BIOMECHANICAL DIFFERENCES BETWEEN TWO-STEP AND THREE-STEP ATTACKING APPROACHES IN FEMALE COLLEGIATE VOLLEYBALL PLAYERS

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Introduction

A volleyball attack is an offensive move made by a player to score a point by hitting the ball over the net and into the opponent's court. Despite being a popular team sport worldwide, there is still a lack of scientific literature focused on examining biomechanical characteristics of attacking motions, as one of the fundamental volleyball-specific skills.

Purpose

The purpose of this study was to examine the differences in biomechanical characteristics between two-step and three-step attacking approaches in female volleyball players.

Methods

Twelve NCAA Division-II athletes (age= 20.4±1.7 years; height= 178.9±11.7 cm; body mass= 73.4±10.2 kg) participated in the present investigation. Upon the completion of the dynamic warm-up protocol, each athlete performed five two-step and three-step attacking approaches while standing on a uni-axial force plate (Roughdeck, Rice Lake Weighing Systems, Rice Lake, WI) with a data acquisition system (BioPac MP 150, Goleta, CA) sampling at 1000 Hz. Each jump trial was separated by a 45-60 sec rest interval. The force plate was positioned in volleyball "Zone 4" (i.e., the left side of the net) and an attacking target was positioned at the average female collegiate attacking height of 2.64 m (Figure 1). The following biomechanical variables of interest were analyzed: peak concentric force (PCF) during the penultimate and ultimate step, peak landing force (PLF), and vertical jump height (VJH) based on the flight time. A paired-sample t-test was used to examine statistically significant ($p<0.05$) differences in biomechanical characteristics between two-step and three-step attacking approaches, and Hedge's g effect sizes to examine the magnitude of difference between the means.

Results

No statistically significant differences in PLF, VJH, and PCF during both the penultimate and ultimate steps were observed between the two-step and three-step attacking approaches. Also, the differences in all of the previously mentioned dependent variables were trivial in magnitude (g=0.02-0.12).

Variables	Two-step approach	Three-step approach	*p*-value	Effect size
PCF-penultimate step	1235.05±166.00	1248.17±173.28	0.473	0.077
PCF-ultimate step	2378.15±315.74	2416.42±312.45	0.196	0.122
PLF	3010.82±451.85	3001.75±462.91	0.877	0.020
VJH	35.51±4.89	34.85±5.28	0.072	0.130

Table 1. Descriptive statistics (x̄±SD) and effect sizes (Hedge's g) for each variable examined in this study during two-step and three-step attacking approaches. PCF – peak concentric force, PLF – peak landing force, and VJH – vertical jump height.

Figure 1. Graphical representation of the testing set-up including uni-axial force plate and attacking target positioned at 2.64 m.

Conclusions

Our findings reveal that two-step and three-step attacking approaches yield similar biomechanical requirements. While further research is warranted on this topic, this may be attributed to the hitting target being positioned at the same standardized height, as well as the testing procedures being performed in a controlled laboratory setting. Overall, these findings may allow practitioners to obtain a deeper insight into the biomechanical requirements of some of the most commonly used attacking approaches that can help with the design of training regimens targeted toward optimizing athletes' on-court volleyball performance.

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