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EFFECT OF ALLOXAN — INDUCED DIABETES ON SERUM ELECTROLYTES AND LIPIDS IN RABBITS

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ABSTRACT :

Effect of alloxan on serum glucose, electrolytes and lipids was observed in 20 induced-diabetic rabbits. Thirteen days after alloxan administration sufficient hyperglycemia was detected and the serum levels of magnesium and sodium were lower significantly. Out of 20, eight Rabbits (40%) developed marked hypomagnesemia and hyponatremia which were inversely associated with the degree of hyperglycemia. Serum HDL-cholesterol was also decreased and triglycerides increased statistically. However, the difference in the mean values of total cholesterol, calcium and potassium were found to be non-significant after alloxan injection .

INTRODUCTION :

In the last few decades, interest in diabetes and related problems has been greatly aroused and a lot of research work has been carried out in this respect because it is now recognised as a common and universal disease. It is one of the most common endocrine disorders and may have wider relations with disturbed electrolyte metabolism[1]. Sodium and calcium are the major extracellar whereas potassium and magnesium are the major intracellular cations in the body[2].

Some of the preliminary studies have suggested that magnesium metabolism might be altered in patients with diabetic acidosis and coma[3] but no systematic study regarding the association of these major electrolytes with diabetes has been documented in the available literature. In the present study, alloxan was used to induce diabetes mellitus in rabbits and the alterations in serum electrolytes and lipids were determined.

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MATERIALS AND METHODS :

Experimental Animals

Twenty healthy male adult rabbits of local strain, weighing 1000-1500 grams, were used in the experimental study. The animals were kept under observation for one week. They were offered green fodder, rabbit feed and fresh tap water ad.libitum.

Collection of Blood for Normal Control Values

One week after keeping the animals under observation, blood samples were collected from their Jugular veins for the determination of glucose, electrolytes and lipids. These served as control values.

Preparations of Diabetic Rabbits

All the rabbits were made artificially diabetics by injecting 2% solution of alloxan monohydrate to each animal into one of the marginal veins of their ear at dosage rate of 150 mg/kg body weight. The diabetes mellitus usually develop within a week in the rabbits[4]. Thirteen days after alloxan administration the blood samples were again collected from these diabetic rabbits for observing the changes in electrolyte and lipids. Serum magnesium and calcium was measured by Pye-unicam SP-9 Atomic Absorption Spectrophotometer, sodium and potassium by Corning 410 C Flame Photometer, serum glucose and lipids were determined by the use of standard kit methods of Boehringer-Mannheim and Human Companies. Elemental analysis of water, fodder and rabbit feed was also carried out. Statistical analysis of the results was assessed by student's T test.

RESULTS :

Table I. Metallic contents of water, fodder and feed used by rabbits (concentration in ppm)

	Mg	Ca	Na	K
Water	450	265	406	138
Fodder	8,702	3,908	16,150	674
Feed	8,126	4,132	17,584	790

The table I indicates the metallic contents of water, fodder and rabbit feed. Table 2 shows effect of alloxan on serum glucose, electrolytes and lipids in rabbits. The mean body weight of the rabbits before and after alloxan administration was 1.3 ± 0.2 kg and 1.2 ± 0.2 kg respectively.

Significantly lower values of magnesium ($P < 0.001$) and sodium ($P < 0.02$) was observed in diabetic rabbits. Out of the total rabbits, eight (40%) alloxan induced diabetic rabbits developed marked hypomagnseemia and hyponaremia.

Table II. Effect of alloxan on serum glucose, electrolytes and lipids in rabbits. Values are represented as mean ± S.D. (Total Rabbits = 20)

Variables	Before Alloxan (Control Value)	After Alloxan Diabetic Values	P Values
Weight (Kg)	1.3 ± 0.2	1.2 ± 0.2	N.S.
Glucose (mg/ld)	82 ± 15	264 ± 34	P < .001
*T. Cholesterol (mg/dl)	145 ± 29	153 ± 32	N.S
HDL-cholesterol (mg/dl)	35 ± 7	29 ± 6	P < 0.02
Triglycerides (mg/dl)	78 ± 13	92 ± 15	P < 0.05
Magnesium (mEq/L)	2.1 ± 0.5	1.2 ± 0.3	P .001
Calcium (mEq/L)	5.4 ± 1.2	5.6 ± 1.3	N.S.
Sodium (mEq/L)	144 — 9	136 ± 7	P < 0.02
Poassium (mEq/L)	4.7 ± 1.1	4.3 ± 1.2	N.S.

*T = Total, N.S. = non-significant.

Serum HDL-cholesterol also decreased (P < 0.02) and serum triglycerides increased (P < 0.05) significantly. However, the difference in values of total cholesterol, calcium and potassium in rabbits, was found to be non-significant before and after the administration of alloxan.

DISCUSSION :-

Diabetes was readily produced by the dose of alloxan used and hyperglycemia became evident, within a few days after its administration. The mean weight loss was non-significant. Serum magnesium and sodium values decreased significantly.

The hypomagnesemia and hyponatremia which is demonstrated in our diabetic rabbits, depends upon the diabetic control state of animals. the underlying cause of hypomagnesemia and hypondtremia in diabetes mellituds is not well established. Although we did not evaluate urinary electrolyte excretion, hypomagnesemia and hyponatremia may be caused at least in part by urinary electrolyte loss[5]. According to some authors, poor metabolic control of diabetes may be another factor which affects the serum electrolyte levels[6].

Ionic deficiency especially of magnesium has been linked both to acute and late chronic complications of the diabetes, hypomagnesemia has also been reported to be associated with diabetic retinopathy[7] and ischemic heart disease[8]. As we observed the hypomagnesemia and hyponatremia in the samples of alloxan — induced diabetic rabbits, it is, therefore, suggested that the measurement of serum glucose concentration should always be part of the initial investigation of patients with electrolyte study, so that the correct treatment for both the electrolyte depletion and hyperglycemia may be started without necessary delay.

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