



The Effect of *Hydnocarpus Laurifolia* Seeds Extract on Blood Glucose in Streptozotocin-Induced Diabetic Rats

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ABSTRACT

As a result of issues with insulin secretion, diabetes mellitus is a metabolic condition that is characterized by hyperglycemia. Diabetes-related chronic hyperglycemia is linked to long-term damage to several human systems, including the kidneys, nerves, bones, eyes, and cardiovascular system, as well as eventual organ failure. Because of their expensive price and extra hazardous side effects, present medications have not been able to provide an acceptable treatment for diabetes mellitus as of yet. So, it is necessary to look for alternate medications for the treatment of diabetes mellitus. Indian medical system uses a number of medicinal plants and their preparations to treat diabetes mellitus. Many investigations, including both scientific and therapeutic trials, have been published in its favour. The therapeutic efficacy of plant-based diabetes treatment is now being taken into account by pharmaceutical businesses and scientific organizations. Many ethnopharmacological techniques mention numerous herbs with anti-diabetic properties. It has been supported by articles that include both clinical and experimental trials. The goal of the current study is to assess the anti-diabetic effects of *Hydnocarpus laurifolia* seeds against STZ-induced diabetics. The body weight and blood glucose level of the seed extract was found to be significantly lower and comparable to that of a standard anti-diabetic medicine (Metformin). In the current study, albino wistar rats were used as test subjects to evaluate the anti-diabetic activities of a methanolic seeds extract of *Hydnocarpus laurifolia*.

Keywords: Diabetic, Anti-diabetic, Streptozotocin, *Hydnocarpus laurifolia* etc.

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INTRODUCTION

Diabetes Mellitus (DM) is an endocrine illness characterized by diminished insulin secretion, damaged pancreatic beta-cells, altered glucose, lipid, and protein metabolism, as well as a higher risk of vascular disease consequences. Although the amount of insulin secreted by the beta cells is normal or slightly below optimal levels, the body's cells do not react to insulin as they would in a healthy person [1]. Globally, the number of diabetic patients has significantly increased as a result of the ageing population, calorie-rich diet intake, sedentary lifestyle, obesity, and stress. Although the current course of treatment offers effective glycemic control, it also has a number of negative consequences. We must therefore search the world of herbs for a brand-new, more potent medication. The search for indigenous antidiabetic agents still continues despite significant advancements in the management of diabetes mellitus with insulin therapy,

oral hypoglycemic agents, a restricted diet, and exercise, either alone or in combination. This is because there have been reports of remarkably positive outcomes with traditional medicine [2].

Hydnocarpus laurifolia is also known as *Hydnocarpus pentandra* (Buch-Ham) Oken, *Hydnocarpus wightiana* Blume, Chaulmoogra, and Tugaraka. *Hydnocarpus* is a member of the Flacourtiaceae family and is widely cultivated in Southeast Asia, primarily in China, Indonesia, Taiwan, Thailand, and Malaysia. It is also found in a variety of tropical forests of the Ghats, as well as along the coasts of Maharashtra to Kerala, Assam, Tripura, and Sri Lanka. Seed of *Hydnocarpus laurifolia* contain a variety of therapeutically useful phytoconstituents, including triterpenoids, aglycones, flavones, glycosides, and a wide range of fatty acids and esters, the seeds of *Hydnocarpus laurifolia* have a high medicinal potential. Flavonolignan-related substances found in seed extracts include hydnocarpin, hydnowightin, neohydnocarpin, luteolin, and isohydnocarpin [3,4]. Chaulmoogric, hydnocarpic, goric, lignoceric, palmitic, oleic, and stearic acids have all been discovered in the seed oil. Certain fatty acids include. The largest concentrations of hydnocarpic and chaulmoogric are found [5,6]. Flavonolignans such as neohydnocarpin, hydnocarpin, and hydnowightin have also been discovered in the seeds of this plant. Triterpenes and the acids acetylbutulnic, butulnic, ursolic, and acetylursolic are said to be present in the stem bark and leaves [7,8].

In the current investigation, diabetic rats induced by Streptozotocin (STZ) were used to assess the therapeutic anti-diabetic efficacy of *Hydnocarpus laurifolia* seed extract. *Hydnocarpus laurifolia* seed extract (100, 200, and 400 mg/kg) was administered orally once daily for 21 days after Streptozotocin. *Hydnocarpus laurifolia* seed extract's effects were compared against the effects of Metformin, which one use for standard.

MATERIAL AND METHODS

Seeds collection

Hydnocarpus laurifolia seeds were purchased from a local market nearby in Dhule, Maharashtra, and were authenticated by Dr. D.A.Dhale (Professor, PG and Research Department of Botany, SSVPS's L.K. Dr.P.R.Ghogrey Science College, Dhule). The seeds were collected, cleaned to remove all dirt, then dried for about four to five days. The seeds weighed about 4 kg. After that the seeds dried, the hulls were taken off and crushed up. The seeds are powdered using an electric grinder. The acquired powder is sieved and dried once more to produce the fine powder.

Extraction methodology [9]

The *Hydnocarpus laurifolia* seeds were extracted using the Soxhlet technique in petroleum ether (60–80°C) and methanol. To achieve thick sticky extract, the extracts were finally evaporated and dried to use a vacuum and tray dryer.

Animals

Healthy adult swiss albino wistar rats of either sex weighing between 160 to 180 gm were used for acute toxicity study and hepatoprotective activity.

Toxicity study: (OECD 423). [10]

According to Organization for Economic Cooperation and Development recommendations No. 423, an acute toxicity study was conducted. Six groups of six albino wistar rats, one of each sex, were created. Rats received single oral doses of seed extract at various dose levels of 50, 250, 500, 1000, 1500, and 2000 mg/kg b.w. Animals were individually observed for the first 30 minutes, then occasionally over the next 24 hours, paying extra close attention to the first four hours and then every day after that for a total of 14 days.

Experimental procedure.

Induction of Experimental Diabetes:[11,12]

An intraperitoneal injection of 60 mg/kg of streptozotocin (STZ) dissolved in 50 mM citrate buffer causes diabetes, and a control animal administered an identical volume of solution in the same ways.

Experimental Procedure: [13,14,15]

Wistar Rats were divided into six groups, each consisting of six animals. The seed extract of *Hydnocarpus laurifolia* was dissolved in water and administered orally. Saline solution and metformin at 500mg/kg were administered orally. Rats were divided into following groups.

Group 1 – Normal

Group 2 - Diabetic treated. (Streptozotocin 60 mg/kg)

Group 3 - Diabetic treated with 500mg/kg of metformin

Group 4 - Diabetic treated with 100mg/Kg *Hydnocarpus laurifolia* seed extract for 21 days.

Group 5 - Diabetic treated with 200mg/Kg *Hydnocarpus laurifolia* seed extract for 21 days.

Group 6 - Diabetic treated with 400mg/Kg *Hydnocarpus laurifolia* seed extract for 21 days

Statistical analysis

The data represent mean S.E.M. Result were statistically by one-way ANOVA followed by dunnet's test. The minimum level of significance was set at $p < 0.005$.

RESULTS

Body weight: Weight loss is an indication of diabetes, and this study found it to be true. When streptozotocin was administered to rats, their body weight was significantly reduced. When compared to the normal group, this reduction was shown to be statistically significant ($P < 0.05$). In comparison to the corresponding diabetes control group, these lowered body weights were found to rise, and this increase was confirmed to be statistically significant in rats treated with *Hydnocarpus laurifolia* seed extract ($p < 0.05$) and metformin ($p < 0.001$) (Tab. 1).

Table 1. Body weight

Effect of *Hydnocarpus laurifolia* seed extract on body weight in Streptozotocin induced diabetic rat.

Group	Body weight (gm)			
	Initial	7 th day	14 th day	21 th day
Normal	188±9.78	190±9.26*	192±8.67*	195±8.67*
Diabetic treated (Streptozotocin 60mg/kg)	214±10.56	210±11.76**	202±10.4**	194±9.34**
STD (Metformin 500mg/kg) + Diabetic treated	197±9.2	193±10.4*	189±8.7*	194±9.78*
100mg/Kg <i>Hydnocarpus laurifolia</i> seed extract + Diabetic treated	201±7.54	198±8.54*	193±9.65*	191±9.3*
200mg/Kg <i>Hydnocarpus laurifolia</i> seed extract + Diabetic treated	199±9.7	192±9.6*	188±8.5**	194±8.65*
400mg/Kg <i>Hydnocarpus laurifolia</i> seed extract + Diabetic treated	198±8.98	197±8.26**	192±9.78**	195±8.56**

Values are expressed as mean±S.E.M. (n=6)

* $P < 0.05$, ** $P < 0.01$, when compared with the Streptozotocin treated group

Blood glucose level: Blood glucose levels rise as a result of streptozotocin selective death of pancreatic islet cells. According to the results of the current study, albino rats exposed to streptozotocin at a level of 60 mg/kg body weight indicate a strong diabetogenic response. On the 7th, 14th, 21th day blood sample collected and check blood glucose level, blood glucose levels in diabetic control rats treated with *Hydnocarpus laurifolia* seed extract and metformin were about three times higher than those of the rats in their respective normal control group. It's interesting to notice that the rise in blood glucose levels in the control groups of diabetics was found to be it to be very statistically significant ($p < 0.05$). In comparison to the respective normal control groups. After oral feeding of *Hydnocarpus laurifolia* seed extract and metformin, these raised blood glucose levels in diabetic rats were reduced. When diabetic and drug-treated animals were compared, when compared to the corresponding diabetic control group, this reduction in blood glucose levels in the drug-treated groups was found to be highly statistically significant ($p < 0.01$). (Tab. 2).

Table 2. Blood glucose level Effect of *Hydnocarpus laurifolia* seed extract on Blood glucose level in Streptozotocin induced diabetic rat.

Group	Blood glucose level (mg/dl)			
	Initial	7 th day	14 th day	21 th day
Normal	119±20.23	121±21.7*	118±19.45*	120±18.14*
Diabetic treated (Streptozotocin 60mg/kg)	679±45.47	689±46.89*	690±45.16**	692±46.98**
STD (metformin 500mg/kg) + Diabetic treated	650±40.21	525±41.2*	460±39.56**	300±35.56**
100mg/Kg <i>Hydnocarpus laurifolia</i> seed extract + Diabetic treated	655±39.30	570±30.34*	512±33.54**	476±30.2**
200mg/Kg <i>Hydnocarpus laurifolia</i> seed extract + Diabetic treated	674±37.56	567±28.32*	501±24.45**	440±25.58**
400mg/Kg <i>Hydnocarpus laurifolia</i> seed extract + Diabetic treated	660±38.98	548±35.98*	498±21.98**	390±20.98**

Values are expressed as mean±S.E.M. (n=6)

*P<0.05, **P<0.01, when compared with the Paracetamol treated group (one-way ANOVA followed by Dunnett test)

DISCUSSION

Streptozotocin has been commonly used to produce diabetes mellitus in animals. It is well known for its selective pancreatic islet-cell cytotoxicity. It disrupts cellular metabolic and oxidative processes [16]. Streptozotocin (60 mg/kg) administered intraperitoneally efficiently caused diabetes in normal rats as shown by body weight loss, glycosuria, hyperglycemia, polyphagia and polydipsia. There have been discoveries of chaulmoogric, hydnocarpic, gorlic, lignoceric, palmitic, oleic, and stearic acids in *Hydnocarpus laurifolia* seed oil. This species' seeds have also been shown to contain flavonolignans, such as hydnocarpin and neohydnocarpin, which may be the reason of their antidiabetic effects [5]. In our present study we have found that standard drug Metformin and *Hydnocarpus laurifolia* seed extract can inverse these effects. The possible mechanism of study plant about its antidiabetic action may be by potentiation of pancreatic secretion of insulin from β -cell of islets or due to improved transport of blood glucose to peripheral tissue [17]. This was clearly showed by the increased level of insulin due to decrease hepatic glucose production and decreases intestinal absorption in diabetic rats treated with standard drug metformin and *Hydnocarpus laurifolia* seed extract. Animals given a dose of streptozotocin also received a seed extract from *Hydnocarpus laurifolia*, which stopped the weight loss. The antihyperglycemic function of *Hydnocarpus laurifolia* seed extract appears to be responsible for its capacity to regain body weight loss. The most significant results of the current study are that, in streptozotocin-induced diabetic rats, a 400 mg/kg body weight dose of a seed extract from *Hydnocarpus laurifolia* for 21 days had a positive effect on body weight as well as blood glucose levels.

Results obtained from the present study are very much positive and similar with metformin, a standard drug used to treat diabetes mellitus. Similar to our observations.

CONCLUSION

Based on the above results, it can be concluded that the active principles present in *Hydnocarpus laurifolia* seed extract for better antidiabetic activity as compared to the Streptozotocin induced diabetic effect. However, more elaborate work is required to establish the efficacy of seed extract by isolating and identifying the active constituents present in the seed extracts which are responsible for the antidiabetic effect.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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