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HYPOGLYCAEMIC EFFECT OF *MORINGA OLEIFERA* AND *AZADIRACHTA INDICA* IN TYPE 2 DIABETES MELLITUS

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ABSTRACT
The present study was designed to investigate clinically the hypoglycemic effect of seeds of Moringa oleifera and Azadirachta indica in Type 2 Diabetes Mellitus. About 55 type-2 diabetes (36 men and 19 women) in the age group of 30-60 years were selected from the Hospital of Acharya Nagarjuna University and Diabetic Care hospital, Guntur and divided into two Experimental (n = 46) and control group (n = 9). The first two experimental were administered Moringa oleifera leaves powder (8gm) and Azadirachta indica seeds powder (6gm) per day respectively in three divided doses for 40 days. The third group of 9 subjects did not receive any treatment and were designated as the control group. There was a significant reduction in fasting blood glucose ($p < 0.01$), the post prandial blood glucose levels ($p < 0.05$) of the subjects in the two groups showed significant reduction, while there was no reduction in the control group. A significant reduction in the mean blood lipid levels of the subjects who were administered the two herbal powders was observed. Among the two herbs selected Moringa oleifera leaves powder was found to be more effective followed by Azadirachta indica seeds powder.

INTRODUCTION

The world cannot remain half healthy and half sick and still maintain its economic, moral and spiritual equilibrium (Scheele, 1998) for; good health is the bedrock on which social progress is built. Disease, decay and death are the natural law of nature (Ray, 1997) which cannot be avoided but can only be delayed. Non-communicable diseases take an enormous toll on lives and health worldwide than communicable disease and it has been pointed out by the World Health Organization (W.H.R. 1999) that nearly 60 per cent of deaths globally are now due to diseases like diabetes mellitus, cardiovascular and respiratory disease, hereditary ailments and the mental and neurological disease.

Diabetes is a chronic metabolic disease that can be treated, but as yet it cannot be cured. People who are diabetic end up getting other medical problems as well with one thing in common – a problem with insulin (Wild *et al.,* 2004). Diabetes is recognized to be common in Asian Indians. The number of people with diabetes in the world is expected to double between the years 2000 and 2030. The greatest absolute increase in the number of people with diabetes will be in India (Abate and Chandali, 2001). Type 2 diabetes (Non Insulin Dependent Diabetes, NIDDM) is a complex disease that involves impaired insulin secretion by pancreatic beta-cells and defects in action on its target tissues (insulin resistance) (Ramachandran *et al.,* 2002). Diabetes is an umbrella term to cover a group of metabolic disorders characterized by insulin resistance and elevated blood glucose levels which can lead to hyperglycemia and dyslipidemia (Hafee and Sumo, 2003).

Traditional medicine has been described as one of the surest means to achieve total health care coverage for the world's population using acceptable, safe and economically feasible methods. In the next millennium traditional medicine would be proved as a backbone of biomedical research. It is estimated by an all India co-ordinated research project in ethno-biology that 8000 species of medicinal plants were used by the local health practitioners which included herbs, shrubs, trees, and climbers with different parts of the same plant used for different purpose (Scoot *et al.,* 1997). Vis mediatrix nature, the healing force of nature, is the underlying precept of the present study entitled, "Hypoglycaemic effect of Moringa oleifera and Azadirachta indica in type 2 Diabetes Mellitus", which aims at identifying the medicinal qualities of two selected herbs.

MATERIALS AND METHODS

Fifty five Non Insulin Dependent Diabetics (36 men and 19 women) in the age group of 30-60 years were selected from the Hospital of Acharya Nagarjuna University and Diabetic Care hospital, Guntur and divided into two Experimental (n = 46) and control group (n = 9). The first two experimental were administered Moringa oleifera leaves powder (8g) and Azadirachta indica seeds powder (6g) per day respectively in three divided doses for 40 days. The third group of nine subjects did not receive any treatment and were designated as the control group. To elicit information regarding the diabetic patients, detailed interview schedule was formulated. The selected samples were interviewed and information regarding their age, sex, socioeconomic status, dietary habits and food and nutrient intake of the selected subjects were assessed using a 24 hrs recall survey for three consecutive days. Body Mass Index (BMI) and biochemical indices such as blood glucose and blood lipid levels were estimated before and after

the administration of the herbal powders.

Inclusion criteria

1. Type 2 diabetic patients with fasting plasma glucose levels equal to or greater than 140 mg/dL of blood without any detectable / visible complications.
2. Type 2 diabetic patients taking oral hypoglycaemic agents with history of inadequate control of blood glucose with these agents.
3. Normal healthy subjects with no family history of diabetes mellitus.

Exclusion criteria

1. Pregnant or nursing patients.
2. Smokers.
3. Patients with G.I.T, hepatic, Cardiovascular, Renal or Endocrine disorder (other than diabetes mellitus) which can interfere with the absorption, metabolism and excretion of the study plant.
4. Patients with any complications of diabetes mellitus.

Patients suffering from type I (IDDM) diabetes mellitus.

RESULTS AND DISCUSSION

Age and activity

From the study it is evident that majority of the selected diabetic patients belonged to the age of 41-60 years *i.e.,* after the age of 40 when the incident of diabetes is precipitated. Type2 diabetes usually occurs in people over 40 years, because pancreatic insulin producing cells progressively lose their function with age (Whitney and Rolfes, 1997).

Body mass index

The distribution of the selected diabetes according to the BMI is presented in Table 1. Among the 55 patients, 10.5 percent of females belong to grade II obesity, 19.4% males and 26.3% of females belonged to grade I obesity. About 38% of patients were at risk of obesity in both sexes and 36.3% of the subjects were normal. According to Chan and Bridges (1998) higher rate of NIDDM may be etiologically linked to the morbid obesity is the metabolic gateway to the disorder of the elderly like type II diabetes, atherosclerosis, hypertension, and osteoarthritis (Sadhukhan, 1997). Besides age and obesity, genetic play an important role in predicting the onset of type II diabetes (Waltson *et al.,* 1995).

Dietary pattern and mean food and nutrient intake of the selected diabetics

Mean food intake of the selected diabetics

Mean food intake of the subjects was calculated and presented in Table 2.

It could be inferred from Table 2 that the diets of both the experimental and the control groups had been modified to suit the requirements of diabetics. The intake of cereals, fats and oils were low compared to the recommended dietary allowances. Pulses and green leafy vegetables were taken in moderation by the experimental and the control group. The intake of fruits, roots and tubers, milk and other vegetables were high compared to that of the recommended dietary allowances. Sugar is totally avoided by both the groups as all the subjects were well aware that it is an instant source of energy and raises the blood glucose level rapidly. Consumption of fleshy foods was negligible.

The intake of simple carbohydrates and fat was restricted in order to reduce the calorie intake. There was a moderate intake of protein through the consumption of pulses, Cereals, milk and other vegetable proteins. Calcium intake was appreciable as they consumed foods like ragi, green leafy vegetables and milk. Since, their cereal intake was restricted the diet was deficient in B-Complex vitamins. The subjects were able to meet the recommended allowances for vitamin C through the intake of tomatoes, onion and coriander leaves which were the substitutes for coconut chutney they had as a regular consumption of green leafy vegetables and other vegetables and of low calorie fruits like guava and oranges. The mean nutrient intake (Table 3) shows that the diet was deficient in iron and fiber.

Impact of selected herbal powders on the blood glucose and cholesterol level of the selected diabetics

Blood glucose values

The fasting and postprandial blood glucose levels estimated at the beginning and at the end of the administration of the selected herbal powders were statistically analyzed. Table 4 depicts the mean blood glucose values of the experimental and control groups. From Table 4 it is evident that the mean blood glucose values of all the three groups had significantly reduced. Diabetics who were administered Moringa oleifera leaf powder and Azadirachta indica seeds powder showed a reduction in fasting blood glucose which was significantly at one per cent level. The post prandial blood glucose level after the administration of Azadirachta indica seeds powder showed a reduction, which was significantly at five percent level. Moringa oleifera leaf powder group showed reduction that was significant at one per cent level. The control group, who were not given any treatment showed slightly higher values, and were also not significant. These results indicate that all the two herbs possess hypoglycemic effect. Moringa oleifera leaves powder in the diet reduces blood sugar with concomitant improvement in glucose tolerance and diabetic symptoms both IDDM and NIDDM patients. Moringa oleifera leaves powder also showed to bring about the hypocholesteromic effect through increased excretion of bile acids and the neutral steroids.

Blood lipid levels

The serum levels of Cholesterol, Triglyceride, LDL cholesterol and HDL cholesterol were estimated at the beginning and at the end of the administration of the two herbal powders. Table 5 gives the mean lipid levels of experimental and control groups. The mean blood lipid levels of all the two groups had

Table 1: Distribution of the selected diabetics according to BMI

BMI classification WFI10	Obesity grade	Male	Female
< 18.5	Underweight	Nil	Nil
18.5-22.9	Normal	11	09
23.0-24.9	At risk of obesity	8	03
25.0-29.9	Obese – I	07	05
>30	Obese – II	Nil	02
Total		36	19

Table 2: Mean food intake of the selected diabetics

Food group	RDA*		Experimental group				Control group			
			Male (n = 32)		Female (n = 14)		Male (n = 4)		Female (n = 5)	
	M	F	I	%D/S	I	%D/S	I	%D/S	I	%D/S
Cereals	470	370	320	-32	328	-11	317	-33	325	-12
Pulses	40	40	61	52.2	55	37.5	64	60	59	47.5
G.L.V.	100	100	78	-22	75	-25	72	-28	69	-31
OtherVegetables	60	40	60	—	64	60	76	27	71	77.5
Roots and Tubers	50	50	125	150	132	165	145	190	120	140
Fruits	30	30	70	133.3	63	110	68	127	70	133.3
Milk	150	100	260	73.3	255	155	280	87	250	150
Fats and Oils	30	20	7.5	-75	8	-60	8	-73	8.5	-57
Sugar and Jaggery	30	25	—	—	—	—	—	—	—	—

* RDA – Recommended Dietary Allowances of ICMR[15]; M – Male; F – Female; I – Intake; D/S- Deficit/Surplus.

Table 3: Mean nutrient intake of the selected diabetics

Nutrients	RDA*		Experimental group						Control group			
			M(n = 18)		F(n = 6)		M(n = 14)		F(n = 8)		M(n = 4)		F(n = 5)	
	M	F	I	%D/S	I	%D/S	I	%D/S	I	%D/S	I	%D/S	I	%D/S
Energy(Kcal)	2425	1875	1840	-24	1766	-6.0	1765	-27	1705	-90	1800	-25.7	1745	-69
Protien (g)	60	50	57	-5	55	+10	58	-3.3	52	+4	60	0	51	+2
Fat (g)	20	20	21	+35	21	+5	27	+35	24	+16.6	26	+30	23	+15
Fibre (g)	45	45	14.5	-64	14.5	-67.7	12	-73	13	-71	14	-68.8	11	-75.5
Iron (mg)	28	28	14.2	-36	14.2	-5.3	14	-50	9.6	-68	12.5	-55	17.2	-82.8
Calcium (mg)	400	400	682	+81	682	+70.5	667	+66.7	498	+24.5	699	+74.7	645	+61.2
Thiamine (mg)	1.1	0.9	0.9	-18	0.9	0	0.72	-34.5	1.27	-22.5	0.9	-18	0.9	0
Niacin (mg)	16	12	14	-7.5	14	+16.6	13	-18.7	9.6	-20	14.9	-6.8	10.1	-15.8
Riboflavin (mg)	1.4	1.1	0.8	-43	0.6	-45	1	-28	0.9	-18	1.2	-14.2	1	-9
Vitamin C (mg)	40	40	50.5	+26.2	59	+49.5	55	+37.5	51	+27.5	56	+40	45	+12.5

* RDA – Recommended Dietary Allowances (2000); M – Male; F – Female; I – Intake; D/S- Deficit/Surplus.

Table 4: Mean blood glucose levels of the experimental and control groups

Groups	Herbal powdersGlucose	Blood (mg/dL)	Initial	Final	't' value
Experimental	Moringa Oleifera	Fasting	162 ± 9.0	117 ± 21.3	5.94**
Group II	Leaves	Post Prandial	219 ± 77.4	163 ± 49.4	2.9*
Experimental	Azadirachta indica	Fasting	149 ± 63	135 ± 71.7	2.6*
Group I	Seeds	Post Prandial	252 ± 84.5	229 ± 91.5	6.9*
Control	No herbal powder	Fasting	159.5 ± 6.8	159 ± 7.4	4.09NS
Group	Supplementation	Post Prandial	224 ± 3.7	251 ± 59.0	1.7 NS

* Significant at 5 per cent ** Significant at 1 per cent NS- Not significant.

Table 5: Mean blood lipid levels of the experimental and control group

Groups	Herbal powders	Blood lipids levels(mg/dL)	Initial ± S.D.	Final ± S.D.	't' value
		Serum total cholesterol	261 ± 20.0	224.0 ± 22.6	6.26 * *
		Serum triglycerides	130 ± 14.2	112 ± 13.9	4.8 * *
Experimental	Moringa Oleifera	HDL - C	57.0 ± 18.5	62.0 ± 19.7	2.24 NS
Group II	leaves	LDL - C	171.0 ± 16.9	122.0 ± 2.9	3.62 *
		VLDL – C	26.0 ± 2.8	22.0 ± 2.9	3.6 *
Experimental	Azadirachta indica	Serum total cholesterol	204 ± 21.4	204 ± 30.1	4.90 * *
Group I	seeds	Serum triglycerides	136 ± 34.3	122 ± 36.9	4.53 * *
		HDL - C	45 ± 11.4	46 ± 10.4	0.79 NS
		LDL - C	157 ± 11.4	134 ± 21.6	4.69 * *
		VLDL – C	27 ± 7.1A	24 ± 7.4	4.96 * *
Control	No herbal powder	Serum total cholesterol	244 ± 34.9	241 ± 34.7	1.56 NS
Group	Supplementation	Serum triglycerides	138 ± 18.0	133 ± 19.6	4.12 * *
		HDL - C	52 ± 8.9	52 ± 8.0	0.01 NS
		LDL - C	164 ± 34	162 ± 35.0	2.03 NS
		VLDL - C	27 ± 3.7	27 ± 3.9	0.23 NS

significantly reduced after administration of the two herbs.

In the Moringa oleifera group and Azadirachta indica seeds powder group all the blood lipids except HDL cholesterol had reduced significantly. Elevated levels of blood cholesterol and triglyceride are the major risk factors for heart diseases. Cholesterol fraction namely low- density lipoprotein (LDL-C) is the most important though not the causative agent. LDL cholesterol, which is a strong atherogen since it favours lipid deposition in tissues including blood vessels, is significantly reduced in subjects who were administered Moringa oleifera leaves powder and Azadirachta indica seeds powder.

The two herbal powders did not show any significant effect on

the HDL cholesterol levels. Triglycerides, which influence lipid deposition and clotting mechanisms, are reduced significantly in the Moringa oleifera leaves powder administered group and Azadirachta indica seeds powder group. The control group showed a significant reduction at one per cent level for serum triglyceride. These results indicate that the two herbs possess hypocholesterolemic properties also.

CONCLUSION

The study conducted with the objective of finding out the efficacy of two herbal powders namely Moringa oleifera leaves powder and Azadirachta indica seeds powder on non-Insulin dependent diabetics reveals a in mean blood glucose values post prandial blood glucose levels, and the mean blood lipid levels Among the two herbs selected Moringa oleifera leaves powder was found to be more effective followed by Azadirachta indica seeds powder.

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