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Associations between organised sports participation, general health, stress, screen-time and sleep duration in adolescents

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Abstract

Aim: Physical activity patterns in adolescents have been associated with general health. Stress, screen-time and sleep are other factors associated with physical activity that influence health in adolescents. Physical activity accounts for several health benefits; however, the impact of organised sports participation to achieve the same health benefits are less explored. This study explored the associations of organised sports participation with general health, stress, screen-time and sleep-duration in adolescents.

Methods: For this cross-sectional study, data from 1139 adolescents (age 13–14 years) from 34 schools were analysed. Data were collected during autumn 2019. Data collection consisted of self-reported questionnaires and standard methods for height and weight measurements.

Results: Adolescents with organised sports participation ≥3 times/week were twice as likely to report better general health (OR: 2.11, CI: 1.45–3.07) and lower screen-time (OR: 1.98, CI: 1.43–2.74). Adolescents with organised sports participation ≥3 times/week were less likely to meet the recommended sleep-duration on weekdays (OR: 0.43, 95% CI: 0.29–0.65).

Conclusions: Adolescents with frequent organised sports participation had better general health, lower amounts of screen-time and shorter sleep-duration on weekdays than those with no participation. Although the causal relationships remain unknown, these results can be relevant when developing strategies promoting physical activity and health in adolescents.

Keywords: exercise, health behaviour, physical activity, sedentary behaviour
1 | INTRODUCTION

General health is a broad term accounting for all well-being. Both mental and physical health are key aspects of general health that are experiencing high-risk trends. Only among children and adolescents, around 20% suffer from mental health disorders,7 and for the same age group, there is also a large amount of perceived stress reported, especially school- and performance-related stress.2

Physical activity (PA) and sedentary behaviour (SB) are two key factors that have several beneficial associations with general health.3,4 The WHO guidelines for PA in children and adolescents are to accumulate at least 60 min of moderate to vigorous PA (MVPA) per day and perform activities that strengthen muscles and bones at least three times per week.5 Physical activity is well researched and recognised as the basis for a good general health, where the benefits of PA for both physical, mental and social health are well established.3 Sedentary behaviour on the other hand has recently been identified as one of the leading modifiable risk factors for physical health disorders in all age groups,6 and one of the main reasons for this is the large increase of screen-time.7 Recreational screen-time and SB have been linked to lower levels of PA and poor general health in adolescents.4 There is a recommendation by the WHO of reducing the time spent sedentary in children and adolescents,5 and some countries, for example Canada, have recommended that the amount of recreational screen-time should not exceed 2 h per day.8 Unfortunately, the recommendations for PA, SB or screen-time are not reflected within today’s society. A large reduction in PA occurs during the transition from childhood to adolescence, and most adolescents do not meet the daily recommendations for PA.9 In line with decreased levels of PA in adolescents, there is a high level of recreational screen-time reported for the same population.10

Another important factor for a good general health is sleep.11 The recommended sleep duration in adolescents is 8–10 h.12 Sleep plays an important role in the brain function, development and behaviour of adolescents, and a lack of sleep can have negative effects in several health outcomes.11 Physical activity is an important factor for sleep quality in adolescents where higher levels of PA are associated with less sleep complaints and better sleep quality.10

With adolescents being such a vulnerable age-group regarding health disturbances along with negative changes in health benefiting behaviours, interventions targeting PA are in need for this population. School-based PA interventions have presented weak results among children and adolescents,13,14 however, leisure PA, for example organised sports participation (OSP), provides a number of positive health benefits.15,16 Research has demonstrated that children and adolescents participating in organised sports were more likely to achieve the guidelines for PA and spent a larger amount of time in MVPA, compared to those who did not participate.16 OSP has been presented to contribute to numerous other health benefits. Depression, psychological well-being, self-esteem, perceived stress and social interactions are all factors that are associated with OSP.15 However, to the authors’ knowledge, research is lacking in this field.

With PA accounting for several health benefits, the impact of OSP to achieve the same health benefits are less explored. The aim of this study is therefore to explore the associations of OSP with general health, stress, screen-time and sleep duration in Swedish adolescents.

The following research questions will be answered:

- Are there any differences in general health, stress, screen-time and sleep duration for the adolescents that participate in organised sports ≥3 times/week compared with 1–2 times/week or those not participating at all?
- Do the associations appear to be different for boys and girls?

2 | METHODS

2.1 | Study design, setting and participants

This was a cross-sectional study, and schools around the area of Stockholm, Sweden, were invited by e-mail to participate. Schools with <15 students in each class, with a sports profile, or with a non-Swedish speaking student population were excluded. Of the 558 invited schools, 84 schools accepted the invitation. One to four classes, all in grade 7 (ages 13-14 years), participated from each school. In total, 1139 students participated, a participation rate at 73% (see flow chart, Figure 1). The participating students received a gift card as a compensation (approximately 30 euros).

2.2 | Ethical statement

To participate in the study, all students and their parents had to give written consent. The study was conducted in accordance with the Declaration of Helsinki and the protocol was approved by the Ethical Review Agency in Stockholm, Sweden (Dnr: 2019-03579).
2.3 | Data collection

The data collection was carried out at the Swedish School of Sport and Health Sciences (GIH) in Stockholm between September and December 2019. The measurements were performed by trained health care professionals and researchers.

2.3.1 | Organised sports participation

Organised sport participation was assessed by a questionnaire including two questions: “Are you active in any sports club/organisation? (e.g. football, swimming, dancing, scouts, gym)” (yes/no), and the following question to those who answered “yes”: “How many times a week do you participate?” (1–5+ times/week). The answers were collapsed into three categories (no/1–2 times/week/≥3 times/week).

2.3.2 | General health

General health was assessed by the question “In general, how would you say your health is?” The answers were dichotomised into “good health” (excellent, very good, good), and “poor health” (fair, poor), in accordance with previous literature.

2.3.3 | Stress

Stress was assessed by a single stress item question, answered on a 5-point Likert scale rating 1 = "not at all," to 5 = "very much" and dichotomised into “low stress” (1–3), and “high stress” (4, 5).

2.3.4 | Screen-time

Screen-time was assessed by two questions about the number of hours of screen-time the participants spent per day outside of schoolwork, separate questions for weekdays and weekends (0–7+ hours/day). The answers were presented as means, and for the ease of comparison with the other variables also dichotomised into ≤2 h, or >2 h, based on the recommendations for recreational screen-time.

2.3.5 | Sleep duration

Sleep duration was assessed by asking the participants at what time they normally go to bed and what time they normally wake up, both for weekdays and weekends, which was then converted into hours. The variables were presented by mean and dichotomised into ≥8 h or <8 h based on the recommended sleep duration for adolescents.
Gender was reported by the participants in the questionnaire. Parental education was extracted from a register at Statistics Sweden (SCB) and dichotomised into low and high education (≤12/>12 years of education). Height (cm) and weight (kg) were measured according to standardised procedures. The participant’s body mass index (BMI) was calculated, and categorised as underweight, normal weight, overweight and obese according to the International Obesity Task Force recommendations with cut-off values depending on age and sex.20

### 2.4 Statistical analyses

The data analyses were performed using IBM SPSS Statistics version 27. Descriptive statistics are presented as proportions for...
categorical variables and means with standard deviation (SD) for continuous variables. To compare girls and boys, chi-square test was used for categorical variables, and independent t-test for continuous variables. Binary logistic regression was used to analyse the associations between OSP (independent variable) and the dependent variables (general health, stress, screen-time and sleep). Gender and parental education were included as confounding factors in the analyses. Data were analysed both as a total sample and stratified by gender. One student reported gender as “other” and was excluded from the analyses stratified by gender or where gender was used as confounder. Significance level was set at $p < 0.05$ and the confidence intervals (CI) at 95%. Tests for multicollinearity were performed and indicated no concern.

3 | RESULTS

Table 1 presents descriptive statistics of the included study population. Of the 1139 students, 51% were girls and 20.4% were overweight or obese. Most of the students (66.2%) had parents with more than 12 years of education.

Just over 70% participated in organised sports, with no significant differences in participation between girls and boys ($p = 0.174$). Good general health was less common among girls (74.3%) than boys (88.7%), $p < 0.001$. Similarly, low stress was more common among boys (90.1%) compared to girls (69.9%), $p < 0.001$. One-third of the students met the recommended level of screen-time on weekdays, with no significant gender difference. However, a larger proportion of boys met the recommendations for screen-time on weekends than girls (19.8% vs. 12.2%, $p < 0.001$). Most of the students met the recommendations of $> 8$ h of sleep, on both weekdays and weekends (86.0% and 95.0% respectively).

Adolescents with OSP ≥3 times/week were two times more likely to achieve a good general health (OR: 2.11, CI: 1.45–3.07), compared to no OSP (see Figure 2). When stratified by gender, boys showed a 4.6 higher OR (CI: 2.36–8.96) of having good health if they had OSP ≥3 times/week compared to no OSP (see Table 2).

Organised sport participation for ≥3 times/week was associated with lower screen-time (weekdays OR: 1.98, CI: 1.43–2.74, weekends OR: 1.86, CI: 1.21–2.85) compared to no OSP. Both girls and boys showed associations between OSP and lower screen-time during weekdays (girls OR: 1.80, CI: 1.14–2.84, boys OR: 2.17, CI: 1.36–3.45), but only boys showed an association during weekends (OR: 2.72 CI: 1.51–4.92).

The adolescents with OSP for ≥3 times/week were less likely to reach the recommended sleep duration on weekdays compared to no OSP (OR: 0.43, CI: 0.29–0.65). Boys who participated both 1–2 times/week and ≥3 times/week were less likely to reach the recommended sleep duration on weekdays (1–2 times/week: OR: 0.32, CI: 0.13–0.76, ≥3 times/week: OR: 0.31, CI: 0.17–0.56), compared to boys with no OSP. Girls only showed a significant association when participating ≥3 times/week (OR: 0.56, CI: 0.32–0.97) compared to girls with no OSP.

No significant associations were found between OSP and stress.

4 | DISCUSSION

The main findings of this cross-sectional study present associations between OSP and better general health and lower amounts of screen-time in a large sample of Swedish adolescents. Further, there was an association between OSP and lower sleep duration for weekdays.

This study showed more significant results between OSP and health outcomes for those adolescents who participated ≥3/week in OSP compared to those participating 1–2 times/week or not at all. These results correspond well with the recommendations of PA, where adolescents are recommended to, beyond the daily recommendations, incorporate moderate to vigorous physical activities at least three times per week.5

When the results were stratified by gender, the association between OSP ≥3 times/week and good general health were only significant in boys. Gender differences have previously been presented in levels of PA and choice of sport participation, where boys are more likely to participate in sports with higher amounts of MVPA than girls.21 Another explanation to the gender-stratified results in this study might be the social contexts of OSP, where girls has been presented more likely to report teasing specific to their sport,
**TABLE 2** Associations between participation in organised sports and the dependent variables, adjusted for parental education and stratified by gender

<table>
<thead>
<tr>
<th></th>
<th>Good general health</th>
<th>Low stress</th>
<th>Low screen-time on weekdays</th>
<th>Low screen-time on weekends</th>
<th>High sleep duration on weekdays</th>
<th>High sleep duration on weekends</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Girls</strong> (n = 545)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
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<td>OR (95% CI)</td>
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</tr>
<tr>
<td>1–2 times/week</td>
<td>0.83 (0.49–1.41)</td>
<td>1.55 (0.75–3.20)</td>
<td>1.34 (0.79–2.29)</td>
<td>1.27 (0.49–3.31)</td>
<td>1.35 (0.78–2.34)</td>
<td>1.15 (0.61–2.14)</td>
</tr>
<tr>
<td>≥3 times/week</td>
<td>1.40 (0.88–2.24)</td>
<td>4.60 (2.36–8.96)</td>
<td>1.22 (0.79–1.89)</td>
<td>1.06 (0.53–2.12)</td>
<td>1.80 (1.14–2.84)</td>
<td>2.17 (1.36–3.45)</td>
</tr>
<tr>
<td><strong>Boys</strong> (n = 521)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
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<tr>
<td>No</td>
<td>REF</td>
<td>REF</td>
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<tr>
<td>1–2 times/week</td>
<td>1.55 (0.75–3.20)</td>
<td>2.43 (1.24–4.77)</td>
<td>1.71 (0.95–3.10)</td>
<td>1.68 (0.98–2.85)</td>
<td>1.79 (1.07–3.01)</td>
<td>1.58 (0.98–2.56)</td>
</tr>
<tr>
<td>≥3 times/week</td>
<td>2.16 (0.58–8.12)</td>
<td>6.56 (2.64–16.24)</td>
<td>3.41 (1.79–6.44)</td>
<td>2.84 (1.46–5.52)</td>
<td>2.98 (1.55–5.75)</td>
<td>2.39 (0.96–6.12)</td>
</tr>
</tbody>
</table>

Note: To indicate significance, *p*-values (<0.05) are marked in bold.
Abbreviations: CI, Confidence Interval; OR, Odds Ratio; REF, Reference group.
and higher levels of body imaging concerns, like body shame and self-surveillance compared to boys. Boys who participate in team sports have also been associated with a higher level of social activity and popularity by friends.

Higher OSP was in this study associated with screen-time for less than 2 h/day. Similar findings have been published in previous studies where screen-time was significantly less in children participating in organised sports more than four times/week. Earlier studies have also published significant results between OSP and cardiovascular fitness (CVF), highlighting the association between a lower amount of screen-time and higher CVF in adolescents. CVF has been sighted as an important health indicator for children and adolescent. Therefore, factors influencing CVF, in this case both OSP and screen-time, might be of relevance when promoting health in this population.

Results from this study present an association between shorter sleep duration and OSP. Although sleep is an important factor for several health outcomes and has been positive associated with PA, systematic reviews have presented worrying results. A large number of students with higher levels of PA report insufficient sleep duration and sleeping disturbances compared to students with lower levels of PA, mainly due to competitions, travel and training. Furthermore, this study only presented significant associations between OSP and sleep duration on weekdays, and not weekends. Previous research have explored the differences between weekdays and weekends and concluded that school start time can be a possible cause of insufficient sleep in adolescents. Early school times together with late trainings might together count for the insufficient sleep in adolescents that participate in organised sports – a consideration that might be of importance for sport clubs and coaches. However, the majority of adolescents in this study were still reaching the recommended sleep duration for both weekdays and weekends. Additionally, recommended mean sleep duration is 9–11 h for children aged 6-13 years and 8–10 h for adolescents aged 14–17 years. Although the population in this study had an average age of 13.4 (±0.3) years, the recommendation of 8–10 h was chosen as many of the participants had turned 14 years or were about to turn 14 years within a few months. The results may have been different if the higher cut-off at 9–11 h had been chosen, where a lower amount of the participants probably would have met the recommended sleep duration.

In this study, no significant associations were found between OSP and stress. Previous literature have presented high levels of stress and lower sleep duration in athletes, especially together with school performance, and by these findings, the OSP might not protect adolescents from perceiving stress.

One of the strengths of this study is the large sample size. However, there were also some limitations. First, a subject of bias was the self-reported questionnaire which is usually less accurate than objective measurements. For sleep duration, an accelerometer could have been used, but to limit the risk of dropouts considering the effort of the participants, the subjective measurement was chosen. Regarding the screen-time, there is still no consensus about objective measurements, and thereby screen-time is still mostly self-reported. To get a broader understanding about the associations between both screen-time and sleep, and OSP, more detailed questions about these variables (e.g. social media use, playing computer games and nap times), could have been added to the questionnaire. For this study, the questions for participation in organised sports only contained frequency and not type of sport or intensity, and thereby the amount of MVPA and the type of PA were not controlled for. Further, the cross-sectional design of this study was a limitation, as it limits the conclusion of causality.

5 | CONCLUSION

This study showed that adolescents that frequently participated in organised sports had a better general health and lower amount of screen-time compared to those who with no participation. There was also an association between OSP and shorter sleep duration on weekdays. Even though causal relations remain unknown due to this cross-sectional study design, these results can be relevant when developing strategies to promote physical activity and health in adolescents.

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CONFLICT OF INTEREST

All authors declare no conflict of interest.

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REFERENCES


