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Negative Air Ionization in School Age Athletes

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ABSTRACT

Negative aeroionotherapy (NAIT) aims to improve adaptation, to increase efficiency and yield in human physical work, sports exercises or physical systematic daily activity.

During the exercise, along with muscular and skeletal system, cardiovascular and respiratory systems are the most involved and requested.

The paper traces the evolution of evidence of adaptation to exercise at a school age group of basketball players, under the influence of negative ionization.

Aeroionotherapy decreases heart rate and diastolic blood pressure after execise, and cardiac resistance index drops in all subjects, to values listed as good and very good.

KEYWORDS : aeroionotherapy, adaptation to exercise, human performance, cardio-vascular variables

Introduction

Negative air ions (NAI) are molecules that have gained (negative ions, anions) or lost (cations, positive ions) an electron. In the air, only a very small proportion of chemical elements are in an ionized form. Air ionization occurs under the influence of natural factors: solar ultraviolet radiation (UV); ground radioactivity; lightning; the passage of water from liquid to gaseous state; in coniferous forests. NAI can be artificially generated through the use of ion generators that can produce the desired ion polarity and controlled concentration (1).

Their concentration widely varies, from 40-50 negative ions per cm^3 into apartments, to 100-200 negative ions/cm^3 in highly polluted cities with intense car traffic, and even up to 50,000-100,000 negative ions/cm cm^3 in the forest or near a waterfall, such as Yosemite Falls (12).

Negative air ionization is used for over a century in both prophylactic, as well as therapeutic applications (3;4;6;7;9).

Using artificial generator of negative ions resulted in increased capacity of static and dynamic work in young athletes (13), improving performance in sports events (10), better cardiovascular respioratory adaptation after exercise; increasing capacity of forced swimming in animals, etc.

The action of air ions on blood pressure and heart rate was emphasized by many authors, which showed that both heavy and light negative air ions lower maximal blood pressure (especially in hypertensives patients), while the positive air ions have the opposite effect (2).

Under the influence of negative ionization the cardiovascular adaptation to effort increases, blood pressure faster returning to the starting values (2; 12).

Ionization aims to improve adaptation, increasing efficiency, human yield during physical work, sports exercise, and physical daily systematic activity (8; 11).

Materials and methods

The paper aims to pursue adaptation to exercise of the cardiovascular system under the influence of negative air ions in young athletes. In a group of 12 pupils, basketball players, aged 15 years, were under investigation the following variables:

A) Physiometric examinations: blood pressure (BP) and heart rate (HR).
B) Method of body's adjustment to muscular effort:

Carlson's fatigue curve test: running 10 seconds on place, knees up, with 10 seconds breaks. We performed 10 repetitions of 10 seconds. The heart rate is recorded before exercise, while sitting; then at 10 seconds after the 10th repetitions; 2 minutes after the 10th repetitions, and 3 minutes after the 10th repetitions. This test puts a high pressure on subject and shows the physical condition, and could be applied anywere, on a great number of subjects, with no need of special devices.

Ruffier index (cardiac index)

Specific defense phase moving in basketball consists of moving forthworth and sloping, with normal and added steps, following 4 directions. The route is followed 4 times; the total time is noted (5).

These investigations were performed both before and after the treatment with negative air ions, increases in blood pressure along with diminutions in differential pressure after effort, as well as high values of heart rate long after the effort, being signs of body's tiredness.

Ionization was performed with a device that allows concomitant exposure of up to 6 persons, concentration of negative ions being 15,000/cm^3 air. Exposure was carried out every day, gradually: 15 minutes in the first day, 20 minutes in the second day, and 25 minutes starting with the third day. In the last 2 days of treatment, the exposure time was reduced by 5 or 10 minutes respectively, avoiding abrupt discontinuation of treatment.

During sessions of air ionization, subjects breathe normally, but at the beginning of each session and every 10 minutes then, subjects are asked to do 10 deep breaths. Subjects placed at a distance of 70-80 cm from the device, were standing with the torso leaning slightly back so that the flow of air ions to be projected on the frontal region. Each subject has had a total of 18 sessions of treatment.

Results and discussion

A) ***Results on physiological indicators***

The normal values of BP at rest for age 12-30 years varies between 90 to 145 mm Hg (for maximum BP, systolic BP, or SBP) and half of the maximum value plus 10 for the minimum BP (diastolic DBP, or DBP). According to the American Heart Association, the normal resting heart rate in this age group is between 70 and 100 bpm (mean 85 beats per minute) (http://www.livescience.com/42081-normal-heart-rate.html).

In our study, the SBP values are comprised between 110 and 140 mmHg (average 122 mmHg), the DBP is between 60 and 75 mmHg (68 on average), and the HR between 48 and 76 beats/min (67 on average). While BP values of the 12 subjects are within the normal limits for their age, average HR is 67 beats/min (18 beats/min under the normal value).

B) Methods of body's adaptation to muscular effort

a) *Carlson's fatigue curve*. The BP and the HR are recorded while sitting on chair, then in the first, the second and the third minute after the cessation of exercise. Resilience to stress is assessed in relation to the recovery time after exercise. The results regarding systolic blood pressure are only significative in the third minute after the test (table 1); results regarding DBP are only significative in the first minute after the test.

Table no. 1. SBP, DBP and HR values recorded after Carlson test

SBP (mmHg)		DBP (mmHg)		Heart rate (beats/min)	
Resting SBP (mean)	**122**	**Resting DBP (mean)**	**68**	**Resting HR (mean)**	**67**
Before NAIT	**min 1 157**	**Before NAIT**	**min 1 64[b]**	**Before NAIT**	**min 1 153[c]**
	min 2 145		**min 2 62**		**min 2 123[c]**
	min 3 130[a]		**min 3 61**		**min 3 113[c]**
After NAIT	**min 1 161**	**After NAIT**	**55[b]**	**After NAIT**	**min 1 105[c]**
	min 2 146		**56**		**min 2 84[c]**
	min 3 143[a]		**61**		**min 3 77[c]**

[a] =p< 0.005; **[b]** =p<0.01; **[c]** =p<0.0001

In the literature it is stated that heart rate responds promptly, in a favorable sense, to the negative air ions action. In our study we found no increases in heart rate after treatment compared with baseline values (initial) for the 3 minutes after exercise, on the contrary, heart rate values are lower than those before treatment in 100% of subjects.

b) Rufier cardiac resistance index (R) is based on the effect of a short and intense exercise on heart rate.

In the morning after wake up or after rest for 5-6 minutes, heart rate (t_0) is measured, lying down or sitting. Then, the subject executes 10 series of races, of 10 seconds each, with 10 seconds rest between series. The heart rate is recorded immediately after the exercise (t_1) and after 1 minute of rest (t_2). Cardiac index is calculated according to the following formula:

$$R = [(t_0 + t_1 + t_2) - 200]:10$$

Values of this index for ages between 6 and 25 years are as lower as endurance is better.

Before negative air ionization all the subjects have had a score over 9 (between 10 and 19.8), that fits in categories rated from "insufficient" to totally insufficient" or inadequate (table 2).

Table no. 2. Changes in cardiac resistance index after negative aeroionotherapy

Values of R in boys	Cardiac resistance to effort	Cardiac resistance index	
		Before NAIT No (%)	**After NAIT No (%)**
0-2	Exceptional	0	0
2-5	Very good	0	5 (41.6)
5-7	Good	0	4 (33.3)
7-8	Normal	0	2 (16.6)
8-9	Lightly insufficient	0	0
9-11	Insufficient	2 (16.6)	1 (8.5)
11-14	Weak-less than mediocre	2 (16.6)	0
14-18	Very weak	7 (58.3)	0
Over 18	Totally insufficient	1 (8.5)	0

After treatment, most subjects showed significant improvement in cardiac resistance index values (between 3.2 and 7.6), moving into higher categories: from "normal" to "very good", with one single exception rated as "insufficient" (9.2). It should be noted that after treatment with negative air ions, all subjects show a decrease in cardiac index values.

c) Specific test of defense and resistance in basketball

Regarding the specific test of defense and resistance in basketball, we find that three quarters of subjects show lower values of the time of achievement (wich means an improvement), only 2 boys (16.6%) are growing their time of execution. Unchanged values are found in one subject.

In conclusion, after negative ionization a pronounced decrease in heart rate occurs in the first three minutes after exercise. There are also slightly decreses in diastolic blood pressure values within the 3 minutes after exercise. The exact meaning of systolic blood pressure changes could not been specified.

Cardiac resistance index shows, in all subjects, a trend of improvement to values ranked as good and very good. Execution time values of specific test of defense and resistance in basketball are lower (=better) in most subjects after NAIT.

Conflict of interest: There is no conflict of interest.

Note: The experiments comply with the current laws in Romania

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