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EFFECT OF DIET ON TRANSAMINASE AND ARGINASE ACTIVITIES

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ABSTRACT

The composition of the diet greatly influences the enzyme activities of the liver. The effect of low carbohydrate diet on AST, ALT and arginase activities in liver and serum of rats was determined in the present study. Liver ALT and serum AST were significantly increased in animals fed on low carbonhydrate diet, the activities of other enzymes remained unchanged.

Introduction

The activities of a number of metabolic enzymes have been shown to be affected by factors like x-radiation, fasting and adrenalectomy (Brin and McKee, 1956). Schimke, (1962) studied the effects of dietary changes on hepatic enzyme activities and reported that removal of protein from diet causes a considerable decrease in arginase levels. The present study was designed particularly to correlate the enzyme levels and their adaptation to the changed condition of diet.

Materials and Method

Male rats belonging to Wister Sprague-Dawley strain and weighing between 140-150 g. were used in the present study. The animals were housed in air-conditioned room and were divided into two groups: animals were fed either a standard laboratory diet (supplied by Lever Brothers Pakistan Limited) or on a low carbohydrate diet for three weeks. The composition of the two diets is given in Table 1. The caloric value of the diet was maintained by decreasing wheat from 30 to 10% and increasing the fats by 10%. The ingredients were thoroughly mixed with water and pellets of suitable sizes were prepared and dried in an oven at 60°C for 24-36 hours. These pellets were then sprayed with vitamin B-complex. The rats maintained for three weeks on standard or low carbohydrate diets were weighed every fourth day. Figure 1 represents. the growth curves of the animals of the two groups. The amount of food consumed by the animals was also determined every third day. The amount of diet consumed is shown in figure 2.

The liver and blood samples for enzyme assay were collected as described in a previous communication (Ahmad & Rahman, 1974). Transferases activities were determined

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by Sigma-Frankel method (Sigma Chemical Co., St. Louis, U.S.A.). One S.F. unit of alanine amino transferase (ALT, EC, 2.6.12) or aspartate aminotransferase (AST, EC 2.6.1.1) forms 4.82 x 10^{-4}µM of glutamate per minute which causes a decrease in optical density of 0.001 at 340 nm/min. Arginase activity was determined according to the method of Greenburg (Greenburg, 1960).

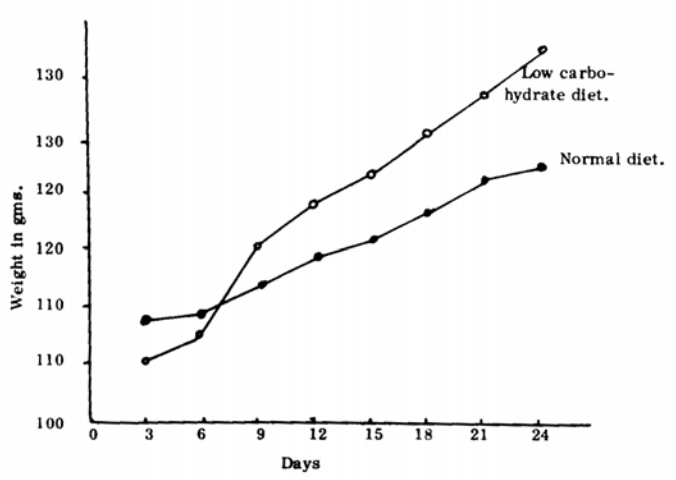

Fig. 1: *Gr*owth *curve for ra*ts: The animals were kept on standard laboratory (o---o) and low carbohydrate (o---o) diets. The weight of the animals is plotted against the number of days.

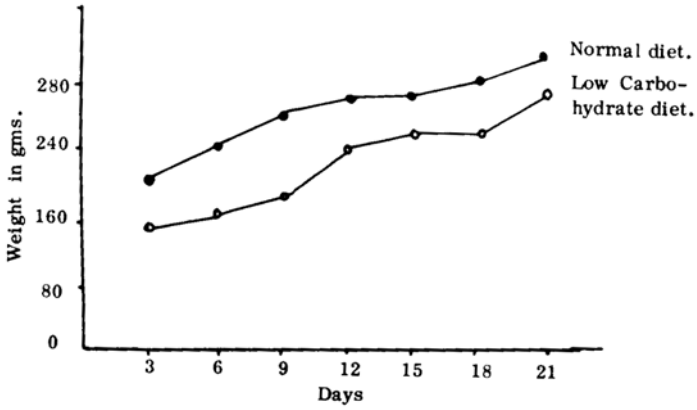

Fig. 2: *Dietary intake:* The animals were maintained of standard laboratory (o - - - o) and low carbohydrate (o---o) diets. The amount of diet consumed by the animals kept on two different types of diet is plotted against the number of days.

Table: 1. Ingredients of Low and Standard Carbohydrate Diets.

Composition	Standard Laboratory Diet (%)*	Low Carbohydrate Diet (%)**
1. Whole wheat	30	10
2. Yellow corn	16	16
3. Milk powder	20	20
4. Cottonseed oil	12	22
5. Alfa alfa (lusion)	2	12
6. Sucrose	1	1
7. Dry meat (Beef)	16	16
8. Liver extract (Beet)	1	1
9. Vitamin B-complex	1/2 oz per lb.	1/4 oz per lb.
10. Cod Liver Oil	1	1
11. Inorganic salts	1	1
i) Sodium chloride	0.5 pans	0.5 parts
ii) Magnesium sulphate	0.02"	0.02"
iii) Calcium lactate	0.48 "	0.48 "

*Approximately 18% protein, 15% Fats, 38% Carbohydrates & 29% H_2O
**Approximately 16% protein, 24% Fats. 28% Carbohydrates & 32% H_2O

Results and Discussion

The data shown in table-2 indicate the effect of diet on activities of transferases in serum and liver and arginase activity in liver. The ALT level in liver and AST level in serum are increased significantly on reduction of carbohydrate in the diet. The levels of other enzymes did not change significantly. The AST level in liver and serum increased. The ALT level in liver shows a two fold increase while there is an insignificant increase in serum ALT level. The arginase level also increased. In providing low carbohydrate diet to the animals it was assumed that there could be increased conversion of protein to carbohydrate thus leading to a more pronounced effect on liver enzymes. These findings are, however, in agreement with those of Freeland and Harper, (1958), who observed an in-crease in glucose-6-phosphatase activity caused by lack of glucose in the diet. Liver en*zyme* system is therefore greatly influenced by changes in the composition of diet. Chang et al., (1971) have reported higher activities of glucose-6-Phosphatase, glucose-6-phosphate dehydrogenase and aldolase in animals fed on high sucrose diet. Hasnain and Rahman, (1972) have shown that when mice are subjected to fasting or kept on a diet with low carbohydrate content, compensate this essential component by increased glyconcogenesis.

Table 2: Effect of Low Carbohydrate Diet on Transaminase and Arginase activities in rats

Diet	Liver		Serum		Arginase
	AST	ALT	AST	ALT	
Standard	42.0 ± 2.0	20.6 ± 1.6	130.0 ± 7.4	45.0 ± 2.6	105.0 ± 6.1
Low Carbohydrate	45.8 ± 2.7	42.2 ± 3.4	147.0 ± 4.8	50.0 ± 1.2	115.0 ± 6.1
P	N.S.	< 0.05	< 0.05	N.S.	N.S.

Each value is a mean of ten observations ± S.E.

It is interesting to note that orginase activity did not change significantly after feeding low carbohydrate diet. It was assumed that with the intake of the rations low in carbohydrate, the protein catabolism will be increased to provide the required energy for the body. But the finding that low carbohydrate intake has no effect on arginase activity may suggest that most of the energy is obtained from the catabolism of fats provided in the diet. Excess amount of fats was necessary in order to maintain the caloric content of the diet.

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