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FACTORS CORRELATED WITH SEPAK TAKRAW SERVE SPEED

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The purpose of this study was to provide a better understanding of what contributes to the speed of the ball during the serve. The serves of seven national elite players (24 ±2.9 y, 182 ±5 cm and 77.9 ±8.8 kg) were filmed during training sessions. Serve speed was measured by radar gun. Selected kinematic variables were calculated from digitised video of 10 to 20 serves per player. Correlation and regression analyses were undertaken. Serve speed was predicted by several different combinations of variables for subjects. Higher order predictors were most often foot-to-foot distance and height of ball at contact. Different instructions should be given to each individual elite athlete in order to improve their speed and consistency of serve.

KEY WORDS: serve speed, kinematics, sepak takraw.

INTRODUCTION: The serve is the first attacking strike in the modern game of Sepak Takraw. Notational analysis conducted by National Sports Institute of Malaysia has shown that a good serve contributes to scoring points and winning the game (Jamal, 2009). One observation was of a Thailand player who served a total of 30 serves and managed to score 14 aces and in total 22 points in one match.

In Sepak Takraw a new serve technique was introduced called "Sepak Kuda" or kuda serve by the Thailand players during the 1995 South East Asean Games held in Chiang Mai Thailand. In this new serve the "tekong" (the server) uses the instep of the foot instead of the dorsum of the foot as the contact surface as in the regular "sepak sila" serve kick. Now players in countries such as Malaysia, Korea, and Thailand have been applying the kuda serve to get speed advantages. A number of researchers have studied the "Sepak Kuda" serve with most studies describing the differences between the "Sepak Kuda" and "Sepak Sila" serve. Sidhitlaw (2000) reported a range of foot velocities from 8.57-11.07 m/s at impact by players of six different countries. The foot velocities of a "tekong" who used the instep of the foot was greater than that obtained by a "tekong" using the inside of the foot. Another study reported that the mean post- contact ball velocity of 16.4m/s for the "Sepak Kuda" was higher than that of the "Sepak sila" serve 14.4 m/s (Zawi 2001). Higher mean post-contact ball velocity of 19.3 m/s for the "Sepak Kuda" serve than the 17.4 m/s for the "Sepak Sila" serve were also reported by Juliana, Wan Abas, Rambely & Abu Osman (2002). The most recent study by Koh, Hin & Sujae (2006) found a significantly larger hip flexion in kuda (-71.5 ±12°) than sila (-93.6 ±8.1°) and larger abduction in kuda (17.1 ±15.5°) than in sila (7.2 ±15.8°) at ball contact. Maximum extension of the knee was thought to generate larger force over a longer distance, increasing the momentum of the kicking leg in the "kuda" serve.

In this study selected kinematic variables, indicators of leg extension and range of motion, were examined for multiple serves in an attempt to determine the major contributor to high velocity kuda serves in Sepak Takraw.

METHODS: Seven Malaysian national elite players (24 ±2.9 y, 182 ±5 cm and 77.9 ±8.8 kg) were videoed with a single standard video camera (50 Hz) during a training session. The camera was positioned at a height of 1.5 m and a distance of 10 m from the subjects' sagittal plane perpendicular to the direction of intended serve. The serve speeds were measured using a Stalker Professional Sports Radar Gun. The radar was positioned at the centre of the court opposite to the server. The tests were performed during two training sessions, however, only four subjects managed to participate in both sessions. In every session ten successful serves were measured for all the subjects. Serves could be performed to any area in the court and there was no specific instruction where they should serve the ball. Silicon Coach Pro 7 software was used to measure the kinematic variables of contact height, ball-to-foot displacement, foot-to-foot distance and foot speed. Height was measured at ball

contact immediately prior to the ball leaving the foot (Figure 1). Horizontal ball-to-foot distance was measured from stance foot to ball contact (Figure 2). Foot-to-foot distance was measured from stance foot to kicking foot during end of back swing (Figure 3). Speed of the kicking foot was measured from digitized video using Silicon Coach Pro and a calibration pole.

Relationships between all the kinematics variables with the speed of the ball were then statistically analysed using SPSS correlation and linear multiple regression and tested with p <.05 significance level. Since the aim of the study was to provide descriptive kinematic factors that correlate with the ball speed during serve in sepaktakraw.
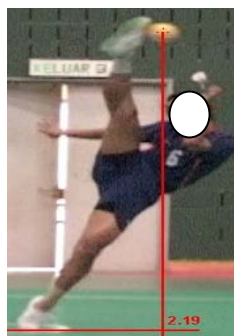
Figure 1: Height of ball at contact.   **Figure 2: Ball to foot.**   **Figure 3: Foot to foot.**

RESULTS: Individual means, and standard deviations (SD) and group mean, SD and range of the kinematics variables are provided in Table 1. Within subjects, height of contact had the least (SD from 2 to 4%) and foot-to-foot distance (SD from 7 to 27%) the greatest variabilty of all the variables. Among subjects, the least difference was in height of ball at contact (SD of 6%) and the greatest difference was for ball-to-foot distance (SD of 53%). A conservative estimate of the perspective error due to possible variation in serve direction is <±2%.

Table 1: Individual means, and standard deviations (SD) and group mean, and range for all kinematics variables.

Subject	Ball speed (m/s)	Height of ball at contact (m)	Foot speed (m/s)	Foot to foot distance at pre serve	Ball to foot distance at contact (cm)
1	18.41 ±0.82	2.35 ±0.10	11.82 ±0.54	0.42 ±0.03	0.64 ±0.16
2	18.44 ±1.5	2.23 ±0.06	11.45 ±0.81	0.61 ±0.08	0.46 ±0.18
3	17.94 ±0.78	2.10 ±0.04	11.08 ±0.45	0.50 ±0.05	0.37 ±0.15
4	18.83 ±1.42	2.06 ±0.05	12.58 ±0.65	0.37 ±0.10	0.36 ±0.11
5	16.76 ±1.24	2.04 ±0.03	10.79 ±0.37	0.40 ±0.03	0.23 ±0.09
6	19.19 ±1.17	2.17 ±0.06	13.05 ±0.35	0.71 ±0.05	0.48 ±0.17
7	17.15 ±1.18	2.31 ±0.04	10.76 ±0.76	0.58 ±0.05	0.13 ±0.09
Mean	18.3	2.2	11.7	0.52	0.38
S.D	1.33	0.13	0.93	0.13	0.2

The regression analysis show that for Subject 1 height of ball contact and foot-to-foot distance are the only factors that significantly contributed to serve speed. Figures 4 to 7 are exemplar scatter grams of the kinematic variables against serve speed for Subject 2.
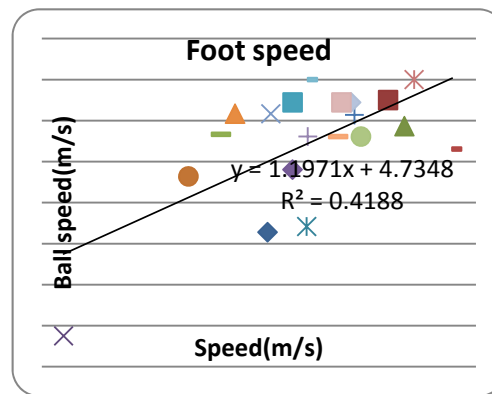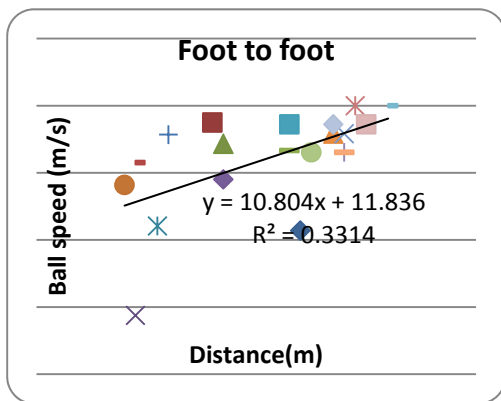
Figure 4: Foot-to-foot distance and ball speed.
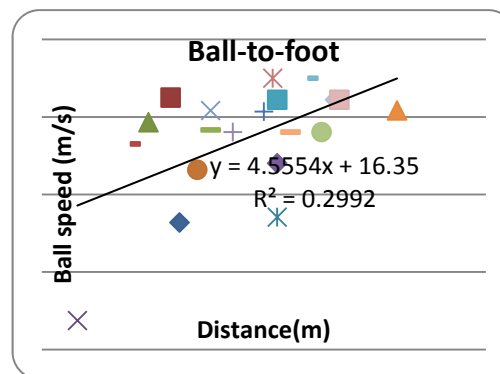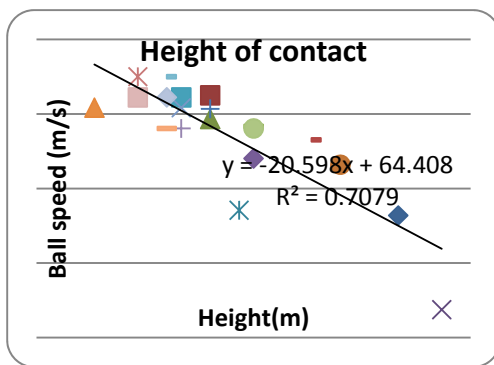

Figure 5: Foot and ball speed.

Figure 6: Height of ball at contact and ball speed.

Figure 7: Ball-to-foot distance and ball speed.

For Subject 2, only height of ball at contact and foot speed significantly contributed to the serve speed. For Subject 3, only height of ball at contact significantly contributed to the serve speed. On the other hand, no variables significantly contributed to the serve speed for Subjects 4, 5 and 7. With Subject 6 foot-to-foot distance, height of ball at contact, and foot speed all significantly contributed to the serve speed.

Six of the seven subjects had negative correlations between height of ball contact and the serve speed. All the variable correlations with serve speed are provided in Table 2.

Table 2: Correlation of all the variables with ball speed

	Height of ball at contact	Foot speed	Foot to foot distance	Ball to foot distance
S1	-0.61	-0.24	0.48	-0.05
S2	-0.84	0.65	-0.58	0.55
S3	-0.46	0.38	0.19	-0.09
S4	0.1	-0.02	-0.34	-0.19
S5	-0.56	0.28	0.23	-0.26
S6	-0.83	0.41	0.61	0.74
S7	-0.52	-0.01	0.76	0.62

DISCUSSION: Subjects performed differently in order to produce the serve speed. For four out of seven subjects variability in their serve speed was explained by different combinations of variables. Some subjects showed only one variable contributed significantly to serve speed but some showed two or more variables that can contribute to the serve speed. Foot-to-foot distance and foot speed were significant predictors of serve speed with three subjects. This means that a longer foot-to-foot distance is likely to produce a faster serve

speed during serve. In subjects 1, 2, 3 and 6 height of contact is a contributor to the serve speed. Although height of contact had a significant result with the serve speed, height of contact was negatively correlated with serve speed. This means that increased height of contact does influence the serve speed but most often contributed to a lower speed of the ball. For foot speed, two subjects had a significant result with serve speed. This is predictable where faster foot speed should increase the serve speed. An effective serve is highly influenced by how the ball is tossed by the tosser. Further study should investigate the kinematics of both the server and toss to ensure that the server has received a toss with optimum height and speed of the ball before serving.

CONCLUSION: Height of ball at contact and foot-to-foot distance was the main predictors of serve speed in Sepak Takraw serve. However, serve speed was predicted by several different combinations of variables for each subject. Thus, different instruction should be given to each elite athlete in order to improve their speed and consistency of serve.

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