HYPOGLYCAEMIC AND HYPOLIPAEMIC EFFECTS OF CYAMOPSIS TETRAGONOLOBA (GUAR) IN NORMAL AND DIABETIC GUINEA PIGS

A. SRIVASTAVA*, G. S. LONGIA, S. P. SINGH AND L. D. JOSHI**

Department of Biochemistry,
M.L.B. Medical College, Jhansi - 284 128 (U.P.)

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Summary : Information available in literature is contradictory regarding the glycaemic and cholesterolaemic activities of various legume proteins. Present work deals with the study of the effect of 'Guar' feeding on serum total lipids, free and esterified cholesterol, triglycerides and phospholipids. Normal and alloxan induced diabetic guinea pigs were kept on the whole seed diet of 'Guar' for four weeks. Blood sugar and total lipid levels were found to be decreased significantly in normal and as well as diabetic animals; free and esterified cholesterol levels were also observed to be lowered significantly in normals, whereas esterified fraction alone was found to be lowered in diabetics. Significant fall in the levels of other lipids i.e., triglycerides, phospholipids and total lipids was also noticed.

Key words : cyamopsis tetragonoloba (Guar) cholesterol blood sugar
total lipids triglycerides phospholipids

INTRODUCTION

Various legumes have been reported to be effective for lowering hpyerglycaemia and hypercholesterolemia (11, 12). Dietary protein has been recognized for its ability to change the plasma cholesterol concentration in chicken (15). The reports relating to the effect of dietary proteins on the level of plasma cholesterol in human beings are contradictory (1,2,14). Keeping this in mind, the present study was undertaken to find out the glycaemic and lipaemic effect of 'Guar', if any, in the normal and diabetic guinea pigs. Bushy and erect plant of 'Guar' generally grows in arid and semi-arid zones, the beans of which are used as a source of vegetable and frequently taken in the diet because of its high nutritive value (31% protein in the boiled beans) (5).

*Reprint requests : Dr. A. Srivastava, Biochemist, Factory Medical Block (OHS) BHEL, Bhopal - 462 022 (M.P.)

**Present adderss : Department of Biochemistry, G.S.V.M. Medical College, Kanpur (U.P.)

MATERIAL AND METHODS

Twenty growing healthy guinea pigs of either sex (350-500 g) were used. They were kept in separate cages. After 24 hr of fasting, diabetes was induced by alloxan (single dose, 150 *mg/kg*, im). Guinea pigs having blood sugar levels above 250 *mg/dl* were selected for the study a fortnight later.

The guinea pigs were divided into 4 groups, each of 5 animals. Group I (normal) and group III (diabetic) animals were given standard pellect diet (Hindustan Lever Ltd; Bombay), which served as control diet groups. Groups II (normal) and IV (diabetic) animals were given previously well soaked commercial seeds of 'Guar' in proportion to their equivalence to 40% seed diet. Diet for control and experimental groups, with tap water *ad ibitum*, was continued for 4 weeks.

The bleeding was done from zero hr to 4 weeks at an interval of 1 week without any anaesthesia (10). Blood samples were analysed for sugar by Somogyi-Nelson method (17). Serum was separated immediately after bleeding for the estimation of total lipids (5). Serum triglycerides (6) and phospholipids (3) were also estimated, along with serum cholestrol (free, esterified and total) (19). The results were statistically analysed and evaluated by applying student's 't' test.

RESULTS

The concentration of all the biochemical parameters studied remained constant in the control groups I and III (Tables I, II and III) while significant changes were observed in the experimental groups II and IV (Tables I, II and III.)

Guar feeding decreased the blood sugar levels in both normal and diabetic guinea pigs (Table I). The decrease was significant and continuous upto the end of 4 weeks.

Serum total lipids showed a significant fall upto 2nd week and the levels were found to be stabilised thereafter in both the groups i.e. II and IV (Table I). The hypolipaemic action of "Guar" feeding was found to be highly significant in group II and less significant in group IV. "Guar" feeding appeared to be highly hypocholesterolaemic in both the groups II and IV (Table II). Though "Guar" feeding caused a highly significant fall in the esterified fraction of cholesterol in both the groups, it could not do so in case of free fraction in diabetic guinea pigs of group IV (Table II). It significantly lowered the free

TABLE I : Effect of Cyamopsis tetragonoloba (Guar) on blood sugar and serum total lipids concentrations in Normal and Diabetic guinea pigs. (Values are mean ± S. D. from 5 animals)

Group	Initial	After treatment			
		After 1 week	After 2 weeks	After 3 weeks	After 4 weeks
		BLOOD SUGAR *(mg/dl)*			
I	101.07±3.87	100.64±2.27	100.24±1.64	100.90±1.21	102.29±3.10
II	108.77±7.10	102.14±5.65	88.54±3.31	80.15±5.49	78.12±4.04**
III	350.92±15.93	353.62±12.42	351.06±12.56	351.46±20.59	352.26±15.90
IV	361.40±17.81	310.14±5.10	296.53±7.04	279.46±8.42	256.79±19.13**
		SERUM TOTAL LIPIDS *(mg/dl)*			
I	162.56±11.59	159.40±12.25	165.70±20.27	160.48±13.82	158.84±13.16
II	153.84±12.66	118.86±15.81	99.50±3.70	103.12±10.25	95.27±9.95**
III	265.60±11.88	267.35±9.59	259.82±6.19	263.89±8.03	264.67±9.34
IV	267.52±11.09	249.19±10.92	249.81±5.11	244.44±6.57	245.86±16.13**

P values : * : ∠0.05, ** : ∠0.001

TABLE II : Effect of Cyamopsis tetragonoloba (Guar) feeding on serum free, esterified and total cholesterol concentration in normal and diabetic guinea pigs.
(Values given are mean ± S. D. from 5 animals)

Group	Initial	After treatment			
		After 1 week	After 2 weaks	After 3 weeks	After 4 weeks
		FREE CHOLESTEROL *(mg/dl)*			
I	5.70±0.70	5.33±0.71	5.05±0.97	5.68±0.88	5.50±1.02
II	5.51±0.47	4.82±0.41	4.63±0.47	4.03±0.72	3.58±0.44*
III	15.66±2.35	15.37±1.87	15.26±2.24	15.55±2.29	15.12±1.38
IV	14.49±1.39	14.13±1.49	13.58±1.07	12.98±0.70	13.13±1.88
		ESTERIFIED CHOLESTEROL *(mg/dl)*			
I	24.37±2.03	25.28±1.55	25.50±3.13	23.14±3.05	24.222±.99
II	24.65±2.21	23.74±2.04	20.96±2.10	19.95±2.67	17.55±1.05*
III	60.27±8.50	56.88±8.06	59.26±7.83	60.53±9.06	61.13±13.04
IV	62.60±8.55	46.11±2.54	39.90±4.34	36.10±6.26	32.41±4.07*
		TOTAL CHOLESTEROL *(mg/dl)*			
I	30.08±1.76	30.62±0.92	30.56±2.86	28.86±2.28	29.73±2.94
II	30.16±2.52	28.76±2.01	25.59±1.94	23.99±2.12	21.13±1.15*
III	75.94±10.76	72.26±9.77	74.53±9.97	76.00±10.27	76.25±13.24
IV	77.09±7.61	60.40±2.27	53.49±4.78	49.09±6.32	45.54±3.76*

P value : * $\angle 0.001$

TABLE III : Effect of Cyamopsis tetragonoloba (Guar) feeding on serum triglycerides and phospholipids concentrations in normal and diabetic guinea pigs.

(Values given are mean±S. D. from 5 animals)

Group	Initial	(After treatment) After 1 week	After 2 weeks	After 3 weeks	After 4 weeks
		SERUM TRIGLYCERIDES (*mg/dl*)			
I	76.66±4.85	75.99±4.16	77.06±4.80	76.46±4.73	77.65±6.22
II	79.99±4.98	74.86±4.75	75.53±4.34	72.13±2.16	69.99±1.44**
III	154.05±3.88	152.42±9.30	154.60±8.45	152.12±7.61	154.10±3.78
IV	140.96±7.95	146.95±4.37	141.30±4.91	133.96±8.05	130.20±4.69*
		SERUM PHOSPHOLIPIDS (*mg/dl*)			
I	55.24±5.77	55.56±4.53	58.20±5.61	59.24±2.05	55.98±5.06
II	53.09±5.46	46.56±5.02	45.04±3.80	41.40±1.25	39.80±2.91
III	67.15±2.83	67.82±2.69	69.06±2.92	67.32±3.21	66.28±3.72
IV	64.95±2.93	58.66±1.88	55.66±4.19	51.49±2.27	49.32±2.70***

P values : * $\angle 0.05$, ** $\angle 0.01$, *** $\angle 0.001$

cholesterol in normal animals of group II. Serum triglyceride concentrations were found to be continuously and significantly decreased upto the end of 4 weeks in normal animals (Group II) but in the case of diabetic animals triglycerides concentration registered a slight increase in the 1st week followed by a continuous and significant decrease (Table III) in the subsequent weeks. Guar feeding also showed its highly hypophospholipaemic activity in the experimental animals of both the groups i.e. II and IV (Table III).

Ratio of total cholesterol to phospholipids concentration was observed to be decreased from 0.568 to 0.530 in normals and from 1.186 to 0.923 in diabetic animals of group IV.

DISCUSSION

Guar appears to contain a potent hypoglycaemic factor confirming earlier findings (11, 16). It is probable that "Guar" feeding may have a direct impact on insulin secretion as certain amino acids are known to stimulate its secretion (4). Since "Guar" is composed of galactomannan (7), which is not hydrolysed in the gastrointestinal tract and classified as an unabsorbable or unavailable carbohydrate, it may reduce the insulin requirment of diabetics, as has been reported (7, 8, 9). In the present study the blood sugar level was decreased in normals as well as diabetic animals.

The hypolipaemic action of "Guar" observed in this study is in agreement with the previous study (13).

"Guar" feeding for 30 days has caused decrease in the total cholesterol level of normal and diabetic animals. Apparently, the rate of fall is proportional to the level of cholesterol. Pulses are believed to exhibit hypocholesterolaemic effect as fibre present in them is known to increase the excretion of bile acids and salts by decreasing their reabsorption (18).

The decrease in triglycerides concentration upon feeding "Guar" can be related to its supressed production because of decreased hepatic lipogenesis or due to early clearence of plasma tiglycerides on account of increased peripheral insulin action.

Following the pattern of total lipids, phospholipids level was also found to be decreased significantly proving its strong hypophospholipaemic action (Table III).

Decrease in total cholesterol/phospholipids ratio in both the normal and diabetic animals of groups II and IV indicates toward the antiatherogenic action of 'Guar'. Further research on this aspect is clearly indicated.

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