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Impact of cluster bean consumption on hyperlipidemia and hyperglycaemia

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Abstract
This study was conducted with the objective to promote cluster bean consumption in the daily diet and assess its effect on life style disorders. The health benefits of cluster beans have been established through laboratory studies on animals. Diet counselling was conducted to highlight the importance of this vegetable and also demonstrate dishes based on this vegetable. A supplementation study was conducted to study the impact of cluster bean among respondents having hyperlipidemia and hyperglycaemia. Blood profile analysed revealed reduced total cholesterol (TC), triglycerides (TG), LDL and VLDL in hyperlipidemic subjects and fasting blood sugar (FBS) and post prandial blood glucose (PPBS) in hyperglycaemic subjects. These results suggest that dehydrated cluster bean powder is effective in hyperlipidemia and hyperglycaemia.

Keywords: cluster bean, diet, cholesterol (TC), triglycerides (TG)

Introduction
Cluster bean or guar bean (*Cyamopsis tetragonoloba* (L.) Taub.) Is an under exploited annual legume which belongs to the family *Leguminaceae (Fabacae).* India produces 80 per cent of guar bean in the world production scenario. (Tripathy and Das, 2013) [7]. Cluster bean has been reported to be a rich source of protein and fibre. It has several health benefits in both its vegetable and powder form (guar gum). They contain vitamins C, K, and a, iron, folate, manganese and dietary fibre. Each of these nutrients play an important role in cardio protection. In addition, guar beans are potentially high sources of phytochemicals (Wang and Morris, 2007) [9]. Cluster bean or guar bean is a well-known traditional plant used in folklore medicine. It acts as an appetizer, cooling agent, digestive aid, laxative and is useful in healthy dyspepsia and anorexia. It is also found to have. Anti-ulcer, anti-secretory, cytoprotective, hypoglycaemic, hypolipidemic and hypoglycaemic properties (Mukhtar *et al*., 2006) [3].

Hypercholesterolemia is a condition which refers to increase in cholesterol levels or increased plasma proteins which is a major risk factor for atherosclerosis (Kumar *et al*., 2007) [2]. In a rat study, it was found that garlic potentiated the beneficial influence of dietary cluster bean on serum, liver and biliary lipids in high cholesterol fed situation (Pande and Srinivasan, 2012) [4, 5]. The freeze dried cluster bean powder consumption reduced total cholesterol and LDL cholesterol to 13.5 per cent and 18 per cent respectively (Patel *et al*., 2012) [4, 5].

Guar gum, an indigestible carbohydrate derived from cluster bean was observed to lower post prandial blood glucose for diabetic patients (Jenkins *et al*., 1976) [1]. When 5g of guar gum in a glass of water was consumed either before dinner or lunch, a definite reduction in PPBS was noted in patients from 1 to 12 weeks. The fall was significant at all levels (Triveni *et al*., 1999) [8]. A significant reduction was noted in serum cholesterol concentration of diabetic subjects after 15 and 30 days of consumption of roasted and cooked guar fibre per day (Soni. Y and Rajnee, 2011) [6].

This vegetable is a very cheap and abundant commodity in the local market. However, its utilization is very low in home preparations and also in large scale food industry. This is largely due to its hard texture owing to its high fibre content. Lack of awareness about the nutritional value of cluster bean is another chief reason why the vegetable remains unpopular. This study aims at exploiting this locally available foods for ensuring health security.

Materials and Methods
Twenty experimental and twenty control subjects, were females selected at random. Ten members of the experimental group comprised of hyperlipidemic subjects (group A) and the remaining of hyperglycaemic subjects (group B).

Socio- economic status, health profile and life style pattern of respondents were assessed using developed schedule. An interview schedule was developed for the purpose which was pretested and used for data collection. Socio economic profile included family size, educational status, family income and food expenditure pattern. Health profile was analysed with respect to family history of disease, duration of disease, disease encountered during the last six months, anthropometric indices like height, weight, waist and hip circumferences. Diet survey was conducted to analyse food consumption pattern, food use frequency, food preferences, food timings and nutrient adequacy of respondents. Life style pattern such as exercise pattern, Leisure time activities, Stress level, Consumption of alcohol/tobacco of respondents were also studied.

The selected subjects were counselled on 'The importance of fibre rich locally available fruits and vegetables for maintaining normal blood profile'. To assess the level of knowledge on diet and health a set of statements were given to

the respondents before and after the session. The demonstration of cluster bean based recipes were also conducted through diet counselling. The respondents were advised to include cluster beans in their daily diet.

The inclusion of cluster beans in the diet was initiated among ten hypercholesterolemic and ten hyper glycaemic subjects. One kilogram of cluster bean was observed to give 125g of dehydrated powder. Twenty gram of cluster bean powder was distributed at the rate of 200g/day for to meet requirement of RDA. The requirement of vegetable for a day is 200g.

The supplementation was conducted for a period of one month to assess the impact of cluster bean powder on hyperlipidemia and hyper glycaemia. The lipid profile of group A subjects and FBS and PPBS of group B were monitored at the beginning and end of the supplementation programme.

In order to interpret results, the generated data was subjected to suitable statistical analysis such as Mean, Percentage, Kruskal Wallis test and paired‘t’ test.

Results

Socio economic profile of the respondents were assessed, majority of the respondents (55%) belonged to the age group between 45 -50 years. The respondents were categorized based on educational level from lower primary to PhD level. Thirty per cent of the respondents in both groups studied up to high school level.

Monthly income of the respondents ranged from 30,000 to 50,000 among 15 per cent of respondents of experimental group and 20% of that of control group. The food expenditure pattern of respondents, was expressed as percentage of total income. It was revealed that above 70 per cent of monthly income was spent for food by 40 percent and 45 percent of the respondents in experimental and control group respectively.

Health profile among 20 respondent families, hyper glycaemia and hyperlipidemia was more prevalent among (40% and 30%) of experimental and control groups. When duration of diseases was conducted a period of 6 to 12 months was observed in 30 per cent of experimental group and 15 per cent of control group. When diseases encountered during last six months was analysed, it was observed that 70 per cent of the respondents of experimental group and 80 percent of control group experienced head ache frequently. This followed by joint pains, back pains and muscle pains in frequency among in both experimental and control group.

As per details of body mass index 45 per cent of experimental group and 35 percent of control group were observed to have BMI of above 25.0 (Obesity). Only 10 per cent of both groups were categorised as normal. In case of waist hip ratio, it was revealed that 70 per cent of the respondents in experimental group and 75 percent of control group had a waist-hip ratio of above 0.85 i.e., obese. While analysing food consumption pattern, 80 per cent of the respondents in experimental group and 90 per cent of the respondents in control group had three meals per day. It was noted that food timings were irregular in 65 percent and 60 percent of the respondents in experimental and control group. When nutrient adequacy was analysed it was found that protein intake and fat intake were higher than RDA. The mean protein and fat intake of experimental group was 118 per cent and 215.8 per cent respectively.

Lifestyle pattern of the respondents revealed 40 per cent and 45 per cent from experimental and control group have irregular exercise pattern. Stress level of the respondents were also assessed, majority of the respondents 70% and 60% of experimental and control group, respondents was found to have moderate level of stress in experimental and control group.

The impact of diet counselling was assessed using a schedule with 10 statements and it was observed that knowledge level had improved.

Table 1: Knowledge level of the respondents

Test category	Mean value
Pre test	4.3
Post test	7.25
Paired ‘t’ test	5.84**

In the supplementation study clinical efficacy of cluster bean supplement was assessed for the respondents having 20g cluster bean powder everyday early in the morning and night through FBS and PPBS examination in hyper glycaemic respondents and total cholesterol, triglycerides, LDL, HDL and VLDL for hyperlipidemic patients. The blood samples were analysed before and after supplementation of cluster bean powder in the hyperlipidemic and hyper glycaemic subjects. The respondents in the experimental group having hyperlipidemia and hyperglycaemia were supplemented with dehydrated cluster bean powder for one month and observed.

The mean total cholesterol of pre supplementation was found to be 235.6 mg/dl while in the post supplementation it had decreased to 217.2 mg/dl. It was observed that there was significant difference in total cholesterol at 5 per cent level in experimental group. Mean triglyceride level was reported to be 140.4 mg/dl during pre-supplementation which reduced to 122.5 mg/dl in experimental group. The mean value of LDL had decreased in experimental group from 162.6 mg/dl to 150.3 mg/dl. The mean value of HDL was assessed, it had increased from 43.2 mg/dl to 50 mg/dl. As for VLDL, the mean value was found to reduce from 27.7 mg/dl to 25.5 mg/dl in experimental group.

Table 2: Lipid profile of hyperlipidemic subjects

Lipid profile		Pre supplementation profile	Post supplementation profile	Paired ‘t’ test
Total cholesterol (mg/dl)	Experimental	235.6	217.2	3.26*
	Control	214.1	223.4	1.99
Triglycerides (mg/dl)	Experimental	140.4	122.5	1.61
	Control	109.7	129.6	0.87
LDL cholesterol (mg/dl)	Experimental	162.6	150.3	1.6
	Control	128	148	2.94*
HDL cholesterol (mg/dl)	Experimental	43.2	50	1.72
	Control	44.8	51.2	1.83
VLDL cholesterol (mg/dl)	Experimental	27.7	25.5	1.11
	Control	21.6	24.5	1.19

The mean values of fasting blood glucose and post prandial blood glucose was observed and it was found that glucose levels of experimental group was significantly different for FBS and PPBS. The mean fasting blood sugar value obtained in experimental group was 147.2 mg/dl during pre

supplementation which reduced to 119.1 mg/dl after post supplementation. Whereas the post prandial mean blood glucose levels was 200.6 mg/dl, in pre supplementation stage which reduced to 155.4 mg/dl.

Table 3: Blood glucose levels of hyperglycaemic subjects

Test Category	Fasting blood glucose (FBS) (mg/dl)		Post prandial blood glucose (PPBS) (mg/dl)	
	Experimental (N=10)	Control (N=10)	Experimental (N=10)	Control (N=10)
Pre supplementation	147.2	147.3	200.6	193
Post supplementation	119.1	150.2	155.4	192
Paired 't' test	5.69**	1.01	3.37**	0.17

Conclusion

Variety in dishes enhanced acceptability of a food product. Diet counselling played an important role in improving knowledge level and dietary practices of the respondents.. The hypoglycaemic and hypocholesterolemic effect was confirmed in this study.

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