



Preventing common injuries in physical education classes at Hanoi Metropolitan University, Vietnam

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Abstract

Background: Injuries in Physical Education (PE) at universities not only impair health but also negatively affect students' psychology and academic performance. At Hanoi Metropolitan University (HNMU), the increasing intensity of elective modules such as Football and Volleyball necessitates a scientific injury prevention protocol.

Methods: The study was conducted in two phases: (1) A survey of injury status among 450 students; (2) A pedagogical experiment on 160 students using the "HNMU-Safe" warm-up protocol modified from the FIFA 11+ program combined with awareness education on R.I.C.E. first aid techniques.

Objectives: To identify common types of injuries and evaluate the effectiveness of a specialized prevention protocol in minimizing risks during PE classes.

Results: The survey phase recorded a cumulative injury rate of 32.4%, with ankle sprains and knee injuries accounting for the highest proportions. Following the intervention, the experimental group (EG) saw a reduction in injury rates to 8.75%, compared to 28.75% in the control group (CG). Chi-square testing indicated a highly significant statistical difference ($\chi^2 = 10.45$; $p < 0.01$). The average recovery time decreased from 4.6 days to 3.2 days.

Conclusion: The application of standardized warm-up exercises, combined with facility condition control and safety education, serves as a breakthrough solution for building a safe and professional learning environment at HNMU.

Keywords: Sports injuries, hanoi metropolitan university, injury prevention, FIFA 11+, specialized warm-up

Introduction

In the modern higher education system, Physical Education (PE) is not merely a prerequisite subject but also a core medium for enhancing health, relieving stress, and shaping student character. At Hanoi Metropolitan University (HNMU), the development strategy for the 2025–2030 period emphasizes comprehensive training, in which intensive movement modules such as Football, Volleyball, and Badminton are increasingly focused on in terms of both intensity and training density. However, a paradox exists: as technical proficiency and exercise intensity increase, the risk of injury rises proportionally, leading to significant health consequences and disrupting students' academic plans.

Empirical studies globally and in Vietnam indicate that injury rates in physical pedagogical environments typically range from 20% to 30%, primarily concentrated in lower limb joints such as the ankles and knees. Common identified causes include: superficial warm-up habits, inaccurate movement techniques, and limited awareness of training safety. Particularly for non-sports major students, the neuromuscular system often has not reached a high level of readiness to react to sudden torsional forces or collisions, leading to serious ligament and soft tissue injuries.

Despite numerous studies on sports injuries in general, a significant scientific gap remains at HNMU: there is currently no specialized, systematic injury prevention protocol validated through experimentation specifically for the students here. The application of international standards such as FIFA 11+ which has proven effective in reducing injuries by 30% to 50% in professional athletes into the university PE environment remains a novel direction lacking specific quantitative evidence in Vietnam.

The urgency of this research also lies in the requirements of educational reform toward a competency-based approach. A PE class is only considered effective when it ensures absolute safety for the learners. Researching the current situation and applying the "HNMU-Safe" protocol (modified from FIFA 11+) not only helps reduce injury rates but also shortens recovery time and enhances students' health self-protection awareness, contributing to a professional and sustainable learning environment. This study aims to fundamentally resolve movement risks through a combination of biomechanical stability exercises and pedagogical safety awareness education.

Materials And Methods

The study utilized a combination of sociological survey methods (questionnaires administered to 450 students) and pedagogical experimentation (160 students).

Phase 1 (Survey): A standardized questionnaire was employed to evaluate the frequency, types, and causes of injuries sustained within the previous 12 months.

Phase 2 (Experiment): 160 students were divided into a Control Group (CG – 80 students, liberal/unstructured warm-up) and an Experimental Group (EG – 80 students, warm up following the HNMU-Safe protocol).

HNMU-Safe Protocol: The protocol consisted of three components (Running/Thermal regulation, Strength/Balance, and Speed/Agility) performed during the first 20 minutes of the class.

Data Processing: SPSS 26.0 software was used to calculate percentages (%), and to perform Chi square (χ^2) and t-tests for quantitative variables.

Results

1. Identifying Injury “Hotspots” Through Large-Scale Survey Data

Analysis of 450 HNMU students reveals a highly concentrated risk profile, reflecting a deficiency in physical preparation prior to exercise.

Table 1: Typical Injury Patterns and Locations at HNMU (n=450)

Injury Type	Rate (%)	Primary Location	Impact Level
Ankle sprains / Inversion	42.5	Ankle	Mobility disruption > 3 days
Muscle strains / minor tears	17.8	Hamstrings, calves	Pain during high-intensity effort
Knee joint injuries	12.3	Cruciate ligaments	High surgical risk
Abrasions and contusions	15.1	Knees, elbows	Aesthetic and daily life impact
Others	12.3	Wrists, fingers	Reduced gripping capacity

The results from Table I illustrate the injury risk profile of students at Hanoi Metropolitan University (HNMU) through the following key aspects:

Concentration of Lower Limb Injuries

The data reveals a risk profile heavily concentrated on the lower extremities:

Ankle sprains and inversions account for the highest proportion at 42.5%, primarily occurring in the ankle region. When combined with muscle strains/minor tears (17.8%) and knee joint injuries (12.3%), the total proportion of lower limb injuries exceeds 70%.

This reflects the characteristics of elective modules at HNMU involving rapid directional changes and high contact (such as football and volleyball), which place extreme pressure on students' ligaments and muscles.

Severity and Pedagogical Implications

Injuries not only impact immediate health but also cause significant disruptions to the learning process:

Mobility: Sprain cases lead to walking disruptions lasting more than 3 days.

Medical: Although knee joint injuries (12.3%) occur less frequently than sprains, they carry a high risk of surgery due to cruciate ligament damage.

Daily Life: Soft tissue injuries such as abrasions and bruises (15.1%) or wrist/finger injuries (12.3%) affect aesthetics and gripping ability in daily activities.

Causes Stemming from Deficient Physical Preparation

The distribution of these injury types is clear evidence of inadequate pre-exercise physical preparation:

The high concentration of ligament and muscle injuries indicates that students' neuromuscular systems have not reached the readiness level required to react to sudden torsional forces or collisions during class.

This confirms the necessity of transitioning from traditional warm-up methods to specialized protocols like HNMU-Safe to create a "shield" protecting these “red zone” locations.

The results of Table I confirm that the ankles and knees are the most vulnerable areas, necessitating a scientific prevention protocol to minimize injury rates and ensure training continuity for HNMU students.

2. The “Failure” of Traditional Warm-ups: Root Cause Analysis

Data indicates an inverse correlation between warm-up quality and accident frequency.

Table 2: Weight of Primary Injury Factors

Factor Group	Rate (%)	Identifiable Characteristics
Superficial warm-up	38.5	Duration < 5 min, simple joint rotation only
Technical errors	25.0	Heel-striking, knee valgus
Infrastructure	18.5	Slippery or uneven surfaces
Physical overload	11.0	Exercising while sleep-deprived or fatigued
Subjective psychology	7.0	Joking during practice sessions

Based on the results from Table II, the root causes of injuries during Physical Education classes at HNMU are identified as follows:

The "Failure" of Traditional Warm-up Methods

The most significant factor is Superficial Warm-up (38.5%). **Characteristics:** Students typically dedicate less than 5 minutes to gentle joint rotation exercises.

Consequences: This approach is insufficient to activate the neuromuscular system or prepare the body to adapt to the intensity of combat and competitive sports. This represents the largest loophole in the current safety protocol.

Technical Errors and Biomechanical Factors

Technical Deviations rank second, accounting for 25.0%. **Characteristics:** Common errors include heel-striking or knee valgus (knees bowing inward) during movement.

Analysis: These postural errors exert direct pressure on the ligament and joint systems, particularly the Anterior Cruciate Ligament (ACL), leading to the severe injuries recorded in Table I.

Impact of Infrastructure and Objective Conditions

Training Infrastructure (18.5%) is an external factor that cannot be overlooked.

Slippery or uneven surfaces act as catalysts for sudden loss of balance.

Despite these being physical defects, the study indicates that through meticulous monitoring and safety-mindset education from instructors, this risk can still be significantly mitigated.

Human Factors: Physical Condition and Psychology

The remaining two factor groups are directly related to the state of the learner:

Physical Overload (11.0%): Exercising while sleep-deprived or fatigued leads to a decline in reflexes and motor control.

Subjective Psychology (7.0%): Behaviors such as joking during practice sessions indicate that a segment of the student population does not yet fully perceive injury risks. Weight analysis reveals that over 60% of the causes (Superficial Warm-up and Technical Deviations) stem from

training methods and student awareness. This confirms that replacing traditional warm-ups with a standardized protocol like HNMU-Safe and enhancing first-aid technical education is the correct path to thoroughly resolve these risks.

3. The “Shield” Effectiveness of the HNMU-Safe Protocol: A Significant Difference

Experimental results among 160 students show a breakthrough reduction in injuries for the group applying the international standard protocol.

Table 3: Comparison of Preventive Performance Between Research Groups

Comparative Indicator	Control Group (CG) (n=80)	Experimental Group (EG) (n=80)	Mitigation Efficiency
Number of recorded injuries	23	7	- 69.6%
Injury rate (%)	28.75	8.75	3.28 times reduction
Statistical Testing	$\chi^2=10.45$	$p<0.01$	Highly significant

Based on the results of Table III, the performance of the injury prevention protocol is demonstrated through the comparison between the control group (CG) and the experimental group (EG) as follows:

Breakthrough Reduction in Injury Cases

The intervention protocol created a distinct quantitative shift between the two groups:

Recorded Cases: The experimental group (EG) recorded only 7 injury cases, whereas the control group (CG) reported 23 cases.

Prevention Efficiency: The application of the new protocol helped reduce the number of injuries by 69.6% compared to traditional free warm-up methods.

Safety Index and Risk Ratio

The percentage-based injury rates indicate a significant disparity in safety levels:

Group CG: Had an injury rate of 28.75%, corresponding to the average level in physical pedagogical environments in Vietnam.

Group EG: This rate dropped to only 8.75%.

Evaluation: Group EG achieved a safety rate of up to 91.25%. The preventive effectiveness of the experimental

protocol was 3.28 times higher than that of the control group.

Scientific Reliability

Statistical testing indices confirm the authenticity of the research results:

Test Values: $\chi^2 = 10.45$ and $p < 0.01$.

Significance: With a value of $p < 0.01$, the difference between the two groups is highly statistically significant. This indicates that the reduction in injuries was not due to chance but was a direct consequence of implementing the HNMU-Safe protocol.

The analysis of Table III provides strong empirical evidence that replacing traditional warm-ups with international-standard biomechanical stability exercises has created a solid “safety corridor”. This protocol not only reduces the frequency of accidents but also significantly enhances professionalism in physical education training at HNMU.

Recovery Speed: Impact of Awareness Education and Proper First Aid

The research demonstrates that sports medicine knowledge helps students “mitigate” the consequences of injuries.

Table 4: Indicators of Motor Function Recovery (Unit: Days)

Subject Group	Mean Absence Duration (M±SD)	Reduction Rate (%)	p-value
Control Group (CG)	4.5 ± 1.2	-	-
Experimental Group (EG)	3.2 ± 0.8	30.4	< 0.05

The results from Table IV demonstrate the effectiveness of awareness education and the correct application of first aid on the motor function recovery speed of students as follows:

Significant Reduction in Academic Disruption

The data reveals a distinct disparity in recovery times between the two research groups:

Control Group (CG): The mean absence duration was 4.5 ± 1.2 days.

Experimental Group (EG): The mean absence duration was reduced to only 3.2 ± 0.8 days.

Efficiency: Implementing the intervention protocol resulted in a 30.4% reduction in recovery time. This means that

students in the EG were able to return to practice an average of 1.3 days sooner than the control group.

The Role of Awareness Education and First Aid Skills

The improvement in recovery speed is attributed not only to physical exercises but also to the acquisition of sports medicine knowledge:

Timely First Aid: Proficiency in and immediate on-site application of the R.I.C.E. (Rest, Ice, Compression, Elevation) protocol helps mitigate the severity of the initial injury.

Elimination of Improper Treatment: Safety education prevents students from panicking or resorting to erroneous

traditional remedies, such as applying hot oil to sprains, which exacerbates swelling and inflammation.

Psychological Impact: Knowledge empowers students to be more proactive in managing their personal health, shifting from a passive to an active intervention model.

Statistical Significance and Practical Value

Reliability: With a $p < 0.05$, the difference in recovery time between the two groups is statistically significant, confirming that these results are the product of a scientific intervention rather than chance.

Training Sustainability: Reducing absence duration ensures the continuity of the PE training program, helping HNMU students maintain their performance and complete their academic plans on schedule.

The analysis of Table IV confirms that the HNMU-Safe protocol serves not only as a “shield” to prevent injuries but also as a “key” to effective risk management. The integration of physical exercise and safety awareness education provides a comprehensive solution for establishing a professional learning environment at HNMU.

Discussion

Analyzing the Injury Mitigation Mechanism of the HNMU-Safe Protocol

The significant reduction in the injury rate from 28.75% to 8.75% (Table III) provides robust empirical evidence regarding the effectiveness of standardized exercises. Unlike traditional warm ups that typically focus on static stretching which can temporarily diminish explosive power the “HNMU-Safe” protocol integrates joint stabilization and concentric/eccentric strength exercises.

The biomedical mechanism involved here lies in optimizing “neuromuscular control”. When students perform single-leg balance exercises and correct landing techniques, the proprioception system is strongly activated. This enables the body to react more swiftly to unexpected torsional forces, thereby protecting the Anterior Cruciate Ligament (ACL) and the ankle more effectively. These findings are entirely consistent with the study by Soligard *et al.* (2008) [6], confirming that FIFA 11+ is the “gold standard” for preventing sports injuries.

Correlation Between Safety Awareness and Recovery Efficiency

The finding of a 30.4% reduction in academic absence within the experimental group (Table IV) elucidates the role of “Knowledge of Results” and self-health management skills. Equipped with knowledge about injury mechanisms and the R.I.C.E protocol (Rest - Ice - Compression - Elevation), students no longer panic or resort to improper treatments, such as applying hot oil to sprains.

This shift represents a transition from a purely physical intervention model to an active education model. Shortening recovery time is not only significant for health but also ensures the continuity of the training program, helping HNMU students maintain better academic performance.

The Role of the Learning Environment and Pedagogical Responsibility

The study indicates that injury risks are closely linked to infrastructure conditions (accounting for 18.5% of causes in

Table II). However, experimental results suggest that even when facility conditions are imperfect, meticulous monitoring and educating students on a “safety first” mindset can significantly compensate for physical defects. Instructors are now not merely technical teachers but also “risk managers”. Dedicating the first 5 minutes of a session to inspecting the training ground alongside students fosters a consensual “safety culture”. This aligns with modern learner-centered teaching trends, where students act as “co authors” in creating a safe training space.

Limitations and Prospects for Practical Implementation

Although the experimental results are highly feasible, the study still has limitations regarding sample size (primarily focused on Football and Volleyball) and the duration of long-term post-experimental follow-up. Nonetheless, the statistical effect size achieved indicates that the HNMU-Safe solution has the potential for broad application across all PE modules at the university. In the future, integrating AI to monitor landing postures in real-time could be the next step toward completely eliminating technical errors that cause serious injuries.

Conclusion

Experimental research at Hanoi Metropolitan University (HNMU) has demonstrated that injuries during Physical Education (PE) classes can be fully controlled and mitigated through scientific intervention measures.

Risk Control Capability: The study confirms that injuries in PE classes can be managed and minimized via systematic and scientific interventions.

Identification of Typical Injuries: Ankle sprains and soft tissue injuries of the lower limbs are identified as the primary risks for students. The root cause stems mainly from superficial warm-up habits, which lack the necessary intensity to prepare the body for vigorous physical activities.

Effectiveness of the Intervention: The implementation of the HNMU-Safe protocol (developed based on the FIFA 11+ foundation) yielded breakthrough results, reducing the injury rate to a minimum of 8.75%. This result is highly statistically significant with a $p < 0.01$.

Transformation in Awareness and Training Culture:

The solution extends beyond physical exercises by empowering students to be more proactive in first-aid skills, thereby significantly shortening recovery times. This plays a crucial role in fostering a safe, professional, and sustainable training culture within the university environment

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