Physical education and sport through the centuries
2026, 13(1), 47-54
ISSN 2335-0598

Original research article DOI: 10.5937/spes2601047P

INFLUENCE OF REGULAR PHYSICAL ACTIVITY ON ALPINE SKIING SKILL ACQUISITION IN CHILDREN

Eva Procházková[1], Gabriela Luptáková[1], Ema Pinkošová[1]

[1]Faculty of Physical Education and Sport, Comenius University in Bratislava, Slovakia

ABSTRACT

Regular participation in physical activity is widely recognized as a catalyst for developing the motor prerequisites necessary for specialized sports skills. This study specifically investigated the impact of regular, organized physical activity on fundamental alpine skiing skill acquisition in school-aged children. Materials and methods: Twenty children (9 girls, 11 boys; age 9.25 ± 1.65 years) were divided into physically active (n = 10) and inactive (n = 10) groups based on their participation in organized sports. Participants were assessed using a battery of ski school-validated tests for fundamental skiing skills, including dynamic balance, turning control, gliding stability, coordinated uphill movement, and the ability to edge the skis. Due to the nonparametric nature of the data, a Mann-Whitney U test was used to compare the performance of the two groups. Results. Statistical comparisons revealed no significant differences in age, height, weight, or body mass index between the active and inactive groups. Most importantly, physically active children demonstrated significantly superior performance in all fundamental skiing skill assessments (p values ranging from 0.001 to 0.007). Specific tests showing significant differences included the Forward Tandem Walking Test, Turning on Skis Test, Sliding Steps Straight Test, and Uphill Sidestep on the Slope Test. Conclusions. These findings emphasize the beneficial role of physical activity in developing skiing-related motor skills and improving alpine skiing performance in school-aged children.

Key words: Pre-adolescents, skiing, physical activity, motor skills

Corresponding author
Eva Procházková
evaryzkova@gmail.com

Copyright: © 2025 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

INTRODUCTION

Physical activity is widely recognized as a cornerstone of children's physical development, with substantial evidence supporting its positive association with motor skills (Barnett et al., 2016). This connection is theorized to be bidirectional, where higher levels of physical activity promote motor skill development, and in turn, increased motor skills lead to greater engagement in physical activities (Stodden et al., 2008; Bukvić et al., 2021). Indeed, studies consistently show that children who engage in regular physical activity tend to exhibit superior motor skills compared to their less active peers (Robinson et al., 2015; Barnett et al., 2016). For instance, preschoolers with higher levels of moderate-to-vigorous physical activity have been found to exhibit superior locomotor skills and greater self-efficacy in movement (Barnett et al., 2016). Furthermore, both structured and unstructured physical activity have been shown to contribute significantly to improved motor abilities over time (Dapp et al., 2021), with the strength of this relationship influenced by factors such as gender, activity intensity, and skill type (Figueroa & An, 2017; Jakšić et al., 2020).

While the general association between physical activity and fundamental motor skills is well-established, less is known about how this general motor proficiency facilitates the acquisition of complex, context-specific specialized skills. The extent to which regular physical activity influences the successful adoption of skills like alpine skiing, for instance, remains largely unexplored. Previous research has identified specific motor abilities crucial for success in alpine skiing, including agility, static leg strength, and balance (Cigrovski et al., 2012; Logan et al., 2015). Moreover, studies indicate that targeted, specialized training focused on these components can improve recreational alpine skiing performance (Zhou, 2023). However, this existing literature often focuses on the outcomes of specialized conditioning, neglecting the contribution of general, regular physical activity—the primary source of fundamental skill development in children—to the initial acquisition of core skiing techniques.

Given the complex interplay between general motor skill development and the acquisition of specialized tasks, this study aims to investigate the specific impact of regular physical activity on the acquisition of fundamental alpine skiing skills in early school-aged children.

METHOD

Participants

The study sample comprised 20 pre-adolescent children (9 girls, 11 boys) with a mean age of 9.25 ± 1.65 years; see Table 1 for full baseline characteristics. Selection criteria mandated that all participants were beginners in alpine skiing, possessing no prior experience on skis, which was verified upon registration for ski lessons at the ski school. Participants were categorized into two groups based on self-reported participation in organized sports: the Physically Active group (PA, n = 10; 5 girls, 5 boys) and the Physically Inactive group (PI, n = 10; 4 girls, 6 boys). Specifically, the PA

group was defined as children engaging in organized sports activities more than twice per week, with a minimum total commitment of 120 minutes. Conversely, the PI group consisted of children who reported no participation or only occasional engagement (less than twice per week) without formal membership in a sports club. The study was conducted in accordance with the principles outlined in the Declaration of Helsinki, and all participants and their guardians provided informed consent before involvement.

Table 1. Baseline Characteristics of the Study Sample (N = 20)

Variable	Mean ($\bar{x}$) ± Standard Deviation (s)	Range (Min - Max)	p-value*
Age (years)	9.25 ± 1.94	6–12	0.26
Height (cm)	135.95 ± 13.29	115–162	0.2
Weight (kg)	32.05 ± 9.36	18–60	0.49
BMI (kg/m²)	16.98 ± 2.08	13.61–22.86	0.55

Legend: p-values indicate the results of the Mann-Whitney U test comparing the Physically Active group (n = 10) and the Physically Inactive group (n = 10). As $p > 0.05$ for all variables, the groups are considered homogeneous at baseline.

Data Collection

Before the assessment, all participants completed a standardized two-hour basic downhill skiing lesson, following the methodology established by Belás & Chovanec (2015). The subsequent individual skiing assessment was conducted under identical conditions, with the testing procedure ensuring that only one participant was evaluated at a time. The assessment protocol measured fundamental skiing abilities across four key components:

1. Dynamic Balance (Forward Tandem Walking Test): This adaptation, based on Koyuncu & Kepenek (2023), was administered in ski boots on flat ground. Participants were instructed to traverse a 6-meter path as swiftly as possible while maintaining a heel-to-toe stance on a 5 cm wide line. The time in seconds required to complete the path without incurring errors was recorded, utilizing the better performance of two attempts.
2. Turning Control (Turning on Skis Test): Adapted from Belás & Chovanec (2015), this test required participants to execute a step turn around a vertical pole while facing it, maintaining contact between their ski tips using the snow plow technique. Performed on flat terrain, the objective was to complete the maneuver as quickly as possible. The faster of two time measurements (seconds) served as the recorded score.
3. Gliding Stability and Efficiency (Sliding Steps Straight Test): This test was adapted from Šimonek & Židek (2021) for the skiing context, replacing running with a sliding step technique over a total distance of 40 meters (4 x 10 meters). Participants were timed in seconds as they swiftly moved between two poles,

circling them twice. The trial was completed once on flat terrain, with the timer stopping upon the crossing of the starting line by the entire length of the skis.

4. Coordinated Uphill Movement and Edging (Uphill Sidestep on the Slope Test): This test (Belás & Chovanec, 2015) required participants to ascend sideways uphill as rapidly as possible across a marked 10-meter area. The assessment was performed on a gentle slope (up to 25°) on both the right and left sides of the body. The best recorded time (seconds) from two attempts per side was used for statistical analysis.

Statistical analysis

Data analyses were performed using IBM SPSS statistical software (Version 23 for Windows; IBM). Prior assessment using the Shapiro-Wilk test revealed a non-parametric data distribution for the variables under investigation. Consequently, the non-parametric Mann-Whitney U test was selected and utilized for two primary purposes: (1) to compare the Physically Active and Physically Inactive groups on anthropometric measures (age, height, weight, and BMI) to control for potential somatic baseline differences; and (2) to assess for significant variations in fundamental skiing skill performance between the two groups. Furthermore, the effect size coefficient (r), calculated using the formula $r = Z / \sqrt{N}$ (where Z is the standardized test statistic and N is the total sample size), was quantified to assess the practical significance of observed differences. In line with established methodological guidelines (Cohen, 1988), the interpretation of effect size magnitude categorizes them as small (≥ 0.10 and < 0.30), medium (≥ 0.30 and < 0.50), and large (≥ 0.50).

RESULTS

Firstly, statistical comparisons conducted to control for potential somatic differences indicated no significant variations between the Physically Active (PA) and Physically Inactive (PI) groups across all measured anthropometric variables. Specifically, the groups were homogeneous with respect to age ($p = 0.26$), body height ($p = 0.20$), body weight ($p = 0.49$), and BMI ($p = 0.55$).

Most importantly, analysis of fundamental skiing skill performance revealed statistically and practically significant differences favoring the PA group across all assessments:

- Dynamic Balance (Forward Tandem Walking Test): Physically Active children exhibited superior dynamic balance, completing the test in a significantly shorter mean time (13.53 ± 3.42 s) compared to the Inactive group (21.19 ± 4.30 s). This difference was highly significant ($p = 0.001$) and demonstrated a large effect size ($r = 0.727$).
- Turning Control (Turning on Skis Test): Significant differences were similarly observed in turning control ($p = 0.002$), with Active participants completing the task in a faster mean time (13.05 ± 3.41 s) than their Inactive counterparts (19.81 ± 4.38 s). The practical significance was large ($r = 0.693$).

- Gliding Stability and Efficiency (Sliding Steps Straight Test): A comparable trend was evident in gliding stability, where the PA group performed significantly faster (56.56 ± 10.15 s) than the PI group (71.28 ± 8.68 s) (p = 0.007). This finding was supported by a large effect size (*r* = 0.609).
- Coordinated Uphill Movement and Edging (Uphill Sidestep on the Slope Test): Significant differences were noted in both directions of the uphill movement test, all yielding a large effect size:
  - Right Side: Active children completed the task in 17.75 ± 6.03 s, significantly faster than Inactive children (26.81 ± 6.44 s) (p = 0.005, *r* = 0.625).
  - Left Side: Active children also demonstrated superior performance (17.84 ± 5.95 s) compared to Inactive children (28.90 ± 7.43 s) (p = 0.002, *r* = 0.676).

Table 2. Comparison of Fundamental Alpine Skiing Skill Performance Between Physically Active and Inactive Children

Skiing Skill Test	Group	Mean ± SD (s)	p-value	Effect Size (r)	Magnitude
Dynamic Balance	Active	13.53 ± 3.42	0.001	0.727	Large
	Inactive	21.19 ± 4.30			
Turning Control	Active	13.05 ± 3.41	0.002	0.693	Large
	Inactive	19.81 ± 4.38			
Gliding Stability	Active	56.56 ± 10.15	0.007	0.609	Large
	Inactive	71.28 ± 8.68			
Uphill Sidestep (Right)	Active	17.75 ± 6.03	0.005	0.625	Large
	Inactive	26.81 ± 6.44			
Uphill Sidestep (Left)	Active	17.84 ± 5.95	0.002	0.676	Large

DISCUSSION

Our findings strongly underscore the positive influence of regular physical activity on the acquisition of fundamental alpine skiing skills. Physically active children consistently and significantly outperformed their inactive peers across all assessed skill components, including dynamic balance, turning control, gliding stability, and coordinated uphill movement. These results are highly congruent with established literature emphasizing the critical role of physical activity in the broader growth and motor development of school-aged children (Bukvić et al., 2021). As this developmental stage is pivotal for motor skill acquisition, our study provides specific empirical evidence supporting the direct association between regular, structured physical activity and enhanced performance in complex, specialized skills like early-stage alpine skiing.

This observed relationship between higher physical activity levels and superior motor performance is further consistent with previous research focusing on

fundamental motor skill development. For example, Odráška et al. (2021) established a significant correlation between the time dedicated to physical activity and fundamental motor skill execution. However, it is noteworthy that while our study identified strong, statistically significant, and large-magnitude differences, some investigations, such as that by Stojmenovic et al. (2021), have reported only limited significant differences. This variance suggests that although regular physical activity generally benefits motor skill acquisition, the degree of benefit may be modulated by individual factors, the specific nature of the motor skills tested, or the quality of the movement experience.

Beyond the overall quantity of activity, the superior performance of the active group may stem from the qualitative aspects of their engagement. Research has highlighted the importance of practice variability, which encompasses novelty, diversity, effort, and success, as crucial factors for motor skill learning and cognitive development (Pesce et al., 2016). These findings suggest that the diverse movement repertoire inherent in regular organized sports contributes to a robust foundation of transferable skills. Furthermore, specific movement similarities, such as those found between inline skating and alpine skiing, have been shown to aid in the acquisition of basic skiing skills (Božić et al., 2017). This notion of skill transfer is further supported by Sekiguchi et al. (2021), who demonstrated that prior experience in related activities facilitates the faster learning of novel, specialized skills. Our results therefore support the premise that regular physical activity builds a versatile motor foundation that readily transfers to the demands of learning alpine skiing.

Despite offering valuable insights, our study is subject to several limitations. First, the small sample size may constrain the generalizability of our findings. Second, the broad age range of participants introduced inherent variability in skill acquisition and development rates. Third, the study's reliance on self-reported data for categorizing physical activity levels may not fully capture the complete picture of individual activity nuances and patterns. Finally, our design did not isolate the effects of specific types of physical activity or explore the influence of underlying genetic, biological, or psychological factors on the PA-skiing skill relationship, all of which may play a significant role. Future research should address these constraints by recruiting larger, more heterogeneous samples and focusing on narrower age cohorts. Furthermore, investigating the differential effects of specific types of organized physical activity on alpine skiing skill acquisition would provide more targeted recommendations for training and intervention programs.

CONCLUSION

In conclusion, this study demonstrates that consistent engagement in regular physical activity is a significant determinant of fundamental alpine skiing skill acquisition in school-aged children. The Physically Active group consistently exhibited significantly superior performance in all assessed fundamental skiing skills, including dynamic balance, turning control, gliding stability, and coordinated uphill movement, when compared to their less active counterparts. These results

are in strong alignment with the existing body of research emphasizing the critical importance of general physical activity for overall motor skill acquisition in school-aged populations. Furthermore, these findings robustly corroborate the established evidence on skill transfer, affirming that consistent and varied physical engagement during pre-school and early school age is instrumental in establishing a versatile motor foundation necessary for specialized skill development. Consequently, these results provide empirical support for prioritizing regular, organized physical activity programs as a means to facilitate the initial learning and proficiency of complex motor tasks, such as alpine skiing, in the school-aged population.

REFERENCES

1. Barnett, L. M., Salmon, J., & Hesketh, K. D. (2016). More active pre-school children have better motor competence at school starting age: An observational cohort study. *BMC Public Health*, *16*, Article 1068. https://doi.org/10.1186/s12889-016-3742-1
2. Belás, M., & Chovanec, L. (2015). *Didaktika zjazdového lyžovania*. ICM Agency.
3. Božić, I., Cigrovski, V., Bošnjak, G., Jakovljević, V., & Tešanović, G. (2017). Contribution of inline skating to learning basics of alpine skiing. *Sportlogia*, *13*(1), 1-8. https://doi.org/10.5550/sgia.171301.en.BCBJT
4. Bukvić, Z., Ćirović, D., & Nikolić, D. (2021). The importance of physical activity for the development of motor skills of younger school age children. *Medicinski Podmladak*, *72*(2), 34-39. https://doi.org/10.5937/mp72-31878
5. Cigrovski, V., Božić, I., & Prlenda, N. (2012). Influence of motor abilities on learning of alpine ski technique. *SportLogia*, *8*(2), 188-201. https://doi.org/10.5550/1200021000
6. Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.
7. Dapp, L. C., Gashaj, V., & Roebers, C. M. (2021). Physical activity and motor skills in children: A differentiated approach. *Psychology of Sport & Exercise*, *54*, Article 101916. https://doi.org/10.1016/j.psychsport.2021.101916
8. Figueroa, R., & An, R. (2017). Correlates of physical activity among children in the United States: A cross-sectional analysis. *Maternal and Child Health Journal*, *21*(1), 136-144. https://doi.org/10.1007/s10995-016-2102-1
9. Jakšić, D., Mandić, S., Maksimović, N., Milošević, Z., Roklicer, R., Vuković, J., Pocek, S., Lakićević, N., Bianco, A., Cassar, S., & Drid, P. (2020). Factors associated with physical activity in adolescents: A cross-sectional study. *International Journal of Environmental Research and Public Health*, *17*(18), 6609. https://doi.org/10.3390/ijerph17186609
10. Koyuncu, B., & Kepenek, V. (2023). The effect of forward tandem walking test on balance in children. *Sağlık Bilimleri Dergisi*, *32*(1), 36-41. https://doi.org/10.34108/eujhs.1190837
11. Logan, S., Webster, E., Getchell, N., Pfeiffer, K., & Robinson, L. (2015). Fundamental movements skills: A systematic review. *Kinesiology Review*, *4*(4), 416-438. https://doi.org/10.1123/KR.2013-0012
12. Odráška, L., Krč, H., & Dolníková, D. (2021). Relationship between physical activity and fundamental motor skills in children. *Journal of Human Sport and Exercise*, *16*(Proc4), S1153-S1162. https://doi.org/10.14198/jhse.2021.16.Proc4.49
13. Pesce, C., Croce, R., Ben-Soussan, T., Vazou, S., McCullick, B., Tomporowski, P., & Horvat, M. (2016). Physical activity and cognitive development: A consensus

statement from the International Society of Sport Psychology. *International Journal of Sport and Exercise Psychology*, *17*(2), 133-149. https://doi.org/10.1080/1612197X.2016.1223421

14. Robinson, L. E., Stodden, D. F., Barnett, L. M., Lopes, V. P., Logan, S. W., Rodrigues, L. P., & Garcia, C. (2015). Motor competence and health-related exercise capacity in youth: A systematic review. *Sports Medicine*, *45*(9), 1273-1300. https://doi.org/10.1007/s40279-015-0351-6
15. Sekiguchi, H., Yamanaka, K., Takeuchi, S., Futatsubashi, G., Kadota, H., Miyazaki, M., & Nakazawa, K. (2021). Prior experience in ball sports facilitates the acquisition of novel ball-related skills. *Scientific Reports*, *11*, Article 12379. https://doi.org/10.1038/s41598-021-91120-7
16. Šimonek, J., & Židek, R. (2021). The relationship between physical activity and motor performance in children. *Человек. Спорт. Медицина [Human. Sport. Medicine]*, *21*(1), 160-167. https://sciup.org/147236687
17. Stodden, D. F., Goodway, J. D., Langendorfer, S. J., Roberton, M. A., Rudisill, M. E., Garcia, C., & Garcia, L. E. (2008). A developmental perspective on the role of motor skill competence in physical activity involvement: An integrated review. *Quest*, *60*(2), 290-306. https://doi.org/10.1080/00336297.2008.10483582
18. Stojmenovic, A., Prvulović, N., & Katanić, B. (2021). Differences in motor skills between physically active and inactive children. *Journal of Anthropology of Sport and Physical Education*, *5*(1), 13-18. https://doi.org/10.26773/jaspe.210103
19. Zhou, Y. (2023). Recreational alpine skiing – An introduction. *Theoretical and Natural Science*, *4*, 404–414. https://doi.org/10.54254/2753-8818/4/20220610

Received on 16.12.2025.
Accepted on 04.01.2026.