POSITION GROUP DIFFERENCES AND ASSOCIATIONS OF SPRINT AND JUMP MOMENTUM IN NCAA DI FOOTBALL ATHLETES.

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Abstract

Sprint and countermovement jump (CMJ) tests relate to sporting activities such as tackling but are influenced by body mass and position in heterogeneous populations such as American football. Recent studies suggest that momentum derived outcomes account for such confounds, but it is unclear if jump momentum equally relates to sprint momentum across heterogeneous positions.

PURPOSE: The purpose of this study was to investigate between-position differences and within-position associations of sprint and jump momentum.

METHODS: As part of an off-season testing battery, forty-two football athletes (age=21.5±1.3y, height=187.5±4.9cm, weight=105.2±22.3kg) completed three CMJ trials with hands akimbo using force plates sampling at 1000Hz (Hawkin Dynamics, Maine, USA) and two 36.58m sprint trials with 10Hz body worn GPS used to derive maximum velocity (Catapult Sports, Melbourne, Australia). Maximum velocity was multiplied with body mass to derive sprint momentum. Jump momentum represented the product body mass and takeoff velocity in the CMJ. Positions were grouped as BIG (offensive and defensive linemen), MID (running backs, tight ends, quarterbacks, and linebackers) and SKILL (defensive backs and wide receivers). One-way ANOVAs were used to assess between-group differences in sprint and jump momentum (α=0.05). Descriptive statistics (mean±SD) and Tukey's HSD tests were used for pairwise comparisons. Within-group associations of sprint and jump momentum were analyzed with Pearson correlation coefficients.

RESULTS: Significant main effects of position were found in both sprint (F(2,39)=58.72,p<.001) and jump momentum (F(2,39)=33.82,p<.001). Tukey's HSD revealed sprint and jump momentum were higher in BIG (1113 ±49;360±22, respectively) compared to both the MID (936±86; 312±37, respectively) and SKILL (824±77; 270±30, respectively) groups(p<.001). Sprint and jump momentum were also higher in MID compared to SKILL (p=.002; p=.001, respectively). Moderate to strong associations of sprint and jump momentum were found in within each position (BIG; r=.56,p=.044, MID; r=.90, p<.001, SKILL; r=.89, p<.001).

CONCLUSIONS: Sprint and jump momentum are both influenced by position. Moreover, the association between sprint and jump momentum ranged from moderate to strong for each group, corroborating previous reports in contact sports such as rugby and warranting further investigation into the usefulness of momentum-derived metrics as a performance indicator in American football.

PRACTICAL APPLICATION: American football is a sport characterized by intermittent generation and withstanding of bodily contacts at high velocities which may be influenced by momentum. Normative data provided by this study may be of use to coaches aiming to prepare athletes for the demands of sport with respect to their position. These data and the correlation coefficient equations may be used for position group specific training prescription predicated on mass- specific velocities.

Introduction

- Sprint and CMJ tests relate to sporting activities such as tackling but are influenced by body mass and position in heterogeneous populations such as American football.
- Recent studies suggest that momentum derived outcomes account for such confounds, but it is unclear if jump momentum equally relates to sprint momentum across heterogeneous positions.
- The purpose of this study was to investigate between-position differences and within-position associations of sprint and jump momentum.

Methods

- As part of an off-season testing battery, forty-two football athletes (age = 21.5±1.3y, height = 187.5±4.9cm, weight = 105.2±22.3kg) completed three CMJ trials with hands akimbo using force plates sampling at 1000Hz and two 36.58m sprint trials with 10Hz body worn GPS used to derive maximum velocity.
- Sprint and Jump Momentum were derived using the equations provided in Figure 1.

A. Sprint Momentum = Body Mass (kg) × Takeoff Velocity (m/s)

B. Jump Momentum = Body Mass (kg) × Maximum Velocity (m/s)

Figure 1. *Calculations used to derive A. Sprint Momentum from a 36.58m sprint and B. Jump Momentum from CMJ.*

- Positions were grouped as BIG (offensive and defensive linemen), MID (running backs, tight ends, quarterbacks, and linebackers) and SKILL (defensive backs and wide receivers).
- One-way ANOVAs were used to assess between-group differences in sprint and jump momentum. Descriptive statistics and Tukey's HSD tests were used for pairwise comparisons.
- Within-group associations of sprint and jump momentum were analyzed with Pearson correlation coefficients.

Results

- Significant main effects of position were found in both sprint (F(2,39)=58.72, p<.001) and jump momentum (F(2,39)=33.82, p<.001).
- Tukey's HSD revealed sprint and jump momentum were higher in BIG (1113 ±49; 360±22, respectively) compared to both the MID (936±86; 312±37, respectively) and SKILL (824±77; 270±30, respectively) groups (p<.001).
- Sprint and jump momentum were also higher in MID compared to SKILL (p=.002; p=.001, respectively).
- Moderate to strong associations of sprint and jump momentum were found in within each position (BIG; r=.56, p=.044, MID; r=.90, p<.001, SKILL; r=.89, p<.001).

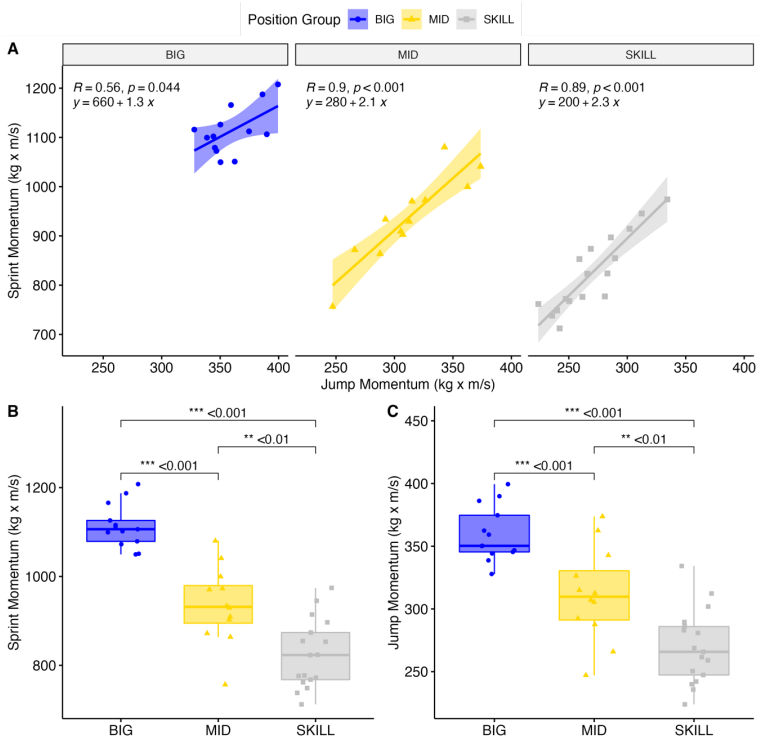

Figure 2. *A. Within-group associations (Pearson's r) between sprint and jump momentum and regression equations. B. Boxplots and Tukey HSD pairwise compassions of sprint momentum for the three position group conditions. C. Boxplots and Tukey HSD pairwise compassions of jump momentum for the three position group conditions.*

Conclusions

- Sprint and jump momentum are both influenced by position.
- Moreover, the association between sprint and jump momentum ranged from moderate to strong for each group, corroborating previous reports in contact sports such as rugby and warranting further investigation into the usefulness of momentum-derived metrics as a performance indicator in American football.

Practical Application

- American football is a sport characterized by intermittent generation and withstanding of bodily contacts at high velocities which may be influenced by momentum.
- Normative data provided by this study may be of use to coaches aiming to prepare athletes for the demands of sport with respect to their position.
- These data and the correlation coefficient equations may be used for position group specific training prescription predicated on mass- specific velocities.
- **Future studies should aim to investigate the relationships and between-position differences of sprint and jump momentum in these athletes when accounting for body composition indices such as lean and fat mass.**