

GENDER DIFFERENCES IN SEASONAL DECLINE OF PHYSICAL ACTIVITY IN NATURAL ENVIRONMENTS AND THEIR ASSOCIATIONS WITH HEALTH LIMITATIONS

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Abstract

Physical activity in natural environments plays an important role in adolescent health, yet seasonality and health barriers may affect participation. Differences in gender may indicate needs for targeted interventions; therefore, the study examined differences in gender in seasonal changes in physical activity and their relationship to health limitations during summer and winter. The sample included 1,034 adolescents (boys, $N = 545$; girls, $N = 489$). Differences in responses underwent evaluation with the chi-square test and Cramér's V . Seasonal changes in activity (summer - winter) underwent analysis with the Mann-Whitney U test. Seasonal differences in health limitations underwent assessment with McNemar's test for paired binary data. Statistically significant differences in gender appeared in both the frequency of physical activity and health barriers ($p < .001$; small to medium effects). Girls showed significantly greater seasonal declines in physical activity ($p < .001$; $r = .10$). Among girls, health limitations increased significantly during winter ($p = .007$), whereas no significant seasonal changes appeared among boys. These findings highlight greater seasonal vulnerability among girls in relation to physical activity in natural environments. We recommend targeted school- and community-based programs that support winter physical activity and reduce health barriers, in particular, girls.

Key words: Adolescents, health promotion, outdoor recreation, participation barriers.

Introduction

Physical activity in natural environments is an important determinant of adolescent health because outdoor movement supports cardiorespiratory fitness, psychological well-being and social connectedness (Bull et al., 2020; Fyfe-Johnson et al., 2021). Yet insufficient physical activity remains widespread among young people worldwide, with girls consistently reporting lower activity levels than boys, making gender-sensitive prevention continuing public health priority (Guthold et al., 2020). Participation in outdoor activity is shaped by season. Cold temperatures, shorter daylight, and reduced accessibility discourage recreation in parks, forests, and other natural settings, leading to lower winter activity and greater sedentary time (Turrisi et al., 2021).

Natural environments may be, in particular, vulnerable to these seasonal effects because use often depends on weather tolerance, perceived safety, and available companionship outdoors (Mygind et al., 2019). Health limitations such as illness, pain, fatigue, or perceived low fitness may further reduce adolescents' willingness to be active outdoors, and these barriers may be reported differently by girls and boys (Ferreira Silva et al., 2022). Despite growing interest in physical activity in nature, evidence integrating gender, seasonality, and health-related barriers in adolescence remains limited; therefore, this study examined differences in gender in seasonal changes in physical activity and their relationship to health limitations during summer and winter.

Materials and Methods

This cross-sectional study included 1,034 adolescents, of whom 545 were boys (52.7%) and 489 were girls (47.3%). The age ($M \pm SD$) of sample was 16.95 ± 1.18 years. Participants attended either grammar schools ($N = 709$, 68.6%) or vocational secondary schools ($N = 325$, 31.4%) (Table 1).

Data collection used questionnaire examining outdoor physical activity and perceived health-related limitations in natural environments across seasons. The instrument covered the frequency of outdoor physical activity during summer and winter, the perceived effect of season on outdoor physical activity, and health-related factors limiting activity in summer and winter. For analysis of seasonal changes in physical activity, responses for summer and winter activity frequency underwent recoding in ordinal numerical scales from 1 to 5, with higher values indicating more frequent activity.

Statistical analysis aimed to identify differences in gender and evaluate seasonal changes in outdoor physical activity and health-related limitations. Associations between gender and responses to Questions 1, 2, 3, 4, and 5 underwent testing with Pearson's chi-square tests of independence. Effect size estimation relied on Cramér's *V*, interpreted according to conventional thresholds. Seasonal changes in physical activity took the form of difference scores (Δ = summer - winter). Because the data had ordinal and nonparametric characters, comparisons of difference scores between boys and girls used the Mann-Whitney U test. Effect size had the form of coefficient *r*, calculated from the standardized test statistics. For seasonal differences in health-related limitations within the same respondents, responses underwent recoding in binary variables (0 = no limitation; 1 = limitation). Comparisons of summer and winter responses then used McNemar's tests for paired binary data. Statistical significance followed the threshold of $\alpha = .05$.

Tab. 1: Characteristics of sample according to gender and school (*N* = 1,034)

Variable	Male	Female	Sample
% of sample	52.7%	47.3%	100%
Age (years; <i>M</i> ± <i>SD</i>)	16.95 ± 1.30	16.94 ± 1.04	16.95 ± 1.18
Grammar school (<i>N</i> ; %)	305 (56.0%)	404 (82.6%)	709 (68.6%)
Vocational secondary school (<i>N</i> ; %)	240 (44.0%)	85 (17.4%)	325 (31.4%)

Results

Differences in gender appeared across all analyzed domains of outdoor physical activity and perceived health-related limitations. In summer, boys reported more often outdoor physical activity than girls. Daily outdoor activity reached 56.5% among boys and 40.7% among girls, whereas girls more often selected several times/ week (45.4% vs. 36.0%), > 1/ week (3.9% vs. 1.8%), and almost never (2.5% vs. 0.0%). In winter, the same pattern continued. Boys reported more often daily outdoor activity (27.2% vs. 13.5%), while girls more often reported 1/ week, > 1/ week, or almost never (Table 2).

Perceived seasonal influence on outdoor activity differed by gender. Girls more often stated that summer enabled more outdoor physical activity (37.8% vs. 23.7%), whereas boys more often indicated that season did not influence their activity (15.2% vs. 7.2%). In the domain of health-related limitations, both genders most reported no limitation in either season; however, girls more often identified high temperatures as summer barriers (24.1% vs. 8.6%) and colds or winter illnesses as winter barriers (32.5% vs. 21.3%). Boys indicated that physical activity improved their health in summer (20.2% vs. 12.1%) and winter (13.6% vs. 4.3%).

Inferential analyses confirmed significant differences in gender for all five questionnaire items, with small-to-medium effect sizes (Cramér's *V* = .183 - .239). Seasonal changes in outdoor physical activity differed significantly between genders. Girls showed greater declines from summer to winter than boys (*M* Δ = 1.125 ± 1.146 vs. .908 ± 1.137; *Med* = 1 in both groups), although the effect size remained small (*r* = .10). Seasonal changes in health-related limitations did not reach significance among boys, but girls showed significant increases in winter limitations compared with summer.

Tab. 2: Comparisons of boys and girls across questions

Analysis	Statistics	<i>p</i>	Effect size	Interpretation
Q1: Summer outdoor physical activity	$\chi^2_{(4)} = 37.451$	1.45×10^{-7}	<i>V</i> = .190	Sig. gender difference
Q2: Winter outdoor physical activity	$\chi^2_{(4)} = 46.121$	2.32×10^{-9}	<i>V</i> = .211	Sig. gender difference
Q3: Perceived seasonal influence	$\chi^2_{(4)} = 34.606$	5.60×10^{-7}	<i>V</i> = .183	Sig. gender difference
Q4: Summer health-related limitations	$\chi^2_{(4)} = 58.882$	4.98×10^{-12}	<i>V</i> = .239	Sig. gender difference
Q5: Winter health-related limitations	$\chi^2_{(4)} = 42.788$	1.15×10^{-8}	<i>V</i> = .203	Sig. gender difference
Seasonal change in activity (boys vs. girls)	<i>U</i> = 118,314	1.14×10^{-3}	<i>r</i> = .10	Girls showed decline
Seasonal change in health limitations: boys	McNemar's	.109	-	Not sig.
Seasonal change in health limitations: girls	McNemar's	.007	-	Sig. winter increase

Discussion

The study highlights gender gaps in outdoor physical activity and shows that this disparity intensifies during winter. Boys reported higher outdoor activity in summer, with 56.5% engaging daily compared with 40.7% of girls. During winter, participation dropped in both groups, yet the reduction appeared steeper among girls, as only 13.5% reported daily activity compared with 27.2% of boys. This pattern fits the statistical findings, because all five questionnaire domains reached significance according to gender, with Cramér's *V* values ranging from .183 to .239. Although the effect size remained small, the consistency of patterns across indicators and across the sample of 1,034 adolescents gives the finding practical relevance. These results support the view that season does not influence overall

activity levels; however, amplifies already existing differences in gender. Adolescents tend to reduce their physical activity during colder months, with summer and spring supporting higher levels of movement (Bélanger et al., 2009; Hjorth et al., 2013). Objective monitoring research further indicates that winter commonly brings lower moderate-to-vigorous physical activity and greater sedentary time. The present data extend that line of evidence by showing that the seasonal decline does not affect girls and boys equally. Instead, girls appear more vulnerable to environmental and personal barriers that limit outdoor activity when weather conditions deteriorate.

An important contribution of this study lies in the identification of perceived health-related limitations. Girls more often reported high summer temperatures as limiting factors (24.1% vs. 8.6%) and more often identified colds or winter illnesses as barriers during winter (32.5% vs. 21.3%). Just girls showed significant seasonal increases in health-related limitations (McNemar's $p = .007$), whereas boys showed no comparable shift ($p = .109$). This finding adds nuance to the interpretation of gender gaps. It suggests that girls not only participate less often; however, also experience seasonal discomforts and health concerns more strongly. Adolescent girls had lower odds of meeting physical activity recommendations and higher odds of perceiving barriers to participation, which supports the present pattern (Rosselli et al., 2020). Reviews focused on adolescent girls emphasize social support, body image, confidence, time pressure, and feelings of safety as recurring determinants of activity behavior (Hopkins et al., 2022; Martins et al., 2015).

In terms of practical perspective, the findings point toward the need for targeted, season-sensitive interventions. Even though the differences in gender in seasonal decline produced small effects ($r = .10$), that effect still carries importance at the population level, in particular, school settings. Meta-analytic evidence indicates that physical activity interventions for adolescent girls achieve better outcomes when they include school-based delivery, peer support, and multicomponent designs tailored, in particular, to girls' preferences and needs (Pearson et al., 2015; Owen et al., 2017). In the context of findings, schools and communities should consider structured winter programs that promote enjoyable outdoor movement, flexible intensity and accessible facilities linked to cold-weather discomfort. Recent evidence underlines the influence of parental support, family resources, and neighborhood context on outdoor physical activity, which suggests that effective intervention should not remain limited to school environments alone (Deng et al., 2024).

Conclusion

This study showed that adolescents' physical activity in natural environments declines from summer to winter, with girls experiencing significantly greater decreases than boys. Girls reported more health-related barriers, in particular, winter illness and seasonal discomfort, and just girls showed significant seasonal increases in perceived limitations. These findings suggest that gender and season jointly shape participations in outdoor activity during adolescence. Institutions (i.e., schools) should, therefore, implement gender-sensitive, winter-focused programs that reduce health barriers and make outdoor activity more accessible and appealing. Such interventions may help sustain year-round physical activity and support adolescent health and well-being.

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Souhrn

Studie se zaměřuje na rozdíly mezi chlapci a dívkami v sezónních změnách pohybové aktivity v přírodním prostředí a na jejich souvislost se zdravotními omezeními. Výzkumný soubor tvořilo 1 034 adolescentů. Výsledky ukázaly, že pohybová aktivita v přírodě od léta do zimy klesá u obou pohlaví, avšak výrazněji u dívek. Dívky zároveň častěji uváděly zdravotní bariéry, zejména vysoké letní teploty, nachlazení a zimní nepohodu, přičemž pouze u nich došlo k významnému zimnímu nárůstu omezení. Zjištění potvrzují potřebu genderově citlivých a sezónně zaměřených školních i komunitních programů, které podpoří celoroční venkovní pohyb a zdraví dospívajících.

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