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Minerals and Blood Pressure in CCl_4 Treated Rats

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The influence of minerals on metabolic pathways is extensive. Minerals have many functions which range from: the structural roles of calcium, the ionic effects of sodium and potassium, to the function of several elements as integral parts in enzymes. Magnesium, for example, is an essential element in normal cardiovascular physiology (McCarron 1982). Some minerals occur in relatively high concentrations while low concentrations are found in trace minerals, and trace elements as iron may also have a role in hypertension.

Experimental renal hypertension has been reduced to normotension after subcutaneous injections of carbon tetrachloride (CCl_4) (Loyke et al 1960, Loyke 1960a). The degree of liver damage has been reduced to a level of mild with a moderate degree of fatty metamorphosis of the liver by dose adjustment (Loyke 1964a). Cross perfusion of renal hypertensive with CCl_4 treated rats resulted in blood pressure reduction suggesting that a depressor substance was present in CCl_4 treated animals' blood (Loyke and Hoobler 1982). To further study the effect of CCl_4, mineral levels were measured in an attempt to understand the relationship to CCl_4 blood pressure lowering effect and attempt to characterize the vasodepressor substance.

MATERIALS AND METHODS

Ten male Sprague-Dawley rats approximately 9 weeks old, obtained from Beaumanor Farm were housed in individual cages. Purina lab chows, which contain 1.2% calcium, 214% iron, 0.19% magnesium, .35% sodium and 1.1% potassium (Yamori et al 1984), and tap water were given ad libitum. Blood pressure was measured by the tail microphonic method (Friedman et al 1949) and all animals weighed weekly. Six male Sprague-Dawley rats initially weighing 200g were

given 0.15ml subcutaneously twice weekly of analytical CCl_4 for a total of 25 doses. Four animals were untreated and served as untreated controls. Blood samples were obtained 6 hours after a normal feeding one day after the last dose of CCl_4 and analyzed in duplicate for determination of serum calcium (ca) by the crescolphtalin complexone method (Gitelman 1967), lithium (Li) by flame photometry, iron (Fe) by atomic absorption (Price 1979), and magnesium (Mg) by methyl thymol blue dye technique (Gitelman et al 1966). Serum potassium (K) and sodium (Na) concentrations were determined by ion selective electrodes. All group data are presented as mean ± 2 standard deviations. Student "t" test was used for computing the significance between CCl_4 and control serum samples.

RESULTS AND DISCUSSION

During the four month exposure of the rats to CCl_4 treatment, none of the treated or untreated control animals perished. The mean pre-treatment weight for the CCl_4 group was 200g and the untreated controls weighed 198g. At the end of the experiment, the CCl_4 group weight was 261g $\pm$ 4.01 and the untreated controls 260g $\pm$ 5.7. Both test and control animals gained weight with normal growth. The initial systolic blood pressure averaged 120 $\pm$ 2.4mmHg for the CCl_4 group and 125 $\pm$ 3.1mmHg for the controls. Blood pressure increased normally in the growing test and control animals. The final systolic blood pressures were 136 $\pm$ 4.01mmHg for the CCl_4 group and 133 $\pm$ 1.66 for the untreated animals at the end of the experience.

The mean serum Ca, Fe, Li, Mg, Mg, Na and K values were not altered after chronic CCl_4 treatment compared with those of the untreated control animals (Table 1).

At this dosage level (0.15ml) of CCl_4 no toxic effects were noted such as weight loss, anorexia, or hair loss. Previous study of liver tissue (Loyke 1964b) showed only a moderate degree of liver damage in the form of fatty metamosphosis following chronic administration of CCl_4 injections to rats. No renal tubular changes were found after the CCl_4 injections and adrenal tissue was reported as normal (Loyke 1964b).

Two other trace metals have been measured after CCl_4 administration. Serum values for copper (Loyke 1984) were found to be significantly decreased after chronic

Table 1. Mineral Levels in Normotensive Treated and Untreated CCl_4 Rats

CCl_4	Ca mg/dl	Fe ug/100ml	K meg/L	Li meg/L	Mg meg/L	Na meg/l
+	9.56±51	342.2±86	5.81±55	.01	2.54±17	144.7±8.4
0	9.0 ±.30	334 ±30	5.48±.39	.01	2.43±.15	140 ±7.1

Mineral values are ±2 standard deviation of the mean.

CCl_4 injections, but zinc levels were not significantly lowered.

In conclusion, data was presented on the relationship of minerals to blood pressure after chronic subcutaneous CCl_4 treatment in the normal rat. Serum Ca, Fe, K, Li, Mg, Na and K levels were not different after CCl_4 injections. Blood pressures were not altered in the normotensive animals after CCl_4 treatment compared to their untreated controls.

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