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RELATIONSHIPS BETWEEN JUMP CHARACTERISTICS OF COLLEGIATE FEMALE ATHLETES COMPETING IN DIFFERENT DISCIPLINES

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Introduction: For strength and conditioning professionals, the monitoring of athletic variables is a pertinent part of the evaluation process of the athletes for which they are responsible. Jump heights (during various jumping techniques) and attributes the athletes exhibit during the jumps (power, velocity, force, etc.) may provide valuable information that could be used to analyze the quality of their training program and how to develop future training programs. Jump analysis is also a very practical method of measuring athletic performance and improvements. Therefore, the purpose of this investigation was to examine the relationships between peak power (related to body mass), peak force (related to body mass), peak velocity (each during a static jump (SJ), countermovement jump (CMVJ), and depth jump (DJ)), jump height during a static jump, and jump height during a countermovement jump on female Division I athletes. A secondary purpose of this work was to analyze any difference between the type of athlete (i.e. the sport in which they participate) on the measures of peak power, peak force, and peak velocity (again, each during SJ, CMVJ, and DJ).

Methods: Seventeen female Collegiate Division I athletes who were presently competing in soccer (n = 10) or volleyball (n = 7) participated in the study. Athletes read and signed written informed consent documents pertaining to all testing procedures in accordance with the guidelines of the University of Mississippi's Institutional Review Board.

All jump performances were determined using a Myotest Triaxial Accelerometer (Myotest, Inc., Sion, Switzerland). Results from this accelerometer were produced using change in position and derivatives of the changes in position. Several studies, among others, have examined the Myotest during loaded jump squats (3), with elite volleyball athletes (2), and with respect to SJ and CMVJ in which the results show there is decent to good concurrent validity with the Myotest with other vertical jump measurement devices for both the SJ (ICCα = 0.98 using the flight time as the determinant of jump height; ICCα = 0.64 using take off velocity as the determinant of jump height) and the CMVJ (ICCα = 0.98 using flight time as the determinant of jump height; ICCα = 0.75 using take off velocity as the determinant of jump height) (1). Test-retest reliability for the Myotest was reported in previous literature also for the SJ (ICCα = 0.92 using flight time and the determinant of jump height; ICCα = 0.83 using take off velocity as the determinant of jump height) and the CMVJ (ICCα = 0.96 using flight time as the determinant of jump height; ICCα = 0.89 using take off velocity as the determinant of jump height) (1).

Relationships between variables were assessed using Pearson's correlation. Between group differences on the measures listed above were assessed a series of one-way ANOVAs. A significance level of $p \leq 0.05$ was set *a priori*.

Results: All athletes (n = 17) were 19.59 ± 1.12 yrs; 170.89 ± 6.52 cm; and 69.90 ± 12.22 kg. For each group: soccer (n = 10; 19.40 ± 1.17 yrs; 167.07 ± 4.24 cm; 66.02 ± 8.57 kg) and volleyball (n = 7; 19.86 ± 1.07 yrs; 176.35 ± 5.22 cm; 75.44 ± 15.08 kg). There were strong ($r \approx 0.75$) to very strong (r = 0.80 – 1.0) correlations between the following relationships, for all subjects: Peak Velocity during CMVJ and Peak Power during CMVJ (r = 0.963); Peak Velocity during SJ and Peak Power during SJ (r = 0.915); Peak Power during CMVJ and CMVJ Height (r = 0.806); Peak Velocity during DJ and CMVJ Height (r = 0.803); Peak Power during SJ and Peak Force during SJ (r = 0.802); Peak Power during CMVJ and Peak Force during CMVJ (r = 0.796); Peak Velocity during CMVJ and CMVJ Height (r = 0.788); Peak Power during CMVJ and Peak Velocity during DJ (r = 0.786); CMVJ Height and SJ Height (r = 0.775); and Peak Velocity during CMVJ and Peak Force during CMVJ (r = 0.750). The following tables provide the strongest correlations for the soccer and volleyball athletes, respectively:

Soccer Only		
SJ Peak Power (W/kg)	SJ Peak Vel. (cm/sec)	0.974
CMVJ Peak Power(W/kg)	CMVJ Peak Vel.(cm/sec)	0.944
SJ Peak Force (N/kg)	SJ Peak Power (W/kg)	0.925
SJ Peak Force (N/kg)	SJ Peak Vel. (cm/sec)	0.855
SJ Height (cm)	CMVJ Height (cm)	0.813
CMVJ Height (cm)	DJ Peak Vel. (cm/sec)	0.788

Volleyball Only		
CMVJ Peak Power (W/kg)	CMVJ Peak Vel. (cm/sec)	0.992
CMVJ Height (cm)	CMVJ Peak Power (W/kg)	0.935
CMVJ Height (cm)	CMVJ Peak Vel. (cm/sec)	0.922
SJ Height (cm)	SJ Peak Vel. (cm/sec)	0.911
CMVJ Peak Force (N/kg)	CMVJ Peak Power (W/kg)	0.880
CMVJ Peak Force (N/kg))	CMVJ Peak Vel. (cm/sec)	0.842
DJ Peak Vel. (cm/sec)	CMVJ Peak Power (W/kg)	0.840
CMVJ Peak Force (N/kg)	DJ Peak Vel. (cm/sec)	0.830
CMVJ Height (cm)	DJ Peak Vel. (cm/sec)	0.816
SJ Height (cm)	CMVJ Peak Vel. (cm/sec)	0.815
DJ Peak Vel. (cm/sec)	CMVJ Peak Vel. (cm/sec)	0.803
CMVJ Height (cm)	CMVJ Peak Force (N/kg)	0.795
SJ Peak Force (N/kg)	DJ Peak Force (N)	-0.771
SJ Height (cm)	CMVJ Peak Power (W/kg)	0.751

Additionally, there was a significant difference between soccer and volleyball players with respect to CMVJ height (p = 0.032) with the volleyball athletes have a greater maximum jump height (35.84 cm) than the soccer players (29.46 cm). There were also two strong statistical trends with respect to differences between the groups on measures of Peak Velocity during CMVJ (p = 0.052; volleyball = 236.00 cm/sec; soccer = 200.20 cm/sec) and on Peak Power during DJ (p = 0.058; volleyball = 4471.43 Watts; soccer = 3632.00 Watts).

Discussion: Results from the current work show that there are relationships between the characteristics of different types of jumps (SJ, CMVJ, and DJ) not only with one athletic population but across sports. This should encourage strength and conditioning professionals to incorporate various types of training throughout their protocols (i.e. strength-power protocols and speed-power protocols, especially with athletes that have an anaerobic component to their sport, to aid in the overall development of actions such as jumping. Additionally, there can be some training effect of the sport discipline relayed in the results. Not only do the volleyball players display significantly higher scores in the CMVJ, but they also have stronger correlations with respect to the CMVJ characteristics whereas the soccer players display stronger correlations with both SJ and CMVJ jump characteristics.

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