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THE EFFECT OF GITALIN IN THE SODIUM PUMP IN ERYTHROCYTES OF *RATTUS NORVEGICUS*

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ABSTRACT

The study reports of the effect of gitalin on the erythrocytes sodium pump of *Rattus norvegicus* the administration of 0.75 mg gitalin daily for seven days increased the aver-age sodium content in erythrocytes. The rise in erythrocyte sodium content following acute gitalin therapy was proportionally more than the number of sodium pumps occupied by gitalin.

Introduction

The low sodium content of cells is attributed to the sodium pump. This transmembrane multi-unit protein structure translocates sodium and potassium ions in the cell and cause ATP hydrolysis (Glynn and Karlish, 1975, Schuurmans Stekhoven *et al.,* 1981). The external end of the pump has a binding site for cardiac glycosides (strophanthin or gitalin) and when this site is occupied the pumping of sodium is reduced (Glynn, 1964; Schwarz *et al.,* 1975). Gitalin *in vivo* or *in vitro* causes a dose dependent rise in the erythrocyte sodium content and therefore this must be attributed to the binding of the gitalin to these pumps.

Till now, the quantitative relationship between these two changes has not been studied. In the present study, the relationship of the changes of sodium, content, active sodium transport and gitalin binding in erythrocytes of *Raaus norvegicus* following gitalin administration for 10 to 15 days was worked out.

Materials and Method

Gilalalin 0.75 mg was administered once a day to each of the eight animals under experiments. The dose gitalin was calculated according to the surface area of the test animals. Blood samples were drawn daily before and following gitalin admnistration. Erythrocyte sodium content and strophanthin sensitive efflux and efflux rate constant were measured according to the method of Cumberbatch and Morgan (1978). The amount of gitalin bound to the sodium pump was measured as a decrease in the binding of radioactively labelled strophanthin at a sufficiently high concentration of 10^{-6} mol/l to ensure the occupation of all available sites (Gardner and Conlon, 1972). Plasma gitalin was measured through radio-immuno-assay.

Results and Discussion

Gitalin administration increased the average sodium content and decreased it efflux rate constantly, so much so the steady state was reached by the 7th day. The results obtained without gitalin from days I to day 7 compared with gitalin administration during the same period are given in table 1. The changes in sodium content and efflux rate constant were similar; but both were significantly greater than the change in the gitalin binding. The explanation for the difference appears to be that some of the bound gitalin had dissociated from the pump sites during the preparation of the cells, or it was displaced from the cells following addition of strophanthin for measuring the binding capacity. There was no effect on gitalin displacing as strophanthin binding plateau showed after 70 min., whether or not the *Rictus norvegicus* were administered gitalin.

The Table 1 indicates comparative columns of sodium content of washed erythrocytes (Na^w. mmol/kg); the reciprocal strophanthin sensitive efflux rate constant for sodium K^{os}/h and the strophanthin binding capacity (OB, arbitrary units), in eight healthy *Ratus norvegicus* before and following treatment with gitalin.

The results demonstrate that the rise in erythrocytes sodium contents during acute gitalin therapy was proportionally more than that accelerated by the number of sodium pumps occupied by gitalin. It may be stated (Glynn, 1964 and Schwartz et. at, 1975) that gitalin diminished the turnover of sodium through a pump without being bound to it. The other possibility was that the effect of gitalin on a pump persisted even when gitalin had left it and thus the number of inhibited pumps was greater than the number of pumps occupied by gitalin on a site at any one time. In other words, there was a multienzyme complex which by binding to the internal part of the sodium pump probably maintained a lo-cal high concentration of ATP (Proverbio and Hoffman, 1977; Fossel and Solomon, 1978). Possibly, this enzyme complex was released when strophanthin was bound to the external end of the sodium pump (Fossel and Solomon, 1978) and these the activity of the pump remained diminished untill the complex occupied its site again.

The presence of an unexpectedly large increase in sodium content may be the in-tropic effect of gitalin (Akera, 1977 and Oktta, 1974). It seems that this effect was due to an increase in the sodium content of the cardiac muscles not entirely due to inhibition of the sodium pump, as a results of gitalin bindings to the glycoside binding site.

Table 1:

	Na^w	1/Na*	K^{os}	OB
Pre-gitalin	3.9 ± 0.32	0.132±0.015	0.22 ± 0.022	160 ± 15
On gitalin	6.2 ± 1.2	0.102±0.022	0.132 ± 0.025	120 ± 13
% change		20.2 ± 5.1	21.2 ± 8.5	10.2 ± 6.0

Each value is a mean of 8 samples with ± SD

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