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Evolution of Respiratory and Neuro-Psychological parameteres Under Negative Air Ionization in School Age Athletes

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ABSTRACT *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 some respiratory volumes at a school age group of basketball players, under the influence of negative ionization.*

All respiratory volumes (VC, FEV, PEF and V max), although not statistically significant (probably because of the small number of subjects in the study) show a growing trend after treatment with negative air ions.

Respiratory Index (R), which reflects the lung functional potential, has improved in all subjects investigated and reached the maximum values at 2/3 of the students.

Regarding the neuro-psychological request, negative ionization has a stimulating effect, improving concentration, especially in subjects proved to be weaker in this regard (especially since the initial yield was lower).

General consideration

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 some natural factors, or can be artificially generated through the use of ion generators that produce the desired ion polarity and controlled concentration (1).

Negative air ionization is used for over a century in both prophylactic applications, as well as therapeutic applications (2,3,6,7,8,9,16).

The influence of negative ionization on human psychic sphere was studied on the one hand, by treating some neuropsychiatric diseases; and on the other hand by prophylactic applications in pupils and students, quantitative improvement of concentrated attention and of intellectual work capacity being obtained (4,5,10,11).

Hypothesis

The paper aims to pursue adaptation to exercise of the respiratory systems and neuro-psychic sphere under the influence of negative air ions in young athletes. Informed consent was obtained from all individual participants included in the study.

Material and methods

In a group of 12 pupils, basketball players, aged 15 years old, the following variables were investigated:

a) Anthropometric measures in order to assess physical development (height; weight; chest perimeter, head circumference, and abdominal perimeter). These examinations were performed during spring (March), the season in which growing variations are small. Height and weight measurements were performed before meals, respecting the technique (12).

b) Physiometric examinations were performed both before and after the treatment with negative air ions: Vital capacity (VC), Forced expiratory volume (FEV1), Maximum ventilation (V max), Peak expiratory flow (PEF); Muscular strength (a Collin dynamometer, calibrated in Kgforce-KgF- was utilized for the measurement of hands strength).

c) Psychological examination assessing focused attention

To assess the concentrated attention, both in qualitative and quantitative aspect, psychological examination were performed (Toulouse-Pieron bars-test). The test demands great concentration and evaluates the aptitude or capacity to concentrate on tasks that are monotonous (5,10).

Ionization was performed with a device that allows concomitant exposure of up to 6 persons, concentration of negative ions being 15,000/cm3 air at a distance of 70-80 cm from the unit. 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.

At the beginning of each session and every 10 minutes then, subjects are asked to do 10 deep breaths. Subjects were standing in a comfortable position, 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 air ionization.

Results and discussion

a) Anthropometric measures

The average height of the 12 basketball players (180.9 ±10,3cm) exceeds the national standard by more than 13 cm (167.6 ±8.5), all investigated subjects being higher.

Average weight (60.7 ± 26.1) is 6 kg higher than the refereneces values (54.8± 9.3). Ten athlets weight more than national standards (from 1 to 27.5 kg), and two athlets are under the national average, with 300 to 800 grams.

Average chest perimeter (82.9 ±5.9 cm) is 2 cm higher than the average values of references (80.7 ±6.6), 7 sub-

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jects are above standard (from 1 to 15.5 cm), and 5 subjects under standard (with values between 2 and 4.7 cm).

The average values of abdominal and head perimeters could not be compared, because we have not established national averages. In our subjects, the difference between Pt and Pa is 8.3 cm (less than recommended values in the literature that mentions that the abdominal perimeter must be less than chest perimeter by 10-15 cm, and even 20 cm in athletic types).

b) Results of physiological variables (functional capacity of the organism)

b1. Ventilatory volumes

The respiratory functional tests were performed only in 8 people out of the 12 participants in the study.

Table no.1. Changes in respiratory volumes compared to normal values

Indicators	Before air ionization				After air ionization			
	Over		Under		Over		Under	
	No.	%	No.	%	No.	%	No.	%
VC (l)	4	50	4	50	6	75	2	25
FEV1 (l/s)	6	75	2	25	8	100	–	–
V max. (l/min)	6	75	2	25	8	100	–	–
PEF (l/s)	4	50	4	50	7	87.5	1	12.5

After air ionization grows the percentage of those with increased vital capacity (table 1). Althought on the average, the VC has increased from 481.1 ± 102.09 (before air ionization) to 542.7 ± 99.9, the difference is not statistically significant ($p>0.05$), but the growth trend it can be seen as a positive aspect.

The same positive finding in terms of FEV and V max.: after ions treatment all subjects show higher levels than baseline, the mean value increasing from 425.3±68.4, and 1276.1±205.3 respectively, to 484.8 ± 74.4 ($p=0.05$) and 1454.6±223.3 respectively ($p<0.001$) after air ionization. PEF increases from 8.1± 1.25 to 10.3 ± 1.20 at the end of treatment ($p< 0.001$).

Only two of all the investigated subjects show decrease in VC and one subject in PEF after treatment (perhaps a lack of patient-doctor cooperation).

b2. Respiratory index (R) helps to determine the respiratory functional potential, as well as the general biological potential, being calculated using the formula:

R = [VC (cm3) / Weight (kg)] x 1/10

In our case, 62.5% of the subjects exceeded the score of 6 ("very good"). Noteworthy is that negative air ions have increased the proportion of subjects (75%) who obtained scores above 8, the maximum score or "excellent" (table 2).

Table no.2. Framing subjects in different categories of respiratory index before and after aeroiontherapy

Score	Before negative ionization		After negative ionization	
	No.	%	No.	%
Poor (0-4)	–	–	–	–
Mediocre (4-5)	–	–	–	–
Good (5-6)	–	–	–	–
Very good (6-8)	5	62.5	2	25
Excellent (peste 8)	3	37.5	6	75
Total	8	100	8	100

b3. Dynamometry (muscle strength)

Compared to the standard value of 38.2 kgf, characteristic for age of 15 years, subjects in the experimental group show significantly higher values for the right hand. Left hand muscle strength is 4 kgf lower than right hand muscle strength (table 3).

Table no.3.Torque values, obtained and standard

Indicator	Averages standard (kgf)	Averages obtained (kgf)
	m±SD	m±SD
Right hand	38.2±11.0	45.5±9.5
Left hand	–	41.4±7.7
Index of force	60–70	74.28±9.11

m= average
SD= standard deviation

Based on data obtained from torque measurements, the index of force (IF) was calculated using the following formula:

IF = (Fr + Fl)/2 X 100/W

where:
Fr = right hand muscle force
Fl = left hand muscle force
W = weight

For boys the value of this index is 60-70. Of the 12 investigated subjects, four of them (33.3 %) are within the normal limits, seven subjects (58.3 %) show values exceeding standard and one subject (8.3 %) has a value below the normal values (46.77).

c. Mental request (Toulouse – Piéron bars-test): quantitative and qualitative yield

The focused attention test was applied both before and after the negative ionization. After treatment, a significant increase of total average of the quantitative yield was noted ($p<0.05$), from 304.1 to 357.3 correctly barred signs.

Analysis of the 4 stages of test reveals a statistically significant increase ($p<0.05$) only at 4 minutes of work (from 74.5 to 113.1 correctly barred signs), indicating a shortened time of adaptation to concentrated attention effort.

In terms of qualitative yield results only considered omissions, and differences appear small, statistically insignificant at stages 2 and 3 of test.

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Conclusions

After treatment with negative air ions, there is an increase in respiratory volumes (VC, FEV_1, V max, PEF) in all investigated subjects. Also increase the proportion of subjects with respiratory index ranked with "excellent".

Muscle strength investigated by dynamometry is much higher than normal values at this age.

As other paper revealed (13,14,15), negative ionization has a stimulatory effect on concentration of attention, in quantitative terms, resulting in shortening the adaptation time to effort.

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