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Impact of foetid Cassia (*Cassia tora* L.) leaf consumption on type 2 diabetic patients

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Abstract
Diabetes mellitus is a disease of carbohydrate metabolism and WHO has declared India as a diabetic capital of the world. Plants used for traditional medicine contain a wide range of substances that can be used to treat chronic as well as infectious diseases. The study was aimed to find the impact of *Cassia tora* leaf consumption on type 2 diabetes subject. Hypoglycemic effect was confirmed in this study.

Keywords: *Cassia tora* Leaves, foetid cassia, supplementation

Introduction
Incidence of diabetes is increasing all over the world and is becoming a problem of significant importance. Diabetes mellitus is a disease of carbohydrate metabolism and WHO has declared India as a diabetic capital of the world. (Bajaj, 2005) [1].
According to International Diabetes Federation, about 366 million people had diabetes in 2011 and by 2030 this will have risen to 552 million. Diabetes is undoubtedly one of the most challenging health problems in the 21st century (IDF, 2006) [4].
The global increase in the prevalence of diabetes is due to population growth, ageing, urbanization and an increase of obesity and physical inactivity Primary determinants of the epidemic are the rapid epidemiological transition associated with changes in dietary patterns and decreased physical activity (Chan *et al*,2009) [3] The major therapy option in diabetes mellitus is life style management. Besides exercise, weight control and medical nutrition therapy, oral glucose lowering drugs and insulin injection are the conventional therapies for the disease (De Fronzo, 1999).
Medicinal and scientific evidence documents the importance of proper diet and benefits of nutritional supplements for health maintenance and prevention of life style diseases [Wagner, 2002] [9]. India is a country with a vast reserve of natural resources and a rich history of traditional medicine. Medicinal plants contain numerous biologically active compounds which are helpful in improving the life and treatment of diseases. Different types of green leafy vegetables were known to be effective in curing different diseases or ailments
due to the presence of certain biologically active micronutrients other than vitamin and minerals. These biologically active nutrients are secondary metabolites like flavanoids, sterols, alkaloids, terpenoids etc which were termed as phytochemicals. (Bhoomamoni *et al*,1999) [2].
Today it is estimated that about 80% people in developing countries are still depending on traditional medicine based largely on species of plants and animals (Chaterjee *et al*, 2006) [4] Medicinal plants used to treat hyperglycemic conditions are of considerable interest for the ethno- botanical community as different parts of the plants are recognized to contain valuable medicinal properties and a number of plants have shown varying degrees of hypoglycemic and ant hyperglycemic activity (Grover *et al*, 2002) [6].
WHO estimated that 80% of world population in developing countries are totally dependent on medicinal plants for their primary health care.Over25 percent of prescribed medicines in industrialized countries are derived directly or indirectly from plants. (Vimalvady *et al*, 2012) [8].
The diverse agro climatic conditionals have blessed India with vast resources of greeneries many of which are still under exploited. There are some less commonly used and inexpensive leafy vegetables whose nutritive potential has not been exploited and documented well with sufficient support even though it is abundantly available. One such green leafy vegetable is *Cassia tora*. It is an India herb used in Ayurveda. The study is formulated to find out the hypoglycemic effect of *Cassia tora* leaves on type two diabetic patients.

Materials and Methods
Fresh leaves were selected form the plot where it was grown with organic input. The leaves were washed with water to remove the dirt particles, dried in a cabinet drier at 60ºc and processed into powder form in an electric mixer. The powder was stored at ambient conditions in zip lock pouches.
The area selected for the supplementation study was Thiruvananthapuram District. In the present experimental study subjects were selected for investigating the effect of *Cassia tora* leaf powder on diseased condition, type 2 diabetes. Ten subject were identified based on the following criteria.
1. Respondents who were willing to co-operate in the study

2. Who were having symptoms of hyperglycemia and
3. Who were not under medications for hyperglycemia.

They were selected through convenient sampling for the supplementation study.

Feeding trial over a given period of time is considered as the most reliable method to determine the impact of food. The feeding experiment was conducted for a period of three months to assess the efficacy of *Cassia tora* leaf powder on hyperglycaemia. *Cassia tora* leaf powder supplement was distributed to the subjects for consumption. The subjects were given 5 gm zip lock pouches of *Cassia tora* leaf supplement twice daily and distributed on a weekly basis. Thirty grams of fresh *Cassia tora* when dried obtained 10 gms of *Cassia tora* leaf powder (ie 30% RDA). The investigator through her good rapport among the respondents personally and through telephone to know whether the subjects where consuming the supplement regularly. The blood profile of the respondents which includes FBS, PPBS, and HbAIC, were assessed at initially, 45th and 90th day of supplementation. The data obtained was analysed using suitable statistical method to make inferences.

Result and Discussion

Close observation was made by the investigator and ensured that the subjects were consuming the supplement correctly. The efficiency of the powder was assessed by monitoring fasting blood sugar, post pandrial blood sugar and HbAIC levels, initially, on 45th day and after 90th day. The respondents were given 5 gm *Cassia tora* leaf powder twice daily. The blood samples were collected and analysed and the details are given in table.

Table 1: Fasting blood sugar level of ten subjects.

Subjects	FBS Level		
	Initial (mg/dl)	On 45th day (mg/dl)	After 90th day(mg/dl)
1	158	140	115
2	190	170	130
3	170	155	130
4	120	105	95
5	190	174	160
6	160	145	120
7	180	155	125
8	130	110	100
9	160	146	130
10	190	152	130
Mean	166.80	147.70	123.50
F Value	10.50		
P value	0.0004*		

Data on the table I revealed that mean fasting blood sugar of pre-test was found to be 166.80 mg/dl. Mean fasting blood sugar level on 45th day of supplementation is 147.70 mg/dl and after supplementation, mean fasting blood sugar level is 123.50 mg/dl. The statistical analysis showed a significant difference between these values (p value = 0.004).

Table 2: Post pandrial blood sugar level of ten subjects

Subjects	PPBS Level		
	Initial (mg/dl)	On 45th day (mg/dl)	After 90th day(mg/dl)
1	205	190	150
2	230	210	170
3	195	175	155
4	150	130	100
5	242	210	190
6	200	175	120
7	235	200	155
8	180	150	130
9	210	190	160
10	255	220	190
Hean	210.20	185.00	152.00
F Value	9.73		
P value	0.0007*		

It is revealed from the above table that mean post pandrial blood sugar of pretest was found to be 210.20 mg/dl. Mean post prandial blood sugar level on 45th day of supplementation is 185.00 mg/dl and after supplementation, mean post prandial blood sugar level is 152.00 mg/dl. The statistical analysis showed a significant difference between the values (P value =0.0007*)

Table 3: HbAIC level of ten subjects

Subjects	HbA1C Level	
	Initial HbAIc(%)	HbAIc(%) after Supplementation
1	6.7	5.2
2	6.9	6.0
3	7.3	6.1
4	6.4	5.4
5	8.4	7.6
6	6.5	5.6
7	7.6	6.1
8	6.2	5.6
9	6.7	6.0
10	7.5	6.7
Mean S D	7.020	6.030
SD	0.675	0.698
T value	3.23	
P value	0.0047*	

It was revealed from the above table that mean glycosylated haemoglobin level was 7.020% wit SD ± 0.675 for pre-test. Post-test mean glycosylated value was 6.030% with SD ± 0.698. The statistical analysis showed a significant difference between these values. (P value. 0.0047*)

Conclusion

India is a country with a vast reserve of natural resources and a rich history of traditional medicines. *Cassia tora* is a popular Indian medicinal plant, has been long used in Ayurvedic system of medicine. Hypoglycaemic effect of *Cassia tora* leaves is confirmed in this study.

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