POSITION-SPECIFIC DIFFERENCES IN COUNTERMOVEMENT VERTICAL JUMP PERFORMANCE IN FEMALE NATIONAL TEAM VOLLEYBALL PLAYERS

Damjana V. Cabarkapa, Dimitrije Cabarkapa, Andrew C. Fry

Jayhawk Athletic Performance Laboratory – Wu Tsai Human Performance Alliance, University of Kansas, Lawrence, KS, USA

Introduction

- Volleyball is a fast-paced game in which players are required to possess adequate physiological characteristics (e.g., strength, agility, power) as well as good jumping ability. Due to the explosive nature of this sport, the countermovement vertical jump (CVJ) has been commonly implemented in practical settings to assess athletes' lower-body neuromuscular performance.

Purpose

- The purpose of the present study was to examine differences in CVJ characteristics across five playing positions (e.g., setters, middle blockers, liberos, outside hitters, and opposite hitters) within a cohort of elite female volleyball players.

Methods

- Nineteen national team athletes (age=22.6±3.2 years; height=184.9±8.1 cm; body mass= 75.5±9.3 kg) participated in this investigation. Each athlete performed three CVJs with no arm swing while standing on a dual uni-axial force plate system (VALD, ForceDecks, Queensland, Australia) sampling at 1000 Hz. Each jump was separated by a 10-15 sec rest interval and the mean value across three jumps was used for the analysis purposes. The dependent variables were braking phase duration, eccentric and concentric peak velocity, impulse, duration, and mean and peak force and power. Due to body mass being similar across playing positions (p=0.534), all force-time metrics were expressed in absolute terms. Also, contraction time, jump height (i.e., impulse-momentum calculation), reactive strength index (RSI)-modified (i.e., jump height divided by time to take-off), and countermovement depth were obtained. A one-way analysis of variance (ANOVA) was used to examine statistically significant position-specific differences (p<0.05).

Results

Variable [unit]	Setters [n=3]	Liberos [n=4]	Middle Blockers [n=4]	Opposite Hitters [n=4]	Outside Hitters [n=4]	*p*-value
Eccentric phase						
Braking phase duration [s]	0.27(0.06)	0.30(0.07)	0.28(0.03)	0.29(0.03)	0.34(0.05)	0.399
Eccentric braking impulse [N·s]	61.2(17.7)	46.2(13.0)	58.4(7.0)	52.5(5.5)	42.7(7.1)	0.142
Eccentric duration [s]	0.48(0.84)	0.49(0.67)	0.47(0.15)	0.46(0.47)	0.51(0.84)	0.848
Eccentric peak velocity [m/s]	-1.46(0.13)	-1.36(0.22)	-1.32(0.21)	-1.38(0.08)	-1.24(0.21)	0.614
Eccentric peak force [N]	1957.7(481.8)	1670.5(313.1)	1893.0(221.7)	1820.5(348.1)	1491.8(108.1)	0.284
Eccentric mean force [N]	757.3(87.9)	676.5(63.4)	800.3(58.7)	779.8(50.7)	698.3(16.2)	0.264
Eccentric peak power [W]	1844.3(525.5)	1445.3(561.8)	1558.8(259.6)	1620.5(315.4)	1196.0(310.1)	0.343
Eccentric mean power [W]	511.0(77.7)	461.8(82.7)	516.8(67.3)	543.0(71.3)	460.0(73.9)	0.466
Concentric phase						
Concentric impulse [N·s]	195.5(29.5)	168.4(13.6)	200.4(13.8)	196.1(28.1)	168.8(6.4)	0.085
Concentric duration [s]	0.27(0.45)	0.28(0.32)	0.27(0.27)	0.28(0.18)	0.30(0.09)	0.463
Concentric peak velocity [m/s]	2.65(0.15)	2.57(0.13)	2.59(0.11)	2.62(0.13)	2.50(0.07)	0.530
Concentric peak force [N]	1946.0(492.0)	1656.3(293.6)	1919.3(215.4)	1802.5(335.1)	1528.8(65.3)	0.306
Concentric mean force [N]	1514.7(344.6)	1298.8(144.5)	1557.5(170.5)	1488.8(287.3)	1258.8(333.2)	0.240
Concentric peak power [W]	3725.7(711.5)	3118.0(311.7)	3874.0(351.9)	3732.3(557.0)	3076.5(181.7)	0.062
Concentric mean power [W]	2164.7(624.0)	1784.0(269.2)	2125.8(257.1)	2050.3(320.1)	1642.8(74.2)	0.181
Other						
Contraction time [s]	0.76(0.12)	0.76(0.94)	0.74(0.20)	0.73(0.65)	0.81(0.86)	0.726
Vertical jump height [cm]	32.8(4.1)	30.6(4.0)	30.9(3.2)	31.6(3.6)	28.7(1.7)	0.605
RSI-modified [ratio]	0.48(0.11)	0.46(0.08)	0.48(0.06)	0.49(0.03)	0.40(0.04)	0.334
Countermovement depth [cm]	-32.8(4.3)	-32.8(2.2)	-30.3(5.0)	-32.3(4.8)	-32.8(2.5)	0.870

Note: RSI – reactive strength index

Conclusions

- Considering that different playing positions tend to display similar neuromuscular performance characteristics within a cohort of elite female volleyball athletes, we can assume that at this level of competition, other factors such as effective execution of tactical and technical skills might be of greater value when determining players' roles on the court.

- Overall, despite not reaching the level of statistical significance, these findings may provide sports practitioners with normative ranges for CVJ performance of top-tier female volleyball players that can help with the design of volleyball-specific training regimens targeted toward optimizing athletes' strength and power capacities.

JAYHAWK ATHLETIC PERFORMANCE LABORATORY

Wu Tsai Human Performance Alliance University of Kansas