Correlation of Power to Fastball Velocity of Collegiate Baseball Pitchers

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ABSTRACT

PURPOSE: To determine which field and laboratory power tests correlate to fastball velocity (FBV) of collegiate baseball pitchers. **METHODS:** Nineteen collegiate baseball pitchers (age = 19.9 ± 1.5 yr, height = 186.5 ± 5.9 cm, body mass = 90.7 ± 13.8 kg, % body fat = 14.6 ± 5.2%) volunteered for this study. Physical field tests were overhead medicine ball throw (OHMBT), bilateral vertical jump (VJ), unilateral VJ for the dominant (D) and non-dominant (ND) leg, standing long jump (SLJ), and lateral-to-medial jump (LMJ) for the D and ND leg. Laboratory tests were bilateral VJ peak power and unilateral VJ peak power for the D and ND leg. The mean and best of 5 fastballs were recorded in a laboratory setting and during off season intrasquad games from the wind-up and stretch. Mean OHMBT was 13.4 $m{\cdot}s^{-1}$, bilateral VJ was 64.24 cm, D leg VJ was 42.1 cm, ND leg VJ was 46.4 cm, SLJ was 257.3 cm, DLMJ was 202.5 cm, and NDLMJ was 205.4 cm. Bilateral VJ peak power was a total of 5609.0 W with the D leg contributing 2830.5 W and the ND leg contributing 2778.5 W. Unilateral D leg VJ peak power was 3371.2 W while the ND leg VJ peak power was 3484.7 W. In the lab, mean FBV from the wind-up off was 36.97 $m{\cdot}s^{-1}$ while the best was 37.44 $m{\cdot}s^{-1}$. In the lab, mean FBV from the stretch with a slide step was 36.71 $m{\cdot}s^{-1}$ while the best was 37.26 $m{\cdot}s^{-1}$. During competitive intrasquad games, the mean FBV from the wind-up was 39.29 $m{\cdot}s^{-1}$ while the best FBV was 39.65 $m{\cdot}s^{-1}$. Mean FBV from the stretch with a slide step was 38.97 $m{\cdot}s^{-1}$ while the best was 39.49 $m{\cdot}s^{-1}$ during competitive intrasquad games. All of these variables were correlated with one another by using a correlation matrix from raw data scores. Because there were only 19 pitchers, df = 17, this resulted in the critical r value for Pearson's correlation coefficient to be 0.456. **RESULTS:** There were significant ($p < 0.05$) moderate positive correlations between OHMBT and mean and best lab FBV from the wind-up (r = 0.482 and 0.467) and mean and best lab FBV from the stretch with slide step (r = 0.518 and 0.510); however, there were no significant correlations between OHMBT and mean and best FBV from the wind-up or stretch during the intrasquad games. Furthermore, there were no significant correlations with any of the bilateral or unilateral field or lab tests with FBV. **CONCLUSIONS:** There were significant relationships between OHMBT in the sagittal plane and FBV from the wind-up and the stretch in a lab setting. There were no relationships to the other field or lab jumping tests. These data contradict the results of previous research that indicated that the LMJ correlated with the throwing velocity. **PRACTICAL APPLICATIONS:** When addressing the lack of significant relationships between bilateral and unilateral field and lab jump test results and FBV, strength coaches must remember that just because they have helped develop strong and powerful pitchers, it does not mean that those outcomes relate to FBV or that those pitchers will improve their FBV. These authors think that those that train baseball pitchers should still focus on strength and power development because if a pitcher is not strong and powerful, their opportunities for successful on-the-field performance may not be optimal. Finally, the use of bilateral and unilateral testing in baseball can be used as markers of fitness improvement, maintenance, or decrements; or baseline data used to determine rehabilitation status for when to return-to-play.

INTRODUCTION

Fastball velocity (FBV) is an important factor for a baseball pitcher's success. Those pitchers who throw a baseball with greater FBV will decrease the hitter's decision time of whether or not to swing at a pitched ball, which will impact the hitter's timing and ability to hit successfully (1). Additionally, having greater FBV will help set-up the pitcher's other pitches, such as the curveball or change-up, and make them more effective due to the change in velocity as well as the movement and location of the pitch (1). Collectively, these advantages will cause more swing and misses by the hitter, making a pitcher who has greater FBV a desirable player to have on a pitching staff.

Coaches that train baseball pitchers are constantly looking for ways to test, monitor, and enhance performance. In their search for potential answers on how to best achieve these outcomes, research results are used to make and support training decisions. Previous correlation research indicates that college-level baseball players with greater bilateral power (3, 5) as well as unilateral power (2) throw with greater velocity.

There is no research examining sagittal and frontal plane, bilateral and unilateral, and field and lab tests to determine if relationships exist with FBV of Division I (DI) college pitchers. Therefore, the purpose of this study was to determine if any field or lab power test correlated with lab and intrasquad FBV from a wind-up or slide-step of DI college baseball pitchers.

METHODS

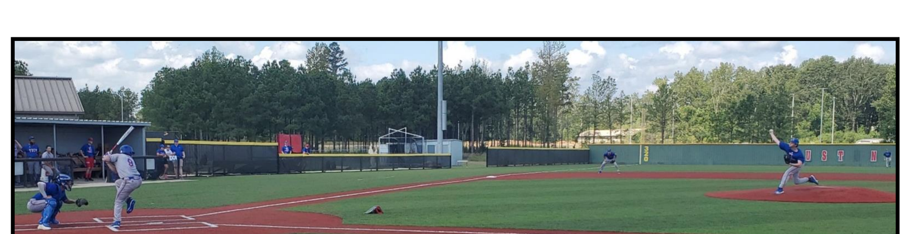
Nineteen DI collegiate baseball pitchers (age = 19.9 ± 1.5 yr, height = 186.5 ± 5.9 cm, body mass = 90.7 ± 13.8 kg, % body fat = 14.6 ± 5.2%) volunteered for this study. Physical field tests were 2 lb overhead medicine ball throw (OHMBT), bilateral vertical jump (VJ), unilateral VJ for the dominant (D) and non-dominant (ND) leg, standing long jump (SLJ), and lateral-to-medial jump (LMJ) for the D and ND leg. Laboratory tests were bilateral VJ peak power and unilateral VJ peak power for the D and ND leg measured from Bertec force plates. The mean and best of 5 FBV were recorded in a laboratory setting with a Rapsodo device while pitchers threw from a custom made pitching mound with embedded force plates as well as during off-season intrasquad games from a pitching mound from the wind-up and from the stretch with a slide-step. Mean OHMBT velocity was 13.4 $m{\cdot}s^{-1}$(30.0 mph), bilateral VJ was 64.24 cm (25.3 in), D leg VJ was 42.1 cm (16.6 in), ND leg VJ was 46.4 cm (18.3 in), SLJ was 257.3 cm (101.3 in), DLMJ was 202.5 cm (79.7 in), and NDLMJ was 205.4 cm (80.9 in). Bilateral VJ peak power was a total of 5609.0 W with the D leg contributing 2830.5 W and the ND leg contributing 2778.5 W. Unilateral D leg VJ peak power was 3371.2 W while the ND leg VJ peak power was 3484.7 W. In the lab, mean FBV from the wind-up was 36.97 $m{\cdot}s^{-1}$ (82.7 mph) while the best was 37.44 $m{\cdot}s^{-1}$(83.8 mph). In the lab, mean FBV from the stretch with a slide step was 36.71 $m{\cdot}s^{-1}$ (82.1 mph) while the best was 37.26 $m{\cdot}s^{-1}$(83.4 mph). During competitive intrasquad games, the mean FBV from the wind-up was 39.29 $m{\cdot}s^{-1}$ (87.9 mph) while the best FBV was 39.65 $m{\cdot}s^{-1}$ (88.7 mph). Mean FBV from the stretch with a slide step was 38.97 $m{\cdot}s^{-1}$ (87.2 mph) while the best was 39.49 $m{\cdot}s^{-1}$ (88.4 mph) during competitive intrasquad games. All of these variables were correlated with one another by using a correlation matrix from raw data scores. Because there were only 19 pitchers, df = 17. This resulted in the critical r value for Pearson's correlation coefficient to be 0.456. Interpretation of correlation coefficient is based on the suggestion of Safrit & Wood (4). Correlations were listed as high (± 0.800 - 1.0), moderately high (± 0.600 - 0.799), or moderate (± 0.456 - 0.599). Statistical significance was set at an alpha level of $p \le 0.05$.

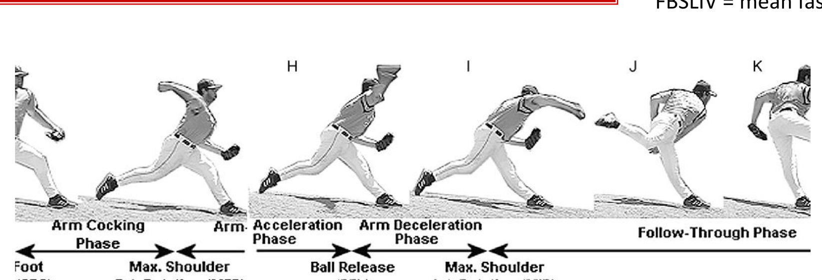
RESULTS

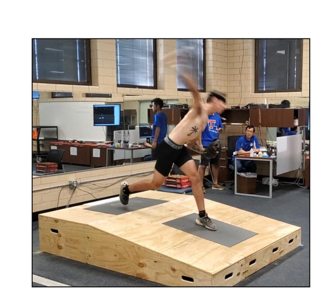
Table 1. Correlations between power variables and fastball velocity from the wind-up and slide-step of DI collegiate baseball pitchers.

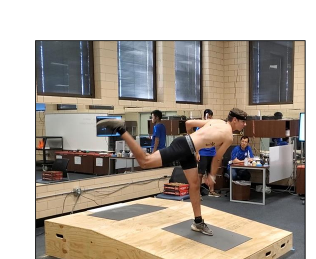
	BM	OHMBT	VJ	PPVJ	PPD	PPND	VJD	PPVJD	VJND	PPVJND	DLMJ	NDLMJ	SLJ
OHMBT	0.313												
VJ	-0.521	0.258											
PPVJ	-0.190	-0.003	0.635										
PPD	-0.245	-0.048	0.648	0.993									
PPND	-0.126	0.048	0.608	0.992	0.970								
VJD	-0.393	0.334	0.835	0.394	0.416	0.362							
PPVJD	-0.135	0.038	0.580	0.920	0.917	0.909	0.414						
VJND	-0.540	0.206	0.852	0.498	0.504	0.483	0.688	0.441					
PPVJND	-0.082	-0.189	0.412	0.927	0.913	0.927	0.192	0.886	0.344				
DLMJ	-0.303	0.149	0.562	0.362	0.368	0.346	0.562	0.457	0.518	0.305			
NDLMJ	-0.303	0.214	0.515	0.366	0.357	0.367	0.504	0.403	0.523	0.317	0.878		
SLJ	-0.234	0.549	0.842	0.548	0.528	0.557	0.753	0.553	0.708	0.324	0.664	0.643	
FBWLV	0.382	**0.482**	0.214	0.091	0.058	0.125	0.326	0.061	-0.038	-0.023	0.025	-0.097	0.301
BFBWLV	0.437	**0.467**	0.227	0.196	0.175	0.217	0.359	0.175	-0.029	0.098	0.053	-0.067	0.304
FBSLV	0.406	**0.518**	0.348	0.317	0.302	0.331	0.302	0.251	0.117	0.175	-0.002	-0.120	0.371
BFBSLV	0.398	**0.510**	0.327	0.328	0.318	0.337	0.294	0.260	0.110	0.169	-0.009	-0.137	0.347
FBWIV	0.317	0.323	0.063	0.203	0.175	0.231	0.021	0.165	-0.071	0.065	-0.161	-0.225	0.230
BFBWIV	0.312	0.291	0.099	0.266	0.240	0.291	0.026	0.225	-0.042	0.131	-0.114	-0.196	0.264
FBSLIV	0.270	0.265	0.181	0.391	0.381	0.398	0.000	0.327	0.072	0.241	-0.158	-0.198	0.289
BFBSLIV	0.297	0.259	0.131	0.374	0.363	0.384	-0.035	0.301	0.033	0.224	-0.184	-0.233	0.251

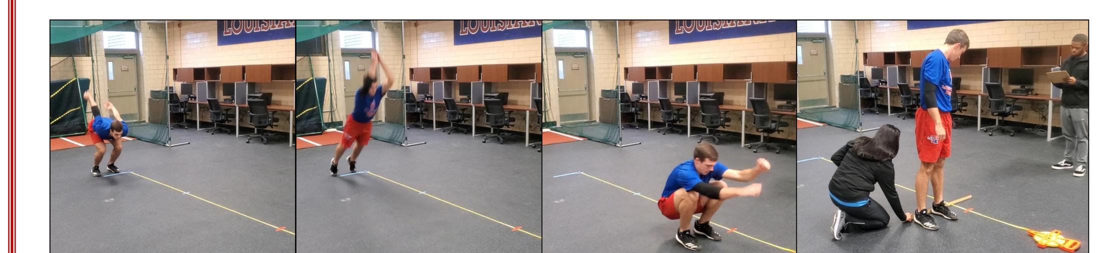
BM = body mass, OHMBT = overhead medicine ball throw, VJ = vertical jump, PPVJ = peak power vertical jump, PPD = peak power dominant leg, PPND = peak power non-dominant leg, VJD = vertical jump dominant leg, PPVJD = peak power vertical jump dominant leg, VJND = vertical jump non-dominant leg, PPVJND = peak power vertical jump non-dominant leg, DLMJ = dominant leg lateral to medial jump, NDLMJ = non-dominant leg lateral to medial jump, SLJ = standing long jump,
FBWLV = mean fastball wind-up lab velocity, BFBWLV = best fastball wind-up lab velocity, FBSLV = mean fastball slide-step lab velocity, BFBSLV = best fastball slide-step lab velocity,
FBWIV = mean fastball wind-up intrasquad velocity, BFBWIV = best fastball wind-up intrasquad velocity, FBSLIV = mean fastball slide-step intrasquad velocity,
FBSLIV = mean fastball slide-step intrasquad velocity, BFBSLIV = best fastball slide-step intrasquad velocity.

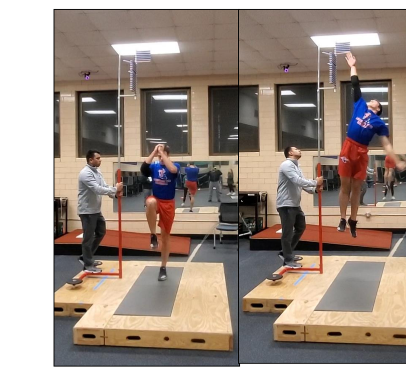












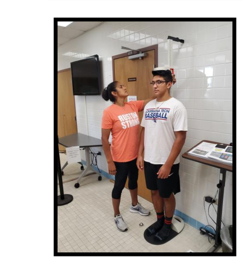


Table 2. Correlations between lab and intrasquad mean and best fastball velocity from the wind-up and slide-step of Division I collegiate baseball pitchers.

	FBWLV	BFBWLV	FBSLV	BFBSLV	FBWIV	BFBWIV	FBSLIV
BFBWLV	0.968						
FBSLV	0.807	0.866					
BFBSLV	0.793	0.858	0.989				
FBWIV	0.670	0.669	0.600	0.611			
BFBWIV	0.660	0.667	0.618	0.630	0.994		
FBSLIV	0.416	0.486	0.639	0.650	0.876	0.897	
BFBSLIV	0.419	0.483	0.634	0.656	0.882	0.902	0.993

CONCLUSIONS

There were significant relationships between the OHMBT in the sagittal plane and FBV from the wind-up and the stretch with a slide-step in the lab setting for DI baseball pitchers. There were no relationships to the other field or lab jumping tests with FBV from the wind-up or slide-step in the lab or from a mound during intrasquad games. These data contradict the results of previous research that indicated that the LMJ correlated with the throwing velocity of college-level baseball pitchers and position players that threw from flat ground (2). The pitchers in the current study were taller, heavier, threw harder, and jumped higher or farther than the baseball players in previous research (2).

PRACTICAL APPLICATION

The OHMBT, which is similar to the arm cocking, acceleration, deceleration, and follow through motions in pitching, related to FBV in the lab; however, not to FBV during intrasquad games. It should be noted that the mean and best FBV in the intrasquad games were greater than those in the lab, most likely due to game-like efforts given in the competitive situations.

When addressing the lack of significant relationships between bilateral and unilateral field and lab jump test results and FBV, strength coaches must remember that just because they have helped develop strong and powerful pitchers, it does not mean that those outcomes relate to FBV or that those pitchers will improve their FBV. These authors think that those that train baseball pitchers should still focus on strength and power development because if a pitcher is not strong and powerful, their opportunities for successful on-the-field performance may not be optimal. Finally, the use of bilateral and unilateral testing in baseball can be used as markers of fitness improvement, maintenance, or decrements; or baseline data used to determine rehabilitation status for when to return-to-play.

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