Woodball Shooting Technique Analysis in Biomechanic Perspective

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***Abstract*— Shooting technique is an important skill in woodball. Furthermore, acquiring the ideal and effective shooting technique is very critical in woodball. This research aims to inquire the woodball shooting technique by biomechanical method. This is a quantitative study with descriptive data analysis, There were several coaching points which will be analyzed such as the athlete posture, the mallet movement, the ball impact, ball direction and the distance. The data were recorded by two 50 fps cameras which were located in the frontal and sagittal plane. Furthermore, the data analyzed by Kinovea 0.8.15 Software There were two woodball athletes which were involved in this study. The results, the ideal shooting technique will be drawn based on the data resulting from athlete posture, the mallet movement, the ball impact, and ball direction. The Conclusion, the shooting accuracy is influenced by the elbow and grip position. These two variables influence the ball impact if there is any difference in the preparation and impact position. Swing needs to be trained so the impact position will not change.**

***Keywords*— biomechanics, woodball, shooting**

I. INTRODUCTION

Sport provides good benefit for health. Furthermore, it also has various kind of types and models which can be selected based on individual preferences. One of the sports which may be recommended for everyone is woodball. Woodball is a modification from golf [1]. It was found in Taiwan by Ming Hui Weng and Kuang Chu Young in 1990 [2]. It was started to be developed in Indonesia in 2006 [3]. The health beneficial reason, simple equipment and rule make it becomes one of the favorite sports in Indonesia[1]. Moreover, it does not only give benefit for elderly, but also was proven developing children gross motor skill[4]. All of equipment is made from wood [5]. Instead of using clubs, woodball uses Mallet. It is a wooden stick which has ninety to one hundred centimeters longs with a hummer head at the top. The gate is used as a target. It is about 15 cm width and 20 cm height. The wooden ball diameter is about 10 cm.

The player shoots the ball to the gate, the least shooting made when directing the ball to successfully passes the gate is the winner [3]. A woodball player with an excellent basic techniques could make a swing with a good accuration [6]. Furthermore, swing accuracy is very important in woodball [1]. Swing will determine the power and direction of mallet [6]. In addition, there are many factor which also influence the accuracy, muscle strength[6] and grip holding technique [7]. The strength of arm, back, core and leg need to be trained [6]. Specifically, grip and arm power contributes long hit accuracy up to 45.18 % [8].

Unfortunately, there is limited study about the detail technique in woodball. This study aims to inquire the ideal and effective shooting technique in woodball. Furthermore, the biomechanical analysis is implemented to analyze each shooting phase i.e. swing, impact and follow through [9].

II. MATERIALS AND METHODS

This is a quantitative study with descriptive data analysis. Each athlete need to perform twelve times middle distance shooting (30 meters). There are several coaching points which will were observed such as the athlete posture, the mallet movement, the ball impact, ball direction and the distance. In addition, shooting accuracy was measured by using the original ball position as an axing between the target and the shooting result. It will be used as a dependent variable in this study. The video was recorded in HD quality 50 fps by using Canon EOS 80D with Canon Lens 18-135 mm STM which were placed in the frontal and sagittal plane.

The research samples of this study are two East Java Woodball athletes who are going to compete in Pra PON 2019. Both of them have more than 2 years' experience to be a woodball athletes who compete in national level.

There are 24 videos which were categorized into sagittal and frontal plane. All of them were analyzed by Kinovea 0.8.15 Software. The SPSS software was utilized to identify the significant different.

III. RESULTS AND DISCUSSION

Overall, male athlete performed middle distance shooting accuracy better than female athlete (table I). He made gate-in-one in his 5th attempt (figure 4). However, female athlete also performed well. She made the best shooting accuracy at 6□ which means less than 50 centimeters form the gate. However, she did not perform constantly.

TABLE I. FRONTAL PLANE ANALYSIS

Athlete	Average		
	Accuracy	*Best*	*Worst*
Male	11°	*Gate-in-one*	30°
Female	24°	6°	42°

A. Frontal Plane

In the frontal plane, the first data analysis is swing. In average, female athlete has lower mallet position than male. However, her hip and grip position were much more steady and firm than male (table II). In this position, she can use his arms and hip power to make the mallet rotates faster and strike the ball harder. However, she made the mallet closer to the left hand up to 126° (figure 1). It means, she could give more power by adding more rotation to the mallet if she make the grip closer.

TABLE II. FRONTAL PLANE ANALYSIS

Athlete	Average		
	Hip	*Grip*	*Mallet Elevation*
Male	172	110	183
Female	174	126	170

Fig. 1. Swing in frontal plane

There are no significant different in ball velocity and grip between male and female athletes. However, there is a significant different in elbow (table III). It seems like the elbow angle gives significant contribution on the ball direction. In short, straight elbow will make the ball direction better. It may be caused by limiting the range of movement in elbow will basically make the grip steady. Furthermore, the straight elbow will act as part of the mallet. So the mallet axis may changes from the grip to the shoulder (figure 2). It will benefit the accuracy by decreasing the change of error.

TABLE III. FRONTAL PLANE ANALYSIS

Athlete	Average		
	Elbow	*Grip*	*Velocity*
Male	167	152	21 m/s
Female	145	150	24 m/s

Fig. 2. Swing in frontal plane

At the follow through, female athlete did a better result than male (table iv). She could turned her hip up to 145□ (figure 3). She can use her flexibility to transform the force which was used in shooting efficiently. On other hand, the male athlete tends to hold the force by using his upper body. It may cause serious injury on his back, shoulders and arms.

TABLE IV. FRONTAL PLANE ANALYSIS

Athlete	Average		
	Hip	*knee*	*grip*
Male	203	181	154
Female	156	167	95

Fig. 3. Swing in frontal plane

B. *Sagital Plane*

Impact is the key of the shooting accuracy, because it leads the result of the shooting. Athletes always predict the ideal position on the preparation. However, it always changes due to the swing which was done by the every athlete. Male athlete has more consistent posture in the preparation and the impact (table V). So he can perform better shooting accuracy than female.

TABLE V. SAGITAL PLANE ANALYSIS

Female Athlete	Average				
	Back	*Elbow*	*Grip*	*Knee*	*Calf*
Preparation	30	145	148	146	82
Impact	34	159	160	144	87

Fig. 4. Shooting accuracy

On other hands, female athletes made more adjustment on her posture. Particularly on her arms, she adjusted her elbow and grip (table VI). It influences the head mallet impact to the ball. The impact may not in the center of the ball anymore. Because the adjustment changed the mallet position. The deeper analysis was performed to observe the ball impact. The result, there are only four shootings which were made in the center of the ball. the other eight shootings, the impact was not in the center anymore. As a result, the shooting accuracy of female athlete is not consistent (figure 5). She made a good shooting accuracy only when she hit the ball in the center.

TABLE VI. SAGITAL PLANE ANALYSIS

Male Athlete	Average				
	Back	*Elbow*	*Grip*	*Knee*	*Calf*
Preparation	36	145	148	146	82
Impact	34	159	160	144	87

Fig. 5. Shooting accuracy

IV. CONCLUSION

In conclusion, shooting accuracy is influenced by the elbow and grip position. These two variables influence the ball impact if there is any difference in the preparation and impact position. Swing needs to be trained so the impact position will not change. Furthermore, swing can be trained by conducting a tool which was developed to improve the accuracy [10]. The gating drill tool is one of the tools which can improve its accuracy [11]. In addition, training model variation can be implemented to improve the accuracy, particularly by moving target [12].

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PAGE 1

PAGE 2

PAGE 3

PAGE 4