



## Injury prevention for vietnamese female beach volleyball athletes

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### Abstract

**Problem Statement:** Beach volleyball is a high-intensity sport performed on unstable sand surfaces and under extreme weather conditions. Although sand surfaces help mitigate direct impact injuries to the joints compared to hard courts, their compliance and unevenness pose significant challenges to the neuromuscular system and joint stability. In Vietnam, while women's beach volleyball is growing rapidly, medical protocols and injury prevention efforts still show a significant gap compared to the international standards set by the FIVB Medical Commission (2024). The prevalence of overuse injuries and acute injuries resulting from technical errors is directly impacting the career longevity and athletic performance of players.

**Approach:** This study employs a synthesis and analysis of epidemiological data from FIVB injury reports (Bahr & Reeser, 2003), combined with a situational survey of the morphology, physical fitness, and injury status of Vietnamese female beach volleyball athletes during Regional Games (SEA Games) and National Championships (Znews, 2022). Furthermore, the study conducts a comparative analysis of anthropometric indices and injury patterns between Vietnamese athletes and international professionals to identify specific risk factors (Bersola *et al.*, 2019).

**Purpose:** The paper aims to identify the most common types of injuries, analyze injury mechanisms based on the biomechanics of movement on sand, and propose a comprehensive prevention framework including: technical optimization, specialized physical conditioning, training environment management, and the application of standardized medical protocols.

**Results:** Data indicate that the rate of acute injuries in beach volleyball is lower than in indoor volleyball (1.8 vs. 5.3 injuries per 1,000 hours) (Juhan *et al.*, 2021). However, overuse injuries account for a high proportion, particularly low back pain (19% - 33%) and patellar tendinopathy (12% - 27%) (Bahr & Reeser, 2003). Vietnamese female athletes have a significantly lower mean height (176.8 cm) compared to top-tier global teams (over 185 cm), leading to an increased frequency and intensity of jumping to maintain offensive efficiency. This results in heightened cumulative stress on the knee joints and spine (Tuoi Tre, 2025).

**Conclusions:** Injury prevention for Vietnamese female beach volleyball athletes needs a strategic shift from reactive treatment to proactive prevention by focusing on core stability, neuromuscular stabilization, and adherence to the PRICE protocol in acute management. Improving court conditions, nutrition, and electrolyte replacement are also pivotal factors in ensuring health and sustaining long-term athletic performance (FIVB Medical Commission, 2024; Bangkok Hospital, 2024).

**Keywords:** Beach volleyball, sports injuries, female athletes, injury prevention, Vietnam

### Introduction

Beach volleyball has undergone a powerful evolution since becoming an official Olympic sport at Atlanta 1996, asserting its position as one of the most attractive and physically demanding sports on the planet (Bahr & Reeser, 2003) [1]. Unlike indoor volleyball, which features 6-player lineups on an 18m x 9m court, beach volleyball requires only 2 athletes to cover the entire 16m x 8m area (Rixtar, 2024; Sodex Sport, 2022) [10, 11]. This shift not only demands that athletes possess comprehensive skills from setting and defending to attacking but also imposes immense biomechanical stress on the body due to continuous movement and jumping on unstable sand surfaces (Rixtar, 2024; Dodds, 2025) [4, 10].

In Vietnam, women's beach volleyball is witnessing significant fan interest and investment from sports governing bodies. Professional pairs at the SEA Games have demonstrated relentless efforts to reach regional levels (Znews, 2022) [15]. However, one of the greatest barriers to enhancing athletic performance is the injury rate. The lack of in-depth research on injury patterns specific to beach volleyball athletes in Vietnam has led to training and prevention programs being duplicated from indoor volleyball, which involves entirely different injury mechanisms (Dodds, 2025) [4].

A defining characteristic of beach volleyball is the playing surface. Sand, with its compliant nature and varying friction, acts as a natural shock absorber, minimizing injuries caused by direct impact forces on the joints during landing (Dodds, 2025) [4]. However, this "friendliness" of the sand comes at a high price: energy expenditure for every stride and jump increases by 30% to 50% compared to hard surfaces. This forces the muscular system, particularly the stabilizing muscle groups in the ankles and lower back, to work at a higher intensity to maintain equilibrium (Dodds, 2025) [4]. Furthermore, environmental conditions such as high sand temperatures and solar radiation accelerate premature fatigue, leading to technical errors that cause injury (FIVB Medical Commission, 2024) [5].

International epidemiological analyses from FIVB studies indicate that while the rate of acute injuries causing time-loss is relatively low, overuse injuries represent a major challenge (Bahr & Reeser, 2003) [1]. For Vietnamese female athletes, this issue is further complicated by limited morphological indices. When natural height does not match that of international opponents, athletes are forced to compensate by increasing training frequency, which directly pushes the locomotor system beyond its tolerance limits (Tuoi Tre, 2025) [13].

The urgency of developing a scientific injury prevention strategy for Vietnamese women’s beach volleyball is undeniable. This strategy must be an integration of sports science, rehabilitative medicine, and technical analysis to safeguard the health and careers of the athletes.

**Materials and Methods**

The study employs a multi-dimensional approach, combining secondary data analysis with field observations. The primary subjects of the research include professional Vietnamese female beach volleyball athletes participating in the 31st and 32nd SEA Games (Znews, 2022; Sports and Physical Training, 2023) [12, 15]. Height and morphological indices were collected and cross-referenced with data from Philippine and international athletes (Bersola *et al.*, 2019) [3]. Injury data were collected through two methods: a retrospective analysis of medical reports over a 12-month cycle and prospective monitoring of injury cases occurring directly during tournaments (Bahr & Reeser, 2003) [1]. Injury definitions adhere to FIVB standards: an injury is

recorded when an athlete requires professional medical attention or is forced to miss at least one day of training (FIVB Medical Commission, 2024) [5].

Regarding analytical methods, the study applies the formula for Body Mass Index (BMI)

$$BMI = \frac{Weight(kg)}{Height^2(m)}$$

The athletes' somatotype (physical classification) was evaluated using the Heath-Carter method (Bersola *et al.*, 2019) [3]. Additionally, the study assessed training court conditions in Vietnam based on technical criteria regarding sand depth and sand quality (MerryLand, 2025) [4].

**Results**

Anthropometric Analysis and International Comparison Morphological characteristics play a decisive role in determining potential injury risk factors.

**Table 1:** Comparison of Mean Morphological Indices of Female Athletes

Subject Groups	Mean Height (cm)	Mean Body Mass (kg)	BMI (kg/m2)	Dominant Somatotype Component
Vietnam National Team (Indoor)	178.0	62.5	19.7	Ectomorph-Mesomorph
Vietnam National Team (Beach)	176.8	59.5	19.0	Balanced Mesomorph
Philippines Athletes	168.0	64.0	22.5	Endomorph-Mesomorph
International Athletes (Top 6)	182.5	73.4	21.8	Mesomorph-Ectomorph

The average height deficit of Vietnamese female athletes compared to international standards (approximately 6-8 cm lower than top-tier teams) creates indirect pressure on the locomotor system (Tuoi Tre, 2025) [13]. To compensate, athletes must execute frequent maximal jumps, leading to

patellar tendon overloading (FIVB Medical Commission, 2024) [5].

Injury Prevalence and Common Anatomical Locations Beach volleyball exhibits a highly specific injury pattern, predominantly characterized by repetitive strain injuries (Juhan *et al.*, 2021) [7].

**Table 2:** Prevalence of Acute and Overuse Injuries in Beach Volleyball

Anatomical Location	Acute Injury (%)	Overuse Injury (%)	Primary Mechanism
Knee Joint	30%	12%-27%	Jumping and unstable landing
Ankle	17%	-	Lateral ankle sprain on shifting sand
Fingers	17%	-	Ball impact during blocking
Lower Back (Lumbar)	-	19%-33%	Lumbar hyperextension during attacking
Shoulder Joint	5%	10%-22%	Repetitive high-velocity spiking

In Vietnam, ligamentous injuries account for up to 43.75% of all volleyball-related injuries, frequently occurring during fall-related incidents (56.3%) (HCMC University of Education, 2023) [12].

Causes of Injuries at Vietnamese Training Centers Field surveys indicate significant gaps in the pre-participation protocols and training execution (HCMC University of Education, 2023) [12].

**Table 3:** Causal Factors of Injuries During Training

Causal Factors	Rate (%)	Specific Impact
Inadequate Warm-up	27.05%	Insufficient elasticity in muscles and ligaments
Excessive Training Load	10.10%	Causes cumulative fatigue and impaired concentration
Substandard Facility Conditions	8.93%	Hard sand or insufficient standardized sand depth
Technical Errors	7.31%	Postural deviations during complex movements

Approximately 90% of injuries are classified as mild; however, non-compliance with recovery periods results in 3-5% of cases progressing to chronic conditions (Tran Thi Thuy, 2023).

**Discussion**

Biomechanical Characteristics and Injury Risks The sand surface is a central factor causing the dissipation of ground reaction forces, forcing the lower leg muscle groups to

operate at significantly higher power outputs (Dodds, 2025) [4]. Accumulated muscular fatigue from navigating unstable sand impairs neuromuscular control, making athletes highly susceptible to lateral ankle sprains (Vinmec, 2024; Rixtar, 2024) [10, 14].

Overuse Injuries: The Primary Challenge Low back pain and patellar tendinopathy represent two severe chronic issues. Offensive maneuvers on sand require complex coordination between lumbar hyperextension and sudden

flexion; if core stability is insufficient, stress is transferred directly to the lumbar spine (Bahr & Reeser, 2003; FIVB Medical Commission, 2024) <sup>[1, 5]</sup>. In Vietnam, due to a smaller physical stature compared to international counterparts, female athletes often employ more "explosive" jumping techniques, which increases tensile stress on the patellar tendon (Tuoi Tre, 2025) <sup>[13]</sup>.

International Benchmarking and Prevention Framework Compared to FIVB standards, Vietnam needs to implement neuromuscular stabilization programs and scientific load management (FIVB Medical Commission, 2024) <sup>[5]</sup>. A comprehensive prevention framework includes:

**Specialized Physical Conditioning:** Focusing on the core, rotator cuff, and ankle-stabilizing muscle groups (Phiten, 2024; Better at Beach, 2024) <sup>[9, 10]</sup>.

**Technical Optimization:** Training for bilateral landing techniques with slight hip and knee flexion to dissipate impact forces (FIVB Medical Commission, 2024; GoodFit, 2024) <sup>[5]</sup>.

**Environmental Management:** Ensuring a minimum sand depth of 30-40 cm and ensuring the sand is free of impurities (MerryLand, 2025) <sup>[4]</sup>.

**Application of the PRICE Protocol:** Implementing Protection, Rest, Ice, Compression, and Elevation immediately following acute injury onset (Bangkok Hospital, 2024; FIVB Medical Commission, 2024) <sup>[2, 5]</sup>.

## Conclusion

Injury prevention is a continuous process that is inseparable from specialized athletic training. For Vietnamese female beach volleyball athletes, injury risks arise from a combination of the demanding biomechanical characteristics of sand surfaces and physical stature limitations relative to international standards.

This study has demonstrated that while acute injuries can be mitigated through proper technique and adequate warm-up protocols, overuse injuries affecting the lower back, knees, and shoulders represent the true barrier to sustainable athletic development. Shifting the paradigm from a "reactive" treatment mindset to "proactive prevention" achieved through neuromuscular stabilization training, core strengthening, and scientific load management is an essential roadmap for elevating Vietnamese women's beach volleyball to new heights.

Moving forward, sports governing bodies should invest in electronic injury surveillance systems and the specialized training of sports medicine professionals dedicated to beach volleyball. Concurrently, standardizing training facilities according to international benchmarks will serve as a vital foundation for protecting the current generation of athletes and attracting young talent to the sport. The health of the athlete remains the ultimate metric for the professionalism of a national sports system.

## References

1. Bahr R, Reeser JC. Injuries among world-class professional beach volleyball players: The Fédération Internationale de Volleyball beach volleyball injury study. *The American Journal of Sports Medicine*, 2003;31(1):119–125.
2. Bangkok Hospital. Prevent the 5 most common injuries in volleyball, 2024.

3. Bersola KAR, *et al.* Anthropometric profile of elite women's volleyball players in the Philippines. *Turkish Journal of Kinesiology*, 2019;5(2):70–81.
4. Dodds T. Sand science: What beach volleyball athletes need to know about training, performance and injury risk. *Lift Clinic*, 2025 May 12.
5. FIVB Medical Commission. FIVB medical injury prevention: Principles of prevention and treatment of common volleyball injuries, 2024.
6. GoodFit. Tips for preventing knee injuries in volleyball, 2024.
7. Juhan TR, *et al.* Epidemiology of beach volleyball injuries, 2021.
8. MerryLand. Technical regulations and standards for sand volleyball courts, 2025.
9. Phiten Vietnam. Effective methods to prevent shoulder pain in volleyball, 2024.
10. Rixtar. Beach volleyball and 7 differences from indoor volleyball, 2024.
11. Sodex Sport. Meaning of hand signals in beach volleyball, 2022.
12. Ho Chi Minh City University of Education. Current status of sports injuries among students of the Faculty of Physical Education. *Journal of Pedagogical Sciences*, 2023, 22–26.
13. Tuoi Tre Online. Vietnam women's volleyball team: Height is not everything, 2025.
14. Vinmec International Hospital. Common volleyball injuries and their management, 2024.
15. Znews. Vietnamese volleyball players standing 1.80 m tall at the 31st SEA Games, 2022.