COMPARING HYPOGLYCEMIC ACTIVITY OF NOPALES (OPUNTIA SPECIES) WITH CONVENTIONAL ANTI-DIABETIC IN DIABETIC RAT MODEL

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Summary

The objective of this study was to evaluate the blood glucose lowering activity of Nopales in streptozotocin induced rats and to compare it with conventional antidiabetic glibenclamide.

Diabetes was induced in rats by injecting Streptozotocin. After two weeks , rats were divided in five groups and administered - nopales 1mg/kg, nopales5mg/kg, glibenclamide 5mg/kg, nopales + glibenclamide , normal saline for 20 days. Blood glucose levels were taken at baseline and then on 7^{th} and 20^{th} day . There was significant decrease in blood glucose levels on 20^{th} day in all the groups. However, nopales 5mg/kg ($p<0.01$)and nopales+ glibenclamide($p<0.01$) showed a greater decrease in blood glucose leves as compared to nopales 1mg/kg($p<0.05$) and glibenclamide 5mg/kg($p<0.05$). To conclude Nopales 5mg/kg shows a decrease in blood glucose levels and this decrease is comparable to conventional antidiabetics

Key-words: Nopales, antidiabetic, diabetic rat model

Introduction

Diabetes mellitus(DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. Reduced insulin secretion, decreased glucose utilization, and increased glucose production contribute to hyperglycemia. The metabolic dysregulation associated with DM causes secondary pathophysiologic changes in multiple organ systems that impose a tremendous burden on the individual with diabetes and on the health care system.

More than 220 million people worldwide have diabetes. In 2005, an estimated 1.1 million people died from it.[1] By 2025, the number of people with DM is expected to increase to 300 million and more than 90% of these will have Type 2 DM.[2] Thus there is a need for control of blood sugar and also the better drugs with least side effects.

As the burden of disease is expected to rise, newer drugs offer an alternative safer mode of treatment. Some of the medicinal plants used are being used in diabetes like Aloe vera, Corandrium sativum, Cucurbita ficifolia, Ocimum gratissumum, Opuntia streptacantha, Eugenia jambolana, Azadirachta indica etc.[3]

Nopales, also known as prickly pear cactus (Opuntia ficus-indica), belongs to the subfamily Opuntioideae. Nopales is native to the American Continent and can be found from the Canadian provinces to South America. While the prickly pear cactus is native to the United States, Mexico, and South America, it grows well in many areas of the world; including Africa, Australia, and the Mediterranean. Although essentially a desert plant, Nopales can survive under a wide variety of climates and grows at elevations ranging from sea level to 15,000 feet. The deserts and semi-arid areas of Mexico and the southwestern United States have the highest concentrations of Nopales. The stem or their crude preparations showed hypoglycemic effect in non-insulin-dependent diabetes mellitus patients (irrespective of its being heated or blended during preparation). Nopales is used as a food supplement to decrease blood glucose levels in Mexico.[4] Flowers are astringent and reduce bleeding and it is used for diarrhea, irritable bowel syndrome and enlarged prostate.[5] It also has anti-inflammatory, antiviral (Herpes simplex virus Type 2, influenza virus, HIV-1), anticancer, anti-hyperlipidemic and hypercholesterolemic, and anti-oxidant effects.[6]

The present study was done to evaluate the hypoglycemic efficacy of this plant and compare it with conventional anti-diabetics.

Materials and methods

Animals

Adult male Wistar rats weighing between 150-200g bred locally in the animal house of Kasturba Medical College, Manipal were used. Animals were acclimatized to the laboratory environment for 5-7 days before entering in the study. They were allowed free access to water and were maintained on standard rat diet under laboratory conditions. 12- hour light/dark cycle was maintained. All procedures were carried with approval of Institutional Animal Ethics Committee (IAEC).

Drugs and extract

Glibenclamide 5mg/kg , nopales 1mg/kg and nopales 5mg/kg. Nopales was obtained as powder form from Eurodrug Laboratories. It consisted of Opuntia streptacantha (40%), Opuntia ficus indica (38%), Opuntia robusta (20%) and non active ingredients (2%)

Induction of diabetes

Streptozotocin at a dose of 45mg/kg body weight of rats (obtained from Sigma Aldrich No. SO130, China) in acetate buffer 0.1M pH 4.5 was administered intraperitoneally. After two weeks, the the blood glucose levels were estimated. The animals with blood glucose of 250 mg/dl were included in the study. Animals were given the drugs. The animals were divided into five groups. Each group consisted of 6 animals

Group I	Control
Group II	Nopales (1mg/kg)[7]
Group III	Nopales (5mg/kg)
Group IV	Glibenclamide (5mg/kg)
Group V	Glibenclamide (5mg/kg) + Nopales (1mg/kg)

All the drugs were given once a day orally at the same time of day from day 0 to day 20.

Collection of blood and measurement of blood glucose

Blood was obtained from rat tail tip. After restraining the rat, the tail was immersed in hot water (45^0C). 1 mm of its tip was cut and a drop of blood which was collected was placed on glucometer strip (Accu-check sensor, Roche group , made in USA). The blood glucose was estimated at baseline and then on the 7^{th} and 20^{th} day .

***Statistical Analysis*:**

The results were analyzed using ANOVA followed by Tukey's test to compare the blood glucose levels between the groups . P-value less than 0.05 was considered significant. The plasma glucose levels were expressed as Mean ± SEM

Results

The data in table 1 shows the baseline blood glucose levels and at seventh and twentieth day of nopales administration. There was no significant difference between the groups at baseline.

Table 1

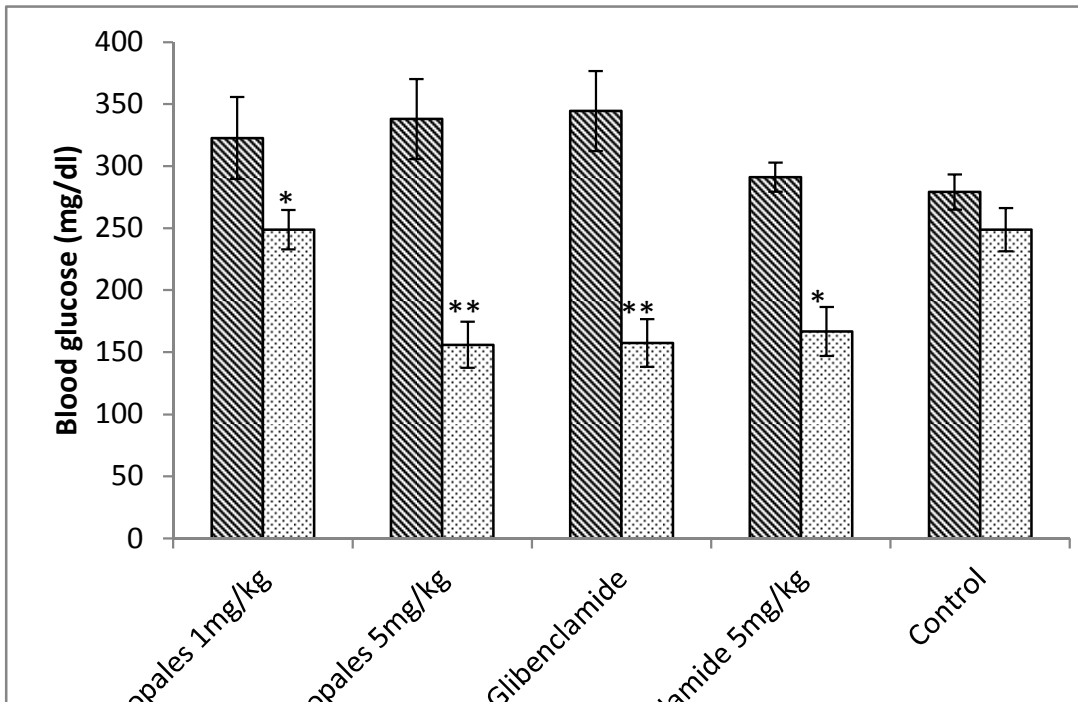
GROUPS	Blood glucose (mg/dl)		
	Day 0	Day 7	Day 20
Nopales (1mg/kg)	322.66 ± 32.94	296.16 ± 21.65	248.88 ± 15.83
Nopales (5mg/kg)	338.00 ± 32.31	269.33 ± 21.63	156.00 ± 18.61
Nopales (1mg/kg) + Glibenclamide (5mg/kg)	344.33 ± 32.33	296.16 ± 29.41	157.50 ± 19.19
Glibenclamide (5mg/kg)	291.00 ± 11.67	277.96 ± 35.18	166.83 ± 19.67
Control	279.16± 14.28	293.33 ± 17.15	248.83 ± 17.32

All values are means ± SEM

The difference between the groups was not significant on 7th day. However on 20th day the difference between the groups was significant ($p<0.01$).

Tukey's post hoc tests revealed that the decrease in blood glucose levels was significant ($p<0.01$) in nopales 5mg/kg group which was comparable to nopales 1mg/kg + glibenclamide 5mg/kg ($p<0.01$). There was also significant decrease in blood glucose levels in nopales 1mg/kg group ($p<0.05$) which was almost similar to glibenclamide 5mg/kg ($p<0.05$) group.

Figure 1 shows the change in blood glucose levels on twentieth day of drug/extract administration as compared to baseline values in different groups.



Values are in mean ± SEM. **p< 0.01, *p<0.05

Figure 1. Blood glucose levels at zero day and twentieth day of drug/extract administration in diabetic rats

Discussion

In this study diabetes was induced by injecting streptozotocin 45mg/kg. It causes selective destruction of β- cells of pancreatic islets and increases blood glucose levels. After inducing diabetes the comparison of blood glucose lowering action of Nopales with conventional antidiabetic Glibenclamide was made.

The results of our study confirm that Nopales extract produces an antihyperglycemic effect. This effect has been postulated due to its fiber and pectin content which decreases carbohydrate absorption[8]. The insoluble fiber content is more in older Nopales but the beneficial effects are due to its soluble and insoluble fiber content.[9] Also the fiber content of Nopales decrease LDL cholesterol and triglycerides in humans taking Nopales supplemental diet[10]. Opuntias streptacantha species has shown to control blood glucose levels in one of the recent study [11].

The blood glucose levels were estimated on 7th and 20th day. Though there was a decrease in blood glucose levels on 7th day, it was not statistically significant. The decrease was statistically significant on 20th day of Nopales administration. The fall in blood glucose was more in Nopales 5mg/kg as compared to Nopales 1mg/kg. The decrease with Nopales 5mg/kg was quite comparable to reduction brought about by Glibenclamide+ Nopales.

The effect of Nopales and Glibenclamide combination did not differ much from the 5mg/kg dose of Nopales alone. So studies are required to know whether Nopales can potentiate the effect of oral antidiabetics. However, results of present study justify the use of Nopales as a food supplement in lowering blood glucose levels.

This study further validates the antidiabetic activity of Nopales that require further characterization.

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