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Original Article

Evaluation of Antidiabetic Activity of Polyherbal Formulations on Type 2 Diabetic Patients: A Single Blinded Randomized Study

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ABSTRACT

Background: The antidiabetic activity of the individual plant parts is well known, but the synergistic or combined effects are unclear. The concept of polyherbalism has been highlighted in *Sharangdhar Samhita*, an Ayurvedic literature dating back to 1300 AD. Polyherbal formulations enhance the therapeutic action and reduce the concentrations of single herbs, thereby reducing adverse events. The study focuses on polyherbal formulations of five different medicinal plants used for the treatment of Type II diabetic patients.

Methods: In the present study five medicinal plants (Mango, Guava, Amla, Garlic and Onion) with proven antidiabetic and related beneficial effects were selected for the preparation. The efficacy of prepared formulations were tested on Type II diabetic patients and compared with placebo diabetic control patients.

Results: The polyherbal formulations produced a significant decrease in blood glucose level after 8 weeks of treatment. Diabetic patients exhibited increase levels of lipid profiles such as cholesterol, triglycerides, and low density lipoprotein cholesterol (LDL-cholesterol), and a decrease in the level of high density lipoprotein cholesterol (HDL-cholesterol) during the first week of treatment. The elevated lipid profiles were restored to near normal by the treatment of polyherbal formulations for all the estimated parameters at 8th week. In addition the polyherbal formulations also restored the BMI, blood pressure, haemoglobin, glycosylated haemoglobin and urinary parameters levels which indicates that they reduce the other complicacies of diabetes. The results of the formulations on Type II diabetic group were strong evidence that not only it restored the glycemic level but also reduced the lipid profile to the near normal.

Conclusion: Based on the findings, the polyherbal formulations have significant antidiabetic potential for Type II diabetic patients

KEY WORDS: Polyherbal formulations, Biochemical and hematological parameters, type 2 diabetic patients, Antidiabetic potential

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INTRODUCTION

Diabetes mellitus is a most common endocrine disorder, affecting more than 300 million people worldwide. Diabetes is a debilitating and life threatening disease as long as mankind. It is a series of metabolic conditions associated with hyperglycemia and caused by defects in insulin secretion and/or insulin action [1, 2]. It is characterized by derangements in carbohydrate, protein and fat metabolism [3]. Diabetes is a condition primarily defined by the level of hyperglycemia giving rise to risk of microvascular damage (retinopathy, nephropathy and neuropathy) and is associated with reduced life expectancy, significant morbidity due to specific

diabetes related microvascular complications, increased risk of macrovascular complications (ischemic heart disease, stroke and peripheral vascular disease), and diminished quality of life.

Diabetes mellitus is a chronic disease whose global spread has given it the characteristics of a pandemic. WHO expert committee proposed two major classes of diabetes mellitus and named as insulin dependent diabetes mellitus (IDDM) or type I and non insulin dependent diabetes mellitus (NIDDM) or type II [4]. The cause of diabetes mellitus is not fully understood. Recently, increasing evidence suggests that free radicals formations are involved in the pathogenesis of diabetes and the development of diabetic complications [5, 6]. The oxidative stress is significantly increased in diabetes because prolonged exposure to hyperglycaemia increases the generation of free radicals and reduces capacities of antioxidation defence systems [5]. The treatment of DM is based on oral anti-hyperglycaemic agents and insulin. The oral anti-hyperglycaemic agents currently used in clinical practice have characteristic profiles of serious side effects [7]. This leads to increasing demand for herbal products with anti-diabetic activity and less side effects.

Understandings on the mechanism of action of antidiabetic / hypoglycemic plants are important, among other things, in the development of rational phytomedicines or polyherbal formulations. When poly herbal anti-diabetes formulations are developed inclusion of herbs exerting their anti-diabetes effects through different mechanisms could be more effective. Further, in the rational development of phytomedicines it is necessary to understand how the medicine works [8]. The present study aimed to determine the ability of polyherbal formulation on blood glucose and lipid profile level in diabetic patients.

MATERIALS AND METHODS

Study design: The present single blinded randomized trial study was done very proficiently with careful and systematic procedures to observe the effectiveness and relation between the type II diabetic patients and the use of traditional polyherbal formulations. It was the combination of observational research and the experimental research. Respectively, daily activities, behaviours are observed and blood glucose level investigated along with the polyherbal formulations. The study was totally 8 weeks, administration of polyherbal formulation thrice a day before each meal and blood biochemical and hematological parameters were routinely written in the table and calculate using statistical analysis. Based on the results, polyherbal formulations were proved to be more convenient and reliable for the treatment of Type 2 diabetes due to their easy availability, low cost, minimum side effects and greater acceptance amongst the users.

Study area & Study population: The study was carried on their nativity place which is nearby Srimuda, Section 25, Shah Alam. The selection of individual was based on careful analysis of different factors, such as socioeconomic status, acceptability, willingness to participate in the study, intelligence, ability to communicate with the volunteers regarding study objectives and methodology, scientific knowledge, ability to monitor dietary patterns correctly etc. Patients already taking oral hypoglycemic agents were requested to take their usual medicine and food after sampling.

The selected twelve patients who suffered by type II diabetes (six male and six female) medically examined and confirmed by type II diabetes will be investigated for the present study. They were divided into two groups (named as Group 1: Placebo diabetic patients; Group 2: Polyherbal treated diabetic patients) consist of six patients (three male and three female) in each group.

Study subjects with inclusion and exclusion criteria and inform consent

The following criteria will use to include or exclude the patients in the present study.

Inclusion Criteria

1. Type 2 diabetic patients with fasting plasma glucose level equal to or greater than 140 mg/dl of blood (WHO study group on diabetes mellitus, 1985, Geneva technical report series 727) [9] without any detectable or visible complications.

2. Type 2 diabetic patients taking oral hypogly-

cemic agents with history of inadequate control of blood glucose with these agents.

3 The patients and control subjects will be of either sex (male or female) between the ages of 35-60 years.

4. Normal healthy subjects with no family history of diabetes mellitus

Exclusion Criteria

1. Pregnant or nursing patients.

2. Smokers

3. Patients with GIT, 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 complication of diabetes mellitus.

5. Patients suffering from type 1 (IDDM) diabetes mellitus.

Preparation of polyherbal formulations

The present study, five plant materials were obtained from grocery shops in an adequate amount (Figure 1). The plant materials were ripened fruit of mango (Mangifera indica), ripened fruit of Guava (Psidium guajava L.) or Jambu batu, the fruit of Amla- Indian Gooseberry (Phylanthus emblica), bulbs of Garlic (Allium sativum) and onion (Allium cepa). All the fruits and bulbs were separately grinded daily according to the required amount using electric fruit grinder in to fine paste. All paste were taken and mixed in the daily basis thrice a day before each meal (breakfast, lunch and dinner) for 8 weeks and administered to the Group 2: Polyherherbal treated diabetic patients as mentioned in the Table 1. The polyherbal formulations were administered orally with drinking water to the patient's before their each meal. Group 1: Placebo diabetic patients treated as control and given normal food and water ad libitum.

Blood Parameters

In the present study, Group 1 and Group 2 patient's BMI, Blood pressure, glucose, glycosylated hemoglobin, lipid profile, hematological profile, urinalysis were investigated. The blood biochemical and hematological parameters will be carried out in the laboratory of Gribbles pathology (Malaysia), SDN, BHD, Klang.

Ethical Consideration

The Consent form were prepared and given to the individuals of normal and diabetic persons. In that form we were clearly informed that their data were only used in this research and were kept very confidential. The proposal for this research was sent to Institutional Ethical Committee, International Medical School, MSU Shah alam for approval of the research and ethical clearance. The study protocol was explained to the individuals in vernacular and a written brief description of the study.

Statistical analysis

All values were expressed as Mean ± Standard Deviation (S.D). The results were statistically analyzed using Windows-based SPSS statistical package (version 10.0; SPSS Inc., Chicago, IL, USA). Statistical significance was considered at $p < 0.05$.

Fig. 1: Polyherbal Formulations Ingredients (70g)

Mango (Mangifera indica) 6g

Guava (Psidium guajava L.)- 10g

Amla (Phylanthus emblica)-3g

Onion (Allium cepa)-50g

Garlic (Allium sativum)-1g

RESULTS AND TABLES

Table 1: Preparation and formulations of five different herbal materials.

S.No	Plant materials	Required amount of paste
1	Mango (Mangifera indica)	6g
2	Guava (Psidium guajava L.)	10g
3	Amla (Phylanthus emblica)	3g
4	Garlic (Allium sativum)	1g
5	Onion (Allium cepa)	50g

Table 2: Effect of polyherbal formulations treatment on the fasting and postprandial plasma glucose level in type II diabetic patients at 0, 4 and 8th weeks.

Subjects (N=6)	Fasting plasma glucose (mmol/l)			Postprandial plasma glucose (mmol/l)		
	0 week	4 weeks	8 weeks	0 week	4 weeks	8 weeks
Diabetic placebo control (DPC)	13.44±1.62	13.31±2.19	11.32±0.51	20.13±2.26	19.15±2.26[a]	18.32 ±1.43
Polyherbal formulations (70g) treated diabetic patients (PHT)	10.31±3.06	9.31±2.40[b]	6.64±1.19[a, b]	21.47±5.53	14.97±1.97[a,b]	12.47±0.59[a,b]

Table 3: Antihyperglycemic effect of polyherbal formulations treatment on plasma glucose level in glucose tolerance test (GTT) at zero weeks.

Subjects (N=6)	Plasma glucose(mmol//l)				
	0 hrs	0.5hrs	1hrs	1.5hrs	2hrs
Subjects (N=6)	Plasma glucose(mmol//l)				
	0 hrs	0.5hrs	1hrs	1.5hrs	2hrs

Each value represents the mean ± SD of six observations.
[a]p<0.05: 0 week vs 4th week; 4th week vs 8th week,
[b]p< 0.05:4th week (DPC) vs 4th week (PHT); 8th week (DPC) vs 8th week (PHT)

Table 4: Antihyperglycemic effect of polyherbal formulations treatment on plasma glucose level in glucose tolerance test (GTT) at 4th weeks.

Subjects (N=6)	Plasma glucose(mmol//l)				
	0 hrs	0.5hrs	1hrs	1.5hrs	2hrs
Diabetic placebo control (DPC)	13.36±1.12	14.99±2.26	15.99±1.73	17.15±0.97	17.32±0.99
Polyherbal formulations (70g) treated diabetic patients (PHT)	13.47±1.12	12.14±0.85[b]	9.66±1.01[a,b]	6.98±2.34[a,b]	6.15±1.64[b]

Each value represents the mean ± SD of six observations.
[a]p<0.05: 0 week vs 4th week; 4th week vs 8th week,
[b]p< 0.05:4th week (DPC) vs 4th week (PHT); 8th week (DPC) vs 8th week (PHT)

Table 5: Effect of polyherbal formulations treatment on plasma glucose level in glucose tolerance test (GTT) at 8th weeks.

Subjects (N=6)	Plasma glucose(mmol//l)				
	0 hrs	0.5hrs	1hrs	1.5hrs	2hrs
Diabetic placebo control (DPC)	12.69±1.39	15.58± 2.16[a]	15.91± 2.06	16.15± 1.69	17.48± 1.38
Polyherbal formulations (70g) treated diabetic patients (PHT)	9.64±0.92[b]	7.79±1.19[a,b]	6.33±1.16[b]	5.48±0.35[b]	4.65±0.45[a,b]

Each value represents the mean ± SD of six observations.
[a]p<0.05: 0 week vs 4th week; 4th week vs 8th week,
[b]p< 0.05:4th week (DPC) vs 4th week (PHT); 8th week (DPC) vs 8th week (PHT)

Table 6: Effect of polyherbal formulations treatment on Lipid profile in type II diabetic patients at 0, 4 and 8th weeks.

Parameters	Diabetic placebo control (DPC)			Polyherbal formulations (70g) treated diabetic patients (PHT)		
	0 week	4th week	8 week	0 week	4th weeks	8 weeks
Cholesterol (mg/dl)	233.03±21.1	234.48±22.5	241.31±8.9	209.83±36.2	173.09±34.7[b]	169.8±17.1[b]
Triglycerides (mg/dl)	217.13±33.2	227.16±10.3	231.15±7.4	238.14±16.8	213.32±13.9[ab]	174.3±14.6[a,b]
LDL-C (mg/dl)	161.16±10.2	164.34±4.7	164.49±4.8	155.16±9.1	131.81±17.9[ab]	110.15±8.3[b]
HDL-C (mg/dl)	45.98±3.04	36.15±3.04[a]	45.74±3.1[a]	45.04±1.7	56.33±2.7[ab]	66.65±8.3[b]
TC/HDL ratio	5.65±0.28	5.21±0.72[a]	5.42±0.26	4.50±0.8[b]	3.94±0.8[b]	3.59±0.49[b]
BMI=kg/m^2	24.49 ±1.22	24.39±1.67	24.14±3.05	24.94±0.99	23.14±1.34[a]	22.32±2.26[a,b]

Each value represents the mean ± SD of six observations.

[a]p<0.05: 0 week vs 4th week; 4th week vs 8th week,

[b]p< 0.05:4th week (DPC) vs 4th week (PHT); 8th week (DPC) vs 8th week (PHT)

Table 7: Effect of polyherbal formulations treatment on haematological profile in type II diabetic patients at 0, 4 and 8th weeks.

Parameters	Diabetic placebo control (DPC)			Polyherbal formulations (70g) treated diabetic patients (PHT)		
	0 weeks	4th weeks	8 weeks	0 week	4th weeks	8 weeks
RBC (million cells /ml)	4.44± 0.91	4.22±0.79	4.29±0.86	4.35±0.95	4.51±0.80	5.45±0.30[a,b]
WBC(billion cells/L)	4.41± 1.19	5.30± 0.66	5.81± 0.88	6.72± 0.89[b]	6.67± 0.42[a,b]	7.28± 1.12[a,b]
Platelets (billion cells/L)	164.28± 7.29	175.8± 9.46	171.78±7.64	171.32±5.15	183.92±11.65	218.98±27.9[b]
Hb (g/dl)	10.99±2.93	9.64±0.29	9.64 ±0.95	10.49±0.81	11.31±1.15[b]	12.11±1.17[b]
HbA1c (%)	7.16±1.30	6.65±1.16	6.64 ±1.09	6.46±0.74	5.81±0.79[a]	5.65±1.19[a]
MCH	27.11± 7.66	29.77± 3.24	28.79± 6.89	31.59± 6.57	28.97± 1.59[a]	32.06± 5.01[a]
MCV	85.64± 7.16	91.58 ± 6.53	94.94 ± 5.24	88.95± 8.13[b]	97.52 ± 7.00[a]	97.35 ± 6.59[a]
PCV	0.34± 0.11	0.44 ± 0.98	0.46 ± 0.23	0.34 ± 0.12	0.45 ± 0.39[a]	0.54 ± 0.02[b]

Each value represents the mean ± SD of six observations.

[a]p<0.05: 0 week vs 4th week; 4th week vs 8th week,

[b]p< 0.05:4th week (DPC) vs 4th week (PHT); 8th week (DPC) vs 8th week (PHT)

Table 8: Effect of polyherbal formulations treatment on Urinary glucose and protein in type II diabetic patients at 0, 4 and 8th weeks.

Parameters	Diabetic placebo control (DPC)			Polyherbal formulations (70g) treated diabetic patients (PHT)		
	0 weeks	4th weeks	8 weeks	0 weeks	4th weeks	8 weeks
Glucose	+++	+++	+++	+++	++	+
Protein	++	++	++	++	+	+

Each value represents the mean ± SD of six observations.

The present prescribed dosage of polyherbal formulations treatment could bring down the fasting and postprandial plasma sugar level to significantly (p<0.05) normal at 4th and 8th weeks compared with zero weeks treatment described in **Table-2**. The antihyperglycemic effect of polyherbal formulations in glucose-loaded hyperglycaemic at zero weeks treatment (**Table-3**). In glucose-loaded diabetic placebo control patients, half an hour after the glucose over-loading, therewas a gradually rise in the blood glucose levels and at the end of two hours and

the glucose level exist as such and there was no declining. But Polyherbal formulations exhibited significant hyperglycemic activity at one; one and half and two hours after it came to normal compared to the Diabetic placebo control patients.

Table 4 shows the antihyperglycemic effect of polyherbal formulations in glucose-loaded hyperglycaemic at 4th weeks treatment. In glucose-loaded diabetic placebo control patients, half an hour after the glucose overloading, there was a gradually rise in the blood glucose levels and at the endof two hours and the glucose level exist as such and there was no declining. But Polyherbal formulations exhibited significant antihyperglycemic activity at half an-hour; one; one and half and two hours after it came down to normal, compared to the Diabetic placebo control patients.

Table 5 shows the antihyperglycemic effect of polyherbal formulations in glucose-loaded hyperglycaemic at 8th weeks treatment. In glucose-loaded diabetic placebo control patients, half an hour after the glucose overloading, there was a gradually rise in the blood glucose levels and at the endof two hours and the glucose level exist as such and there was no declining. But Polyherbal formulations exhibited significant antihyperglycemic activity at zero; half an-hour; one; one and half and two hours after it came down to normal, compared to the Diabetic placebo control patients.

The effect of polyherbal formulationson cholesterol, triglycerides, LDL-C, HDL-C, TC/HDL ratio, and BMI in type II diabetic patients at 0, 4 and 8th weeks. Cholesterol, HDL-C and TC/HDL ratio and BMI were unchanged in diabetic placebo control patients until the experiment conducted. But cholesterol, triglycerides, LDL-C, HDL-C, TC/HDL ratio was significantly increased in 4th and 8thweeks treatment of polyherbal formulations compared to zero week treatment. But the BMI was significantly decreased in 4th and 8thweeks treatment of polyherbal formulations compared to zero week treatment (**Table-6**).

Table-7 shows the effect of polyherbal formulations on RBC, WBC, platelets, MCH, MCV, Hb, HbA1c and PCV ratio in type II diabetic patients at 0, 4 and 8th weeks. RBC, MCH, MCV, Hb, HbA1c were unchanged in diabetic placebo control patients until the experiment conducted. But RBC, WBC, platelets, MCH, MCV, Hb, HbA1c and PCV were significantly increased in 4th and 8thweeks treatment of polyherbal formulations compared to zero week treatment.

The effect of polyherbal formulations treatment on Urinary glucose and protein in type II diabetic patients at 0, 4 and 8th weeks**.** The urinary glucose and protein were decreased in 4th and 8thweeks treatment of polyherbal formulations compared to zero week treatment (**Table- 8**).

DISCUSSION

Many herbal products have been described for the care of diabetes mellitus in ancient literature of 'Ayurveda' in worldwide. The present study found significant improvement in the level of blood glucose and glucose tolerance with the use of polyherbal formulation containing the bulb of Mango, Guava, Amla, Garlic and Onion in type II diabetic patients. Sustained reduction in hyperglycaemia may decrease the risk of developing micro vascular complications and most likely reduce the risk of macro vascular complications [10]. In the present study, we screened the antidiabetic activity of the polyherbal formulation using the glucose-induced hyperglycaemic model. Excessive amount of glucose in the blood induced the insulin secretion. This secreted insulin will stimulate peripheral glucose consumption and control the production of glucose through different mechanisms [11].

The polyherbal formulations might be producing its hypoglycaemic effect by an extra-pancreatic action [12], e.g. possibly by stimulating glucose utilization in peripheral tissues [13, 14]. Also, it could be the result of an increase in glycolytic [15] and/or glycogenic enzymes activity in peripheral tissues [13]. Also it has one more possibility that the polyherbal formulations may decrease the secretion of the counter regulatory hormones (glucagons, cortisols and growth hormones) [16] and thereby decrease the plasma glucose in diabetic patients.

The levels of serum lipids are usually elevated in diabetes mellitus and such an elevation represents a risk factor for coronary heart disease [17]. High level of total cholesterol is

one of the major factors for coronary heart diseases and it is well known that hyperlipidemia and the incidence of atherosclerosis is increased in diabetes [16]. This abnormal lipids is mainly due to the uninhibited actions of lipolytic hormones on the fat depots mainly due to the action of insulin. Under normal circumstances, insulin activates the enzyme lipoprotein lipase, which hydrolyses triglycerides. However, in a diabetic state, lipoprotein lipase is not activated due to insulin deficiency resulting in hypertriglyceridemia [18].

It is well known that HDL plays an important role in the transport of cholesterol from the peripheral blood to the liver by the reverse cholesterol transport pathway [19]. The plasma levels of cholesterol and triglyceride increased, contributing to secondary complications of diabetes [20, 21]. Also insulin deficiency is associated with hypercholesterolemia. Insulin deficiency may be responsible for dyslipidemia, because insulin has an inhibitory action on HMG-CoA reductase, a key rate-limiting enzyme responsible for the metabolism of cholesterol rich LDL particles. The mechanism responsible for the development of hypertriglyceridemia and hypercholesterolemia in uncontrolled diabetes in humans are due to a number of metabolic abnormalities that occur sequentially [22]. In our study also, the diabetic patients showed hypercholesterolemia and hypertriglyceridemia and the treatment with the polyherbal formulations significantly decreased both cholesterol and triglyceride levels. This implies that the product can prevent or be helpful in reducing the complications of lipid profile seen in some diabetes patient in whom hyperglycaemia and hypercholesterolemia coexist quite often.

Lipoprotein abnormalities play an important role in the causation of diabetic atherosclerosis [23]. Dyslipidaemia causes morbidity and mortality in patients with type 2 diabetic mellitus and the most common pattern in type 2 diabetic patients are elevated TG and LDL, and decreased HDL cholesterol concentrations [24]. The modifications of LDL lipoprotein increase atherogenicity and available data suggest that LDL is more atherogenic in individuals with type 2 diabetes mellitus [25]. In the present study, diabetic patients exhibited a significant elevation of LDL-C while HDL-C was decreased. Polyherbal formulations administration resulted in lowering the plasma levels of LDL-C with elevation of HDL-C level. Since both diabetes and hyperlipidemia are considered to be major risk factors for the premature atherosclerosis and essentially all the cholesterol in atherosclerotic plaques is derived from that of circulatory cholesterol. The antihyperlipidemic effect of Polyherbal formulations in particular could be considered as of possible therapeutic value.

The present studies show that the polyherbal formulations possess a definite hypotriglyceridemic and hypocholesterolemic properties in diabetic patients at 8 weeks of treatment. The repeated administration polyherbal formulations for a period of 8 weeks resulted in a significant decrease in lipid parameter levels of various tissues when compared to the diabetic placebo control. It is well known that polyherbal formulations have a direct effect on lipids or the present hypolipidemia is achieved due to controlled hyperglycaemia.

The previous research studies found that the higher Body mass index (BMI) with obesity (BMI 30-<35 kg/m^2) always associated with increased mortality risk [26, 27] as well other complications like cardiovascular disease, hypertension and stroke [28]. BMI criteria are currently the primary focus in obesity treatment recommendations as well as diabetes. In the present study polyherbal formulations significantly decreased BMI in diabetic patients, confirmed that administration of polyherbal formulations could be reduce the complications of diabetes and other cardiovascular diseases.The degree of anemia in diabetes patients can be associated with a number of factors, including glomerular filtration rate, urinary albumin excretion rate, and glycated Hb (HbA1c) levels [29]. Anemia has been reported to be due to diminished erythropoietin production by failing kidneys and increased non-enzymatic glycosylation of RBC membrane proteins [30]. In the present study, alterations in the RBC, RBC indices, Hb, and PCV levels of the diabetic patients suggest occurrence of anaemia. The observed increase in these para-

meters on polyherbal formulations treated patients suggests its potency in the management of the ailment.

The reduced levels of WBC and platelets in diabetic patients indicate a suppression of the immune system [31]. Platelets are fragment of cells that participates in blood clotting, they initiate repair of blood vessels walls and are also considered as an acute phase reactant to infection or inflammation. These cells identify and eliminate pathogens, either by attacking larger pathogens through contact or by phagocytosis [32]. They form part of the innate immune system, which is also an important mediator in the activation of the adaptive immune system [33]. The reduced immunity can contribute to the various complications associated with DM. The polyherbal formulations were able to raise the hematological profile to an appreciable level compared to the placebo diabetic control, suggesting a boost in the immune system. It shows polyherbal formulation administration for 8 weeks has been reported to restore immune responses, reduce the incidence of infections, and prolong survival.

In diabetic patients, the levels of HbA1C are increased due to the persistent hyperglycaemia which results in glycation of hemoglobin. The concentration of HbA1C is related to diabetic retinopathy, nephropathy, and neuropathy and it is considered as a tool for the diagnosis and prognosis of diabetes-associated complications [34]. The synthesis of hemoglobin is reduced in diabetic patients [35]. In our study, administration of polyherbal formulations significantly decreased the HbA1C and increased Hb levels in diabetic patients. The ability of polyherbal formulations to decrease HbA1C levels in diabetic rats showed its potentials to prevent the diabetic-associated complications.

Proteinuria, a hallmark feature of early glomerular damage in patients with diabetes, is associated with renal hemodynamic and histologic changes [36]. It is widely known that hyperglycaemia can induce microalbuminuria by a hyperfiltration mechanism that is related to NO metabolism alteration [37], increased synthesis of reactive oxygen species, or loss of nephrin in podocytes as shown by different investigators [38]. Administration of polyherbal formulations can decrease proteinuria in these diabetic patients by improving the exaggerated oxidative state in the kidney tissue.

CONCLUSION

Based on the present study, we found that intake of polyherbal formulations have beneficial effects on Type 2 Diabetic patients when serum Glucose, lipid profile and hematological parameters were observed and no after effects were noticed. Long term, in-depth toxicological and molecular level studies are needed to provide further information and confirmation of these findings.

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REFERENCES

[1]. Afifi FU, Al-khalid A, Khalil E: Studies on the in vivo hypoglycemic activities of two medicinal plants used in treatment of diabetes in Jordanian traditional medicine. J Ethnopharmacol 2005, 100: 314-318.

[2]. Ahmed I, Goldstein B: Diabetes mellitus. Clinics in Dermatol 2006, 24: 237–246.

[3]. Djomeni PD, Tedong L, Asongalem EA, Dimo T, Sokeng SD, Kamtchoung P: Hypoglycemic and antidiabetic effects of root extract of Ceiba pentandira in normal and diabetic rats. Afr J Trad Cam 2006, 3: 129-136.

[4]. Alberti KGM, Zimmet PZ: Definition, Diagnosis and classification of diabetes mellitus and its complication. Part 1: Diagnosis and classification of Diabetes mellitus, Provisional report of a WHO consultation. Diabetes Med 1998, 15: 539-553

[5]. Colman PG, Wang LI, Lafferty KJ: Molecular biology and autoimmunity of type I diabetes mellitus. In: Drazini B, Melmed S, LePoith D, eds. Molecular and Cellular Biology of Diabetes Mellitus- Insulin Secretion. New York: Alan R. Liss Inc. 2006: 125-137.

[6]. Giugliano D, Ceriello A, Paolisso G: Diabetes Mellitus, hypertension, and cardiovascular disease: which role for oxidative stress. Metabolism 1995, 44: 363-368.

[7]. Pickup J, Williams G: Text Book of Diabetes. Blackwell, Oxford, 1991: 467-469

[8]. Augusti KT, Sheela CJ: Antiperoxide effect of S-allyl cystine sulfoxide, an insulin secretagogue in diabetic rats. Experientia 1996; 52: 115-119.

[9]. WHO: Expert Committee on Diabetes Mellitus . Second Report. Technical Report Series 646. Geneva, 1980.

[10]. Latha M, Pari L, Sitasawad S, Bhonde R: Insulin secretagogue activity and cytoprotective role of the traditional antidiabetic plant Scoparia dulcis (Sweet Broomweed). Life Sci 2004, 75:2003-2014.

[11]. Andrew JK: Diabetes. New York: Churchill Living Stone, 2000.

[12]. Dabis G, Michon D, Gazenav J, Ruffie A: interet clinique d'une strategie biologique adaptee au diabete sucre. La vie medicale 1984, 8: 277–290.

[13]. Naik SR, Filho JMB, Dhuley JN, Deshmukh A: Possible mechanism of hypoglycaemic activity of basic acid, a natural product isolated from Bumelia sartorum. J Ethnopharmacol 1991, 33: 37–44.

[14]. Obatomi DK, Bikomo EO, Temple VJ: Anti-diabetic properties of the African Mistletoe in streptozotocin induced diabetic rats. J Ethnopharmacol 1994, 43: 13–17.

[15]. Steiner DF, Williams RH: Action of phenetyl biguanide and related compounds. Diabetes 1959, 8: 154–157.

[16]. Roman-Ramos R, Flores-Saenz JL, Alarcon-Aguilar FJ: Antihypertensive effect of some edible plants. J Ethnopharmacol 1995, 48: 25–32.

[17]. Umamaheswari S, Leena Dennis Joseph, Srikanth J, Lavanya R, Chamundeeswari D, Uma Maheswara Reddy C: Antidiabetic Activity of a Polyherbal Formulation (DIABET). Inter J Pharma Sci 2010, 2: 18-22

[18]. Pushparaj PN, Low HK, Manikandan J, Tan BK, Tan CH: Antidiabetic effects of Cichorium intybus in steptozotocin-induced diabetic rats. J Ethnopharmacol. 2007, 111:430-434.

[19]. Wang L, Zhang XT, Zhang HY, Yao HY & Zhang H: Effect of Vaccinium bracteatum Thunb. leaves extract on blood glucose and plasma lipid levels in streptozotocin-induced diabetic mice. J Ethnopharmacol 2010, 130:465-469.

[20]. Palumbo PJ: Metformin: effect on cardiovascular risk factor in patients with non-insulin dependent diabetes mellitus. J Diabetes Complicat 2008, 12:110-109.

[21]. Arvind K, Pradeep R, Deepa R, Mohan V: Diabetes and coronary artery diseases. Indian J Med Res 2009, 116:163-176.

[22]. Murali B, Upadhyaya, UM, Goyal RK: Effect of chronic treatment with Enicostemma littorale in non-insulin dependent diabetic (NIDDM) rats. J Ethnopharmacol 2008, 81:199-204.

[23]. Lewis GF, Steiner G: Hypertriglyceridemia and its metabolic consequences as a risk factor for atherosclerotic cardiovascular disease in non-insulin dependent diabetes mellitus. Diab Metab Rev 2006, 12:37-56.

[24]. Loh KC, Thai AC, Lui KF, Ng WY: High prevalence of dyslipidaemia despite adequate glycaemic control in patients with diabetes. Ann Acad Med Sing 2006, 25: 228-232.

[25]. Steiner G, Stewart D, Hosking JD: Baseline characteristics of the study population in the Diabetes Atherosclerosis Intervention Study (DAIS). World Health Organization Collaborating Centre for the Study of Atherosclerosis in Diabetes. Am J Cardiol 2009, 84: 1004-1010.

[26]. Whitlock G, Lewington S, Sherliker P: Bodymass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. Lancet 2009, 373:1083–96.

[27]. Flegal KM, Graubard BI, Williamson DF, Gail MH: Excess Deaths Associated with Underweight, Overweight, and Obesity. JAMA 2005, 293: 1861–7.

[28]. Berrington de Gonzalez A, Hartge P, Cerhan JR: Body-mass index and mortality among 1.46 million white adults. N Engl J Med 2010; 363: 2211–9.

[29]. Thomas MC, MacIsaac RJ, Tsalamandris C: Unrecognized anemia in patients with diabetes: a cross sectional survey. Diabetes Care 2003, 26:1164-1169.

[30]. Arun GS, Ramesh KG: Improvement of insulin sensitivity by perindopril in spontaneously hypertensive and streptozotocin-diabetic rats. Indian J Pharmacol 2002, 34:156-164.

[31]. Palacios I, Lozano M, Moro C: Antioxidant properties of phenolic compounds occurring in edible mushrooms. Food Chem 2011, 128: 674-678.

[32]. Oyedemi SO, Adewusi EA, Aiyegoro OA, Akinpelu DA: Antidiabetic and haematological effect of aqueous extract of stem bark of Afzelia Africana (Smith) on streptozotocin-induced diabetic Wistar rats. Asian Pac J Trop Biomed 2011, 1: 353-358.

[33]. Bruce A, Johnson A, Lewis J, Raff M, Roberts K, Walters P: Molecular Biology of the Cell. 4th ed. New York and London: Garland Science, 2002.

[34]. Palsamy P, Subramanian S: Resveratrol, a natural phytoalexin, normalizes hyperglycemia in streptozotocin-nicotinamide induced experimental diabetic rats. Biomed Pharmacother 2008, 62: 598–605.

[35]. Prabhu KS, Lobo R, Shirwaikar A: Antidiabetic properties of the alcoholic extract of Sphaeranthus indicus in streptozotocin-nicotinamide diabetic rats. J. Pharma Pharmacol 2008, 60:909–916.

[36]. Kikkawa R, Koya D, Haneda M: Progression of diabetic nephropathy. Am J Kidney Dis 2003, 41 : S19 –S21

[37]. Ishii N, Patel KP, Lane PH, Taylor T, Bian K, Murad F, Pollock JS, Carmines PK: Nitric oxide synthesis and oxidative stress in the renal cortex of rats with diabetes mellitus. J Am Soc Nephrol 2001, 12: 1630 –1639.

[38]. Forbes JM, Bonnet F, Russo LM, Burns WC, Cao Z, Candido R, Kawachi H, Allen TJ, Cooper ME, Jerums G, Osicka TM: Modulation of nephrin in the diabetic kidney: Association with systemic hypertension and increasing albuminuria. J Hypertens 2002, 20: 985 –992.

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