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STUDY ON CHANGING HEMATOCRIT VALUES AFTER A21 DAY STAGE OF TRAINING (ATHLETICS) ON SAND OF BLACK SEA SEASIDE (CONSTANȚA, ROMANIA)

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Abstract

Background. It is known that performance athletes, in the desire to achieve the best results, seek to train themselves in the most favorable conditions for increasing sports performance.

Objectives. The research aims to achieve a significant increase in the athletes' performance by modifying the values of the hematocrit, possibly by introducing into the training plan a training course on the beach, resulting in physiological and biochemical changes favorable to the effort capacity .

Methods. The research was conducted on a group of 10 performance athletes during a 21-day training course on Constanta Beach. In order to accomplish this research we used the experiment method, the static-mathematical method, the graphic representation method.

Results. The analysis of the data shows that after the training on the beachthat, hematocrit values increase by more than 1% after training at the seafront training, thus increasing the athletes' ability to work.

Conclusions: Making one or more beach training stages significantly improves the performance of runners by triggering physiological, haematological changes in the body of athletes conducive to increased performance

Keywords: hematocrit, aerobic capacity, beach.

Introduction

Air is a mixture of nitrogen (78% of the atmospheric gases), oxygen (21%), water vapors, carbon dioxide (0.03%) and a large number of other gases in very small quantities: natural gases(argon, neon, hydrogen, etc.) or gases produced by human activities: urban and industrial pollution.

Continental air also contains various suspended particles such as pollen, plant spores, bacteria, fungi, allergens, dust.

Sea air covers a very small area of the coast and it has the following features:

- it is richer in oxygen and contains less CO_2 than continental air;
- due to the photosynthesis conducted byseaweeds, it has a higher water vaporcontent(hygrometry);
- it contains fewer pollutants and suspended particles;
- it is rich in negative ions;
- its physical characteristics (pressure, temperature, hygrometry) are more stable than those of continental air.

Many articles address the benefits of these particles, with reference to the work of Robert Escombe (2009, *Ionization, the benefits of negative ions*, 8th Edition, Edition du Dauphin). The topic does not seem to raise interest for research in Romania (even we have Black Sea), so it is difficult to get the information, however applications can be found in many countries (for instance, negative iongenerators for vehicles in Japan).

What are negative ions?

Negative ions are particles which build up a negative electrical charge when they receive a significantenergy supply, for instanceunder the effect of electromagnetic solar radiation, UV radiation, storms, natural radioactivity in rocks (granite rocks), photosynthesis in plants, the bustle of forests and grass or large bodies of water in motion (rivers, waterfalls, waves and oceans).Thus, the negative ions of sea air are created due to the sea and waves

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movements: water spraying breaks the electrically chargedmolecules.

Concentration of negative ions in different areas on the earth:

The base ofwaterfalls: 10 000 upto 50 000 ions/cm^3

Mountain: between 8 000 and 12 000

Seaside: 4000

Forest: 3000

Rural area: 1 200

Pollutedcity: 50

Car:15

Negative ions promote the exchange of oxygen and CO_2 between the lungs andblood and between blood and tissues: breathing is more effective, the organs receive more oxygen, which improves their performance. They also reduce serotonin (neurotransmitterof the central nervous system) and activate the cortisol secretion which has an anti-inflammatory effect. At the same time, we notice enhanced sports performance, mood, tone, focus, sleep quality and low stress-vulnerability (according to Robert Escombequoted above).

According to another source, negative ions reduce heart rate, blood pressure and metabolism in persons already suffering from disorders, they have lower effects or little effect on ordinary people and, in some cases, no effect has been noted (according to alternative medicine practitioners, Quebec).

The effects of iodine:

Iodine is essential for the thyroid;it is found on the thyroid hormones in order to make active hormones. They adjust metabolism rate: too many hormones = fast metabolism in all the organs, including the brain; not enough hormones = slow metabolism; no hormone = life is impossible without it.

Hematocrit

Red blood cells contain a protein called hemoglobin which transports oxygen from the lungs in the body.

The hematocrit is a test which measures the volume ofred blood cells (erythrocytes) compared to the total blood volume. Blood consists of erythrocytes, white bloodcells (leukocytes) and thrombocytes suspended in a fluid portion called plasma.The hematocrit is the ratio of the red blood cells volume to the volume of all these components, called whole blood. The value is expressed as a percentage or fraction. For instance, a hematocrit level of 40% means that there are 40 milliliters of red blood cells in 100 milliliters of blood.The test is a quick and easy way to assess the red blood cells of a person and to assess anemia.

Erythrocytesare produced in the bone marrow and released in the blood flow when they are mature or almost mature. They are usually about 37-49% of the blood volume. Erythrocytes contain hemoglobin, a protein relatedto oxygen. Their primary function is to carry oxygen from the lungs in the tissues and organs of the body.

Erythrocytes (red blood cells) also carry a small part of carbon dioxide, a by-product of the cellular metabolism, from the tissues and organs back into the lungs, where it is removed. The life span of a red blood cell is 120 days and the bone marrow must constantly produce new erythrocytesto replace those aging, degrading orwhich are lost by bleeding.A series of conditions may affect either the production of new red blood cells by the bone marrow, or the lifespanof these cells or which result in significant bleeding.

The hematocrit reflects both the number of red blood cells and their volume (average body volume or ABV).

If their size decreases, the hematocrit will decrease as well and vice versa. In general, the hematocrit will increase when the number of red blood cells increases and the hematocrit will drop to less than normal when there is a low red blood cellsproduction by the bone marrow, an increase in cells destruction or in case of massive bleeding.

If the bone marrow is not able to produce new erythrocytes soon enough, the total number of red blood cells and the hematocrit will decrease, causing anemia.

In case of anemia, the body does not have the ability to release enough oxygen into the tissues and organs, thus causing a state of fatigue and weakness. In case of polycythemia, too many erythrocytesare produced (which causes an increased hematocrit) and blood may thicken, causing a slow blood flow and similar issues.

Assumptions: Implementation of a trainingsession.As a result of these studies, we proposed to researchthe influence of negative ions concentration on professional athletes' workload, due to physiological and biochemical changesconducive to the support of workload.

Materials and methods: We note that the research protocol has been carried out in accordance with the Helsinki Declaration, the Treaty of Amsterdam and the Directive 86/609 EEC and approved by the Ethics Commission within Education and Sports Department of "1 Decembrie 1918" University of Alba Iulia, in terms of human subjectsresearch.

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Test	Average	Average diff.	Median	Minimum	Maximum	Coefficient of variation	WILCOXON TEST		Effect Size
							Z	P	
Initial	41.90	1.27	43.20	35.34	44.60	3.14%	-1.378	1.08	0.51
Final	43.17		44.5	35.98	47.20	3.68%			

The research procedures have been fully explained to the participants in the study and their written agreements have been received prior to the commencement of the research.

Time and place of the studies: The studies have been carried out between 20.03.2017-10.04.2017, on the sand of Black Sea Beach,Constanța, Romania.

Subjects: 10 athleteswithin the sports section:track and field athletics, which have trained on the beach for21 days, they have had the same training schedule, the same diet and have benefited from the same nutritional supplements.
and 10 athletes within the sports section: track and field athletics, which have trained on the stadiumin Constanțafor 21 days, they have had the same training schedule, the same diet and have benefited from the same nutritional supplements.

Testsapplied:blood samples have been taken and the hematocrit results have been compared before and afterthe training session.

Results: Hematocrit values expressed in %, before and after the 21-day sports training on the beach

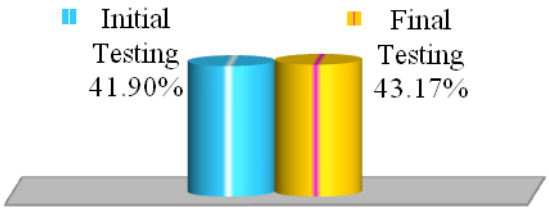
HEMATOCRIT HCT - %

NAME SURNAME	BEFORE THE 21-DAY TRAINING SESSION	AFTER THE 21-DAY TRAINING SESSION
R.E	44.6	45.9
V.E	43.9	46.2
L.I.C	44.2	45.1
B.A.	38.6	39.4
C.A	35.34	35.98
D.A.	45.9	47.2
M.B.	44.2	46.1
P.A.	39.2	40.8
B.M.	42.5	44.0
M.A-M.	40.6	41.0

At the end of the training session on the beach, we note an average increase of the hematocrit HTC by1.27 (2.9%), from 41.9 to 43.17%. Both tests indicate that data dispersion is homogeneous. According to the Wilcoxon nonparametric test, the average increase ofthehematocrit HTC is statistically significant, the significance threshold p = 1.08> 0.05 for z = -1.378. The chartshowing the average values ofthehematocrit HTC within the two tests is submitted below:

HEMATOCRITHTC

Average Values



21-DAY STAGE OF TRAINING ON SAND OF BLACK SEA BEACHCONSTANȚA
HEMATOCRIT HTC

INTERPRETATION OF RESULTS

21DAY STAGE TRAININGAT THE FARUL STADIUM CONSTANȚA

HEMATOCRIT HTC

Test	Average	Average	Median	Minimum	Maximum	Coefficient	WILCOXON TEST	Effect

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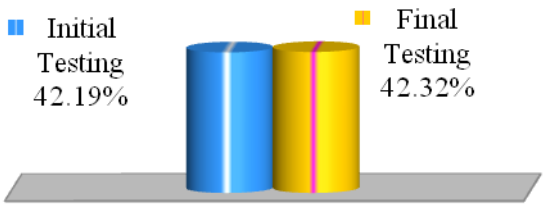
		diff.				of variation	Z	P	Size
Initial	41.90	0.12	43.0	33.50	48.20	9.7%	-2.585	0.010	0.58
Final	42.81		43.1	34.00	48.30	9.4%			

INTERPRETATIONOFRESULTS

Related to the hematocrit HTC, we note an average increase at the end of the training session at the seaside by 0.12 (0.6%), from 41.90 to 42.81%. Bothtests indicate that data dispersion is homogeneous. According to the Wilcoxon nonparametric test,the increase of the hematocrit HTC is statistically significant, the significance threshold p = 0.010 <0.05 for z = -2.585. The effect size index (0.58) indicates a high to very high difference between the two tests. The chart below shows the average values of the hematocrit HTC within the two tests.

HEMATOCRIT HTC
Averagevalues



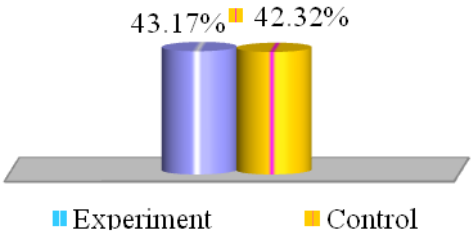
EXPERIMENTVS CONTROL
HEMATOCRIT HTC

Groups	Average	Average diff.	Median	Minimum	Maximum	Coefficientof variation	MANN WHITNEY TEST Z	P	Effect Size
Experiment	43.17	0.85	44.5	35.98	47.20	8.3%	-0.151	1.08	0.13
Control	42.32		43.05	34.00	48.30	9.4%			

INTERPRETATIONOFRESULTS

At the end of the training session, the average value of the experiment group (43.17%) concerningthehematocrit is higher than the one of the control group (42.32%). Data dispersion is homogeneous in both groups. Mann-Whitney test indicates a difference (1.12%) which is statistically significant,thesignificance threshold p = 1.08> 0.05, for z = -0.151. The averages of each of the two groups at the end of the training session on the beach andat the seasideareshown in the chart below.

HEMATOCRIT HTC
Averagevalues



Discussion: Due totheairwhich is rich in negative ions present on the beach, physiological changes occur.

Discussion: At present, two lines of empirical evidence suggest that NAI(Negative Air Ions) can affect organisms. The first of these involves epidemiological data. The possibility that air ions may influence human health has been suggested since the beginning of the 20th century. Studies in the 1950's and 1960's indicated that human well-being was affected by weather conditions. Warm dry winds such as the Siroccoco (Italy), Sharkije (Egypt), Santa

Ana (California), Hamsin or Sharav (Middle East) or the Foehn (Central Europe) are associated with a sudden increase in morbidity. With such winds, related to elevated levels of positive ions, about 30% of the general population reported migraine, depression, irritability, lethargy or respiratory symptoms. Physiological and neurological changes resulted in an increase in human errors. Sulman and Kreuger's work led to the hypothesis that serotonin was involved in a mechanism of interaction between air ions (concentrations and polarity ratio) and biological systems Kreuger A.P., & Reed, E. J., Biological impact of small air ions. Science, 193, 1209-13, 1976.; Sulman, F.G., Danon, A., Pfeifer, Y., Tal., E. & Weller, C.P., Urinalysis of patients suffering from climatic heat stress (Sharav). International Journal of Biometereorology, 14, 45-53, 1970. ;Sulman, F.G., Levy, D., Lunkan, L., Pfeifer, Y., & Tal, E., Absence of harmful effects of protracted negative air ionisation. International Journal of Biometerology, 22, 53-58, 1978). Because of NAI suppress serotonin levels in the same way that natural sunlight suppresses melatonin, evidence for the impact of ions on psychophysiological status is provided by the findings of naturalistic and laboratory studies. Over the years, it has been claimed that NAI can influence, in several mammalian species, growth, metabolism, immunological responses, and reactions to environmental stressors (Soyka, F., The ion effect. Bantum Premium, U.S, 1991.) This controversial literature has been reviewed by Kotaka, S., Effects of air ions on microorganisms and other biological material. CRC Critical Review of Microbiology, 6, 109-149, 1978). NAI have been proved to slow growth of bacterial cultures and reduce viable cell count in bacterial aerosols(Charry, J. &Kavet, R., Air ions: Physical and biological aspects. CRC Press, 1987;Escombe, A.R., et al., Upper room ultraviolet light and negative air ionization to prevent tuberculosis transmission. Plos Medicine, 6, 1-12, 2009). In addition, a study found that negative ions significantly enhanced the cytotoxic activity of natural killer (NK) cells, and significantly decreased the incidence of cancer and inhibited tumor growths (Yamada, et al., Water-generated negative air ions activate NK cell and inhibit carcinogenesis in mice. Cancer Letters, 1-8, 2005).

Conclusions: Analysis of the data collected before and after the training on the beach shows an increase of the hematocritvaluesby 1.1%, compared to 0.3 % for the training on the stadium. This indicates a favorable increase in red bloodcells,oxygen carriersin athletes'bodies;thereis a higher increase for the group who performed training on the beach, in comparison with those who performed training on the stadium.

Following our theoretical andexperimentalresearch, we recommend:

- conductinga training session on the beach during the autumntraining period and a training session on the beach during the spring training period significantly improves athleticperformance due to physiological changes produced by the large amount of ions inhaled during the training session.

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