

EFFECTIVENESS OF SHADOW TRAINING USING BADMINTON STEPS APPLICATION IN INCREASING FOOTWORK AGILITY ON BADMINTON ATHLETE

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Abstract: The purpose of this study was to see how the effect of shadow training using the badminton step application on footwork agility. This research is experimental design. Research data collection was carried out by obtaining pre-test and post-test data with a sample of 10 athletes during the experimental study which was held at the UNJA Jambi Sports building. PB member. UNJA sampled in this study were over ten years old. Tohar's proposed 30-second leg exercise was used as an instrument in this investigation with a validity of 0.706 and reliability of 0.808. Data were analyzed quantitatively using normality and homogeneity tests and t-tests for hypothesis testing. Based on the results of the t-test, the researcher believes that giving shadow exercises using the badminton step application can make a good contribution because using the badminton step application can give orders to athletes during shadow training stably. The results showed that shadow training with badminton tank steps had an effect on footwork agility. Furthermore, the findings of the paired sample t-test on the pre-test and post-test data resulted in a value at -9000 with a significant (2-tailed) $0.000 < 0.05$, supporting this conclusion. So based on the data obtained T-count is -9000 and has a significance value of $0.000 < 0.05$. It can be concluded that shadow training with badminton has an effect on an athlete's footwork agility. Therefore, it can be concluded that shadow training affects the application of the badminton steps on footwork. There is a significant influence in increasing footwork agility using shadow exercises with the application of badminton steps. Based on the results of the t-test, the researcher believes that giving shadow exercises using the badminton step application can make a good contribution because using the badminton step application can give orders to athletes during shadow training stably.

Keywords: training, shadow, badminton, steps application, agility.

INTRODUCTION

The development of badminton is very rapid at this time and many new players have qualified to play qualities, therefore in Indonesia, they must develop existing programs so that they become better so that they can make badminton achievements in Indonesia superior. Seeing the development of badminton in Indonesia and supported by a qualified training center is overseen by the Indonesian Badminton Association in almost all cities and districts. Badminton schools or clubs are a place for early athletes to develop, and their existence is very important in producing young players who are expected to play badminton in the future. To achieve optimal achievements, badminton athletes must be nurtured gradually, both in schools, clubs, and training halls in their respective regions. The most significant factors in achieving adequate training results are training targets and training plans that are packaged in stages according to the skills of the athlete. Badminton is a game sport that can be played indoors or outdoors on a court with lines that vary in length and width. (Leong & Krasilshchikov, 2016), A badminton game is a rally game. The higher the level of play of an athlete, the longer the rally ball is played. Badminton is a difficult sport that requires good physical fitness while also having the second largest fan base in the world after football (Arganata, 2016). (Yudaparmita & Adnyana, 2021), argues that badminton is a sport in which players use a variety of beating tactics ranging from slow to fast, as well as deceptive moves. (Rusdiana et al., 2021), suggesting that badminton is two or four players competing in the racket sport of badminton on a rectangular court with a high net in the middle. Badminton is a game in which the player aims to drop the shuttlecock onto the opponent's court while defending the shuttlecock from falling on his court, (Hinda Zhannisa & Sugiyanto, 2015). (S. Nugroho et al., 2021), badminton requires good qualities of strength, endurance, flexibility, speed, agility, and coordination of movements. In the badminton game, agility is an essential aspect of achieving agility, which can be done with various kinds of exercises such as zig-zag

exercises, shuttle runs, squat jumps, squat thrusts, dogging runs, and shadows. However, in this study, the researchers discussed shadow exercises in doing shadow exercises there are various types of shadow exercises, shadow point movement exercises, shuttlecock taking practices, and shadow feather exercises (Muthiarani, 2017). In this study, researchers used shadow exercises using an application, namely the badminton steps application, guided by the application of shadow training to improve agility, there was no shadow training utilizing the application, this made the researchers confident in conducting this research. (Tyan, 2021), shadow is a movement without a ball whose activity is like playing a real game. This shadow exercise can improve agility. (T. Nugroho et al., 2018), activities performed quickly and precisely are what define agility (Marganda Limbong, 2021), agility is a movement that can make the legs move without losing balance.

To gain agility in training, one must know the purpose of the training, the overall goal of the training is to assist coaches, coaches, and sports teachers in using and developing conceptual abilities and skills to help players realize their full potential and achieve peak performance (Bompa & Buzzichelli, 2015). (Wea & Samri, 2022), suggest the purpose of training is to help athletes maximize their abilities and potential. The purpose of training is to improve the physical condition of an athlete to the maximum, (Nasrulloh et al., 2021, 2022; Wahyudi, 2018) According to (Bompa & Buzzichelli, 2015; Ichsan Sabillah et al., 2022), training is a way to perfect the ability of exercises that include theoretical and practical information, methods, and guidelines, to achieve goals on time. This is to the view that (Khomari, 2015), regular, directed, increased, and repetitive training loads are used to prepare children methodically, physically and cognitively to achieve optimal success.

In carrying out exercises, trainers must have training principles, namely according to (Bompa & Buzzichelli, 2015), including: (1) individual, (2) adaptation, (3) overload, (4) progressive load, (5) specifications, (6) varied, (7) warming up and cooling, (8) periodization, (9) reversibility (reverse), (10) moderate load (not excessive), (11) exercise must be systematic, and (12) long-term exercise. Furthermore, in a more specific and accurate training program, sports technology assistance is needed for coaches and athletes, (Muthiarani & Yuniana, 2021). (Sobko et al., 2020), Modern badminton is a demanding athletic sport requiring players to react rapidly, move fast across the court, and make snap judgments. Athletes must possess the agility to be able to achieve this.

In badminton, agility is the aspect that supports achievement that has the most influence according to (Muthiarani & Yuniana, 2021). Agility is defined as the ability to change posture quickly and with good coordination. (Fauzi et al., 2020; Gumantan & Mahfud, 2020), agility is the ability to change direction quickly, which is an essential element possessed by athletes. Agility is a physical ability that a badminton athlete must have to compete, (Karyono & Paluris, 2022). In badminton, agility refers to the ability to change direction precisely and quickly and move the body from side to side, (Gunawan & Elfry, 2021). Agility training is an exercise that is used by athletes in various sports, (Kusminto et al., 2021). Agility is defined as the ability to change direction quickly and be able to also keep the body in balance, (Maryono et al., 2017). (Özgür & Hotaman, 2020), The ability to use various racquet techniques, in addition to physical and physiological factors, is a requirement for the highest performance in badminton, but from that the agility of a strong contribution in supporting achievements.

Agility is the ability to quickly change the direction of movement of the body or body parts. Agility is the ability to change direction and position without losing balance quickly. Because agility is a very influential aspect of badminton, obtaining agility that can support the achievements of athletes requires the proper training methods. (Rahmat Putra Perdana dkk, 2018), agility is defined as the ability to change postures quickly and with solid coordination, indicating that a person's agility is quite good. To have good agility, you can train with shadow exercises, namely shadow exercises that are done without using a ball, Shadow is a shadow movement exercise that steps forward, sideways, and backward without using a shuttlecock According to (Budi & Malang, 2020), badminton shadow practice is done only by hitting the shadow instead of the shuttlecock. (Marpaung & Manihuruk, 2017), Shadow steps are footwork exercises that modify body position to make it easier for players to hit the shuttlecock in its position while on the court Shadow training is a badminton exercise that imagines the movements of the game, (Suhartik et al., 2022). (Wismanadi et al., 2020), shadow training is an exercise in hitting and chasing the shuttlecock as in the actual game but without a shuttlecock. (Rahman & Warni, 2017), Shadow training is a movement exercise on the badminton court without a shuttlecock by performing movements like in a game. Even though the shadow is created just by hitting the shadow, the movements are identical to badminton games, including the movement of running after the shuttlecock to the right, left, forward, or backward, stepping quickly, jumping to perform a jump smash, and

simultaneously hitting the shadow shuttlecock. In this study, researchers used shadow exercises using an application, namely the badminton steps application, to give a signal that the type of exercise was included in the type of shadow point movement exercise, (Muthiarani, 2017), shadow point movement is giving vocal commands and hand signals to direct. The movement of players around the badminton court is known as point shadow movement.

The application used is the badminton steps application, badminton steps is an application developed by Oranda Apps used to improve agility in playing badminton, this application provides badminton footwork training using random shadow footwork exercises to improve agility. Using this application to provide the agility of the athlete's foot requires accuracy and foresight from the coach in compiling a program to be given to athletes.

In doing shadow exercises, it can be done by stepping movements into the corner of the field. Footwork can be practiced in various methods, including holding the shuttlecock in a particular position and moving/stepping in on certain direction (shadow movement). Shadow badminton is a mental activity where you imagine yourself playing badminton. In badminton there are six target areas of footwork, namely (1) movement to the left of the face, (2) movement of the face to the right, (3) movement to the left side, (4) movement to the right side, (5) movement to the right and to the left. Back, and (6) movement to the left and back, (Poole, 2013).

Looking at previous studies that are relevant to the researcher's research, the first study (Rahman & Warni, 2017) entitled "influence of shadow 8 exercise on agility in badminton players. Mustika Banjarbaru Ages 12 – 15 Years" and the second study (Marpaung & Manihuruk, 2017) entitled "the effect of shadow training on increasing agility in badminton game" and the third study (Saputra, 2020) entitled "the effect of shadow exercise on increasing agility badminton athletes. Fifty City", from the three previous studies that the researcher compared with the research to be conducted, there are several things that distinguish the first different research subjects, and that makes the researchers believe and really want to do this research because from the three previous studies in giving treatment or giving exercise there is no there are those who use the application of these differences, researchers are very confident in conducting this research. The purpose of this study, firstly, the researcher wants to provide a new type of exercise to athletes to improve footwork agility and the researcher will obtain data on how much influence the badminton steps application has in improving footwork agility.

The problems today in the field are the lack of footwork agility or athlete's footwork, unprogrammed forms of exercise, not varying the provision of footwork exercises, and lack of physical training and footwork exercises. Footwork is essential in badminton, according to (Kardani & Rustiawan, 2020), In the badminton game, footwork is a fast and precise movement, and footwork is essential. (Taufik, 2015), footwork is defined as foot movement that regulates body position to make it easier to produce action hits based on that position. Footwork in badminton is the core foundation of the overall badminton movement, (Huang & Zhang, 2021). footwork is the most basic badminton skill that athletes must possess, requires the ability to accelerate or slow down and change direction on the court, and is associated with accurate shooting and improved game performance, (Chiu et al., 2020).

The analysis results require training adjustments for athletes and providing variations in training so that training is not monotonous for athletes. From the author's observations and interviews with the trainer, PB. UNJA, which is centred on training in the Jambi PORKES building, lacks leg agility or footwork due to less than optimal training and often not achieving the program targets carried out in training. The unprogrammed form of exercise and the lack of focus in providing training causes a decrease in the athlete's physical condition, impacting reduced leg agility and significantly impacting the decline in athlete achievement. Physical exercise is an essential exercise to improve skill, lack of physical exercise, footwork training and not varying the provision of exercise is one of the causes of decreased achievement. This study aims to see the effect of shadow training using the badminton steps application on footwork agility.

MATERIALS AND METHODS

According to Sutrisno Hadi (Mardian, 2020), the experimental technique is an activity that involves pre-test, practice, and post-test. Each experiment must compare at least two or more groups as the main activity in a scientific investigation. Experimental research, is research conducted to see how a treatment (treatment) or independent variable (variable x) affects the dependent variable (variable y). This study project tries to see how the independent variable of therapy involves the dependent variable or the symptoms of a particular group compared to other groups using other treatments. This study uses a pre-test (T1) to determine a player's initial ability. This study was carried out after the pre-test was completed (X). Researchers conducted a final test after treatment (T2). The outcome of the

treatment was determined using pre-and post-testing. Pre-test and post-test were used in this study.

The place of this research is located in the PB hall. UNJA Jambi. This research was conducted for approximately four weeks, starting after obtaining a research permit. Implementation in 1 week, there are four meetings. The population used in this study were PB athletes. UNJA consists of 15 athletes. From this population, a sample of 10 athletes was obtained from the conditional sampling technique, namely those aged over 10-18.

Collecting data in this study using a measurement test, the test instrument used for collecting initial data (pre-test) and final data (post-test) using a foot exercise test, Tohar designed a series of leg exercises used to collect data in this investigation with validity. 0.706 and 0.808 reliability. The data collected in this study were data (pre-test) from the number of athletes who performed a series of footwork tests for 30 seconds and data (post-test) from the number of athletes who performed a series of footwork tests for 30 seconds after the sample was treated with the method shadow training using the badminton steps application badminton steps.

Data analysis technique using t-test. The data analyzed were the data on the 30-second leg exercise test and before and after the test. The analysis in this study uses parametric statistics by using the help application, namely the IBM SPSS statistic 25 application. Normality and homogeneity tests are essential tests in this study. The purpose of the normality prerequisite test is to ensure that the data is standard or not so that the data analyzed is by the tests to be carried out using SPSS 25 with the normality test using the Kolmogorov-Smirnov with a significant level of 5%. If the statistical significance is more significant than 0.05, the data is normally distributed; however, if the statistical significance is less than 0.05, the data are not normally distributed.

The homogeneity test is the second test required and checks whether the pre-test and post-test data are similar. With the help of the SPSS 25 program, the homogeneity test in this study used the Levene test with a significant level of 5%. If the significant level is greater than 0.05, the data is homogeneous or has the same variance. Still, if the significance level is less than 0.05, the data is not homogeneous or has a different variance.

This research aims to see the effect of shadow training using badminton steps application on footwork agility. To determine whether exercise has an effect, it must be analyzed using paired sample t-test or independent t-test with a significant level of 5%, namely by comparing the data from the pre-test to the data from the post-test results. Data analysis used SPSS 25 and paired sample t-test or independent t-test. If the significant count is less than 0.05, Ho is rejected, and Ha is allowed, so it can be concluded that exercise affects footwork agility. On the other hand, if the signature count is more than 0.05, then Ho is accepted, and Ha is rejected, and it can be stated that the exercise does not affect footwork agility in badminton athletes. The results of the paired sample t-test on the data from the pre-test and post-test results are shown below.

RESULT

The results of the study can be seen in Table 1, the results of increasing shadow training using the badminton steps application.

Table 1. The results of the pre-test, post-test, improvement, and average (mean)

No	Pre-test	Post-tes	enhancement
1	11	12	1
2	8	9	1
3	12	14	2
4	10	12	2
5	9	11	2
6	12	13	1
7	16	18	2
8	15	17	2
9	12	13	1
10	10	11	1
Mean	11,5	13	1,5

Based on the statistical analysis data in Table 1, it can be seen that the average pre-test is 11.5, the average post-test result is 13, and an increase in the mean from pre-test to post-test was 1.5.

Table 2. Normality Test Results

Data	Kolmogorov-Smirnov ^a			
	Statistic	Df	Sig.	
Learning outcomes	pre test	.221	10	.182
	post test	.200	10	.200*

Based on the data above, the test data from the pre-test results of the six-elbow agility in badminton athletes were normalized by the Kolmogorov-Smirnov method, which was carried out with the help of SPSS 25. The significance was 0.182, and the statistical significance of the post-test data was 0.200. The statistical significance of all these data is greater than 0.05, which is the tolerance level for the Kolmogorov-Smirnov normality test, implying that the data in this study are normally distributed.

Homogeneity Test

The homogeneity test is a preparatory test in this study that determines whether the pre-test and post-test data are similar. With the help of the SPSS 25 program, the homogeneity test in this study used the Levene test with a significant level of 5%. If the considerable level is greater than 0.05, the data is homogeneous or has the same variance. Still, if the significance level is less than 0.05, the information is not homogeneous or has a different conflict.

Table 3. Homogeneity test results

No	Data	Sig Count	Sig	Information
1.	Pre-Test	0.893	0,05%	Homogen
2.	Post Test	0.896	0,05%	Homogen

Based on the data above, regarding the normality test using SPSS 25, the results of the pre-test sig-count of 0.893 and post-test sig-count 0.896 from the two data obtained were greater than 0.05, so the data in this study were homogeneous.

Hypothesis testing

This research aims to see the effect of shadow training using badminton steps application on footwork agility. To determine whether exercise has an effect, it must be analyzed using paired sample t-test or independent t-test with a significant level of 5%, namely by comparing the data from the pre-test to the data from the post-test results. Data analysis used SPSS 25 and paired sample t-test or independent t-test. If the significant count is less than 0.05, then Ho is rejected, and Ha is allowed, so it can be concluded that the exercise affects footwork agility if the signature count is more than 0.05, then Ho is accepted, and Ha is rejected, and it can be stated that the exercise does not affect footwork agility. The results of the paired sample t-test on the data from the pre-test and post-test results are shown below.

Table 4. Uji t paired samples test

	Paired Samples Test			Information
	t	Sig.	Sig 5%	
Pre-test	-9.000	0.000	0,05	Sig.
Post test				

The conclusion of the hypothesis test above shows that the value of sig (2 tailed) is 0.000, which indicates that sig is less than 0.05. This means that Ho is rejected and Ha is accepted, which means that there is an effect of exercise on footwork agility.

DISCUSSION

Exercise is an activity that is carried out continuously and programmed to get better results than before doing the exercise. (Aprilia et al., 2018), Exercise is a systematic process of practicing or working that is done for some time in a structured manner. (Tamim, 2017), in carrying out training, athletes must master various aspects that can help them achieve their goals, such as physical, technical, tactical, and mental conditions. To be able to achieve optimal performance, training must focus on elements of strong physical, technical, tactical, or mental development, (Fansuri & Situmeang, 2021). In the exercise, there are also training goals and objectives, namely to improve the abilities and perfect the potential possessed by the athletes who are fostered. The purpose of training is to implement concepts and programs for athletes to achieve peak performance, (Bompa & Buzzichelli, 2015). The main purpose of training is to shape and help athletes achieve the best performance/ability, (Firdaus Soffan Hadi, 2016). Various variables in badminton support the success of playing, including tactics, technique, and physicality. In the physical aspect, according to Sapta Kunta (Sumintarsih, 2012), badminton players are needed to develop physical components, one of which is talent. Agility or Agility is the ability to quickly and decisively shift the direction and position of one's body while moving without losing balance. Agility relates to balance and helps cover the field by changing direction rapidly, (Ahmed et al., 2022).

In the world of badminton, agility is very important for athletes to have because to be able to catch the shuttlecock provided by the opponent with fast movements, agility is needed. (Hotwani, 2021), agility is a movement with high intensity leading to an explosive movement pattern. Agility to change body position quickly and correctly without losing balance when moving sequentially in a short time, followed by strengthening intrinsic muscles, (Hermilasari et al., 2020). Get agility can be trained with the shadow training method: shadow training is an exercise that is done without using the ball, which is done the same as playing. (Yudaparmita & Adnyana, 2021), shadow training is instructing athletes or giving instructions to athletes to make movements to the corners of the field, like playing for real without using the ball. (Winarno, 2019), shadow badminton is a movement without a shuttlecock carried out from one place to another. From the explanation above, the researcher tried to compare the research conducted by the researcher with a similar study, the first research was conducted by (Gunawan & Elfry, 2021) entitled "effort to improve agility through shadow exercise at the athletes of the blutanline union with Kartini Malang, the results showed that the exercise shadow improves agility, speed, and balance, in the study Gunawan and Elfry used shadow training, but it was not explained what type of shadow exercise was applied ". The second research is a study conducted by (Marpaung & Manihuruk, 2017) entitled "the effect of shadow training on increasing agility in badminton games, in carrying out shadow training in Marpaung and Manihuruk's research it is also not explained what type of shadow exercise is used", compared with research conducted by researchers, the shadow exercise given is a type of shadow point movement exercise using an application called badminton steps, this application gives orders in the form of directions to be followed by athletes.

Based on the research, the average pre-test result was 11.50, and the average post-test result was 13.00 and the average increase after treatment was 1.5. In the normality test, the results from Kolmogorov-Smirnova are taken, namely, the sig value with the provision that if the sig value > 0.05 , then the data is normally distributed and vice versa if the sig value < 0.05 , then the information is not normally distributed, in this study the researchers obtained the results The pre-test sig value is 0.182 and the post-test sig value is 0.100, the results of the two data > 0.05 , it can be concluded that the data is normally distributed.

The results of the pre-test sig-count of 0.893 and the post-test sig-count of 0.896 from the two data obtained using SPSS 25 were greater than 0.05, indicating that the data in this study were homogeneous. After knowing the data from this study is homogeneous, the new researcher can choose a follow-up test that will be used to get the results of whether shadow using the badminton steps has an effect or not. The result of the t-value is -9000 with a significant (2-tailed) count of 0.000 when the data from the paired sample t-test are confronted with data from the pre-test and post-test findings. Based on the paired-sample t-test, H_0 is rejected, and H_a is accepted, indicating that the shadow practice of badminton steps application has an effect.

CONCLUSION

Based on the discussion and conclusions from the results of research data on the impact of shadow training using the badminton steps application on footwork, researchers explore the most important aspects that support athlete

achievement, one of which is footwork agility. Improve footwork agility which gives significant results by using the badminton steps application; this application also makes it easier for coaches to provide shadow training programs that will provide footwork agility which is the essential aspect in supporting achievement in badminton then this research can have implications for: Motivation and knowledge of coaches will use the application of badminton steps to apply shadow training in training programs to improve the agility of badminton athletes' footwork, their motivation, and knowledge of athletes to look for other methods to improve the footwork agility of badminton athletes, as a suggestion for PB coaches. UNJA and agility training guidelines have been designed to be developed in various forms to improve footwork agility. There is a significant influence in increasing footwork agility using shadow exercises with the application of badminton steps. Based on the results of the t-test, the researcher believes that giving shadow exercises using the badminton step application can make a good contribution because using the badminton step application can give orders to athletes during shadow training stably.

Disclosure statement

No author has any financial interest or received any financial benefit from this research.

Conflict of interest

The authors state no conflict of interest.

REFERENCES

- Ahmed, S., Saraswat, A., & Esht, V. (2022). Correlation of core stability with balance, agility and upper limb power in badminton players: a cross-sectional study. *Sport Sciences for Health*, 18(1), 165–169. <https://doi.org/10.1007/s11332-021-00789-w>
- Aprilia, K. N., Kristiyanto, A., & Doewes, M. (2018). Analysis of the application of training principles to improving the physical condition of PPLOP badminton athletes in Central Java in 2017/2018. *Journal Power Of Sports*, 1(1), 55–63. <https://doi.org/10.25273/jpos.v1i1.2210>
- Arganata, M. A. (2016). Indonesian Men's Doubles Badminton Defeat from Korean Men's Doubles Player. *Jurnal Kesehatan Olahraga*.
- Bompa, T., & Buzzichelli, C. (2015). *Periodization Training for Sports-3rd Edition*. <https://books.google.com/books?id=Zb7GoAEACAAJ&pgis=1>
- Budi, I., & Malang, U. (2020). Ratio of interval training in shadow badminton training ratio of interval training in shadow badminton training. *Journal Sport Area*, 186–198.
- Chiu, Y. L., Tsai, C. L., Sung, W. H., & Tsai, Y. J. (2020). Feasibility of smartphone-based badminton footwork performance assessment system. *Sensors (Switzerland)*, 20(21), 1–11. <https://doi.org/10.3390/s20216035>
- Fansuri, H., & Situmeang, R. (2021). Contribution of variation of ladder drill training to badminton athlete's agility. *Jurnal Olahraga Dan Kesehatan Indonesia*. <https://doi.org/10.55081/joki.v1i2.308>
- Fauzi, M., Wiriawan, O., & Khamidi, A. (2020). Effect of Hiit and Saq Training on Agility and Speed. *Multilateral Jurnal Pendidikan Jasmani Dan Olahraga*, 19(2), 146. <https://doi.org/10.20527/multilateral.v19i2.8910>
- Firdaus Soffan Hadi, D. (2016). The Effect of Ladder Drills Exercise on Increasing the Agility of U-17 Students at the Jajag Football Association, Banyuwangi Regency. *Jurnal Pendidikan Jasmani*, 26(1), 213–228.
- Gumantan, A., & Mahfud, I. (2020). Development of Agility Measurement Test Tools Using Infrared Sensors. *Jendela Olahraga*, 5(2), 52–61. <https://doi.org/10.26877/jo.v5i2.6165>
- Gunawan, A., & Elfry. (2021). Efforts to improve agility through shadow training for badminton union athletes with Kartini Malang. *Jurnal Pendidikan Jasmani Khatulistiwa*, 1–6. <https://doi.org/10.26418/jpjk.v2i1.47112>
- Hermilasari, Irianto, & Gondo, A. A. (2020). The effects of eccentric strengthening exercises on foot alignment change, malleolus height and agility level of junior badminton players in Makassar. *Enfermeria Clinica*, 30, 104–110. <https://doi.org/10.1016/j.enfcli.2019.07.045>
- Hinda Zhannisa, U., & Sugiyanto, F. (2015). Model of Physical Test for Talent Scouting in Badminton Skill Under 11 Years Old in DIY. *Jurnal Keolahragaan*, 3(1), 117–126. <https://doi.org/10.21831/jk.v3i1.4974>
- Hotwani, R. (2021). Impact of Strength and Plyometric Training on Agility, Anaerobic Power and Core Strength in Badminton Players. *Journal of Medical Pharmaceutical and Allied Sciences*, 10(4), 3254–3258. <https://doi.org/10.22270/jmpas.v10i4.1300>
- Huang, W., & Zhang, F. (2021). Application of Core Strength Training in Badminton Footwork Teaching with Computer Aid. *Journal of Physicists: Conference Series*, 1992(2), 22091. <https://doi.org/10.1088/1742-6596/1992/2/022091>
- Ichsan Sabillah, M., Tomoliyus, Nasrulloh, A., & Yuniana, R. (2022). The effect of plyometric exercise and leg muscle strength on the power limb of wrestling athletes. *Journal of Physical Education and Sport ® (JPES)*, 22(6), 1403–1411. <https://doi.org/10.7752/jpes.2022.06176>
- Kardani, G., & Rustiawan, H. (2020). Comparison of the results of shuttle run training with shadow training on footwork agility in badminton. *Jurnal Keolahragaan, Universitas Galuh*, 6(2), 105–111. <https://doi.org/10.25157/jkor.v6i2.4935>
- Karyono, T. H., & Paluris, D. S. (2022). The Effect of Basic Movement Training on Changing Places on Badminton Athletes' Agility. *Jurnal Olahraga Prestasi*, 18(1), 17–21.
- Khomari, M. G. P. E. dan A. (2015). The Effect of Playing Reaction Lights on the Agility of Footwork (Footwork) Participants of the Serulingmas Badminton School Age 12-17 Banjarnegara 2014. *E-Journal Pendidikan Jasmani Kesehatan Dan Rekreasi, Vol. 4*(No.07).
- Kusminto, P. T., Kusnanik, N. W., & Mintarto, E. (2021). Effect of Box Drill and Jump Drill Training on Agility and Speed. *Jurnal Ilmiah Mandala Education*, 7(1), 39–48. <https://doi.org/10.36312/jime.v7i1.1690>
- Leong, K. A. H. L., & Krasilshchikov, O. (2016). Match and Game Performance Structure Variables in Elite and Youth International Badminton

- Players. *Journal of Physical Education and Sports*, 16(2), 330–334. <https://doi.org/10.7752/jpes.2016.02053>
- Mardian, R. (2020). The Effect of Passing to the Wall and Pairing Practices on Volleyball Down Passing Skills. *Jurnal Cerdas Sifa Pendidikan*, 3(2017), 54–67.
- Marganda Limbong, D. (2021). Effect of Exercise With Reaction Lights and Shuttle Run on Footwork Agility in PB Badminton Participants. Tj Achievement Tebo. *Indonesian Journal of Sport Science and Coaching*. <https://doi.org/10.22437/ijssc.v3i2.15621>
- Marpaung, D. R., & Manihuruk, F. (2017). The Effect of Shadow Training on Increasing Agility in Badminton Games. *Jurnal Ilmiah Ilmu Keolahragaan*, 3(1), 40–50.
- Maryono, Rahayu, S., & Rustiana, E. R. (2017). Agility Training Methods and Ankle Flexibility on Dribbling Skills. *Journal of Physical Education and Sports*, 6(1), 66–71.
- Muthiarani, A. (2017). *The effect of shadow training using sequential steps and crossed steps on footwork agility of PB badminton athletes. Wiratama Jaya, Yogyakarta* (Vol. 4).
- Muthiarani, A., & Yuniana, R. (2021). The effect of shadow training using sequential steps and cross steps on badminton athlete's footwork agility. *Jurnal Keolahragaan*, 9(1), 108–117. <https://doi.org/https://doi.org/10.21831/jk.v9i1.32256>
- Nasrulloh, A., Deviana, P., Yuniana, R., & Pratama, K. W. (2021). The Effect of Squat Training and Leg Length in Increasing the Leg Power of Volleyball Extracurricular Participants. *Teoriâ Ta Metodika Fizičnogo Vihovannâ*, 21(3), 244–252. <https://doi.org/10.17309/TMFV.2021.3.08>
- Nasrulloh, A., Prasetyo, Y., Nugroho, S., Yuniana, R., & Wahyudin Pratama, K. (2022). The effect of weight training with compound set method on strength and endurance among archery athletes. *Journal of Physical Education and Sport ® (JPES)*, 22(6), 1457–1463. <https://doi.org/10.7752/jpes.2022.06183>
- Nugroho, S., Nasrulloh, A., Hadi Karyono, T., Dwihandaka, R., & Wahyudin Pratama, K. (2021). Effect of intensity and interval levels of trapping circuit training on the physical condition of badminton players. *Journal of Physical Education and Sport ® (JPES)*, 21, 1981–1987. <https://doi.org/10.7752/jpes.2021.s3252>
- Nugroho, T., Pinatih, G. I., Munawwarah, M., Sri Handari Adiputra, L. M. I., Griadhi, I. P. A., & Irfan, M. (2018). The addition of Core Stability Combination Exercises in Footwork Exercises Increases Agility of Women's Badminton Players Pb. Puma Mas Madiun. *Sport and Fitness Journal*, 6(1), 83–90. <https://doi.org/10.24843/spj.2018.v06.i01.p11>
- Özgür, B., & Hotaman, F. (2020). Relationship between some motoric and technical performance characteristics of u17 turkish national badminton players. *Journal of Physical Education and Sport*, 20(3), 2205–2212. <https://doi.org/10.7752/jpes.2020.s3296>
- Poole, J. (2013). *Belajar Bulutangkis*. Bandung, CV Pionir Jaya.
- Rahman, T., & Warni, H. (2017). The effect of shadow 8 training on agility in PB badminton players. Mustika Banjarbaru aged 12-15 years. *Multilateral Jurnal Pendidikan Jasmani Dan Olahraga*. <https://doi.org/10.20527/multilateral.v16i1.3660>
- Rahmat Putra Perdana dkk. (2018). Factor Analysis of Arm Muscle Power, Leg Muscle Power, Flexibility, Eye-Hand Coordination, Reaction Speed and Agility in Male Students of Badminton Achievement Development at Tunas Pembangunan University in Surakarta City. *Surakarta*, 1, 5. <https://doi.org/10.1128/AAC.03728-14>
- Rusdiana, A., Razali, M., Abdullah, B. I. N., Syahid, A. M., & Haryono, T. (2021). Original Article Badminton overhead backhand and forehand smashes : a biomechanical analysis approach. *Journal of Physical Education and Sports*, 21(June), 1722–1727. <https://doi.org/10.7752/jpes.2021.04218>
- Saputra, T. W. (2020). The effect of shadow training on increasing the agility of badminton athletes PB. Fifty cities. *JURNAL STAMINA*.
- Sobko, I., Zharkova, Y., Vitsko, S., Zhukov, V., & Tsapko, A. (2020). Formation of doubles and mixed categories in Badminton using multivariate analysis methods. *Journal of Physical Education and Sport*, 20(6), 3138–3145. <https://doi.org/10.7752/jpes.2020.s6425>
- Suhartik, Harwanto, & Sumardi. (2022). The effect of shadow training on the accuracy of badminton forehand smash in class X MA Darul Ulum Waru Sidoarjo. *STAND : Journal Sports Teaching and Development*. <https://doi.org/10.36456/j-stand.v2i2.4945>
- Sumintarsih. (2012). Principles and Exercise Programs to Improve Physical Fitness. *Proceeding Seminar Nasional PPs UNY*, 425–434.
- Tamim, M. H. (2017). The effect of training methods (reciprocal and inclusion) on kinesthetic perception on the badminton overhead lob forehand technique. *Jurnal Keolahragaan*, 5(1), 71. <https://doi.org/10.21831/jk.v5i1.12806>
- Taufik, K. (2015). The effectiveness of footwork training compared to shadow training on agility in badminton players. *Jurnal Pendidikan Olahraga Dan Kesehatan*.
- Tohar. (1992). *Sports Choice Badminton*. Semarang: IKIP Semarang.
- Tyan, N. A. (2021). Comparison of Shadow Exercises with Multiball Exercises on the Frequency of Forehand and Backhand Table Tennis in Extracurricular at SD Supriyadi Semarang. *Journal of Physical Activity and Sports (JPAS)*. <https://doi.org/10.53869/jpas.v2i1.33>
- Wahyudi, A. N. (2018). The effect of high intensity interval training (hiit) and circuit training on speed, agility, and leg muscle power. *Journal of Sport and Exercise Science*, 1(2).
- Wea, Y. M., & Samri, F. (2022). The Effect of Plyometric Depth Jump Exercise on the Ability to Do Jumping Smash in Badminton Game. *JURNAL PENJAKORA*, 9(1), 19–24. <https://doi.org/10.23887/penjakora.v9i1.45977>
- Winarno, W. (2019). Efforts to Increase Foot Speed Through Shadow Badminton Method in Badminton Game. *Jp.Jok (Jurnal Pendidikan Jasmani, Olahraga Dan Kesehatan)*, 2(2), 36–47. <https://doi.org/10.33503/jpjok.v2i2.446>
- Wisnadi, H., Kafrawi, F. R., Pramono, M., Firmansyah, A., & Rusdiawan, A. (2020). Ratio of Interval Training in Shadow Badminton Training to Power and Speed. *Journal Sport Area*. [https://doi.org/10.25299/sportarea.2020.vol5\(2\).5019](https://doi.org/10.25299/sportarea.2020.vol5(2).5019)
- Yudaparmita, G. N. A., & Adnyana, K. S. (2021). Improving agility through the application of shadow training in physical education learning badminton material. *Jurnal StahnM Pukuturan*, September, 56–64.

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