The effects of the exhaustive 400m. crawl Swimming on some biological values in college students

Sherif M. Adel El Sangari

Sport specialist physical Education Fac. Zagazig University
Email: sherifsangary@yahoo.com

Abstract: The purpose of this study was to investigate the effects of the exhaustive 400m crawl swimming on some biological values in college students, they were divided to control (n = 10) and swimmers (n = 10) The control group were adapted to swim irregularly, while swimmers were training regularly 3 time weekly. All the participants executed an exhausted 400 m. crawl swim test. Heart rate, blood pressure, respiratory rate, cortisol, testosterone, lactate and performance time was determined. Blood sample was withdrawn before and after test. The results indicated a low heart rate, B/P, Respiratory rate in swimmers than control, that means that swimmers are more fit, testosterone was higher in swimmers, cortisol lower than control after test. Swimmers performed better, their lactate lower at rest and higher after the test. Conclusion: regular swimmers have higher testosterone, higher anabolic action on muscles, lower cortisol due to better capability and less stress during the test. Swimmers perform better, their low resting lactate and higher one after test means higher cardio-vascular endurance and fitness.
[Sherif M. Adel El Sangari. **The effects of the exhaustive 400m. crawl Swimming on some biological values in college students.** *J Am Sci* 2015;11(12):26-29]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 5

Key words: Biological values, performance, crawl swimming, exhaustive test.

1. Introduction:

Considering proper development of children and youngsters and shaping their hygienic and health habits, it is important to choose the kinds of exercises which can be done throughout the whole life. This form of activity can be swimming which as a form of exercising in utilitarian aspect fits into broad range of notion of physical recreation (Janouska, 2008).

The issues of the speed of learning swimming due to its importance have been investigated in many scientific research (Bartkowiak, 1995 & 1997).

The effectiveness of swimming is important to improve health physical fitness and control and coordinate many different activities (Maglisho, 2005) (Cross, 1999).

Neemat Adel Rahman (200) reported that water is a media with higher concentrate than air, and swimming exercise increase adaptation and is similar to weight training and have the same result like weight training program, as swimming permit to train two agonist muscles.

Larsen (2003) and Goldstein and Brown (2001) reported that cortisol and testosterone are derivative of cholesterol, testosterone exert promote protein anabolism and growth together with masculinizing effects and cortisol increased by stress and exerts a catabolic effect and is essential for resisting stress.

Endogenous hormones are essential for biological reactions during physical work by modulating anabolic and catabolic processes. Testosterone and cortisol are playing a significant role in metabolism of protein as well as carbohydrate metabolism (Urhausen et al, 1995). Those factors of skeletal muscle synthesis and atrophy. The precursor to synthesize the testosterone and cortisol is choleserol, but their functions as different. Testosterone, steroid hormone, is secreted by the leydig cells of tests and the main function is anabolism (Borrett et al, 2010, Davis et al, 200). The evidence showed the functions of testosterone could increase muscle mass, strength, erythropoietin (EPO), elevated aerobic power and glycogen synthesis in muscle.

Cortisol is also a steroid hormone and secreted by adrenal cortex. The main function is catabolism, it can promote decomposition of protein from skeletal muscle and lymphatic tissue. Also it can inhibit glucose intake and degraded of fatty acid which become the source of energy. The exercise increase testosterone and cortisol and both are agonists at the receptor level of muscle cells. Testosterone increased after an acute bout of resistance or endurance exercise (Publinen et al, 2002, Lin et al, 2008, Hackney et al, 1995), others reported an increased cortisol level in resistance and endurance exercise (Tremblay et al, 2007), but there is no information on the hormonal response before and after acute exhaustive exercise test in non athletes and athletes individuals. Therefore, the purpose of the study was to investigate the effects of the exhausting 400m crawl swimming on some biological values including heart rate, blood pressure, Respiratory rate and Testosterone and Cortisol hormones, Lactate and performance.

Research hypothesis

There are a significant statistical changes of the effect of the exhausting (400m) crawl swimming on biological value between the control group and swimmers for the favor of swimmers.

2. Subjects and Methods

Twenty healthy student aged 18-20 volunteered were included in this study. The control group (n = 10) were not involved in regular swimming but can swim for 400m. The swimmers (n = 10) were training 3 days a week at least, they were without any sport injury, all subjects gave written informed consent.

Experimental design:

After warm upon 3 minutes. All subjects started to perform 400m. crawl swimming, and time recorded, for each participant, then cool down for 3 minutes.

Blood collection and analysis:

All Baseline samples were taken between 9 and 9, 30 a.m. then began the exercise swimming. Blood samples were collected through anticubital vein in a test tube, then the samples were centrifuged for 10 minutes and the serum stored –20˚C until analysis. The collection of blood was done before and after 400m. crawl swimming. Elisa was used to analyze testosterone and cortisol. Accusport for lactate determination. Also heart rate, B/P and respiratory rate lactate and performance were determined for each participant before and after the exhausting exercise crawl swimming for 400 m.

Statistical analysis:

All statistical analysis were performed using SPSS. All data presented as means ± SD and statistical significance was set at $P < 0.05$. Independent "t" test was used to compare means of subjects characteristics.

3. Results

Cortisol concentration revealed a higher resting concentrations in swimmers than control also cortisol increased after 400m crawl in case of the control group compared to swimmers.

Testosterone was higher in case of swimmers at rest and after 400m. crawl swimming compared to control group.

All physiological parameters heart rate, B/P, respiratory rate decreased in swimmers compared to control at rest and after 400m. crawl.

Lactate was lower at rest and higher after 400 crawl swim in case of swimmers compared to control performance score was lower in swimmers than control.

Table (1): Statistical analysis of some basic characteristics of the control and experimental group.

Variables	Control	Experimental	t
Age (yrs)	18.3 ± 3.4	18.8 ± 5.3	NS
Height (cm)	174 ± 6.5	173 ± 6.4	NS
Weight (g)	78.4 ± 6.8	76.3 ± 6.3	NS

P < 0.05, Non significant change between the two group

Table (2): Cortisol and testosterone concentrations at rest and after 400m. crawl in control and experimental group n = 10

Variables	Control		Experimental		t
	B	A	B	A	
Cortisol (ng/ml)	68±7.2	134±8.4	102±9.4	122±8.1	S
Testosterone (ng/ml)	3.1±0.8	6.2±0.9	5.8±0.7	8.9±0.94	S

P < 0.05, Significant change between the two groups at rest and after scrawl swimming

Table (3): Heart rate, B/P and respiratory rate in swimmer and control group before and after 400m. crawl

Variables	Control		Experimental		t
	B	A	B	A	
Heart rate (Pulse/min.)	72±6.8	162±10.3	68±5.4	154±9.7	S
B/P systole mm/Hg	122±6.6	125±6.4	120±5.4	124±5.7	
Diastole	82±7.4	85±3.1	80±5.6	83±3.2	S
Respiratory rate (Breath/min.)	14±2.1	35±4.4	13±2.2	32.±3.1	S

P < 0.05, Significant change between the two groups at rest and after scrawl swimming

Table (4): Lactate production and performance level during the exhausting 400 m. crawl swimming of he control and swimmers. n = 10

Variables	Control		Swimming		t
	B	A	B	A	
Lactate (Mmol/L.)	1,5±0.2	3.6±1,0	0.9±0.	4.3±0.8	S
Performance Record (min)	4.5 ± 1.1		4.1 ± 0.7		S

P < 0.05, Performance score was lower in swimmers than control lactate was lower at rest and higher after 400m. crawl swim in case of swimmers compared to control.

4. Discussion

The research hypothesis: there are a significant statistical changes of the effect of the exhausting 400 swimming dash on biological value between the two groups for the favor of swimmers.

Table (2) indicated a higher resting cortisol concentrations in swimmers than control participants also cortisol increased after 400m. crawl in case of control group compared to swimmers. Testosterone was higher in case of swimmers a rest and after 400 m. crawl swimming compared to control group.

Mougios (2006) reported that cortisol enhance gluconeogenesis, glycogen synthesis and protein synthesis in the liver and raise glucose concentration and proteolysis in muscle. At high concentration suppress the immune system. Also cortisol increase physical and mental stress. Cortisol increases in exercise exceeding 60% of O2 max. and after resistance exercise. He also added that athletes have higher resting cortisol than non athletes. So, measuring cortisol at rest may aid in estimating physical and mental stress, and after exercise may show how the participant receives a particular load. This result agree with the research data Table (2). As for testosterone it is responsible of development of male reproduction and muscle of athletes, they have anabolic action and promote protein synthesis and strenuous exercise increases testosterone in athletes more than non athletes which was reported in table (2). The magnitude of the rise depends on exercise intensity and duration as reported by Davis et al (2000), Filaire et al (2000), Hackney et al (995) and Mujika et al (1996) reported hormonal responses to training and its tapering off in competitive swimmers which denotes that the testoserone and cortisol response to different training intensity (Fry et al, 1991), Mc Murry et al (1995).

In case of the physiological parameters including heart rate, B/P, respiratory rate at rest swimmers posses lower results compared to control group. Also after 400m. crawl swimming, swimmers heart rate B/P respiratory rate was lower compared to control group (Table 3).

These results were also reported by Tremblay et al (2004) Urhausen et al (1995), Volpe et al (2007). Barrett et al (2010) stated that many cardiovascular and respiratory mechanisms must operate in an integrated fashion if the oxygen needs of the active tissue are to be met and the extra carbon dioxide and heat removed from he body during exercise. Circulatory changes increase muscle blood flow while maintaining adequate circulation in the rest of the body.

They also added that during exercise, the amount of oxygen entering the blood into the lungs is increased because the amount of oxygen added to each unit of blood flow per minute are increased.

Ying-lan et al (2008) reported that there is an abrupt increase in ventilation with the onset of exercise, followed after a brief pause by a further increase, due to depth in respiration this is accompanied by an increase in respiratory rate when the exercise is more strenuous. The increased respiratory rate noticed after exhaustive crawl swimming (Table 3) may be due to the increased depth of breathing, this result was also reported by Wasserman (1996) in their study respiratory control during exercise.

Williams (2012) stated that the inherent rythmicity and conductivity of the myocardium is influenced by the cardio vascular center of he medulla, which transmits signal to the heart through the sympathetic and parasympathetic autonomic nervous system. Stimulation of the sympathetic causes the heart to beat faster as in strenuous exercise. Acetylcholine of the parasympathetic is released to slow the heart rate.

As for the changes in blood pressure, Overgaard and Dzavik (2011) reported that systolic blood pressure is used to estimate the strain against the arterial walls during ventricular contraction and when combined with heart rate, can be used to describe the work of the heart. Diastolic blood pressure, provides an indication of peripheral resistance, or the ease with which blood flows from the arterioles into the capillaries and blood pressure fluctuates between a systolic level 120 mmHg and diastolic level 80 mmHg.

Table (4) revealed the lactate production and performance level during the exhausting 400 m. crawl swimming of the control and swimmer participants, lactate level was decreased at rest and increased after swimming in case of swimmers compared to control group, whereas performance level was for the favor of the swimmers compared to control participants.

Gastin (2001), Tietz (1995) were in accordance with these results. Mougios (2006) stated that the muscle lactate concentration can rocked from 1 m mol-kg at rest to 30 m mol-kg during maximal exercise indicating a massive anaerobic catabolism of carbohydrate. This is accompanied by an increase in the acidity of the cytosol, since the net conversion of glucose and glycogen to lactate is accompanied by proton production.

McCardle et al (2000) stated that highly trained athletes may be able to perform at 80% of their maximal capacity for aerobic metabolism, and the generation of lactate in a maximal exercise bout is increased with specific anaerobic training. Also well trained athletes have shown that after performing

strenuous exercise, lactate concentrate is 20-30% higher than in untrained subjects.

The discussion of the results indicated that the research hypothesis have been realized.

Conclusion

The results indicated that swimmers have higher anabolic hormones and higher resting cortisol concentration probably because of high intensities at which swimmers train compared to control, the lower cortisol level after the exhausting crawl swimming indicated better capability and less stress during crawl of the swimmers performance duration was in favor of the swimmers, possess low resting lactate and higher lactate level after 400 m. crawl swimming. The physiological results denote a higher fitness swimmers compared to the control group.

References

1. Barrett, K., Barman, S, Boitona, S (2010): Medical Physiology. McGraw Hill, Lange
2. Bartkowiak, E (1995): The technique of swimming. Szkoleniowe, Warszawa.
3. Bartkowiak, E (1997): Effectiveness of learning swimming. AWF in Warszawie, Poland.
4. Cross, R (1999): Swimming teaching and coaching. ASA Swimming Ent.
5. Davis N., P. Galassetti, D.H. Wasserman, & D. Tate (2000): Effects of gender on neuroendocrine and metabolic counter- Regulatory responses to exercise in normal man, the Journal of Clinical Endocrinology and Metabolism, Vol. 85, No. 1, 224-230.
6. Filaire E., B. Legrand, K. Bret, M. Sagnol, J.M. Cottet-Emardm, & J.M. Pequignot, (2002): Psychobiologic responses to 4 days of increased training and recovery in cyclists, international journal of sports medicine, Vol. 23, No. 8, 588-94.
7. Fry W., A.R. Morton, & D. Keast (1991): Overtraining in athletes, sports medicine, Vol. 12, No. 1, 32-65.
8. Gastin, P (2001): Energy system interaction and relative contribution during maximal exercise. Sports Med. 31, 725.
9. Goldstein, J and Brown, M (2001): The cholesterol Quarter. Science, 292.
10. Hackenry C., M.C. Premo, & R.G. McMurray (1995): Influence of aerobic versus anaerobic exercise on the relationship between reproductive hormones in men. Journal of sports sciences, Vol. 1, No. 4 305-11.
11. Janoska, B. (2008): Studies on the effects of teaching children how to swim at initial stage.W Roclaw, Poland.
12. Larsen, P (2003): Textbook of Endocrinology. Saunders, USA.
13. Mac Cardel, W, Kach, F, Katch V (2000): Exercise Physiology. 4th ed. Philadelphia, USA.
14. Maglisho, E (2005): Swimming faster. Human kinetics, USA.
15. McMurray G., T.K. Eubank, A.C. Hackney (1995): Nocturnal hormonal responses to resistance exercise, European journal of applied physiology and occupational physiology. Vol. 72, No. 1-2, 121-6.
16. Mougios, V (2006): Exercise biochemistry. Human Kinetics, USA.
17. Mujika I., J.C. Chatard, S. Padilla, C.Y. Guezennec, A. Geyssant (1996): Hormonal responses to training and is tapering off in competitive swimmers: relationships with performance, European journal of applied physiology and occupational physiology, Vol. 74, No. 4, 361-6.
18. Neemat Abdel Rahman (2000): Aerobic activities Mansheet El Maaref, Alex. Overgaard, C. Dzavik, V (2011): Inotropes and Vasopressors. Circulation 118, 1047.
19. Pullinen T., Mero A., Huttunen P., Pakarinen A., Komi P.v. (2002): Resistance exercise-induced hormonal responses in men, women, and pubescent boys, Medicine and science in sports and exercise, Vol. 34, No. 5, 806-13.
20. Tietz, N (1995): Clinical guide to laboratory tests. Saunders, Philadelphia. Temblay S., Copeland J.L., and Van Helder W. (2004): Effect of training status and exercise mode on endogenous steroid hormones in men. Journal of Applied Physiology, Vol. 96, No. 2, 531-9.
21. Urhausen A., Gabriel H., and Kindermann W. (1995): Blood hormones as markers of training stress and overtraining, Sport medicine, Vol. 20, No. 4, 21-276.
22. Volpe L., Lowe M., Woodhouse R., and King C. (2007): Effect of maximal exercise on the short-term kinetics of zinc metabolism in sedentary men, British Journal of sports medicine, Vol. 41, No. 3, 156-61.
23. Wasserman, T (1996): Respiratory control during exercise. American Physiology Society, 2, 120. Williams M (2012): Cardiovascular and respiratory responses to exercise. Circulation 120, 1040.
24. Ying-Lan, T, Lin, T, Tsou, C. (2008): The effect of Aerobic exercise on heart rate Naviability in obese people 50 I Chaper World Congress.

11/1/2015