

ORIGINAL ARTICLE

Preventive Role of *Zingiber Officinale* against Hyperglycemia in Alloxan Induced Diabetic Rats

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Abstract:

The experimental animal study was undertaken to investigate the preventive role ginger juice against hyperglycemia in alloxan induced diabetic rats. Male wistar rats, (130-150)gm wt. fed on standard diet and water ad libitum, were divided into 3 groups (n=6) in each group: Group-I, non-diabetic control group, Group-II, diabetic control & Group-III, normal rats pretreated with ginger before they were made diabetics. Diabetes was induced by inj. alloxan 150mg/kg body wt., i.p (Group-II, on 2nd day & Group-III, on the 9th day). Rats having blood glucose level of more than 7mmol/L on day 5 (72 hours after alloxan inj) were considered diabetic & selected for experiment. Rats of Group-III received *Zingiber officinale* (ginger juice) (4ml/kg.body,wt orally) for 7 days (day 2-day8) through ryles tube before alloxan induction & 3days after the induction. On day 12, animals were sacrificed under light ether anaesthesia, blood was collected by cardiac puncture for blood glucose estimation. Pretreatment with *Zingiber officinale* (ginger) juice significantly ($p < 0.01$) reduced alloxan induced hyperglycemia. *Zingiber officinale* (ginger) is one of the most widely used spices and is reputed to have medicinal properties against diabetes mellitus. This study suggests that pretreatment with *Zingiber officinale* (ginger) prevents the development of hyperglycemia in alloxan induced diabetic rats.

Introduction:

Diabetes mellitus is a chronic, debilitating but controllable metabolic disorder. The incidence and prevalence of diabetes mellitus are increasing worldwide in line with lifestyle changes and population aging. The prevalence of diabetes for all age- groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2013. The epidemic of diabetes is not restricted to affluent westernized countries but is also affecting developing countries. The Chronic hyperglycemia of diabetes

is associated with long term damage, dysfunction and failure of various organs¹¹.

Diabetes causes millions of people to suffer the loss of quality of life. That's why, Governments and other healthcare providers around the world are investing in health education, diagnosis, treatments for this chronic disorder. But the only cost-effective way of dealing with diabetes is to prevent it. Herbal remedies have been used in medical practices for many years in East Asian countries and account for

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approximately 80% of medical treatments in the developing countries.

In recent years ginger has become a subject of interest because of its beneficial effects on human health. It was reported that ginger has medicinal properties against digestive disorders, rheumatism & diabetes¹. Pharmacologically, the plant (fresh rhizome) or its extracts have been investigated for its hypoglycemic^{3,5}, hypocholesteromic^{5,6,7}, anti-inflammatory^{9,10}, anti-microbial⁹ and anti-cancer activities⁸. Akhani et al. reported that ginger pretreatment inhibited streptozotocin induced hyperglycemia & hypoinsulinaemia³. The inorganic part of a medicinal plant contains mainly mineral elements, which are responsible for the hypoglycemic activity. In support of this view, a number of essential minerals (Ca, Zn, K, Mn & Cr) are known to be associated with the mechanism of insulin release and its activity in different animals & human beings⁸.

The present study was undertaken to investigate the preventive role of fresh ginger juice against hyperglycemia in pretreated rats followed by the induction of diabetes.

Materials and method:

This experimental animal study was done in the department of Pharmacology & Therapeutics, Dhaka Medical College and Hospital in collaboration with the Department of Pathology of Ibrahim Medical College, Dhaka.

Plant materials and preparation of juice: The fresh juice of *Zingiber officinale* (ginger) was obtained from local market. 1 kg of fresh rhizome were crushed, and then squeezed in muslin cloth to obtain the juice using the method of Akhani et al⁴. Sodium benzoate (0.5%) was added as preservative. The juice was stored in the refrigerator at 2-8°C in a

well closed glass container. Male wistar rats weighing between 130-150 gm were housed in polycarbonate cage at a regular temperature (22±2°C) & humidity (55%) controlled room with a 12h light/12h dark cycle for 12 days and were fed on standard rat pellet diet and allowed to drink water ad libitum.

Induction of diabetes in rats: After 24 hours fasting rats of group (II & III) were injected alloxan 150mg/kg b.w.i.p. on Day 2 and day 9 of the study respectively. Fasting blood glucose levels were estimated on day 1 (before inj. alloxan), on day 5 (72 hrs after inj. alloxan) and day 12 of the experimental study. Blood glucose was estimated by placing a test strip in the glucometer (ACCU-CHECK, Roche diagnostic GmbH). A drop of blood was collected by aseptically cutting the tail at the tip (0.1cm) with sharp sterile blade and then applying the drop of blood to the test area of the strip. Rats with blood glucose of more than 7mmol/L on day 5 (i.e 72 hrs after inj. alloxan) were considered diabetic & selected for experiment.

Rats were divided into 3 groups (n=6, in each group). Group I Normal (non diabetic) control, Group II: Diabetic control & Group III: Normal rats pretreated with ginger before they were made diabetics, rat of this group received *Z. officinale* (ginger) at a dose of 4ml/kg body weight as per Akhani et al⁴ for 10 days (day 2-day 11), orally through ryles tube. On the 12th day of the study, animals were sacrificed under light ether anaesthesia, whole blood was collected by cardiac puncture for estimation of blood glucose.

The results are presented as mean ±SD. Unpaired 't' test was performed and p value <0.05 was considered as statistically significant. Diabetic control is compared with normal.

Treated group is compared with diabetic control. Effects of *Z. officinale* (ginger) juice on blood glucose level in normal, diabetic & pretreated rats:

The mean±SD of blood glucose (mmol/L), in normal non-diabetic rats (Group-I) on day 1 and day 12 of the study were 5.40±0.76 and 5.45±0.76 respectively, while in diabetic control rats (Group-II) were 5.57±0.12 and 8.52±0.68 respectively. The difference between two groups (Group-I vs Group-II) were statistically significant (p<0.001) suggesting that inj. Alloxan significantly increased the blood glucose level. The mean±SD of blood glucose (mmol/L), of diabetic control rats (Group-II) and of pretreated rats (Group-III, normal rats pretreated with ginger for 7 days before inj. Alloxan and 3 days after induction) on day 12 of the study were 8.52±0.68 and 7.50±0.42 respectively. The difference between two groups (II & III) were statistically significant (p<0.01), suggesting that pretreatment with ginger juice before inj. Alloxan produced significant decrease in blood glucose level when compared with diabetic control. The results are shown in Table-I and II.

Table-I: Effects of *Z. officinale* (ginger) on blood glucose in non-diabetic, normal control (Group-I) & diabetic control rats (Group-II.)

Fasting blood glucose (mmol/L)	Group -I (n=6)	Group -II (n=6)	P value
At 1 st day	5.40±0.76	5.57±0.12	0.619ns
At 12 th day	5.45±0.76	8.52±0.68	.001***

Data were expressed as Mean±SD, **= significant at 0.01, ***= significant at 0.001 ns = not significant

Table-II: Effects of *Z. officinale* (ginger) on blood glucose in Diabetic control (Group-II) & pre-treated rats (Group-III).

Fasting Glucose (mmol/L)	Group -II (n=6)	Group -III (n=6)	P value
At 1 st day	5.57±0.12	5.73±0.56	0.493ns
At 12 th day	8.52±0.68	7.50±0.42	0.011**

Data were expressed as Mean± SD, **= significant at 0.01, ns = not significant

Discussion:

The present study was undertaken to investigate the preventive role of *Zingiber officinale* (ginger) juice against hyperglycemia in alloxan induced diabetic rats. Injection of alloxan (150 mg/kg body weight, intravenous) produced marked hyperglycemia. Treatment with *Zingiber officinale* (ginger) juice (4ml/kg body weight, per oral) for 7 days from 2nd day to normal rats before they were made diabetics & 3 days after the induction, produced significant blood glucose lowering effects. Thus suggesting preventive role of *Zingiber officinale* (ginger juice) against hyperglycemia in alloxan induced diabetic rats. The results are in agreement with those of previous studies³⁻⁵, who showed similar blood glucose lowering effects in pretreatment with *Zingiber officinale* (ginger) in different experimental animal models.

Conclusion:

The present study demonstrated the preventive role of *Zingiber officinale* against hyperglycemia in alloxan induced diabetic rats. Further studies are suggested for investigating possible mechanism(s) of action. More studies would be necessary to validate this claim.

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