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Effect of *Cyamopsis tetragonoloba* (Guar) on blood parameters in normal human subjects

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Abstract
In country like India, majority population is vegetarian. Carbohydrates constitute the main source of calories which in turn causing hyperglycemia and diabetes. To overcome such problems, fiber diets play an important role. So the present study was conducted "The effect of guar fibers on carbohydrate metabolism". The study was conducted on 20 normal healthy subjects by feeding them 20 gm roasted guar legumes per day for 20 days. The blood samples were analyzed for blood glucose and total serum cholesterol before and after intake of guar fibers. The fasting blood glucose level was found to be reduced after intake of guar legumes. This might be due to gelling properties of guar fibers that retarded the digestion of carbohydrates resulting in decreased blood glucose level. Similarly serum cholesterol level was also reduced after intake of guar legumes. This might be due to the fact that guar fiber bound the cholesterol and retarded its absorption, resulting in decreased serum cholesterol level.

Keywords: *Cyamopsis tetragonoloba*, blood parameters, normal human subjects

Introduction
Plant fibers are the portions of plant foods that are not digested in the human small intestine. During the century, remarkable advances have been made in defining the characteristics and importance of most nutrients such as carbohydrate, proteins, fats, vitamins and minerals. Plant fibers have largely been neglected because they were considered to have no nutritive values. Evidence is emerging that plant fibers have profound influences on human nutrition because they alter the absorption and metabolism of many nutrients (James *et al*. 1979) [6].

The plant cell walls are made of structural fibers including cellulose, lignin, many different hemicellulose and pectins. The gums and mucilage have special functions such as repair of injured areas. Carbohydrates which are digestible (e.g. - starch and dextrin) and indigestible fibers are termed as storage polysaccharides. The storage polysaccharides from certain beans (e.g. guar gum) are of particular interest because of their profound influence on carbohydrates and lipid metabolism. From an analytical stand point, plant fibers can be divided on basis of water solubility (1) insoluble fibers (2) soluble fibers. The insoluble fibers include cellulose, lignin and many hemicelluloses and soluble fibers include pectin, some hemicellulose gums, mucilage and storage polysaccharides are not components of cell wall but have biochemical and physiological properties that resembles the pectins and certain hemicellulose. Gums are group of highly branched polysaccharides containing glucuronic and galacturonic acid as well as xylose, arabinose and mannose. Guar gum is classifed as a mucilage but is major storage polysaccharide. This galactomannan with molecular weight of approximately 220,000 is derived from Indian cluster been Cyamopsis tetragonolobus. After separation from husk and germ, the endosperm is ground to a fine particle size and marketed as guar gum. Because of its water absorption and binding capacity it is used in proper industry cosmetics, pharmaceuticals.

When carbohydrates including plant fibers are ingested together reduced hyperglycemia is ensured as compared with the same amount and type of carbohydrates ingested without plant fiber. The long term effects of increasing fiber intake on glucose tolerance of normal individuals are not well delineated. Some studies suggested that high fiber diets may improve glucose tolerance whereas another study failed to note significant alternation (Wapnick *et al*., 1972) [14],

Review of Literature

Jenkins *et al*., (1978) [8] have reported an improvement in glucose tolerance when a fiber source was added to the test meals of either healthy or diabetic subjects. Although gums and viscous types of fibers (i.e. guar and pectin) were found to be most effective in glucose tolerance. The removal of fiber from carbohydrates food is also believed to lead to over consumption of food and obesity which is an important factor in causation of diabetes and ischaemic heart disease.

As the intake of dietary fiber is increased, the apparent availability of other utilizable components of diet is decreased (Southgate & Durmin, 1970) [13].

Guar gum, a gel forming unabsorable carbohydrates derived from the cluster bean *Cyamopsis tetragonoloba* was shown to lower the post prandial blood glucose in diabetics (Jenkins *et al*., 1976) [7], when added to rich test meal of carbohydrates.

Fibers exert their effect on carbohydrates metabolism in many ways of which must remains to be understood. Fibers slows the absorption of glucose from the small intestine and lowers the post prandial hyperglycemia. In activities of glucose metabolism, enzymes are also increased with ingestion of high fiber diet (HCF). Guar advocated in diabetic diet for its high fiber content belongs to leguminous family, Synthesis, metabolism and release of cholesterol from the liver may be directly or indirectly altered by plant fibers. Some studies (Zilversmit, 1974) [15] suggested that hepatic cholesterol synthesis was increased by plant fiber intake whereas other suggested that synthesis was decreased.

The concentration of serum cholesterol decrease with the high fiber diet. The lowering of serum cholesterol values is probably related to law fat contents associated with high fiber content of these diets.

Soluble fibers have distinct hypocholesterolemic effect in man (Anderson and Wark, 1979) [3]. In-soluble plant fibers are relatively ineffective in lowering the serum cholesterol.

Nemerous studies have demonstrated that addition on non digestible fiber such as pectin, whole bran to food improved glucose tolerance in normal and diabetic patients (Anderson and Chen, 1979) [1]. Most of these studies, however, were short term experiments extending over hours to days and did not establish the feasibility or the efficacy of chronic fiber treatment. In the few long term studies (Simposon *et al*., 1981) [11] in which both carbohydrates and fiber content of the diet were increased, making it difficult to determine which was responsible for the beneficial effects. Furthermore, the mechanism by which fiber improve metabolic control in diabetic patients remain unknown.

All these observations have lead to study the effect of locally available and cost wise quite economical pods of guar (*Cyamopsis tetragonoloba*), which are rich in their fiber contents, in normal subjects. Guar gum was explored as a source of high fiber diet by (Jenkins *et al*., 1976) [7]. Anderson and Sieling (1981)² also highlighted the beneficial effect of naturally occurring complex carbohydrates' in diabetes. Thus scanty and diversant reports are available over human population regarding the effect of Cyamposis tetragonoloba (Guar) on carbohydrates and lipid metabolism.

Therefore, it is thought worthwhile to investigate the effect of *Cyamopsis tetragonoloba* (Guar) on blood glucose and cholesterol levels in normal healthy subjects.

Material and Methods

The present follow up study was on 20 subjects aged between 25 to 40 year. They were randomly selected irrespective of their caste and creed. Detailed history was taken to exclude any major illness likely to affect carbohydrate and lipid metabolism. The subjects having history of drug intake, radiation and any infection during the study were excluded from the present study.

These subjects presented themselves for the present study on the basis of personal request, relationship and their eternal eagerness to known the effect of guar fiber on their blood parameters.

The subjects were asked to take 20 gm dried guar legumes in roasted form from per day for 20 days in addition to their routine diet. The roasted guar legumes when with salt and chilli become very testy and villagers take it routinely with great avidity. Each subject acted as his/her own control. Thus any change occurred in blood parameters reflect the effect of guar fibers on these parameters.

From each subject 5 ml of fasting blood from antecubetal vein was withdrawn before and after 20 days intake of guar fiber. The sample was analyzed for blood glucose and total cholesterol by semi auto analyzer using enzymatic kits. Results are tabulator in Table 1.

Table 1: Mean values of blood parameters before and after 20 days intake of 20 gm dried roasted guar legumes per day

Blood parameters mg%	Before intake of guar legumes Mean ± SD	After intake of guar legumes Mean ±+ SD	p value
Glucose	87.6±6.5 (80.2 to 98.8)	81.5±2.3 (76.0 to 88.4)	<0.001
Cholesterol	183.5±14.7 (151.6 to 190.6)	170.4±10.6 (150.2 to 184.3)	<0.001

Figures in parenthesis indicate the range.

Result and Discussion

It is evident from table I that mean fasting blood sugar level was found to be 87.6±6.5 with a range of 80.2 to 98.8 mg per cent in normal healthy subjects before taking guar legumes. These values are in collaboration with the findings of Singh (2000) [12].

The blood sugar level was reduced to 81.5±2.3 with a range of 76.0 to 88.4 mg per cent after 20 days consumption of guar fibers in the form of roasted legumes 20 gm per day. The decreased in blood sugar level as compared to that of control was statistically significant as shown by p value (p<0.001). The decrease in blood sugar level in guar fiber consuming subjects might be due to the gelling properties of these fibers that retard the digestion of carbohydrate. The undigested carbohydrate may escape into the colon and may be lost in feces as reported by Leeds *et al*., 1975 [10] and Jenkins *et al*. (1976) [7]. Table I showed that serum cholesterol level ranged from 151.6 to 190.6 with an average of 183.5±14.7 mg per cent in normal control subject before consumption of guar fibers. These finding were in close agreement with observation made by Dutt (1967) [5].

It is revealed from table I that mean total serum cholesterol was found to be 170.4±10.6 with a range of 150.2 to 184.3 mg per cent in normal subject after consumption of 20 gm roasted guar legumes per day for 20 days. The decrease in serum cholesterol level after consumption of guar fiber was statistically significant as compared to that of before consumption as evident by p-value (p<0.001).

Although serum cholesterol level remain within normal limit but the significant decrease in serum cholesterol level after

consumption of guar legumes might be due to the fact that guar fiber may bound the cholesterol and in turn it retard absorption resulting decreased serum cholesterol level. Kay and Truswell (1977) [9] reported plant fiber supplements were accompanied by increased fecal excretion of cholesterol and plant sterols as well as bile acids. It might also be possible that guar fibers may cause the depletion of bile acids by fecal excretion, resulting diversion of cholesterol into bile acid formation and decreased cholesterol may be available for circulation.

Summary and Conclusion

The important of dietary fibers to human health has popularized now a days. It has been reported that inadequate fiber intake due to high consumption of processed and refined food could be the cause of high incidence of heart disease, cancer and diabetes (Burkit and Trowell, 1975) [4]. So that present study "The effect of guar fibers on blood glucose and cholesterol levels in normal healthy subjects was conducted:

1. The present study was conducted in 20 normal healthy subjects.
2. They were asked to take 20 gm dried roasted guar legumes per day for 20 days along with their routine diets.
3. Fasting blood samples were taken before starting the feeding of guar fibers and after 20 days of intake of 20 gm roasted guar legumes per day.
4. The blood samples were analyzed for fasting blood sugar as well as total cholesterol by semi auto analyzer using enzymatic kits.
5. The fasting blood sugar was found to be reduced after intake of guar legumes might be due to gelling properties of guar fibers that retarded the digestion of carbohydrates resulted decrease blood sugar level.
6. The serum total cholesterol was found to be reduced by intake of guar legumes might be due to the fact that guar gibers bound the cholesterol and retarded its absorption causing depletion in serum cholesterol level.
7. Thus, guar fibers have an important role in reducing both blood glucose and serum cholesterol levels.

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