СЕКЦІЯ 2. ПРОФЕСІЙНИЙ ТА ДИТЯЧО-ЮНАЦЬКИЙ СПОРТ

SOME ASPECTS OF PHYSICAL TRAINING FOR HIGHLY QUALIFIED SWIMMERS DURING THE TAPERING PERIOD

Eduard Feroyan

Georgian State University of Physical Education and Sport,

Georgia, Tbilisi, eduardferoyan@gmail.com

Abstract. Changes in muscle force were measured during the tapering period in 17 elite male swimmers. The research was conducted before, during, and after a 14-day tapering period. Two types of tests were used: on land and in water using a special device to measure the maximum power output of arm muscles. The same parameter was also studied during a water test: each athlete had to swim 200 meters at a specified speed, which was 90% of their maximum. During the tapering period, no changes in acid balance were detected as a result of physical exertion, but a significant increase in movement power was observed (in both tests). Results improved by an average of 2.9% (due to increased muscle strength).

Key words: swimming, muscle strength, tapering.

Introduction. It is known that prolonged intensive exercise leads to a decrease in muscle strength at certain stages, and consequently, in performance results [1, 4]. In order for swimmers to reach their peak athletic form during the competition period, high training volumes are reduced (on average 2–8 weeks before competitions) [2]. Despite the fact that such volume reduction is practiced in many sports, there is little data on the physical changes occurring in the body during this period, or on the effect of tapering on athletic performance.

The aim of the study was to determine the arm muscle strength of swimmers, acid balance in the blood (lactic acid and pH) after swimming a

standard 200-meter distance before, during, and after 14 days of training with a reduced regimen (tapering). The athletes then participated in control competitions.

Organization and research methods. All swimmers (17 elite male swimmers) members of the Georgian national team trained daily for 5 months prior to the study. On average, they swam 8500 meters per day over the course of four weeks. Approximately 75% of the sessions consisted of high-intensity interval swimming. During the tapering period (14 days), the total volume was reduced daily – from 6800 meters (on day 1) to 3500 meters (on day 13); swimmers did not train in the evening on the 3rd and 7th days. For comparison, the best result of each swimmer before and after tapering was taken. The maximum hand force was measured at various arm movement speeds using a special device both in water (Swim Force test) and for work on land (Vasa Swim Ergometer). This trainer allows for precise imitation of arm stroke movements in freestyle and butterfly swimming, and exercises can be performed at a specified speed. The power output was determined by dividing the total load by the time taken to complete one stroke [3].

The next test was also conducted in water – the swimmer covered a distance of 200 meters at a speed of 90% of their maximum. The swimmer's power output in water was determined. The swimmer had to use their specialized stroke and maintain a certain pace (using a special device – underwater metronome (Tempo trainer pro)). After a 3-minute rest, samples were taken to measure lactic acid content and levels of pH, PCO2, PO2, and HCO3. Heart rate was recorded during the recovery period.

Tests on the trainer and for power determination were conducted on the 1st day of tapering and on the day following the competitions. Tests for lactic acid samples and other acid balance components were conducted on the 1st and 7th days of tapering and on the day following the competitions.

Results of the research and their discussion. All swimmers improved their athletic performance after the study (Table 1). Regardless of the distance (from 50 to 1500 m) and swimming style, the results (compared to the season's

best) were improved from 0.2 to 4.2%, with an average value of 2.9%. Thus, there are differences between the periods before and after tapering.

Table 1 – Results of swimmers' performances before and after the two-week training period with reduced volume

Swimming stroke	Distance (meters)	Before tapering	After tapering	Changes (%)
Freestyle	50	23.35	23.29	–0,26
	100	52.02	50.90	–2,15
	200	1.55,50	1.51,45	–3,51
	400	4.05,65	3.56,05	–3,91
	1500	16.17,63	15.38,83	–2,98
Breaststroke	100	1.05,40	1.03,41	–3,04
	200	2.20,78	2.15,46	–3,78
Backstroke	100	55.93	54.20	–3,09
	200	2.08,92	2.04,55	–3,39
Butterfly	100	55.83	54.55	–2,29
	200	2.05,50	2.02,45	–2,43
Medley	200	2.09,61	2.03.55	–4,23
	400	4.36,77	4.29.25	–2,72

Due to the reduced volume of training load, power output values significantly increased in both tests: on land – by 17.7%; in water – by 24.6%.

Data from swimming the 200-meter distance are presented in table 2.

Table 2 – Changes in acid balance and pulse recovery time after swimming a 200-meter distance at a steady pace

Day of the tapering period	Distance swimming time (s/200)	Lactate (mmol/ l)	pH	HCO_3 (mmol/ l)	Pulse (beats/min)
I	128,6±4,1	10,1±1,1	7,125±0,040	16,1±0,86	124±5
VII	128,1±4,6	9,6±0,6	7,114±0,018	16,1±0,84	123±6
XV	123,5±4,2	8,8±0,9	7,148±0,023	17,2±1,17	128±9

Swimmers complained of severe fatigue and inability to train during the tapering period, but felt a significant increase in strength during the final competitions.

Recent research data showed a close relationship between biokinetic strength and sprint speed (speed in freestyle swimming). The improvement in

swimmers' performance results after the tapering period was also confirmed by improved indicators when performing exercises on the trainer. This means that arm strength affects performance. However, other factors that, in combination with arm strength, can have a significant impact on performance cannot be ignored.

The results of tests on the special trainer and on measuring power during swimming revealed that the best sprinters can achieve a higher peak power than swimmers who show lower times in sprint distances. An increase in power level by 8.6% corresponds to an increase in maximum speed by 2.8%, which is similar to an improvement in swimming time at competitions by 3.1%.

Conclusion. According to the research results, during intensive training, swimmers experienced a significant decrease in muscle strength and power level. At the same time, long-distance swimmers after a heavy training load showed an insufficiently high level of "explosive" strength, which recovered after a certain rest period. Thus, repeated days of high-intensity training prevent an athlete from performing at or near their peak, which can be addressed by reducing physical stress.

List of sources of information:

1 Baumrtová, S., Jebavý, R., & Hojka, V. (2017). The influence of explosive power on the performance of an elite swimmer in 25 and 50 metre pools. *Acta Universitatis Caroline: Kinanthropologica*, Vol. 53, Issue 2: 107-115.

2 Bowman, B., & Mujika, I. (2009). Tapering World Champion Swimmers. Tapering and peaking for optimal performance. *Champaign: Human Kinetics*: 123-130.

3 Kadi, T., Wada, T., Narita, K., et al. (2022). Novel Method for Estimating Propulsive Force Generated by Swimmers' Hands Using Inertial Measurement Units and Pressure Sensors. *Sensors. 22*: 6695.

4 Whitten, P. (2005). Strength and Power. *Swimming World*. *September*: 44-45.