Predictors Of Phase Angles And Jump Heights For The Lower Extremity Injury In Adolescent Female Basketball Players

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Summary

The purpose of this study was to use bioelectrical impedance analysis (BIA) and force plate metrics to predict lower extremity injury risk in adolescent female basketball players. Phase angle asymmetry (the difference between legs) significantly predicted injury (p<.0001). Receiver Operating Characteristic (ROC) analysis showed that BIA-derived parameters demonstrated superior predictive accuracy (AUC = 0.84) compared to force plate metrics (AUC = 0.74). Squat jump height also showed significant predictive value. These results suggested that BIA has the potential to be a valuable tool for injury risk assessment in this population, although further research is needed for validation.

Introduction

Bioelectrical impedance analysis (BIA), which measures phase angle, is increasingly recognized for assessing cellular health in athletes. Higher phase angle values indicate better cell membrane integrity and physiological condition, making BIA useful for injury recovery monitoring and training optimization [1,2]. This is particularly relevant in basketball, where dynamic movements often cause lower extremity injuries [2,3]. However, research on injury prevention and return-to-play standards for adolescent female athletes remains limited. The purpose of this study was to address this gap by utilizing BIA and force plate assessments to identify injury risk indicators.

Methods

This study recruited 32 female players from Taiwan's top-ranked senior high school basketball teams. They were confirmed by the athletic trainer as trainable players and players cleared to return-to-play after injury. Three trials of body composition testing were conducted in their fasted states using a multifrequency BIA device (Tanita 980, Japan). After a dynamic warm-up, three trials of countermovement jumps, countermovement jump-rebound, and squat jumps were performed on a pair of force plate (Hawkin dynamic, USA). Averaged data of three trials were used for the logistic regression models to predict the injury state based on the phase angles obtained from the bioimpedance and jump heights obtained from the force plate.

Results and Discussion

The analysis identified phase angle asymmetry as a significant predictor of the injury status, χ^2 (1, N = 61) = 19.45, p < .0001. A one-degree increase in asymmetry corresponded to a 467,627-fold rise in injury odds, while a 0.1-degree difference increased injury risk 3.65-fold. Previous research has demonstrated that variations in total-body composition influence both sports performance and injury risk [1].This study findings highlighted the importance of balanced leg health, as phase angle asymmetry may indicate injury susceptibility. Additionally, squat jump height significantly predicted injury risk, with an odds ratio of 1.09e-13, indicating that higher squat jump height was associated with reduced injury risk. The Receiver Operating Characteristic (ROC) curve analysis showed that combining phase angle and jump height achieved an Area Under Curve (AUC) of 0.84, outperforming force plate parameters from a squat jump test (AUC = 0.74).

Conclusions

The results suggested that phase angle may be valuable for assessing injury risk in adolescent female basketball players. However, the dramatic increase in injury odds associated with phase angle differences needs further investigation to ensure its accuracy and clinical relevance. Future research should focus on validating these findings and exploring the practical applications of BIA in preventing basketball injuries.

References

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Table 1: The results of the logistic regression model using BIA-derived and force plate-derived parameters to predict injury.

Variables	Estimate	Std Error	χ^2	P value	Lower 95%	Upper 95%	Odd Ratio (per unit)	Odd Ratio (per 0.1 unit)
Difference in phase angle (between legs)	13.10	3.70	12.05	<0.01*	336.58	6.497e+8	467627.5	3.68
Squat jump height (m)	-29.845742	11.988219	6.20	<0.05*	167779.6	5.75e+81	1.09e-13	0.05