The Impact of Ionized Air (Aeronization) on the Blood Counts of Lab Rats

Z Habaeva¹, O Bzikov¹, A A Arutyunyants¹
¹North Ossetian State University, Vladikavkaz, Russia

E-mail: siktir90@mail.ru

Abstract. The article submits the research results and the estimation of the negative aeroions influence on the animals living capacity. The rats blood peculiarities are analyzed in the conditions of the negative aeroions excess and lack in the breathed in air.

1. Introduction

The aeroions are the integral components of the atmospheric air. Depending on their types (light, moderate, and heavy), concentration, polarity they may affect living beings differently [1,2]. Meanwhile, only the light ones are of the positive nature, exercising their capacity on the various levels of living matter starting from the cellular level to the organismic one. It determines the high importance of aeroions in the breathable air [1,3,4,5]. Apart from that, according to the studies of A.L. Chizhevsky the absence of negative aeroions in the inhaling air results in lower vital signs of animals and their extinction as a result [1]. Systematic studies on the feasibility of using artificial aeroions for optimization of the state of plant and animal species were initiated in the 20-th century. Since then, it has been shown that the effect of aeroions on living organisms is determined by different variables including the initial functional state of the object and the subject of the research, the doze of aeroions, their polarity and duration [3]. As underlined by A.L. Chizhevsky, aeroions being involved into the process of regulation of main life-support mechanisms make a significant difference to the dynamics of essential functions [1]. The issues concerning the monitoring of ion composition of the air in the workplace, improvement of the environmental health and productivity of the population [6,7,8], quality control of the air at stock-raising and poultry-breeding facilities are actual to date [9,10,11]. The matter of using aeroniontherapy in the treatment of bronchopulmonary diseases, burns, etc. is viewed as the issue for the future [3].

One of the central mechanisms controlling the general functional state of the organism is the blood system. Blood is known to take part in the process of regulation of the energetic metabolism by defining the functionality of the skeletal muscles and body in general. It also plays an important role in the regulation of the immunological status of an organism by stabilizing the specific and non-specific mechanisms of resistance. In connection with the numerous data on the positive effect of the negative aeroions on the general state of the organism, working efficiency, attention, respiratory system and corrective influence of aeroions on the clinical biochemical blood counts etc. the matter of determination of the level of the adaptive capacity of the organism drawing from the blood counts is of particular interest nowadays. The studies on this subject were carried out on white lab rats.
The aim of the study: in the present paper the assessment of the status of animals placed for a long period of time (30 days) under conditions of excess and lack of negative aeroions was carried out. It was made on the basis of the blood picture of the animals.

2. Material and methods
The research was carried out on 45 non-pedigree white male lab rats weighing 220-240 g. All the rats were divided into three groups: control group with ordinary aeration, group with excess of negative aeroions in the air (experiment 1), group with lack of negative aeroions in the air (experiment 2).

The analysis of the state of animals in the conditions of lack of aeroions was conducted in a special geometric chamber that provided air filtration from all the types of aeroions (Figure 1). On the principle of operation the chamber was similar to the one of A.L. Chizhevsky [1] and consisted of a blower providing air pumping, a tube with absorbent cotton restraining all types of aeroions [11] (Kumaritaev, Khabaeva 2008). The size of the chamber allowed to keep there 5 rats together without causing hypodynamy in them. Their diet was well-balanced and followed entirely nutrient requirements of laboratory rats.

![Figure 1. The chamber of disionization installation: 1 – body, 2 – cover, 3 – slatted floor, 4 – urine bag, 5 – rat water bottle, 6 – food feeder, 7 – grain storage area, 8 – power supply, 9 – disionizing filter, 10 - suction blower.](image)

The electroeffluvial aeroionizer (of «Diode» production) was used as a source of the aeroions of negative polarity. Physiological doses of aeroions (10^3 \( \text{cm}^3 \)) were taken during the research. The whole experiment lasted 5 weeks. Within 2 weeks of completion of the experiment the animals were in the conditions of usual aeration. Then the repeat survey on blood picture in all the three groups of animals was carried out.

In order to get some rat blood, the tip of rat tail was cut off and the blood slides were taken from the bleeding wound. The blood draw was taken once at the end of the experiment. The blood counts were determined according to the method proposed by N.M. Nickolaev, hemoglobin was measured with the help of hemoglobinometer AGF-03-1, differential white blood cell count was defined by...
means of 11-key counter; more than 100 white blood cells have been counted during the research. Statistical processing of the data obtained was carried out according to the Student’s method. Taking into consideration that the blood draw was taken once (at the end of the experiment), the comparative analysis of blood counts of rats in the control and experimental groups was made according to the difference of the average between uncorrelated samples.

3. Results and discussion

The relevant calculations for the estimated blood parameters of rats under various conditions of aeration (usual, with excess or lack of aeroions) are represented in the Table 1.

Table 1. The dynamics of blood counts of rats in the conditions of excess and lack of negative aeroions.

| Blood counts         | Control group | Group with excess of negative aeroions | Group with lack of negative aeroions |
|----------------------|---------------|---------------------------------------|-------------------------------------|
|                      | M₁±m pM₁-M₂  | M₂±m pM₁-M₃                          | M₃±m pM₂-M₃                        |
| Hemoglobin           | 93.96±1.14 p<0.001 | 110.84±2.35 p<0.001                | 84.2±2.4 p<0.001                   |
| Erythrocytes         | 3.2±0.18 p<0.001  | 3.8±0.17 p<0.001                    | 2.7±0.11 p<0.001                   |
| Leukocytes           | 3.2±0.34 p<0.001  | 4.7±0.17 -                           | 4.0±0.45 -                         |
| ESR                  | 2.0±0.05 -       | 2.3±0.2 p<0.001                     | 2.8±0.12 p<0.001                   |
| Band neutrophils     | 2.2±0.22 p<0.001  | 5.29±0.54 -                          | 2.8±0.33 p<0.001                   |
| Segmented neutrophils| 29.45±1.88 -     | 28.6±2.35 -                          | 27.5±1.35 -                        |
| Eosinophils          | 6.0±0.82 p<0.001  | 4.1±0.3 p<0.01                       | 4.2±0.4 -                          |
| Lymphocytes          | 61.78±3.25 -     | 63.01±1.5 -                          | 57±2.2 p<0.05                      |
| Monocytes            | 4.05±0.32 p<0.001 | 10.5±1.14 -                          | 3.6±0.45 p<0.001                   |

The table shows that, in the conditions of abundance of negative aeroions in the air inhaled by the rats, statistically significant changes have been observed in almost all the counts of blood picture. The rates of hemoglobin (p<0.001), erythrocytes (p<0.001), and leukocytes (p<0.001) have increased sustainably; the increase of the ESR (erythrocyte sedimentation rate) turned out to be insignificant. The analysis of differential white blood cell count showed the decrease of eosinophils (p<0.001) taking place at a time with the increase of band neutrophils (p<0.001) and monocytes (p<0.001); the rates of segmented neutrophils have not been modified significantly.

In the conditions of the lack of negative aeroions in the inhaling air the level of segmented neutrophils, lymphocytes, and monocytes has changed insignificantly. In all the rest cases the changes of the blood counts have turned out to be considerable and multidirectional. Thus, deprivation of aeroions has resulted in significant decrease of the level of hemoglobin (p<0.001), erythrocytes (p<0.001), and eosinophils; the values of the indicators of ESR (p<0.001), leukocytes, and band neutrophils (p<0.001) have also increased.

Two weeks after the sessions of aeroionization and deprivation of aeroions and getting the animals back into the conditions of natural aeration, the repeat analysis of blood picture was made. The results, represented in the Table 2 suggest a vanishing effect of excessive aeration and deprivation on the blood counts under analysis; the discrepancies between control and experimental groups have not been found.
Table 2. The blood counts of rats in the conditions of natural aeration.

| Blood counts       | Contr. group | Exper. 1   | Exper. 2   |
|--------------------|--------------|------------|------------|
|                    | M₁±m         | M₂±m       | M₃±m       |
| Hemoglobin         | 94,16±1,5    | 96,24±2,4  | 90,2±3,5   |
| Erythrocytes       | 3,2±2,4      | 3,1±0,17   | 3,0±0,11   |
| Leukocytes         | 3,8±0,5      | 4,0±2,5    | 3,9±4,45   |
| ESR                | 2,2±0,07     | 2,3±0,5    | 2,1±0,4    |
| Band neutrophils   | 2,5±0,22     | 2,6±0,54   | 2,4±0,33   |
| Segmented neutrophils | 30,0±2,1   | 29,5±1,15  | 26,5±2,0   |
| Eosinophils        | 6,0±0,82     | 5,5±0,35   | 5,9±0,45   |
| Lymphocytes        | 60,0±3,65    | 62,5±2,4   | 59±2,28    |
| Monocytes          | 4,9±0,32     | 5,0±1,14   | 4,8±2,45   |

The aggregation of the results obtained made it possible to distinguish at least two groups of facts. In the conditions of additional aeration of the air with the physiological doses of negative aeroions, the increase of the level of leukocytes has been observed. It was possible thanks in large part to the band neutrophils, monocytes, and the decrease of eosinophils; the amount of erythrocytes and hemoglobin in these conditions has risen steadily. Within two weeks of cessation of aeronization all the transformations observed in the blood picture of lab rats have turned out to be temporary.

Such dynamics of blood counts can be regarded as a short-term increase of protective and compensatory capacities of an organism in the conditions of aeronization and the incorporation of adaptive mechanisms through the system of hematopoiesis.

It’s a widely known fact, that blood pressure lability in terms of the external environmental factors stems from the capacity of blood to respond rapidly with alterations of its morphology (due to the availability of neurohumoral mechanisms of regulation of blood formation) and the functional diversity of blood. The increase of erythrocytes and hemoglobin counts may be viewed as cumulative adaptive changes in the blood picture of animals placed for a long period of time in the conditions where the air inhaled was enriched by negative aeroions. The increase in the level of neutrophils together with the count of monocytes suggests the improvement of non-specific resistance mechanisms of an organism in relation to the environmental factors.

The corresponding changes of blood picture in the conditions of lack of aeroions in the inhaling air demonstrate the reduced adaptive capacity of the organism manifesting as the significant decrease of hemoglobin, erythrocytes, lymphocytes, and monocytes counts. The rising of the level of ESR, regarded by A.L. Chizhevsky as a process of loss of electrical properties of blood, and a corresponding improved ability of red blood cells and proteins to form colloids must also be viewed in this same context. The lowering of ESR in the conditions of excessive aeration results in enhanced suspension properties of blood.

4. Conclusion

Within the available data in the literature on a complete blood count and the duration of present experimental studies, the alterations in the blood picture caused by aeroionization must be regarded as the result of an increase of hemopoiesis, not as a consequence of release of blood out of the blood-pool. However the mechanism of activation of blood-forming organs in the conditions of aeronization remains to be unclear for us. Alterations of eosinophils alongside with the increase in the amount of band neutrophils define the necessity of more detailed examination of the role of aeroions in the organism vital activity.

Lack of aeroions have resulted in declining blood-forming function. On the other hand, however, in these conditions the rats had more stable differential white blood cell count: changes of monocytes and eosinophils were in the normal range. Moreover the increase of band neutrophils in the control group turned out to be smaller than in the group with the conditions of excessive aeronization.
5. References
[1] Chizhevsky L A 1980 *Aeronavigatsia in the national economy* (Moscow: Stroyizdat) 488
[2] Smirnov V V 1980 The atmospheric ions *Proceedings of the Institute of experimental meteorology* vol 24(89) 8-29
[3] Skipetrov V P, Bespalov N N and Zorˈkina A V 2001 Treatment with air ions of oxygen and (Saransk: “SWMO”) 70
[4] Golˈdstein N 2008 Reactive oxygen species as vital components of the air environment http://parkon.narod.ru/0402life.htm/20.01.2008
[5] Habaeva Z G and Kozhieva D V 2003 The impact of arondale on animals and man *Third int. Conf. Actual problems of ecology in the modern world* (Maykop) 119-20
[6] Pleteneva T V 2012. Air ions and human environment *Bulletin of PFUR*, series Medicine 2 28-34
[7] Chernyj K A 2012 Improvement of methods for monitoring the safety and air quality of the working area in the control of air ion composition in modern engineering production *Fundamental and applied problems of technology* 2-3(292) 121-126
[8] Plekhanova Y M 2011 Improvement of working conditions of the personnel on responsible objects of power industry due to development and use of the device for cleaning and ionization of air (Chelyabinsk) 19
[9] Bocharov 2008 Improving the efficiency of arondale poultry houses with the cell contents (Volgograd) 16
[10] Lobodin P V 2013 Biological justification of complex application of aeroionization and products of beekeeping at cultivation of calves (Ufa) 19
[11] Tspeleeva E V 2005 Influence of aeroionization on natural resistance and immune status of calves vaccinated against salmonellosis autoref. kand. veterinary Sciences (Ufa) 24
[12] Kumaritov F S, Habaeva Z G and Aikova D V 2008 Analysis of the impact of airions on animals *Vestnik MANEB* vol 13 3 94-97