



GEOSPORT FOR SOCIETY

Scientific Journal founded in 2014 under aegis of University of Oradea (Romania),
University of Debrecen (Hungary), University of Gdansk (Poland)
ISSN 2393-1353

Edited by Oradea University Press
1, University Street, 410087, Oradea, Romania

Journal homepage: <http://geosport.uoradea.ro/geosport.html>



Investigations concerning the influence of sports trainings carried out in a protected area (Natura 2000 site) on various physiological and biological parameters for athletes

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Article history: Received: 02.12.2016; Revised: 05.01.2017; Accepted: 30.06.2017; Available online: 07.07.2017

Abstract. The study propose a comparative analysis of biochemical and physiological parameters and their dynamics in athletes training in two different locations: the campus stadium in the Oradea University and a protected area- Valea Roșie Natura 2000 site. The research was conducted between 31st of May 2016 –9th of June 2016 on the players of a female volleyball team of Oradea's University Sport Club, aged between 18 and 24. We used

Polar RC3 heart rate monitor, monitoring: distance travelled in each exercise, duration, calories consumed, heart rate, minimum and maximum altitude. After the effort, biological samples were taken, analysing the following indices: Creatine kinase (CK), Lactate dehydrogenase (LDH) and Sideremia; the data interpretation and the results highlighted that organizing outdoor trainings in sites like Natura 2000 has a favourable influence on the biochemical parameters, had a contribution to "breaking" the routine and being a motivating factor for athletes in their activity.

Keywords: female volleyball team, blood samples, Creatine kinase, Lactate dehydrogenase, Sideremia

Introduction

The training conditions, the motivation of athletes, the environmental factors or air quality are elements that significantly contribute to the athletic performance of a sportsperson (Dragoş, 2014). The benefits of sports practicing and recreational activities in different environments were debated and researched over time, studies being made even for elderly (Cauwenberg et al., 2011; Zadarko et al., 2011, Iliş et al., 2017, Portegijs et al., 2017; Zijlemaa et al., 2017) are also mentioned (Baltaretu, 2012, Turk 2016, Herman a., 2016, Herman b., 2016) other activities of this kind carried out in protected areas. Furthermore, physiological and biological effects of practicing physical exercises have been investigated in a series of specific papers (Brancaccio et al., 2006; Brancaccio et al., 2007; Baird et al., 2012, Jastrzębski et al., 2015).

Based on the existing ideas, in alliance with the desire to create the premises for a future research in this direction, we proposed a pilot study in order to establish the influence of the environment on some physiological and biochemical parameters relevant in assessing the training of professional athletes.

Thus, in order to achieve this objective, we hypothesized that the physical effort undertaken during training and therefore the effort and biochemical parameters can be influenced by environmental conditions and air quality.

The main objective can be summarized in a comparative analysis of biochemical and physiological parameters and their dynamics in two athletes training locations (the campus stadium in the Oradea University and the Valea Roşie Natura 2000 site).

The Valea Roşie Natura 2000 site is a complex specific habitat of forests with *Asperulo-Fagetum* type, of which forests occupy 86%, followed by land occupied by forests in transition (5%), pastures (5%), grape vine (2%) orchards (2%). In this area, with a surface of 819 ha there are 14 species protected of rare plants found on the red list, species of amphibians and reptiles of national importance (Herman et al., 2016).

Material and methods

The present research was conducted between 31st of May 2016 –9th of June 2016 on the players of a female volleyball team of Oradea's University Sport Club, aged between 18 and 24, the team playing in the senior level of the A 2 West Division. In order to obtain relevant and objective results, during the study period three training workouts were conducted, with an average duration of 60 minutes,

identical in content and type of effort. Blood samples were collected in the mornings after performing the effort and have been subjected to analysis and interpretation.

Training sessions (Szabo-Alexi, 2009, Szabo-Alexi et al., 2016) were held for three consecutive days in the period 31st of May 2016 – 2nd of June 2016, on the sports campus of the University of Oradea (fig.1,3) (located in Oradea city, in the Crisurilor Plain, Bihor County, on the left side of Crișul Repede River, at about 110 m altitude); there was a break of 10 days following a new series of training during 12th of June–14th of 2016, in the Valea Roșie Nature 2000 site (Türk et al., 2004, Baltaretu, 2012) (located in Oradea's Hills (fig.1), at altitudes around 150 m, a protected natural area situated on the territory of Bihor County, in north-western Romania, coupled with the collection of blood samples in the mornings after performing the effort.



Figure 1. The sports fields location within the campus of University of Oradea and Valea Roșie Nature 2000 Site, Bihor County, Romania

The exercises of each player have been tracked using a Polar RC3 heart rate monitor, a model that incorporates GPS tracking¹. The following indices were monitored: distance travelled in each exercise, duration, calories consumed, heart rate, minimum and maximum altitude. After the effort, biological samples were taken, analysing the following indices: Creatine kinase (CK), Lactate dehydrogenase (LDH) and Sideremia. The data obtained were downloaded using the Polar software and the data analysis and interpretation functions were used). The dedicated web application was used, and the medical analyses were performed on the Beckman

Coulter AU680 analyser, Beckman Coulter reagents were used according to IFCC standardized methods. The laboratory is RENAR (Romanian Accreditation Association) accredited according to ISO15189: 2013².



Figure 2. Running surface within Valea Roșie Nature 2000 site.



Figure 3. Running surface on sport camp, the Campus University of Oradea site.

Results

The statistical analysis reveals that there is no significant difference in the parameters of the effort carried out at the campus stadium of the University of Oradea and in the Valea Roșie Nature 2000 site respectively; but from the point of view of the biological samples, two of the three parameters (Creatine kinase and Lactate dehydrogenase) expose significant changes after the Valea Roșie Nature 2000 training. Thus, the Independent t Test indicates a value of 2.44 in the statistical analysis of Creatine kinase (table 1), 1.90 for Lactate dehydrogenase (table 2) and 1.72 for Sideremia (table 3). Comparing these values with the one-dimensional critical values we can see that if the first two measurements can reject the null hypothesis for the Sideremia biological parameter, we cannot reject this hypothesis, which is also reinforced by the one-dimensional critical probability where the value displayed for Creatine kinase and Lactate dehydrogenase is lower than all α usual values.

Table 1. Test t of statistics for Creatine kinase

t-Test: PairedTwoSample for Means		
	Variable 1	Variable 2
Mean	159,75	234,0833333
Variance	4022,568182	8236,992424
Observations	12	12
Pearson Correlation	0,099848821	
Hypothesized MeanDifference	0	
df	11	
t Stat	-2,442958094	
P(T<=t) one-tail	0,016325508	
t Criticalone-tail	1,795884819	
P(T<=t) two-tail	0,032651016	
t Criticaltwo-tail	2,20098516	

Table 2. Test t for Lactate dehydrogenase

t-Test: PairedTwoSample for Means		
	Variable 1	Variable 2
Mean	104,4166667	145,3333333
Variance	1818,44697	1852,424242
Observations	12	12
PearsonCorrelation	-0,513433268	
HypothesizedMeanDifference	0	
df	11	
t Stat	-1,901637848	
P(T<=t) one-tail	0,041859013	
t Criticalone-tail	1,795884819	
P(T<=t) two-tail	0,083718026	
t Criticaltwo-tail	2,20098516	

Table 3. Test t for Sideremia

t-Test: PairedTwoSample for Means		
	Variable 1	Variable 2
Mean	90,66666667	120,5
Variance	914,2424242	2443,181818
Observations	12	12
PearsonCorrelation	-0,079805454	
HypothesizedMeanDifference	0	
df	11	
t Stat	-1,723393267	
P(T<=t) one-tail	0,056385992	
t Criticalone-tail	1,795884819	
P(T<=t) two-tail	0,112771984	
t Criticaltwo-tail	2,20098516	

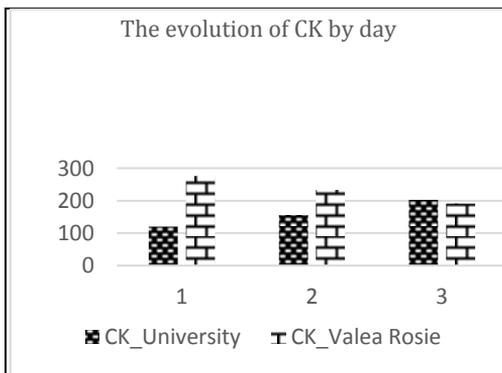


Figure 4. The dynamics of Creatine kinase evolution

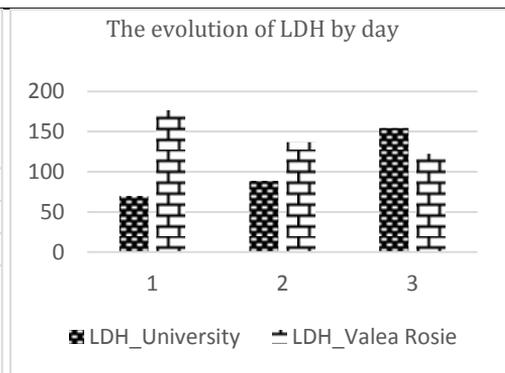


Figure 5. The dynamics of Lactate dehydrogenase evolution

Analyzing the data for CK and LDH, a correlation can be made between the results and the purpose of the study (basically the values obtained from the effort carried out on the stadium on the campus of the University of Oradea are increasing

for days 1,2,3 (fig.4) while the results of the effort carried out in the Valea Roşie Nature 2000 site are decreasing for days 8, 9, 10 (fig. 5).

Discussions

The above situation can be explained by the fact that the muscles are progressively stressed in the effort deployed at the campus of the University of Oradea, while the effort carried out within the Valea Roşie Nature 2000 site is easier to perform (probably also due to the superior oxygenation, psychic relaxation of the athletes, the softer surface on which the physical effort is performed (grounded land (fig. 3). In fact, on the stadium from the campus of the University of Oradea fatigue accumulates (LDH increases), the muscles are progressively stressed (CK increases), there is a period of insufficient break to eliminate the total CK released (muscles are still stressed). However, the muscular stress is easier to perform (CK decreases) and muscle fatigue decreases (LDH decreases) in the Natura 2000 site.

Conclusions

Organizing trainings in sites like Natura 2000 has a favourable influence on the biochemical parameters, but a lesser one on the physiological parameters, as they are conducted in a friendly environment. The link between environmental conditions in which athletes achieve their training and the dynamics of biochemical parameters can provide important data on how to act at certain stages of the training. Conducting training in different environmental conditions and "breaking" the routine can be a motivating factor in engaging athletes in their activity. It is partially confirmed that the physical effort made during training and, implicitly, the biochemical parameters may be influenced by environmental conditions and air quality. According to the results obtained, there are prerequisites for carrying out extensive research in this direction.

Acknowledgements

With all due acknowledgments for the participants who received information about the objectives, procedure and benefits of this study and agreed to participate in the study, implicitly in the sampling of biological samples.

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