

## The Influence of Arm Length, Eye – Hands – Foot Coordination and Arm Power on the Bowling Ability of Male Cricket Athletes



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**ABSTRACT:** This study aims to determine the effect of arm length, hand-eye coordination, and arm-toe coordination on the bowling ability of male cricket athletes in Jakarta. Data collection was carried out in early January 2021, which took place at the campus of the Jakarta State University Cricket Arena. The method of research used in this research is survey method with path analysis technique or path analysis. The sample used in this study amounted to 18 people who came from the male Cricket Athlete in Jakarta. The first test that was carried out was measurement of arm length. Then proceed with a test of eye-eye coordination, arm power and bowling ability for male cricket athletes in DKI Jakarta. The hypothesis testing technique used in this study is to use path analysis techniques. The data that has been obtained aka n through a process of analysis of the data through SPSS. The results of this study are: 1) the direct effect of variable  $X_1$  on  $Y$  ( $X_1 \rightarrow Y$ ) or  $(r_{1y}) = -0,245$ . So the effect of arm length ( $X_1$ ) directly affects bowling ability ( $Y$ ) of  $-0.245$  or  $-24.5\%$ . 2) The direct effect of variable  $X_2$  on  $Y$  ( $X_2 \rightarrow Y$ ) or  $(r_{2y}) = 0.535$ . So the effect of eye-hand-foot coordination ( $X_2$ ) directly affects bowling ability ( $Y$ ) by  $0.535$  or  $53.5\%$ . 3) The direct effect of variable  $X_3$  on  $Y$  ( $X_3 \rightarrow Y$ ) or  $(r_{3y}) = 0.457$ . So the effect of arm power ( $X_3$ ) directly affects the bowling ability ( $Y$ ) of  $0.457$  or  $45.7\%$ . 4) The direct effect of variable  $X_1$  on  $X_3$  ( $X_1 \rightarrow X_3$ ) or  $(r_{13}) = 0.552$ . So the effect of arm length ( $X_1$ ) directly affects arm power ( $X_3$ ) by  $0.552$  or  $55.2\%$ . 5). The direct effect of variable  $X_2$  on  $X_3$  ( $X_2 \rightarrow X_3$ ) or  $(r_{23}) = 0.407$ . So the effect of hand-eye coordination ( $X_2$ ) directly affects arm power ( $X_3$ ) by  $0.407$  or  $40.7\%$ . 6) The indirect effect of variable  $X_1$  on  $Y$  through  $X_3$  ( $X_1 \rightarrow X_3 \rightarrow Y$ ) or  $(r_{13y}) = 0.552 \times 0.457 = 0.253$ . So the effect of arm length ( $X_1$ ) indirectly affects bowling ability ( $Y$ ) through arm power ( $X_3$ ) by  $0.253$  or  $25.3\%$ . 7) The indirect effect of variable  $X_2$  on  $Y$  through  $X_3$  ( $X_2 \rightarrow X_3 \rightarrow Y$ ) or  $(r_{23y}) = 0.407 \times 0.457 = 0.186$ . So the effect of hand eye coordination ( $X_2$ ) indirectly affects bowling ability ( $Y$ ) through arm power ( $X_3$ ) by  $0.186$  or  $18.6\%$ .

**KEYWORDS-** Bowling ability, Cricket, Arm length, Hand-Foot Coordination, Power Arm.

### I. INTRODUCTION

Cricket is a sport played by eleven players in one team. Cricket is included in the sport of small ball games. This cricket has been played in several countries in the world (Johnstone, Mitchell, & Gerwyn Hughes, 2 Tim Watson, 2014). As the sport of cricket has continued to develop and spread in several regions in Indonesia, the competition between each region has become tighter. In fact, in all regions such as DKI Jakarta, Bali, Central Java, and Kalimantan there are already training for student cricket athletes. This is a form of the seriousness of each regional government to prepare the next generation which is expected to become regional pride in achieving sports achievements. In addition, the Indonesian Cricket Association Central Management also often holds national level competitions between students, universities, and the public. With increasingly fierce competition, the skill quality and technical mastery of cricket players from each region must also be improved so that they are not left behind with other regions and are able to perform better.

There are several cricket clubs in Indonesia, including clubs from DKI Jakarta who participate in the cricket league organized by the Indonesian Cricket Association in collaboration with the Jakarta Cricket Association or abbreviated as JCA. This league is a professional cricket league with the number T20. Some of the clubs from Jakarta include Rawamangun Cricket Club, Taman Kemayoran Cricket Club, Senayan Cricket Club, and Jakarta Barbarians Cricket Club. Judging from the participation of the DKI Jakarta Men's Cricket Team in various domestic and foreign championships, of course there are several things that are used as material for corrections and improvements to be able to improve the quality of the team and each player who is getting better. That is the reason why every cricket player must have and master cricket techniques well.

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One strategy to win a cricket match can be done by bowling as well as possible and right on target. Bowling if the ball is not hit by the batsman or the ball hits the post which is behind the bat or batsman. If the bowler is able to do bowling well, it will pressure the opponent because the opponent's score is not optimal. To get good bowling results, good technique mastery and mental and physical readiness are required. Hand-eye coordination is one of the physical components that supports success in bowling. Given that the bowling movement has several quite complex sequences when seen with the naked eye, it is very necessary to have good coordination of movements for each athlete so that they are not able to experience difficulties when doing these movements. In addition, arm power also influences the correctness of motion or good technique correction in this bowling technique. The dominant bowling movement such as this throwing motion which must be done as hard as possible and in a fast time, requires the athlete's arm power to support the success of this bowling movement. To support good bowling skills, you need a proportional arm length, eye-to-foot coordination, and good arm power. These three things seem to be related to each other to produce a perfect bowling move, so that the bowler can get a lot of wickets and be able to win matches quickly.

Cricket is a field-based sport, with each team consisting of 11 players (Stuelcken, Pyne, & Sinclair, 2007). Cricket is a sport that is well known by the world community. This cricket has been played in various countries in the world (Johnstone, Mitchell, & Gerwyn Hughes, 2 Tim Watson, 2014). Bowling is an act of throwing that begins with running or walking and ends with the ball arriving at the hitter which is an activity carried out when throwing the ball in cricket (Jolimont and Victoria, 2005). An important aspect of bowling assessment to identify illegal acts is the measurement of elbow extension that occurs in the last phase of the ball release (Spratford et al., 2015). The balls used for men differ from the size of the balls for women. Standard cricket balls have a maximum circumference of 229 mm and a maximum weight of 163 g (Mohotti, Fernando, & Zaghoul, 2018).

Here are some mistakes made by bowlers, including:

1. Wide. If the ball comes too wide and cannot be hit, automatically the hitter will get a score for free.
2. No Ball. If the incoming ball does not bounce and the ball comes above the hitter's waist, the bowler crosses the line when releasing the ball, the bowler bends his hand while bowling, or the ball comes bouncing so hard that the ball passes over the hitter's head.

The purpose of this bowling technique itself is to turn off the batsman and prevent the batsman or hitter from getting a score. Here are a few ways to kill or stop a batsman for a score:

1. Bowled. The batsman makes inappropriate movements so the ball does not hit the bat's surface completely and thus the ball hits the stump behind the batsman.
2. Leg before Wicket (LBW). The batsman makes a move by letting the ball pass and then advancing the foot, but the batsman's foot is either directly in front or straight with the stump.
3. Caught. The ball is caught by the opponent or fielder after the batsman hits the ball with a bat strike without touching the ground first.
4. Run-Out. When the batsman tries to run for the score, the batsman does not move or slides the bat late on the crease or safe boundary when the ball hits the post (stump) after being thrown by a fielder, or a goalkeeper to destroy the bails.
5. Stumped. The batsman makes an inaccurate movement so the ball doesn't hit the surface of the bat perfectly and the batsman is outside the safe limit then the ball reaches the goalkeeper and destroys the stump and bails.

The bowling law of central cricket is that the ball is properly delivered with respect to the arm if, after the bowler's arm has reached shoulder level for the swing, the elbow joint must not be bent partially or completely from that point until the ball leaves the hand (Marshall & Ferdinand's, 2015). To determine whether a bowler movement bowling properly, it would require measuring instruments or instruments. Movement of bowling can be said to be valid if the movement is done perfectly in accordance with the techniques and rules. In 2000, cricket legal holder

Marylebone Cricket Club (MCC) clarified laws involving elbow extension during bowling action, they define the rules when delivering the ball in a bowling motion which either sees no straightening or extension, either partial or complete, in the elbow joint during the swing phase of the upper arm horizontally until the ball leaves the hand (Alderson, Spratford, Elliott, Portus, & Brown, 2018).

One of the efforts to improve sports performance for athletes is with an appropriate and proportional state of the body or anthropometric constitution. Anthropometrics are used as benchmarks in supporting sports achievement in relation to height, weight, sitting height, leg length, body fat thick arm length, body circumference and others (DR. Dikdik Zafar Sidik et al.,

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2019). Arm length is one of the members of the body that is included in anthropometric measurements, namely one of the upper limbs consisting of the upper arm, forearm, hand and fingers (Sugito, Pd, Zawawi, & or, 2018). Long arms can affect the speed of movement and the speed is proportional to the radius, namely the length of a person's arm (Awang Roni Effendi, 2015).

Coordination is the ability to repeatedly organize smoothly and accurately (Sharma, 2020). Hand-ankle coordination is the ability to perform movements with various levels of difficulty quickly and efficiently and with full accuracy (Rusli Lutan, 2000).

Arm muscle explosive power or arm power is a basic ability of physical condition which is one of the factors in achieving cricket sport achievement, especially in performing bowling technique. Power is the product of strength and speed (Sukadiyanto, 2010). Bompaa in the journal Mariati mention that power, there are two kinds of such power absolute mean power to fix a maximum external load, while power relative mean power is used to overcome the burden of its own weight (Mariati et al., 2018).

In performing this bowling technique, athletes must have a good physique. Good physical condition is one of the supporting factors for the success of a throw or bowling in this cricket sport. An athlete must have a body that is proportional to the character or specialist in the branch he is involved in, as well as cricket. Arm length is one of the body constitutions of a person who has an influence on bowling achievement in cricket. With a proportional arm length it will also be easier for a bowler to place the ball in the good length area, which is the area where the ball falls which is hard to hit by the batsman.

## II. METHOD

This research was conducted with a quantitative approach using a survey method with path analysis techniques. Quantitative research is a method for testing certain theories by examining the relationship between variables (Sugiyono, 2012). The purpose of quantitative research is to find knowledge or to test deductive hypotheses (Guo, 2014). Path analysis technique or often referred to as path analysis is the relationship between the influence of independent variables, intervening variables and dependent variables where the researcher clearly defines that a variable will be the cause of other variables which are usually presented in diagrammatic form (Noor, 2011). The research design required in planning and implementing this research can be seen in the figure below:

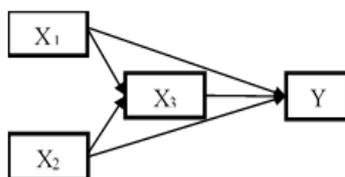


Figure 1 Research Design

### Information:

X<sub>1</sub>: Arm Length

X<sub>2</sub>: Hand-Foot Coordination

X<sub>3</sub>: Power Arm

Y: Bowling Ability

In this research, the data were obtained through parameter tests which will be carried out in the field. Using existing measurement tools from several experts and development instruments created by the research team. In researching bowling ability using research development. The measurement test instrument used to measure the length of the arm is a steel gauge. For the eye-foot coordination variable, the pass the ball instrument is used. Variable power arm using a test instrument kneeling power ball sideways and variable capability b o w ling meng use instrument development outcomes researchers who have dilakuakan validity and reliability testing.

After all samples were tested using existing instruments, then the data were processed using the SPSS application. The data that has been obtained will go through the data analysis process through 1). Data description, 2). Data normality test and data variation homogeneity test, 3). Regression linearity test and regression significant test, 4). Path analysis which includes hypothesis testing.

## III. RESULT AND DISCUSSION

This study contained four variables, consisting of three exogenous variables or independent variables and one endogenous variable or dependent variable. These variables include: Arm Length (X<sub>1</sub>), Hand-Foot Coordination (X<sub>2</sub>), Arm Power (X<sub>3</sub>) and Bowling Ability (Y).

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Collecting data from the four variables, the researcher used a test technique using a validated instrument to measure arm length, eye-hand coordination, arm power and bowling ability. The values presented from the raw data were processed using descriptive statistical methods with the SPSS for Windows program. The following will be presented a recapitulation of the total score for each variable:

**Table 1: Data Description of Variable Bowling Ability, Arm Length, Hand Eye Coordination and Arm Power.**

Statistics	Variable			
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	Y
Number of samples (n)	20	20	20	20
Maximum Value	86	45	980	80
Minimum Value	77	26	590	51
Range	9	19	390	29
Average ((X))	80.40	35.50	693.50	63.17
Standard Deviation (S)	2.68	4.48	94.72	9.23
Variance (S <sup>2</sup> )	7,20	20.05	8971.32	85.13

## 1. Bowling Ability Variable (Y)

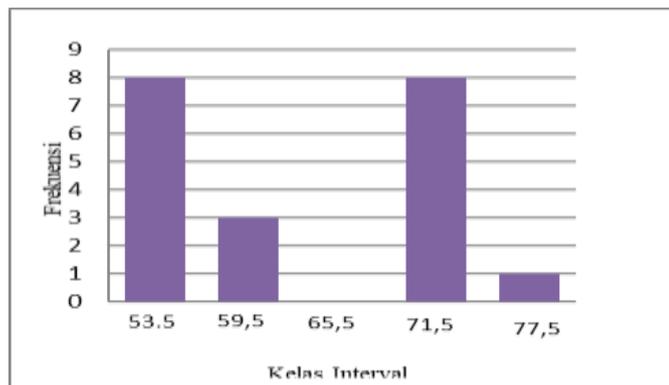
Data from the recapitulation of the total score for each variable was processed through the help of the SPSS for windows computer program. After the residual standard test was carried out on the outlier data, the data summary of the Bowling Ability variable (Y) was carried out.

The results from the data description table show that the data from the results of Bowling Ability are quite varied. Based on the figure below, it shows the empirical value range of 29 with the lowest value of 51 and the highest value of 80. Furthermore, it is known that the average or mean value is 63.17 and SD 9.23 and the variance is 85.13. Furthermore, the number of classes and frequency distribution in variable Y are as follows:

**Table 2: Bowling Ability Interval Table**

Interval Class	Absolute Frequency	Relative Frequency
51-56	8	40%
57-62	3	15%
63-68	0	0%
69-74	8	40%
75-80	1	5%
<b>TOTAL</b>	<b>20</b>	<b>100%</b>

Based on the table above, it can be seen that in the bowling ability variable, there are 0 respondents (0%) who get the average value, 11 respondents (55%) are below the average, and 8 respondents (45%) are above the average. The Achievement interval described by the Histogram can be seen as follows:



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## 2. Variable Arm Length (X<sub>1</sub>)

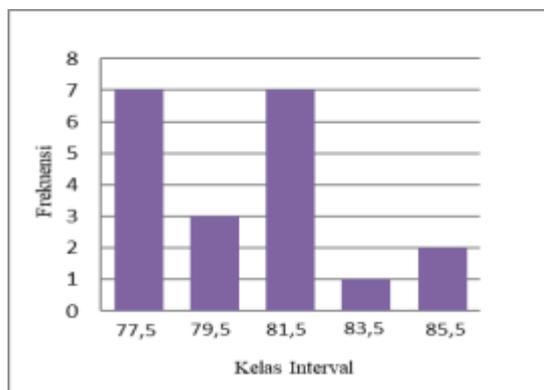
The data from the recapitulation of the total score for each variable were processed through the help of the SPSS for windows computer program after the residual standard test was carried out on the outlier data, the data summary of the variable arm length (X<sub>1</sub>).

The results from the data description table show that the data from the results of Bowling Ability are quite varied. Based on the picture below, it shows the empirical value range of 9 with the lowest value of 77 and the highest value of 86. Furthermore, it is known that the average or mean value is 80.40 and SD 2.68 and variance of 7.20 Furthermore, the number of classes and frequency distribution in variable X<sub>1</sub> is as follows:

**Table 3: Arm Length Table (X<sub>1</sub>)**

Interval Class	Absolute Frequency	Relative Frequency
77-78	7	35%
79-80	3	15%
81-82	7	35%
83-84	1	5%
85-86	2	10%
<b>TOTAL</b>	<b>20</b>	<b>100%</b>

Based on the table above, it can be seen that in the Arm Length variable, there are 3 respondents (15%) who get the average value, 7 respondents (35%) are below the average, and 10 respondents (50%) are above the average. The Achievement interval described by the Histogram can be seen as follows:



## 3. Hand and Foot Coordinating Variable

The data from the recapitulation of the total score for each variable was processed through the help of the SPSS for windows computer program. After the residual standard test was carried out on the outlier data, the data summary of the variable data for the coordination of the ankle and ankle (X<sub>2</sub>).

The results from the data description table show that the data from the ankle-foot coordination results are quite variable. Based on the figure below, it shows the empirical value range of 19 with the lowest value of 26 and the highest value of 45. Furthermore, it is known that the average or mean value is 35.50 and SD 4.48 while the variance is 20.05. Furthermore, the number of classes and the frequency distribution of the variable (X<sub>2</sub>) are as follows:

**Table 4: Hand-Foot Coordination Table (X<sub>2</sub>)**

Kelas Interval	Frekuensi Absolute	Frekuensi Relatif
26-29	2	10%
30-33	4	20%

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34-37	9	45%
38-41	3	15%
42-45	2	10%
<b>TOTAL</b>	<b>20</b>	<b>100%</b>

Based on the table above, it can be seen that in the Eye Hand and Foot Coordination variable there are 2 respondents (10%) who get the average value, 6 respondents (30%) are below the average, and 12 respondents (60%) are above the average.

#### 4. Variable Arm Power ( $X_3$ )

The data from the recapitulation of the total score for each variable was processed through the help of the SPSS for windows computer program after the residual standard test was carried out on the outlier data, the data summary of the Power Arm variable ( $X_3$ ).

The results from the data description table show that the data from the arm power results are quite variable. Based on the table below, it shows the empirical value range of 390 with the lowest value of 590 and the highest value of 980. Furthermore, it is known that the mean or mean value is 693.5 and SD 94.72 and Variance 8971.32. Furthermore, the number of classes and frequency distribution in the variable ( $X_3$ ) are as follows:

**Table 5: Arm Power Interval Table**

Interval Class	Absolute Frequency	Relative Frequency
590-667	11	55%
668-745	4	20%
746-824	4	20%
825-902	0	0%
903-980	1	5%
<b>TOTAL</b>	<b>20</b>	<b>100%</b>

Based on the table above, it can be seen that in the arm power variable there are 0 respondents (0%) who get the average value, 13 respondents (65%) are below the average, and 7 respondents (35%) are above the average.

#### IV. CONCLUSIONS

There is an effect of arm length ( $X_1$ ) on bowling ability (Y). This means that the better the arm length, the better the bowling ability that will be produced. Conversely, the lower the arm length, the lower the resulting bowling ability. There is an effect of eye-hand-foot coordination ( $X_2$ ) on bowling ability (Y). There is an effect of arm power ( $X_3$ ) on bowling ability (Y). This means that the better the arm power, the better the bowling ability that will be produced. Conversely, the lower the arm power, the lower the resulting bowling ability. There is an effect of arm length ( $X_1$ ) on arm power ( $X_3$ ). There is an indirect effect of arm length ( $X_1$ ) on bowling ability (Y) through arm power ( $X_3$ ). There is an indirect effect of eye-hand-foot coordination ( $X_2$ ) on bowling ability (Y) through arm power ( $X_3$ ).

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