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19 UNDERGRADUATE RESEARCH CRITIQUE

Research Critique on "Influence of Sports Flooring and Shoes on Impact Forces and Performance During Jump Tasks"

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ABSTRACT

Introduction: Jumping serves an imperative role in increasing the performance of athletes of numerous sports, which also induces lower extremity injuries due to the impact force generated by the movement. It was evident that jumping on sports flooring with proper shoes could reduce the risk of injures. However, the interaction between them is biomechanically unclear.

Purpose: The purpose of this critiqued study was to identify the effectiveness of sports flooring and shoes when performing jump tasks.

Methods: Twenty-one healthy participants (Men, 26.8±5.7 years) performed two types of jump tasks as follows; 1) four maximal jumps consecutively while maintaining strong ankle movements with full knee extensions (Ankle jump task). 2) two maximal countermovement jumps with knee flexion at approximately 90° (Multi-jump task). The participants conducted both jump tasks on a combination of five sports flooring (SF) conditions [thickness: 7.5 mm (SF2), 11 mm (SF3), 14 mm (SF1), and 18 mm (SF4), no flooring (SF0)] and two types of shoes (non and cushioned shoes). Three trials were performed for each sports flooring and shoe combination (total of 10). The vertical ground reaction force (Fz), peak vertical ground reaction force (PVGRF), and vertical instantaneous loading rate (VILR) were recorded using two Arsalis 3D force plate systems. Jump performance was assessed by jump height and concentric work (Wcon). The analysis of variance test (ANOVA) was performed to determine the individual effectiveness of each shoe and flooring types on impact forces and jump performance during each jump task.

Results: Sports flooring was more effective in lowering VILR ($p < 0.001$) compared to the PVGRF ($p = 0.636$) during ankle jump task. SF4 lowered VILR more than SF0 ($p = 0.012$) and SF1 ($p = 0.018$) when non-cushioned shoes were worn. Compared to SF0, SF1, and SF2, VILR was also lower in SF4 when cushioned shoes were worn ($p < 0.001$) as well as compared to SF3 ($p = 0.035$). VILR was the lowest in

SF4 compared to SF0 ($p < 0.001$) and SF2 ($p=0.004$) during multi-jumps with non-cushioned shoes. No considerable differences on VILR were identified for all flooring types with cushioned shoes. Sports flooring did not affect PVGRF during multi-jumps. However, shoe types had a greater influence on both VILR and PVGRF. VILR was lower with cushioned shoes during both ankle jumps (95%CI: -943 to -607 N.s-1.kg^{-1}, $\omega^2 = 0.31$) and multi-jumps (95%CI: -979 to -627 N.s-1.kg^{-1}, $\omega^2 = 0.31$). There was an increase in PVGRF during ankle jumps with cushioned shoes, while PVGRF was lower with non-cushioned shoes during multi-jumps. Cushioned shoes also appeared to increase jump performance (higher jump height) during multi-jumps than non-cushioned shoes (95%CI: 0.3 to 0.9 cm; $\omega^2 = 0.06$)

Conclusion: Sports flooring and shoes mostly influenced VILR. However, shoe types had more influence on impact force and jump performance variables, increasing jump height and peak ground reaction force. Cushioned shoes were found to be the most effective in lowering VILR for both jump tasks. As higher VILR is linked to sports-related injuries, cushioned shoes are the more preferred type of shoe-wear for reducing sports injuries.

Critique: The focus of the study was to determine the effectiveness of sports flooring and shoe types on impact force and jump performance. The research revealed that sports flooring and shoes lessen VILR and PVGRF. However, shoe types had a greater influence on both impact force and jump performance-related variables. As multiple combinations of sports flooring and shoes were utilized, various sports environments were replicated. Therefore, the research can highlight the importance of creating sport-specific shoes that can effectively decrease VILR and improve jump performance. A limitation to the research is that only twenty-one male participants were studied. This could have contributed to the difficulty of indentifying the effectiveness of sports flooring and shoe types on jump height. A bigger sample size could have yielded values that show a higher presence of possible statistical significance between jump height and jump performance. In addition, the research may not be applicable to women athletes due to potential reasons such as women having less lower-body strength and a lower center of mass. The research could have also produced more accurate results by having the participants perform a back arm swing while jumping. The participants could have been hindered from jumping maximally as their hands were positioned on their hips. Future studies should focus on testing sport-specific jump techniques to determine ideal sports shoes and sports flooring combinations that effectively reduce injuries and enhance jump performance.

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