

球棒握棒位置之長度和肌力對揮棒打球速度和球飛距離的影響

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[摘要] 揮棒打球速度是優秀的棒球打擊者的必要條件之一。其影響的主要因素有握棒位置、打擊者的握力和背肌力等肌力這些都會影響揮棒速度和球飛距離。本研究以20名大學棒球選手為受測者，先行測試受測者之握力和背肌力，並以4次高飛長球進行測試打球期間之揮棒速度和球飛距離之最大值作為受測者之依變項。比較不同握棒位置（自球棒下沿算起0、3、6cm三種位置）為其自變項，經統計結果發現握力和揮棒速度之間呈現有顯著的相關，但是在球飛距離則無顯著的相關。全身性的肌力強度的表現（包含背肌力）這些與揮棒打球速度和球飛距離有顯著的相關，握棒距離越長會有較快揮棒打球速度和較大的球飛距離。這些都是表現在握棒距離較短可以有快速迴轉擊球，這點可使正確的選球機會提高同時有更大的爆發力可以提供打擊所需的力量。

關鍵詞：揮棒打擊速度、球飛距離、背肌力、揮棒速度。

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I. Introduction

Baseball produced in the United States of America developed at the center of the North American Continent, and has been developing on a global scale now. Although it was born in the U.S., it can be said that nowadays baseball is more countries popular in East Asia such as South Korea, Taiwan, and Japan, and the Caribbean Sea than the U.S.

Various scientific studies on baseball have been conducted. For example, Jobe et al.(1983) examined pitching mechanism of the baseball player by using the electromyogram method and high speed camera. Many other studies on batting, like a report of Hirano(1984), Ichimaru(1997), or Ichimaru et al.(2002), and throwing, like a report of Ito(2001), Jobe et al.(1983), Pappas et al.(1985) or Toshima(1980) have been also published.

In such research activities, even if the baseball population increases and compares with other sport items from a professional baseball to amateur, it is overwhelming numerousness, and it is difficult to even grasp the number of teams and number correctly. Furthermore, if the event to which the softball etc. were similar is added, the ratio will not see a kind. Thus, baseball is loved as a game or recreation sports from the child to the adult. Moreover, when we watch the baseball as a game, while being materialized by 1-team nine players and repeating an offence and defense 9 times by turns, it is the game which scrambles for a score.

To being scoring because a ball makes a goal, on baseball, a general ball game is not the ball itself and is scoring by a "player" crossing home. As a role of the ball at this time, the player of the ball thrown by pitcher side starts by striking back that ball, using a bat as a batter. It is scoring because a batter becomes a runner, turns around first base, second base, and third base in order and crosses home by Official Baseball Rules(2011).

Therefore, it becomes an important element whether it has the ability to strike the thrown ball at the rate of how much at which angle in which direction. That is, hit ball speed is mentioned as one of the conditions of the batter excellent in baseball. So, this research considered the influence which it has on hit ball speed as a factor which has on hit ball speed paying attention to muscular power, such as the length of a bat, grip, and back strength.

II. Method

A. Subjects

The subjects were 20 university field baseball players with long years of experience in Japan. Their physical characteristics were shown in Table 1.

Table 1. Physical characteristics of subjects

	Hight(cm)	Body weight(kg)
Average	170.4	67.8
SD	5.6	6.8

B. Measurement period

This research was carried out in the Fukuoka University of Education baseball field in November immediately after completing all the fixed league matches of the years of a Fukuoka 6 college-baseball league.

C. Measurement Item and Method

1. Measurement of grip strength

Grip strength of both right and left hand was measured per kg based on the enforcement point of the athletic ability test which the Ministry of Education, Culture, Sports, Science and Technology of Japan employs by using a hand dynamometer (1999).

2. Measurement of back strength

Back strength was measured per kg like grip strength by using the back strength meter.

3. Measurement of batted ball speed

The used ball was made by Mizuno Corp., Japan. Batted ball speed was measured by using the speed meter of Asics Corp. and by the tee batting method which they are usually performing.

4. Measurement of batted ball driving distance

Batted ball distance was measured by the lines on the ground. The used ball was made by Japanese Mizuno Corp. Batted ball driving distance was performed by long tee batting. The grip of the bat in this case was the same as measurement of batted ball speed.

5. About the grip position of a bat

Three kinds of grip positions of the bat were shown in Photo1. That is 0 cm, 3 cm, and 6 cm from the grip end of the bat. In addition, the participants swung the same in 3 types of the bat grip.

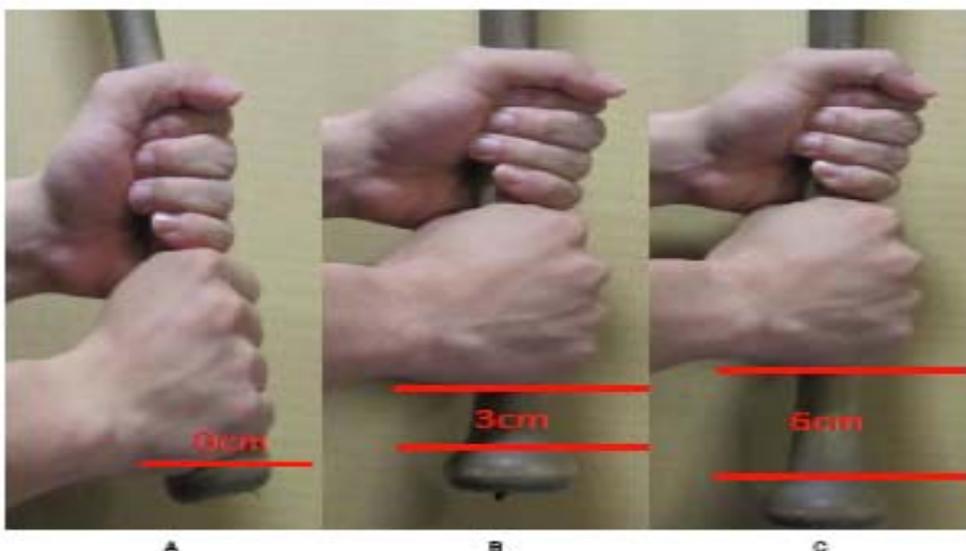


Photo. 1 Grip position of bats. A, B, C are apart 0cm, 3cm, 6cm from the grip ends, respectively.

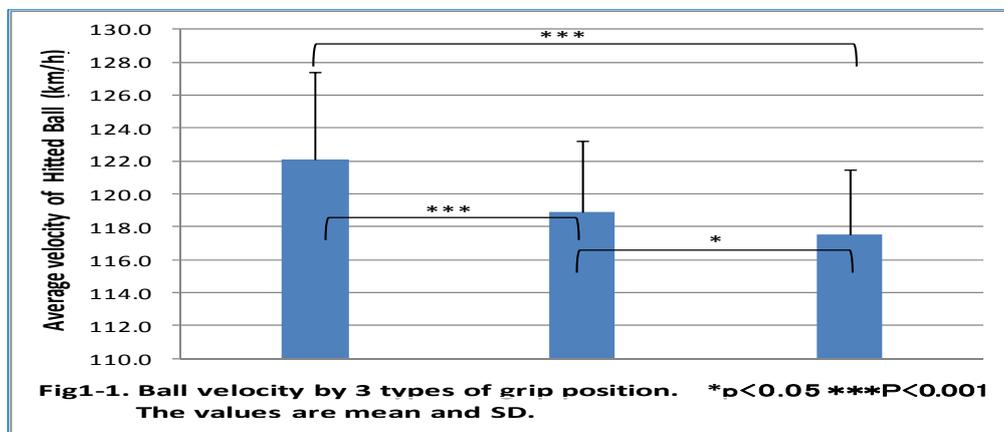
6. Statistical Method

Data were processed by paired t-test, and referred to as $P < 0.05$ about the significant difference level. Moreover, the correlation coefficient was computed about the relation between muscular power, batted ball speed, and hit ball driving distance, and the significance was examined.

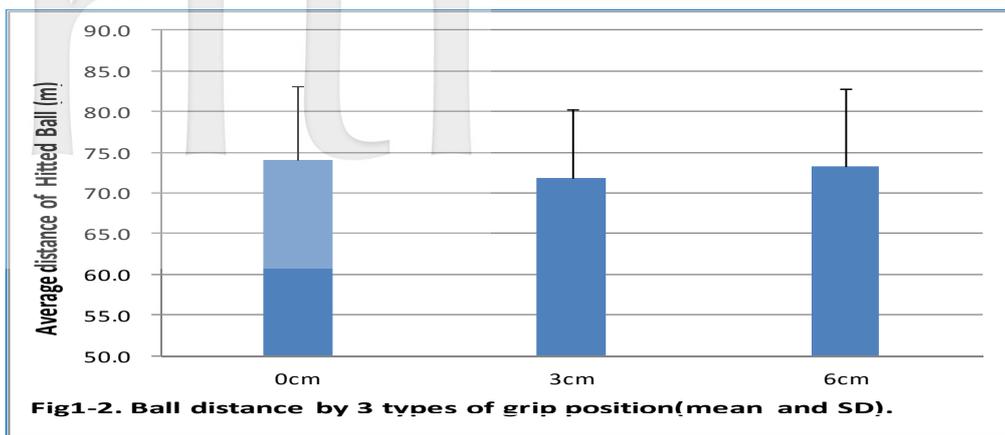
III. Results

A. Examination of the bat length by the grip position

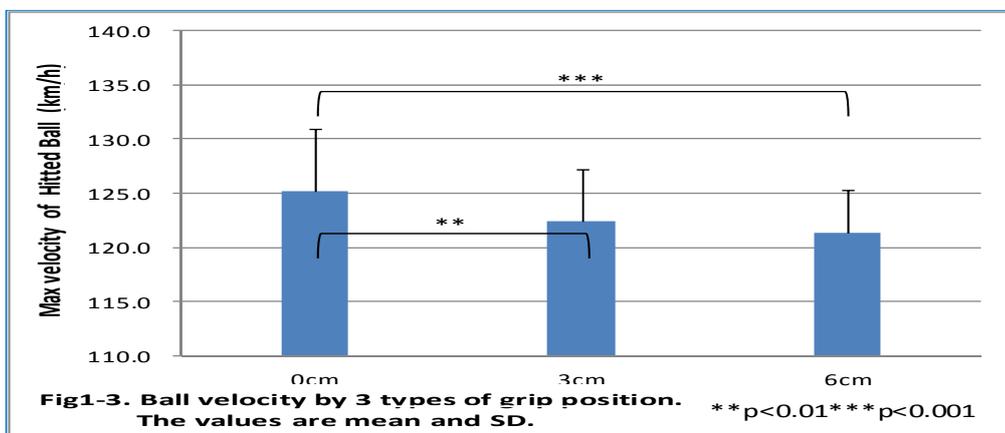
The average values of batted ball speed according to differences of the grip positions were shown in figure 1-1. As shown in the figure, a significant difference was found among three positions, the significant differences of the 0.1% level were accepted between 0 cm, 3 cm, and 6 cm, and the significant difference was also accepted with the 5% level between 3 cm and 6 cm.



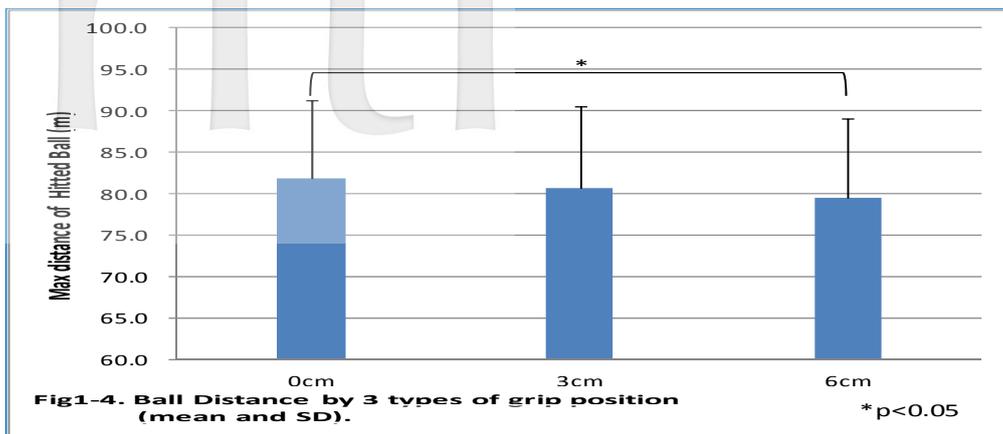
The average values of driving distance according to the differences of the grip positions were shown in figure 1-2. As shown in the figure, a significant difference was not found among three lengths.



The maximal result of the batted ball speed according to the differences of the grip positions was shown in Fig. 1-3. As shown in the figure, the significant difference was accepted with the 1% of level between 0 cm and 3 cm, and the significant difference was accepted with the level of 0.1% risk between 0 cm and 6 cm.



The maximal result of the driving distance was shown according to the differences of the grip positions were shown in Fig. 1-4. As shown in the figure, the significant difference was accepted with the level of 5% risk only between 0 cm and 6 cm.



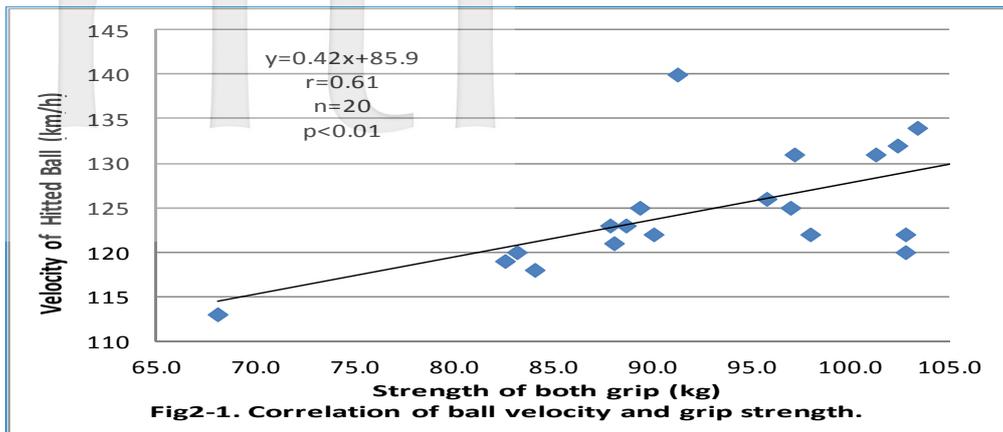
B. The measurement results of muscle strength and the hitting performance

The grip and back muscle strengths were shown in table2 of muscular power and blow performance. As shown in the table, the results from the descriptive analysis regarding the dominant hand, the contrary hand, sum of the both hands, back strength, and the grip of both hands and back strength were presented in Table 2.

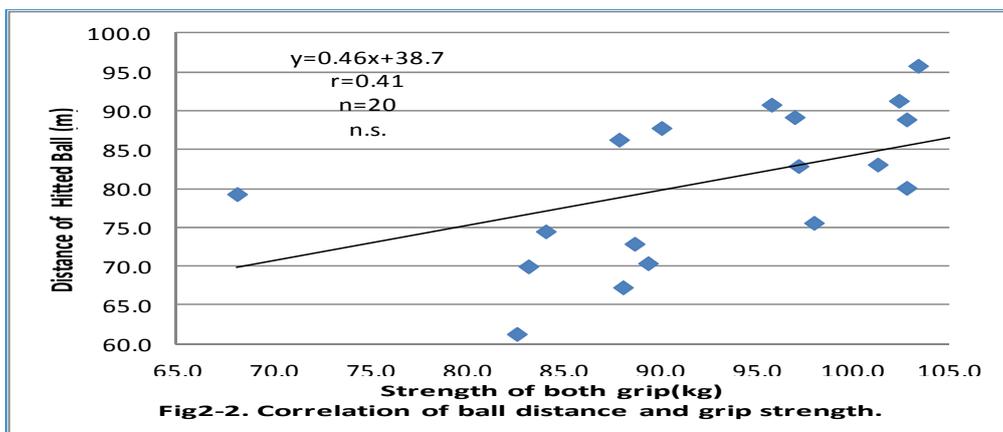
Table2. Measurement results of grip and back strength

	dominant hand (kg)	contrary hand (kg)	both hands (kg)	back (kg)	hands and back (kg)
Average	48.1	44.9	93.0	141.1	234.1
SD	4.7	5.3	9.1	22.8	26.9

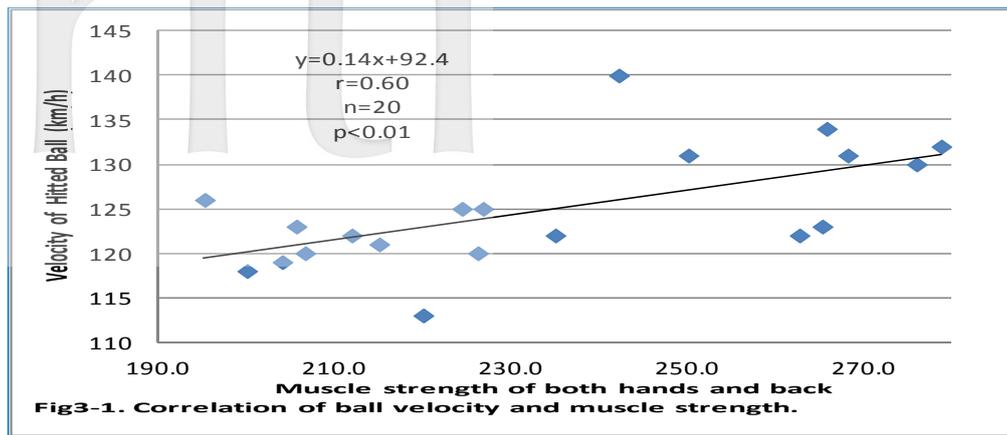
The relation between the measurement results of such muscular power and batted ball speed or/and driving distance was shown from figures 2-1 to figure 3-2. The correlation between the sum of the grip strength of both hands and hit ball speed was shown in Fig.2-1. As shown in the figure, significant positive correlation was accepted with the 1% level of the correlation coefficient 0.61 between the sum of the grip strength of both hands and batted ball speed.



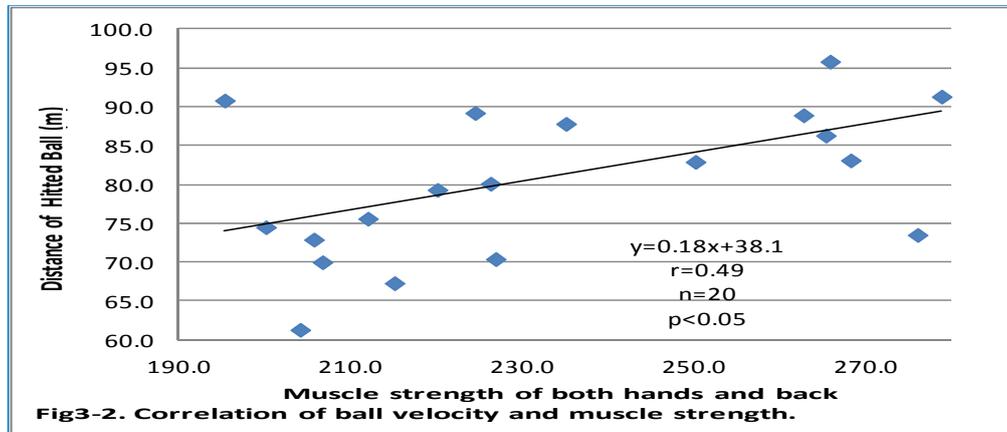
The sum of the grip strength of both hands and the hit ball driving distance was shown in Fig. 2-2. As shown in the figure, there was not a significant correlation between the sum of the grip strength of both hands and hit ball driving distance in spite of getting the positive correlation of correlation coefficient 0.41.



The relationship between the total muscle strength of the both grip strengths and back strength and batted ball speed was shown in Fig. 3-1. As shown in the figure, there was a significant positive relationship between the sum strength of the both hands and the back strength and batted ball speed correlation with a significant 1% level of the correlation coefficient 0.60.



The relationship between the total muscle strength of both grip strengths and the back and driving distance was shown in Fig. 3-2. As shown in the figure, there was a significant positive relationship between the sum strength of the both hands and the back strength and batted ball speed correlation with a significant 5% level of the correlation coefficient 0.49.



IV. Discussion

Scientific research on baseball is done among many countries till today including the United States of America where baseball was developed. Moreover, the baseball itself can be said that baseball is more popular in East Asia, such as South Korea, Taiwan, and Japan than the U.S.. Similarly, various reports of research including the

sports medicine or biomechanics research to which the report of research about baseball clarified the mechanism of pitching of the baseball player by Jobe and others (1983) by the electromyogram method and high speed camera method by an insertion type electrode method are made. These are related with a blow on the character for many years like a report of Hirano et al.(1980), Ichimaru(1997), Ito et al.(2001), Ichimaru et al.(2002), , it is overwhelmingly related with pitching like Toshima (1980) in Japan and Jobe et al.(1983) and Pappas et al.(1985) in the United States in many cases. Moreover, in the latest research, a practical report also came to be seen like Nakamura et al.(2012) and Kido et al.(2013).

As a practical study on baseball, this research examined what kind of influence the differences of the grip positions and muscular power would have on hitting performance. As a result, it was found that that the grip position of a bat made hitting a ball more quickly and also made it hit longer, but seldom affecting the driving distance of a hit ball was accepted, as shown in figure from 1-1 to Fig. 1-4. It was thought that it became possible to multiply a hit ball by number of rotations because of shortening the bat. For this reason, it seems that a difference was not between the cases of bat lengths. Since the angle of batted ball also influences driving distance, it is suitable for a short bat.

Moreover, it is considered to be the strength of grip to give such a situation, and it just showed in Fig. 2-1 and Fig. 2-2. There were significant positive correlation between grip strength and batted ball, but not between grip strength and the driving distance. It is suggested that a short bat could the ball to increase the number of rotations. What is depended on the ability of bat control which becomes an ideal angle for flying a batted ball in the distance, and a ball to have been multiplied by many number of rotations is conjectured. And, as the relation with the value of the synthetic muscular power which applied grip and back strength was shown in Fig. 2-3 and Fig. 2-4. There were significant positive correlation between the speed of a batted ball and

both of driving distance.

Probably, we may think that back strength is larger than the grip strength to participate for driving distance and speed greatly.

V. Conclusion

In order to clarify relation between the length of a bat and muscular power, to influence on batted ball speed and hit ball driving distance, we examined the relationship into the subject, and the following became clear.

A. Although the bat became a batted ball with the quick longer one, driving distance seldom changed.

B. Although the one where grip is also strong became a quick batted ball, there was no significant correlation between driving distance.

C. The strength of systemic muscular power had correlation with batted ball speed and driving distance.

These things were suggested to be the close relation to the number of rotations of a batted ball. That is, the length of a bat is reduced. For this reason, it is thought that hit ball speed is also reduced. However, it became possible to add many number of rotations to a batted ball with strong grip, and also it was guessed that the angle of a batted ball was also suitable.

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The Influence of Different Grip Position of a Baseball Bat and Muscular Strength on Batted Ball Speed and Driving Distance

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Abstract Batted ball speed is regarded as one of the skills that excellent batters have in baseball. This study examined how the differences of grip positions and muscular strength such as grip strength and back strength influence on batted ball speed or driving distance.

The subjects were 20 university baseball players, and their grip and back strength were measured. Each subject also did tee and long tee batting for four times each by holding the end of the grip of a bat, 0cm, 3cm and 6cm from the end. Their maximal and average data were recorded

The results were that there was a significant correlation between grip strength and batted ball speed, but there was no significant correlation between driving distance and batted ball speed. Strength of systemic muscular power including back strength had a significant correlation with speed and driving distance of batted ball.

As for the influences of positions of the grip on batted ball speed and driving distance, there was a greater tendency that faster ball speed and a longer driving distance could be achieved by holding the lower end of the grip. This had a larger influence on speed than driving distance. It was thought that this result was due to quicker speed and higher swing accuracy by holding a bat short. It was also inferred that the strength of grip positively correlates with the quantity of rotations and power on the ball.

Keywords: Grip position, Batted ball, Ball speed, Driving distance.

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