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ORIGINAL ARTICLE

ANTIDIABETIC POTENTTIAL OF A NOVEL POLYHERBAL PREPARATION IN ALBINO RATS

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Abstract

The present work was executed to evaluate the anti-diabetic potency of a polyherbal preparation. The objective of this study is to induce experimental diabetes mellitus using streptozotocin in normal Albino wistar rats and study the antidiabetic activity of polyherbal formulation (FD1) by comparison of levels of glucose between normal and diabetic rats. Hypoglycemic agents from natural and synthetic sources are available for treatment of diabetes. Indian medicinal plants have been found to be useful to successfully manage diabetes. The effect of ethanolic extracts of leaves of *Alstonia scholaris,* Heartwood of *Pterocarpus marsupium,* Heartwood of *Embelia ribes* investigated in normal, and streptozotocin induced diabetic rats. Significant anti diabetic activity was exhibited by the poly herbal formulation. Serum glucose level was found to be increased in diabetic animals. Treatment with the polyherbal Preparation 200 mg/kg body wt for 15 days in diabetic animals has shown significant decrease in serum glucose levels in comparison to control animals. The study reported that polyherbal preparation at a dose of 200 mg/kg body weight showed significant decline in blood glucose level.

1 | INTRODUCTION

Diabetes mellitus is a heterogeneous metabolic disorder characterised by altered carbohydrate, lipid and protein metabolism (1). The management of diabetes mellitus is considered a global problem and successful treatment is yet to be discovered. The modern drugs, including insulin and oral hypoglycemic agents, control the blood sugar level as long as they are regularly administered and they also produce a number of undesirable effects (2,3). The treatment of diabetes mellitus has been attempted with different indigenous plants and polyherbal formulations (2, 4, 5).

Traditional medicines all over the world have advocated the use of herbs to treat diabetes since time immemorial. Many Indian plants have been investigated for their beneficial use in different types of diabetes and reports occur in numerous scientific journals (6). In the Ayurvedic system of medicine, as mentioned in ancient Indian books like Charak, Samhita, Mahdhav Nidan and Astang Sanghra, there are about 600 plants, which are stated to have antidiabetic property (7). Wide arrays of plant derived active principles representing numerous phytochemicals have demonstrated consistent hypoglycemic activity and their possible use in the treatment of diabetes mellitus. Indian plants which are most effective and commonly studied in relation to diabetes and its associated complications are : *Allium cepa, Allium sativum, Aloevera, Cajanus cajan, Coccinia indica, Caesalpinia bonducella, Ficus bengalenesis, Gymnema sylvestre, Momordica charantia, Ocimum sanctum, Pterocarpus marsupium, Swertia chirayita, Syzigium cumini, Tinospora cordifolia, graecum* and *Trigonella foenum (*8, 9,10).

Keeping the above information in view, an indigenous polyherbal preparation was developed containing the extracts of Alstonia scholaris, Centella asiatica, *Corchorus trilocularis and Morinda pubescens.*

2 | MATERIALS & METHODS

2.1 Plant Material

The dried leaves of *Alstonia scholaris,* Heartwood of *Pterocarpus marsupium,* Heartwood of *Embelia ribes* were purchased from authorized local herbal supplier at Ujjain (M.P.). The dried leaves of *Alstonia scholaris,* Heartwood of *Pterocarpus marsupium,* Heartwood of *Embelia ribes* were identified and authenticated by Head, Institute of Pharmacy, Vikram University, Ujjain (M.P.).

2.2 Preparation of Extracts

The The dried leaves of *Alstonia scholaris,* Heartwood of *Pterocarpus marsupium,* Heartwood of *Embelia ribes* were extracted by ethanol solvent extraction method with the help of soxhlet apparatus. The plant material first extracted with petroleum ether to remove fatty materials then from extraction solvent ethanol. The extracts were concentrated under vacuum, dried at about 60 °C and then stored in a refrigerator.

2.3 Animals

Wistar albino rats of either sex weighing between 100–150 gm of either sex were obtained from central animal house, Institute of Pharmacy, Vikram University, Ujjain (M.P.). The animals were stabilized for 1 week; they were maintained in standard condition at room temp; normal light dark cycle. They had been given standard pellet diet and water ad-libitum throughout the course of the study. The animals were handled gently to avoid giving them too much stress, which could result in an increased adrenal output.

2.4 Development of Polyherbal formulation (FD1)

The polyherbal formulation (FD1) was developed by combining the dried extracts of the plant extracts 100 mg/kg each. The polyherbal formulation (FD1) was prepared by mixing leaves of *Alstonia scholaris,* Heartwood of *Pterocarpus marsupium,* Heartwood of *Embelia ribes* extract in the ratio of 1:1:1 respectively.

3 | DETERMINATION OF ANTIDIABETIC ACTIVITY:

3.1 Streptozotocin Induced Rat Model for Diabetes

The wistar albino rats were given injection of Streptozotocin at a dose of 60 mg/kg intraperitoneally (i.p.). After six weeks of Streptozotocin injection, blood glucose levels of the animals were checked with the help of diagnostic kit and the animals which had blood glucose levels of 250 mg/dl or more were considered to be diabetic and selected for further

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study.[11]

The animals were allotted into four groups of 6 animals each. Group I served as normal control and was orally administered with only the vehicle, 0.5% CMC. Group II was kept as diabetic control and was given only 0.5% CMC. Group III was diabetic and given treatment with the standard drug, Glipizide (0.25mg/kg). Group IV was diabetic and was administered the polyherbal formulation (FD1) (200mg/kg). The treatments were given daily morning for a period of 15 days with oral feeding tube.

Blood samples were collected from the retro orbital plexus of the animals, 15th day, under the effect of ether anesthesia. Serum was separated by centrifuging at 10000 rpm for 25 minutes at 7°C temperature. Serum glucose levels were determined by the method of glucose oxidase-peroxidase using diagnostic kit and compared with Glipizide, the standard drug.

3.2 Statistical Analysis

The results were calculated as mean ± SEM and statistically assessed by two way analysis of variance (ANOVA) followed by Bonferroni post test. The values were considered to be significant when $p< 0.05$.

4 | RESULTS AND DISCUSSION

Polyherbal preparation showed significant antidiabetic activity at 15th days at 200 mg/kg dose levels. The diabetic control group exhibited significant increase ($p<0.001$) in blood glucose levels at all time periods in comparison to the normal control group. The polyherbal formulation (FD1) indicated significant decrease ($p<0.001$) in blood glucose level at day 15 against the diabetic control group and the reduction in blood glucose level was comparable to Glipizide at 15th day.

Alstonia scholaris acts by increasing the production of insulin whereas the *Pterocarpus marsupium* helps in regeneration and restoration of β cells of the pancreas. *Alstonia scholaris* is reported to have insulin like action. *Alstonia scholaris and* Heartwood of *Embelia ribes* .[8,9,10]

This implies that the polyherbal preparation can prevent or be helpful in reducing the complications of blood glucose level via decrease in lipid profile seen in some diabetics in whom hyperglycemia and hypercholesterolemia coexist quite often. The diabetic hyperglycemia induced by streptozotocin produces elevation of plasma level which are considered as significant markers of cardiovascular and renal dysfunction.[12]

5 | CONCLUSION

The study indicates that the developed polyherbal formulation (FD1) at a dose of 200mg/kg body weight is effective in significantly reducing blood glucose levels in diabetic rats and its anti-diabetic activity is comparable to Glipizide. The significant hypoglycemic activity of the polyherbal formulation (FD1) might be due to the varied mechanism of action of each of the herbal drug present in the formulation. Hence, the developed polyherbal formulation (FD1) might prove to be a safe alternative for the existing anti-diabetic synthetic drugs.

However further studies need to be carried out to explore the mechanism of action of each plant and to define the active phytochemicals present in each plant extract.

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TABLE 1: Effect of polyherbal preparation on the blood glucose level (mg/dl) of normal and diabetic Rats

Groups Parameters	Dose	Zero Day (Fasting Blood Glucose Level)	3rd Day (After STZ induction of Diabetes Blood Glucose Level)	5th Day (After induction of diabetes with Treatment Blood Glucose Level)	10th Day (After induction of diabetes with Treatment Blood Glucose Level)	15th Day (After induction of diabetes with Treatment Blood Glucose Level)
Group-I Normal Control (NC)	Ve-hi-cle 2 ml/k	75.83± 1.956	76.21± 0.598	75.26± 0.297	77.52± 0.264	75.22± 0.176
Group-II Diabetic Control (DC)	STZ (60 mg/kg)	76.5± 0.140***	386.5± 0.241***	408.2± 0.549***	410.2± 0.524***	412.2± 0.521***
Group-III Positive Control Glipizide (PC)	5 mg/k	72.67± 0.978***	385.5± 0.751***	210.6± 0.185***	168.4± 0.364***	70.05± 0228***
Group-IV Formula-tion (FD1)	200 mg/kg	76.00± 0.840***	396.5± 0.211***	265.8± 0.153***	182.8± 0.421***	75.66± 0.587***