

10.2478/tperj-2025-0021

Sports injuries in school settings: a descriptive analysis and a preventive-rehabilitation framework for middle school students

Rebbouh ABDENACER¹, Bentoumi ZINELABEDINE², Abdelmajid Ahmed Ibrahim Sayah LEMBAREK³

Abstract

Aim. This study analyzed the prevalence and causes of sports injuries among middle school students and evaluated the effectiveness of a preventive-rehabilitation program.

Material and method. A descriptive-analytical design was applied to 120 students using questionnaires and observations. Data were analyzed using descriptive and correlational statistics.

Results. Ankle sprains (23.3%), finger injuries (18.3%), and hamstring strains (14.2%) were the most frequent. Students in the program showed fewer injuries ($\bar{X} = 1.04$ vs. 1.73), greater preventive awareness (8.2 vs. 5.1), and better motor performance (16.7 vs. 13.8). Significant correlations were found between program participation and awareness ($r = 0.72$, $p < 0.01$).

Conclusions. The framework reduced injury rates and improved awareness, supporting its inclusion in school physical education.

Keywords: Sports injuries, prevention, rehabilitation, school students, physical education.

¹ PhD student at the Institute of Physical Activities and Sports Sciences, Ouargla, Algeria. e-mail: abdenacerrebbouh@gmail.com

² PhD student at the Institute of Physical Activities and Sports Sciences, Ouargla, Algeria. e-mail: zinosp880@gmail.com

³ PhD Candidate | Faculty of Physical Education and Sports Science University of Tripoli, Libya. e-mail: jjali9093@gmail.com

Introduction

Sports participation during adolescence plays a fundamental role in fostering physical growth, motor skill refinement, psychological well-being, and social integration(Jingili et al., 2023). Regular engagement in school-based physical education provides students with opportunities to enhance self-confidence, develop teamwork and communication skills, and adopt lifelong healthy habits. Despite these well-documented benefits, the school context often presents multiple risk factors that may increase the likelihood of sports-related injuries. These include limited supervision, insufficient warm-up routines, inadequate equipment, overcrowded classes, and the absence of structured preventive strategies(Leyenaar et al., 2023).

Globally, sports injuries among school-aged youth have been identified as a growing concern for educators, health professionals, and policymakers. Musculoskeletal injuries—such as sprains, strains, and contusions—constitute the majority of cases and may affect students' participation in physical education, academic involvement, and long-term physical activity levels. Studies increasingly emphasize that early adoption of preventive measures, including neuromuscular training, balance exercises, joint-stability programs, and structured warm-up protocols, substantially reduces injury incidence and enhances functional movement and overall motor performance(Anders et al., 2024).

Furthermore, several theoretical and applied models support the integration of preventive and rehabilitative approaches within school systems. The multistage injury prevention model, for example, highlights the importance of addressing intrinsic and extrinsic risk factors before injuries occur. Complementarily, the rehabilitation-oriented framework stresses the need for early detection and timely intervention to minimize long-term physical and psychological consequences. Evidence from school-based trials demonstrates that combining preventive education with simple, standardized training routines can lead to significant reductions in musculoskeletal injuries and improved physical competence among adolescents(Derman et al., 2023).

Despite the growing body of international research, many educational environments—particularly in developing contexts—still lack structured frameworks that merge prevention with rehabilitation. Physical education teachers often manage injuries based on personal experience rather than evidence-based protocols, and the absence of institutional guidelines limits the implementation of systematic preventive programs. This gap underscores the need for practical, context-specific models adapted to local resources, school constraints, and student needs.

In response to these challenges, the present study aims to:

- describe the current patterns and characteristics of sports injuries in middle school settings; and
- propose a practical preventive-rehabilitation framework tailored to the needs of middle school students and the realities of the local educational context.

By addressing both preventive and rehabilitative dimensions, this framework seeks to support teachers, administrators, and health practitioners in promoting safer physical activity, reducing injury risk, and enhancing the overall well-being and physical development of students through evidence-based strategies.

Materials and method

Design and Participants

A descriptive-analytical design was adopted involving 120 middle school students (males and females) from Ouargla Province. Participants were divided into two groups: one applying the proposed preventive-rehabilitation program and another following the regular physical education curriculum.

Data Collection

Data were gathered through structured questionnaires and observation checklists assessing injury types, frequencies, affected body areas, and preventive awareness levels. General motor performance was rated using a 20-point evaluation scale.

Description of the Proposed Preventive-Rehabilitation Program

The proposed program was designed to reduce the incidence of common sports injuries and improve physical readiness. It lasted eight weeks, with two 45-minute sessions per week integrated into physical education lessons. Each session included:

Warm-up and joint mobility (10 min): Dynamic exercises for flexibility and activation.

Muscle-strengthening and core stability (15 min): Focus on lower limbs, abdomen, and back.

Balance and proprioception training (10 min): Activities to enhance coordination and prevent ankle or knee injuries.

Stretching and recovery (5 min): Safe post-activity stretching of major muscle groups.

Injury prevention education (5 min): Short discussions on safety, hydration, and correct technique.

The program emphasized gradual progression and was supervised by trained physical education teachers to ensure safety and consistency.

Statistical Analysis

Data were analyzed using descriptive statistics (means, standard deviations, percentages) and correlation coefficients (r) to determine relationships between program participation, awareness, and injury frequency. A significance level of $p < 0.01$ was adopted.

Results

Table 1. Distribution of Sports Injuries by Type

Type of Injury	Freq	Percentage
Ankle sprain	28	23.3
Finger injury (volleyball)	22	18.3
Hamstring strain	17	14.2
Lower back pain	15	12.5
Knee or leg bruise	12	10
Minor miscellaneous injuries	26	21.7
Total	120	100

Source: Field study data collected by the researcher

Table 1 shows that ankle sprains were the most common type of injury (23.3%), followed by finger injuries (18.3%) and hamstring strains (14.2%). Overall, lower-limb injuries represented the majority of reported cases, reflecting the physical demands of school sports activities.

Table 2. Comparison Between Groups (With and Without the Proposed Program)

Group	Mean Injuries	SD	Preventive Awareness (out of 10)	General Motor Performance (out of 20)
Without program	1.73	0.58	5.1	13.8
With proposed program	1.04	0.49	8.2	16.7

Source: Field study data collected by the researcher

Table 2 shows that students who participated in the proposed preventive-rehabilitation program recorded fewer injuries (1.04 vs. 1.73), higher preventive awareness (8.2 vs. 5.1), and better general motor performance (16.7 vs. 13.8) compared to those who followed the regular physical education curriculum. These results demonstrate the positive impact of the program on injury reduction and physical performance.

Table 3. Injury Characteristics by Gender and Practice

Variable	Mean Injury Rate	Muscular Injuries (%)	Joint Injuries (%)
Males	1.58	63.2	36.8
Females	1.21	48.7	51.3
Practicing outside school	1.67	60.5	39.5
Non-practicing	1.12	49.1	50.9

Source: Field study data collected by the researcher

Table 3 indicates that males exhibited a higher mean injury rate (1.58) compared to females (1.21), with a greater proportion of muscular injuries. Students who practiced sports outside school also reported higher injury rates (1.67) relative to non-practicing students, suggesting increased physical load and reduced recovery time.

Table 4. Correlations Between Key Variables

Relationship	Correlation (r)	Significance (p)
Program implementation – Preventive awareness	0.72	< 0.01
Preventive awareness – Injury rate	-0.68	< 0.01

Source: Researcher's own computation based on field data

The results show a strong positive correlation between program implementation and preventive awareness ($r = 0.72$), indicating that the proposed program significantly enhances students' understanding of injury prevention. Additionally, preventive awareness is strongly and negatively correlated with injury rate ($r = -0.68$), suggesting that higher awareness levels are associated with fewer injuries.

Discussions

The present study showed that ankle sprains, finger injuries, and hamstring strains were the most frequent types of sports injuries among middle school students. These findings are in line with recent research indicating that ankle sprains represent a substantial proportion of lower-limb injuries in adolescent athletic populations, reflecting the biomechanical demands and rapid directional changes typical of school sports participation (Berkey et al., 2024). Similar patterns have been highlighted in systematic reviews on youth injury epidemiology, which consistently report sprains and strains as the most common injury categories among physically active adolescents (Picot et al., 2024).

Gender-based differences were also evident, with males exhibiting higher injury rates and a greater proportion of muscular injuries compared to females. This trend is consistent with earlier studies suggesting that gender-specific biomechanical characteristics, movement patterns, and higher participation intensity among males contribute to differing injury risk profiles during adolescence (Goossens et al., 2024). In addition, the higher injury frequency among students who practiced sports outside school likely reflects increased cumulative physical load, exposure to unsupervised activities, and insufficient recovery – all factors well documented in youth injury literature.

A key contribution of this study lies in demonstrating the effectiveness of the preventive-rehabilitation program. Students who participated in the intervention experienced a significant reduction in injury incidence, accompanied by notable improvements in preventive awareness and motor performance scores. These outcomes reinforce the evidence supporting structured, school-based intervention protocols that combine neuromuscular conditioning, proprioceptive training, and educational components (Berkey et al., 2024). The strong positive correlation between program implementation and preventive awareness, along with the negative correlation between awareness and injury rate, aligns with findings from recent meta-analyses showing that multicomponent prevention programs can reduce injury incidence by up to 30–35% among youth populations (Goossens et al., 2024). This underscores the theoretical premise that enhancing knowledge and safe-movement behavior plays a critical mediating role in injury prevention.

Despite the promising results, several limitations should be acknowledged. The reliance on self-reported injury data and observational assessments introduces potential reporting bias, and the eight-week duration of the program limits conclusions regarding the long-term sustainability of its effects. Furthermore, the study sample was restricted to a specific educational context, which may affect generalizability. Future research should employ longitudinal designs, incorporate clinical verification of injuries, and involve larger, more diverse school populations to validate and expand upon the present findings.

Overall, the results underscore the importance of integrating evidence-based preventive and rehabilitative strategies into school physical education curricula. By enhancing students' awareness, improving their physical preparedness, and creating safer sports environments, schools can play a pivotal role in reducing injury risks and promoting healthier, more sustainable participation in physical activity among adolescents (Picot et al., 2024).

Conclusion

Based on the findings of this study, sports injuries among middle school students represent a significant concern, with ankle sprains, finger injuries, and hamstring strains being the most prevalent types. Such injuries negatively affect students' participation in physical education, reduce motor efficiency, and increase the likelihood of recurring injuries if they are not properly managed.

The implementation of a structured eight-week preventive-rehabilitation program effectively reduced the frequency of injuries, enhanced preventive awareness, and improved overall motor performance. These outcomes highlight the importance of incorporating targeted preventive measures and functional conditioning into school sports activities.

To sustain these benefits, schools should adopt comprehensive, evidence-based injury-prevention frameworks that include proper warm-up protocols, balance and strength training, and regular educational sessions on safe movement and recovery. Physical education teachers and school health authorities must collaborate to ensure systematic application, continuous monitoring, and periodic evaluation of such programs in order to safeguard students' health and promote lifelong engagement in safe physical activity.

Recommendations

Based on the study results, the following recommendations are proposed:

Integrate structured preventive-rehabilitation programs in schools:

Since sports injuries—particularly ankle sprains, finger injuries, and hamstring strains—are prevalent among middle school students, it is recommended that schools adopt structured, evidence-based preventive-rehabilitation programs as a regular part of the physical education curriculum to minimize injury risk and enhance motor performance.

Implement consistent warm-up and conditioning routines:

To reduce the incidence of muscle and joint injuries, students should regularly perform scientifically designed warm-up, balance, and strength exercises before engaging in sports activities. These should be incorporated systematically into all physical education sessions.

Provide teacher training in injury prevention and early intervention:

Physical education teachers should undergo continuous professional development focused on injury prevention strategies, biomechanical safety, and early detection of musculoskeletal issues, ensuring safer practice and effective rehabilitation management.

Promote preventive awareness among students and families:

Awareness campaigns and educational sessions should emphasize correct exercise techniques, appropriate footwear, hydration, and recovery habits. Families should be encouraged to support safe physical activity practices and timely reporting of injuries.

Establish school-based injury monitoring systems:

Schools should implement injury surveillance mechanisms to document, analyze, and address recurring injury patterns, allowing early identification of high-risk students and more targeted preventive strategies.

Strengthen institutional and policy support:

Educational authorities and policymakers should mandate the inclusion of injury prevention programs in the national curriculum, ensure adequate resources for implementation, and promote collaboration between schools and sports medicine professionals.

Encourage further research:

Future studies should employ longitudinal designs with objective clinical assessments to evaluate the long-term effectiveness and cost-efficiency of preventive-rehabilitation programs, and to identify contextual factors—such as training load, previous injury history, and psychosocial influences—that affect program outcomes.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

No funding was received for this study, and all procedures were performed independently within the framework of educational and institutional ethics.

Acknowledgments

The authors would like to express their sincere gratitude to the participating students, physical education teachers, and school administrators for their cooperation and commitment throughout the study. Special thanks are extended to the educational authorities for facilitating data collection and supporting the implementation of the preventive-rehabilitation program. The authors also appreciate the valuable feedback provided by colleagues during the research design and analysis phases.

References

1. Anders, J. P. V., Neltner, T. J., Smith, R. W., Arnett, J. E., Housh, T. J., Schmidt, R. J., & Johnson, G. O. (2024). Unilateral and Bilateral Isokinetic Leg Extensions Exhibit No Differences in Neuromuscular Excitation Under Maximal and Fatiguing Conditions. *Journal of Strength & Conditioning Research*, 38(3), 474–480. <https://doi.org/10.1519/JSC.0000000000004652>
2. Berkey, R., Sunesara, A., Allen, L., Pontiff, R., DeVries, A., & Fisher, S. R. (2024). Ankle Injury Prevention Programs for Youth Sports: A Systematic Review and Meta-analysis. *Sports Health: A Multidisciplinary Approach*, 16(6), 1029–1037. <https://doi.org/10.1177/19417381241231588>
3. Derman, W., Runciman, P., Eken, M., Boer, P.-H., Blauwet, C., Bogdos, M., Idrisova, G., Jordaan, E., Kissick, J., LeVan, P., Lexell, J., Mohammadi, F., Patricio, M., Schwellnus, M., Webborn, N., Willick, S. E., & Yagishita, K. (2023). Incidence and burden of injury at the Tokyo 2020 Paralympic Games held during the COVID-19 pandemic: A prospective cohort study of 66 045 athlete days. *British Journal of Sports Medicine*, 57(1), 63–70. <https://doi.org/10.1136/bjsports-2022-106234>
4. Goossens, L., Cardon, G., Witvrouw, E., Verhagen, E. A. L. M., & De Clercq, D. (2024). An Injury Prevention Programme in Physical Education Teacher Education Students: Process Evaluation Using the RE-AIM Sports Setting Matrix. *Translational Sports Medicine*, 2024(1), 5717748. <https://doi.org/10.1155/2024/5717748>
5. Jingili, N., Oyeler, S. S., Ojwang, F., Agbo, F. J., & Nyström, M. B. T. (2023). Virtual Reality for Addressing Depression and Anxiety: A Bibliometric Analysis. *International Journal of Environmental Research and Public Health*, 20(9), 5621. <https://doi.org/10.3390/ijerph20095621>
6. Leyenaar, J. K., Arakelyan, M., Acquilano, S. C., Gilbert, T. L., Craig, J. T., Lee, C. N., Kodak, S. G., Ignatova, E., Mudge, L. A., House, S. A., & Brady, R. E. (2023). I-CARE: Feasibility, Acceptability, and Appropriateness of a Digital Health Intervention for Youth Experiencing Mental Health Boarding. *Journal of Adolescent Health*, 72(6), 923–932. <https://doi.org/10.1016/j.jadohealth.2023.01.015>

7. Picot, B., Lopes, R., Rauline, G., Fourchet, F., & Hardy, A. (2024). Development and Validation of the Ankle-GO Score for Discriminating and Predicting Return-to-Sport Outcomes After Lateral Ankle Sprain. *Sports Health: A Multidisciplinary Approach*, 16(1), 47–57. <https://doi.org/10.1177/19417381231183647>