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**CONTRIBUTIONS IN LEADING SCIENTIFIC TRAINING**  
**SWIMMING**

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**Abstract**

In specialty literature, the aspects of the effects of training stimuli on the athlete are analyzed from interdisciplinary perspectives. Thus, they are emphasized by several researchers from the psychologically and medical view point, having monitored the biochemical indexes during or right after the specific effort was done. The training of the performance swimmers requires the answers' finding regarding the effort-fatigue-stress variables conducting that are necessary in order to optimize the sportive performance and implicitly, the sportive longevity increasing. The purpose of the research is to identify the concrete ways of the methodological conducting of the swimming individualized training based on determining the relation between effort-fatigue-stress, by determining the psychological profile regarding the stress reactions and by determining the individual variables of some biochemical and hormonal parameters, in order to optimize the performance capacity. We assumed that the obtained information related to the psychological profile of the performance swimmers can represent objective marks in the training methodological controlling. During this research we used the following methods: the survey method for finding the competition stress (SCAT), the felt stress level, PSS, the competition anxiety level; biochemical analysis.

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**Keywords:** Swimming; performance; effort parameters.

## 1. Introduction

In specialty literature, the aspects of the effects of training stimuli on the athlete are analyzed from interdisciplinary perspectives. Thus, they are emphasized by several researchers from the psychologically and medical view point, having monitored the biochemical indexes during or right after the specific effort



was done: Anshel M.H. (2001); Ker J. H., Wilson G. V., Svebak S., și colab. (2006, p. 1557–1567); Verma J.P, Bhukar J. P., Sanjeev Kumar (2011); Allen M. S., Jones M., Paul J., și colab. (2013, p. 697-706); Nashua Whdan (2014, p.143-148); Carrasco L., Villaverde C. Oltras C.M., (2007, pg. 239-244); Angelini F., Buonocore D., Sara Rucci, Stesina G., și colab. (2011, p. 34); Bbebetos E., Antoniou P. (2012, pg.107-110); Soriaa M., González-Haroa C., Ansóna M., (2015, pg.113-119).

The specific stress of the effort, the psychological, physiological and motor parameters analysis were investigated by the following researchers: Boroș-Balin I., (2009) Mellalieu S. D., Neil R., și colab., (2009, pg. 729-744) Macovei S., Lambu E. A., Tonița F. 2011, pg. 65-70).

The training of the performance swimmers requires the answers' finding regarding the effort-fatigue-stress variables conducting that are necessary in order to optimize the sportive performance and implicitly, the sportive longevity increasing.

**The purpose of the research** is to identify the concrete ways of the methodological conducting of the swimming individualized training based on determining the relation between effort-fatigue-stress, by determining the psychological profile regarding the stress reactions and by determining the individual variables of some biochemical and hormonal parameters, in order to optimize the performance capacity.

At the beginning of this research we stated the following questions?

1. Does the training and competition effort determine the stress?
2. How can we determine and measure the stress or self-stress level that can influence the sportive performance?
3. What methodological guidelines can be adopted in order to balance the effort-fatigue relation and avoid the distress appearance?

## **2. Research hypothesis**

1. We assume that the obtained information related to the psychological profile of the performance swimmers can represent objective marks in the training methodological controlling.

2. The values' variables of some biochemical and hormonal parameters in different training stages reveal the stress profile provided by training stimuli for each performance swimmer and their values can determine adequate rehabilitation procedures.

## **3. Content, Methodology**

During this research we used the following methods: the survey method for finding the competition stress, Sport Competition Anxiety Test (SCAT), the felt stress level, PSS (Cohen - Williamson questionair), the competition anxiety level; biochemical analysis made at the National Institute for Sports Medicine and at the Sante Clinic laboratories from Pitesti and Deva.

The pilot experiment was done as case study for the cadets and juniors performance swimmers of the "Viitorul" Sportive Programme High School. The blood and urine samples for the biochemical analysis were collected in four trials, in different training periods, in order to have a proper understanding of the way that the body reacts to different adaptation periods, in training and competition, for this age of the swimmers. The biochemical and hormonal analysis were focused on determining the following parameters: CBC, Blood sugar, Cholesterol; ESR; Catecholamines; Cortisol, Prolactin.

## 4. Results, Discussions

### 4.1. The Analysis and Interpretation of the Psychological Tests

a) The analysis and interpretation of the results for P.S.S. questionnaire - The ranking of the felt stress

For M.R. swimmer, the questionnaire was applied on 25.09.2015. The swimmer was before the training period, after one month holiday. At the end of the answers, the score of the swimmer was 18 points. Because the scores around number 13 are considered as middle stress values, the swimmers is framed having a score that is close to the high stress, without overcoming the 20 points level.

On 17.12.2015, at maximum 1 hour after finishing the 100 m backstroke in the frame of Cadets National Championships, the same questionnaire was applied again, the obtained score being 22 points which indicates a high level of stress.

b). The analysis and interpretation of the Cohen-Williamson questionnaire

The evaluation instrument was used at the same dates as previous one. We found that the subject recorded at the first evaluation a 30 point score which indicates that, at the beginning of the training he has a stress level that its 5 points higher than the minimum score, but bellow the stress high level score. At the second evaluation we found that the swimmer recorded a score of 41 points, a score that is over the values of the questionnaire that was applied at the beginning of the training period. The 41 points value indicates that the stress level that was felt by the swimmer is increasing during the previous month of the competition.

c). The analysis and interpretation of the results from the competition anxiety questionnaire.

**Table 1.** The results of the competition anxiety questionnaire

Nr. crt.	Case study	Age (years)	Anxiety type		
			Cognitive anxiety (score)	Somatic anxiety (score)	Self confidence (score)
1.	M.R	14	8	6	11

This type of questionnaire has been applied only on the 17.12.2015 and the recorded athlete scores for the 3 types of the measured anxiety, point out that the athlete M.R. makes a high anxiety score for self confidence, which means that the athlete doesn't trust himself, and he undermines his value. The cognitive anxiety is the second weak point of the athlete, with 8 points. The somatic anxiety is the least affected in the competition.

d)The analysis and interpretation of the Anxiety test Sport Competition (SCAT)

The evaluation instrument has been used only after the competition, after an hour, and the athlete's results are shown in the table.

We notice that the subject shows a medium level of anxiety after the race.

**Table 2.** The questionnaire results for the Sport competition anxiety test (SCAT)

Nr. crt.	Case study	Age (years)	Result	Interpretation
1	M.R	14	22	Middle anxiety level

#### 4.2. The Analysis and Interpretation of the Biochemical Analysis Results

The analysis and interpretation of the biochemical parameters values regarding the physical effort impact over the functional state of the body for the swimmer M.R., has been realized for each determined parameter

**Table 3.** The biochemical analysis results of swimmer. M.R.

The determined biochemical parameters	Basal blood testing effort 28.09.2015 08:14	Basal blood testing effort 16.11.2015 11:11	A week before the contest		During contest	
			Before the effort 11.12.2015 09:21	After the effort 11.12.2015 09:30	Before the effort 17.12.2015 15:41	After the effort 27.11.2015 15:50
Leucocytes (WBC) (10 <sup>3</sup> /ul)	5.9	6.4	6.7	9.9	7.5	13.7
Neutrophils (%)	40.3	52.3	48.6	40.1	36.3	35.5
Eosinophils(%)	4.1		2.1	2.1	2.9	2.0
Basophiles (%)	0.6		0.7	0.9	0.8	1.2
Lymphocytes (%)	49.2	45.1	44.7	51.9	54.3	54.0
Monocytes (%)	5.8	9.2	3.9	5.0	5.7	7.3
Red blood cells (10 <sup>6</sup> /uL)	5.47	4.22	5.68	6.65	5.34	5.84
Haemoglobin (HGB) (g/dl)	15.1	15.5	15.61	15.8	14.7	16.0
Haematocrit (HTC) (%)	44.6	42.0	46.7	46.8	43.9	48.5
MCV (Fl)	82	87.5	82	83	92	83
MCH (pg)	27.6	32.2	27.5	27.9	27.6	27.3
MCHC (g/dl)	33.8	36.9	33.4	33.7	33.5	32.9
RDW (%)	12.4	13.5	12.1	12.4	12.3	12.4
Platelet (PLT) (10 <sup>3</sup> /uL)	279	352	286	318	284	369
MPV (Fl)	8.7	7.4	8.4	8.4	8.2	7.9
Tombrocrit (PCT) (%)	0.243	0.260	0.242	0.269	0.232	0.293
PDW (%)	14.0		14.0	14.0	13.8	12.8
Neutrophils (10 <sup>3</sup> /uL)	2.38		3.24	3.98	2.72	4.86
Eosinofile (10 <sup>3</sup> /uL)	0.24		0.14	0.21	0.22	0.27
Limfocite (10 <sup>3</sup> /uL)	2.90	2.9	2.98	4.15	4.07	7.39
Basophiles (10 <sup>3</sup> /uL)	0.04		0.05	0.09	0.06	0.16
Monocytes (10 <sup>3</sup> /uL)	0.34	0.6	0.26	0.50	0.43	1.00
ESR(mm/h)	5	10	5	5	5	5

a) During breaks the leucocytes have normal values, but after effort, they present increased values (from 6.7 to 9.9), after the race effort, the number of lymphocytes increases to 14.7, over the maximum normal values by 0.2.

b)the neutrophils have normal values during breaks, but after physical effort, the values drop. During the race, both before and after the physical effort, it can be noticed values under the normal limits (35.5, the minimum value being 40)

c) During breaks the eosinophils have normal limits values, higher before the competition effort, but with dropping values after the competition effort.

d) the basophiles have normal values before the physical effort, but after it they present insignificant increases, being higher after the competition effort. (0.8 to 1.2)

e) the lymphocyte have values in normal limits before the effort and an insignificant rise after the physical effort.

f) the monocyte have values in the normal limit, before the effort, but also after the physical effort is finished, the highest rising being recorded after the competition effort (7.3), but it remains between the normal parameters.

g) The red blood cells have normal values in the basal effort, but in the previous week of the race, they show high levels over the normal values, both before (5.68), but also after the effort, with a rise until 6.68. During the race, they have normal values before the effort and over the normal limits by 0.24 , after the effort finishes.

h) The haemoglobin level during breaks records values at the highest level of the normal limit, but after the physical effort, a rise can be seen for the biochemical value, the highest being recorded after the physical effort during the race (16.0).

i) The haematocryt values show in the basal effort high values in the normal limit with high levels after the physical effort by 48.5 over the normal limit.

j) The biochemical values MCV, MCH, MCHC and RDW show values at the low level of the normal limit, both before and after the physical effort.

k) The platelet show values between the normal limits, both before and after the physical effort, by showing insignificant rises after the competition effort. The medium volume (MPV), shows values in the low level of the normal values, with insignificant rises after the physical effort.

l) PCT shows values in the normal limit both before and after the physical effort, with insignificant rises after the effort.

m) PDW shows values in the normal mediums both before and after the physical effort, a rise in the normal limits happening after the competition physical effort.

n) The neutrophiles values can be noticed in this swimmer case in some normal limits, with a little rise after the physical effort from the race, but between normal limits.

o) the eosinophils don't show significant rises after the physical effort in relation to the recorded values before basal.

p) the lymphocytes have normal values, with rises after the physical effort. For athlete M.R. it can be shown some significant rises and surpass of the normal limit, after the physical effort from the race, with values up to 0.89.

r. the values of the basophiles show values between normal limits with insignificant rises after the physical effort.

s. the ESR shows values between normal limits, which aren't influenced by the physical effort.

### 4.3. The Analysis and Interpretation of the Hormonal Results

**Table 4.** The hormonal analysis results of M.R. swimmer

The determined hormonal parameters	Basal blood testing effort 28.09.2015 08:14	A week before the contest		During contest	
		Before the effort 11.12.2015 09 :21	After the effort 11.12.2015 09:30	Before the effort 17.12.2015 15 :41	After the effort 27.11.2015 15:50
Epinephrine (nmol/l)	0.75	<0.50	<0.50	<0.50	<0.50
Nor Epinephrine (nmol/l)	3.01	4.11	7.57	<0.50	15.41
Dopamine (nmol/l)	<0.50	<0.50	<0.50	<0.50	<0.50
Prolactin (ng/ml)	6.53	7.21	9.16	8.291	14.6
Cortisol	12.0	12.3	10.9	4.74	15.1
Glycaemia (mg/dl)	85	82	115	97	129
Total Cholesterol (mg/dl)	162	154	164	160	185

1) epinephrine shows values between normal limits (< 0.50 nmol/l), no matter what is the time when the blood testing has been taken or if physical effort was done; 2) norepinephrine shows values over the medium after physical effort with a more significant rise after the physical effort from the race (11.75 over the maximum normal value); 3) dopamine shows values of < 0.50 under the reference biological level, no matter the blood testing time and the state of the body. 4) the prolactin values show rises after the physical effort, rising after the competition effort, over the maximum normal limit; 5) the cortisol shows values between the normal limits with a rise over the 4 o'clock P.M. ones, after the race effort; 6) the blood pressure level before the physical effort and after, it is placed between normal values and after the physical effort, it records rises which go over the normal limits, reaching to 129 after the competition effort; 7) the total cholesterol values show normal values limits with rises after physical effort.

### 4. Conclusions

The results of this research underline that the training effort for swimming causes a psychological and physical stress, causes the discharge of the nor epinephrine from the pituitary.

The results show that the physical effort generates increases of the medium level of prolactin and after the psychological stress in the race, it reaches values beyond those registered after the physical effort from the training. The competition determines the cortisol discharge after the physical effort and because of the psychological stress. The neutrophils drop under the previous normal medium values for the physical exercise.

The rise of the lymphocytes number is done by the physical effort, by raising the nervous system, as also by the emission of catecholamine.

The physical exercise from the training and from the competition, associated with the psychological stress from the competition, produces to the body, for the trained swimmers, biochemical and hormonal changes, and also has an influence in the performance capacity.

## References

- Allen M., S., Jones M., McCarthy, P., J., Sheehan-Mansfield, S., & Sheffield D., (2013). Emotions correlate with perceived mental effort and concentration disruption in adult sport performers, *European Journal of Sport Science*, 13, 697-706.  
<http://dx.doi.org/10.1080/17461391.2013.771381>
- Angelini F., Buonocore D., Rucci S., Stesina G., Stefan, I. L., Bonuccelli A., Tencone F., Marzatico F., (2011). Oxidative stress vs hormonal profile in plasma and saliva: application in sport performance, *Journal of the International Society of Sports Nutrition* 2011, 8(Suppl 1):P34,  
<http://www.jissn.com/content/8/S1/P34>
- Anshel M. H., (2001). Qualitative Validation of a Model For Coping With Acute Stress in Sport., *Journal of Sport Behavior*, Volume: 24 Source Issue: 3, <http://www.biomedsearch.com/article/Qualitative-Validation-Model-Coping-With/77384742.html>
- Bebetsos E., Panagiotis A., (2012). Competitive state anxiety and gender differences among youth greek badmintonPlayers, *Journal of Physical Education and Sport*, 12(1), Art 17, pp. 107 - 110, 2012. Accessed at 26.03.2016  
[https://www.researchgate.net/publication/225027931\\_Competitive\\_state\\_anxiety\\_and\\_gender\\_differences\\_among\\_youth\\_Greek\\_badminton\\_players](https://www.researchgate.net/publication/225027931_Competitive_state_anxiety_and_gender_differences_among_youth_Greek_badminton_players)
- Boroş Balin I., (2009). The psychological stress and the physic effort capacity, PhD thesis. Accessed at 26.03.2016, retrived from [https://www.google.ro/?gws\\_rd=cr,ssl&ei=HLz2Vq--M8HYyAO445-wDw#q=boros+balint+iulia+rezumat+teza](https://www.google.ro/?gws_rd=cr,ssl&ei=HLz2Vq--M8HYyAO445-wDw#q=boros+balint+iulia+rezumat+teza)
- Caracso L., Villaverde C., Oltras C., M., (2007), Endorphin responses to stress induced by competitive swimming event, *Journal of Sports Medicine and Physical Fitness*; Jun 2007; 47, 2; ProQuest Centralpg. 239/245
- Dubiţ N., S., (2016). Preliminary researches regarding the efort/fatigue/stress relation in performance sport. Research report presented in Pitesti University, PhD School in Sport and Physical Education Science
- Ker J. H., Wilsong V., Svebak S., Kirkcaldy B. D., (2006). Matches and mismatches between telic dominance and type of sport: Changes in emotions and stress pre- to post-performance, *Personality and Individual Differences*, Volume 40, Issue 8, June 2006, pp.1557–1567, doi:10.1016/j.paid.2005.10.024
- Macovei S., Lambu E., A., Toniţa F., (2011). Study concerning the precmpetition anxiety ocurrence in high performance athletes from Do Martial Arts. *Discobolul, NUPES Journal*, VI, 3(25), Accessed at 21.07.2016, retrived from [http://www.unefs.ro/discobolulmagazine/extenso/2011/Discobolul\\_3\\_2011\\_extenso.pdf](http://www.unefs.ro/discobolulmagazine/extenso/2011/Discobolul_3_2011_extenso.pdf)
- Mellalieu S., D., Neil R., Hanton S., Fletcher D., (2009). Competition stress in sport performers: Stressors experienced in the competition environment, *Journal of Sports Sciences*, 27:7, 729-744, DOI: 10.1080/02640410902889834. Accessed at 24.03.2016, retrived from <http://dx.doi.org/10.1080/02640410902889834>
- Soriaa M., González-Haroa C., Ansóna M., José L., López-Colónb, Escaneroj F., (2015). Plasma levels of trace elements and exercise induced stress hormones in well-trained athletes, *Journal of Trace Elements in Medicine and Biology* 31 (2015) 113–119. Accessed at 26.03.2016 retrived from, [www.elsevier.com/locate/jtemb](http://www.elsevier.com/locate/jtemb)
- Verma J.P, Bhukar J. P., Sanjeev Kumar, (2011). A study on stress stimuli among the students of Physical Education. *Journal of Physical Education & Sport / Citius Altius Fortius*;2011, Vol. 11 Issue 1, ISSN: 2333-9721 , pp. 48 . <http://www.oalib.com/paper/2862580>
- Whdan N., (2014). Effects of relaxation training on muscle tension and the performance level of 50m front crawl swimming, *Science, Movement and Health*, Vol. XIV, ISSUE 1, 2014 January 2014, 14 (1): 143-148. Accessed at 26.03.2016, retrived from <http://www.analefebs.ro/anale-febs/2014/i1/pe-autori/23.pdf>