Rubber Bat Effect of Maximal Ball Velocity in Table Tennis

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Abstract. This study is focused on the analysis of the characteristics and the effects on the ball speed of smash stroke using different types of bat rubber. The types of bat rubber researched in this study are inverted, pimped out and hard rubber. The study samples are table tennis athletes of Table Tennis Student Activity Unit at UPI Bandung. The data of the study is obtained by conducting video analysis using motion software analysis system (Frame-DIAS IV). From the result of this study, speed data of each type of bat rubber is obtained. One-way ANOVA statistical test shows that there is no significant difference on the ball speed between inverted and hard rubber types. Another result shows that there are significant differences of ball speed which are produced by using inverted and hard rubber types. Some of the factors that influence these differences are pips orientation and thickness of each rubber. This test result shows that the selection of bat rubber types is vital in improving the quality of athlete performance.

1. Introduction

Basically, a bat consists of a wooden handle, sponge and rubber. The combination from these three components determines the bat quality [2]. It therefore needs to find the best combination between those three components and the type of game to produce a good game. The bat rubber is a component which really affects the bat quality because this component has direct contact with the ball [1]. The bat rubber that is used in table tennis game has different characteristics. The correlation directly affects the circumstances of the ball after being hit. In connection with the contribution of rubber bat on the quality of the game, this study, which analyse the characteristics of rubber bat types that are used and the effects on the resulting stroke speed, is conducted [3]. In this study, the types of bat rubber that became the object of study are inverted, pimped out and hard rubber types. They are selected because they are quite popular and widely used by professional players. Next, this study is focusing only on the ball speed when performing a smash stroke. For another stroke technique, namely spin, translational and rotational motion have to be considered in the speed measurement whereas in smash technique, we only consider translational motion [4]. By doing this study, it is expected to give new insights about the characteristics of each type of bat rubber and the effects on the resulting stroke speed.
2. Methods
The methodology used in this study is quantitative descriptive method. The free variable in this study is the type of bat rubber used, while the bound variable is the ball speed. This study is conducted in the sport hall of UPI campus. The study samples are 6 male students, members of Table Tennis Student Activity Unit, who have above average smash techniques. The instruments used in this study are 2 video cameras (Panasonic HC-V720), ball throwing machine and motion software analysis system (Frame-DIAS IV).

![Types of bat rubber characteristics](image)

**Figure 1.** Types of bat rubber characteristics
The first step of the data collection technique in this study is data retrieval using 3 types of bat rubber and 6 samples. In this study, the sample in question is table tennis player who has above average smash technique. Each sample executes as many as 10 smash strokes on target. The data retrieval is conducted by recording samples that are executing smash technique by using 2 cameras. The data which is analysed in this study is the value of the difference between the initial speed and the final speed. The statistical
test used is one-way ANOVA. The confidence level of this study is 95%, so the value of \( \alpha \) in this study is 0.05. All statistical tests are conducted using SPSS 21 software.

3. Results and Discussion

Based on the calculation results, it is discovered that the average value of the differences in ball speed of inverted, pimpled out and hard rubber types of bat rubber consecutively are 12.2 m/s; 12.6 m/s; 10.8 m/s. The results show that the differences in ball speed of inverted and pimpled out rubber type are not significant. It indicates that the usage of those two types of bat rubber will produce the same speed. This result is produced because those two types of bat rubber have the similarity in terms of thickness. They both have sponge.

The speed comparison of them is significant. The average speed value of inverted rubber type is higher than hard rubber type. It shows that inverted rubber type produces 16.86% faster stroke compared to hard rubber type. The results of this comparison can be explained by analysing the characteristics of each type of bat rubber. Pimpled out rubber is rubber with pimples facing outwards. The characteristics of this rubber are very good for performing smash but it is not suitable for performing spin. Pimples on the outward surface cannot generate an effective spin of the ball because not all parts of the ball touch the rubber so that the torsion of the ball is not great. The speed is generated not only by the performance of the top sheet, but it is also by the pressure of the ball on the sponge so the surface widens when the ball impacts. The character of this rubber is suitable for players with combination (all round) type of game. The existence of a sponge as the place for attaching pimpled out rubber type also gives a quite big contribution on the resulting speed of the stroke.

4. Conclusion

Based on the result of the study, we can conclude several important points from this study. Comparison of the average difference in speed shows that pimpled out rubber bat generates faster stroke. But statistical test shows that there is no significant difference between the average values of inverted and pimpled out bat rubbers. But there are significant differences in speed of inverted and hard rubber types along with pimpled out and hard rubber types. The average speed of inverted rubber type is higher compared to hard rubber type because of the differences of pimples orientation on both of the bat rubber types. The average speed of pimpled out bat rubber is higher compared to hard rubber type because of the differences in the thickness of rubber on both of the bat rubber types.

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