Potential and limitations of short backhand serve in badminton: Kinematics analysis

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Abstract

Moreover backhand short serve is an important element of the main character in badminton, where not many people can maximize the potential and limits of each athlete, such as power, speed, accuracy, and motion efficiency. This study aims to determine the potential and weaknesses of short backhand serve in badminton through a kinematic analysis approach, with a sample of children aged 12-16 years PB Pendowo Semarang City. The method used quantitative with a descriptive analysis approach, and the analysis is assisted by using the Kinovea 0.9.4 series software. The sampling technique used is purposive sampling with two criteria; age (12-16 years old) and participation in a Semarang city-level tournament. The results showed that the PB Pendowo Semarang City athletes in the implementation phase are in the "Appropriate" category, with a percentage of 66.6%. The instruments used in this data collection are observation and documentation. Several factors that influence the level of conformity are muscle mass, arm length and height, and training intensity. This research can still be developed in future research by discussing more specific things, such as focusing on active wrists and, more specifically, explain about flick movement in the wrist motion. Additional supporting literacy in the backhand short serve analysis could help the athletes and coaches to reach effective movement to get points using the backhand short of serving as the first attack.

Keywords: motion analysis, backhand short serve, potential, limitations

INTRODUCTION

His position. Several types of sports that are popular and growing rapidly in Indonesian society, including badminton, have very complex basic techniques defined very complex because each athlete is required to have speed, strength, and good strategy in dealing with opponents (Sumanjaya, 2015). An athlete is also required to be able to master all the basic techniques in this sport, such as backhand, smash, lob, and drive to serve in the research of Wardana & Dra. Ika Jayadi, (2017) explains that the basic movements in badminton have the same body posture in hitting movements, the difference is the power and accuracy used in making punches, for example, when lob, smash, and drop shot or cop in the same taking attitude. The correct movement in basic techniques is expected to improve performance and prevent injury (Irawan et al., 2020; Irawan, Jannah, et al., 2021; Irawan, Nomi, et al., 2021).

There are several basic techniques that badminton athletes must master, technique is a skill that must be mastered by someone to be able to

play the sport (Nandika et al., 2017). According to Taufan et al., (2016), for someone to play badminton, one must master various basic game techniques correctly, including racket grip, footwork, and various basic hitting techniques. Some of the most popular basic techniques to learn are the smash, backhand, drop shot, forehand, and serve. Serve is a basic technique that is mandatory and very important to master, the serve is an early technique in badminton that serves as a sign that the game has started (Hussain, Ahmed, Mohammad, et al., 2011) the serve is also referred to as the first attack in badminton because it is very important to master the technique. This type of serve is the most widely used, especially in men's competitions (Gawin et al., 2013). Male athletes tend to use short backhand serve in a ratio of 91% points (Carboch & Smocek, 2020).

Based on the distance of the serve, the type of badminton serve is divided into two parts. At first, namely long serve, one of which is flick serve, and the second is short serve. Short serve or short serve must be done "softly" or as thin over the net and land as close as possible to the opponent's serve field (Singh & Mishra, 2020) so that it will be difficult for the opponent to make a return. Researchers are interested in discussing the analysis of what factors affect the suitability of the backhand short serve motion of badminton athletes when they are in the field. This is reinforced by the results of researchers' observations of the sample, namely athletes from PB Pendowo, Semarang city, with an age range of 12-16 years. This observation is carried out before data collection, or you could say this observation is used as a benchmark for the condition and performance of athletes in the field without any engineering and manipulation of athletes' movements when training or competing.

This research becomes more interesting to discuss because there is no clear and specific discussion or review related to the analysis of motion potential based on appropriate biomechanics (both in Indonesia and specifically at the research location), moreover backhand short serve is an important element or main character. In badminton, where not many people

can maximize the potential and limits of each athlete, such as power, speed, accuracy, and motion efficiency.

This study aims to determine the potential and weaknesses of short backhand serve in badminton through a kinematic analysis approach. Based on research from Wijaya, (2017), it is stated that the analysis of the service motion in badminton viewed anatomically, physiologically, and biomechanically affects the right and wrong of the action. Therefore, researchers are interested in discussing what factors affect the suitability of the backhand short serve.

METHOD

The type of this study uses a single case study, which allows researchers to carry out in-depth and specific exploration of certain events of a phenomenon (Wahyuningsih, 2013), Mariotto et al., (2014) also added that this method allows for better dialogue between researchers and their research both in terms of management, usefulness, and overall. The approach used in this method is analysis and evaluation. The population in this study was the PB Pendowo club, Semarang City. The number of samples studied was nine people selected using a purposive sampling technique with the provision that they were 12-16 years old and had at least won the top 3 at the Semarang city level. Quantitative data in this study were obtained through photo and video recordings of backhand service movements which were then analyzed using the Kinovea application series 0.9.4 (Arjunnaja et al., 2022). This study has passed the Ethical Clearance (EC) with number 366/KEPK/EC/2021 as part of the legality protocol of human research procedures.

The research procedures in the data collection in PB Pendowo Semarang City are preparation, which is the stage to prepare tools and materials before the implementation of data collection, such as the preparation of DSLR cameras, tripods, questionnaires, and informed consent. Then the implementation of data collection in this procedure includes how to collect data in the field, such as camera angle positions,

briefings, and athlete direction when taking videos and photos (giving cues and so on). At last, the data processing, the data that has been collected, is then recapitulated and processed using the Kinovea 0.9.4 series software (motion analyzer).

Kinematic parameters of motion, especially in the backhand short serve motion, are divided into three main motion phases, namely the preparation phase, the implementation phase, and the follow-through phase, this opinion is based on research (Sumardi et al., 2015). Details of the 3 phases of the backhand short serve motion have their respective descriptions, for the preparation phase starting from the beginning of the movement, where the athlete holds the shuttlecock until the wrist is actively flexed, the implementation phase starts after the active wrist is flexed which is then followed by impact (the racket hits the shuttlecock) until Active wrist strikes with the lever position and the cubits straight parallel to the carpal or metacarpal, the last is the follow-through phase starting after the impact phase until the shuttlecock is completely released from the hand and leads to the opponent's court and is followed by an active wrist hyperextension position (as form part of the "continuation" of the backhand short serve). There is an important role of the arm muscles as a machine or motor that performs the movement when hitting the muscles of the legs or feet. Apart from being a pedestal when doing stances, the leg muscles are also used as a movement stabilizer.

RESULT

There are 3 phases of movement in the implementation of the backhand service, including the preparation phase, the implementation phase (impact), and the follow-through phase. The basis for determining the 3 phases of the movement is based on the research of Sumardi et al., (2015), which states that there are 3 phases of movement, namely the preparation, implementation, and continuation phases. Several variables or indicators measured in this study were right wrist extension angle (°), right

wrist hyperextension (°), left elbow extension (°) and left knee extension (°) in the implementation phase.

The focus of the researchers in this article is only to discuss the stages in the implementation phase. Because in the movement phase, researchers and readers will better understand how the criteria for time, distance, speed, and angle of the short backhand serve are good and correct. In addition to measuring kinematic data, as shown in Table 1. above, the researchers also measured anthropometric data such as weight, height, and BMI (Body Mass Index) of each athlete as supporting data. The number samples consisted of 9 people, with eight men and one woman specifications.

Table 1. Anthropometric data.

n = 9	Mean ± SD	Min	Max
Age *(year)*	13,44 ± 1,236	12	15
Height *(cm)*	156,5 ± 11,649	134	175
Weight *(kg)*	46,97 ± 11,482	27	63
BMI *(kg/m^2)*	18,91 ± 2,784	15,08	22,63

Analysis in the implementation phase of the backhand short serve conducted by PB Pendowo athletes in Semarang City stated that as many as two athletes were in the "Very Appropriate" category with a percentage of 22.2%, as many as six athletes were included in the "Agree" category with a percentage of 66.6%. One athlete was in the "Not Appropriate" category with a percentage of 11.1%, and 0 athletes were in the "Not Appropriate" category. It can be concluded that the average backhand short serve movement of PB Pendowo athletes in Semarang City in the implementation phase has the "Appropriate" Criteria. The level of conformity data determined above is based on the validator's assessment with the following calculation results.

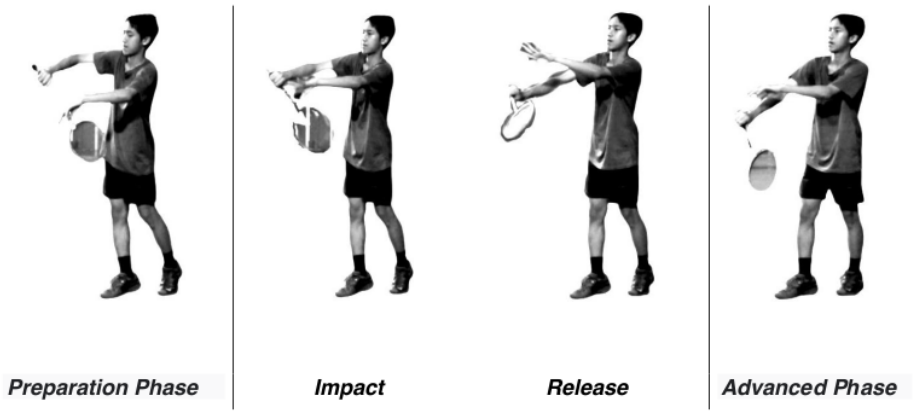

Figure 1. Backhand short serve movement phase

In the implementation phase, there are two movements: impact and release. Impact occurs on objects that move in one straight line or two straight lines (Afrizal, 2013). The release is the momentum when the ball leaves the hand (Kharim & Nurkholis, 2018). Texier et al., (2012) added that the direction of the shuttlecock is basically a parabola, but the direction and magnitude of the angle are influenced by power, direction, and the wind on the field.

DISCUSSION

Analysis in the implementation phase of the backhand short serve conducted by PB Pendowo athletes in Semarang City stated that as many as two athletes were in the "Very Appropriate" category with a percentage of 22.2%. As many as six athletes were included in the "Agree" category, with a percentage of 66.6%. One athlete was in the "Not Appropriate" category with a percentage of 11.1%, and 0 athletes were in the "Not Appropriate" category. So it can be concluded that the average backhand short serve movement of PB Pendowo athletes in Semarang City in the implementation phase has the "Appropriate" Criteria. The determination of this value is based on research (Arikunto, 2009) related to the Likert scale, research (Grice, 2016) and (Dermawan, 2019) related to the determination of instruments and motion variables. Then it was specified again with the help of 2 expert validators and references from (Irawan & Permana, 2020)

and (Irawan et al., 2019) by ticking the checklist " √ " in the available column when data collection in the field.

The value of each variable per movement phase is as follows, and the serve time has an average of 0.11 seconds with a standard deviation of ± 0.02 seconds, the distance between legs has an average of 0.22 meters with a standard deviation of ± 0.13 meters, for right wrist extension data in the implementation phase or active phase has an average of 157.65° with a standard deviation of ± 14.73°, right wrist hyperextension has an average value of 218.45° with a standard deviation of ± 12.79°, elbow extension left with a mean value of 131.68° with a standard deviation of ± 24.18°, for left knee extension data has a mean of 165.17° and a standard deviation of ± 5.57°.

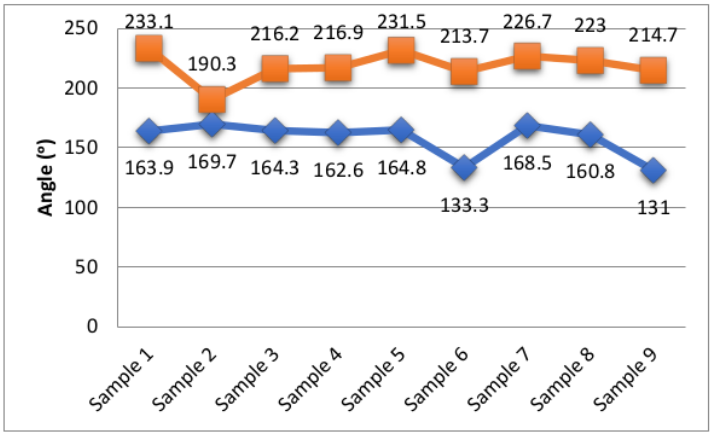

Figure 2. Extension and hyperextension of the right wrist

The results of the analysis of the extension angle of the right wrist backhand short serve are presented in Figure 2, with the lower results of the extension angle in sample no.6 having an angle of 133.3° and sample no.9 having an angle of 131°. The average extension angle of 9 athletes from PB Pendowo Semarang City is 157.65° with a minimum value of 131° and a maximum value of 169.7°.

Meanwhile, the backhand short serve right wrist hyperextension data presented that the higher result of the hyperextension angle of sample no.1 has an angle of 233.1°; and the lower is in sample no.2 has an angle of

190.3°. The average hyperextension angle of 9 PB Pendowo athletes in Semarang City is 218.45° with a minimum value of 190.3° and a maximum value of 233.1°.

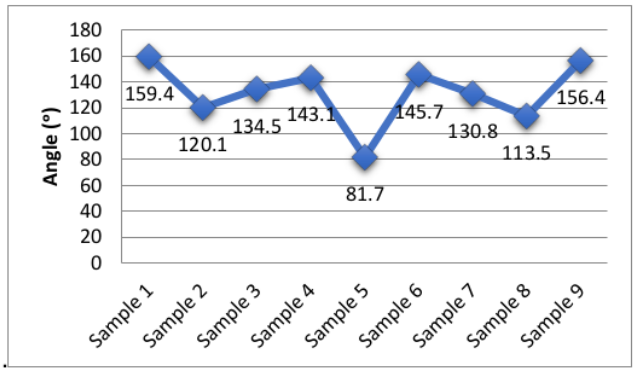

Figure 3. Left elbow extension angle

The results of the researcher's analysis related to the left elbow extension angle variable in the implementation of the short backhand serve in the implementation phase are presented in Figure 3, with the results of the extension angle in all samples with a lower was of 81.7° and the higher was 159.4°. Next, Figure 5 will present data on left knee extension in the implementation phase of each PB Pendowo athlete in Semarang City.

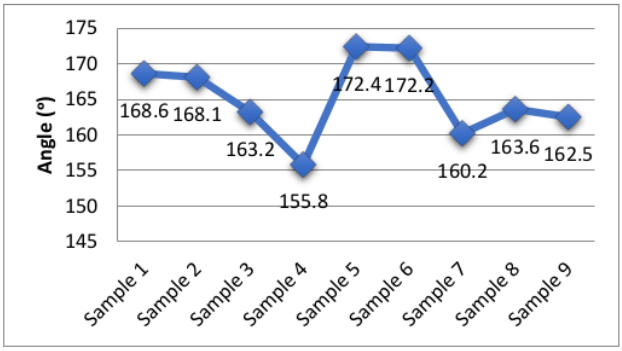

Figure 4. Left knee extension angle

The results of the researcher's analysis related to the left knee extension angle variable in the implementation of the short backhand serve in the implementation phase are presented in Figure 4, with the average

results of the extension angle was 165.18° with a lower value of 155.8° and higher value of 172.4°.

Several factors that can affect the level of suitability of the athlete's backhand short serve in the field include muscle mass, especially if the athlete is still too young or a child, of course, there are still difficulties in maximizing a movement, especially a serve, therefore more intense training is needed. In addition to power or muscle mass, according to Listanto, (2021), when athletes serve, they do not only rely on 100% leg power but also other more complex components such as coordination, speed, flexibility, and balance. Badminton athletes must also pay attention to mental and physical conditions to support performance on the field (Hinda Zhannisa & Sugiyanto, 2015).

The factor of arm's length and athlete's height also affects the success and suitability of every movement in badminton, including serve. Based on the field researchers' analysis, if an athlete has a height and arm length above the average, it will make it easier for them to reach and hit (cross) the shuttlecock to the opponent's area. Musofan, (2007), in the development of his research, stated that to be a good badminton player, it is necessary to have a body posture with height, such as slenderness. In terms of serve, especially short backhand serve, they will greatly benefit because compared to the net's height with their posture, it will be easier to cross the shuttlecock into the opponent's territory.

Because basically, all talents, potential, and supporting physical conditions will not be maximized without serious training. Based on research by Hussain, Ahmed, Bari, et al., (2011) to improve service skills by practising hand, elbow and shoulder auctions. Intense exercise can be done using assistive devices to facilitate and strengthen wrist rotation, both in serving movements and other movements, Irawan et al., (2016), human motion is significantly influenced by several biomechanical factors such as ideal angle or body segmentation and body torque. In addition to these factors, athletes also need continuous and well-programmed regular training.

CONCLUSION

The potential for success and suitability of the short backhand serve of PB Pendowo athletes is classified as "Appropriate" in the implementation phase of the backhand short serve with a percentage of 66.6%, with an average right wrist extension angle of 157.65^{o}, an average right wrist hyperextension angle of 218, 45^{o}. The analysis of kinematic data in this study found the relationship between the success and weakness of athletes influenced by muscle mass or power, arm length and height, as well as intense training. This study limitation also found that the result of speed and time in the backhand short serve technique needs more efficiency at the centre of the movement, and power is in the active wrist. Hopefully, future research can discuss certain parts or angles, such as the active wrist, to be more specifically described with other supporting literacy to make it more complex so that this article can become one of the standard references for research on the theme of analysis and motion kinematics.

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