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EFFECT OF VERTICAL JUMP ON QUICKNESS, AGILITY, ACCELERATION AND SPEED PERFORMANCE IN CHILDREN SWIMMER

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Abstract
The purposes of this study were to examine effect of vertical jump on quickness, agility, acceleration, and speed performance.
Method. A total of 20 girls and boys swimmers volunteered to participate in this research. The mean (SD) age was 11,50±1,64 years, height was 1,46±0,11 m, and weight was 40,50±10,02 kg for the 8 girls swimmers. The mean (SD) age was 11,40±1,59 years, height was 1,45±0,12 m, and weight was 39,80±13,58 kg for the 12 boys swimmers. we applied a testing procedure that included measurements of the quickness, acceleration, speed, agility, and vertical jump. We was applied pro-agilty test for agility. Quicness was evaluated for 5 m. Acceleration was evaluated using a 15 m. Speed was evaluated using a 50 m test. Vertical jump evaluated using a jumping mat with electronic system. Each test was applied three times, with a 3-minute interval, and the best result was recorded.
*Results.*A significant relationship existed between quickness, agility, acceleration and speed with vertical jumping ($P<0.05$). A unit increase in vertical jumping lead to a change in the rate of 0,9 %, 5,5 %, 2,4 % and 9 % respectively in quickness, agility, acceleration and speed performance. In conclusion, when swimmers have highest vertical jump, they can more success in agility and speed. This skills is important for quickly turns, fathoms.
Conclusions. Vertical jump effected quickly less than acceleration. This situation may change to another branch of sport and age group.
*Key words***:** Swimming, vertical jump, girls and boys, sports.

Introduction

Swimming is a very demanding sport that requires extreme muscle strength, quickness, and endurance (Balilionis et al. 2012). Speed, quickness, and agility training is perfect for seniors because it will condition fitness aspects that are generally lost with age-speed, agility and quickness (Miller et al. 2001). Linear actions such as acceleration and top end speed can be affected by changing the mechanics of the arms or legs. Agility actions are more common in athletic events and may require a higher degree of coordination. Agility requires the integration of several biomotor skills such as dynamic balance, muscular coordination, effective core development, and stretch shortening cycle development (Brown and Vescovi 2003). 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). The limiting factor in sprinting is the vertical jumping due to the acceleration of gravity and because high horizontal jumping production is requested (Schleihauf 2004)**.** Vertical jump is a fundamental part of the many sports. Vertical jump testing is a common method used by coaches to assess jump height and muscular power (Bobbert et al. 1996; Hespanhol et al. 2007; Lara et al. 2006; Ravn et al. 1999). Vertical jump is a measurement that coaches, strength and conditioning professionals frequently use as an objective functional measurement (Leard et al 2007). On agility-related investigation found that T-test performance could be predicted from leg power, leg speed, and agility, again suggesting a relationship between sprinting characteristics and agility (Pauole et al 2000). Start performance in swimming is a combination of reaction time, vertical and horizontal force. Both the vertical and horizontal forces off the

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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). Therefore, the purposes of this study were to examine effect of vertical jump on quickness, agility, acceleration, and speed performance in swimmers.

Material and method

A total of 20 girls and boys swimmers volunteered to participate in this research. The mean (SD) age was 11,50±1,64 years, height was 1,46±0,11 m, and weight was 40,50±10,02 kg for the 8 girls swimmers. The mean (SD) age was 11,40±1,59 years, height was 1,45±0,12 m, and weight was 39,80±13,58 kg for the 12 boys swimmers. we applied a testing procedure that included measurements of the quickness, acceleration, speed, agility, and vertical jump. 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, mat, cone, and tape measure for distance were used. Timing of all repetitions was measured by an electronic timing system (Smart speed lite system, Fusion sport, 2010). 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.

Testing Procedure

Pro agility test

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. Test was applied three times, with a 3-minute interval, and the best result was recorded for statistical analysis.

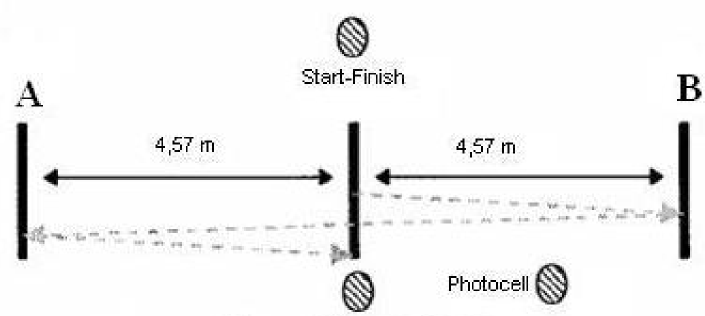

Figure 1. Pro-Agility Test

Quickness, acceleration, and speed tests

Photocells were placed at the start, 5 m (quickness), 15 m (acceleration), and 50 m (speed) 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. Therefore, Quicness was evaluated for 5 m. Acceleration was evaluated using a 15 m. Speed was evaluated using a 50 m test. Tests were applied three times, with a 3-minute interval, and the best result was recorded for statistical analysis.

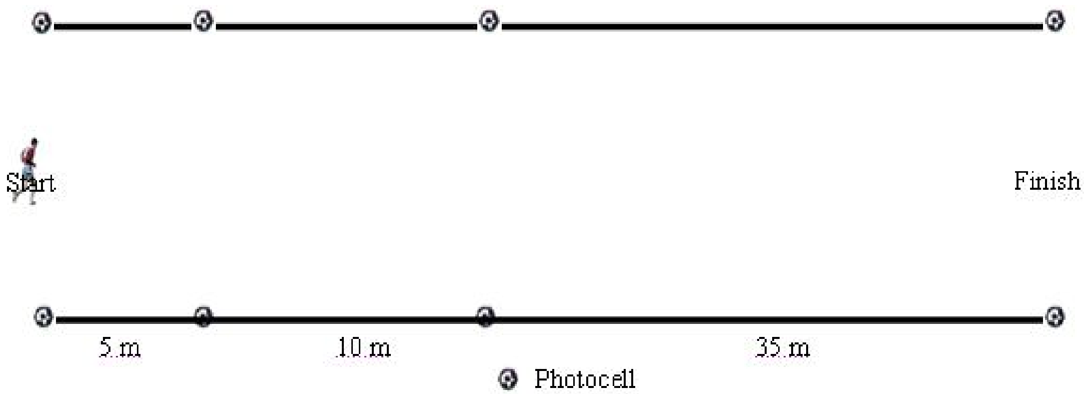

Figure 2. Quickness test for 5 m, acceleration test for 15 m, and speed test for 50 m.

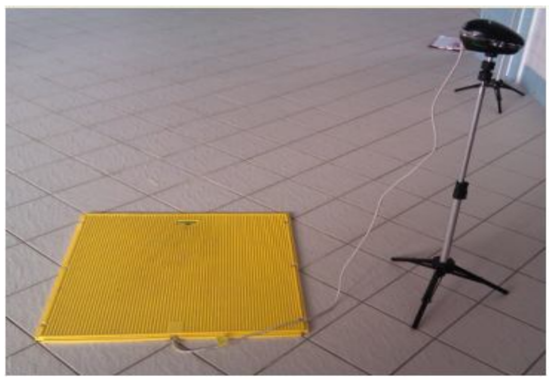

Figure 3. Equipment for vertical jump test

Statistical Analysis

SPSS 16.0 statistical program was used for evaluation and calculation of the data. The data was summarized and evaluated by the means and standard deviations. To explain relationship between measurements, Pearson Correlation analysis was used according to the results of the test of normality, and linear regression analysis was used to predictive power of explanation on vertical jumping of quickness, agility, acceleration and speed. The significance level was taken as 0.05.

Results

Table 1. Data summary for swimmers by their gender.

Variables	Female (N=8)		Male (N=15)	
	Mean (sec)	Std. deviation	Mean (sec)	Std. deviation
Age (yıl)	11,50	1,64	11,40	1,59
High (m)	1,46	0,11	1,45	0,12
Weight (kg)	40,50	10,02	39,80	13,58

The mean (SD) age was 11,50±1,64 years, high was 1,46±0,11 m, and weight was 40,50±10,02 for the 8 female; the mean (SD) age was 11,40±1,59 years, high was 1,45±0,12 m, and weight was 39,80±13,58 for the 15 male.

Table 2. Data summary for swimmers by their gender.

Variables	Female (N=8)		Male (N=15)	
	Mean (sec)	Std. Deviation	Mean (sec)	Std. deviation
Quickness	1,31	0,09	1,36	0,10
Agility	6,28	0,19	5,87	0,41
Acceleration	3,06	0,22	3,02	0,21
Speed	8,85	0,85	8,91	0,70

Vertical jump	23,29	7,11	27,48	4,82

The mean (SD) quickness was 1,31±0,09 seconds, agility was 6,28±0,19 seconds, acceleration was 3,06±0,22 seconds, and speed was 8,85±0,85 seconds, and vertical jump was23,29±7,11 for the 8 female; the mean (SD) quickness was 1,36±0,10 seconds, agility was 5,87 ±0,41 seconds, acceleration was 3,02±0,21 seconds, and speed was 8,91±0,70 seconds, and vertical jump was 27,48±4,82 for the 15 male.

Table 3. Analaysis of regression between quickness, agility, acceleration, speed with vertical jumping

Dependent variables	Variables		B	Standart hata	Beta	T	P
Quickness	Vertical jumping		-0,009	0,004	-0,494	-2,270	0,037
	R = 0,494	R^2 = 0,244	F = 5,152	P = 0,037			
Agility			-0,055	0,012	-0,766	-4,621	0,000
	R = 0,766	R^2 = 0,587	F = 21,351	P = 0,000			
Acceleration			-0,024	0,005	-0,741	-4,419	0,000
	R = 0,741	R^2 = 0,550	F = 19,529	P = 0,000			
Speed			-0,090	0,021	-0,733	-4,313	0,001
	R = 0,733	R^2 = 0,538	F = 18,606	P = 0,001			

As shown Table 1, the model is found to be meaningfull in the regresssion results of vertical jumping ($P<0,05$). A significant relationship existed between quickness, agility, acceleration and speed with vertical jumping ($P<0.05$). A unit increase in vertical jumping lead to a change in the rate of 0,9 %, 5,5 %, 2,4 % and 9 % respectively in quickness, agility, acceleration and speed performance.

Discussion

In this study, a significant relationship existed between quickness, agility, acceleration and speed with vertical jumping ($P<0.05$). A unit increase in vertical jumping lead to a change in the rate of 0,9 %, 5,5 %, 2,4 % and 9 % respectively in quickness, agility, acceleration and speed 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 vertical jump, agility, acceleration, speed, and quicknes in swimming. Mero and colleagues (Mero et al. 1981) saw a significant correlation between sprinting performance and jumping tests. Barnes et al. (2007) found the relationship between agility and jumping performance. It indicates that individuals with greater countermovement performance also have quicker agility times and suggests that training predominantly in the vertical domain may also yield improvements in certain types of agility performance. Also, it reported in agreement with other studies that examine sprinting performance. Hennessy and Kilty (2001) also found that countermovement, drop jump, and bounding jump tests relate to sprinting performance. Both the countermovement and drop jump test were found to explain 63% of sprinting performance; however, the drop jump test explained 55% of the relationship. In a previous study (Sheppard et al. 2008) was examined the potential strength, power, and anthropometric contributors to vertical jump performances. Very strong correlations were observed between relative (absolute height-standing reach height) depth jump performance and relative counter-movement vertical jump (0.93; $p \leq 0.01$). The single best regression model component for relative counter-movement vertical jump was the relative depth jump performance, explaining 84% of performance. The role of maximum strength in jumping performance was not clear but speed-strength qualities were considered important. It was concluded that reactive strength is relatively more important for jumping from a run-up than for the standing vertical jump, and this should be reflected by appropriate training methods and test protocols for the assessment of athletes who jump (Young et al. 1999). Hoffman et al. (1996) found the important relationships between leg strength, vertical jump, speed, and agility on playing time.

Conclusion, when swimmers have highest vertical jump, they can more success in agility and speed. This skills is important for quickly turns, fathoms. Vertical jump effected quickly less than acceleration. This situation may change to another branch of sport and age group.

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