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Short communication

BIOMECHANICS OF JUMP FLOAT SERVE IN THE WOMEN'S NATIONAL VOLLEYBALL TERM OF THAILAND

Sirirat HIRUNRAT*

School of Human Kinetic and Health, Faculty of Health Science Technology,

HRH Princess Chulabhorn College of Medical Science, Chulabhorn Royal Academy, THAILAND

ABSTRACT

The jump serve is a beautiful, exciting movement that offers a greater chance of scoring than the regular float serves. Recently, it plays a key role in getting a score in Thailand's women's national volleyball team. The results of this study were analyzed and presented to Thailand's national volleyball coaches and athletes. The biomechanics data in this study included the kinematic aspects of the jumping serve in different levels of the athlete's experience including the youth (Mini VB), youth 17 (U17), youth 18 (U18), and senior (Senior) women's volleyball teams in 2018–2019. The benefit of this study could apply to coaches and athletes for training development in the future.

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KEYWORDS: Biomechanics/ Jumping Serve/ Kinematic

***Corresponding author**: Sirirat HIRUNRAT

School of Human Kinetic and Health, Faculty of Health Science Technology,

HRH Princess Chulabhorn College of Medical Science, Chulabhorn Royal Academy, THAILAND

E-mail: u_kai@hotmail.com

INTRODUCTION

In 2009, Thailand's women's national volleyball team won the Asian Volleyball Championship and brought volleyball into the spotlight. Thereafter volleyball became a popular sport with the general public. One of the aspects of the game that garnered a lot of attention was the jumping serve movement which played a key role in Thailand's championship win.

The jump serve is a beautiful exciting movement that offers a greater chance of scoring than the regular float serve. Onuma S., one of the key players from Thailand's women's national volleyball team in 2009, has been recognized for her outstanding jumping serves to hit the ball at a speed of more than 100 km/hr. Recognizing the importance of the jump serving in determining the outcome of a volleyball game, in 2010, the Sports Authority of Thailand's Sport Science Department decided to invite experts in the field of sports biomechanics to discuss and develop a science-specific analysis of this issue. Our biomechanics teams and Mr. Kiattipong R. who was the head coach at that time, therefore, agreed to study the jump serve in Thai women's volleyball players, and our study was initiated for the first time. Therefore, this study aimed to examine the kinematic aspects of the jump serve at different levels of the athlete's experience including the youth (Mini VB), youth 17 (U17), youth 18 (U18), and senior (Senior) women's volleyball teams.

METHODS

In this study, our research team conducted a video motion analysis of the players competing in major global games, the World Grand Prix (or the Nation League). Additionally, we also analyzed movement posture data from the youth and young women's levels of the Thai national team for a comparative study. The results came from the winning team of youth athletes aged under 12 years old who joined the "Aviation Radio Mini Volleyball" competition. The winning teams from different elementary schools in each region compete in the finals in Bangkok and therefore only one team was the best, and be used in this study. The kinematic aspects of the jump serve include 1) the angular velocity of shoulders, elbows, and wrists joints, 2) the center of mass during the ball impact (velocity and position), 3) ball velocity, 4) hand position and 5) energy expenditure were examined in different levels of the athlete's experience including the youth (Mini VB), youth 17 (U17), youth 18 (U18), and senior (Senior) women's volleyball teams in 2018–2019.

RESULTS AND DISCUSSION

The biomechanics data include the angular velocity of joints (shoulders, elbows, and wrists), the center of mass during the ball impact (velocity and position), ball velocity, hand position, and energy expenditure were shown in Table 1.

Table 1. The average biomechanics data of "Jump Float Serve" while hand-hitting the ball in the youth (Mini VB), youth 17-18 (U17) (U18), and senior (Senior) women's volleyball teams in 2018–2019.

Teams	Angular Velocity			Center of Mass during Impact Ball		Ball Velocity (km/hr)	Hand Position (m)	Energy Expenditure (Kcal/attempt)
	Shoulder (deg/s)	Elbow (deg/s)	Wrist (deg/s)	Velocity (m/s)	Position (m)			
Mini VB (2018)	284.92	1024.36	149.00	2.22	1.03	58.99	1.88	7.34
U17 (AVC2018)	283.96	1147.68	275.79	2.42	1.33	60.96	2.29	16.20
U18 (2019)	246.25	1019.70	162.13	2.74	1.38	62.62	2.38	18.86
Senior (VNL2019)	326.12	743.41	119.37	2.13	1.41	54.71	2.43	17.26

Data from Sports Biomechanics in Thailand Volleyball Team

(Assoc.Prof.Sirirat Hirunrat and Pacharaporn Porkachamnan)

From Table1, athletes in the youth age range, under 12 years (Mini VB) used the upper limbs that consist of shoulders and elbows (284.92 deg/s and 1024.36 deg/s) together fast, but their wrists (149.00 deg/s) were not strong enough to use compared with U17 (275.79 deg/s) and U18 (162.13 deg/s) indicate the angular velocity of the elbow increased in the U17 and U18. Interestingly, in the senior group (VNL2019), the jump serve became more technique. The position of the peak and the angular velocity of the elbow and the wrists (743.41 deg/s and 119.37 deg/s) were reduced compared to the U17 (1147.68 deg/s and 275.79 deg/s) and U18 (1019.70 deg/s and 162.13 deg/s), except for shoulder joints being open and fast forward (shoulder angular velocity = 326.12 deg/s.) with complete float serve skills type (Biomechanics of Volleyball Float Serve, http;//studiousguy.com Physics).

The serving technique of the senior group (VNL2019) requires pulling back when the hand hits the center of the ball at the point where the ball is at the highest position (Hand position = 2.43 m) with the body moving or transferring the body weight forward very quickly (Center of mass velocity = 2.13 m/s.) indicate the senior group being used various techniques that have been collected from their experience. Finally, we found that there was no significant difference in selected kinematic and kinetic variables between women youth and national teams [4]. This result suggested that the jump serve is indeed related to the velocity of the ball after contact.

The maximum angular acceleration which occurs at the elbow when the hand touches the ball was elucidated and shown. Interestingly, our results were consistent with the previous study by Coleman et al. in 1993[1]and indicated that practicing the net spike jump could be a great way to improve the serving jump, however, the velocity after the hit of the jump serve should be less than that of the net spike[2]. For the techniques used by Mr. Kiattipong R. about how to train the jump serve in outstanding athletes, he recommended that practice the jump serve should be trained at a young age using the same rhythm and gestures as the jumping spike. The gesture consists of 3 elements which are the position of the hand hitting the ball, the ball speed after the hand hits the ball, and the direction of movement of the ball after the hand hits the ball. Moreover, Chung et al. found that the athlete must hit the ball with maximum force at its highest point[3]. After collecting data, the results were analyzed and presented to all the coaches and athletes by the researcher using easy-to-understand biomechanical explanations.

Meanwhile, the authors and team still doing experiments on movement kinematics in the Thai women's volleyball team regularly. We believe that the benefit of the study could apply to coaches and athletes for training development in the future.

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