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RELATIONSHIPS BETWEEN QUICKNESS, AGILITY, AND ACCELERATION PERFORMANCE IN BOY SWIMMERS

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Abstract

The aim of the research. The purposes of this study were to examine relationships between quickness, agility, and acceleration performance in boy swimmers.

Methods of research. Sixteen boys swimmer volunteered to participate in this research. The mean (SD) age was 11,19±1,76 years, height was 1,45±0,12 m, and weight was 39,19±13,35 kg for the 16 boys swimmers. we applied a testing procedure that included measurements of the quickness, acceleration, and agility. Each test was applied three times, with a 3-minute interval, and the best result was recorded. At the beginning of each session, All athletes completed a 10 minute dynamic warm-up consisting of jogging, dynamic stretching and submaximal sprints. Timing of all repetitions was measured by an electronic timing system. Photocells were placed at the start, 5 m (quickness), 10 m (acceleration), and 15 m (acceleration) in order to collect sprint times over the 3 distances. For agility performance, the subjects started on a centerline. The subjects sprinted 4.57 m to the left, then 9.14 m to the right, and finally 4.57 m back to finish as they crossed the centerline.

Main results. A significant positive correlation existed between quickness with accelaration for 5 m, acceleration for 10 m, and agility (r = 0,843, 0,653, 0,776, respectively) (P<0,05), also, there were positive relationship between agility performance with quicness, acceleration for 10 m, and acceleration for 15 m (r = 0,776, 0,733, 0,899, respectively) (P<0,05). There were no relationship between acceleration for 10 m performance and acceleration for 15 m performance (r = 0,425; P>0,05).

In conclusion. Swimmers need to agility, quickness, and acceleration for quickly turns, fathoms, and reactive starts. So, trainers should design the annual training program which has quickness, acceleration, and agility based on swimmer's growth and maturation process.

Key words: Swimming, functional performance, children, sports.

Introduction

Swimming has been recognized as a part of comprehensive physical activity programs for people and is an exercise modality that is highly suitable for health promotion and disease prevention, and is one of the most popular, most practiced and most recommended forms of physical activity. (Hutzler et al. 1998; Tanaka 2009). Swimming is a very demanding sport that requires extreme muscle strength, quickness, and endurance (Balilionis et al. 2012). Energy expenditure in swimming is represented by the sum of the cost of translational motion and maintenance of horizontal motion. The cost of the latter decreases as speed increases (Lavoie and Montpetit1986). Start performance in swimming is a combination of reaction time, vertical and horizontal force. Both the vertical and horizontal forces off the block may be trainable with strength and power training, and support for this is provided by the significant correlation between vertical jumping ability and starting performance observed in swimming (Pearson et al. 1998). The mechanisms behind the link between agility, acceleration and quickness for starting performance are probably multifactorial. For example, heavy-resistance training has been shown to induce hypertrophy and concomitantly increase the size and number of the sarcoplasmic recticulum, thus increasing the rate of release and reuptake of calcium, and improving muscle contraction and relaxation rate all of which would be positive adaptations for increasing power in the quickly swim start (Ørtenblad et al. 2000; Ross and Leveritt 2001). Agility does not have a global definition, but it is often recognized as the ability to change direction and start and stop quickly (Gambetta 19969). Also, agility performance has been defined as the speed in changing direction and control correct body position while quickly changing direction through a series of movements (Sheppard and Young 2006). Agility

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implies greater involvement of deceleration and the ability to reactively couple it with acceleration and deals with the quickly changes in direction and the ability to effectively couple eccentric and concentric actions in ballistic movements (Baechle and Earle 2000). High-speed actions during sport competition can be categorized into actions requiring agility and acceleration. Acceleration is the rate of change in velocity that allows a player to reach maximum velocity in a minimum amount of time (Little and Williams 2005). Accelerating from a stationary position or a moving start requires high force generation capacity to overcome the body's inertia. Quickness is considered both a multidirectional skill that combines explosiveness, reactiveness, and acceleration and agility while incorporating flexibility, strength, and neuromuscular coordination by allowing the athlete to move at a higher rate of speed (Brown and et al. 2000). Scientific research in swimming over the past years has been oriented toward multiple aspects that relate to applied and basic physiology, metabolism, biochemistry, and endocrinology (Lavoie and Montpetit1986; Smith and et al.2002). We can find no published literature on functional performance which is named agilty, quickness and acceleration in swimming. Swimming requires the coordination of whole body. If swimmers want to has very well coordination they have to well trained as agility, quickness, and acceleration performance for start, quickly returns, changes in direction, muscle contraction and relaxation. Agility, acceleration and quicknes are important components of sport performance. Therefore, the purposes of this study were to examine relationships between quickness, agility, and acceleration performance in boy swimmers.

Material and method

Sixteen boys swimmer volunteered to participate in this research. The mean (SD) age was 11,19±1,76 years, height was 1,45±0,12 m, and weight was 39,19±13,35 kg for the 16 boys swimmers. we applied a testing procedure that included measurements of the quickness, acceleration, and agility. Before conducting the investigation, all subjects were informed of the risks of the study and gave informed consent. The study was approved by an ethics board and met the conditions of the Helsinki Declaration. Each test was applied three times, with a 3-minute interval, and the best result was recorded. At the beginning of each session, All athletes completed a 10 minute dynamic warm-up consisting of jogging, dynamic stretching and submaximal sprints. Automated timers, cone, and tape measure for distance were used. Timing of all repetitions was measured by an electronic timing system. The beam was set at a height of 0.5 meters above the start/finish line. Subjects' height is measured with an instrument sensitive to 1 mm. Their body weight is measured with a weigh-bridge sensitive up to 20 g while they are dressed in only shorts (and no shoes). Height variable is in terms of meters, and body weight variable is in terms of kilograms.

Pro agility test. The subjects started on a centerline facing the researcher. The subjects sprinted 4.57 m to the left, then 9.14 m to the right, and finally 4.57 m back to finish as they crossed the centerline. Test was applied three times, with a 3-minute interval, and the best result was recorded for statistical analysis.

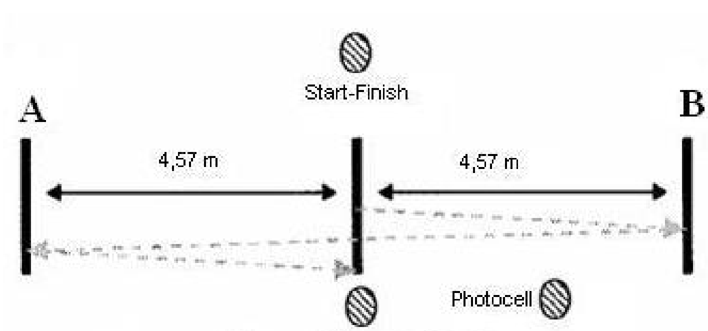

Figure 1. Pro-Agility Test

Quickness and acceleration tests

Photocells were placed at the start, 5 m (quickness), 10 m (acceleration), and 15 m (acceleration) in order to collect sprint times over the 3 distances. The starting position was standardized for all subjects. Athletes started in a 2- point crouched position with the left toe approximately 30 cm back from the starting line and the right toe approximately in line with the heel of the left foot. All subjects wore rubber-soled track shoes.

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Therefore, Quicness was evaluated for 5-m. Acceleration was evaluated using a 10-m and 15-m test. Test was applied three times, with a 3-minute interval, and the best result was recorded for statistical analysis.

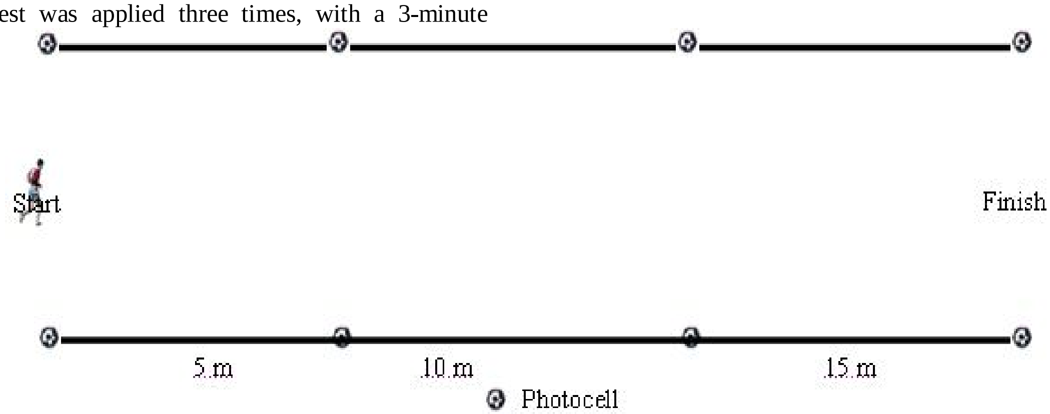

Figure 2. Quickness test for 5 m, acceleration test for 10 m and 15 m.

Statistical Analysis

We summarized the data and evaluated the means and standard deviations. The better of 3 trials was used for analysis for each test. Relationships between quickness, agility, and acceleration was then determined by Pearson correlations. An alpha level of 0.05 was used for all analyses. Statistical analyses were conducted in SPSS 16.0

Results

Table 1. Stature characteristics of the subjects and performance

	N	Mean	Std. Deviation
Age (years)	16	11,19	1,76
High (m)	16	1,45	0,12
Weight (kg)	16	39,19	13,35
Quickness (s)	16	1,34	0,10
Acceleration for 10 m (s)	16	2,24	0,16
Acceleration for 15 m (s)	16	3,02	0,21
Agility (s)	16	5,92	0,45

The mean (SD) age was 11,19±1,76 years, high was 1,45±0,12 m, and weight was 39,19±13,35 for the 16 boys swimmer; the mean (SD) quickness was 1,34±0,10 second, acceleration for 10 m was 2,24±0,16 second, acceleration for 15 m was 3,,02±0,21 second, and agility was 5,92±0,45 second for the for boys swimmer.

Table 2. Bivariate correlations for quickness, acceleration, and, agility variables.

		Quickness	Acceleration for 10 m (s)	Acceleration for 15 m (s)	Agility
Quickness	R		$0,843^{*}$	$0,653^{*}$	$0,776^{**}$
	P		0,000	0,008	0,002
	N		16	16	16
Acceleration for 10 m (s)	R	$0,843^{*}$		0,425	$0,733^{*}$
	P	0,000		0,114	0,004
	N	16		16	16
Acceleration for 15 m (s)	R	$0,653^{*}$	0,425		$0,899^{*}$
	P	0,008	0,114		0,000
	N	16	16		16
Agility	R	$0,776^{*}$	$0,733^{*}$	$0,899^{*}$	
	P	0,002	0,004	0,000	
	N	16	16	16	

*P<0,05

Performance results are shown in Table 2. A significant positive correlation existed between quickness with accelaration for 5 m, acceleration for 10 m, and agility (r = 0,843, 0,653, 0,776, respectively) (P<0,05), also, there were positive relationship between agility performance with quicness, acceleration for 10 m, and acceleration for 15 m (r = 0,776, 0,733, 0,899, respectively) (P<0,05). There were no relationship between acceleration for 10 m performance and acceleration for 15 m performance (r = 0,425; P>0,05).

Discussion

In the present study, a significant positive correlation existed between quickness with accelaration for 5 m, acceleration for 10 m, and agility (r = 0,843, 0,653, 0,776, respectively) (P<0,05), also, there were positive relationship between agility performance with quicness, acceleration for 10 m, and acceleration for 15 m (r = 0,776, 0,733, 0,899, respectively) (P<0,05). There were no relationship between acceleration for 10 m performance and acceleration for 15 m performance (r = 0,425; P>0,05). Quickness and acceleration was evaluated for 5 m and 10 m (Cronin and Hansen 2005). The acceleration was evaluated using a 10-m test, as previously used by (Wilson et al. 1993). Miyashita et al. (1992) have reported a significant correlation between swim performance to 5 m and leg-extensor power (r = 0.76). West et al. (2011) have reported the strong negative correlation between lower body strength and time to 15 m. Bishop et al. (2009) have reported that, by engaging in explosive-power training sessions in addition to habitual aquatic regimes, swim time to 5.5m was significantly improved, on average by 0.59 seconds, equating to a 15% improvement in performance. Several studies have examined the influence of different physiological parameters in swimming (Holmer and Gulstrand 1980; Town and Vanness 1990; West et al. 2005). But no studies have evaluated the agility, acceleration and quicknes in swimming. Changing direction ability or quick start and stop represent a complex motor ability which is usually called as agility in literature (Bompa 1999; Graham 2000). Although agility represent an important feature for a successful performance in different sports (Trninic et al. 2001; Müler et al. 2000), its physiological and muscular determining are known little (Markovic 2007). Some biomechanical studies show that changes direction can be related with muscle strength and force. Mostly in practicing movements including agility, leg extensor muscle are stretched tight concentrically and following an acceleration phase it includes a fast deceleration phase in which leg extensor muscles are stretched eccentrically (simonsen et al. 2000). To carry out a quick changing direction, it requires attaining to time of contact to quite short place, and so power is required to be produced at a brief period (Young et al. 2002). Consequently, it can be presumed that a high leg extensor strength and force can be related to a successful agility performance (Bompa 1999). Up to now, there has been no evidence of a relation between agility performance and lower extremity strength and force (Markovic 2007).

Conclusions

In conclusion, swimmers need to agility, quickness, and acceleration for quickly turns, fathoms, and reactive starts. So, trainers should design the annual training program which has quickness, acceleration, and agility based on swimmer's growth and maturation process.

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