Chemistry Research Journal, 2017, 2(4):214-219

Available online www.chemrj.org

Research Article

ISSN: 2455-8990
CODEN(USA): CRJHA5

Hypoglycemic Effect of Polyherbal Formulation in Alloxan Induced Diabetic Rats

Navneet Sharma*, Anju Goyal

***Faculty of Pharmacy, Pacific Academy of Higher Education and Research University, Udaipur, Rajasthan, India**

Abstract Diabetes is a leading cause of morbidity and mortality in the world. There is currently an active search for antidiabetic drugs with greater effectiveness with fewer and less adverse side effects. Therefore, in present study the hypoglycemic potential of polyherbal formulation was investigated in alloxan induced diabetic rats. A list of medicinal plants with proven antidiabetic and related beneficial effects of herbal drugs used in treatment of diabetes is compiled. These include *Gymnema sylvestre, Syzygium cumini, Trigonella foenum- graecum, Azadirachta indica, Momordica charantia, Curcuma Longa, Piper Nigrum, Terminalia Bellirica, Swerita Chirayita and Paneer Pera.* The formulated polyherbal preparation was further examined for its glucose tolerance and antidiabetic activity in rats. Antidiabetic effect was analyzed in alloxan- induced diabetic rats of the polyherbal formulation. Glibenclamide was used as the standard drug. The percentage yield, phytochemical parameter of the polyherbal formulation was assessed. Polyherbal formulations in Alloxan induced diabetic rats showed significant decrease in blood glucose.

Keywords Diabetics, herbal, hypoglycemic

Introduction

Diabetes is a metabolic disorder characterized by chronically elevated blood glucose above the normal range. Hyperglycemia, or raised blood sugar, is a common effect of uncontrolled diabetes. Over 347 million people worldwide have diabetes [1]. In 2004, an estimated 3.4 million people died from consequences of high fasting blood sugar [2]. More than 80% of diabetes deaths occur in low- and middle-income countries [3]. WHO projects that diabetes will be the 7th leading cause of death in 2030 [4]. There are two types of diabetics. Diabetes mellitus (DM) is a group of metabolic diseases in which there are high blood sugar levels over a prolonged period. Symptoms of high blood sugar include frequent urination, increased thirst, and increased hunger. If left untreated, diabetes can cause many complications. Acute complications include diabetic ketoacidosis and nonketotic hyperosmolar coma. Serious long-term complications include cardiovascular disease, stroke, chronic kidney failure, foot ulcers, and damage to the eyes [5]. Diabetes insipidus (DI) is a condition characterized by excessive thirst and excretion of large amounts of severely dilute urine, with reduction of fluid intake having no effect on the concentration of the urine[6].There are Acute and chronic complications. Acute complication includes Diabetic ketoacidosis, Hyperglycemic Hyperosmolar Nonketotic Coma (HHNC), Diabetic neuropathy typically involves both the autonomic and peripheral nervous system, Skin and mucous membrane complications and coma. Chronic Complications includes Cardiovascular disease, Ocular Complications, Renal Complications, Nerve Damage, Vascular Disease, Heart Disease and Stroke, Amputations, Sexual Dysfunction and Diabetics Nephropathy. Insulin Deficiency Results into –Hyperglycemia, glucosuria and loss of large amount of water (osmotic diuresis). Depletion of glucagons in liver and tissues and Glycogen content of liver and skeletal muscle is reduced. All these

abnormalities are treated by the administration of insulin. Marketed insulins are quick acting Lispro (Humalog), short acting Regular (R), intermediate acting NPH (N) or Lente (L), long acting Ultralente (U) and NPH and Regular insulin mixture. Another alternative treatment of diabetes has been *β*-cells transplant.
The objective of present research work is to study the hypoglycemic potential of polyherbal formulation in alloxan induced diabetic rats.

Material and Method

This herbal medicine is polyherbal preparation in which 9 classic herbs have been combined in a powder form. All the ingredients of herbal medicine have been known in Indian traditional system of medicine for their antihyperglycemic potential. Also many of these possess antihyperlipidemic and antioxidant activity.

Table 1: Details of plants part selected for preparation of extracts

S. No.	Botanical Name	Common English Name	Hindi Name	Part Used
1	*Gymnema sylvestre*	Gymnema	Gurmar	Leaf
2	*Syzygium cumini*	Jamun	Jamun	Seed
3	*Trigonella foenum- graecum*	Fenugreek	Methi	Seed
4	*Azadirachta indica*	Neem	Neem	Leaf
5	*Momordica charantia*	Bittergourd	Karela	Fruit
6	*Curcuma Longa*	Turmeric	Haldi	Root
7	*Piper Nigrum*	White Pepper	Safed Mirch	Fruit
8	*Terminalia Bellirica*	Bellirica	Bahera	Skin, Fruit
9	*Swerita Chirayita*	Chirayita	Chirayita	Whole Plant

Gymnema sylvestre: Gymnemic acid prevents the binding of carbohydrates to the intestine receptors so that the glucose absorption by the intestines is inhibited and 'empty calories' are not stored. This action promotes weight loss. Gymnemic acid has antidiabetic properties, which reduce blood sugar considerably [7].

Syzygium cumini: The leaves and bark are used for controlling blood pressure and gingivitis [8].

Trigonella foenum- graecum: The saponin-rich extracts reduce cholesterol levels [9].

Azadirachta indica: Neem is considered a major component in Ayurvedic and Unani medicine and is particularly prescribed for skin diseases. Neem oil is also used for healthy hair, to improve liver function, detoxify the blood, and balance blood sugar levels [10].

Momordica charantia: Herbal medicine, bitter melon is used for tumors, wounds, rheumatism, malaria, vaginal discharge, inflammation, menstrual problems, diabetes, colic, fevers, worms. It is also used to induce abortions and as an aphrodisiac [11].

Curcuma Longa: Curcumin has been shown to exhibit antioxidant, anti-inflammatory, antiviral, antibacterial, antifungal, and anticancer activities and thus has a potential against various malignant diseases, diabetes, allergies, arthritis, Alzheimer's disease, and other chronic illnesses [12].

***Piper nigrum*:** Indian long pepper is used to improve appetite and digestion, as well as treat stomach ache, heartburn, indigestion, intestinal gas, diarrhea, and cholera, diabetics [13].

Terminalia bellerica: *Terminalia bellerica* is one of the three key ingredients of Triphala, a natural compound that provides overall support for digestive function and helps ensure that the digestive tract works at an optimal level [14].

Swerita Chirayita: Chiretta is helpful in treating gastrointestinal ailments, like food poisoning, diarrhea and gastroenteritis. The bitter constituents of the herb work together to lower blood sugar [15].

Diabetic mellitus is now a days most common disease that is seen in most of the human beings. Oral preparations as well as parentral preparations are available but some side effects will be there with it. To avoid all the side effect polyherbal preparations are available and research is still going on for enhancing the use of poly herbal preparation to which almost all the human beings are compatible and safe.

Alcohol soluble extractive, water soluble extractive, benzene soluble extractive, petroleum ether extractive, Hydro-alcohol extractive, loss on drying, ash value, acid insoluble ash, water soluble ash, Hydro-alcoholic extraction, Preliminary phytochemical investigation of extracts was determined. .

Toxicity Test

Acute Oral Toxicity- Acute Toxic Class Method

The principle is based on a stepwise procedure with the use of a minimum number of animals per step to obtain sufficient information on the acute toxicity of the test substance to enable its classification. The substance is evaluated using a stepwise procedure, each step using three animals of either sex. Absence or presence of compound related mortality of the animals will determine the next step of:

- No further testing is required
- Dosing of three additional animal with the same dose
- Dosing of 3 animal at the next higher or the next lower dose level.

Description of the Method

1) **Selection of animal species**
   Healthy young albino rats (18921/PO/a/12/CPCSEA) of either sex weighing 175-225g (2 to 3 months of age) were used for acute toxicity study to determine LD_{50} of hydroalcoholic extract of plant powder.
2) **Preparation of Animals**
   The animal were randomly selected, marked to permit individual identification and kept in polypropylene cages for one week prior to dosing to allow acclimatization of them to laboratory conditions.
3) **Preparation of doses**
   All the extracts were prepared as a suspension by triturating with water and 1% carboxy methyl cellulose.
4) **Administration of doses**
   The test substances are administered in a single dose by gauge using a stomach tube. Prior to dosing, animals were kept for 12 h of fasting. Then animals were weighed and test substance was administered. After the dose was administered food was withheld for a further 3-4 h.
5) **Number of animals and dose levels**
   In each step three animals were used in each group. Study was begun at 2000 mg/kg body weight. The procedure of dose selection and finalizing LD_{50} cut off values is as, $1/5^{th}$ and $1/10^{th}$ of this lethal dose were taken as effective dose (therapeutic dose) for subsequent anti- diabetic activity.

Results and Discussion

Moisture and volatile content were found to be less than 10% w/w indicating that individual plant material has been properly dried.

Extractive values were determined by maceration process using non-polar solvent petroleum ether (40-60 ºC), benzene and polar solvent ethanol and water. The extractive values of plant powder have been found to be 13.82 to 19.17 % w/w with polar solvents ethanol and water and 12.30 % w/w to 11.26 % w/w with non polar solvent benzene and petroleum ether (40-60 ºC).

Table 2: Phytochemical parameters for formulation

S. No.	Parameter	Result
1.	**Extractive Value**	
	Alcohol	15.44%
	Aqueous	13.82%
	Benzene	12.30%
	Petroleum Ether	11.26%
	Hydro Alcoholic	19.17%

2.	**Loss on drying**	11%
3.	**Ash values**	
	Total ash	12%
	Acid insoluble ash	3%
	Water soluble ash	1%
4.	**Percentage Yield Using Different Solvent**	
	Aqueous	11.75%
	Alcohol	14.70%
	Benzene	10.50%
	Petroleum ether	08.45%
	Hydro Alcoholic	19.75%
5.	**Total Flavonoid**	
	Aqueous	125.84 ± 2.88
	Alcohol	132.01 ± 1.74
	Benzene	105.17 ± 3.42
	Petroleum ether	96.28 ± 2.47
	Hydro Alcoholic	168.5 ± 2.75

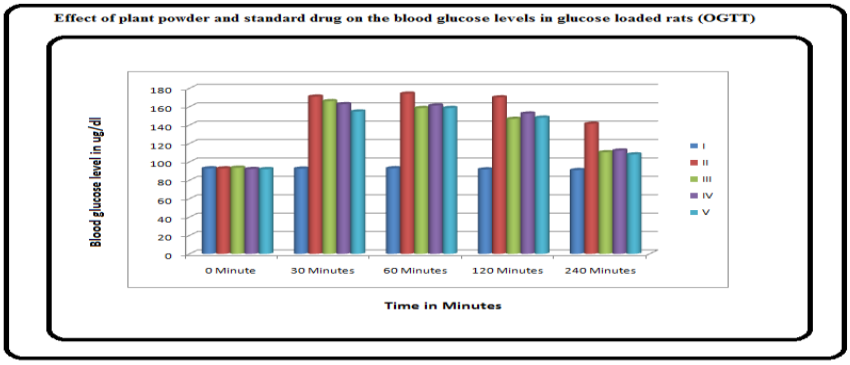

Figure 1: Effect of plant powder and standard drug on the blood glucose levels in glucose loaded rats (OGTT)

Group I - Only vehicle treated
Group II Control only glucose (2000 mg/kg) treated
Group III- Glucose + Gilbenclamide 2.5 mg/kg
Group IV- Glucose+ Extract low dose 200 mg/kg
Group V- Glucose+ Extract- high dose 400 mg/kg

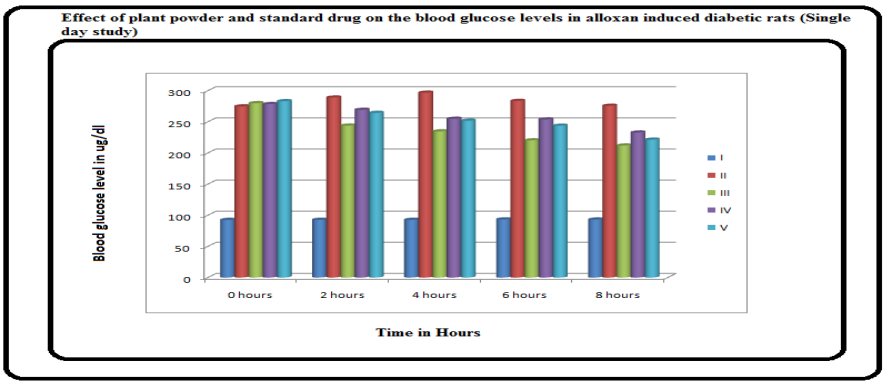

Figure 2: Effect of plant powder and standard drug on the blood glucose levels in alloxan induced diabetic rats (Single day study)

Group I- Only vehicle treated
Group II- Control only alloxan (60 mg/kg) treated
Group III- Alloxan+ Gilbenclamide 2.5 mg/kg
Group IV- Alloxan+ Extract low dose 200 mg/kg
Group V- Alloxan+ Extract- high dose 400 mg/kg

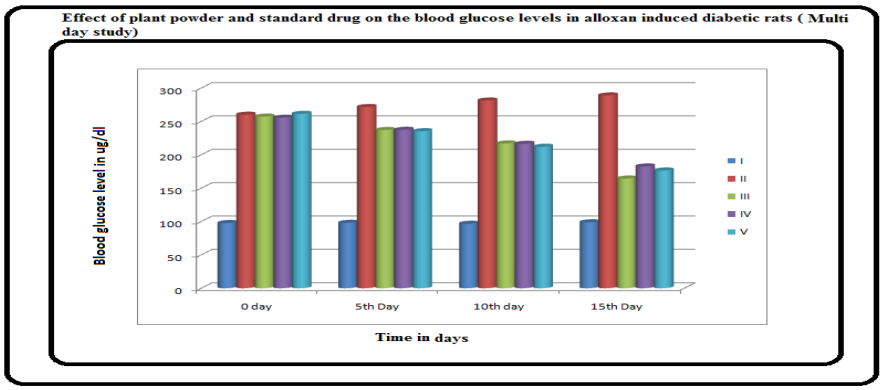

Figure 3: Effect of plant powder and standard drug on the blood glucose levels in alloxan induced diabetic rats (Multi day study)

Group I- Only vehicle treated
Group II- Control only alloxan (60 mg/kg) treated
Group III- Alloxan + Gilbenclamide 2.5 mg/kg
Group IV- Alloxan+ Extract low dose 200 mg/kg
Group V- Alloxan+ Extract- high dose 400 mg/kg

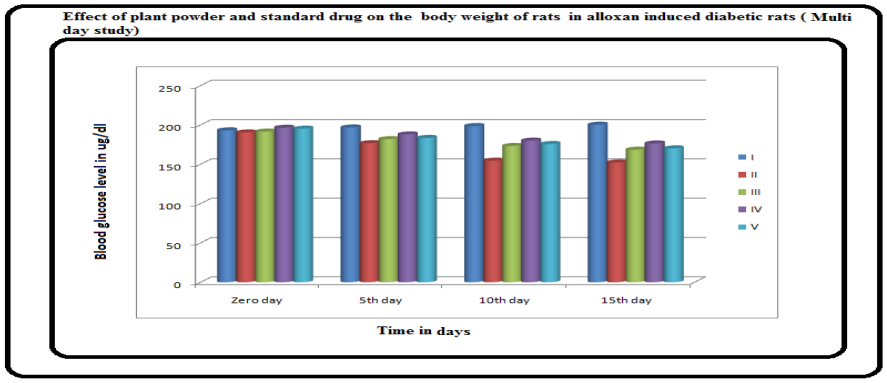

Fig. 4: Effect of plant powder and standard drug on body weight in alloxan induced diabetic rats (Multi day study)

Group I- Only vehicle treated
Group II- Control only alloxan (60 mg/kg) treated
Group III- Alloxan+ Gilbenclamide 2.5 mg/kg
Group IV- Alloxan+ Extract low dose 200 mg/kg
Group V- Alloxan+ Extract- high dose 400 mg/kg

Conclusion

All the plants discussed in the research exhibit significant clinical and pharmacological activity. The potency of herbal drugs is significant and they have negligible side effects than the synthetic anti diabetic drugs. In this research

article an attempt has been made to focus on estimation of hypoglycemic activity of plants and maybe useful to the health professionals, scientists and scholars working in the field of pharmacology and therapeutics to develop evidence based alternative medicine to cure different kinds of diabetes in man and animals. Isolation and identification of active constituents from the plants, preparation of standardized dose and dosage regimen can play a significant role in improving the hypoglycemic action.

References

1. Danaei, G., Finucane, M. M., Lu, Y., Singh, G. M., Cowan, M. J., Paciorek, C. J., *et al*. (2011). National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2· 7 million participants. *The Lancet*, *378*(9785), 31-40
2. Global health risks. Mortality and burden of disease attributable to selected major risks Geneva, World Health Organization (2009). 947-948.
3. Mathers, C. D., & Loncar, D. (2006). Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Medicine*, *3*(11), e442.
4. World Health Organization. (2011). *Global Status Report on Noncommunicable Diseases 2010*. Geneva: World Health Organization.
5. *Kitabchi, A.E., Umpierrez, G.E., Miles, J.M., Fisher, J.N. (2009).* "Hyperglycemic Crises in Adult Patients with Diabetes.". *Diabetes Care 32*(7), 1335–1343.
6. Saborio, P., Tipton, G. A., & Chan, J. C. (2000). Diabetes insipidus. *Pediatrics in Review*, *21*(4), 122-129.
7. Manohar, S. H., Naik, P. M., Praveen, N., & Murthy, H. N. (2009). Distribution of gymnemic acid in various organs of *Gymnema sylvestre*. *Journal of Forestry Research*, *20*(3), 268-270.
8. Swami, S. B., Thakor, N. S. J., Patil, M. M., & Haldankar, P. M. (2012). Jamun (*Syzygium cumini* (L.)): A review of its food and medicinal uses. *Food and Nutrition Sciences*, *3*(8), 1100.
9. Yadav, U. C., & Baquer, N. Z. (2014). Pharmacological effects of *Trigonella foenum-graecum* L. in health and disease. *Pharmaceutical Biology*, *52*(2), 243-254.
10. Subbarayappa, B. V. (1997). Siddha medicine: an overview. *The Lancet*, *350*(9094), 1841-1844.
11. Wu, S. J., & Ng, L. T. (2008). Antioxidant and free radical scavenging activities of wild bitter melon (Momordica charantia Linn. var. abbreviata Ser.) in Taiwan. *LWT-Food Science and Technology*, *41*(2), 323-330.
12. Gupta, A., Mahajan, S., & Sharma, R. (2015). Evaluation of antimicrobial activity of Curcuma longa rhizome extract against Staphylococcus aureus. *Biotechnology Reports*, *6*, 51-55.
13. Gülçin, İ. (2005). The antioxidant and radical scavenging activities of black pepper (Piper nigrum) seeds. *International Journal of Food Sciences and Nutrition*, *56*(7), 491-499.
14. Ahmad, I., Mehmood, Z., & Mohammad, F. (1998). Screening of some Indian medicinal plants for their antimicrobial properties. *Journal of Ethnopharmacology*, *62*(2), 183-193.
15. Kumar, V., & Van Staden, J. (2015). A review of *Swertia chirayita* (Gentianaceae) as a traditional medicinal plant. *Frontiers in Pharmacology*, *6*, 308.