CORRELATION BETWEEN SINGLE-LEG COUNTERMOVEMENT JUMPS, SPRINTS, AND CHANGE-OF-DIRECTION IN COLLEGIATE BASKETBALL PLAYERS

J. Pfau, C. Reyes | Linfield University – McMinnville, Oregon
Department of Health, Human Performance, & Athletics– Wright Family Sport Science Lab

ABSTRACT

Explosiveness and speed are critical to performance among athletes in general, because of lower-limb power. Common field tests, such as a countermovement jump (CMJ), single leg countermovement jump (SL-CMJ), Isometric Mid-Thigh Pull (IMTP), 20-yard sprint (20 YD), and change of direction T-Test (TT) could be used to correlate the performance of the athlete. **PURPOSE:** To evaluate correlations between field tests in collegiate basketball athletes. Secondly, it was investigated if lower-limb power asymmetries influence an athlete's physical performance. **METHODS:** NCAA Division III men's and women's basketball players (n = 35) performed three maximum effort attempts on each the SL-CMJ, CMJ, and IMTP on a force plate (Hawkins Dynamics, Westbrook, ME). Six specific metrics were collected between the jumping and pull tests. In addition, two maximal 20YD and two TT were performed, where incremental time splits and completion times were recorded using a laser timing system (VALD Performance, Queensland, Australia). Pearson product moment correlations were used to examine relationships between metrics. Linear regressions were then used to follow-up on those correlations, examining the predictive measurements between all the metrics. **RESULTS**: Analyses displayed strong predictive relationships between several of the field tests ($p < 0.001$). The relationships with the highest r^2 values included JH against TT (0.77), 20YD against TT (0.68), and JH against 20YD (0.65). Secondly, no significant relationships were calculated when examining the magnitudes of lower body asymmetries and field test performances ($p > 0.05$). **CONCLUSION:** Performance testing in this study resulted in some correlations and predictive qualities to physical performance characterized by the SL-CMJ, CMJ, IMTP, 20YD, and T-Test. Although these performance tests can be used to quantify levels of strength and speed, it is not definitive that these qualities create a complete basketball player. Other factors such as shooting, defense, and basketball IQ should be considered. Finally, future directions should evaluate the possible asymmetries and look at its correlation to injury prevention, as well as continued profiling similar to the methods of this study with a larger pool of athletes of different playing, i.e. high school, NAIA, all NCAA levels, and professional.

INTRODUCTION

Running fast, jumping high, and changing direction in a proficient manner is vital for an athlete's success. Often athletes are tested on their ability to jump off two feet. But, in a sport like basketball, where players are constantly running and jumping off one foot and making sharp cuts and constantly changing direction, having strong lower limb strength and power is crucial for success and injury prevention.

Testing the single-leg countermovement jump allows sport scientists and coaches to observe an athlete's asymmetry between their left and right legs. By understanding these asymmetries, actions can be taken allowing for the athlete to improve their physical performance by reducing the asymmetries and strengthening weaknesses.

In sport science, valid and reliable tests are crucial for the sake of athlete profiling and benchmarking. With the various number of tests that can be conducted, sport scientists are in the constant quest of choosing the tests that are the most time-consuming, provide impactful data, as well as carry concurrent validity to reduce the total number of tests needed to perform on each athlete, regardless of the sport.

PURPOSE & HYPOTHESIS

The primary purpose of the study was to evaluate and correlate the athletic output of collegiate basketball players through a variety of physical testing to understand their performance level. Secondly, it was to investigate if lower limb asymmetries had any influence on the athlete's overall performance. It is hypothesized that those athletes that exhibit a greater asymmetry will perform at a lower level than those with less asymmetric values.

METHODS

N =	14	21
Age =	19.79 + 1.25	21.75 + 2.2
Height =	131.86 + 21.3	185.74 + 6.1
Body Mass =	63.61 + 1.78	80.0 + 10.0

Table 1: Descriptive statistics of subjects
Read and signed an informed consent form approved by institution IRB and physical screening questionnaire (PAR-Q+) prior to participation. Approval of utilizing humans as subjects approved by IRB prior to data collection.

TEST	DESCRIPTION
20 Yard Sprint	The 20-yard sprint is used to indicate the athletes first step quickness and is a simple measurement of an athlete's speed over a specific distance.
Agility T-test	Agility T-test examines how an athlete can move quickly laterally, change direction and accelerate and decelerate rapidly. This is a timed test so the athlete's performance is determined by how fast they can complete the test.
Double & Single Leg Countermovement Jump	Countermovement jump examines an athlete's lower limb strength and ability to perform a vertical jump involving a downward motion, followed by an immediate upward leap based on a reactive scale.
Isometric Mid Thigh Pull	The isometric mid thigh pull test evaluate an athlete's overall strength by testing and athletes' ability to produce by an all-out effort vertical bar pull involving an athlete's full body.

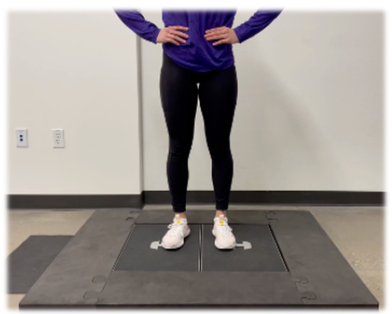

Figure 1: Uniaxial dual force plate system for countermovement jumps (Hawkin Dynamics, Westbrook, MN)

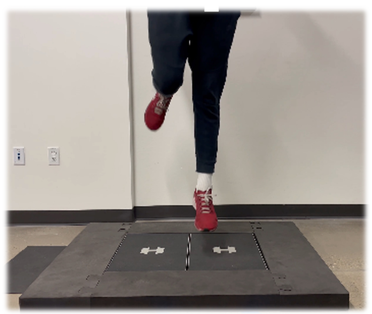

Figure 2: Uniaxial dual force plate system for single-leg countermovement jumps (Hawkin Dynamics, Westbrook, MN)

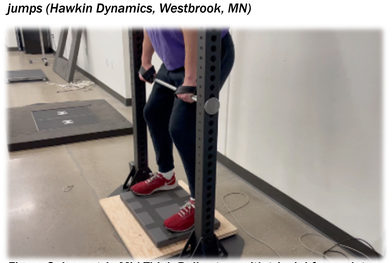

Figure 3: Isometric Mid Thigh Pull set-up with triaxial force plate system (Bertec, Columbus, OH; Hawkin Dynamics, Westbrook, MN; & Zeus Fitness, Vancouver, British Columbia, Canada

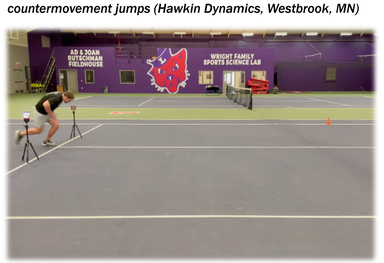

Figure 4: Photoelectrical laser timing system for 20-yard sprint and T-Test (VALD Performance, Queensland, Australia)

RESULTS

	20YD Sprint (sec.)	T-Test COD (sec.)	CMJ Height (cm)	IMTP Peak Force (N)
Women's Basketball	3.06	11.10	27.73	1917.85
Men's Basketball	2.91	9.94	41.39	2823.52

Table 2: Descriptive statistics of performance between men's and women's teams

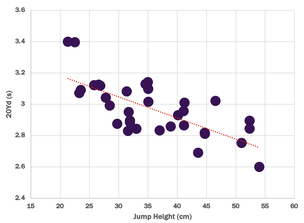

Figure 5: Jump Height vs. 20yd Sprint
$R^2 = 0.65$, $p < 0.05$

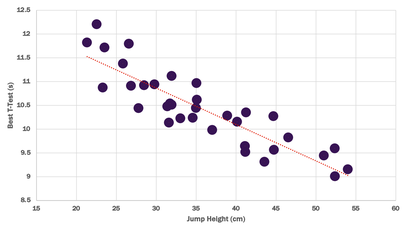

Figure 6: Jump Height vs. T-Test COD
$R^2 = 0.77$, $p < 0.05$

Figure 7: 20yd Sprint vs. T-Test COD
$R^2 = 0.68$, $p < 0.05$

CONCLUSIONS & PRACTICAL APPLICATIONS

Countermovement jump height had a strong correlation with change of direction performance during the T-Test. The 20-yard sprint also displayed a strong correlation against the T-test. There was no significant relationship between the lower body asymmetries between the right and left legged countermovement jumps. Although this study had correlations between athletic performances, it is not a sole determent of a complete athlete. Each sport has its own needs and qualities that can affect the athlete and how the game is being played.

Finally, future directions and practical would be to go more in depth in testing the asymmetries between the left and right legs of the athletes. Profiling and monitoring of the athletes on a weekly basis should be incorporated throughout the athletic season. With the asymmetries we can evaluate possibly injury prevention methods. As well as continued profiling like the methods of this study with a larger pool of athletes of different playing, i.e. high school, NAIA, all NCAA levels, and professional.

REFERENCES

1. Camuncoli F, Barni L, Nutarelli S, et al. Validity of the baiobit inertial measurements unit for the assessment of vertical double- and single-leg countermovement jumps in athletes. *International Journal of Environmental Research and Public Health*. 2022;19(22):14720.
2. Espada M, Jardim M, Assunção R, et al. Lower limb unilateral and bilateral strength asymmetry in high-level male senior and professional football players. *Healthcare*. 2023;11(11):1579.
3. Guan, Y., Bredin, S. S. D., Taunton, J., Jiang, Q., Wu, N., & Warburton, D. E. R. (2022). Association between inter-limb asymmetries in lower-limb functional performance and sport injury: a systematic review of prospective cohort studies. *Journal of Clinical Medicine, 11(2): 360.*
4. Pamuk O, Makaracı Y, Ceylan L, et al. Associations between force-time related single-leg counter movement jump variables, agility, and linear sprint in competitive youth male basketball players. *Children*. 2023;10(3):427.
5. Pérez-Castilla A, García-Ramos A, Janicijevic D, et al. Between-session reliability of performance and asymmetry variables obtained during unilateral and bilateral countermovement jumps in basketball players.