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Research Paper

Comparative Evaluation of Nigella Sativa Against Antidiabetic And Antioxidant Properties

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ABSTRACT
AIM AND OBJECTIVE
Aim: *Comparative Evaluation of Nigella Sativa Against Antidiabetic And Antioxidant Properties.*
Objective*:1. Collection and Authentication of plants 2. To study the Antidiabetic and Antioxidant Properties of the methanolic extract of Nigella Sativa seeds. 3. To develop alloxan-induced diabetes in a rodent model.4. To compare the pharmacological actions with standard drug.*
Material and Methods*: Rats (200-250 gm) were randomly divided into five groups with each group having 6 animals and received the following treatment. Drug (Nigella sativa extract).induction group on which administrated alloxan monohydrate administration at 150 mg/kg through the intraperitoneal route. standard group administered Glibenclamide at 10 mg/kg through oral route daily for 14 days. standard group administered Glibenclamide at 10 mg/kg through oral route daily for 14 days.*
Conclusion*: The experimental results suggest that the plant methanolic extract of Nigella sativa is antidiabetic and antioxidant activity. The different active components are found in Nigella sativa, which may be responsible for the actual antidiabetic. The present investigation indicates that methanolic extract of Nigella sativa exert significant protection against alloxan-induced diabetes.*
Keywords*: Nigella Sativa, Anti-diabetic activity, Glibenclamide*

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I. INTRODUCTION

Pancreas

The anatomy of pancreas

The pancreas is an elongated organ, light tan or pinkish in color, it extended retroperitoneally across the posterior abdominal wall from the second part of the duodenum to the spleen. The right side of the organ (called the head) is encircled by the duodenum, the tapered left side extends slightly upward (called the body of the pancreas) which forms the main bulk of the organ, ends in the tail that lies in contact with the spleen [1]

Pancreas histological structure

The pancreas consists of exocrine and endocrine cells making upto 98% of the human pancreas. The pancreas acinar cells are grouped into lobules forming the ductal system which eventually joins into the main pancreatic duct. The main pancreatic duct itself usually joins the common bile duct to enter the duodenum as a short single duct at the ampulla of cater [2].

Insulin

Pancreatic cells from exocrine and endocrine pancreas are also interrelated given that they lack basal membranes. Peri-insular acini possess larger number of zymogen granules than acini removed from islets. The presence of insulin nearby also impacts the morphology of peri-insular acini. circulation while it has a preventive effect on the body against developing the metabolic disease diabetes mellitus, due to inhibition of hepatic gluconeogenesis [3]

Secretion

Beta cells produce insulin in two phases; the first is a rapid, triggered phase and the second phase is slow release. The rapid triggered phase occurs in reaction to different types of factors such as glucose, glucagon-like peptide-1 (GLP-1), glucose independent insulinotropic peptide (GIP), adrenaline via 2 receptors, and arginine, leucine, acetylcholine and chole-cyctokinin (CCK) [4]The converted form of glucose, glucose-6- phosphate, enters

glycolysis, in which it forms pyruvate, which then enters the pathway for ATP generation in mitochondria via the citric acid cycle[5]

II. MATERIAL AND METHOD

1. Material

1.1 Plant selected : In the present study, Nigella sativa seeds was selected because of its traditional uses. Seeds of Nigella sativa was bought from a traditional herbal shop.

1.2 Drugs protocol: Glibenclamide was purchased from apex medical store, Nagpur and Alloxan monohydrate (Sigma Chemicals, USA) 6.1.3. Experimental Animals and IAEC approval The animals were used as healthy male Wistar rats (200-250 g) were obtained Kusum life science A 3, MIDC, Wasmat, Hingoli.

1.3 Instrument: Auto-analyzer, U-V spectrophotometer, Centrifuge, Digital weighing balance, volumetric flask, mortar, Grinding mill, Glucometer, Micro centrifuge, Rotary evaporator, Oven.

2. Methods

2.1 Collection and authentication of Nigella sativa: Seeds of Nigella sativa was bought from a traditional herbal shop from a designated location and identified by a botanist. Firstly, Nigella sativa seeds were thoroughly washed and dried in sunlight for few days. Afterwards, the dried seeds were crushed into powder pulverized in electric grinder and the powder was passed through sieve No.60 and used for further extraction [6]

2.2 Experimental protocol: The treatments were administered to rats, 1 day ahead of alloxan monohydrate administration and daily treatment continued for 14 days. The experimental design and exposure protocol are shown in Table 1[7].

Table 1: Experimental animal group

Sr. No	Animal Groups	Treatment
1.	**Control**	Received tween 80 by p.o for 14 days
2.	**Diabetic Group**	Alloxan monohydrate 150 mg/kg intraperitoneally (I.P) for14 days.
3.	**Standard**	Treatment of glibenclamide at 10 mg/kg p.o daily for 14 days.
4.	**NSS 400 mg/kg**	Treatment of 400 mg/kg NSS extract p.o for 14 days
5.	**NSS 800 mg/kg**	Treatment of 800 mg/kg NSS extract p.o for 14 days
6.	**NSS 1200 mg/kg**	Treatment of 1200 mg/kg NSS extract p.o for 14 days

III. RESULTS

1. Qualitative screening of phytochemicals from different extracts of N. sativa seeds

The phytochemical screening was achieved through biochemical testing on different methanolic extracts of N. sativa seeds to detect the presence of major natural or medicinally active components. This qualitative screening test showed different results in different extracts of N. sativa seeds as shown in Table 2. A significant indication about the presence of alkaloids, steroids, Cardiac glycosides, terpenoids, flavonoids, phenols, and tannins were shown in the methanolic extracts of N. sativa seeds. whereas saponins were absent in the following extract.[8]

The results of the present study showed that N. sativa seeds are great reservoirs of medicinally active ingredients (phytochemicals) and they are consistent with earlier phytochemical screening studies done on different solvent extracts and oil of N. sativa seeds which also reported that N. sativa seeds extracts are rich in the above-mentioned phytoconstituents. Bioactive constituents such as alkaloids, flavonoids, phenols, tannins and terpenoids are known to increase the antioxidant in responses against oxidative stress.

Table 2: Phytochemical constituent of Nigella sativa extract

Secondary metabolite	Test results
Alkaloids	+
Flavonoids	+
Phenols	+
Tannins	+
Cardiac glycosides	+
Steroids	+
Saponins	-
Terpenoids	+

+: Present, -: Absent

2. Effect of methanolic extract of N. sativa on body weight of Alloxan monohydrate induced diabetic rats.

This work aimed to clarify the anti-diabetic properties of the methanolic extract (NSS) from N. sativa seeds, which demonstrated anti-hyperglycemic properties. Prior to the administration of NSS and Glibenclamide supplements, the rats' baseline body weights did not differ significantly. After 14 days of research, the rats treated with NSS (800 mg/kg and 1200 mg/kg) and Glibenclamide (10 mg/kg) had a significantly higher body weight than the diabetic groups. Prior to treatment, all groups' fasting glucose levels were much higher ($P \leq 0.001$) than those of the normal group. After the seventh day, the NSS-treated groups exhibited a dose-dependent decrease in fasting glucose compared to the diabetic group ($P \leq 0.001$).[9]

Following a 14-day NSS supplementation period, the insulin levels of the diabetic rats significantly increased in a dose-dependent manner when compared to the diabetic control group ($P \leq 0.001$, Table 4). 800 mg/kg and 1200 mg/kg body weight were determined to be the most efficient in lowering fasting glucose levels based on the results of the dosage fixation experiments.

Table No.3: Effect of Methanolic extract of N. sativa on body weight of Alloxan monohydrate induced diabetic rats

Animal groups	1st Day	7th Day	14th Day
Control	240 ±5. 6	258 ±4. 9	274 ±6. 2
Diabetic Group	245 ±5. 2	215 ±3. 6	180 ±6. 5
Standard	232 ±2. 5	250 ±3. 0***	270 ±4. 2
NSS 400 mg/kg	242 ±8. 2	230 ±7. 6	212 ±6. 5
NSS 800 mg/kg	235 ±3. 2	239 ±2. 8*	256 ±3. 5**
NSS 1200 mg/kg	238 ±4. 5	248 ±3. 6**	268 ±4. 3***

3. The impact of N. sativa methanolic extract on blood glucose levels during fasting

All of the groups' fasting blood glucose levels have initially increased significantly as a result of the diabetes induction, as Table illustrates. When compared to the normal control group, the diabetes control group exhibits a significant rise during the course of the study ($p<0.001$). On the fourteenth day of the experiment, the extract treated groups and the standard treatment group showed a substantial drop in fasting blood glucose levels as compared to the diabetic control group ($p<0.001$). As seen in Table 5, the impact is more noticeable in the standard (10 mg/kg) group, methanolic extract (800 mg/kg), and methanol (1200 mg/kg) groups.

Table No.4: Effect of N. sativa extract on fasting blood glucose levels

Animal Groups	1st Day	7th Day	14th Day
Control	84.01 ±4. 64	88.21 ±5. 58	80.29 ±6. 53
Diabetic Group	334.77 ±6. 50	356 ±8. 20	374 ±7. 20
Standard	90.9 ±8. 50	92.25 ± 9. 50	86.4 ±5. 60
NSS 400 mg/kg	215.15 ±8. 5	185±9. 2	160 ±10. 5
NSS 800 mg/kg	115.25 ±7. 40	104.15 ±8. 60*	98.28 ±9. 50**
NSS 1200 mg/kg	98.56 ±6. 20*	98 ±9. 50**	91.55 ±8. 40**

4. Methanolic Plant Extract's Impact on Alloxan-Induced Diabetic Rats' Renal Profile

The blood urea and serum creatinine were among the test values. The results showed that higher levels of blood urea and serum creatinine were seen in the diabetic group, which received glibenclamide at a dose of 10 mg/kg p.o., indicating renal impairment. Serum creatinine and blood urea levels were lower in the N. sativa 400 mg/kg, 800 mg/kg, and 1200 mg/kg groups that were given the methanolic extracts of the seeds orally as opposed to the diabetic group.

Table No. 5: Methanolic Plant Extract's Effect on the Renal Profile in Rats With Alloxan-Induced Diabetes.

Animal Groups	Serum Creatinine (mg/dl)	Blood Urea (mg/dl)
Control	1.25	26.18
Diabetic Group	2.18	49.61
Standard	1.32	29.89
NSS 400 mg/kg	1.92	42.25

NSS 800 mg/kg	1.48	37.15
NSS 1200 mg/kg	1.40	33.20

5. Histopathological study

Hepatocytes from the normal control group displayed a normal hepatic cellular architecture in histological analyses. Rats given a toxicant showed severe centrilobular necrosis and vacuolization in their liver sections. The livers of the groups treated with alloxan displayed a loss of normal architecture with the presence of regenerating nodules divided by prominent fibrous septa extending from the central vein, whereas the livers of the normal control group displayed normal liver architecture with normal hepatocytes and portal lobules.

Rats given 10 mg/kg p.o. of glibenclamide and alloxan showed nearly normal liver tissue in the liver segment compared to the standard group. Rat liver sections treated with 400 mg/kg bw of Nigella sativa methanolic extract and alloxan displayed aberrant portal tract morphology, with significant levels of inflammatory cells surrounding the central vein and no necrosis (NSS 400 mg/kg). Rat liver sections treated with 800 mg/kg bw of Nigella sativa methanolic extract and alloxan showed no necrosis NSS 800 mg/kg and fewer inflammatory cells surrounding the major vein. Rat liver sections treated with alloxan and 1200 mg/kg bw of Nigella sativa methanolic extract displayed almost normal liver architecture, with low inflammatory cellular infiltration. Hepatocyte regeneration surrounding the major vein was also noted.

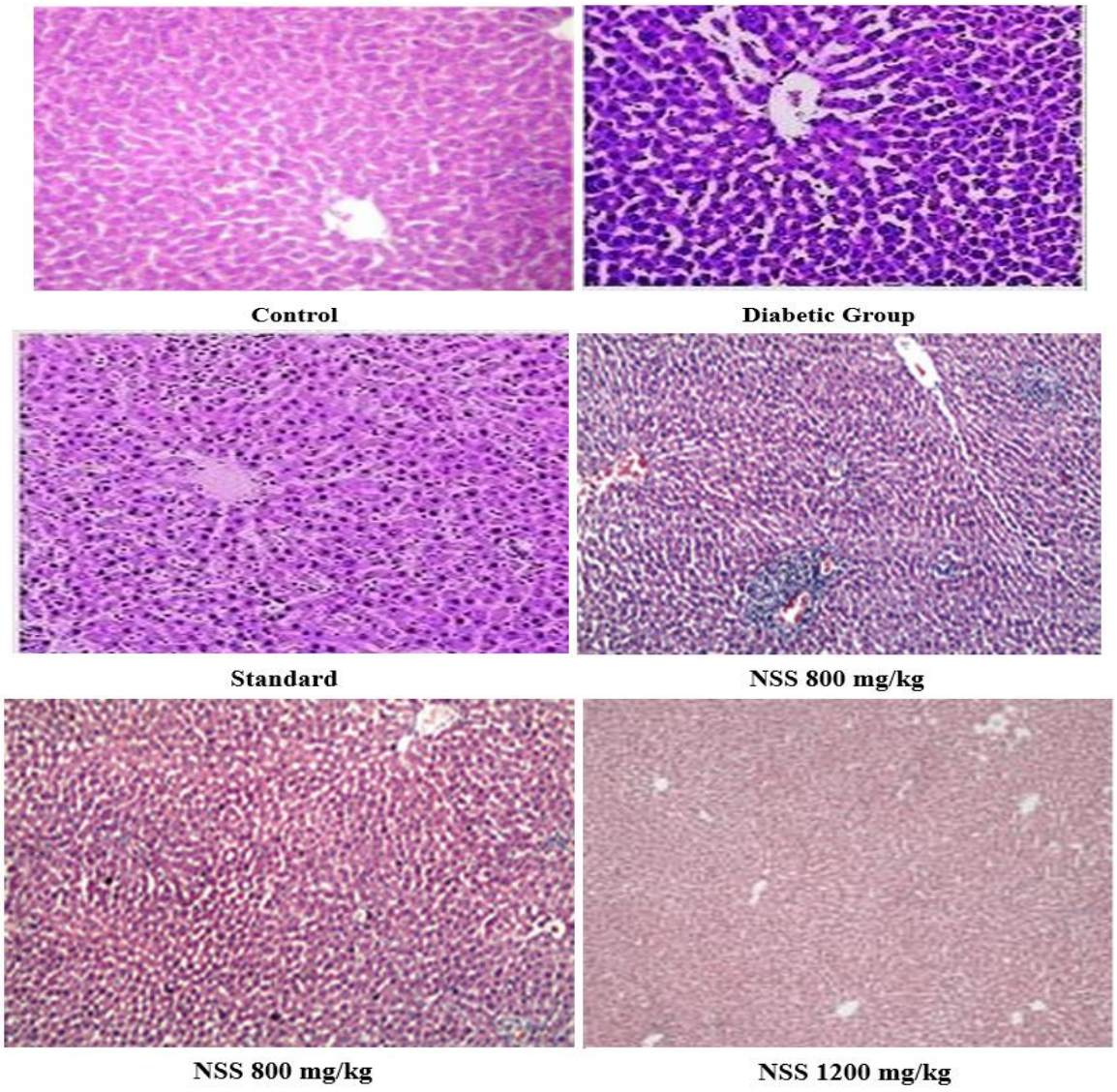

Figure : Histopathological representation of liver in alloxan induced diabetic in rat treated with various formulations (H and E stain, ×40)

IV. DISCUSSION

A complicated metabolic condition called diabetes mellitus is typified by persistent hyperglycemia brought on by either insulin resistance or reduced insulin production. In order to effectively manage diabetes, measures that can stabilize blood glucose levels and lessen related problems are required. In this study, we sought to assess the medicinal potential of Nigella sativa methanolic plant extracts in an animal model of diabetes produced by alloxan. The methanolic plant extracts' chemical contents were revealed using phytochemical screening. The presence of a variety of bioactive substances suggests that these extracts may have health advantages. These substances include tannins, saponins, flavonoids, alkaloids, steroids, phenols, anthraquinones, phenolatannins, glycosides, and terpenoids (Table 2).

The findings showed that at higher extract concentrations, Nigella sativa seeds have a significant capacity to scavenge free radicals (2,2-diphenyl-1-picrylhydrazyl). Ascorbic acid was used as a reference when measuring the absorbances at 570 nm. The experimental setup included various treatment categories, enabling a thorough assessment of the plant extracts' antidiabetic properties.

The vehicle (between 80 w/v, p.o.) was the sole thing provided to the control group, which helped define the baseline characteristics. A diabetic reference group was established by administering 150 mg/kg of alloxan intraperitoneally. Glibenclamide (10 mg/kg, P.O.), the typical medication, served as a positive control.[10]

Additional information about the effects of the plant extracts and their possible mechanisms of action was obtained by histopathological investigation. The control group showed typical tissue architecture and a low level of infiltration of inflammatory cells. Conversely, the diabetes control group displayed notable inflammation and production of granulomas, signifying the existence of diabetes. treated with glibenclamide, the usual medication, showed better tissue morphology and less inflammation than the diabetic control group. In a similar vein, tissues treated with 400 mg/kg, 800 mg/kg, and 1200 mg/kg of NSS methanolic extracts, respectively, showed enhanced tissue structure and decreased infiltration of inflammatory cells. The positive effects of the plant extracts on the renal and hepatic profiles were one of the study's noteworthy findings.

V. CONCLUSION

The findings of the experiment indicate that Nigella sativa plant methanolic extract has antioxidant and antidiabetic properties. Nigella sativa contains the many active ingredients that may be in charge of the plant's real antidiabetic effects. According to the current study, Nigella sativa methanolic extract significantly protects against diabetes induced by alloxan.

By utilizing alloxan to produce diabetes, there are increases in Ch, TG, LDL, and a decrease in HDL levels in the diabetic group compared to the control group. The hypolipidemic impact of this plant was demonstrated by a decrease in standard measurements of cholesterol, TG, LDL, and HDL as compared to the diabetic control group utilizing NSS. Rats treated with glibepenclamide showed decreased levels of Ch, TG, and LDL and increased levels of HDL in NSS 1200 mg/kg as compared to the diabetic control group. The suppression of fatty acid production could be the cause of the hypolipidemic impact.[11]

Histopathological analysis of the liver revealed the recovery of injured tissue in sections compared to the diabetes control group. In addition to medications used in contemporary medicine, a number of plant species have been reported to have hypoglycemic action in academic and popular literature. Even though the exact chemical makeup of herbal medications is unclear, they are nevertheless routinely prescribed due to their perceived efficacy, low incidence of side effects in clinical trials, and affordable price. It is clear from the research above that this plant has therapeutic qualities. Nevertheless, additional research and analysis are needed to identify the active substances that cause the hepatoprotectivity.

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