Int J Pharm Bio Sci 2013 Apr; 4(2): (B) 382 - 388

Research Article **Pathology**

International Journal of Pharma and Bio Sciences **ISSN 0975-6299**

ANTIDIABETIC EFFECTS OF *RICINUS COMMUNIS* ON THE BLOOD BIOCHEMICAL PARAMETERS IN STREPTOZOTOCIN INDUCED ALBINO RAT

SEEMA MANN*, P. K. SINGH, ANITA AND ANIL KUMAR GUPTA

Department of Zoology, School of Life Sciences, Dr B. R. Ambedkar University, Agra, India.

ABSTRACT

The present investigation was carried out to evaluate the antidiabetic effects of *Ricinus communis* leaves extract on the streptozotocin induced diabetic rats. Oral administration to ethanolic leaves extract was given (200mg/kg body weight) for 7, 15, 30, 45 and 60 days respectively. The decreased cholesterol, HDL, LDL, triglyceride and insulin; while increased SGOT, SGPT, ALP, ACP and glucose after streptozotocin induction, however, increased and decreased significantly after *Ricinus communis* treatment respectively. The results clearly show that the extract of *Ricinus communis* potent hypoglycemic activity.

KEYWORDS : **Streptozotocin, *Ricinus communis*, lipid profile, liver profile, insulin, glucose.**

SEEMA MANN
Department of Zoology, School of Life Sciences,
Dr B. R. Ambedkar University, Agra, India.

Corresponding author

INTRODUCTION

Ayurveda is the vedic system of health care that developed in India over 5000 years ago. It was codified by the sage physician's charka and the sage surgeon shushruta Ayurveda is a holistic system of medicine from India that use constitutional model.[1] In recent times focus on plant research has increased all over the world and a large number of evidences have collected to show immense potential of medicinal plants used in various traditional system.[2] Diabetes mellitus is a complex syndrome involving sever insulin dysfunction in conjugation with gross abnormalities in glucose homeostasis and lipid metabolism. It is a major risk factor for stroke, heart disease and other blood vessel diseases. High levels of circulating lipid due to an increased turn over of fatty acid, as such molecules are used to generated energy by via â-oxidation[3]. The diabetes mellitus is a major public health problem mentained in the developed as well as developing countries. It is ranked seventh among the leading causes of death, and third when its fatal complications are taken into account. Traditional antidiabetic plants might provide useful sources of new oral hypoglycemic compounds prepration from development as pharmaceutical entities as simply a dietary adjunct to existing therapies. Herbal treatments are becoming increasing by popular as the herbal preparations have no or least side effects[4]. The castor bean plant (*Ricinus communis*) is a member of the family Euphorbiaceae. *Ricinus communis* is native to tropical Africa, but because the plant was recognized for its production of oil with many desirable properties, it has been introduced and cultivated in warm temperature region through out the world.[5] Ricin is synthesized in the castor bean endosperm. It seems to have a promising value for the development of a potent phytomedicine for diabetes, though further comprehensive pharmacological investigations are needed to elucidate the exact mechanism of action at the molecular level of the *Ricinus communis* root extract. A bioactive ingredient to promote regeneration of beta cells of langerhans and also insulin induced glucose uptake by the tissues and improve glucose tolerance and promote peripheral utilisation of glucose[6]. This study was thus initiated with the aim of evaluating the effect of the alcoholic leaves extract of *Ricinus. communis* on the blood biochemical parameters aid insulin activity in streptozotocin induced diabetic rat.

MATERIALS AND METHODS

The colony of albino rats was breed in the animal house of Zoology Department, School of Life Sciences. Seventy healthy male albino rats of almost equal size, weight (120 – 180gm) and age (8 weeks) were selected for the present study. The albino rats were housed in polypropylene cages maintained in controlled temperature (25 ± 5ºC) humidity (65 ± 10%) and light cycle (12 hrs light and 12 hrs dark). They were fed with Goldmohar brand feed (manufactured by Lipton India Pvt. Ltd., New Delhi) and water *ad libilum*. Plant material and preparation of Ethanolic extract standard protocol was drawn up in accordance with good laboratory practices (GLP) regulation of WHO (1988)[7]. The young leaves of *Ricinus communis* was collected from the plant house and identified taxonomically by Department of Botany, School of Life Sciences, Khandari Campus, Dr. B.R. Ambedkar University, Agra. The young leaves of *Ricinus communis* 500g was extracted with 90% ethanol (1L), ketp in magnetic stirrer at room temperature for 48 hrs, and filtered through whatmann no. 1 filter paper. The residue was discarded and the filtrate was concentrated under reduced pressure at 40ºC with Roto -Vapor and the final dry extract obtained. This material was stored in the freezer, suspended in 200 ml ethanol and was administered to the experimental animals[8,9 ,10]. Albino rats were starved for 24 hrs. and divided into placebo control groups and experimental groups. Diabetes induced in each rats in experimental group was injected by a single intraperitoneal injection of streptozotocin at a dosage of 60 mg/kg body weight (S.D. fine chemical Ltd., Mumbai, India) in sterile saline[11]. After 72 hrs.

of streptozotocin injection the diabetic rats (glucose levels > 250 mg/dl) were separated and used for the investigation. The selected seventy albino rats of almost equal weight and size were divided into seven groups of 10 rats each. The one group of albino rats were as treated as controlled the next group was treated with streptozotocin and last five groups of diabetic rats were given an alcoholic leaves extract of *Ricinus communis* 200 mg/kg body weight[10]. The acute extract of *Ricinus communis* was administerated for a period of 7, 15, 30, 45 and 60 days respectively. The fresh blood was taken in the sterilized centrifuged glass tubes, and kept undisturbed in a vertical position for about two hrs. at the room temperature when the blood starts clotting the centrifugation was done at 2000 rpm for about thirty minutes, so as to get rid the serum of any suspended red cells. Now the supernatant serum was separated from the cell debrix by a filter paper. The serum samples was obtained and used for estimation of biochemical parameters. Serum glucose was estimated by the GOD/POD method[12] and insulin was assayed by Radio Immuno Assay (RIA) method[13]. Total cholesterol[14], HDL[15], Triglycerids,[16] AST and ALT,[17] ALP[18] and ACP[19]. All the data were statistically analyzed by using students 't' test and ANOVA. All results were expressed as mean ± SEM.

RESULTS

In whole experiment results of *Ricinus communis* treated groups were compared with that of streptozotocin induced control group while simple controlled groups were shown only for compared with streptozotocin induced controlled group.

Table 1

Effect of Ricinus communis on the lipid profile in treptozotocin induced albino rat

Groups	Cholesterol	High Density Lipoprotein	Low Density Lipoprotein	Triglyceride
7 days control	94.83 ± 0.468	50.16 ± 0.505	16.36 ± 0.486	79.4 ± 1.367
7 days STZ	90.58 ± 0.617	46.26 ± 0.475	15.87 ± 0.426	76.60 ± 1.586
7 days R.C.	91.35 ± 0.560^{NS}	46.67 ± 0.833^{NS}	16.08 ± 0.474^{NS}	77.17 ± 1.560^{NS}
15 days Control Group	96.98 ± 0.504	51.04 ± 0.887	16.62 ± 0.315	80.19 ± 1.316
15 days STZ	86.62 ± 0.466	46.76 ± 0.577	15.05 ± 0.406	75.36 ± 1.424
15 days R.C.	87.76 ± 0.501^{NS}	47.59 ± 0.783^{NS}	15.30 ± 0.463^{NS}	76.62 ± 1.60^{NS}
30 days Control group	99.22 ± 0.417	52.47 ± 0.331	17.47 ± 0.155	81.10 ± 1.464
30 days STZ	84.45 ± 0.499	47.34 ± 0.311	14.19 ± 0.215	74.87 ± 1.164
30 days R.C.	86.59 ± 0.480***	48.65 ± 0.746**	14.45 ± 0.44*	76.01 ± 1.576*
45 days Control group	100.41 ± 0.618	53.48 ± 0.416	17.94 ± 0.668	82.65 ± 1.658
45 days STZ	82.33 ± 0.533	44.69 ± 0.421	13.76 ± 0.448	73.15 ± 1.268
45 days R.C.	85.41± 0.464***	47.09 ± 1.161***	14.67 ± 0.435**	75.39 ± 1.591**
60 days control	101.82 ± 0.637	54.62 ± 0.505	18.42 ± 0.640	82.15 ± 1.338
60 days STZ	78.94 ± 0.331	43.80 ± 0.305	13.02 ± 0.505	72.17 ± 1.638
60 days R.C.	84.34 ± 0.348***	45.62 ± 0.611***	13.60 ± 0.405**	74.55 ± 1.631**

(n = 10)

(a) $\Rightarrow$ P value $\geq$ 0.05, (b) $\Rightarrow$ P value $\leq$ 0.05, (c) $\Rightarrow$ P value $\leq$ 0.01, (d) $\Rightarrow$ P value $\leq$ 0.001

Cholesterol **:** The cholesterol of albino rat decrease significantly (p≤0.05) after 7, 15, 30, 45 and 60 days after streptozotonic induction. However, increased non-significantly (p≥0.05) after 7 and 15 days; while very highly significant (p≤0.001) after 30, 45 and 60 days of *Ricinus communis* treatment (Table 1). *High Density Lipoprotein* : The High Density Lipoprotein of albino rat decreased after 7, 15, 30, 45 and 60 days after streptozotocin

induction. However, increased non-significantly (p≥0.05) after 7 and 15 days, highly significantly (p≤0.001) after 20 days and very highly significant (p≤0.001) after 45 and 60 days of *Ricinu. communis* treatment (Table 1). *Low density Lipoprotein* : The Low density Lipoprotein of albino rat decreased after 7, 15, 30, 45 and 60 days after streptozotocin induction. However, increased non-significantly (p≥0.05) after 7 and 15 days, while significantly (p≤0.05) after 30 days and highly significantly (p≤0.001) after 45 and 60 days of *Ricinus communis* treatment (Table 1). *Triglyceride* : The Triglyceride of albino rat decreased after 7, 15, 30, 45 and 60 days after streptozotocin induction. However, increased non-significantly (p≥0.05) after 7 and 15 days, while significantly (p≤0.05) after 30 days and highly significantly (p≤0.001) after 45 and 60 days of *Ricinus c ommunis* treatment (Table 1).

Table 2
Effect of Ricinus communis on the enzyme profile in Streptozotocin induced albino rat

Groups	SGOT	SGPT	ACP	ALP
7 days control	385 ± 0.370	158 ± 0.315	26 ± 0.695	272 ± 0.573
7 days STZ	456 ± 0.352	173 ± 0.215	39 ± 0.365	290 ± 0.203
7 days R.C.	437 ± 0.481^{NS}	167 ± 0.354*	37 ± 0.714^{NS}	284 ± 0.031^{NS}
15 days Control Group	386 ± 0.631	158 ± 0.466	27 ± 0.631	268 ± 0.333
15 days STZ	528 ± 0.435	182 ± 0.388	41 ± 0.601	298 ± 0.334
15 days R.C.	497 ± 0.493**	173 ± 0.348**	37 ± 0.789^{NS}	286 ± 0.384^{NS}
30 days Control group	387 ± 0.314	157 ± 0.644	25 ± 0.314	272 ± 0.631
30 days STZ	556 ± 0.414	199 ± 0.234	42 ± 0.344	303 ± 0.541
30 days R.C.	501 ± 0.780**	182 ± 0.387***	38 ± 0.733^{NS}	292 ± 0.437^{NS}
45 days Control group	384 ± 0.816	156 ± 0.944	24 ± 0.347	266 ± 0.537
45 days STZ	596 ± 0.416	230 ± 0.314	43 ± 0.447	310 ± 0.524
45 days R.C.	486 ± 0.739***	201 ± 0.548***	36 ± 0.696**	295 ± 0.750^{NS}
60 days control	386 ± 0.034	157 ± 0.157	27 ± 0.563	270 ± 0.613
60 days STZ	661 ± 0.334	265 ± 0.457	47 ± 0.653	322 ± 0.448
60 days R.C.	480 ± 0.770***	198 ± 0.488***	35 ± 0.683***	302 ± 0.531*

(n = 10)
(a) $\Rightarrow$ P value $\geq$ 0.05, (b) $\Rightarrow$ P value $\leq$ 0.05, (c) $\Rightarrow$ P value $\leq$ 0.01, (d) $\Rightarrow$ P value $\leq$ 0.001

SGOT : The Serum glutamate oxaloacetic transaminase of albino rat decreased after 7, 15, 30, 45 and 60 days after streptozotocin induction. However, increased non-significantly (p≥0.05) after 7, highly significantly (p≤0.001) after 15 and 30 days and very highly significantly (p≤0.001) after 45 and 60 days of *Ricinus communis* treatment (Table 2). *SGPT :* The Serum glutomate pyruvic transaminase of albino rat increased after 7, 15, 30, 45 and 60 days after streptozotocin induction. However decreased significantly (p≥0.05) after 7, highly significantly (p≤0.001) after 15 and very highly significantly (p≤0.001) after 30, 45 and 60 days of *Ricinus Communis* treatment (Table 2). *ACP :* The Acid phosphatase of albino rat increased after 7, 15, 30, 45 and 60 days after streptozotocin induction. However, decreased non-significantly (p≥0.05) after 7, 15 and 30 days, highly significantly (p≤0.001) after 45 and very highly significantly (p≤0.001) after 60 days of *Ricinus Communis* treatment (Table 2). *ALP :* The Alkaline phosphatase of albino

rat increased after 7, 15, 30, 45 and 60 days after streptozotocin induction. However, decreased non-significantly (p≥0.05) after 7, 15, 30 and 45 days, significantly (p≤0.001) after 60 days of *Ricinus Communis* treatment (Table 2).

Table 3
Antidiabetic effect of Ricinus communis on the blood in Streptozotocin induced albino rat

Groups	Insulin	Glucose
7 days control	2.51 ± 0.180	138 ± 1.472
7 days STZ	2.00 ± 0.168	400 ± 1.412
7 days R.C.	2.15 ± 0.103^{NS}	354 ± 1.408**
15 days Control Group	2.53 ± 0.184	140 ± 1.470
15 days STZ	1.66 ± 0.144	435 ± 1.480
15 days R.C.	1.88 ± 0.101**	318 ± 1.115***
30 days Control group	2.21 ± 0.212	138 ± 1.415
30 days STZ	1.49 ± 0.112	452 ± 1.405
30 days R.C.	1.88 ± 0.681**	297 ± 1.306***
45 days Control group	2.61 ± 0.169	137 ± 1.455
45 days STZ	1.21± 0.119	483 ± 1.465
45 days R.C.	2.00 ± 0.324***	278 ± 1.406***
60 days control	2.62 ± 0.283	139 ± 1.543
60 days STZ	0.86 ± 0.183	513 ± 1.513
60 days R.C.	2.31 ± 0.304***	225 ± 1.334***

(n = 10)

(a) $\Rightarrow$ P value $\geq$ 0.05, (b) $\Rightarrow$ P value $\leq$ 0.05, (c) $\Rightarrow$ P value $\leq$ 0.01, (d) $\Rightarrow$ P value $\leq$ 0.001

Insulin : The Insulin of albino rat decreased after 7, 15, 30, 45 and 60 days after streptozotocin induction. However increased non-significantly (p≥0.05) after 7 days, highly significantly (p≤0.001) after 15 and 30 days, very highly significantly (p≤0.001) after 45 and 60 days of *Ricinus Communis* treatment (Table 3). *Glucose :* The Glucose of albino rat increased after 7, 15, 30, 45 and 60 days after streptozotocin induction. However decreased highly significantly (p≤0.001) after 7 days, very highly significantly (p≤0.001) after 15, 30, 45 and 60 days of *Ricinus Communis* treatment (Table 3).

DISCUSSION

Diabetes mellitus is associated with profound alterations in lipid and lipoprotein metabolism by altering the activities of various enzymes. streptozotocin is a chemical agent for experimental induction of diabetes in the rats. In diabetes the insulin is markedly depleted but not absent result in decreased glucose utilization by insulin requiring tissues like liver and an increased glucose production through an increased rate of gluconeogenesis both resulting in hyperglycemia[20]. In the present work, the oral administration of ethanolic leaves extract of *Ricinus communis* decrease serum glucose and insulin level in diabetic rats. This hypoglycemic effect may be due to depression of key gluconeogenic enzymes or the increase in the levels of glucose transporter and stimulation of glucose uptake in peripheral tissues[21]. Another effect of this plant may be that it preserves the â cells of islets of langerhens and □ cells function which results in a significant increase in insulin secretary activity[22]. In this context a number of other plants have also been reported to have hypoglycemic and insulin release stimulatory effect in streptozotocin induced rat[23]. Therefore, in the present study an increase insulin level after *Ricinus communis* alcoholic extract may be due to stimulation of insulin secretion by amino acid seems to be a promotes transported of amino acid in to the tissue cells as well as intracellular formation of protein[24,25]. Similar findings have been reported in rat due to beneficial effects of *Ricinus communis* and in guinea pig due to *Ricinus communis* leaves lowering the glucose level in Type I diabetic and hypoglycemic effect of *Ricinus* leaves[26]. In the present study decrease the cholesterol, HDL, LDL and TG due to streptozotocin; while increase due to the beneficial effect of *R. communis*. The sulphur compound of *Ricinus*

communis like S-allyl-Cysteine, S-ethyl-cystein and S-praphyl-cysteine inhibited the cholesterol synthesis significantly[27.28]. The metabolism of lipid affecte by *Ricinus* by which inhibited the cholesterol synthes is and their metabolism due to *Ricnus communis*[25]. In the present study SGOT, SGPT, ALP and ACP increase due to sterptozotocin while decrease due to the beneficial effect of *Ricinus communis*. The hepatoprotective action of *Ricinus communis* which protect liver from various toxicant and help in regeneration, less count of degrading hepatocytes[29,25]. In rabbits due to *Ricinus communis* induced enzymes of drug metabolism and improve liver function[30,31]. The reduction in these superficial liver enzymes like SGOT, SGPT, ALP, and ACP level and its mechanism by *Ricinus communis* that involved to increase the cytochrome enzyme through its antioxidant property and it also responsible for protection against hepatic assault[32,33].

CONCLUSION

On the basis of the results of this investigation it could be concluded that *Ricinus communis* alcoholic leaves extract have a significant antidiabetic effect. This effect may be due to the presence of saponins, flavonoids, and other constituents present in leaves which could act synergistically or independently on the molecular level.

REFERENCES

1. Kirtikar KR, Basu BD. Indian medicinal plants, IInd edition. Bishan Singh, Mahendra Pal Singh, Dehradun; pp. 180-183, (1985).
2. Sokolski WT, Vavra JJ, Deboer C, Dietz A, Hanka LJ. "Streptozotocin, a new antibacterial antibiotics". Antibiot. Annu.; 7: 230-235, (1975).
3. Scott M, Grundy K. Diabetes and cardiovascular disease. Circulation; 100: 1134-1146, (1999).
4. King H, Aubert, R, Herman W. Global burden of diabetes 1995-2025 prevalence, numerical estimates and projection Diabetes Care; 21: 1414-1431, (1998).
5. Morris MM, Candeia RA, Silva FC, Bezerra AH, Jr. Fernandes VJ, Souza AG. Thermoanalytical characterization diesel: Renewable and Sustainable Energy Reviews; 11: 964-975, (2003).
6. Pant MC. Essential of biochemistiry. Xth Eds: Kedar Nalh Ram and Co, Meerut; pp. 107-109, (1994).
7. World Health Organization. Basic OECD principles of GLP: pp. 1-35, (1998).
8. Kokate CK. Practical Pharmacognosy. 3rd eds. Vallabh Prakashan. New Delhi : pp 107 – 109 (1994).
9. World Health Organization (WHO). Quality control methods for medicinal plants.WHO Geneva Switzerland; 115-129, (2001).
10. Govindarajan R, Sreevidya N, Vijaykumar M, Thakur M, Dixit VK, Mehrotra S. Standardization and determination of antioxidant activity of *Ricinus communis*. Nat. Prod. Sci; 11: 165-169, (2005).
11. Ahmed I, Adeghate E, Sharma AK, Pallot DJ. Effects of *Momordica charantia* fruit juice on islet morphology in the pancreas of streptozotocin diabetic rats. Diabetes Res. Clinical. Pract; 40: 145-51, (1998).
12. Trinder P. Determination of glucose using glucose oxidase with an alternative oxygen acceptori. Ann. Clinical. Biochem; 6: 24-27. (1969).
13. Rosalyns Y, Solomona AB. Assay of plasma insulin in human subjects by immunological methods. Nature; 184: 1648-1649, (1959).
14. Wybenga DR. Estimation of total cholesterol in the serum. Clin. Chem; 16: 980, (1970).
15. Warnick GT, Nguyen, Albert AA. Comparison of improved precipitation method for quantification of high density lipoprotein cholesterol. Clin. Chem; 39: 39-46, (1985).

16. McGowan MW. Estimation of the concentration of triglyceride in plasma. Clin. Chem; 29: 29-538, (1983).
17. Reitman S, Frankel S. Estimation of SGOT and SGPT in serum. Am. J. Clin. Path; 28: 56-62, (1957).
18. Kind PRN, King EJ. Estimation of alkaline phosphatase in serum. J. Clin. Path; 7: 322, (1954).
19. King EJ, Jagatheesan, KA. Estimation of acid phosphatase in serum. J. Clin. Path; 12: 85, (1959).
20. Goodman LS, Gilman A. The pharmacological basis of therapeutics. 17th Ed; p. 1490-1510, (1985).
21. Vajpayi AP, Singh PK, Manish K, Anil KG, Manish KS, Sharmila U. Mode of Action of *Monordica cochinchinensis* on on serum glucose and insulin activity in streptozotocin induced Diabetic rats. Asian Jr. of Microbiol. Biotech. Env. Sc; 9 (4) : 779 – 782, (2007).
22. Ivorra MD, Paya M, Villas A. A review of natural products and plants as potential antidiabetic drugs. J Ethnopharmacol; 27: 243-275, (1989).
23. Venkatesh Waran S, Pari L. Effects of *Coccinia indica* on blood glucose, insulin and hepatic key enzymes in experimental diabetes. Pharmacol. Biol; 40: 23-28, (2002).
24. Shokeen P, Anand P, Murali YK, Tandon V. Antidiabetic activity of 50% ethanolic extract of *Ricinus communis* and its purified fractions. Food and chemical toxicology; 46 (11): 3458-3466, (2008).
25. Behl CR, Pande MB, Pande DP, Radadia NS. Nutritive value of wilted castor (*Ricinus communis* L.) leaves for crossbred Sheep: Indian J. Anim. Sci; 56: 473-474, (2008).
26. Rao MV, Sreenivasula M, Chengaiah B, Reddy KJ, Chetty CM. Herbal medicines for diabetes mellitus. A Review Toxicology; 16: 3458-3466, (2008).
27. Gardner CD, Lawson LD, Block E, Chatterjee LM, Kiazard A, Balise RR, Kraemes HC. The effect of raw gralic vs gralic supplements on plasma lipids concentrations in adults with moderate hypercholesterolemia. A clinical trail. Archieves of Internal Medicine; 167; 346-353.
28. Benavides GA, Squadrito GL, Mills RW. Hydrogen sulfide mediates the vasoacctivity of gralic. Proc. Natl. Acad. Sci; 104 (46): 17977-17982, (2007).
29. Meiling WC, Margaret, AJ. Effect of the gralic on carbohydrate metabolism and lipid synthesis. J. Nutr; 110: 931-936, (1980).
30. Jelodor GA, Malek M, Motadagen Sirus MH. Effect of fenugrek, onion and gralic on blood glucose and histopathology of pancreas of alloxan-induced diabetic rats. Ind. J. Med. Sci; 59: 64-69, (2005).
31. Visveswaran D, Santrani T. Effect of *Phyllanthus niruri* and *Ricinus communis* on carbon tetrachloride induced hepatotoxicity in rabbits. Ind. I. Pharm. Sci; 48 : 160 (1985).
32. Adolfo, Andrade-Cetto, Heinrich M. Mexican plants with hypoglycaemic effect used in the treatment of diabetes. Journal of Ethnopharmacology; 99: 325-348, (2005).
33. Mazumdar UK, Gupta M, Rajeshwar Y. A antihyperglycemic effect and antioxidant potential of *phyllanthus niruri* (Euphorbiaceae) in streptozotocin induced diabetic rats European Bulletin of Drug Research; 13: 1, (2005).