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Correlation Between Linear Sprint Speed and Force Production

CONFERENCE ABSTRACT

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Abstract

Linear sprinting is essential for athletic performance, especially in sports that require rapid acceleration and top-end speed. Force production is a known contributor to sprinting ability; however, the specific roles of horizontal and vertical force across sprint phases are not fully understood. This study aimed to examine the relationship between linear sprint speed and force production in college baseball players, hypothesized that horizontal force would better predict acceleration, and vertical force would better predict maximal velocity. Thirty male collegiate baseball players (ages 18–24) participated in this correlational study. Acceleration was measured using a 10-yard dash, while maximal velocity was assessed with a 10-yard fly sprint, following a 20-yard build-in. Horizontal force production was evaluated using countermovement and pause broad jumps. Vertical force production was measured using countermovement and pause vertical jumps. The stretch-shortening cycle (SSC) was assessed by comparing countermovement and pause conditions. Sprint times were recorded with Brower timing gates, and jump performance was measured using jump mats. Pearson correlations were used to examine relationships between sprint and jump variables, and paired t-tests compared jump conditions. Statistical significance was set at $\alpha = .05$. Strong, significant negative correlations were found between 10-yard sprint times and all jump measures, indicating that greater force production corresponded with faster acceleration. Correlations ranged from $r = -0.66$ to $r = -0.72$ ($p < .001$). The 10-yard fly sprint also showed

moderate-to-strong negative correlations with all jump variables ($r = -0.55$ to -0.61 , $p \leq .002$), suggesting that both horizontal and vertical force production contribute to maximal velocity. A moderate positive relationship was observed between eccentric utilization ratio (EUR) in the broad jump and maximal velocity ($r = 0.48$, $p = .007$). Additionally, countermovement jumps produced significantly greater distances and heights than pause jumps in both horizontal and vertical conditions ($p < .001$), demonstrating the benefit of SSC utilization. Force production was found to be strongly associated with both acceleration and maximal sprint speed. While horizontal force plays a key role in acceleration, vertical force also contributes meaningfully across sprint phases. The SSC enhances force output and should be incorporated into training. Overall, a combination of horizontal, vertical, and SSC-focused training methods is recommended to optimize sprint performance.

Keywords: athletic performance, force production, vertical force