

THE CONSEQUENCES OF CHRONIC ALUMINUM SULFATE INTAKE ON SOME BIOCHEMICAL PARAMETERS IN RATS

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Abstract

To evaluate the consequences of chronic aluminum sulfate intake in some biochemical parameters (plasmatic proteins, albumens, globulins, urea and creatinins) in rats, 28 white Wistar rats was divided in three experimental groups (E₁, E₂, E₃) and in one control group (C) to which aluminum sulfate was administered in water during six month as follows: E₁ – 200 ppb; E₂: 400 ppb; E₃ 1000 ppb and C: tape water 50-70 ppb aluminum. Chronic aluminum sulfate in drinking water determined in rats significant decrease of total proteins and albumens comparative to C group, indirectly related to aluminum intake; significant increase of globulins in E₁ and E₂ groups and significant decrease in E₃ comparative to C group; significant uremia and creatinemia increase in E groups comparative to C group (excepting creatinine in E₁ and E₃ groups).

Keywords: *aluminum sulfate, water, rats, biochemical parameters.*

Introduction

During much time, aluminum was considered a non-toxic element and its use had no restrictions. However, over the last two decades, scientific publications have continuously contradicted this affirmation (Perl, 2005). Much pathology has been effectively related to the accumulation of aluminum in the organism. The goal of the study was to evaluate the consequences of chronic aluminum sulfate intake on some biochemical parameters (plasmatic proteins, albumens, globulins, urea and creatinine) in rats.

Experimental

The study was carried out on 28 adult white Wistar rats divided in three experimental groups (E₁, E₂, E₃) and one control group (C)

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during six month. Aluminum sulfate was administered in drinking water as follows:

- E₁: 200 ppb (exceptional limit Romanian standard 1342/1991)
 - E₂: 400 ppb
 - E₃: 1000 ppb
- } (levels found in aluminum industry surrounding areas water supplies for animals - Trif et al., 2002, Drugă et al., 2004)
- C: tap water – 50-70 ppb

Biochemical parameters: VET SCREEN analyzer determined total proteins, albumens, globulins, urea and creatinine. The obtained data were statistically processed by ANOVA method and Student test.

Results and Discussions

The results are summarized in table 1.

Table 1 - Total proteins, albumens, globulins, urea and creatinine mean values consecutive aluminum sulfate intake during six month

Specification	x±Sx			
	E ₁	E ₂	E ₃	C
Total proteins (g/dl)	6.31±0.03	6.30±0.04	4.9±0.03	6.42±0.04
Albumens (g/dl)	3.91±0.03	3.92±0.03	3.51±0.04	4.25±0.04
Globulins (g/dl)	2.4±0.03	2.37±0.05	1.38±0.07	2.17±0.06
Urea (mg/dl)	11±0.22	14.14±0.40	11.57±0.37	8.14±0.26
Creatinine (mg/dl)	0.54±0.03	1±0.03	0.5±0.03	0.5±0.02

Total proteins were significantly lowered in E groups comparative to C group ($p < 0.05$) (-1.83%; -1.99%; -23.77%). Excepting E₃ group, total proteins level was between physiological limits (6.1-7.8 g/dl - Uray, 1992, quoted by Ghergariu et al., 2000). The increasing aluminum intake determined significant decrease of total proteins concentrations (E₃/E₂ and E₃/E₁).

Albumens concentrations significantly decrease in E groups, which received aluminum comparative to C group (-8.05%; -7.72%; -17.45%)($p < 0.05$), albumens level, excepting c group being behind the physiological limits (4.5g/dl-Uray, 1992, quoted by Ghergariu et al., 2000; 4.12 ± 0.18- Meingassner and Schmook, 1989).

The increasing aluminum intake determined significant decrease of albumens concentrations ($E_3 < E_2$ and $E_3 < E_1$). The total proteins and plasmatic albumens decrease was emphasized by Cherroret et al., (1995), too, consecutively aluminum chloride and aluminum lactate administration in rats during 14 days.

Globulins were significantly higher than in C group in those E groups, which received 200 (E_1) and 400 ppb aluminum (E_2) (+10.54%; +9.21%). Contrariwise, globulins were significantly lower in-group, which received 1000ppb aluminum (E_3) (-36.20%). Globulins mean values in C, E_1 and E_2 groups were higher than physiological limits (1,8 mg/dl - Meingassner and Schmook, 1989) and behind that in E_3 group.

It can be remarked the indirect correlation between globulins concentration and aluminum intake. It has been established significant differences between E_3 and E_2 groups and E_3 and E_1 groups. The increasing globulins level can be explained by hepato-renal pathologies which aluminum is known that to can induces.

Uremia mean values were significantly higher in E groups comparative to C group (+35.13%; +73.71%; +42.13%). The increasing aluminum intake determined significant uremia values increase, but not directly related to aluminum intake.

The increasing aluminum intake from 200 to 400 ppb determined a 28.53% uremia increase. The increasing aluminum intake from 200 to 1000 ppb determined, contrariwise, just a 5.18% uremia increase. The increasing aluminum intake from 400 to 1000 ppb determined even an 18.17% uremia decrease.

This dynamics suggests that the diminished effect of high aluminum intake could be due by limited aluminum absorption and, in consequence, by a less aggressive effect on kidneys.

Mean values of creatinine were higher comparative to C group only in E_1 and E_2 groups. The increase was significant only in E_2 group (+100%), when it was higher even than physiological limits (0.64 ± 0.06 - Meingassner and Schmook, 1989). The increasing aluminum intake from 200 to 400 ppb determined significant creatinine increase. Contrariwise, the increasing aluminum intake from 200 and 400 ppb to 1000 ppb determined creatinine decrease ($E_3 < E_1$: insignificant decrease; $E_3 < E_2$: significant decrease).

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The diminished effect of 1000 ppb aluminum intake could be due, similar as in uremia case, to limited aluminum absorption and in a reduced adverse effect on kidneys.

Conclusions

Chronic aluminum sulfate in drinking water determined in rat:

- Significant decrease of total proteins and albumens comparative to C group, indirectly related to aluminum intake ($p < 0.05$ just for the increasing from 400 to 1000 ppb, respectively for 200 to 1000 ppb aluminum).
- Significant increase of globulins in E₁ and E₂ groups (which received 200 and 400 ppb aluminum) and significant decrease in E₃ (which received 1000 ppb aluminum) comparative to C group.
- Significant uremia and creatinemia increase in E groups comparative to C group (excepting creatinine in E₁ and E₃ groups).

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