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ANTI DIABETIC EFFECT OF CASSIA FISTULA AMONG SELECTED TYPE 2 DIABETES

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Diabetes has become a major global threat to human security and prosperity and overwhelms health systems completely. Medicinal herbs an alternative medicine system is extremely rich sources of type 2 diabetes remedies. *Cassia fistula* [family-*caesalpiniacea*] also known as Indian Laburnum is considered as a medicinal plant having hypoglycemic property. This study was carried out to find the antidiabetic action of the stem bark powder of *Cassia fistula* to selected type 2 diabetes. Twenty male subjects with type 2 diabetes who fulfilled the selection criteria were selected randomly and were equally grouped as experimental and control group. Three grams of *Cassia fistula* bark powder was supplemented to the experimental group for a period of 45 days with the approval of Institutional Human Ethical Committee. Biochemical tests such as fasting, postprandial blood sugar, HbA1c and urea and creatinine were estimated for both control and experimental groups and results were analysed statistically. The mean fasting and postprandial blood sugar level in the experimental group reduced from 153.50±11.157 mg to 120±9.07 mg and 235.50±32.524 mg to 206±30.67 mg respectively which was significant at 5% level and there was a reduction in the initial mean of 7.09±0.519% HbA1c in experimental group to 7.02±0.505% which was significant at $p<0.01$ level. The bark powder of Cassia fistula was found to be very effective in controlling blood sugar level of diabetes and proved its importance as a valuable medicinal plant.

Keywords: Type 2 diabetes, Bark, Anti diabetic, Blood sugar, Medicinal plant

INTRODUCTION

Diabetes Mellitus is a disorder of metabolism of carbohydrate, protein and fat due to absolute or relative deficiency of insulin secretion and with varying degree of insulin resistance (Alagapan, 2000). The recent International Diabetes Federation (IDF, 2011) has pegged 366 million people to suffer from diabetes which is expected to reach a staggering 552 million in 2030 despite of several effective preventive efforts and actions.

Diabetes leads to significantly reduced quality of life and life expectancy due to life-threatening co-morbidities and complications (Peter, 2013). Wlid *et al.* (2004) indicated that the population growth, ageing, urbanization and increasing prevalence of obesity and less physical activity of people has lead to the increased incidence of diabetes. Traditional medicinal plants and herbs possess no or fewer side effects, are easily available and are relatively of low cost (Valiathan, 1998; and Vasudevan *et al.*, 2009).

Cassia fistula (Caesalpiniaceae), known as "Golden Shower", "Indian laburnum" is a medicinal plant of immense importance (Asolkar, 1992) and has been referred to as "Aragvadha" or "Disease Killer" in ayurveda (www. Ayurvedichomeremedies.com, 2013). All parts of the plant have medicinal value and have a high therapeutic value and it exerts an antipyretic and analgesic effect (Patel *et al.*, 1965).

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The bark of *Cassia fistula* have been scientifically proved to possess antioxidant properties (Siddhuraju *et al.*, 2002; and Nirmala *et al.*, 2008), antidiabetic (Einstein, 2012), mild laxative for children and pregnant women (Ali *et al.*, 2012). Hence an attempt was made to study and prove the beneficial effect of this unexploited cost effective and easily available bark, as an alternative and remedial measure towards management of type 2 diabetes.

MATERIALS AND METHODS

A total of 200 subjects with type 2 diabetes attending the selected private clinics in Muthialpet, Lawspet and Kirumabapakkam of Puducherry, during the study period were selected to conduct the study based on random sampling. From the total sample a subsample of twenty stable male diabetes based on various selection criteria were selected and were divided equally into experimental and control group. A well framed questionnaire was administered to collect general information.

Preparation of Cassia fistula Bark Powder

Cassia fistula stem bark with thickness of 3-6 mm was collected cleaned and washed and sun dried and powdered with a mechanical blender and stored in air tight containers at room temperature and was analysed for its nutrient content. Fresh bark was collected periodically within duration of 45 days, was processed and supplemented as a fresh powder to the selected type 2 diabetes in zip locked plastic bags each containing three gram of dried bark powder.

Supplementation of Bark and its Impact

Approval from The Institutional Human Ethics Committee from Bharathidasan Government College for Women was obtained to carry out the supplementation of *cassia fistula* bark powder to the selected diabetic samples. Both the control and experimental groups were monitored carefully and were advised to continue their regular medication and diet as usual during the study period of 45 days.

Dosage and Duration

Up to 10 g of herbal powder is advisable in ayurvedic treatment (Kaur, 2013), the stem bark is reported to be eaten raw for stomach ache (Ashwin, 2009), dried bark powder in a dose of 1-2 g daily with honey is orally taken for chronic headache (Ministry of Health Department of Traditional Medicine, Mayanmar). Hence three grams of powder was chosen to be appropriate and the experimental group was advised to consume three gram of bark powder in raw form along with a glass of plain or hot water early in the morning or before breakfast continuously for a period of 45 days.

Biochemical Analysis

Five ml of fasting and postprandial blood samples of both control and experimental groups were collected for analysis before supplementation, every 15th day during the study period of 45 days and after supplementation. HbA1c was analysed before and after supplementation. Serum creatinine and urea levels were analysed after the the completion of supplementation. Fasting serum samples were analyzed for glucose, Serum glucose and was determined by GOD (glucose oxidase)/POD (peroxidase) method of Trinder (1969). HbA1c was analysed in auto analyzer and the procedure followed was based on the Nathan *et al*. (1984). Plasma creatinine was carried out using Jaffe's method (Bowers and Wong, 1980) and Urea was estimated using Beckman BUN Analyzer.

RESULTS AND DISCUSSION

Nutrient Analysis of Bark Powder

Food composition provide information on chemical forms of nutrients and the presence and amounts of interacting components and thus provide information on their

Table 1: Nutrient Analysis vs Nutrient Computed

Nutrients	Analyzed Values % w/w	Computed Values* % w/w
Moisture	2.1.	7.6
Total ash content	8.48	6.68
Total fat content	0.76	-
Crude fiber content	5.16	32.26
Total crude protein	0.07	4.88
Total carbohydrate	83.41	72.47
Total calorific value	340.76 kcal/100 g	332.65 kcal/100 g

Note: * Sukla *et al.* (2013).

bioavailability (Elmadfa, 2010). The Table 1 shows the nutrient analysis of *Cassia fistula* bark samples for 100 g with that of nutrient computed by Sukla *et al.* (2013).

Nearly equal values of the ash, carbohydrate and calorific value was noted in the present study with that of computed values of Sukla (2013). Difference in moisture level, fiber and protein content may be due to the variances in method of analysis or in the dry bark powder vs fresh bark powder.

Impact of Supplementation of Bark Powder on Selected Sub Samples

Twenty male type 2 diabetes who fulfilled the inclusion criteria were grouped equally as experimental (n = 10) and control (n = 10). The experimental group was supplemented with three grams of dried *Cassia fistula* bark powder in raw continuously for a period of 45 days. The control group was allowed to consume the regular diet and medication without any herbal supplements. The impact of supplementation was studied in terms of biochemical parameters.

Mean Body Parameters

The age, height, weight and Body Mass Index (BMI) of the selected subsamples grouped as experimental and control is given in Table 2.

Table 2: Mean Body Parameters of the Selected Subsamples

Parameters	Mean ± Standard Deviation	
	Experimental Group (n = 10)	Control Group (n = 10)
Age (years)	52.4 ± 3.33	51.8 ± 3.42
Height (m)	1.681 ± 5.45	1.638 ± 5.38
Weight (kg)	66.1 ± 3.54	68.73 ± 3.46
BMI (kg/m²)	23.804 ± 0.65	22.981 ± 0.75

The mean age of the experimental Vs control subsamples was 52.4 and 51.8 years respectively. Almost similar height was noted between both the groups. A mean difference of 2.63 was observed with regard to weight between experimental and control group.

Biochemical Parameters Before and After Supplementation

Biochemical parameters such as blood glucose levels, HbA1c, serum creatinine and urea and lipid profile was analyzed for both experimental and control group.

Blood Glucose Levels

The blood glucose level such as fasting glucose and postprandial glucose of both the groups was estimated before the supplementation, during 15th day, 30th day and after supplementation using standard procedures. The impact of supplementation is depicted in the Table 3.

The mean initial fasting glucose levels of subjects were 153.6±21.39 and 153.5±11.157 mg/dl in the control and experimental group respectively. With gradual reduction of values after supplementation mean fasting glucose levels were 149.9±22.55 and 120.0±9.079 mg/dl with a mean decrease of 33.5 mg/dl in the experimental group which showed a significant reduction ($p<0.001$) in the fasting glucose.

A decrease in fasting levels could be attributed to the continuous education programme given to control group about diabetes. Between the experimental and control group both fasting glucose and postprandial was significant at $p<0.001$ level.

The result was in accordance to the study by Nirmala *et al.* (2008) on diabetic rats which showed that hexane extract of *Cassia fistula* bark tends to bring the parameters significantly towards normal better than hypoglycemic drug (Glibenclamide).

The mean postprandial level in the control group showed minimum improvement whereas in the experimental group

Table 3: Mean Blood Glucose Levels of Control and Experimental Group

Parameters mg/dl	Control Group Mean ± S.D				Experimental Group Mean ± S.D			
	Before	15th day	30th day	After	Before	15th day	30th day	After
Fasting blood glucose	153.6±21.39	152±19.98	150.4±134.6	149.9±22.55	153.5±11.15	145.7±10.13	134.6±9.84	120±9.07
Postprandial glucose	241±43.66	237.9±43.30	238±42.92	228.9±50.58	235.5±32.52	228.6±32.28	219±31.63	206.3±30.67

Table 4: Experimental vs Control

Parameters mg/dl	Desired Level	Experimental Group (E)			Control Group (C)			't' Value E vs C
		Before	After	't' Value	Before	After	't' value	
Fasting Blood Glucose	70-110	153.5 ±11.157	120 ±9.079	14.652*	153.6 ±21.39	149.9 ±22.55	5.170*	3.889
Postprandial glucose	100-140	235.5 ±32.52	206.3 ±30.63	16.99**	241.0 ±43.66	238.0 ±50.58	1.193**	1.208

Note: * Not significant, ** Significant at p<0.001 level.

there was a decrease from 235.5±32.5 mg/dl before supplementation to 206.3±30.67 mg/dl after supplementation which was significant at p<0.001. Studies by Vasudevan *et al.* (2009) and Einstein *et al.* (2013) also shows that *Cassia fistula* bark extracts had potent antidiabetic effect.

Glycated Haemoglobin

According to WHO (2011) recommendation, Glycated Haemoglobin (HbA1c) is used as a diagnostic test for diabetes provided the assay are standardized to criteria and International reference value. The Table 5 shows the HbA1c levels of the control and experimental group assessed on 0th day and 90th day of supplementation.

The table shows that there is reduction in the initial mean of 7.09±0.519% HbA1c in experimental group to 7.02±0.505% which was significant at p<0.01 level.

Blood Creatinine and Urea Levels

Creatinine has been found to be a reliable indicator of kidney function along with blood urea nitrogen levels; both provide more precise information about kidney function than with creatinine level alone. Creatinine and urea levels were analysed (Table 6) for the subsamples in order to understand the toxicity load after supplementation of the bark powder.

Blood Creatinine and urea was analysed to find the effect of herb supplementation on the kidney clearance. In both control and experimental group the urea and creatinine were within the normal range. The normal creatinine level is 0.7-1.4 mg/dl for male and urea is 10-45 mg/dl (Harrisons, 2002). The mean creatinine and urea showed minimum difference and was not statistically significant. Thus creatinine and urea level shows that there was no adverse effect due to bark supplementation in the experimental group.

Table 5: Mean Hba1c Values of the Control and Experimental Group

Group	Mean HbA1c Value		't' Value	'p' Value
	0th day	90th day		
Control	7.85±0.43	7.84±0.41	2.78	0.236*
Experimental	7.09±0.51	7.02±0.50	3.28	0.010**

Note: * Not significant, ** Significant at p<0.01 level.

Table 6: Mean Blood Creatinine and Urea Levels

Parameters mg/dl	Control	Experimental	't' Value	'p' Value
Creatinine	1.09 ± 0.179	1.12 ± 0.168	-0.386	0.704*
Urea	27.8 ± 3.91	28.2 ± 3.45	-0.242	0.811*

Note: * Not significant.

CONCLUSION

It is becoming clear that traditional systems of medicine have become a topic of global importance. A current estimate from the World Health Organization implies that developing countries rely heavily on traditional medicines. Herbal or phytochemical gain popularity due to historical and cultural reasons.

Therefore, in a necessity to find an economically as well as a therapeutically effective herb in the treatment of diabetes, *Cassia fistula* a plant with immense medicinal property was identified showed a beneficial effect in reducing blood glucose levels and did not exhibit any adverse effect on creatinine and urea level. The present study highlights that the herb as an alternative system in control of diabetes as well proved to be hypocholestermic.

Thus further study could be investigated to achieve lead molecules in the search of novel herbal drugs. Also the effects of *Cassia fistula* could set a basis of polyphenol containing extracts, having important practical implications

for food quality and potential utilization in multi component biological and food systems.

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