Body Composition and Neuromuscular Performance in Collegiate Baseball Pitchers and Position Athletes

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INTRODUCTION

- Reductions in lean body mass and neuromuscular readiness can impact baseball performance during a season. However, studies examining changes in body composition and neuromuscular readiness are limited in baseball athletes.

- PURPOSE: Investigate changes in body composition and neuromuscular readiness, via countermovement jump (CMJ) performance metrics

METHODS

- National Collegiate Athletic Association Division I baseball players (mean ± SD: n= 29, pitchers n= 13, position players n=16, 20.5±0.5 years, 184.7±5.9 cm, 87.8±12.8 kg) participated in preseason (week 1) and postseason (week 18) body composition (BC) and CMJ testing sessions.

- BC testing was assessed with dual-energy X-ray absorptiometry. BC Metrics included: body mass (BM, kg), fat-free mass (FFM, kg), body fat percentage (BF%), bone mineral content (BMC, g), and bone mineral density (BMD, g/cm2).

- CMJ was assessed using bilateral force plates. CMJ Metrics included: jump height (JH, cm), reactive strength index modified (RSImod, AU), peak braking force relative to body mass (PBF, N/kg), and peak propulsive force relative to body mass (PPF, N/kg)

- Repeated measures analysis of variance (RMANOVA) 2 (time) x 2 (group [position]) were used to evaluate changes over time. Paired samples t-tests examined group differences when interactions were present (p<0.05).

- Relationships between variables were evaluated via Pearson correlation coefficients, which were defined as very weak: < 0.20; weak: 0.20–0.39; moderate: 0.40–0.59; strong: 0.60–0.79; very strong: >0.80.

KEY FINDING

Seasonal declines in BM, FFM, JH, and PPF suggest that there was reduced neuromuscular performance over the course of the competitive season

Table 1. BC & CMJ Performance Testing Metrics

BC & CMJ Metrics	BM	FFM	JH	RSImod	PBF	PPF
Team Preseason	89.18±9.68	73.36±7.76	43.31±5.22	0.57±0.13	26.95±3.14	27.00±1.97
Team Postseason	86.47±8.75*	71.36±6.92*	41.24±4.91*	0.56±0.10	26.56±2.02	21.52±1.69*
Pitcher Preseason	90.10± 7.89	73.60±6.4	43.30±3.36	0.60± 0.16	28.20±2.71	26.92±2.19
Pitcher Postseason	87.33±7.32	71.31±5.89	40.86±4.62	0.56± 0.12	26.65±2.03†	22.63±1.74$
Position Preseason	88.43±11.12	73.12±8.91	43.32±6.47	0.54±0.10	25.94±3.18	27.06±1.85
Position Postseason	85.77±9.94	71.38±7.85	41.55±5.26	0.56± 0.09	26.49±2.09†	20.62±0.99$

Values represented as mean ± standard deviation (n=29)
BC: Body Composition; CMJ: Countermovement Jump; BM (kg): Body Mass; FFM (kg): Fat Free Mass; JH (cm): Jump Height; RSImod (AU): Reactive Strength Index modified; PBF (N/kg): Peak Braking Force Relative to Body Mass; PPF (N/kg): Peak Propulsive Force Relative to Body Mass
*Significantly different from same group's preseason value (p < 0.05, within-group)
† Significant group × time interaction (p < 0.05)
$ Significant group × time interaction (p < 0.001)

Figure 1. Pearson Correlation between Measures of Performance and Body Composition
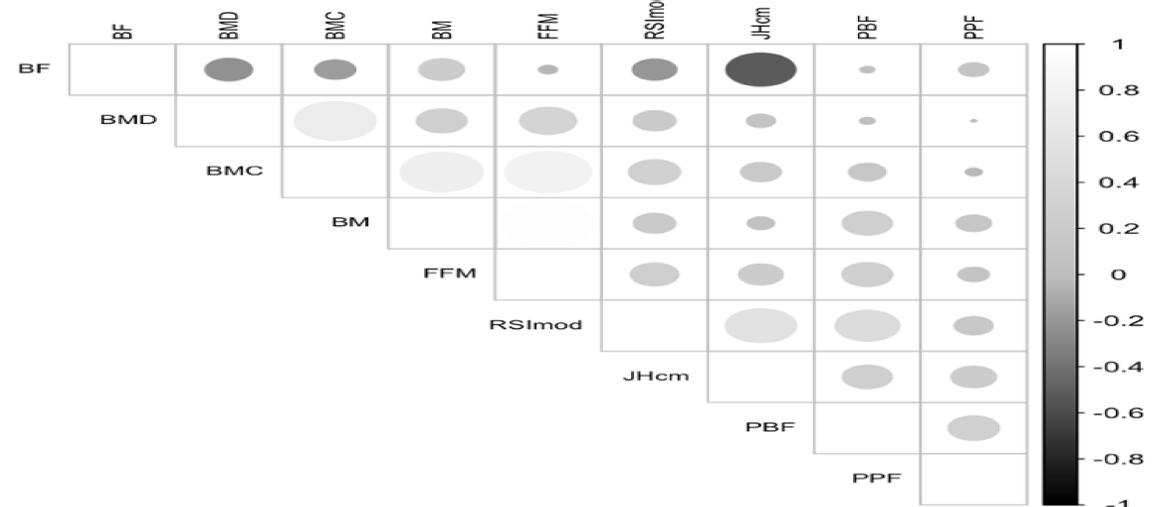
Legend
BM (kg) = Body Mass
FFM (kg) = Fat Free Mass
BF (%) = Body Fat Percentage
BMC (g) = Bone Mineral Content
BMD (g/cm²) = Bone Mineral Density
JH (cm) = Jump Height
RSImod (AU) = Reactive Strength Index Modified
PBF (N/kg) = Peak Braking Force Relative to Body Mass
PPF (N/kg) = Peak Propulsive Force Relative to Body Mass

RESULTS

- Athlete CMJ performance are included in Table 1 (Mean ± SD).

- From preseason to postseason significant reductions in BM, FFM, JH and PPF took place (p < 0.05) (Table 1).

- An interaction effect was observed for PBF and PPF (p < 0.05), indicating position-specific differences (Table 1).

- Post-hoc analysis showed PBF decreased only in pitchers (p = 0.012), while PPF declined in both pitchers and position players (p < 0.001) (Table 1).

- There were weak positive correlations between BM and PBF (r=0.27, p=0.04), BMC and RSImod (r= 0.29, p=0.03), FFM and PBF (r= 0.27, p=0.039), as well as a negative moderate correlation between BF% and JH (r= -0.52, p<0.001) (Figure 1).

CONCLUSIONS & PRACTICAL APPLICATIONS

- Seasonal changes in PBF amongst pitchers, but not in position players indicate that neuromuscular fatigue is potentially linked to differing sport demands between position types.

- The observed correlations between BC parameters and CMJ performance highlights how reductions in lean mass can negatively impact indicators of neuromuscular readiness.

- Strength and conditioning professionals are recommended to monitor BC and CMJ performance during the baseball season to identify the need for potential countermeasures. Position-specific assessments are also warranted to characterize workload-dependent neuromuscular fatigue.

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