Turkish Journal of Sport and Exercise
http://dergipark.ulakbim.gov.tr/tsed/index
Year: 2016 - Volume: 18 - Issue: 1 - Pages: 114-118
DOI: 10.15314/tjse.76836

ISSN: 2147-5652

Effects of the anthropometric and kinematic parameters on 50 m freestyle swimming performances

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Abstract

The aim of this study was to determine the effects of the anthropometric and kinematic parameters on 50 m freestyle swimming performances in swimmers. The study group of the research consists of 31 students, whose ages are 23.29 ± 2.65 years, who are studying in School of Physical Education and Sports, Selçuk University, and who swim at least for 4 years. In the study, body fat percentage making the various anthropometric measurements on the students, their body fat percentages and body compositions were determined. After 50 m freestyle swimming, the scores of the students were recorded. During these measurements, the students were monitored by means of video camera and their arm cycles were also determined. Stroke rate, tine of 50 m freestyle swimming, and Pearson correlation coefficient of anthropometric variables were calculated. In assessment of the results of correlation analysis, the range of 0.30-0.70 was defined as middle level relationship and range of 0.70-1.00 as high level relationship. In this study carried out to measure the effect of stroke rates of 50 m freestyle swimmers on performance, a negative middle level relationship was observed between body weight and time of 50 m freestyle swimming. This relationship indicates that when body weight increases, freestyle swimming performance will improve. In addition, the fact that the swimmers in this study have a endo-meso body type is an important finding pointing out the performance increase.

Keywords: Anthropometry, freestyle swimming, stroke rate.

INTRODUCTION

Swimming, utilizing lifting force of water, is a sport based on pushing the body forward in water via beating hands and feet (2). Sportive swimming is defined as the ability of athlete to be able to pass certain distances in water in the shortest time by means of freestyle, backstroke, breaststroke, and butterfly techniques (13). Knowing how to swim has an important place in the life. Swimming is not only a sport but also it has great importance in evaluating leisure times and gaining strength, and in rehabilitation. It even enables some muscle to develop symmetrically and steadily. In swimming sport, there is no dysfunctional muscle group. Even if one swims in low effort, one can move with little force and easily. Besides this, it engrains in sense of trust (5).

In training and competitions, it is swum with the different positions and movements in the four separate techniques: freestyle, backstroke, breaststroke, and butterfly. Among these techniques, backstroke technique is swum in supine position and the other techniques in facedown position and horizontal and near-horizontal positions. In terms of body position, leg kick, arm pulling, position of head, breathing, and condition, for techniques have different characteristics (4,7).

In swimming branch that is common in our country, determining anthropometric and kinematic features will be positive in terms of trainers. Thanks to this, besides being successful in swimming sport and being able to identify athletes with high potential, important information will be obtained about appropriate training methods. In this study, it was aimed to determine the effects of the anthropometric and kinematic features swimmers have on their performances of 50 m freestyle swimming.

MATERIAL AND METHOD

The Study Group

Thirty-one swimmers who were students in School of Physical Education and Sport participated in this study. Subjects were 23.29±2.65 years old and had swimming experience at least for 4 years. Before the study, subjects were informed about the study by researchers. All subjects gave an signed consent from before the study. The study was approved by the university ethic committee.

50 meter Freestyle Swimming

The study was carried out in Olympic Closed Swimming Pool of Selçuk University. Pool water temperature was at 28.5°C and environmental temperature at 29°C. The scores of athletes in 50 m freestyle swimming were recorded in seconds and in measurements, Casio branded digital chronometer was used. Arm cycles, as a results of taking by means of DCR-HC53E digital video camera (Sony) were identified by using an interface playing video images in computerized media.

Athletes warmed up for 15 minutes before beginning to swim. Athletes were placed in a lane as if they are competing and 3 referees were assigned to record the score of each athlete. 50 m swimming was started by starting whistle, while simultaneously operating chronometer, and after completing distance of 50 m, their scores were recorded. During measurements in this distance, the athletes were monitored by means of video camera and their arm cycles were determined.

Anthropometric Measurements

The height, sitting height, arm length, length of hand and leg, diameter measurements (measure of femoral bicondylar diameter, humeral bicondylar diameter, measure of wrist diameter), peripheral measurements (extension biceps, flexion biceps, femoral periphery, calf periphery), body skin curve and fatty percentages (thickness of biceps skin curve, thickness of subscapular skin curve, thickness of suprailliac skin curve, thickness of chest skin curve, thickness of abdominal skin curve, thickness of femoral skin curve, lower leg calf skin curve) of the students participating in the study were taken (6,15). In calculating, somatotype formulas of Heath Carter were used.

Statistical Analysis

The values of arithmetic mean, standard deviation (SD), and minimum and maximum of the data obtained in the study were determined. In evaluating the relationship between stroke length and time of 50 m swimming and anthropometric variables, Pearson correlation coefficient was used. In evaluating the results of correlation analysis, the range of 0.30-0.70 was defined as middle level relationship and range of 0.70-1.00 as high level relationship. Statistical significant level was set at 0.05.

RESULTS

When Table 1 is examined, mean age of the swimmers was identified as 23.29±2.65 years; mean height as 175.19±10.62 cm; and body weight as 69.84±12.38 kg. When Table 2 is examined, endomorphic value of the swimmer group was identified as 5.00±1.36; mesomorphic value as 3.45±1.08; and ectomorphic value as 2.69±1.05. Body fat percentage was determined as 14.02±3.26; stroke rate as 65.06±9.66; and time as 45.13±12.38 sec.

When Table 3 is examined, it was identified that there was a statistically positive and significant relationship between upper leg and lower leg measurements that are among anthropometric measurement ($P<0.05$). It was seen that there was a negative and opposite directional relationship between stroke rate and flexion biceps. In spite of this, any statistically significant relationship was not identified between stroke rate and the other anthropometric measurements ($P<0.05$).

Table 1. Physical characteristics of the swimmers.

Variables	Mean	SD
Age (years)	23.29	2.65
Height (cm)	175.19	10.62
Body weight (kg)	69.84	12.38

Table 2. Body Compositions of the swimmers.

Variables	Mean	SD
Endomorph	5.00	1.36
Mesomorph	3.45	1.08
Ectomorph	2.69	1.05
Body fat percentage (%)	14.02	3.26
Stroke rate (repeated)	65.06	9.66
Time (sec)	45.13	7.44

Table 3. The relationship between the anthropometric measurements, stroke rates, and times of 50 m freestyle swimming.

Variables	Stroke rate	Time of 50 m Freestyle Swimming
Age	-0.152	-0.004
Height	-0.268	-0.289
Body Weight	-0.294	-0.380*
Biceps	0.323	0.537**
Triceps	0.331	0.550**
Supscapula	0.036	0.169
Suprailiac	0.231	0.516**
Chest	0.263	0.473**
Abdomen	0.208	0.403*
Upper Leg	0.383*	0.604**
Lower Leg	0.414*	0.624**
Hand Length	-0.129	-0.220
Hand Diameter	-0.097	-0.066
Leg Diameter	-0.128	-0.339
Leg Length	-0.132	-0.058
Arm Length	-0.006	0.128
Sitting Height	0.229	-0.532
Humeral Bicandylar Diameter	-0.192	-0.364*
Femoral Bicandylar Diameter	-0.088	-0.337
Biceps during Flexion	-0.356*	-0.476**
Biceps during Extension	0.027	-0.084
Femur	-0.041	0.017
Lower Leg	-0.314	-0.227
Endomorph	0.240	0.515**
Mesomorph	-0.198	-0.458**
Ectomorph	0.029	0,166
Body Fat Percentage	0.252	0.502**

*P<0.05 **P<0.01

It was identified that there was a statistically significant and positive directional relationship between the time of 50 m freestyle swimming and biceps, triceps, suprailliac, chest, lower leg, upper leg, endomorph, body fat percentage ($P < 0.05$), and abdomen ($P < 0.01$) that are among anthropometric measurements. It was also identified that there was an opposite directional relationship between the time of 50 m freestyle swimming and flexion biceps, mesomorph ($P < 0.05$), humerus, and body weight ($P < 0.01$). In spite of this, any statistically significant relationship was not identified between the time of 50 m freestyle swimming and the other anthropometric measurements ($P > 0.05$).

DISCUSSION

In a study carried out on 5 national male swimmers, whose ages range between 18-16 years, height was measured as 180.7±5.81 cm and body weight as 73.3±6.22 kg (4). In a study carried out on 24 male swimmers, whose age range between 18 and 21 years, height was measured as 175.7±5.23 cm and body weight as 71.3±6.9 kg (6). In another study carried out on junior and young water polo national team, for the measurement value of 16 young national and 11 junior national athletes, in young team, height was found as 179.33±4.65 cm and body weight as 73.83±7.84 kg, while in junior team, height as 181.11±6.16 cm and body weight as 83.36±6.26 kg (1).

Height and body weight of 13 age males, who are the member of Canadian Young National Team, were determined as 168.2±7.7 cm, and 58.1±9.3 kg, respectively; height and body weight of 14 age males, as 174.2±5.9 cm, 63.9±7.2 kg, respectively; and height and body weight of 15 age males, as 176.9±5.7 cm, 65.8±6.5 kg, respectively (17). Mean height of 8 swimming athletes in ages of 17-20 and 8 "swimming with paddle" athletes of in age of 17-26 were found as 180.4±3.09 cm, 177.2±5.62, respectively, while their mean body weights, as 79.4±6.6 kg and 71.5±3.89 kg, respectively (3). Pre-exercise body weight of male group, whose mean age are 22±1.5 and who take education of swimming technique for 3 months was found as 62.7±6.1 and their post-exercise body weight as 63.4±5.3. Body fat percentage before exercise was found as 16.3±3 and body fat percentage after exercise as 15.5±2.2 (12). When the means of height and body weights, determined in our study, are compared to literature means, they show parallelism.

In a study carried out on 5 male national swimmers, whose ages range between 18-26 years, endomorph, among somatotype values, was determined as 2.5; mesomorph as 4.0; and ectomorph as 3.3 (14). In another study carried out on 24 male swimmers, whose ages range between 18-21 years, endomorph, among somatotype values, was determined as 2.83 ±0.78; mesomorph as 4.31±0.85, and ectomorph as 2.46±0.91 (16). In a study carried out on the players of young national water polo consisting of 16 athletes and the players of junior national water polo consisting of 11 athletes, somatotype values for the junior athletes were identified mesomorph as 4.86±0.74 in junior players and mesomorph as 4.86±0.74 in young players (1).

In literature review carried out, as the level of becoming elite of the swimmers increase, some differences were identified compared to our study we have carried out. This may be resulted

from that our study consists of the athletes participating in amateur competition and the sports are not regularly trained.

In a study, mean percentage of body fat of 8 swimming athletes in 17-20 ages and 8 "swimming with paddle" athletes in 17-26 ages were determined as ; 12.68%±2.35 and 10.42%±1.53, respectively (3). In another study carried out on the female swimmers, the time of 50 m swimming was found as 45.122 ± .293 sec, while for males, this time was 47.319 ± 6.768 (sec) (9).

In a study carried out elite and non-elite females, the time of 50 m freestyle swimming was found as 42.46±3.0911, while for elite females, this value was 34.487±1.6224. In a study carried out elite and non-elite males, the time of 50 m freestyle swimming was found as 39.015±3.9516 while for elite males, this value was 32.748±2.1641 (11).

In a study carried out on the female swimmers, the stroke rate of 50 m swimming was found as 55.588 ± .957, while for males, this value was 62.957 ± 10.576 (9). In another study carried out elite and non-elite females, the stroke rate of 50 m freestyle swimming was found as 31.86±4.525, while for elite females, this value was 56.27±5.442. In a study carried out elite and non-elite males, the stroke rate of 50 m freestyle swimming was found as 31.23±3.516 while for elite males, this value was 56.56±3.087. In literature review carried out, the similar results similar to the study we have carried out were found (11)

In some studies, it was identified that stroke rate of the swimmers was effective on the total time and that another factor affecting the total time was also the body weights of the swimmers (10). For 20 male swimmers, the variables that are related to their performances of 50 m freestyle swimming were determined. In this study, a negative significant relationship was found between swimming time and length of stroke and between the height of swimmer and his/her arm length. On the other hand, it was observed that there was a positive significant relationship between the length of stroke and length of arm and negative significant relationship and between the length of stoke and the time of 50 m freestyle swimming (8)

In conclusion; it was identified that stroke rate of 50 m freestyle swimming and times of 50 m freestyle swimming did not differentiate. Between body weight and time of 50 m freestyle swimming, negative middle level relationship was observed. This relationship shows that when body weight increases, performance of freestyle swimming will also improve. This study shows that parameter of body weight is a leading parameter for being able to become successful in swimming sport.

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