and normal weight/underweight (90th BMI percentile and below). Based on recommendations of the American Academy of Pediatrics,<sup>22</sup> screen media consumption was dichotomized by more or less than 120 min daily. Using median split, time playing outdoors was dichotomized by more or less than 60 min. Active commute to school was dichotomized by at least three days/week (i.e. on most days of a five day week); sporting activities outside of organized sports by more or less than 60 min weekly (median split). Parental PA and health consciousness assessed in two questions ('are you physically active?': yes/no, and 'do you rate yourself as health-

conscious?': not at all, hardly, mainly, very) were dichotomized by self-reported classification as physically active or not, and not/hardly health conscious or (very) health conscious, respectively. Parental body weight status was dichotomized by BMI below or above 25 (i.e. normal weight or overweight); parental education was dichotomized by parents having graduated from high school or higher and those not having graduated from high school. Using median split, the cut-point for monthly household income was set at 3000€ and living space was differentiated by at least 120 sqm or less. Migration status was determined whether at least one parent was born outside of Germany or the child had been spoken to in a foreign language during the first years of life.

### Data management and statistics

Habitual PA was dichotomized by engagement in at least four days of 60 min of MVPA (median split). Participation in organized sports was dichotomized by engagement of more or less than 75 min per week (median split). Descriptive statistics including means, percentages and standard deviations (SD) were calculated. Logistic regression was used to determine odds ratios (OR) for parental and child-related correlates using median split. All statistics were performed with SPSS Statistics 19 (SPSS Inc, Chicago, IL, US) using a significance level of  $\alpha = 0.05$ .

## Results

### Participant characteristics

Table 1 shows a summary of the participants' anthropometric characteristics and time spent participating in sports. Boys were significantly taller and heavier than girls, but there was no difference in BMIPCT. Prevalence of overweight and obesity was generally low and did not differ between boys and girls, either. Significant sex differences were found for weekly habitual PA as well as participation in organized sports with boys displaying a significantly higher level of both.

### Physical activity and sports participation

Only 31.8% and 22.0% of boys and girls, respectively, spent at least four days per week being moderately to vigorously physically active for at least 60 min per day and 50.7% and 46.1% of boys and girls, respectively engaged in more than 75 min per week organized sports, mainly playing football (soccer), doing gymnastics and swimming (20.4%, 18.1% and 4.1%, respectively).

### Behavioural correlates

Adjusted odds ratios for child-related correlates are shown in Table 2. Children were significantly more likely to engage in 60 min of MVPA on at least four days per week if they engaged in sporting activities outside of sports clubs and school for more than 60 min per week (OR 1.73; CI 1.36, 2.20) and participated in organized sports for more than 75 min per week (OR 1.39; CI 1.10, 1.77). Similarly, children were

**Table 1 – Participant's characteristics. Values are means and SD. \*) significant difference,  $p \leq 0.05$  BMIPCT = BMI percentiles; MVPA = moderate-to-vigorous physical activity.**

	Boys	Girls	All
Number (n; %)	862 (50.3)	852 (49.7)	1714 (100)
Age (years)	7.1 (.6)	7.1 (.6)	7.1 (.6)
Height (cm)*	124.5 (6.4)	123.2 (6.1)	123.8 (6.3)
Body Mass (kg)*	24.9 (4.8)	24.3 (4.8)	24.6 (4.8)
BMIPCT	48.7 (27.2)	48.4 (27.4)	48.6 (27.3)
Overweight/Obese (%)	5.0/4.2	5.1/2.9	5.0/3.5
60 min MVPA (days/week)*	2.9 (1.7)	2.5 (1.6)	2.7 (1.7)
Organized sports (min/week)*	102.7 (104.9)	92.4 (90.8)	97.6 (98.2)

significantly more likely to participate in more than 75 min per week in organized sports if they engaged in sporting activities outside of sports clubs and school for more than 60 min per week (OR 1.43; CI 1.51, 1.77) and reached the daily guideline of 60 min MVPA on at least four days per week (OR 1.39; CI 1.10, 1.77). Boys were significantly more likely to engage in 60 min of MVPA on at least four days per week (OR .69; CI .54, .88), as were children who played outside for more than one hour per day (OR 1.69, CI 1.28, 2.23). Further, overweight children and those, who spent more than two hours per day in front of screen media, were significantly less likely to participate in organized sports (OR .63; CI .43, .93 and OR .74; CI .58, .95, respectively). On the other hand, overweight children reached the guideline of MVPA significantly more often than normal weight children (OR 1.59; CI 1.06, 2.38). Children who used means of active transportation to school on at least three days per week were also significantly more likely to participate for more than 75 min per week in organized sports (OR 1.37; CI 1.10, 1.70). Migration had no significant effect on sports participation or PA.

Table 3 shows odds ratios for family-related correlates. Children with at least one physically active parent were significantly more likely to engage in organized sports (OR 2.14; CI 1.63, 2.82). If their parents were well educated, children

**Table 2 – Odds ratios for child-related correlates grouped according to habitual physical activity and organized sports participation; OR [95% CI], \*) significant,  $p \leq 0.05$ , †) habitual physical activity (MVPA) or organized sports participation, depending on the dependent variable.**

	Physical activity	Organized sports
Gender	.69* [.54; .88]	.85 [.68; 1.04]
Weight status	1.59* [1.06; 2.38]	.63* [.43; .93]
Sports participation/MVPA†	1.39* [1.10; 1.77]	1.39* [1.10; 1.77]
Non-organized sports	1.73* [1.36; 2.20]	1.43* [1.15; 1.77]
Media consumption	.95 [.72; 1.26]	.74* [.58; .95]
Playing outside	1.69* [1.28; 2.23]	1.08 [.86; 1.36]
Active travel to school	.86 [.67; 1.11]	1.37* [1.10; 1.70]
Migration	.85 [.62; 1.16]	.99 [.76; 1.30]
Correctly classified (%)	73.1	56.9
Cox & Snell	.05–.07	.03–.04
R <sup>2</sup> –Nagelkerke R <sup>2</sup>		

**Table 3 – Odds ratios for family-related correlates grouped according to habitual physical activity and organized sports participation; OR [95% CI,\*) significant,  $p \leq 0.05$ .**

	Physical activity	Organized sports
Parental PA	1.04 [.77; 1.41]	2.14* [1.63; 2.82]
Parental weight status	1.08 [.79; 1.48]	.94 [.71; 1.24]
Parental health consciousness	1.27 [.97; 1.66]	1.09 [.86; 1.39]
Maternal education level	1.47* [1.09; 1.98]	1.28 [.97; 1.68]
Paternal education level	1.38* [1.03; 1.87]	1.15 [.88; 1.51]
Household income	.86 [.63; 1.17]	1.28 [.98; 1.69]
Single parent	1.54 [.92; 2.57]	.92 [.56; 1.51]
Size of flat/house	1.06 [.79; 1.42]	1.20 [.93; 1.55]
Access to a garden	1.07 [.69; 1.65]	.97 [.65; 1.43]
Correctly classified (%)	71.7	61.1
Cox & Snell	.02–.03	.06–.08
R <sup>2</sup> –Nagelkerke R <sup>2</sup>		

were significantly more likely to be physically active for more than 60 min per day on at least four days per week (OR 1.47; CI 1.09, 1.98 and OR 1.38; CI 1.03, 1.87, for mothers and fathers, respectively). Parental health consciousness and weight status had no significant effect on PA or sports participation, nor had family income, size of the children's home or whether they had access to a garden or being raised by a single parent.

## Discussion

This paper presents the relationship between habitual PA and organized sports participation with various child- and environmental-related attributes in a large sample of German primary school children. According to Sallis and Owen,<sup>23</sup> PA is a complex behaviour, which is influenced by multiple factors. One of the results indicate that children's engagement in sporting activities outside of sports clubs is associated with their habitual PA as well as their participation in organized sports. Similarly, participation in sports clubs and habitual PA correlate positively with each other. These findings are supported by previous studies.<sup>24</sup> On the other hand, using questionnaire and heart rate monitoring, Deflandre et al.<sup>25</sup> observed 80 schoolchildren showing that the most sport-involved children are not necessarily the most active ones. However, in their study, it has been suggested that children with excess body weight are more likely to hesitate to undertake sports activities which supports the findings of overweight and obese children being less likely to engage in organized sports. This is strengthened by similar findings where participation in organized sports was associated with a 2.1% reduction in BMI<sup>9</sup> but also contradicted by others where neither children's weight status nor body fatness was associated with sports club participation.<sup>26</sup> Results of the present study also show contradicting results as body weight was negatively associated with organized sports while higher body weight increased the odds of higher PA. While overweight children seem to be more hesitant to engage in organized sports, they reached the daily guideline of 60 min of MVPA more often than normal weight children. One possible explanation for this might be that parents of overweight

children are more likely to be biased and maybe overestimate their child's amount of PA, as has previously been seen in studies examining parents' ability to estimate their children's weight status.<sup>27</sup>

This study also emphasizes the importance of free play on PA levels in children as more time spent playing outdoors was associated with increased PA. Similar results were reported in preschool children<sup>28</sup> as well as schoolchildren.<sup>11</sup> However, interventions increasing children's time spent playing outdoors have shown inconsistent results on their PA levels.<sup>29</sup>

Similarly, associations between non-organized PA and active commute are inconsistent. It has been shown that active transport was associated with PA only in boys and predominantly associated with non-organized play (running around, playing football).<sup>30</sup> Sirard et al.<sup>31</sup> however, found that 5th grade students who commuted to school actively on a regular basis were more active after school and adolescent boys in Portugal reported higher participation rates in habitual PA and organized sports when commuting to school actively.<sup>32</sup>

Over the last decade, however, a decline in time spent outdoors was observed<sup>33</sup> while screen media consumption has increased.<sup>34</sup> While screen media use is positively associated with increased body weight<sup>35</sup> results on the relationship between screen media use and PA are inconsistent in children.<sup>36</sup> In this study, children who used screen media for more than two hours per day were less likely to engage in organized sports but no effect on habitual PA was observed. Marshall and colleagues<sup>37</sup> also found a significant and inverse relationship with television viewing only for vigorous PA. Welk et al.<sup>38</sup> however, argue that vigorous activity may be recalled more easily and the possibility of sampling errors need to be considered as well.<sup>37</sup> Yet, an inverse correlation between screen media time and fitness has been reported previously,<sup>26</sup> which could be mediated by the fact that children who watch more television engage less in vigorous PA as well as organized sports.

Further, parental PA seems to be a significant factor for children's engagement in organized sports participation.<sup>39</sup> It is well known that parents are one of the most important socialising agents for children, and their PA behaviours are generally considered to be one of the strongest determinants of children's activity patterns.<sup>40</sup> Additionally, parents who introduce a belief in the value of sports and PA may exert a lasting effect on their children.<sup>41</sup>

Therefore, it has been suggested to include families as important mediators for PA, especially outside of school.<sup>42,43</sup> Parental support and encouragement seem to be of key importance in shaping PA levels in primary and middle school-aged youth, especially in terms of organized sports.<sup>44</sup> Similarly, it has been shown that parents are able to provide an environment that can significantly influence a child's desire to participate in organized sports, and their support may be paramount in encouraging participation during a child's formative and adolescent years.<sup>45</sup> However, not only parental support and actual PA seem to have an impact on children's sports involvement, it has also been shown that perceived PA of parents significantly contributes to the variance in PA amongst 9- to 10-year old children.<sup>36</sup> Trost et al.<sup>46</sup> however, suggest parental modelling may be an insufficient

influence on children's activity since parental PA itself does not remove barriers, which could explain why no effect occurred for habitual PA. Instrumental parental support, such as transporting and encouraging the child, appears to be necessary and it can be argued that active parents are more likely to introduce their children to sports clubs. Active parents may be more willing to provide the necessary support and at younger ages sports participation is probably more a parental choice to engage their children in sporting activities rather than the child's own choice.<sup>47</sup> It further has been suggested that parent training or family counselling may be more effective to promote children's PA than engaging parents in PA with their family.<sup>48</sup>

In contrast to parental PA, which affected the child's participation in organized sports, parental education seems to affect children's habitual PA. Interestingly, monthly family income had no influence on PA or sports participation. These findings are partly contradicted by another large German study where girls from a lower socio-economic background (defined as parental education level and household income) are more likely to comply with current PA guidelines.<sup>15</sup> In a recent study in the UK assessing correlates of objectively measured PA in 7-year old children however, no association between maternal education and habitual PA was found<sup>49</sup> and it has been argued that only studies using self or parental reports find significant socio-economic differences in PA.<sup>50</sup>

Relying on self-reported PA and sports participation along with the assessed correlates such as parental body weight, height and their health-consciousness is the primary limitation of this study. Even though questions used to determine habitual PA, participation in organized sports and their correlates have been taken out of a well-established and validated instrument,<sup>21</sup> the results should be interpreted with caution since they are based on self-report, which is known to be subject to recall and recording bias.<sup>51</sup> This may also explain why the variability of habitual PA and participation in organized sports could only be explained to a minor extent. A second limitation is the cross-sectional design of this study which does not allow for causal interpretation. Additionally, this sample has a rather low prevalence of overweight and obese children which therefore may not be truly representative for all children in Germany. Moreover, since children were recruited from schools about to take part in a health-promotion programme, a selection bias cannot be ruled out. Further, even though type of organized sports participation was assessed, it was not accounted for and may play a role in influencing the outcomes in this study, particularly if considering varying intensities of several different types of sporting activities. Despite these limitations, the comprehensive assessment of children's weight status in a large cohort as well as the consideration of a multiplicity of independent factors should be considered a strength of this study. Further research, however, should thrive to use objective measures in order to fully investigate the factors associated with children's PA behaviours and their participation in organized sports.

In summary, results of the present study show a significant association of PA with gender, free outdoor play and parental education level. Interestingly, weight status was positively associated with PA, but a negative association was observed

for participation in organized sports. Screen media consumption was also only associated with sports participation as was parental PA.

Due to the complexity of PA and sports participation future interventions should not focus on the child only, but involve parents as well to foster a sustainable active lifestyle.

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## Author statements

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### Ethical approval

The study was approved by the Ministry of Culture and Education as well as the University's ethics committee and is in accordance with the declaration of Helsinki.

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### Competing interests

We declare there is no conflict of interest.

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