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HYPOGLYCEMIC EFFECT OF *ACALYPHA INDICA* LINN. PLANT EXTRACTS ON STREPTOZOTOCIN INDUCED DIABETES IN RAT

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ABSTRACT

The plant *Acalypha indica* Linn. is commonly known as Indian *Acalypha* and it belongs to the family Euphorbiaceae, found in all parts of the tropics. This herbs found in fields and wastes places throughout the hotter parts of the world. The plant has wide uses in the traditional medicines of various countries and reportedly possesses diuretic, purgative and anthelmintic properties, besides being also used for bronchitis, asthma, pneumonia, scabies and other cutaneous diseases. In the present study different extract of *Acalypha indica* plant was evaluated on fasting and posts prandial blood sugar in both insulin and non insulin dependent diabetes mellitus rats. The induction of diabetes was done by using streptozotocin in neonates. Oral administration of petroleum ether, chloroform, acetone and methanol extracts of the bark (100 mg/kg, p.o.) for 21 days caused a decrease in fasting blood sugar (FBS) in diabetic rats. Among all the extracts, methanol extract was found to lower the FBS significantly (P<0.001) in diabetic rats. Methanol extract also caused a significant decrease (P<0.01) in post prandial blood sugar level in diabetic rats. Results of the test were compared with the standard antidiabetic drug glibenclamide (5mg/kg, p.o). Thus the present study indicates that the methanol extract of *Acalypha indica* possess antidiabetic activity.

INTRODUCTION: Diabetes mellitus is a heterogeneous group of disorders characterized by abnormalities in Carbohydrate, protein, and lipid metabolism[4]. The central disturbance in diabetes mellitus is an abnormality in insulin production or action or both, although other factors can be involved. Hyperglycemia is a common end point for all types of diabetes mellitus and is the parameter that is measured to evaluate and manage the efficacy of diabetes therapy.

Diabetes mellitus occurs in several forms, approximately 10% of diabetes patients have type 1 diabetes mellitus, an autoimmune disease that destroys insulin- producing beta cells in the pancreas leading to decrease in the concentration of insulin in the body and the remainder have type 2 (Non insulin dependent diabetes mellitus).

Type 2 diabetes mellitus is a metabolic disorder characterized by a progressive decline in insulin action (insulin resistance, followed by the inability of pancreatic ß cells to compensate for insulin resistance) normally compensate for insulin resistance by secreting greater amount of insulin needed to maintain glucose homeostasis [5]. In non insulin dependent diabetes mellitus this cell function becomes impaired due to insulin resistance leading to deterioration in

glucose homeostasis and subsequent development of impaired glucose tolerance.

Diabetes mellitus is recognized as a major risk factor for cardiovascular diseases (CVD) such as atherosclerosis, heart attack, stroke, etc. About 75% of deaths among men with diabetes and 57% among women with diabetes are attributable to CVD. Many medicinal plants have been evidenced for having anti diabetic activity having lipid lowering character. Ethnobotanical information also indicates that more than 800 plants are used as traditional remedies for the treatment of diabetes throughout the world.

Acalypha indica Linn. is an annual erect herb 30-75 cm in height. Branches are numerous, long, ascending, finely pubescent. It is commonly known as Indian *Acalypha* and it belongs to the family Euphorbiaceae, found in all parts of the tropics. This herbs found in fields and wastes places throughout the hotter parts of the world. The plant has wide uses in the traditional medicines of various countries and reportedly possesses diuretic, purgative and antihelmintic properties, besides being also used for bronchitis, asthma, pneumonia, scabies and other cutaneous diseases [3, 6].

The activities delivered by the plant reported are analgesic, Anti-inflammatory, Antihelmintic activity, Anti bacterial and anti fungal activity, Anti tubercular activity, antioxidants [8-19]. The plant reported to consist of Alkaloids, Catachols, Flavonoids, Phenolic compounds, Saponins, Steroids, Tannins [7]. Therefore, the present study was conducted to evaluate the sugar lowering potential of bark extract of this plant on streptozotocin induced NIDDM rats.

MATERIAL AND METHODS:

Plant and Chemicals: *Acalypha indica* plants were collected from the forest of Raisen district of Madhya Pradesh in the month of august. The plant was identified and authenticated and deposited in the department. Streptozotocin was purchased from Calbiochem, Germany. Standard antidiabetic drug glibenclamide was obtained from Ranbaxy Research Laboratories, Gurgaon, India. Analytical grade chemicals including various organic solvents (petroleum ether, chloroform, acetone and methanol) from E. Merck India Ltd., and Ranbaxy Laboratories India, were used for the extraction and phytochemical study of the constituents.

Preparation of Different Plant Extracts: Whole plant was shade dried at room temperature, ground into fine powder and then extracted (amount 450g) with solvents of increasing polarity such as petroleum ether, chloroform, acetone and methanol for 24h with each solvent by hot extraction using Soxhlet apparatus at a temperature of 60ºC. The extracts were concentrated under reduced pressure using a rotary evaporator to constant weight and collected and preserved in desiccator for further studies.

Phytochemical Study: A portion of residue from each extract was subjected to phytochemical analysis in order to see the presence of sterols, alkaloids, carbohydrates, tannins, phenols, etc. in the plant extracts [20].

Determination of Blood Sugar Level in Diabetic Rats:

Animals: Wistar albino rats of either sex were randomly bred in the Institutional animal house. The animals were housed in standard polypropylene cages and maintained under controlled room temperature ($22^{o}+2^{o}C$) and humidity (55+5%) with 12:12 h light and dark cycle. All the animals were provided with commercially available rat normal pellet diet and water *ad libitum*. The guidelines of the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) of the Govt. of India were followed and prior permission and clearance were obtained from the institutional animal ethics committee for conducting the animal experiments.

Induction of diabetes: Diabetes mellitus was induced in five day old neonates (50 animals) by intraperitoneal injection of streptozotocin (90 mg/kg in 0.1M citrate buffer *p*H 4.5). The control group received equivalent amount of citrate buffer. The animals were allowed to live with their respective mothers and weaned from breast feeding at 4 weeks of age. Eight weeks after injection of streptozotocin, the rats were checked for fasting blood sugar (FBS) level by glucose oxidase-peroxidase method. Animals showing FBS more than 150 mg/dl were considered as diabetic (38 animals) and included for the study [21].

Treatment protocol: The diabetic animals were divided into six groups, each containing six animals and one group of normal non diabetic animals. All the extracts of *A. indica* plant was given at a dose of 100 mg/kg, orally for a period of 21 days as a suspension in Tween 80 to different groups of diabetic animals.

Gr I: Normal animals received Tween 80 in a dose of 1% suspension in distilled water.

Gr II: Diabetic animals received Tween 80 in a dose of 1% suspension in distilled water.

Gr III: Diabetic animals received standard antidiabetic drug glibenclamide (5mg/kg, p.o.)

Gr IV: Diabetic animals received Petroleum ether extract (100mg/kg, p.o.)

Gr V: Diabetic animals received chloroform extract (100mg/kg, p.o)

Gr VI: Diabetic animals received acetone extract (100mg/kg, p.o)

Gr VII: Diabetic animals received methanol extract (100mg/kg, p.o.)

At the end of the experimental period the animals were fasted overnight for 8h and blood was taken from the retro orbital plexus under mild ether anesthesia, serum was separated out and blood sugar level was evaluated by the method of glucose oxidase-peroxides method using span diagnostic kits.

Antihyperglycaemic Assay:

Oral Glucose Tolerance Test: The six groups of diabetic animals and one group of normal animals were fasted overnight. Hyperglycaemia was induced by oral administration of 75% glucose solution .The standard oral glucose tolerance test was performed on all animals before and after giving the treatment[21].

Statistical analysis: The results were expressed as Mean ± SEM. The unpaired t-test was used for analyzing the data between two groups. Statistical analysis of data was initially performed by using analysis of variance (ANOVA) when the overall ANOVA was significant, unpaired t-test was applied to study the difference among the groups.

RESULTS AND DISCUSSION:

Phytochemical study: The whole plant extract of *Acalypha indiac* Linn. was assayed for the presence of Anthroquinone, Alkaloids, Catachols, Flavonoids, Phenolic compounds, Saponins, Steroids, Tannins, Triterpenoids.

The result concluded the presence of Alkaloids, Catachols, Flavonoids, Phenolic compounds, Saponins, Steroids [7].

Effect on fasting blood sugar and post prandial Blood Sugar Level of Diabetic Rats: The effect of different extracts on serum glucose level in the diabetic rats shown in **Table 1** revealed that all the extracts caused reduction in blood glucose level but maximum reduction was found.

TABLE 1: EFFECT OF *A. INDICA* PLANT EXTRACTS ON FASTING BLOOD SUGAR OF DIABETIC RATS (n=6)

Group	Blood sugar (mg/dl) before treatment	Blood sugar (mg/dl) after treatment	% reduction in blood sugar
Control (diabetic rats)	253 ± 1.3	235 ± 0.8	-------
Normal (Tween 80, 1 ml/kg, p.o.)	90 ± 0.8	96 ± 1.1	--------
Diabetic + Standard drug (5 mg/kg, p.o.)	250± 1.1	90 ± 1.3***	67
Diabetic + Pt. ether (100 mg/kg, p.o.)	254± 1.2	143 ± 0.9*	43
Diabetic + Chloroform (100 mg/kg, p.o.)	260± 1.5	137 ± 1.2 *	45
Diabetic + Acetone (100 mg/kg, p.o.)	257 ± 2.4	132 ± 0.06*	48
Diabetic + Methanol (100 mg/kg, p.o.)	240 ± 4.5	116 ± 1.35 **	51

Results are expressed as Mean ± SEM. Results of the test and standard groups are compared with the control group. *P<0.05, **P<0.01, ***P<0.001

In the group treated with methanol extract. Methanol extract showed 51% reduction (P<0.01) as compared to glibenclamide which showed 67% reduction in fasting blood sugar. **Table 2** summarizes the effect of the plant extracts on post prandial sugar level. There is no significant decrease in the glucose level in animals

without treatment. *A. indica* and glibenclamide treatment caused significant decrease in blood sugar level after 2 hours. Administration of streptozotocin caused rapid destruction of pancreatic ß cells in rats, which led to impaired glucose-stimulated insulin release and insulin resistance, both of which are marked feature of type II diabetes. The hypoglycaemic effect of plant extracts is generally dependent upon the degree of pancreatic ß cell destruction and useful in moderate streptozotocin induced diabetes. The lesser the degree of pancreatic ß cells destruction, the more useful the herb is in treating diabetes in animals.

TABLE 2: EFFECT OF *A. INDICA* PLANT EXTRACT ON POST PRANDIAL BLOOD SUGAR LEVEL OF DIABETIC RATS (n=6)

	Glucose tolerance test(before treatment)		Glucose tolerance test(after treatment)	
Group	**1 hr**	**2 hr**	**1 hr**	**2 hr**
Normal	120± 0.5	80± 0.7	140 ± 0.3	125 ± 0.7
Control	320± 1.2	223 ± 1.1	212 ± 0.6	200 ± 1.2
Standard	310 ± 0.8	185± 1.5	142± 0.3	122±1.6***
Pt ether	316± 0.12	212 ± 0.9	170 ± 0.8	151 ± 0.4*
chloroform	280± 0.4	209 ± 0.8	182 ± 1.1	149± 0.2*
methanol	305 ± 0.6	195 ± 1.6	152± 1.6	129± 0.3**
acetone	309 ± 0.5	209 ± 0.9	162 ± 1.5	134 ± 1*

Results are expressed as Mean ± SEM. Results of the test and standard groups are compared with the control group. *P<0.05, ** P<0.01, ***P<0.001.

CONCLUSION: Among all the extracts tested, methanol extract caused significant reduction in the serum blood glucose level as compared to glibenclamide. Methanol extract caused 51% reduction in FBS level in diabetic animals whereas glibenclamide caused 67% reduction in sugar level. Methanol extract also caused a significant (P<0.01) decrease in post prandial blood sugar level in diabetic animals.

Preliminary phytochemical screening revealed the presence of Alkaloids, Catachols, Flavonoids, Phenolic compounds, Saponins, Steroids. Estimation of insulin level and insulin receptor may give more insight into the mechanism of its antidiabetic action. There is ongoing research to isolate and characterize the bioactive compound(s) responsible for the antidiabetic activity of *A. indica***.**

REFERENCES:

1. Pathartha Guna Chinthamani': 179.
2. Ridley, 1924. Flora Malay Peninsula 3. 274.
3. Kirtikar KR and Basu BD (1999). In: Indian Medicinal Plant, vol. III, India. 2262-2263.
1. Hearse DJ, Cellular damage during myocardial ischemia: Metabolic changes leading to enzyme leakage, *In*: Enzymes in Cardiology, John Wiley and Sons, Chi chester, 1979, pp. 1-21.
4. Srinivasan K, Viswanad B, Asrat L and Kaul CL, Combination of high fat diet fed and low dose streptozotocin treated rats: A model for type II diabetes and pharmacological screening, *J Pharmacol Res*, 2005, **52**, 313-320.
5. Indian *Materia Medica* by Dr. K.M. Nadkarni, Volume I, pages: 17-19.
6. C. Chitravadivu, S. Manian and K. Kalaichelvi, Qualitative Analysis of Selected Medicinal Plants, Tamilnadu, India, Middle-East Journal of Scientific Research 4 (3): 144-146, 2009
7. M Aminuar Rahman, Sitesh C Bachar and Mohammed Rahmatullah, Analgesic and Anti-inflammatory activity of methanolic extract of *Acalypha indica* Linn, Pak. J. Pharm. Sci., Vol.23, No.3, July 2010, 256-258
8. B.Chengaiah, K.Mahesh Kumar, M. Alagusundaram, C. Sasikala, C. Madhusudhan Chetty, *In- vitro* antihelmintic activity of root of *Acalypha Indica* Linn, International Journal of PharmTech Research, Vol.1, No.4, pp 1499-1502, Oct-Dec 2009.
9. Lakshmi, S, Antibacterial potential of *Acalypha Indica* against human pathogens, International Journal of Current Research, Vol. 1, pp. 001-004, January, 2010.
10. Omar, R., Ali Rahman, Z., Latif, M.T., Lihan, T. and Adam J.H, In Vitro Antibacterial and antifungal properties of *Acalypha indica* (KUCING GALAK) Proceedings of the Regional Symposium on Environment and Natural Resources 10-11th April 2002 Vol 1: 503-508.
11. Renu Gupta, Bandana Thakur, Pushpendra Singh, H.B. Singh, V.D. Sharma, V.M. Katoch & S.V.S. Chauhan, Anti-tuberculosis activity of selected medicinal plants against multi-drug resistant Mycobacterium tuberculosis isolates, Indian J Med Res 131, June 2010, pp 809-813.
12. Beena Joy, Molly Mathew, Anti-oxidant studies and chemical investigation of ethanol extract of *Acalypha indica* Linn. Recent Progress in Medicinal Plants, Volume 27.
13. S. Sharma, T. Singh and R. Vijayvergia, Molluscidal activity of some medicinal plants, Journal of Herbal Medicine and Toxicology, 2009; 3 (2) 155-157.
14. Ernie H. Purwaningsih, Nurhadi Ibrahim, Hamdani Zain. Arjo Tedjo, Neuro-protection and neuro-therapy effects of *Acalypha indica* Linn. Water extract ex vivo on musclus gastrocnemius Frog, MAKARA, KESEHATAN, VOL. 12, NO. 2, December 2008: 70-75.
15. Hiremath SP, Rudresh K, Badami S, Patil SB, Patil SR, Post-coital antifertility activity of *Acalypha indica* L. JEthnopharmacol.1999 Nov 30, 67(3), 253-8.
16. K. Rajendran1, Annie Shirwaikar, Maneesh Mehta, R. Vijaya Bharathi, *In vitro* and *in vivo* anti-snake venom (Daboia russelli) studies on various leaf extracts of *Acalypha indica* Linn, International Journal of Phytomedicine 2010; 2: 217-220.
17. S. Kalimuthu, P. Rajesh, V. Rajesh Kannan, B. Balamurugan, T.M. Chandrasekar, Antiulcer activity of Methanolic extract of *Acalypha indica* Linn. (Euphorbiaceae) by Pylorous Ligture and Swim Stress Induced Ulceration, Journal of Pharmacy Research 2010, 3(11), 2779-2783.
18. Hiremath SP, Rudresh K, Badami S, Patil SB, Patil SR. Post-coital antifertility activity of *Acalypha indica* L. J Ethnopharmacol. 1999 Nov 30; 67 (3):253-8.
19. Chatterjee A and Prakashi S. The Treatise of Indian Medicinal Plants, Vol. I, Publication and Information Directorate, New Delhi, 1994, 41-42.
20. Portha B, Kerogoat M, Blondel O and Bailbe D, The rat models of NIDDM by neonatal streptozotocin, Diabet Met, 1989, 15, 61-75.

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