Relationship among Swimming Performance and Selected Physiological Parameters in Competitive Male Age Group (10-14 years) Swimmers

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ABSTRACT

The purpose of the study is to find out the relationship among selected physiological qualities and swimming performance. The present study also aimed to find out the potential deficiencies, if any, and to undertake remedial measures to overcome the training stresses. The physiological variables obtained from this study will enable to find out the physiological status of the young swimmers. A total of thirty age group swimmers, age ranging from 10-14 years, were selected as subjects for this study. The physiological parameters included back strength, grip strength, maximum oxygen consumption (VO_2 max), and maximum and recovery heart rate. Measurements for VO_2 max was done by Gas Analyser (Oxycon Champion, Erich Jaeger, Germany) and exercise was done on computerised motor driven treadmill (Erich Jaeger, Germany). Heart rate was measured by ECG Monitor. Back and grip strength were taken by back and grip dynamometers, respectively. Swimming performance was evaluated by 50 meter free style swimming time. The results revealed that strength component (both back and grip strength) is significantly correlated to swimming speed. There is a significant relationship between swimming performance and VO_2 max. Heart rate response depicted that there is a significant negative correlation between maximum heart rate and VO_2 max. Maximum heart rate is also significantly and negatively correlated to back strength and VO_2 max. Recovery heart rate (1st minute) is significantly and negatively correlated to strength component (both back and grip strength), VO_2 max and also with swimming speed. From the above study, it can be concluded that swimming speed is significantly correlated to strength and maximum aerobic capacity, indicating that both these qualities can influence the performance.

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INTRODUCTION

Competitive swimming is the interaction of a number of factors which include optimally developed physical and physiological characteristics of highly motivated well trained skilful swimmers. Among physiological characteristics, physical work capacity is the most important factor. This is reflected by aerobic and anaerobic capacity of swimmers (Khanna and Saha, 1992). Various reports are available on the physiological characteristics of the champion and age-group swimmers (Holmer et al, 1974; Magel and Faulkner, 1967). The need for scientific selection and training of athletes at young age has attracted the attention of the exercise physiologists to study physiological responses to exercise in children, during the growth period (Bar Or, 1973; Rode & Shepard, 1973; Howald et al, 1974; Ichikawa & Miyashita, 1980; Bar Or, 1983; Rowland, 1985; Voccaro & Mahon 1987). Energy production for metabolic activities can, in general terms, be devided into aerobic and anaerobic components. In man maximal aerobic power has been used as a criterion to study the efficiency and performance and performance capacity of the aerobic energy component (Hollmann et al, 1964; Saltin and Astrand, 1967 Gollnick et al, 1972 Berg; 1974). Apart from technique, tactics and skill, competitive swimming is an interaction of number of factors like morphological, physiological, biochemical, biomechanical and psychological. Amongst the physiological characteristics, back strength, VO_2 max, O_2 debt, and recovery heart rate plays a vital role in improving sports performance. The aim of the present study was to find out the relationship among selected physiological qualities and swimming performance. The study could provide the useful information to coaches, scientists and researchers, regarding above relationship. The study will produce guidelines for trainers and coaches to develop training programme for young swimmers, engaged in competitive sport. The present study also aimed to find out the potential deficiencies, if any, and to undertake remedial measures to overcome the training stresses. The physiological variables obtained from this study will enable us to find out the physiological status of the young swimmers. The findings of the present study can be compared with the International counterparts, which will help to set the target for future goal.

METHODOLOGY

A total of thirty age group swimmers, age ranges from 10-14 years, were selected as subjects for this study. They were undergoing training under specialised coaches. In the present study, selected strength and endurance are important factor in determining the level of performance. Physiological functions are measured in the laboratory in terms of back and grip strength, oxygen consumption and heart rate, which are again dependent on other coordinated physiological functions, particularly of circulatory, respiratory and muscular systems. For this purpose, back strength, grip strength, maximum oxygen consumption (VO_2 max) maximum and recovery heart rate were measured. Measurements for VO_2 max was done by Gas Analyser (Oxycon

Champion, Erich Jaeger, Germany) and exercise was done on computerised motor driven treadmill (Erich Jaeger, Germany). Heart rate was measured by ECG Monitor. Back and grip strength were taken by back and grip dynamometers, respectively (Senoh, Japan). Fifty meters swimming timing, for all the swimmers, were taken with the help of stop watch. From the timing the speed was also calculated. Mean and standard deviation was done for all the physiological parameters selected for the present study. Correlation co-efficient was computed to find out the relationship among the above mentioned physiological parameters and swimming performance. The above analysis was done using standard statistical package SPSS.

RESULTS & DISCUSSION

Mean, standard deviation and standard error of mean of physiological parameters, of age group swimmers, are presented in Table 1. The Table depicts that mean back strength of young swimmers of the present study is 88.13±19.20 kg, with a minimum of 58 kg and a maximum of 127 kg. Mean grip strength (right & left), of the present age group swimmers, are 22.93±5.71 and 22.97±5.12 kg, respectively. The absolute and relative VO_2 max of the age group swimmers of the present study are 2.17±0.68 l/min and 48.5±5.62 ml/kg/min, respectively. Mean maximum heart rate of the age group swimmers of present study is 203.5±4.59 b/min. Mean recovery heart rate (1st minute after maximum exercise) of the age group swimmers of present study is 151.8±13.33; Mean timing for 50 meter free style swimming is 37.15±3.80 second. Mean speed of the swimmers is 1.36±0.16 meter/second.

Table-1 : Mean, Standard Deviation and Standard Error of Mean of Physiological and Performance Variables of Age Group Swimmers.

Variables	Mean	Standard Deviation	Standard Error of Mean	Minimum	Maximum
Back Strength (kg)	88.13	19.20	3.51	58.00	127.00
Grip strength-Right (kg)	22.93	5.71	1.04	15.00	36.00
Grip strength-Left (kg)	22.967	5.123	0.935	16.000	37.000
VO_2 max (l/min)	2.174	0.676	0.123	1.130	3.510
VO_2 max (ml/kg/min)	48.50	5.62	1.03	40.36	62.73
Maximum Heart rate (bpm)	203.50	4.59	0.838	189.00	214.00
Recovery Heart rate (bpm)	151.80	13.33	2.43	131.00	173.00
50 meter swimming (free style) timing (sec)	37.147	3.801	0.694	28.000	41.300
Swimming speed (m/sec)	1.3617	0.1565	0.0286	1.2100	1.7900

Correlation matrix of physiological and performance variables of age group swimmers is presented in Table 2.

Table-2: Correlation Matrix of Back Strength, Grip Strength, VO_2 Max, Maximum & Recovery Heart Rate and Swimming Performance of Age Group Swimmers.

	Back Strength	Grip Strength (right)	Grip Strength (left)	Absolute VO_2 max	Relative VO_2 max	Max Heart rate	Recovery Heart rate	50 m timing
Grip Strength (R)	0.759*							
Grip Strength (L)	0.739*	0.951*						
Absolute VO_2 max	0.881*	0.735*	0.734*					
Relative VO_2 max	0.876*	0.851*	0.847*	0.916*				
Max Heart Rate	–0.416*	–0.243	–0.323	–0.494*	–0.488*			
Recovery Heart Rate (1st min)	–0.631*	–0.839*	–0.790*	–0.623*	–0.755*	0.255		
50 m swimming timing	–0.810*	–0.904*	–0.872*	–0.816*	–0.924*	0.258	0.861*	
Swimming Speed	0.815*	0.911*	0.890*	0.820*	0.927*	0.272	–0.837*	–0.995*

The Table reveales that age of the swimmers is significantly correlated with back strength and maximum aerobic capacity. Strength component (both back and grip strength) is significantly correlated with swimming speed which showed that strength is one of the performance determining factor. There is a significant relationship between swimming performance and VO_2 max. Heart rate response depicted that there is a significant negative correlation between maximum heart rate and VO_2 max. Maximum heart rate is also significantly and negatively correlated with back strength and VO_2 max. Recovery heart rate (1st minute) is significantly and negatively correlated with strength component (both back and grip strength), VO_2 max and also with swimming speed, indicating that the swimmers having quick recovery can perform better. A high aerobic capacity (VO_2 max) is an advantage in endurance sports. Similarly, a high anaerobic capacity is an advantage in sprint or power events; but success in any type of activity requires technique, tactic and skill perfection. Almost all the sports activities have aerobic and anaerobic components; the dominance depends on the intensity and duration of the game or activity. Nevertheless, if the aerobic power of the competitor is relative to the anticipated measurement, for a given sport, the coach should attempt to correct this by emphasizing a change of training schedule. Moreover, the competitor's peak value is known, re-evaluation can provide the means of monitoring recovery from injury or illness.

CONCLUSION

From the above study, it can be concluded that the age group swimmers of the present study possess optimum strength as compared to 1992 Indian age groups swimmers. Swimming speed is significantly correlated with strength and VO_2

max, indicating that both these qualities can influence the performance. As there is a significant negative correlation between 1st minute recovery heart rate and swimming speed (calculated from 50 meters swimming timing), it can also be concluded that in competitive swimming the swimmers having faster recovery can perform better.

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