



DEVELOPMENT OF SPEED AND SPEED REACTION IN PARALYMPIC SWIMMERS

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Abstract: Sport is a systematic and intensive physical activity aiming to increase athletes' power of success and to help them reach the highest level of sports performance. Paralympic swimming is an adaptation of the sport of swimming for athletes with disabilities. This research attempts to analyze how physically disabled swimmers can be successful by using swimming development methods. For the development of Paralympic swimming, certain tools and equipment were used in weekly training hours determined in a certain period of time. Eight male swimmers were selected whose physical parameters were close to physical disabilities. The effects of the swimming equipment used in the training programme, such as hand and foot flippers and swimming parachutes, have been examined for a period of one month in the pre-race period. A stopwatch or timer is a counter for accurate measurement of time.

The purpose of the study is to examine and determine the physical development of physically disabled swimmers.

Keywords: sport; disability; Paralympic swimming; improvement in swimming; stopwatch; hand and foot swim fins; indoor swimming pool.

INTRODUCTION

Sport is a competitive, solidary and cultural concept that improves the individual's abilities under certain rules, including the individuals or groups for socialization, development of spirit and physique.

Swimming is the name given to the sport which is done by moving your body in the water only with the help of your arms and legs. The movement of different parts of the body is coordinated with the breathing, while the swimmer moves in one of the following styles: freestyle, butterfly, breaststroke and backstroke (Balan 2015: 1679). Also, swimming is a sport that is very suitable for the human body and is related to natural movements, just like walking and running. Swimming is a sport that requires high volume and training intensity, such as long distance training, interval training, sprint training, specific training specialized in a certain style (Penggali et al. 2018: 34).

Swimming is one of the most practiced sports disciplines by disabled people. The reason is the fact that they can exercise their motor skills under conditions of eliminated gravity (Becheva 2020).

According to Balan (2015), "swimming can become a means used for social integration, a modality for spending spare time or a means of education because of the combination between the specific skills with the other parts of the general education (intellectual, aesthetic, ethical)" (Balan 2015: 1680).

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Swimming for disabled swimmers according to their physical disabilities has been part of the Paralympic Games since 1960. These swimmers are divided into different classes to compete in free-style, backstroke, butterfly, breaststroke and medley (mixed) competitions. The activities are divided into two groups: for visually impaired athletes and for other disabled athletes. Mentally disabled athletes competed in swimming for the first time at the 1996 Atlanta Paralympic Games. Swimming has played a major role in attracting the attention of distinguished Paralympic athletes.

Each athlete with disabilities requires an individual technical approach which considers his/her anatomical and functional characteristics (Imparato et al. 2021: 689). A disabled swimmer can be more or less affected in the lower or upper limbs according to pathology, and consequently to perform a flip that is less efficient from a propulsive point of view. This is the element that characterizes the performance gap of athletes. In reference to world records, disabled swimmer times are three times slower than those of a non-disabled swimmer (D'Isanto et al. 2019: 79).

According to Szajer (2019), able-bodied swimmers show a lower level of somatic anxiety and a higher level of self-confidence and motivation for realization than Paralympic swimmers. That is why teachers should have all the patience and attention that *“any other point from the swimming learning programme is not as difficult and easily achieved by the disabled persons as the initializing step”* (Arheim, Sinclair 1995: 156).

According to Penggalih et al. (2018), an appropriate diet and a training programme are important to provide high energy demand, to build an optimal somatotype, and to enhance athletes' performance (Penggalih et al. 2018: 34).

Optimal aerobic and anaerobic endurance are very important for swimmers. Good speed, drag force in the water, and optimal aerobic capacity are required for swimming athletes. Body weight, somatotype, bone width, muscle mass, and fat percentage are closely related to buoyancy and drag force in swimming.

The training process and the training load in Paralympic swimmers has been observed and described quantitatively by Pelayo et al. (1999). Other studies have analyzed the performance of these athletes in competitions (Daly et al. 2001; Daly et al. 2003; Satkunskiene et al. 2005). According to Smith (2002), the training-performance relationship depends on an individual athlete's long-term training process, current level of fitness, physiological capacity and technique improvement (Smith 2002).

Paralympic swimmers follow a traditional periodization of the training process. Great training volume is apparent throughout the training block, with the highest volume in the late training phase, 4–8 weeks before an important competition. Coaches follow this period of increased volume with substantial decreases in training volume in the taper phase, particularly main set volume, 0–4 weeks prior to a competition. Training intensity levels remain much the same throughout the training block, with small increases in the taper phase as swimmers practice race pace intervals immediately before important competitions (Fulton 2010: 471).

The purpose of the study is to examine the development of speed and reflex speed of physically disabled swimmers from the Turkish Paralympic swimming team after an applied training programme.

METHODOLOGY

The article has been developed on the basis of modern theories about the development of Paralympic swimming. The contingent of the study included eight male swimmers whose physical disabilities and physical parameters were close to each other. Their average age was 16,5 years (Table 1.).

Table 1. Distribution of the subjects of the study

Gender	Number	Age	Disability / Number
Male	8	16,5 years	No arms / 2
			No legs / 2
			With one leg / 2
			With one leg and one arm / 2

A limitation of our study is the small sample size, which was dictated by our aim to include only disabled swimmers from the Turkish Paralympic swimming team who participated in systematic training.

For the purpose of the survey, we used three tests:

1. *Reaction light test.* We used a standardized light reaction measurement method. In this method, the screen of a computer is fully red, and when it turns green, the athletes should click the mouse pad as quickly as possible. The results were recorded in milliseconds (ms).

2. *Reaction sound test.* This is a sound response test. We used a standardized sound response measurement method. In this method, the screen is orange, and when the athlete hears the sound, he should click the mouse pad as quickly as possible. The results were recorded in milliseconds (ms).

3. *300 m freestyle swimming.* The results were recorded in minutes (min).

We conducted training in Paralympic swimming 5 days a week, 4 hours a day (2 hours in the morning and 2 hours in the afternoon). During the training, we used hand and foot flippers, swimming parachutes, a stopwatch and an indoor swimming pool as tools to improve the swimming of physically disabled swimmers. We created a competitive atmosphere by ensuring that everybody swim in separate lanes from time to time.

The effects of the swimming equipment used in the training programme, such as hand and foot flippers and swimming parachutes, have been examined for a period of one month in the pre-race period. In particular, the development of the speed and reflex speed was monitored.

RESULTS AND DISCUSSION

For the development of Paralympic swimming athletes, certain tools and equipment were used in weekly training hours determined in a one-month period of time (pre-race period). It can be seen that the anthropometric indicators of height and weight did not change much during that short time frame. However, an important tendency towards a decrease in body weight can be observed on the basis of the athletes' increasing height (Tables 1 and 2).

As seen in Tables 1 and 2 and in Figure 1, the average height of the Paralympic swimmers was 166,62 cm at the beginning of the experiment and 167,37 cm at the end, whereas the average weight was 59,25 kg at the beginning and 58,62 kg at the end. We think that intensive physical work during the training in the pre-race period is the reason for the body weight optimization. The average age of the athletes was 16,5 years, which explains the height increase. Also, a decrease can be seen in the variation of these two indicators in a second survey.

The sound and light tests applied show that the time for speed reaction of Paralympic swimmers has decreased.

The average time for light reaction was 0,392 ms at the beginning and 0,286 ms at the end. There is a difference of 0,106 ms between the two tests (Tables 1 and 2 and Figure 1). It can also be seen that the range of the studied indicator and the variation have decreased at the end of the study.

Table 2. Mean value and variation of assessment parameters at the start of the experiment

Assesment	Min	Max	R	Mean value	SD	Variation
Height	160	170	10	166,62	3,29	10,84
Weight	50	65	15	59,25	4,55	20,78
Light reaction test	0,311	0,437	0,126	0,392	0,048	0,002
Sound reaction test	0,349	0,592	0,243	0,49	0,073	0,005
300 m freestyle swimming	4:52:24	8:42:25	3:50:01	6:34:14	0,056	0,003

Table 3. Mean value and variation of assessment parameters at the end of the experiment

Assesment	Min	Max	R	Mean value	SD	Variation
Height	162	172	10	167,37	3,2	10,27
Weight	51	63	12	58,62	4,20	7,69
Light reaction test	0,234	0,325	0,091	0,286	0,039	0,001
Sound reaction test	0,257	0,478	0,221	0,4	0,073	0,005
300 m freestyle swimming	4:10:13	6:56:32	2:46:19	5:20:59	0,043	0,001

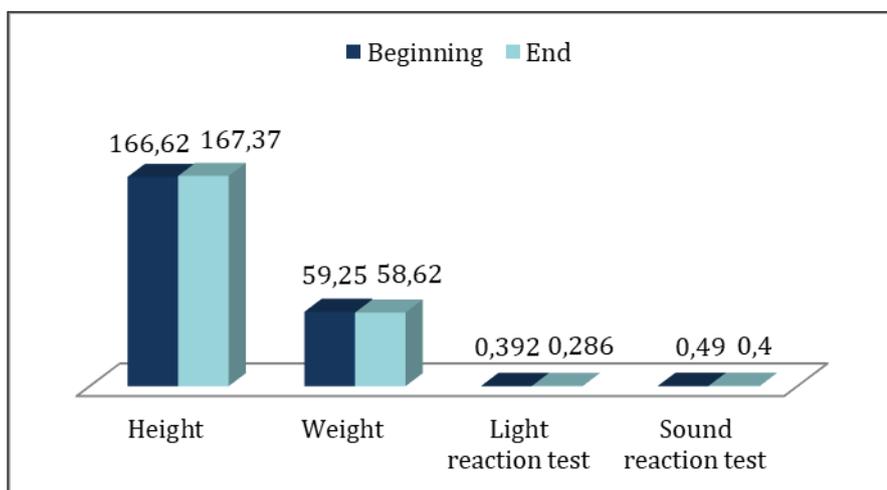


Figure 1. Average values of anthropometric and specialized speed reaction tests

We also observed a decrease in the average time for sound reaction. At the beginning of the survey, the average time for sound reaction was 0,49 ms, while at the end it was 0,4 ms. The difference is 0,09 ms (Tables 1 and 2 and Figure 1). Furthermore, we can see that the variation of the studied indicator has remained on the same level as in the beginning, but the range of the values has decreased. We believe this is due to the intensive swimming training in the pre-race period, and to the use of different specialized swimming tools.

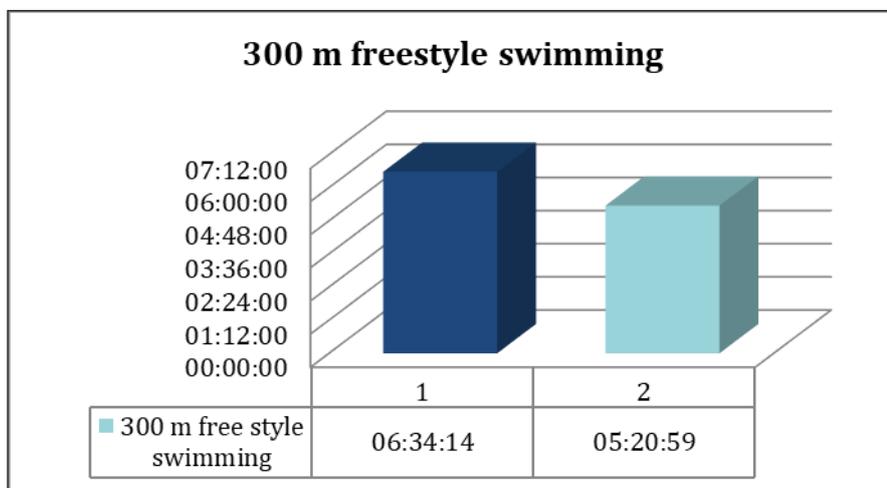


Figure 2. Average values of 300 m freestyle swimming test

As seen in Tables 1 and 2 and in Figure 2, we have taken the 300 m freestyle swimming time of eight physically disabled male athletes with a stopwatch. The average time at the beginning and the end of the training period is 6:34:14 min and 5:20:59 min respectively. Thus, the difference between the two examinations is 1:13:15 min. It can be noticed that the time for swimming the 300 m distance has decreased. The range and the variation of the results of this test have also decreased in the second examination. We believe that these results are due to the applied training means.

We also subjected the results of the tests to a comparative analysis and found that only the light reaction test shows a statistically significant difference, supported by a high guarantee probability of $Pt < 99\%$. The results of other tests indicate that the differences are not supported by relevant statistical reliability ($Pt > 95\%$), which we believe is due to the limited contingent of the study – only eight athletes, and to the short study period of one month.

CONCLUSIONS

All observed indicators have improved during the period of the study. The speed and speed reaction development of Paralympic swimmers from the Turkish Paralympic swimming team has been traced. The results from the sound and light tests and the 300 m freestyle swimming test have improved. Body weight has also been optimized. The increased body height corresponds to the young age of the swimmers and to their continuing period of growth.

Despite the lack of statistically significant differences in four of the five tests carried out, we believe that the changes are due to the applied training means and methods. We also assume that the differences are not supported by relevant statistical reliability due to the limited contingent of the study – only eight athletes, and to the short study period of one month.

We see that the intensive physical work done within one month during the pre-race period has yielded positive results in terms of the average values of the tracked indicators at the end of the study. After swimming with hand and foot flippers and with swimming parachutes, the development in speed and speed reaction of physically disabled swimmers improved. We are sure that the pre-race period is a very important time for the development of speed and speed reaction of Paralympic swimmers, as well as a prerequisite for good results in the competition period.

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