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# THE EFFECT OF PLYOMETRIC TRAINING METHODS ON THE RESULTS OF START JUMP DISTANCE IN THE SPORT OF SWIMMING

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***Abstract***
*Plyometrics is an explosive physical training method used to increase power output, force production, and speed. Plyometrics is a way to push muscles to achieve maximal strength quickly and thus serves to increase explosive-reactive power through a variety of movements and is a popular training approach. Therefore, plyometric training is expected to have an effect on the results of the starting jump distance, and researchers aim to study more deeply the effect of plyometric training on the results of the starting jump distance in swimming. This study uses a quantitative approach with an experimental method with a One Group Pretest-Posttest Design research design. The population in this study involved 70 Tritons swimming club athletes located at the Horizon Swimming Pool, Bandung City, then the sample used was 15 people selected using purposive sampling techniques, with the instruments used being taken from the results of measuring the distance of the swimming start jump with the Kinovea application. The data were processed and analyzed using a normality test withShapiro Wilkthen analyzed using the T test with SPSS 25. The T test value is with a Sig. (2-tailed) value of 0.000, based on the test results, the Sig. (2-tailed) value <.05 so that H0 is rejected. then it can be concluded that there is a significant influence between plyometric training on the results of the start jump distance of swimming sports. Thus, because of this significance, it can be seen that plyometric training can affect the start jump distance of swimming sports.*
***Keywords:*** *plyometrics, jump start distance, swimming*

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## INTRODUCTION

The short starting distance is often experienced by swimmers and can have a major impact on their performance. According to (Rifandi & Syahara, 2019) starting is an important skill that must be trained so that the fall distance can be maximized because starting is the best way to enter the pool to start a swimming race, whether freestyle, breaststroke, butterfly, or backstroke. A slow starting

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jump can cause an incorrect starting position in the race (Benjanuvatra et al., 2007). Research shows that athletes who do not have sufficient leg muscle strength or explosive power will have difficulty producing a strong and fast jump when starting (Matúš et al., 2022). Therefore, to achieve better starting performance, swimmers must maximize the horizontal speed generated during the on-block phase when entering the water and reduce the amount of deceleration during the underwater phase (Naemi & Sanders, 2008). In recent years, the starting techniques commonly used are grab start and track start. Competitive swimmers tend to use one of these two diving techniques, namely the track start (Chueh-yu, 2012). Swimmers can move their center of mass more forward in the water in a track start compared to a grab start and thus have a shorter distance covered during the block start phase (Blanksby et al., 2002).

Grab start is done by placing both feet in front of the block and hands holding the front edge of the block, while the track start places one foot on the front edge of the block and the other foot on the back of the block (Chueh-yu, 2012). In another explanation, it is explained that the starting technique has changed over time, and swimmers can now place 1 foot (track start) or 2 feet (grab start) on the front edge of the block (Krüger et al., 2002). Research shows that track start tends to produce a longer jump distance than grab start, thanks to a more optimal take-off angle (Holthe, Michael J.; McLean, 2001). Swimming start is highly dependent on the strength and explosive power of the leg muscles, especially during the initial push from the starting block. In fact, muscle strength and power (e.g. jumping from the starting block and turning in swimmers) play a relevant role in competitive performance (Taladriz et al., 2016). There are several training methods to increase leg muscle strength, one of which is plyometric training (Cañas-Jamett et al., 2020). Plyometric training can greatly influence how well an athlete starts a swim. Athletes who do not have good leg strength will not get the best results from their starts (Gemaini et al., 2023).

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Plyometrics is an explosive physical training method used to increase power output, force production, and speed. Plyometrics is a method of rapidly pushing muscles to maximal force and thereby serves to increase explosive-reactive power through a range of motion and is a popular training approach (Lockwood & Brophey, 2004). It has been shown to be effective in increasing the force-generating potential of explosive-reactive movements (Bishop et al., 2009). Several studies have examined the effects of plyometrics in swimming, which may have sport-specific benefits for kicking propulsion and horizontal force (Cossor et al., 1999). Increases in horizontal force (7%) and horizontal takeoff velocity (16%) had significant performance implications for start time and fall rotation (Potdevin et al., 2011). A period of rapid concentric contraction in the muscle following rapid eccentric lengthening of the muscle fibers under load increases the force produced by the muscle (Vaczi et al., 2013). Some support for the potential role that strength and power may play in swimming starts comes from the sprinter literature where studies have shown that lower body strength is a major determinant of starting performance in sprinting (Cronin & Hansen, 2005).

The effects of plyometrics can improve physiological qualities that indicate increased sports performance (speed, strength, and power) if utilized and trained properly (Utamayasa et al., 2020). In addition, plyometrics allows the networkThe connective tissues and muscle fibers become more elastic, so that the muscles can store energy during the deceleration phase and release it during the acceleration phase (Asmussen & Bonde-Petersen, 1974). Plyometric training can also increase the athlete's reaction speed top start signal (Clutch et al., 1983). Plyometrically trained athletes have a nervous system that responds more quickly to signals or instructions, allowing them to react more quickly after the start signal. This gives them an advantage in the race. All of these muscles are essential for producing a strong initial push when starting the swim. However, although the benefits of plyometric training are clear, its application is still rarely carried out in

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several swimming clubs. According to (Pereira et al., 2023) that providing plyometric training is very important for swimmers because it can affect the quality of their start. Previous studies have applied plymetric training in several swimming clubs but the Tritons Swimming Club rarely applies plyometric training to increase the starting jump distance. In previous studies according to (Rebutini et al., 2016) plyometric training can have an effective impact on the results of swimming start jumps and is known to be a solution to the problem of lack of start jump distance results. According to (Robinson et al., 2004) the effect of plyometric training on swimming has special benefits for kicking and horizontal jumps at the start. In previous research conducted by (Fischetti et al., 2018) providing plyometric training can cause a greater increase in speed and explosive strength of the lower legs, of course this can be applied to the sport of swimming. So the novelty of this study is by implementing plyometric training at the Tritons Swimming Club. Overall, increasing leg muscle strength through plyometric training can contribute significantly to the results of jump starts in swimming. Therefore, it is important for coaches and athletes to consider this training method in their training programs to achieve optimal performance when doing swimming starts.

Swimming is a competitive sport or exercise performed at an individual or team level that requires a person to move their entire body through water without using any other elements other than arm and leg movements (ÖZKADI et al., 2022). The sport is practiced in swimming pools or open water (such as the ocean or a lake). Competitive swimming is one of the most popular sports in the Olympic Games (Pyne & Sharp, 2014). Competitions for breaststroke, backstroke, butterfly, freestyle, and medley are held individually. For team events, four swimmers can compete in freestyle or medley. Competitive swimming is a unique sport. Athletes must push against a liquid, not a solid, to propel their bodies forward while competing in a fluid environment, almost in a “hanging” position (ÖZKADI et al., 2022).

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## METHOD

This study uses a quantitative approach with an experimental method with a One Group Pretest-Posttest Design research design. The population used in this study were as many as 70 Tritons swimming club athletes located at the Horizon Swimming Pool, Bandung City, and the sampling technique used in this study was purposive sampling. In this study, the sample was Tritons Swimming Club athletes totaling 15 athletes, with the criteria, athletes are age group 1 (KU1), have trained for at least 3 years, have participated in at least 3x competitions at the provincial or national level. The location of the study was carried out at the Horizon Hotel swimming pool in Bandung City, then in this study the instrument was taken from the results of measuring the distance of the swimming start jump with the Kinovea application.

Dataobtained at the beginning of the experiment as initial data and at the end of the experiment as final data. The data that has been collected from the pre-test and post-test participants then carried out a normality test to determine the normality of the data that has been obtained. Therefore, the researcher used a statistical test approach (Shapiro-Wilk), because the sample used was less than thirty people, then it was analyzed using the paired simple T-test using SPSS 25 (Fadluloh et al., 2024). This test is to determine whether there is a difference or influence, data analysis is used to determine whether there is a significant increase in plyometric training on the distance of the start jump in swimming sports.

## RESULT AND DISCUSSION

**Table 1.** Descriptive Statistics

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Pre-Test | 15 | 255 | 345 | 305.67 | 24,988 |
| Post-Test | 15 | 258 | 348 | 308.73 | 24,826 |
| Valid N (listwise) | 15 | | | | |

Table 1 shows that the pretest obtained an average pre-test score of 305.67 while the post-test obtained a score of 308.73, then the standard deviation of the pre-test was 24.988 while the standard deviation of the post-test was 24.826, the lowest

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pre-test score was 255, while the post-test was 258, the highest pre-test score was 345, while the post-test was 348. And the N value of the pre-test was 15, then the N value of the post-test was 15. Furthermore, the author conducted a normality test in table 2.

**Table 2.** Tests of Normality

| | Shapiro Wilk | | |
|---|---|---|---|
| | Statistics | df | Sig. |
| Pre-Test | .906 | 15 | .116 |
| Post-Test | .904 | 15 | .108 |

Shapiro Wilk Testto show the results of the data normality test. Table 2 shows that the pre-test statistical value is .906, df 15, and Sig. is .116. While in the post-test obtained a statistical value of .904, df 15, and Sig. is .108. Based on the test results, both data obtained a Sig. value > 0.05, then both data are declared "Normally Distributed". Therefore, the author uses a parametric approach in making a hypothesis. The results of the hypothesis test are presented in Table 3.

**Table 3.** Paired Samples Test

| | | Paired Differences 95% Confidence Interval of the Difference Upper | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|
| Pair 1 | Pre-Test - Post-Test | -2,534 | -12,357 | 14 | .000 |

The table shows the results of the hypothesis test using*Paired Sample t-Test*. Table 3 shows the t-test value of-12,357, with a Sig. (2-tailed) value of 0.000, Based on the test results, the Sig. (2-tailed) value < 0.05 so that H0 is rejected, it can be concluded that there is a significant influence.

## DISCUSSION

Based on the results of research on the effect of plyometric training on the distance of the start jump in swimming, researchers revealed that there was a significant influence of both variables. This is in line with research conducted by(Fischetti et al., 2018) entitled Effects of plyometric training program on speed and explosive strength of lower limbs in young athletes in the study that providing

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plyometric training can cause a greater increase in speed and explosive strength of the lower limbs.

It is related that plyometric training can be a training option.explosive muscle power,explosive power refers to fast and strong time in expression (Purnami & Dr. Mochamad Purnomo, S.Pd., 2019) Explosive power is the ability of muscles to direct maximum force in a very short time. And according to the opinion(Sovia wahyuni, 2020) with the presence of stamina, explosive muscle power helps in the process of pushing and turning. Then the strength and speed factors are factors that greatly influence the expression (Purwadinata & Wijono, 2020). Explosive power must be possessed by swimming athletes in the expression (Primary, 2022) mastering freestyle swimming skills, athletes must have good explosive power or leg muscle power. If an athlete has good explosive power, then his body movement coordination will be maximized when doing freestyle swimming. So, in the explanation expressed by(Pericles, 2016)The principle of the plyometric training method is that the muscles are always contracting both when lengthening (eccentric) and when shortening (concentric) to produce a large and explosive amount of force quickly.Thus, this research can be a solution to problems in the swimming club environment, especially in the Tritons swimming club in Bandung City.

The results of this study indicate that the significant value is .000, based on the test results, the Sig. (2-tailed) value <.05 so that H0 is rejected, this indicates that the plyometric training program has a significant effect on the distance of the swimming start jump. So this study is expected to help to be a valuable input for swimming club managers in designing training programs and for athletes in improving their start jumps. This study is expected to provide benefits, both from various aspects, one of which is that this study can be used as material and information for coaches and athletes to understand how important plyometric training is to support a career to become a better athlete. For further

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research, the scope of the sample must be expanded to include populations from diverse cultural and socio-economic backgrounds and include various professions.

## CONCLUSION

Thus it can be concluded that the effect of plyometric training can increase the distance of the start jump in swimming sports, one of which is increasing the jump of the Tritons swimming club athletes in Bandung City. This shows that intense training using a plyometric training program can be an effective program and a good strategy in an effort to increase the start jump in swimming sports.

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