The Relation Between Swimming Performance and Muscles Strength

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Abstract

Aim: The aim of this study is to examine the relation between strength/power development level and 50 m freestyle and backstroke swim times. **Methods:** A total of 10 swimmers (mean age 11.60 ± 1.43 years), girls (n=4) and boys (n=6), participated in this study. All of them have been practicing swimming for 3-4 years, one hour twice a week. The study uses 50 m swim times achieved in a competition (freestyle/ backstroke) and strength measurement test results - standing long jump (SLJ), bent-arm hang (BAH), plank (P), superman (S), right hand grip (RHG), and left hand grip (LHG). **Results:** A statistical analysis of data reveals a negative statistical correlation ($r = -0.808$, $df = 8$, $p = 0.005$) between the 50 m backstroke swim time and the (SLJ) test results. The data show there is a negative statistical correlation ($r = -0.692$, $df = 8$, $p = 0.026$) between the 50 m freestyle swim time and the (BAH) test results. Significant negative correlations are found between the 50 m freestyle swim time and the hand grip test results ($r = -0.724$, $df = 8$, $p = 0.018$); ($r = -0.743$, $df = 8$, $p = 0.014$). Significant negative correlations are between the 50 m backstroke swim time and the hand grip test results as well ($r = -0.713$, $df = 8$, $p = 0.021$); ($r = -0.714$, $df = 8$, $p = 0.020$). **Conclusions:** The interpretation of these results reveals that the level of strength/power development influences swimming performance. For the most part in this study, significant negative correlations are found between the 50m freestyle/backstroke swim time and the (SLJ, BAH, RHG and LHG) strength test results.

Keywords*: freestyle, backstroke, muscle strength, correlation.*

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1. Introduction

Numerous studies have highlighted the relationship between the level of strength development and swimmers' performance (Zampagni, Casino, Benelli, Visani, Marcacci, & De Vito, 2008); Girold, Calmels, Maurin, Milhau, & Chatard, 2006; Aspenes, Per-Ludvik Kjendlie, Hoff, & Helgerud, 2009; Gola, Urbanik, Iwańska, & Madej, 2014, Toskić, 2018). This relationship is statistically stronger for short distances, and decreases as distances increase (Gola, Urbanik, Iwańska, & Madej, 2014). Dry-land training can influence the ability of muscles to generate propulsive forces in water, especially for short distances (Lubkowska, Wiażewicz, & Eider, 2017). Some studies confirm the influence of dry-land training, particularly maximal no weight strength training (Garrido, Marinho, Reis, van den Tillaar, Costa, Silva, & Marques, 2010), on swimmers. A swimmer's strength/power also manifests itself over longer distances, when the swimmer must perform turns at the end of the pool. The duration of these turns influences the final performance. Push force into the wall and short contact with the wall depend on swimmers' strength, which is why coaches recommend using strength/power development training (Hermosilla, Sanders, González-Mohíno, Yustres, & González-Rave, 2021).

The main aim of this study is to examine the relationship between strength/power development level and 50 m freestyle and backstroke swim times. The results achieved in a competition held for young swimmers on the 4th of June 2022 were used as reference times.

2. Materials and Methods

2.1. Study group

A total of 10 swimmers (mean age 11.60 ± 1.43 years), girls (n=4) and boys (n=6), participated in this study. All of them have been practicing swimming for 3-4 years, one hour twice a week, except during summer school holidays when they go on break for about 6 weeks.

2.2. Measurements

The participants took part in a competition where their 50m freestyle and backstroke times were recorded.

Two weeks after the competition, 10 swimmers participated, with parental consent, in a series of tests to determine their level of strength/power development. The strength/power tests we conducted were: standing long jump (SLJ), bent-arm hang (BAH), plank (P), superman (S), right hand grip (RHG), and left hand grip (LHG).

In the (SLJ) test, we measured the distance between the take-off line and the landing area.

In the (BAH) test, we measured the time the swimmers could stay in hanging position with supinated grip, flexed upper limbs and chin above the bar. The (P) test consisted in measuring the time the swimmers could hold their position (face down, resting on forearms). The (S) test consisted in lying in a facedown position, extending both arms and legs, and holding this position as long as possible. The (RHG/LHG) test consisted in holding a dynamometer and recording the scores.

3. Results and discussions

Table 1 shows the 50m freestyle & backstroke swimming times and the strength test results of the young swimmers.

Table 3. Descriptive statistics with the results on 50m freestyle/ backstroke and the results for strength and power tests

	Time on 50m freestyle	Time on 50m backstroke	Standing long jump	Bent-arm hang	Plank	Right hand grip strength	Left hand grip strength
Mean	49.6090	47.4570	164.8000	22.5120	114.1730	25.3000	24.8000
Std. Deviation	9.55549	7.03925	25.31052	19.40609	67.84274	6.84836	7.29992
Minimum	37.52	39.00	128.00	2.06	34.94	15.00	16.00
Maximum	66.00	61.00	216.00	67.00	223.06	39.00	37.00

A statistical analysis of our data reveals that there is a negative statistical correlation ($r = - 0.808$, $df = 8$, $p = 0.005$) between the 50 m backstroke swim time and the (SLJ) test results (Table 2).

Table 4. Pearson correlation, time on 50m backstroke and standing long jump

		Time on 50m backstroke	Standing long jump
Time on 50m backstroke	Pearson Correlation	1	-.808**
	Sig. (2-tailed)		.005
	N	10	10
Standing long jump	Pearson Correlation	-.808**	1
	Sig. (2-tailed)	.005	
	N	10	10

**. Correlation is significant at the 0.01 level (2-tailed).

Our data show a statistically significant negative correlation (r = - 0.692, df = 8, p = 0.026) between the 50 m freestyle time and the (BAH) test results (Table 3).

Table 5. Pearson correlation, time on 50 m freestyle and bent-arm hang

		Time on 50m freestyle	Bent-arm hang
Time on 50m freestyle	Pearson Correlation	1	-.692*
	Sig. (2-tailed)		.026
	N	10	10
Bent-arm hang	Pearson Correlation	-.692*	1
	Sig. (2-tailed)	.026	
	N	10	10

*. Correlation is significant at the 0.05 level (2-tailed).

Data analysis reveals a significant negative correlation (r = - 0.724, df = 8, p = 0.018) between the 50 m freestyle time and (RHG) test results (Table 4).

Table 6. Pearson correlation, time on 50m freestyle and right hand grip strength

		Time on 50m freestyle	Right hand grip strength
Time on 50m freestyle	Pearson Correlation	1	-.724*
	Sig. (2-tailed)		.018
	N	10	10
Right hand grip strength	Pearson Correlation	-.724*	1
	Sig. (2-tailed)	.018	
	N	10	10

*. Correlation is significant at the 0.05 level (2-tailed).

A significant negative correlation (r = - 0.743, df = 8, p = 0.014) is found between the 50 m freestyle time and the (LHG) test results (Table 5).

Table 7. Pearson correlation, time on 50m freestyle and left hand grip strength

		Time on 50m freestyle	Left hand grip strength
Time on 50m freestyle	Pearson Correlation	1	-.743*
	Sig. (2-tailed)		.014
	N	10	10
Left hand grip strength	Pearson Correlation	-.743*	1
	Sig. (2-tailed)	.014	
	N	10	10

*. Correlation is significant at the 0.05 level (2-tailed).

There is a significant negative correlation (r = - 0.713, df = 8, p = 0.021) between the 50 m backstroke time and the (RHG) test results (Table 6).

Table 8. Pearson correlation, time on 50m backstroke and right hand grip strength

		Time on 50m backstroke	Right hand grip strength
Time on 50m backstroke	Pearson Correlation	1	-.713*
	Sig. (2-tailed)		.021
	N	10	10
Right hand grip strength	Pearson Correlation	-.713*	1
	Sig. (2-tailed)	.021	
	N	10	10

*. Correlation is significant at the 0.05 level (2-tailed).

A statistical analysis of our data reveals a significant negative correlation (r = - 0.714, df = 8, p = 0.020) between the 50 m backstroke time and the (LHG) test results (Table 7).

Table 9. Pearson correlation, time on 50m backstroke and left hand grip strength

		Time on 50m backstroke	Left hand grip strength
Time on 50m backstroke	Pearson Correlation	1	-.714*
	Sig. (2-tailed)		.020
	N	10	10
Left hand grip strength	Pearson Correlation	-.714*	1
	Sig. (2-tailed)	.020	
	N	10	10

*. Correlation is significant at the 0.05 level (2-tailed).

In this study, we have found negative correlations between 50 m swimming times and limb muscle strength.

Although we have not found a significant correlation between the 50 m freestyle time and (SLJ), the chart line stretches from the upper left corner to the lower right corner, which indicates a negative correlation ($r = - 0.478$, $df = 2$, $p = 0.163$). The correlation between 50 m freestyle swim times and plank test scores is negative (though not significant) ($r = - 0.478$, $df = 8$, $p = 0.163$).

In one of the studies, the participants who had the highest speed in swimming 25m and 50m freestyle were those with higher scores in the tests conducted to determine strength in elbow flexors, shoulder flexors and shoulder extensors (Gola, Urbanik, Iwańska, & Madej, 2014).

In another study, the participants who showed higher levels of strength in lower limb extensors and abdominal muscles performed better over short distances (Toskić, D, 2018).

The conclusion of another study is that dry-land training, which includes bench presses and medicine ball throws, in addition to in-water resistance training (using water parachute and hand paddles) facilitate increase in strength levels and implicitly higher performance in speed events (Amara, Barbosa, Negra, Hammami, Khalifa, & Sabri, 2021).

4. Conclusions

The interpretation of the results reveals that the level of strength/power development influences swimming performance. This shows how important it is for swimmers to be involved in strength development training that is also carried out on dry land.

For the most part in this study, significant negative correlations have been found between 50 m freestyle/backstroke swim times and (SLJ, BAH, RHG and LHG) strength test results.

No significant negative correlations have been found between 50 m swim times and plank and superman test results.

A continuation of such a study, with more participants and by including an experimental group to participate in dry-land strength development training, is needed.

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