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The Relationship Between Wrist Flexibility, Arm Muscle Strength, and Arm Explosive Power on Lob Shot Ability in Badminton

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A. Conception and design of the study; **B.** Acquisition of data; **C.** Analysis and interpretation of data; **D.** Manuscript preparation; **E.** Obtaining funding

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ABSTRACT

This study aims to determine; 1) Want to know the relationship between wrist flexibility and lob shot ability in badminton. 2) Want to know the relationship between arm muscle strength and lob shot ability in badminton? 3) Want to know the relationship between arm explosive power and lob shot ability in badminton? 4) Want to know the relationship between wrist flexibility, arm muscle strength, and arm explosive power together on the ability to hit lobs in badminton among Watansoppeng 1 Public High School students? The population is students of Watansoppeng 1 Public High School. The sample used was 60 male students. The sampling technique is to use a simple random sampling technique. The variables involved in this research are the independent variables' physical condition and lob-hitting ability. The test instruments used were physical conditions consisting of wrist flexibility, arm muscle strength, and arm explosive power, while the ability to hit a lob by smashing 10 times. The data analysis techniques used are descriptive analysis and analytical analysis. The research results concluded that; (1) There is a significant relationship between wrist flexibility and lob ability in badminton, (2) There is a significant relationship between arm muscle strength and lob ability in badminton, (3) There is a significant relationship between arm explosive power and lob ability. in badminton, and (4) There is a significant relationship between wrist flexibility, arm muscle strength, and arm explosive power on lob shot ability in badminton.

Keywords : Flexibility; Strength; Explosion power; Lob Shot; Badminton

INTRODUCTION

Sport is discussed in a scientific context, so various characteristics must be expressed in general terms. This concept provides a fundamental perception of the breadth and depth of the existence of sports when studied more deeply (Asfiyani & Sulistyarto, 2016). However, scientifically in developing sports, it would be holistic to reveal part of the field of sports science (Mangun et al., 2017). The fact is that the characteristics of sports are directly related to the characteristics of human behaviour and various kinds of activities in society (Lutan, 2012). The premise that has developed states that the essence of sports activities is playing in situations where humans demonstrate their skills in carrying out movements

(El-Gizawy & Akl, 2014). Through the statement above, it can be concluded that the characteristic of sports activities is the demonstration of physical skills to achieve victory or to improve performance (Hidayat et al., 2019).

Developing talented and potential athletes in a sport will speed up and make it easier to achieve excellent performance (Wiriawan, 2013), and conversely, developing athletes with less potential will make it impossible to produce achievements (Wang & Liu, 2011). Therefore, talent search and selection of potential talent to be developed in a sport such as badminton (Maulina, 2015) is the first and main step in developing achievement if you want to achieve excellent performance (Hinda Zhannisa & Sugiyanto, 2015).

The game of badminton is a game that has been socialized not only as a recreational sport but the emphasis is more on it as an achievement sport (Williyanto & Raharjo, 2016). So the form of activity or training given in playing, the reference is to improve achievement (Triansyah, 2019). The sport of badminton is one of the sports that requires physical conditions because playing badminton in movement patterns requires speed, strength, explosive power, endurance, flexibility, balance, and coordination (Hammado et al., 2020). The game of badminton consists of several basic techniques consisting of serve, netting, drive and lob". Of the basic techniques stated above, the basic technique that is the focus point or object in this research is the lob punch.

The lob punch is identical to a punch to start an attack or an attacking punch because the lob punch aims to damage the opponent's position or push the opponent far back so that the frontcourt is open (Yuliawan & Sugiyanto, 2014). This blow is most often performed on singles players rather than doubles players because shielding in singles is how the opponent is forced to be easily killed (Kim, 2017). The criteria for a lob shot in badminton are hard and high and the speed of the shuttlecock is fast towards the back of the opponent's court. Thus, to do a lob, you must have arm muscle strength. Apart from having strong arm muscles, badminton players must also have good wrist flexibility and explosive arm power to be able to make a perfect lob shot and make it easier to get the right moment to add points (SUSANTO, 2017). Lobs are generally done from behind, both in singles and doubles play. The ability to hit a good lob will push the opponent back away from the front court so that it is empty and also make it easier for us to return to a ready position before the opponent makes a countershot (Subarjah, 2018). To do a lob shot from the back area, you can do it using either a forehand or a backhand. However, of the two methods, the easiest one to do is forehand (Rahmat et al., 2019). The muscles that concentrate are the abdominal muscles, waist, arm muscles, wrists and so on.

Based on the author's experience in playing badminton, movements that only control muscle strength still do not provide maximum support for the results of lob shots. Thus, the explosive power and flexibility of the wrist will provide maximum space for movement and the power provided will also be doubled (Wijayanto & Wiliyanto, 2022). To prove it, the combination of wrist flexibility, arm strength and explosive power will produce maximum lob shots.

Flexibility is a very important agility motor in all sports, especially in badminton (Krismon et al., 2022). It can be said that all sports, including lob shots in badminton, require flexibility (Ariyanti, 2014). Therefore, flexibility is a quality that shows a segment of a joint or muscle and a group of muscles to move as optimally as possible according to the possibility of the muscle lengthening and shortening and making maximum use of the space for joint movement (Sutari & Syahara, 2019). The quality of flexibility makes it possible to make maximum use of joint movement space (Nurcahya, 2016). Flexibility is the ability to make movements within the range of motion of a joint (Sahabuddin, Syahruddin, & Fadillah, 2022). Apart from the range of motion

of the joints, flexibility is also determined by the elasticity of the muscles, tendons and ligaments (Hariandri et al., 2018). Badminton players who have good wrist flexibility (Sahabuddin, 2023), will direct greater force when hitting a lob. This is because, with good wrist flexibility, badminton players will be able to direct greater force when making a lob shot (Rubiyatno & Suganda, 2021). Thus, to get a fast, strong and accurate lob shot, the wrist flexibility angle must be high (Lasmita et al., 2018). Flexibility development exercises can affect the wrist muscles, tendons and ligaments, as well as strengthen movements to be able to move to the maximum limit and expand joint movements (Datukramat, Z. A., & Jusrianto, 2019). Flexibility training restores normal range of movement, improves muscle flexibility and elasticity (Hakim et al., 2022), develops more efficient blood flow in the capillary network, causes muscle relaxation, and reduces the possibility of injury in fatty tissue (Maulana et al., 2020).

Strength is one of the physical elements that is needed in most sports, especially badminton, besides that it can also show balance and protect a person from the possibility of injury (Yusuf, 2015). Muscle strength is the ability of a muscle or group of muscles to provide resistance in carrying out a physical activity. Because strength is the driving force of every physical activity, strength also plays an important role in protecting players from possible injury, as well as strength, players can run quickly, throw and hit further and more efficiently, hit hard, and can also help strengthen the stability of joints. joints (Mangngassai et al., 2020). Developing strength can be obtained through resistance training: such as training using the weight of our own limbs and external loads. The concept of strength development can be stated that strength development must be truly consistent in the training program (Ibrohim et al., 2022). The effectiveness of a strength training program does not only depend on the systematic design of the program. Any exercise with the correct concept can make a big contribution if carried out regularly by paying attention to the correct principles. One of the training programs is known as weight training, which is recognized as an effective training program for increasing strength, ability to push, endurance, and speed of movement (Sahabuddin et al., 2021). Based on the description above, it is related to activities in the game of badminton, strength is needed to make a strong and fast shot to produce a fast and strong shuttlecock speed towards the opponent's back. In other words, muscle strength is a component that determines the quality of arm movement strength (Wilastra, 2022). Arm muscle strength is very important and plays a role in all elements of movement in the game of badminton, especially the lob shot.

Arm explosive power is very much needed in various sports, especially sports which involve heavy and fast activities or activities that must be carried out in the shortest possible time against a load (Prayadi & Rachman, 2013). The strength and speed of the arm muscles are directed together to overcome the burden in a relatively short time (Nofrizal, 2019). Explosive power is the ability of muscles to overcome resistance to very rapid contractions, and explosive power is very important for explosive sports. This view states that two important elements in explosive power are muscle strength and speed in directing maximum power to overcome resistance (Utoro, 2019). In general, explosive arm strength is known as one of the physical components that are needed in various sports, but explosive arm strength is not the only determining element in carrying out sports activities so that you appear skilled in achieving existing physical achievements. Strength remains the basis for determining explosive power (Sahabuddin, Syahruddin, Amahoru, et al., 2022). Before explosive power training, players must already have a good level of muscle strength. It is not enough for a badminton player to just train to increase strength, strength must be increased to what is called explosive power (Fattahudin et al., 2020). Therefore, explosive power is determined by the elements of strength and speed, so explosive power training methods cannot be separated from speed and strength training methods. So it can be said that explosive arm power is more needed in sports, especially

badminton (Putra et al., 2019). Apart from that, arm explosive power has a very important role in sports that require players to use their arms, or direct explosive power in a limited time. To obtain good explosive power capabilities, the elements of strength and speed need to be developed which can be integrated into a movement pattern (Edmizal & Maifitri, 2021). So it will give rise to the ability of explosive power to achieve maximum power to overcome load resistance in a short time (Lengga et al., 2020). The role of explosive arm power in the game of badminton, especially the ability to hit lobs, where players have to swing their arms to reach the ball. The better a player's explosive arm strength, the more they can control when to make fast and strong arm swings.

METHODS

The research variables that want to be studied in the research consist of (1) Independent variables: wrist flexibility, arm muscle strength, and arm explosive power, while (2) The dependent variable is the lob punch. The research design or research design used in the research is correlational.

The population of this study was 115 male grade 1 students at SMA Negeri 1 Watansoppeng. The sample taken or used in the research was 40 people of the male gender obtained using a simple random sampling technique by drawing lots. The data that needs to be collected in this research includes data on wrist flexibility, arm muscle strength, arm explosive power and lob-hitting ability. The collected data needs to be analyzed descriptively and inferentially to test research hypotheses. So the overall statistical data analysis used generally uses computer analysis in the SPSS version 15.00 program with a significance level of 95% or α 0.05.

RESULTS AND DISCUSSION

Result

Table 1.
Results of descriptive analysis for each variable

Variable	N	Mean	Stdv.	Max.	Min.
Wrist Flexibility (X1)	40	79,58	3,265	86	74
Arm Muscle Strength (X2)	40	28,93	3,668	38	23
Arm Explosive Power (X3)	40	3,76	0,216	4,30	3,40
Lob Shot (Y)	40	16,45	4,157	24	10

Table 2.
Normality test results for each variable

Variable	KS - Z	P	α	Information
Wrist Flexibility (X1)	0,110	0,200	0,05	Normal
Arm Muscle Strength (X2)	0,112	0,200	0,05	Normal
Arm Explosive Power (X3)	0,122	0,136	0,05	Normal
Lob Shot (Y)	0,103	0,200	0,05	Normal

Table 3.
Results of correlation and regression analysis for the first hypothesis

Variable	r/R	Rs	F	t	sig
Wrist flexibility (X1) Lob Shot (Y)	0,632	0,400	25,301	5,030	0,000

Table 4.
Results of correlation and regression analysis for the second hypothesis

Variable	r/R	Rs	F	t	sig
Arm muscle strength (X2) Lob Shot (Y)	0,566	0,320	4,228	0,000	0,566

Table 5.
Results of correlation and regression analysis for the third hypothesis

Variable	r/R	Rs	F	t	sig
Arm Explosive Power (X3) Lob Shot (Y)	0,621	0,385	4,882	0,000	0,621

Table 6.
Regression analysis results for the fourth hypothesis

Variable	r/R	Rs	F	t	sig
Wrist flexibility (X1) Arm muscle strength (X2) Arm Explosive Power (X3) Lob Shot (Y)	0,783	0,612	18,962	2,773	0,000

Discussion

There is a relationship between wrist flexibility and lob shot ability in badminton

The results of statistical analysis show that there is a significant relationship between wrist flexibility and lob shot ability in badminton. If the research results are linked to the underlying theory and framework, then basically the results of this research support and strengthen existing theories and previous research results. The ability to hit a lob in badminton requires wrist flexibility. Wrist flexibility is a basic ability of a physical component that has a very important role. The ability to hit a lob in badminton can be achieved well if students have wrist flexibility because the movement of a lob in badminton is the ability to move aggressively. Therefore, the flexibility of the wrist that students have will be very helpful in the movements needed when making a lob shot. Thus, there is a significant relationship between wrist flexibility and lob shots in badminton.

There is a relationship between arm muscle strength and lob shot ability in badminton

The results of statistical analysis show that there is a significant relationship between arm muscle strength and lob shot ability in badminton. If the results of this research are linked to the underlying theory and framework, then basically the results of this research support and strengthen existing theories and previous research results. Judging from its role in performing lob shots in badminton, namely to pull body weight and maintain balance when executing lob shots. The body position always maintains balance with both legs moving simultaneously. And keep both feet in a balanced position immediately after hitting the lob. Also needed when hitting a lob. So arm muscle strength is the most basic and dominant factor that will determine whether or not a student is successful in making a lob shot in badminton. What can be proven from the test results is that a student who can do push-ups with a greater number of repetitions or can pull and push the hand dynamometer will have a better lob shot ability in badminton compared to a student who does push-ups with fewer number of repetitions. However, besides being strong, it

also has to be flexible. Flexibility can be interpreted as a person's ability to make the widest possible movements within the range of motion of the joints, he also has elastic muscles. Harsono (1988:163) states the limitations of flexibility: ... a flexible person is a person who has a wide range of movement in his joints and has elastic muscles. The importance of flexibility is to prevent injury to muscles and joints. Besides that, flexibility will make the movements easier. Thus, there is a significant relationship between arm muscle strength and lob shot badminton ability.

There is a relationship between arm explosive power and lob shot ability in badminton

The results of statistical analysis show that there is a significant relationship between arm explosive power and lob shot ability in badminton. If the results of this research are linked to the underlying theory and framework, then basically the research results support and strengthen existing theories and previous research results. Explosive power is a combination of strength and speed and is the basis for carrying out every form of activity. It is also often interpreted as explosive power which means the ability to exert maximum power in a relatively short time. The results of this research support Harsono's theory which states that "Power is the ability of muscles to direct maximum force, in a very fast time." This opinion states two important elements in explosive power, namely muscle strength and muscle speed in exerting maximum force to overcome resistance, So it can be concluded that explosive power is the ability of muscles to exert maximum strength in a very fast time. Therefore, explosive power as the main driver in carrying out leg and hand movements when executing a lob punch, is supported by two physical components, namely strength and speed or explosive power of arm muscles. So in carrying out foot and hand movements in sports, the ability to hit lobs in badminton can provide maximum results. Because explosive power is a combination of strength and speed, it is necessary to explain the power itself. Strength is a basic ability of physical components that has a very important role. The ability to perform lob shots in badminton can be achieved well if students have arm muscle strength and leg strength because leg and arm movements are the ability to make fast movements in performing lob stroke skills in badminton. Therefore, the arm muscle strength that students have will help in the movements needed when doing the lob shot in badminton for SMA Negeri 1 students. Thus, there is a significant relationship between arm explosive power and lob shots in badminton.

There is a relationship between wrist flexibility, arm muscle strength, and arm explosive power on lob shot ability in badminton

The results of statistical analysis show that there is a significant relationship between wrist flexibility, arm strength and arm explosive power with lob shot ability in badminton. If the results of this research are linked to the underlying theory and framework, basically the results of this research support and strengthen existing theories. A student needs these three physical elements, namely wrist flexibility, arm muscle strength, and arm explosive power. The lob movement in badminton requires very short movements in the execution process. Everything that is done with high activity requires good physical abilities, thus the process of implementing lob skills in badminton is an activity that is carried out quickly which of course requires physical abilities such as wrist flexibility, arm muscle strength and arm explosive power. These three physical elements are very helpful in the movement of the lob shot ability in the game of badminton because they are supported or supported by wrist flexibility, arm muscle strength, and arm explosive power in the movement of the lob shot ability in the game of badminton.

Arm muscle strength is the ability of the muscles in the arms to be able to perform maximum movements. The arm as the driving force in the ability to hit the lob in badminton will always move to carry out this movement. According to research conducted, it has been revealed that the ability to hit a lob in badminton is related to wrist flexibility, arm muscle strength, and arm explosive power. An athlete's aggressiveness in foot and hand movements influences lob shot ability in badminton. Thus, there is a significant relationship between wrist flexibility, arm muscle strength, and arm explosive power on lob shot ability in badminton.

CONCLUSION

According to the results of the hypothesis testing analysis based on the problem posed, the following conclusions can be drawn:

1. There is a significant relationship between wrist flexibility and lob shot ability in badminton
2. There is a significant relationship between arm muscle strength and lob shot badminton ability.
3. There is a significant relationship between arm explosive power and lob shot ability in badminton
4. There is a significant relationship between wrist flexibility, arm muscle strength, and arm explosive power on lob shot ability in badminton.

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