

Exploring the interplay: Hand muscular power, hip flexibility, and lob shot proficiency in badminton

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Abstract

The ability to make lob shots in badminton is a crucial ability to be mastered by badminton players. The players always use this punch during badminton matches. Players who are not able to make this shot well and consistently will have difficulty serving the punch given by the opponent. The physical component that supports lob ability is still very minimal in language by researchers, so it needs to be studied in order to provide new knowledge for badminton coaches. This study aimed to investigate the relationship between hand muscle explosive power and hip flexibility with lob-hitting ability in badminton. A total of 54 samples participated in this correlational study consisting of 33 men (average age 19.10±0.30 years) and 21 women (average age 18.18±0.39 years). The process of collecting lob ability data was carried out by conducting a lob ability test on all research samples. Arm muscle explosive power data was obtained by performing two hand medicine ball puts, and hip flex data was obtained by conducting sit and reach tests. After the data of all these research variables were obtained, the data were obtained using descriptive statistics and hypothesis testing was carried out by conducting a product-moment correlation test. Before testing the hypothesis, the data normality test was used to meet the classical assumptions of the correlation test. The results of this study showed that there was a correlation between the explosive power of the arm muscles and the ability to hit lob ($r = 0.62$, $p = 0.05$), hip flexibility also correlated with the ability to punch lob ($r = 0.60$, $p = 0.05$), besides that the explosive power of the arm muscles and hip flexibility together had a relationship with the ability to hit lob in badminton ($R = 0.71$, $p = 0.05$). The ability to perform lob strokes correlated with both physical elements, namely arm muscle explosive power and waist flexibility, so badminton coaches can optimize both physical components if they want to improve their athletes' lob-hitting abilities.

Keywords: shot technique, lob shot, badminton, racket sport, physical aspect

Introduction

Badminton is a sport that is proliferating and is widely played by people in various countries, including Indonesia (Han Lim & Aman, 2017). This sport is a type of exercise that is done with high intensity and fast movements. Shuttlecock came quickly after being hit into the opponent's field area (Gomez et al., 2019; Abián-Vicén et al., 2018). This sport requires its players to have good physical condition and punching techniques. To be able to play well, both elements must also be trained as well as possible (Ooi et al., 2009). The role of the coach is needed to improve these two elements. Players must get a sufficient portion of training so that the increase in physical ability and mastery of hitting techniques in the sport can increase (Suratman et al., 2019; Yuksel et al., 2015). This combination of physical condition and good hitting technique will have an impact on the high quality of the game. When the players have good abilities, the attractiveness of a match will be higher, and the competitive level of competition will also be better in quality (Ardiantoro & Sunarmi, 2020). Badminton players must have fast movement abilities to move forward, backward, and jump while doing various types of punches in badminton games (Phomsoupha & Laffaye, 2015; Alder et al., 2019).

Previous research has investigated several punching techniques in the game of badminton. Study experiments conducted by (Liu et al., 2021) stated that play practice can improve the ability to hit forehand clear, wall volleyball, game performance, and tactical understanding of playing badminton. Similarly, it is also revealed that play practice is also able to improve students' tactical understanding, game performance, and specialized content knowledge skills (Hastie et al., 2022). In addition, action research has also been conducted to improve the drop-shot skills of junior athletes. This study resulted in an increase in drop shot ability by 79.1% from observer 1 and 80.1% from observer 2 after treatment (M. P. Sari et al., 2020).

Punches that lead to the back area of the field and high (lob) prove more difficult for opponents at the time of the match. A good combination of lob and net shots will be one of the deadly strategies that can make it

difficult for opponents. The playing styles of the world's top female athletes continue to evolve, and one of them is doing a varied combination of lob and net. This style of play has become a new trend in women's singles and has become one of the new strategies for the daughters of the world's top players (Li, 2022). In the C1 category of paralympic table tennis athletes, the dominant strokes made by them are backhand lob, forehand drive and backhand drive; this shows that the existence of this type of punch is also popular in other sports (Guarnieri et al., 2023). Additionally, a study analysis of sports performance during the men's singles final match between Victor Akselsen and Kento Momota revealed that the lob punches given by both players were the main shot for them to get points from their opponents. The results of the study explained that Victor Akselsen gets points from opponents by using smash, net, and lob punches, while Kento Momota gets points from Victor Akselsen by making drop shots and lobs (J. R. Sari & Ahdika, 2023).

The movement patterns of athletes when playing in real match situations have also been studied by previous researchers so that the direction of movement of the players can be known and become significant information for players and coaches to develop the next training program (Valldcabres et al., 2020). In an experimental study (Ali & Siong, 2023) conducted on 68 students for 6 weeks, it was revealed that the treatment of the experimental group by providing students with a comprehensive badminton training module was able to have an excellent positive change impact on students compared to the ability of students who continued to learn with conventional methods. Their ability to play badminton has improved significantly. The students in the experimental group experienced an increase in their ability to perform high serve by 18.36%, backhand short serve skill by 21.59%, and lob shot skill by 19.37%. This study also has an impact on meaningful learning experiences for students, with the meaningfulness of learning, they feel it has a positive effect on improving their learning outcomes. A quantitative descriptive study stated that the most common hitting technique errors occur when performing long serves. These errors occurred as much as 5.68%, while the errors that occur in the lob technique are not too many, which is only 0.44% (Limatahu et al., 2020). The duration of playing badminton in a match is getting longer, and as a consequence, the number of rallies that occur will also increase. Long rallies require a lot of power and a number of lob strokes as well, so they need to be trained and improved (Abián et al., 2014). In addition, the number of strokes in the fonds group phase is less than in the playoff phase, which tends to be more. The players who have entered the playoff phase are required to be able to show maximum performance to win the game when they have entered the playoff phase. Opponents who have become more balanced and even better in ability are one of the factors that make the playoffs even more challenging and require a long rally (Chiminazzo et al., 2018). Smashes that are done consecutively can overwhelm the opponent to return the shuttlecock well consistently. This can be an opportunity and strategy to defeat the opponent (Lin et al., 2022). From several studies that have been done before, research that investigates what factors will affect lob ability has not been done, so what factors will support the ability of the technique, especially physically, is not yet known. Therefore, this study aimed to examine the relationship between hand explosive power and hip flexion with the ability to punch lob in badminton. The lob ability of the students is very useful. When they play, as nutmeg is the case when doing a match, the ability to carry the shuttlecock high towards the back of the field will also greatly help the players to return the attack given by the opponent.

Material & methods

Study design

This study used a quantitative approach with a correlational method. Researchers aimed to investigate the relationship between arm muscle explosive power and hip flex with lob-hitting ability in badminton.

Participant

Participants in this study were students of the coaching department of the Faculty of Sports Sciences, totaling 54 students. Participants came from 3 classes of Badminton courses, consisting of 33 men (average age 19.10 ± 0.30 years) and 21 women (average age 18.18 ± 0.39 years). The participants involved are students who can play badminton in the medium category. Their ability to play badminton was not proficient and skilled.

Instrument

Lob Research instruments are tools or facilities used by researchers in collecting data so that their work is more accessible and the results will be better. In this study, the instrument used for data collection was the ability to hit the lob (*clear test*). This lob test, according to French in (Komari, 2018), with *half-competition ranking criteria*, has a validity of 0.60, while a reliability of 0.98 is obtained by means of the even-odd method. The test begins with the testee standing in the right service compartment holding a racket, ready to make a *clear*. A trained feeder feeds the shuttlecock in a *straight direction*, and the shuttlecock must pass through a rope stretched 14 feet from the net mast. The lob shot is made straight towards the target tile 20 times. Before the feeder hits the shuttlecock, the testee was not allowed to move first, and after hitting it must return to its original place. When the shuttlecock falls above the target line, a higher score is given.

The explosive power of arm muscles

Arm muscle explosive power test using a two-hand medicine ball put to the test. This test aims to measure the explosive power of the arm and shoulder muscles. The equipment needed for this test is a medical ball weighing 2.7216 kg (6 pounds), Lime or colored insulation, a soft rope to hold the body, a bench, and a

measuring instrument/roller meter. The implementation of this test begins with Testi sitting on a bench with a straight back, Testi holding the medical ball with two hands, in front of the chest and under the chin, Testi pushing the ball far forward as far as possible, the back remains attached to the back of the chair when pushing the ball, Testi's body was held using a rope by the assistant tester. Testi repeated three times. Before performing the test, the testicle may do it once. The assessment of this test was carried out by measuring the distance from the place where the ball fell to the end of the bench. The value obtained is the farthest distance from the three tests performed.

Hip flexibility

To measure the flexibility of a person's hips, a sit and reach test with a reliability level of 0.997 and validity of 0.993 is used. The test was carried out with the testee sitting upright with both feet close and both toes flush with the edge of the measuring instrument. The testee then made a bending motion or snubs forward. Position the hands while straightened parallel to the feet. The amount of pulling strength of the testee's back muscles can be seen on the measuring device after the subject performed the test, which is measured in centimeters. Conducted three times, the best score was taken.

Procedures

The research process began with searching for information and observation. After the information was obtained, ask permission from badminton course lecturers and registered students to participate as research subjects. Researchers provide an explanation regarding the purpose and type of test to be carried out, this is so that they can understand what will be done. Before the test was carried out, the participants were given the opportunity to try the test they will do. The data collection team tasked with assisting in the implementation of the three tests has prepared all the necessary test equipment and called one of the participants to be tested. The three series of tests were carried out in one full day. All participants were in good health, and no one suffered any injuries at the time of data collection.

Statistical analysis

The first and second hypothesis testing in this study was analyzed using a simple correlation test. The third hypothesis is tested by multiple correlation tests. Before hypothesis testing was carried out, a normality test was first carried out as a Shapiro-Wilk test. Data analysis This research was conducted with the help of Microsoft Excel and SPSS version 25 applications.

Results

This study consisted of 54 participants, namely 31 men and 21 women, and their characteristics are shown in Table 1.

Table 1. Characteristics of the Participant

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age	54	18.00	19.00	18.91	0.29
Height	54	150	175	163.35	5.95
Weight	54	43	87	56.21	8.90

Before performing data analysis using Pearson correlation, data normality tests were first carried out using the Shapiro-Wilk test. The results showed a normal distribution with a p -p-p-value of 0.034 for the Hip Flex Variable, 0.09 for the arm muscle explosive power variable and 0.02 for the lob punch ability variable. Then, a multiple correlation analysis was performed to test the third hypothesis and obtained a value of $R = 0.71$. $P < 0.05$. Table 2 showed the statistical descriptive sex variable analysis of the research sample.

Table 2. Gender variable analysis

Statistics	Hip flexibility		Arm Muscle Explosive Power		Lob Abilitie	
	Woman	Man	Woman	Man	Woman	Man
Mean	43.80	41.42	4.31	4.32	52.95	55.53
Standard Deviation	4.35	4.18	0.31	0.29	6.57	6.45
Minimum	36	35	3.76	3.75	43	46
First quartile	40	38	4.05	4.21	48	50
Median	44.50	41	4.30	4.26	51.50	55
Third quartile	48.75	44.25	4.65	4.34	59.5	60.75
Maximum	50	50	4.90	5.06	64	68

Table 3. Results of the correlation test of research variables

Variable	N	Lob Abilities	p - Value
Hip flexibility	54	0.60	<0.05
Arm Muscle Explosive Power	54	0.62	<0.05

Discussion

The results of this study showed that there was a correlation between the explosive power of arm muscles and lob ability with an *r*-value of 0.62, which means that the level of relationship between the two variables is in the fairly strong category. This is in line with the results of previous research, which states that the ability of athletes to lob is needed to win the match. When players get a commensurate opponent in a match, then one point is mostly obtained by doing Long Relly. When doing Relly, many types of punches are made by players including lobs. Lob punches really require a lot of power, as well as smash. Players are required to be able to lift the shuttlecock as high as possible towards the back area of the opponent's court, this is so that the shuttlecock is not responsible and easy to smash by the opponent. Arm muscle strength is requested when lob, so that the resulting lob remains consistent with optimal results. The results revealed that the number of really that happened to the world's top players amounted to more than 14.40 strokes to produce one point (Qian et al., 2021). The explosive power of the arm muscles when performing a lob blow is indispensable. A study conducted by (França et al., 2021) states that athletes' performance will be much better when athletes have good explosive power because every punch made will be more optimal when compared to athletes who do not have good power. Explosive power is not closely related to VO2max. However, VO2 max plays a role in keeping muscles from experiencing fatigue too quickly so that the quality of the blow will be maintained (Ahsan & Ali, 2021).

In the second hypothesis, the results of this study showed that there is a correlation between hip flexibility and lob ability with an *r* value of 0.60 which means that the level of relationship between the two variables is in the reasonably strong category. This is in line with the results of previous studies, which stated that the level of flexibility of athletes will decrease with age. The flexibility they have must continue to be trained in order to be maintained (Martínez-Silván & Johnson, 2020; Antara et al., 2023). Similarly, badminton players must continue to train the flexibility of their waist and hands in order to make maximum lob strokes (Haryanto et al., 2023). Gender does not influence the level of flexibility owned, but the lower extremity has a role in supporting the level of waist flexibility (Kim et al., 2021). The results of another study conducted by (Ocarino et al., 2021) revealed that senior athletes have more substantial torque compared to young athletes. This is because senior athletes have had trained muscles for a more extended period compared to their juniors, but the flexibility of their hamstring and hip muscles has not changed. In addition, trainers must also be able to provide the right form of exercise methods so that the improvement of exercise results can be optimal (Umar et al., 2023; Loudcher & Fabian, 2020; Singh et al., 2022; Schweizer et al., 2011; Ceylan & Saygin, 2015).

In the third hypothesis, the results of this study showed that there was a correlation between arm muscle explosive power and flexibility with lob ability with an *R*-value of 0.71, which indicated that the level of relationship between the two independent variables with the dependent variable is in the strong enough category. This is in line with the results of previous research, which states that hip flexibility needs to be trained to support the movements to be carried out when exercising, including badminton. The flexibility of the back will be maximized if the hip muscles are stretched first with good stretching techniques so that the range of motion can be maximized when used when playing badminton. Of the several existing stretching techniques, vibration-assisted stretching has the most optimal impact in activating muscle function to become more flexible (Ko et al., 2020). Therefore, badminton coaches are advised to do this so that athletes who will train and compete can move with an optimal level of flexibility. The role of hip flexibility is also explained by research conducted by (Nourbakhsh et al., 2018), which explains that an athlete who has flexible hip muscles will help to produce strong power when making punches, including the type of lob punch in badminton. The power generated with the help of a flexible hip will be greater when compared to athletes who only hit using their hands.

The results of this research had implications for badminton coaches as well as players/athletes. A deep understanding of the role of arm muscle explosiveness and hip flexibility in supporting maximum lob ability will provide athletes and coaches with new insights. Training programs that have been made can be evaluated based on the recommendations of this research; in the future, trainers can improve exercise programs that have been designed by considering these two aspects of variables. In addition, a good understanding of a badminton coach about what are the physical aspects that will support good lob ability is also needed because the coach will be able to focus the exercise program and look for forms of exercise to increase the explosive power of arm muscles and plate flexibility to optimize the ability of the athlete, with the good of these two supporting variables, the accuracy, ability to control, and power to make lob strokes will increase. Furthermore, the insights from this study will also have implications for sports injury prevention. Coaches will be able to identify which areas need special attention when athletes make lob shots. Although this study has provided new knowledge about the sport of badminton, especially the determining factors to maximize lob strokes, the lack of samples involved in this study causes a lack of meaningfulness of generalization of research results.

Conclusions

The results of this study showed that the explosive power factor of arm muscles and hip flexibility has a reasonably close relationship with the ability to lob in badminton. Players who have good arm explosive power will have a solid and good quality lob shot, as well as good hip muscle flexibility will also support optimal lob ability. The player can prepare their shot maximally, and the players can also reduce the risk of injury when having a reasonable degree of flexibility. Muscles that are able to lengthen and shorten optimally will not be too stretched with the occurrence of injury. Badminton requires fast and agile movements, so muscle flexibility is needed to restore the shuttlecock quickly and maximally. Theoretically, the results of this study had an impact on the development of knowledge in the field of badminton sports training, especially in the element of physical condition; these two physical variables can be the basis for coaches to develop a comprehensive training program for their athletes. These two variables, if trained optimally by the coach, will make the quality of the athletes' lob shots more difficult for opponents to return during the match. Future research is recommended to investigate other physical aspects that are thought to have a relationship that is no less closely related to lob ability, as well as technical aspects that need attention. Physical and technical components are two components that complement each other and cannot be separated to support badminton athletes to their peak performance.

Conflicts of interest

The authors have no conflict of interest.

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