

ISSN 2509-4327 (print)
ISSN 2510-4780 (online)

Inter
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Deutscher Wissenschaftsherold German Science Herald

№ 2/2017

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Impressum

Deutscher Wissenschaftsherold – German Science Herald

Wissenschaftliche Zeitschrift

Herausgeber:

InterGING

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31789 Hameln, Germany

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Gestaltung:

N. Gavrilets

Auflage: № 2/2017 (Juli) – 25

Redaktionsschluss Juli, 2017

Erscheint vierteljährlich

Editorial office: InterGING

Sonnenbrink 20

31789 Hameln, Germany

Tel.: + 49 51519191533

Fax.: + 49 5151 919 2560

Email: info@dwherold.de

Deutscher Wissenschaftsherold - German Science

Herald is an international, German/English language,

peer-reviewed, quarterly published journal.

№ 2 2017

Passed in press in Juli 2017

Druck: WIRMachenDRUCK GmbH

Mühlbachstr. 7

71522 Backnang

Deutschland

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INDEXING: Google Scholar, WorldCat, InfoBase Index, Journal Index, Citefactor, International Scientific Indexing, JIFACTOR, Scientific Indexing Services, International Institute of Organized Research.



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CHARACTERISTIC OF ALUMINUM SALTS INFLUENCE ON INDEXES OF ION REGULATIVE RENAL FUNCTION IN MATURE AND IMMATURE RATS AGAINST THE BACKGROUND OF THE PINEAL GLAND HYPERFUNCTION

Abstract. *It is known that reabsorption of sodium ions is one of the most energy-dependent kidney process, which is the basis for providing homeostatic functions, especially ion regulatory, acid regulatory and excretory, which differ in mature and immature rats. These differences are often conditioned by insufficient maturity of nephron tubules, juxtaglomerular and regulatory mechanism in immature rats. In order to assess the impact of nephrotoxic action of aluminum salts in the ion regulatory function of the kidney and under the conditions of hyperpituitarism of the pineal gland, we studied the effect of 14-day action of aluminum chloride compounds on the ion regulatory function in 24 white male rats. It was found that the environmental stress of aluminum salts is accompanied by a nephrotoxic effect, which is characterized by the development of the loss of sodium ions with urine due to a damage of the nephron tubular portion. Hyperfunction of the pineal gland causes a nephrotoxic effect of aluminum salts in mature rats with a more significant manifestation of the syndrome of loss of sodium ions in the urine, which is probably conditioned by high level of melatonin.*

Key words: kidney, aluminum chloride, pineal gland.

Introduction. Nowadays, the increase of xenobiotics action is beyond the scope of biological adaptability of ecosystem and can cause changing environmental habitat, create straight threat to life and health of population. The intake and accumulation of aluminum salts in organs and tissues of human body have a nephrotoxic action, which is conditioned by disorders of metabolic processes and development of different pathologies [1, 2, 7, 9]. Complexes with phytoestrogens polyphenols, drinking water, food, cosmetics, pharmaceuticals and vaccines are sources of intake aluminum in vitro [3, 4, 6]. Despite the prevalence of aluminum compounds, the question about the impact of aluminum salts on the ion regulatory function of the kidney has not been studied sufficiently under the condition of hyperfunction of the pineal gland in mature rats [5, 8, 10].

Objective: to study the influence of toxic effects of aluminum chloride on the ion regulatory function in mature and immature rats and under the conditions of hyperfunction of the pineal gland.

Materials and methods. The experiments involved 24 mature and immature nonlinear male albino rats weighing 0,06-0,10 kg and 0,14-0,20 kg respectively. We studied a nephrotoxic effect of aluminum salts on ion regulatory renal function. Aluminum chloride in a dose of 200 mg/kg was administered chloride intragastrically daily within 14 days of the experiment at 8.00 a.m. and 8.00 p.m. with the 1% starch slurry. Hyperthyroidism of the pineal gland was simulated by keeping the animals in conditions of constant illumination (24.00L:00D) for 7 days. The ion regulatory function was assessed in terms of excretion of sodium ions and their concentrations in the urine,

absolute and relative cation reabsorption, filtration charge and sodium ions clearance, sodium-potassium ions in the urine factor, concentration index of sodium ions, the values of the proximal and distal transport.

Results and discussion.The assessment of the ion regulatory renal function in intact immature rats which were administered aluminum salts (Table 1.) showed that the concentration of sodium ions in the urine increased. The excretion of sodium ions tended to increase. The filtration fraction of sodium ions in the conditions of administering aluminum salts in immature rats was characterized by a downward trend compared to the control. The clearance of water free of sodium ions tended to reduce in the conditions of administering aluminum salts in immature rats.

The concentration index of sodium ions increased reliably. The distal reabsorption of sodium ions tended to reduce due to the administration of aluminum salts in immature rats. An analysis of ion regulatory renal function

values in mature intact rats after introduction aluminum salts (Table 2.) showed that the concentration of sodium in the urine increased. Filtration fraction of sodium ions in case of introducing aluminum salts in mature rats was characterized by a downward trend compared to the control. The trend toward the growth was recorded for the excretion of sodium ions, standardized by the glomerular filtrate speed. The clearance of sodium was growing. The clearance index of sodium ions increased reliably.

An analysis of the values of the ion regulatory renal function in mature and immature rats after introducing aluminum salts against the background of the pineal gland hyperfunction (Table 3.) showed that the concentration of sodium in the urine was higher in mature rats. We established a similar pattern regarding the excretion of sodium ions, standardized by the glomerular filtrate rate. The distal reabsorption of

Table 1.
Values of the ion regulatory function of the kidney in intact immature rats under the influence of aluminum salts ($\bar{x} \pm S_x$)

Values	Immature rats (Al) (n=6)	Control(n=6)
1	2	3
The concentration of sodium ions in the urine mmol / l	1,50±0,29	0,50±0,05 p<0,01
The excretion of sodium in urine mmol / 2h 100g	2,43±0,76	0,99±0,23
Filtration fraction of sodium ions, umol / min 100 g	17,50±5,44	25,51±5,32
The excretion of sodium,umol / min 100 g	2,54±0,72	1,08±0,19
The excretion of sodium ions, mg / 100 ml Ccr	0,03±0,01	0,009±0,0004
Concentration index of sodium, stand units	0,01±0,002	0,003±0,0003 p<0,01

Table 2.
Values of the ion regulatory function of the kidney in intact mature rats under the influence of aluminum salts ($\bar{x} \pm S_x$)

Values	Mature rats (Al) (n=6)	Control (n=6)
1	2	3
The concentration of sodium ions in the urine mmol / l	1,90±0,15	0,70±0,03 p<0,001
The excretion of sodium in urine mmol / 2h 100 g	3,23±0,56	1,96±0,26
The excretion of sodium,umol / min 100 g	3,46±0,43	2,17±0,17 p<0,02
The excretion of sodium, mg / 100 ml Ccr	0,03±0,01	0,01±0,006
Clearance of sodium-free water, ml / 2h·100 g	1,95±0,31	3,19±0,08 p<0,01
Clearance of sodium ions ml / 2h 100 g	0,03±0,004	0,01±0,0002 p<0,05
Concentration index of sodium, stand units.	0,01±0,001	0,005±0,0002 p<0,001

Table 3.
Values of ion regulatory function of the kidney in mature and immature rats under the influence of aluminum salts against the background of the pineal gland hyperfunction ($\bar{x} \pm S_x$)

Values	Mature rats(Al) (n=6)	Immature rats(Al) (n=6)
1	2	3
The concentration of sodium ions in the urine mmol / l	1,03±0,25	0,75±0,02
The excretion of sodium in urine mmol / 2h 100 g	2,38±0,85	1,15±0,19
The excretion of sodium, umol / min 100 g	2,63±0,72	1,29±0,13
Clearance of sodium-free water ml / 2h 100 g	2,73±0,28	1,84±0,23 p<0,05
Clearance of sodium ions ml / 2h 100 g	0,01±0,006	0,009±0,001
Concentration index of sodium, stand units.	0,008±0,001	1,84±0,23 p<0,001
Distal reabsorption of sodium ions, micromoles / 2h 100g	349,10±41,60	229,50±28,60 p<0,05
Distal reabsorption of sodium ions, micromoles / 100ml Ccr	1,31±0,09	0,85±0,03 p<0,001

sodium ions after introducing aluminum salts in mature rats tended to decrease. The proximal reabsorption in the comparison group was higher in mature rats.

Conclusions. The analysis of aluminum salts influence on the ion regulatory renal function in mature and immature rats showed that studied environmental stress is accompanied by a nephrotoxic effect, which is characterized by the development of the loss of sodium through urine nephron tubular damage. Hyperfunction of the pineal gland causes nephrotoxic effect of aluminum

salts in mature rats with a significant manifestation of the syndrome of loss of sodium in the urine, which is conditioned by high level of melatonin.

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Deutscher Wissenschaftsherold German Science Herald

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed
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№ 2/2017 – 25
Passed in press in Juli 2017



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