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Article

Contribution of Ladder Drill and Dryland Circuit Training to 50-meter Freestyle Swimming Speed in 13-to-14 Male Swimmers Aquatic Swimming Club

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Abstract

The objective of this study was to assess the impact of ladder drill and dryland circuit exercises on the pace of 50-meter freestyle swimming in male swimmers aged 13-14 years at the Aquatic Swimming Club in Medan. The researchers employed an experimental approach utilising a pre-experimental design consisting of a single group with pretest and posttest measurements. The sample comprised 8 adolescent male swimmers, aged 13-14 years, who were actively involved in the club. They were recruited via purposive sampling. The study was carried out for a duration of 6 weeks, consisting of 18 training sessions, conducted 3 times a week. Measurements were obtained using 40-meter sprint tests, medicine ball throw tests, and 50-meter freestyle swimming speed tests conducted both before and after the training treatments. The data underwent analysis through normality tests, homogeneity tests, correlation tests, and regression tests. The findings demonstrated that ladder drill training made a noteworthy contribution of 59.29% to enhancing 50-meter freestyle swimming speed. Similarly, dryland circuit training had a substantial impact, accounting for 77.44% of the improvement. Furthermore, when both training methods were combined, they together contributed 62% to the enhancement of swimming speed. The study found that both ladder drill and dryland circuit training have a substantial impact on improving the 50-meter freestyle swimming speed of male swimmers aged 13-14 at the Aquatic Swimming Club in Medan. Additionally, the dryland circuit training was found to have a greater effect than the ladder drill.

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INTRODUCTION

Swimming is a popular and beneficial aquatic activity that can be enjoyed by individuals of all ages and socioeconomic backgrounds. It is a sport that involves regular and purposeful physical movements to enhance functional abilities. According to the 2022 Sports Law, which outlines the requirements for athletes pursuing coaching and championship-level competition, consistent, methodical, integrated, tiered, and sustainable training is essential for attaining success.

Swimming is an aquatic activity that encompasses a multitude of water-based pursuits, including diving, water polo, competitive swimming, and open water swimming (Dinata & Wijaya, 2006). At the regional, governmental, and international levels, there are four swimming techniques that are frequently the subject of debate, according to Haller (1982). The four types of swimming are divided into four categories: a) Butterfly Style, b) Backstroke, c) Breaststroke, and d) Freestyle. Freestyle swimming is swimming done by lying on one's back and swinging both legs alternately from the top to the bottom.

On Friday, February 10, 2023, researchers conducted field observations and interviews with coaches at the Aquatic Swimming Club in Medan. During these observations, the researchers observed athletes engaging in various activities, including warm-ups, core exercises, and cooling down. Based on these observations, the researchers identified potential issues with freestyle swimming. When swimming at speed, the athletes were observed to perform hand pulls and foot pushes (strokes and pushes) in a manner that did not facilitate the production of optimal speed. This resulted in a 50-meter freestyle swimming speed that was still classified as very slow, as evidenced by the attached test results. These results may be attributed to a number of factors, including physical, nutritional, and other variables. With regard to physical factors, the Aquatic Swimming Club of Medan regularly conducts specialized physical training on a monthly basis. Based on these observations, researchers have identified a need for coaches to provide more targeted physical exercise to athletes, particularly in training for increased speed when performing pushing and pulling movements.

In order to address the aforementioned issues, the researchers conducted tests to assess the athletes' movement speed abilities. These tests included a 40-meter sprint

test, which was used to determine the athletes' movement speed, and a medicine ball test, which was employed to measure their arm power. Additionally, to further complicate the study, the researchers also tested the athletes' ability to swim 50 meters freestyle. The results of the aforementioned tests on male teenage swimmers at the Aquatic Swimming Club in Medan indicate that their performance remains unsatisfactory. The test results are attached for your reference. In order to address these shortcomings and propose a training regimen that could enhance the athletes' performance, we conducted a research study entitled "The Contribution of Ladder Drill and Dry Land Circuit Training to 50 Meter Freestyle Swimming Speed in 13-to-14 Male Swimmers Aquatic Swimming Club Medan".

METHODS

The methodology employed in this research is an experimental approach, utilizing data collection procedures through tests and measurements with the objective of providing a systematic, factual, and accurate description of the phenomenon under study. This methodology aligns with the previously mentioned problems and research objectives.

Research Design

The author employed a pre-experimental design approach, utilizing a one-group pretest-posttest design, to conduct quantitative research in this study. According to Arikunto (2014), a one-group pretest-posttest design is a research activity involving the administration of an initial test prior to the provision of treatment and a final test subsequent to the conclusion of the treatment.

This study was conducted at Bahagia Swimming Pool, located at Jalan Bahagia By Pass in the Medan Kota Sub-district of Medan City, North Sumatra, Indonesia (20226). The research period spanned from May to June 2023, with 18 meetings held over a six-week period. Training sessions were conducted three times a week, on Mondays, Wednesdays, and Fridays between 3 and 5 pm.

Population and Sample

As defined by Sugiyono (2017), the population is a generalization area consisting of objects and people who have certain attributes and characteristics chosen by

researchers to study and then draw conclusions. The population of this study consisted of twenty athletes from the Medan aquatic swimming club. The purposive sampling method was used to collect a sample of eight people for this study. Purposive sampling is a sampling approach based on the researcher's belief that the selected respondents will provide the necessary information in accordance with the research objectives. The use of conditional sampling was employed to select samples for this investigation, with the following criteria being met by the selected samples: (i) male, (ii) aged 13-14 years, (iii) proficient in freestyle swimming, and (iv) active members of the Aquatic Swimming Club in Medan.

Measurement

40m Speed Test

Objective : To measure sprinting speed on dry land

Tools and facilities : Stopwatch, cones, straight and flat 40 meter running track

Implementation :

a. The 40-meter running track should be marked with boundary cones that are 10 meters apart.
b. Each test taker stands upright at the start, with the front foot directly on the starting line.
c. The timekeeper gives the "ready" signal while standing at the finish line and waving the flag to signal the start of the test. The stopwatch is held as the timer starts running when the arm is raised.
d. Once the test is complete, stop the stopwatch.
e. Emphasize to test takers the need to complete the test as quickly as possible.
f. Test takers can repeat the experiment twice.

Table 1. Assessment of 40m Sprint Test Norms

Male	Category
< 5,2 Sec	Excellent
5,2 - 6,0 Sec	Good
6,0 - 6,4 Sec	Enough
6,4 - 7,6 Sec	Medium
> 7,6 Sec	Less

Seated Medicine Ball Throw

Objective : To measure the explosive power of the arm muscles with your back against the wall.

Tools and facilities : 1-2 kg medicine ball, flat floor, wall, and meter tool.

Implementation : The subject sits with their back against the wall and their feet shoulder-width apart, facing where the ball is thrown. Hold the ball in front of the chest, and then throw it as hard as possible in the forward direction. It is forbidden to throw the ball if the body is not against the wall. Throws are made three times and the farthest distance is recorded.

Table 2. Medicine Ball Test Norm Assessment

Male	Category
>6.23	Excellent
5.38 –6. 22	Good
4.53 -5.37	Enough
3.68 – 4.52	Medium
<3.67	Less

50 Meter Freestyle Swimming Speed Test

Objective : To measure 50 meters freestyle swimming speed

Tools and Facilities : 4 stopwatches and stationery

Implementation : The sample performed a swimming test similar to a race consisting of 1 starter, a timer (adjusting to the number of athletes), and1 style judge.

Data Analysis Technique

Data collected from pre-test and post-test results were analyzed using normality, homogeneity, correlation, and regression tests:

1. Finding the average (Sudjana, 2005)

$$\bar{X} = \frac{\Sigma X}{n} \quad (1)$$

2. Finding the standard deviat (Sudjana, 2005)

$$S^2 = \frac{n\Sigma x^2 - (\Sigma x)^2}{n(n-1)} \quad (2)$$

3. Finding the T-Score (Nurhasan, 2001)

$$T - Score = 50 + 10\left(\frac{x - \bar{x}}{s}\right) \quad (3)$$

4. Normality Test (Sudjana, 2005)

$$Z_i = \frac{xi - \bar{x}}{S} \quad (4)$$

5. Finding the data homogeneity using F test (Sugiyono, 2017)

$$F = \frac{Varian\ Terbesar}{Varian\ Terkecil} \text{ atau } F = \frac{S_1^2}{S_2^2} \quad (5)$$

6. Finding the Regression Significance test (Sudjana, 2005)
   a. Simple regression

$$F = \frac{RJK\,(b/a)}{RJKS} \quad (6)$$

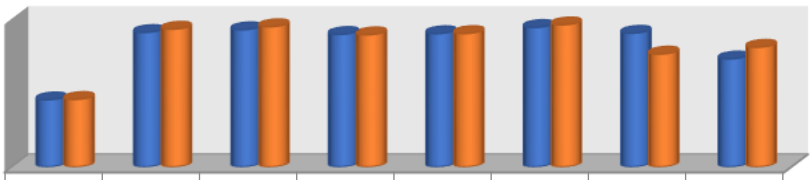
   b. Multiple Regression

$$F = \frac{R^2(n-k-1)}{K(1-R^2)} \quad (7)$$

RESULTS AND DISCUSSION

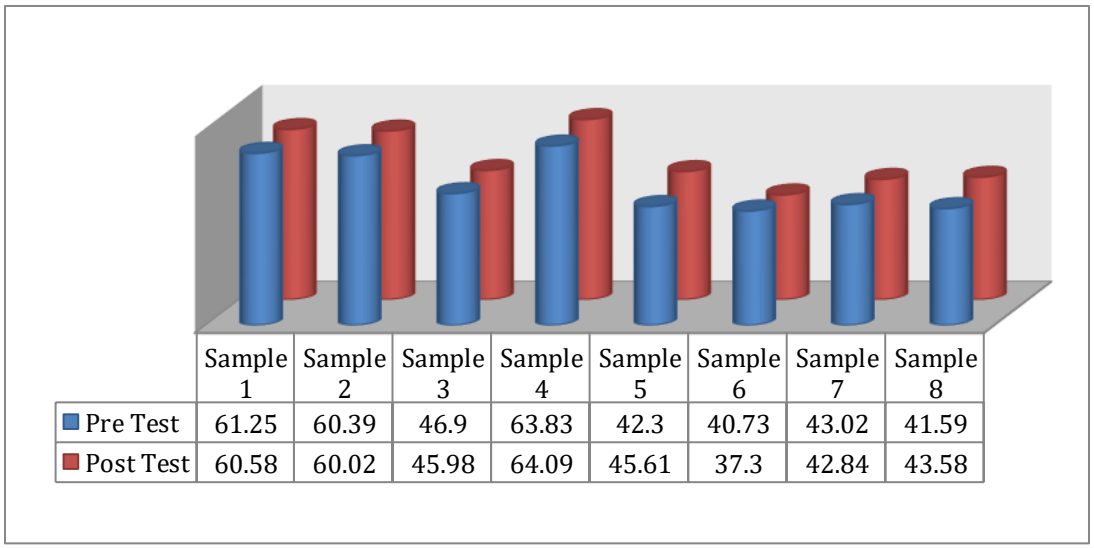
Description and Research Result

After conducting research and carrying out measurement tests that have been carried out, then obtained data on the variables of Medicine Chest Ball, Standing Board Jump and 50 Meter Freestyle Swimming Ability in Medan Aquatic Swimming Club Athletes in 2023 obtained the following data



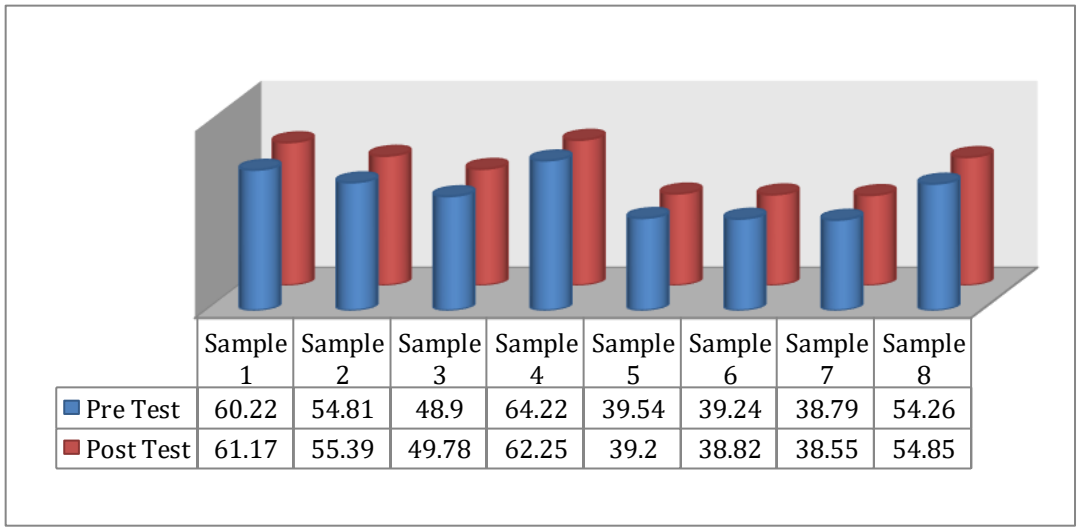
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8
Pre Test	27.27	54.55	55.66	53.77	54.08	56.6	54.24	43.83
Post Test	27.43	55.89	56.9	53.62	54.12	57.65	45.81	48.58

Fig. 1. Pre-Test and Post-Test Data of Sprint 40 Meters Assessment



	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8
Pre Test	61.25	60.39	46.9	63.83	42.3	40.73	43.02	41.59
Post Test	60.58	60.02	45.98	64.09	45.61	37.3	42.84	43.58

Fig. 2. Pre-Test and Post-Test Data of Medicine Ball Assessment



	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8
Pre Test	60.22	54.81	48.9	64.22	39.54	39.24	38.79	54.26
Post Test	61.17	55.39	49.78	62.25	39.2	38.82	38.55	54.85

Fig. 3. Pre-Test and Post-Test Data of Freestyle Swimming 50 Meters Assessment

Normality Test

Through the 40-meter sprint post-test data column, we get L_o = 0.2221 and 0.285 with n = 8, with v1 = (n-1) = (8-1 = 7) and the real level α = 0.05. Due to the data (0.2221 < 0.285), it is concluded that the sample comes from a normal population. Meanwhile, the post-test medicine ball test data column obtained Lo = 0.2811 and 0.285 with dk = (n-1) = (8-1 = 7) and the real level α = 0.05. Due to the data $L_{count} < L_{table}$ (0.2811 < 0.285), it is concluded that the sample comes from a normal population.

Table 3. Data of Normality Test

Variables	Average and Standard Deviation	L_o	L_{table}	α	Ket
Post test data of sprint 40 meters	$\bar{X}_i$= 50 S =10	0,2221	0,285	0,05	Normal
Post test of medicine ball	$\bar{X}_i$= 50 S =10	0,2811	0,285	0,05	Normal
Post test data of freestyle swimming	$\bar{X}_i$= 50 S =10	0,2349	0,285	0,05	Normal

Based on the post-test data column of freestyle swimming ability, L_o = 0.2349 and 0.285 are obtained with n = 7 with dk = (n-1) = (8-1 = 7) and the real level α = 0.05. Due to the data L_{count} < L_{table} (0.2349 < 0.285), it is concluded that the sample comes from a normal population.

Homogeneity Test

The homogeneity test between the pre-test and post-test data of the 40-meter sprint value for α = 0.05, V1 = n – 1, and V2 = n - 1 was obtained = 3.79. This means F_{count} < F_{table} (1.575 < 3.79). It is concluded that the pre-test and post-test data of 40-meter sprint training are homogeneous.

Homogeneity test between pre-test and post-test data of medicine ball assessment with α = 0.05, V1 = n – 1, and V2 = n - 1 was obtained = 3.79. This means that F_{count} < F_{table} (0.78 < 3.79). It is concluded that the pre-test and post-test medicine ball data are homogeneous.

Homogeneity test between pre-test data and post-test data of freestyle swimming ability with an alpha value of 0.05, V1 = n - 1, and V2 = n - 1 was obtained 3.79. This means that F_{count} < F_{table} (1.08 < 3.79). It is concluded that the pre-test and post-test data of freestyle swimming ability are homogeneous.

Hypothesis Testing

Testing the first hypothesis is the contribution of training from ladder drill to the 50 meter freestyle swimming ability of young male swimmers at Aquatic Swimming Club Medan. Obtained F_{count} equal to 9.02 and F_{table} equal to 5.99 then F_{count} > F_{table} so that there is a significant contribution of the exercise to freestyle swimming ability by 59.29%

Testing the second hypothesis is the training contribution of dryland circuit training to the 50 meter freestyle swimming ability of young male swimmers at Aquatic Swimming Club Medan. Obtained F_{count} equal to 22.02 and F_{table} equal to 5.99 then $F_{count} > F_{table}$ so that there is a significant contribution of the exercise to freestyle swimming ability by 77.44%.

Hypothesis testing three is the contribution of training from ladder drill and dryland circuit to the ability of 50 meters freestyle swimming on young male swimmers at Aquatic Swimming Club Medan. Obtained F_{count} equal to 9.60 and F_{table} equal to 5.79, then $F_{count} > F_{table}$. Thus, there is a significant contribution of the two exercises to freestyle swimming ability by 62%.

Discussion

These results are consistent with previous research in the field of swimming performance enhancement. A study by Amaro et al. (2017) found that a 6-week dryland training program, which included exercises such as medicine ball throws and plyometrics, significantly improved swimmers' upper body strength and power, leading to better swimming performance. Similarly, Sadowski et al. (2012) reported that a 6-week plyometric training program enhanced lower body power and swimming start performance in young swimmers. The current study's findings on the effectiveness of ladder drill training are also supported by research conducted by Bishop et al. (2009), which demonstrated that agility training using ladder drills improved athletes' change of direction speed and agility, factors that are crucial in swimming, especially during turns and underwater phases (Amaro et al., 2017; Bishop et al., 2009; Sadowski et al., 2012).

The present study's results highlight the importance of incorporating both pool-specific training and dryland exercises in the training regimen of young swimmers. The combination of ladder drill and dryland circuit training led to a 62% improvement in the swimmers' 50-meter freestyle performance, showcasing the synergistic effects of these training methods. This finding is in line with the recommendations of Crowley et al. (2018), who emphasized the need for a well-rounded training program that includes both water-based and land-based exercises to optimize swimming performance. Future research could explore the long-term effects of such training interventions and

investigate the optimal frequency, intensity, and duration of ladder drill and dryland circuit training for different age groups and swimming events (Crowley et al., 2018).

CONCLUSION

The results of hypothesis analysis and the discussion of research results indicate that ladder drill training significantly contributes to 50-meter freestyle swimming ability. Similarly, dryland circuit training contributes to 50-meter freestyle swimming ability, and the combination of ladder drill and dryland circuit training also contributes to 50-meter freestyle swimming ability.

It is recommended that other researchers examine a broader range of factors that contribute to and influence freestyle swimming ability. In order to enhance the performance of athletes, coaches should prioritize training programs that align with the specific needs of athletes and are adapted to age, gender, and training goals. Additionally, training treatments should be more varied and consistent in order to achieve optimal outcomes.

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