Journal of Medical Care Research and Review
Received 2 May 2021 | Revised 25 June 2021 | Accepted 15 July 2021 | Published Online 28 Aug 2021

DOI: https://doi.org/10.15520/mcrr.v4i07.177
JMCRR 5 (8), 1108–1111 (2021)
ISSN (O) 2589-8949 | (P) 2589-8930 IF:1.6

ORIGINAL ARTICLE

Anti-Diabetic potential of a Polyherbal formulation (FA1) in STZ Induced Diabetic Rats

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Abstract

The aim of the present study was to determine the anti-diabetic activity of a polyherbal formulation (FA1) in streptozotocin induced diabetic rats. The ethanolic extracts of leaves of *Alstonia scholaris,* Heartwood of *Pterocarpus marsupium,* Heartwood of *Embelia ribes* were prepared. The wistar albino rats were injected with 60 mg/kg of streptozotocin intraperitoneally to induce diabetes. After six weeks of streptozotocin injection, polyherbal formulation (FA1) was daily administered at a dose of 200 mg/kg body weight to diabetic rats for a period of 15 days. Blood samples were collected from the retro orbital plexus of the eye and blood glucose level was estimated by glucose oxidase-peroxidase method. The study indicated that polyherbal formulation (FA1) at a dose of 200 mg/kg body weight showed significant decline in blood glucose level.

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1 | INTRODUCTION

Diabetes mellitus is a severe metabolic disorder which is indicated by hyperglycemia due to lack of insulin or the action of insulin on its target tissues or both. It is one of the major public health problem which is now becoming a global epidemic.[1] The rising glucose level in blood, in diabetes, results due to combination of unhealthy diet, physical inactivity, defect in insulin secretion in response to food and reduced sensitivity of the target tissues to insulin action.[2] The chronic metabolic disorder which affects about 150 million people of the world is going to increase to 300 million by the year 2025.[3] The synthetic oral anti-diabetic drugs and insulin which are being currently used for the control of diabetic complications are effective in controlling the elevated blood glucose levels but they have various side effects and do not control the complications related to diabetes.[4] Traditional medicinal plants are being used worldwide for many diabetic complications. Various herbal drugs and minerals have been described in olden traditional literature for the treatment of diabetes mellitus. Herbal drugs are considered to be safe and do not have much side effects compared to synthetic drugs.[5] There-

fore, exploring the hypoglycemic potential of medicinal plants has become very important to provide mankind with safer alternative of herbal drugs.

The present study has been carried out to determine the hypoglycemic potential of some medicinal plants and the anti-diabetic activity of their polyherbal formulation (FA1)in diabetic rats.

2 | MATERIALS AND 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 (FA1

The polyherbal formulation (FA1) was developed by combining the dried extracts of the plant extracts 100 mg/kg each. The polyherbal formulation (FA1)was prepared by mixing leaves of Alstonia scholaris, Heartwood of Pterocarpus marsupium, Heartwood of Embelia ribes extract in the ratio of 2:1:4 respectively.

3 | EXPERIMENTAL DESIGN

3.1 | Streptozotocin Induced Neonatal 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 study.[6]

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 (FA1)(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

Supplementary information The online version of this article (https://doi.org/10.15520/mcrr.v4i07.177) contains supplementary material, which is available to authorized users.

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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 statisticallyassessed by two way analysis of variance (ANOVA) followed by Bonferronipost test. The values were considered to be significant when $p< 0.05$.

4 | RESULTS AND DISCUSSION

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 (FA1) 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 Heartwood of Pterocarpus marsupium helps in regeneration and restoration of β cells of the pancreas. Heartwood of Embelia ribes is reported to have insulin like action.[7,8] One study reports that Alstonia scholaris and Heartwood of Embelia ribes produces hypoglycemic activity due to PPAR γ/α agonist mechanism thus improving insulin resistance condition.[9]

5 | CONCLUSION

The study indicates that the developed polyherbal formulation (FA1)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 (FA1) might be due to the varied mechanism of action of each of the herbal drug present in the formulation. Hence, the developed polyherbal formulation (FA1) 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 formulation (FA1) on blood glucose level

Groups Parameters	Dose	Zero Day (Fasting Blood Glucose Level)	3^{rd} Day (After STZ induction of Diabetes Blood Glucose Level)	5^{th} Day (After induction of diabetes with Treatment Blood Glucose Level)	10^{th} Day (After induction of diabetes with Treatment Blood Glucose Level)	15^{th} Day (After induction of diabetes with Treatment Blood Glucose Level)
Group-I Normal Control (NC)	Vehicle 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 Formulation (FD1)	200 mg/kg	73.50± 0.717***	341.4± 0.632***	268.9± 0.110***	187.1± 0.368***	85.62± 0.875***

How to cite this article: Mandoria N., Dashora D., Ahirwar K., Khilvadkar D.P. **Anti-Diabetic potential of a Polyherbal formulation (FA1) in STZ Induced Diabetic Rats**. Journal of Medical Care Research and Review. 2021;1108−1111. https://doi.org/10.15520/mcrr.v4i07.177