Lower Limb Asymmetry and Change of Direction Performance: An Integrative Analysis of Explosive Strength Metrics in Female Athletes

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Résumé

Abstract

Background: Lower limb explosive strength is critical in sports performance, particularly in tasks requiring rapid change of direction (COD). While overall strength contributes to agility, the role of inter-limb asymmetry remains less defined. Prior literature presents mixed findings-some suggest asymmetry hampers COD, while others report minimal effects. Understanding which strength measures are most predictive of COD can refine athlete assessment and training.

Methods: This study examined 44 female athletes (age: 26.01 ± 7.00 (years, to investigate the relationship between lower limb asymmetries and COD performance. Asymmetry was assessed through three parameters: Isometric Mid-Thigh Pull (IMTP) force, Countermovement Jump (CMJ) force, and CMJ stiffness. Each metric was computed for left and right limbs using force plate analysis. COD was evaluated using the Half T-test. Pearson correlation analyses were conducted to determine associations between lower limb asymmetry and COD performance.

Results: Significant positive correlations were found between COD time and CMJ stiffness asymmetry ($r = 0.419$, $p = 0.005$), CMJ peak force asymmetry ($r = 0.388$, $p = 0.009$), and IMTP peak force asymmetry ($r = 0.315$, $p = 0.037$). Among the three, stiffness asymmetry had the strongest relationship with slower COD times. This suggests that dynamic, elastic characteristics may influence agility more than static strength parameters.

Conclusion: Asymmetries in explosive strength metrics-particularly those derived from dynamic tests like CMJ-are significantly associated with COD performance in female athletes. These findings highlight the importance of assessing both force and stiffness asymmetries in training and injury prevention programs. Coaches and sports practitioners should implement targeted unilateral training (e.g., single-leg plyometrics or specific strength drills) to correct imbalances and enhance agility performance. Additionally, regular monitoring of stiffness asymmetries is also advised, especially during physical conditioning and return-to-sport phases.

Keywords: asymmetry, countermovement jump, stiffness, change of direction, explosive strength, IMTP

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