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# GLOBULAR RESISTANCE MODIFICATION ON RATS CONSECUTIVELY TO $Al_2(SO_4)_3$ ADDITION FOR TWO GENERATION

# MODIFICAREA REZISTENŢEI GLOBULARE LA ŞOBOLANI, CONSECUTIV APORTULUI DE $Al_2(SO_4)_3$, TIMP DE DOUĂ GENERAŢII

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*Some of the major modifications on membranes produced by the oxygen reactive species are membranal structure and functions modifications, lipids peroxydation, membranal protein alterations and transportation disturbances thru membranes. A series of xenobotics like oxidant pollutants, lead, aluminium and others directly or indirectly are producing thru metabolization free radicals which interact with cells components and alterate their functions. The purpose of this paper was to relieve the impact of aluminium cumulative addition onto globular resistance on rats. Has been administrated three levels of aluminium (*200ppb, 400 ppb şi 1000 ppb*) as $Al_2(SO_4)_3$ ad libidum in water. Was followed their toxicity impact on the globular resistance for two generations. The results indicate a decrease of globular resistance directly correlated with the aluminium addition.*
**Key words***: rats, globular resistance, aluminium*

## Introduction

It's well known that aluminium toxicity is hard to be confirmed in a shot period of time, because just after a long period the $Al^{+3}$ ion effects causes digestive, nervous and in hematopoetical system changes [6].

The present study was aimed to determinate the toxicity impact of different aluminium additions levels on the osmotic resistance of erythrocyte membrane for two generations.

## Materials and Methods

The study was made on two experimental batches each of 20 male Wistar rats of two generations. Each batch was formed of 4 lots, 5 individuals each: a control batch (C) and 3 experimental batches.

The experimental batches from the first generation $E_1F_{1n}$ , $E_2F_{1n}$ , $E_3F_{1n}$ were made of males from paternal generation ($E_1$, $E_2$ , $E_3$ – exposed to the aluminium

addition from the water in doses of 200 ppb,400 ppb, respectively 1000 ppb, from weanling for 6 months) mated with females exposed to the same aluminium levels just over gestation.

The experimental batches from the second generation $E_1F_{2\,n}$ , $E_2F_{2\,n}$ , $E_3F_{2\,n}$ have been made of male from the first generation (exposed to the same aluminium levels from weaning to 3 months – sexual maturation) mated with females exposed just over gestation.

The 200 ppb doses represents the exceptionally admitted limit by the 1342/91 stass and 400 ppb and 1000 ppb doses are values found in water for animals use in Slatina area.

Blood samples were taken on sodium citrate by slaughtering thru euthanasia.

The hemoglobin values and osmotic resistance were determined (R.O., expressed through the hemolisys degree in NaCl hypotonic solutions) through Drabkin method (at Perkin-Elmer Spectrophotometer, $\lambda$=540 nm).

## Results and Discussions

The obtained results are presented in tables 1 and 2 and graphics 1 and 2.

Table 1

**Mean values of hemoglobin at control and experimental batches**

| | $E_1F_{1n}$ | $E_2F_{1n}$ | $E_3F_{1n}$ | C |
|---|---|---|---|---|
| Hb G/100 ml | 14.05±0.11 | 13.22±0.22 | 11.25±0.09 | 15.25±0.52 |
| | $E_1F_{2\,n}$ | $E_2F_{2\,n}$ | $E_3F_{2\,n}$ | |
| Hb G/100 ml | 13.48±0.07 | 12.75±0.32 | 10.49±0.15 | |

Table 2

**Maximal and minimal osmotic resistance at control and experimental batches**

| | C | $E_1F_{1n}$ | $E_2F_{1n}$ | $E_3F_{1n}$ | $E_1F_{2\,n}$ | $E_2F_{2\,n}$ | $E_3F_{2\,n}$ |
|---|---|---|---|---|---|---|---|
| R.O.max. % NaCl | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 |
| R.O.min %NaCl | 0.55 | 0.65 | 0.700 | 0.800 | 0.75 | 0.800 | 0.800 |
| % hemolisys | 0.56± 0.22 | 1.68± 0,35 | 1.94± 0.42 | 2.89± 0.39 | 1.4± 0.28 | 1.14± 0.88 | 2.96± 0.55 |

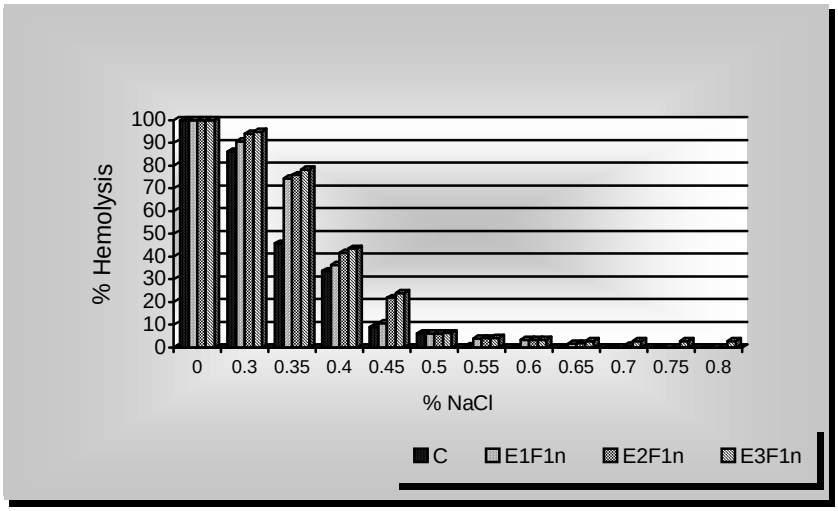
The hemoglobin levels (table 1) in all batches were situated in physiological values from literature [9]. The exception was $E_3F_{2n}$ batch, whose hemoglobin value was under the inferior limit. During the experiment, hemoglobin decrease

compared to control was remarked ($E_1F_{1n}$ : - 7,86% $E_2F_{1n:}$ - 13,31%, $E_3F_{1n}$ : - 26,22% , $E_1F_{2\ n}$ : - 11,6%, $E_2F_{2\ n}$: -16,39%, $E_3F_{2\ n}$: -31,21%). This decrease was accentuated at the second generation and directly correlated with the administrated aluminium level.

The hemoglobin values decrease at the aluminium intoxicated rats administrated in the water, has been observed by other authors also [7,5]. After Zaman et all. opinion in [6] the aluminium induces the disturbance of eritropoesys, also shown by other authors [4,12]. The decrease of the hemoglobin level can be explained as a consequence of the synthesis period inhibition of hemus and the decrease of enzymes activities [3].

Graph 1

The hemolisys degree at the first generation in the three levels of aluminium administration



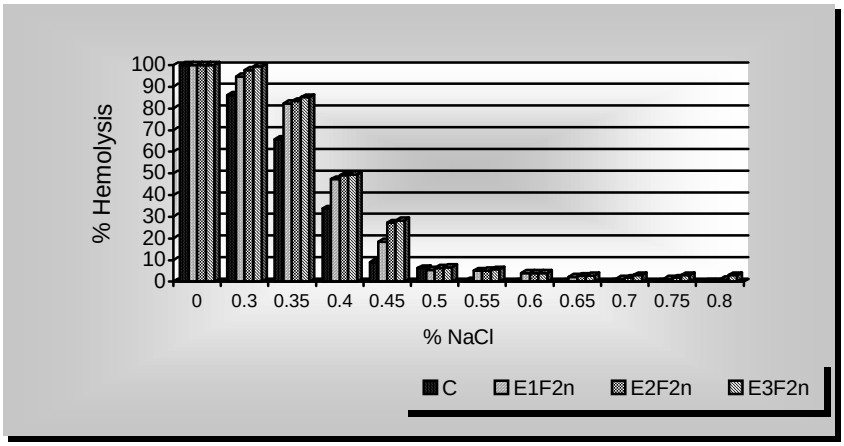

The maximum osmotic resistance (table 2) was equal in the control and experimental batches (0,3%NaCl),situated in the physiological values for rats, after Hoffman and Col in Ghergariu and Col[5].

The minimum osmotic resistance (table 2) at the control was situate between the physiological limits from the literature, after Czopp and col. in Ghergariu and col.[5] (0,56%NaCl). Otherwise, the experimental batches have registered a decrease, the most emphasis were obtained at the 1000 ppb aluminium exposure level, at the first and the second generation (at 0,8% NaCl), but also at the 400 ppb aluminium level at the second generation.

The hemolisys process has growth directly with the aluminium administration and even more at second generation

Graph 2

The hemolisys degree in hipotonic solutions at the second generation in the three levels of aluminium administration

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In literature, the dates over the aluminium impact over the eritrocitary membrane resistance are divergent. P. Galle in Rusu and col.[10] has shown that the aluminium stays at the origin of same anemia by the substitution of iron in the hemoglobin synthesis stages. After Sargozi and col. (2003) in Trif A. [11] the aluminium cellular toxicity is most determined by the eritrocitary membrane disruption.

Like other xenobiotics, the aluminium generate in cells free radicals and reactive species of oxygen that causes peroxydation of fatty-acids and the oxydation of SH-groups of membranal proteins leading to membranal fluidity decrease, producing major damages of these [2, 7]. As a result of these membranal damages is producing a decrease of the membranal ATP-asys activity, a decrease of the energy released by the ATP molecule – essential for keeping the membranal integrity [3,5]. Studies regarding the exposure at low doses of $Al_2(SO_4)_3$ have shown that this can lead to the alteration of the rheological properties of blood with major effects on the mechanical proprieties of the eritrocitary membrane [10]. The aluminium hemolytic activity is bounded to the changes made by it in eritrocitary membrane, especially after a long administration period.

## Conclusions

The aluminium administrated in dose equal to the highest limit admitted by stass as well as doses found in the polluted area with aluminium (Slatina) has shown the increase of eritrocitary membranal fragility directly related with the administrated dose.

The lowest globular resistance shown up at 400 ppb, respectively 1000 ppb levels at second generation when also was registered a highest degree of hemolisys.

The aluminium administration in water for a longer period of time can induce hemolisys.

**Bibliography**


1. **Chilh-Hung Guo, Guoo-Shyng W. Hsu, Li-Yun Lin, Yun-Hsin-Wang, Maw-Sheng Yah**- *Distribution Patterns of Trace Metals and of Lipid Peroxidatio Plasma and Erythrocytes of rat Exposed to Aluminium,* Biological Trace Element Research, Oct. 2004, Vol. 101, issue 1, pp. 58-60.
2. **Dejica,D. –** (2000) Stresul oxidativ în bolile interne, Ed. Casa Cărţii de Ştiinţă, Cluj-Napoca.
3. **Fulton, B., E.H.,Jeffery** (1994)**-** *Heme oxygenase induction:a possible factor in aluminium-associated anemia*, Biol. Trace Element Res,40, pag.9
4. **Garbossa, G., G., Galvez, E., Castrom, A., Nesse,** (1998)- *Oral aluminium administration to rats with normal renal function.1.Impairment of erythropoiesis,*- Hum Exp. Toxicol., 17 (6), 312-317.
5. **Ghergariu, S., Pop, A., Kadar,L., Marina Sînu** (2000).– Manual de laborator clinic veterinar, Ed. ALL Educational, Bucureşti.
6. **Gromusz - Kalkovska, K., D.E., Szubartowska, A., Uinkiewicz-Winiarczyk** (2004), *Influence of Drinking Water-Administered Aluminium on Morphology and Respiratory Function of Blood in Rats,* Polish Journal Environmental Studies, Vol. 13. No5, pag. 515-519.
7. **Kowalczyk,E**., **Kopff,A., Kedziora,J., Blaazczyk,J., Kopff,M., Niedworok,J., Fijalkowshi, P.** (2004)-*Effect of long-term aluminium chloride intoxication on selected biochemical parameters and oxidative0antioxidative balance in experimental animals,*Polish Lournal of Environmental Studies, vol.13,No.1,41-43
8. **Mahieu,S**., **Contini,M., Gonzale,M., Millen,N., Elias,M.M**.(2000**)-** *Aluminium toxicity. Hematological effects*, Toxicoll lett.,111,pag.235.
9. **G.Meingassner, F.P Schmook**. – Reference values for Crl:CD (SD)BR Rats –Sandoz-Research Institute, Viena,1992.
10. **Rusu, V.B., T.,Baran, D.D., Brănişteanu** (1988)- Biomembrane si patologie, Ed.Med., Bucureşti.
11. **Trif, Alexandra, Maria Drugă, M., Drugă, Letitia Stana, F., Muselin, Ileana Brudiu D., Morar** (2004)- *Dynamics of some hematological parameters in broiler consecutive aluminium sulphate dietary intake*, Macro and Trace Elements Mengen und Spurenelemente, First Volume, Friedrich Schiller Unioversity Jena, pag.. 295-301.
12. **Vittori,D., G., Garbossa, C., Lafourcade** (1999)- *Morphological and functional alterations of erythroid cells induced by long-term ingestion of aluminium,* J.Inorg.Bioch., 76, pag.113.

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*Dintre modificările majore cu impact asupra membranelor produse de speciile reactive ale oxigenului, sunt modificări în structura şi funcţiile membranelor, peroxidarea lipidelor, alterări ale proteinelor membranare, tulburări de transport prin membrană. O serie de xenobiotice printre care: poluanţi oxidanţi, plumbul, aluminiul etc,. produc prin metabolizare în mod direct sau indirect radicali liberi care interactionează cu componenţii celulari şi le alterează funcţiile. Studiu efectuat a vizat evidenţierea impactului aportului cumulativ de aluminiu asupra rezistenţei globulare ţobolani. S-au administrat 3 nivele de aluminiu (200 ppb, 400 ppb şi 1000 ppb) sub formă de $Al_2(SO_4)_3$ în apă ad libitum şi s-a urmărit impactul toxicităţii acestuia asupra rezistenţei globulare, timp de două generaţii Rezultatele obţinute indică o scădere a rezistenţei globulare în relaţie directă cu aportul de aluminiu.*

**Cuvinte cheie***:* sobolani, rezistenţa globulară, aluminiu.