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Changes in Electrolytes Balance of New Zealand Rabbits in Response to the Blended Treatment of Drinking Water with Alum and PolyDADMAC

Medani AB[1], El Badwi SMA[2] and Amin AE[2]

[1]*University of Medical Sciences and Technology, Faculty of Pharmacy, Khartoum ,Sudan*
[2]*Department of Medicine, Pharmacology and Toxicology, University of Khartoum, Sudan*

***Corresponding Author:** Medani AB, University of Medical Sciences and Technology, Faculty of Pharmacy, Khartoum ,Sudan.

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Abstract

The possible safe use of alum as a water treatment for human consumption was evaluated in New Zealand rabbits. Six heads of New-zealand rabbits were divided into 2 groups. Group 1 animals were the non-dosed controls. The test group was given both 1% alum and 1% polyDADMAC 1:2 for a period of 10 weeks after an adaptation period of two weeks during which the animals were under ideal experimental conditions.

Fluctuations in electrolyte levels of Mg, Fe, Na, K, Ca and P were monitored in comparison to the non-dosed control rabbits. On evaluation of the above results, the interactive water treatment with 1% alum and 1% polyDADMAC 1:2 was considered toxic to New Zealand rabbits at the dose rates tried suggesting use as a water treatment for human consumption may not be possible. Practical implications of the results were highlighted and suggestions for future work are put forward.

Keywords: *Alum; PolyDADMAC; Interactive; Drinking water treatment; New Zealand rabbits*

Introduction

In 1925 alum was first tried for the purpose of drinking water treatment in Sudan, especially during the flood season to be suitable for the healthy human consumption with a maximum allowable level (MAL) of 150 mg/L. Most of the available working staff is not satisfactorily qualified educationally and the disposal system to eliminate the outcome of the sludge of the chemical reactions that happen during treatment of the turbid water is not adjusted well to the laws of environmental health regulations.

Throughout time, alum did not give satisfactory results in the reduction of turbidity of water, so new methodologies were introduced with special preference to polyDADMAC polymer. Toxicological data was always lacking and hence subjected this use to a lot of debate .This experiment is a trial to lead the way out.

Material

Animals

Six, 5-7 month old mixed, clinically healthy Newzealand rabbits were purchased from Balsam Pharmaceutical Laboratories in the vicinity of Khartoum North and housed, prophylacticly dosed. The rabbits were ear tagged, given a 2-week preliminary period during which lucerne was fed and Nile drinking water was provided ad libitum.

Administration of the Doses

Test materials, polyDADMACandalum ($AlSO_4$), were prepared in separate stocks each as 1% solution. The two test solutions were blended at 1:2 of the polymer and alum respectively. Animals were weighed-distributed into two experimental groups. Test blend was given orally to rabbits of group 2 in drinking Nile water daily. The untreated controls were rabbits of group 1.

Chemical Methods

Blood samples obtained the ear vein of rabbits before and after dosing with the joint solution [1]. Venous blood samples were centrifuged at 3000 r.p.m. for 5 minutes and stored at -20°C until analyzed and investigated for the changes in the electrolytes magnesium, iron, sodium, potassium, calcium and phosphorus.

Statistical Methods

The difference between mean values of data was analyzed by the un-paired students- t-test [2].

Results

Group /Dose	Mg (mg/dl)	Iron (µg/dl)	Na (mg/dl)	K (mg/dl)	Ca (mg/dl)	P (mg/dl)
G_1(un-dosed)	1.56 ± 0.17	256.23 ± 39.81	125.41 ± 3.22	5.07 ± 0.12	11.38 ± 0.10	4.34 ± 0.13
G_{14} (1:2 solution)	0.39 ± 0.42**	35.93 ± 9.50**	ND	ND	3.17 ± 0.67**	1.52 ± 0.09***

Table 1: *Chemical electrolytes changes.*

*ND= Not determined ** denotes P < 0.01 *** denotes P < 0.001*

The concentrations of all the electrolytes in the serum of test rabbits showed significant (P < 0.01-0.001) decreases, although Na and K were not determined when compared to the control group.

Discussion

In this study, the slow movement, hind limb were mostly pertinent to the stimulation of the central nervous system (CNS) with suggested inhibition of the serum cholinesterase activity which was not, unfortunately, measured leading to abnormal posture and gaits and nervous sings due to the action of the organ chlorides as a diffuse stimulant of the C.N.S. [3-5]. This can be attributed to significant change in electrolytes. This may lead in some instances to muscle shivering, tremors and paralysis especially if accompanied by the miscellaneous polymer effects indicated by the significant (P < 0.01-0.001) decreases in some electrolytes like sodium, potassium, calcium, phosphorus and magnesium. These electrolytes have effects on muscle action, potential and eventual spasms [6,7].

The lungs of the rabbits of group 2 showed adhesions, congestions, and hemorrhages, while sand lymphocyte infiltrations were clear. These pulmonary disorders may be attributed to the direct irritant action of the drug as whole or alum alone.

Severe congestions, hemorrhages of cortex and medulla, shrinkage of glomeruli and renal focal areas of necrosis may be attributed to renal damage due to severe decrease in electrolytes [8].

Conclusion

The dose bended as 1% alum and 1% polyDADMAC Cat 1:2 on acute basis, was concluded to be toxic to Newzealand rabbits in terms of electrolyte concentration.

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