

EFFECTS OF GINGER JUICE ON BLOOD GLUCOSE IN ALLOXAN INDUCED DIABETES MELLITUS IN RATS

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Abstract

Objective: To find out the effects of ginger (*Zingiber officinale*) juice blood glucose in alloxan induced-diabetes mellitus in rats.

Methods: This experimental study was done in the Department of Pharmacology & Therapeutics, Dhaka Medical College, Dhaka, in collaboration with the Departments of Pathology, Ibrahim Medical College, Dhaka between January and December 2009. This experimental animal study was divided into two parts, which were Experiment-1 and Experiment-2. Experiment 1 comprises of 12 rats and divided into 2 groups each group having 6 rats. Rats of group-A was non-diabetic normal control group and group-B was fed with ginger (*Zingiber officinale*) in a dose of 4ml/kg body weight orally through Ryle's tube. Experiment-2 comprised of 12 rats divided into 2 groups each containing 6 rats labeled as group C, group D. Rats of groups C administered alloxan 150 mg/kg intraperitoneally on the 2nd day of the study. Rats of group D were administered alloxan 150mg /kg intraperitoneally and ginger (4ml/kg of body weight orally) on the 2nd day of the study.

Results: The fasting blood glucose level at day 12 in the rats treated with ginger (*Zingiber officinale*) 4 ml /kg body weight orally daily for 12 days showed reduction in fasting blood glucose level as compared to control group, but not significant, which indicates that ginger has no effect in lowering blood glucose of normal rats. The fasting blood glucose levels at day 12 in the rats of group D (treated with ginger and alloxan) showed highly significant reduction in fasting blood glucose level as compared to diabetic control group ($p<0.002$).

Conclusion: Consumption of ginger produced a significant antihyperglycemic effect in experimentally induced diabetic rats.

Key words: Ginger, blood glucose, alloxan, diabetes mellitus, rats.

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Introduction:

Diabetes mellitus is one of the most common endocrine disorders affecting almost 6% of the world's population. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030¹. The Incidence and prevalence of diabetes mellitus are increasing worldwide, in line with lifestyle changes and population aging. Herbal

remedies have been used in medical practices for many years in East Asian countries and account for approximately 80% of medical treatments in the developing countries². Therefore, herbal medicine is growing popularity in western country and become more and more important in people healthcare. In recent years, ginger has become a subject of interest because of its beneficial effects on human health. Ginger has a broad range of biological activities including anti-bacterial, anti-convulsant,

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analgesic, anti-ulcer, and anti-fungal^{2,3}. There is also evidence that ginger may help in the treatment of cardiovascular disease due its anti-inflammatory, anti-platelet and hypolipidemic effects⁴. Researchers reported that 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^+ etc.) are known to be associated with the mechanism of insulin release and its activity in different animals & human beings^{5,6,7}. The present study was designed to see the effects of ginger (*Zingiber officinale*) extract on blood glucose in alloxan induced diabetes mellitus in rats.

Methods:

This experimental study was done in the Department of Pharmacology & Therapeutics, Dhaka Medical College, Dhaka, in collaboration with the Department of Pathology, Ibrahim Medical College, Dhaka, and the Department of Chemistry, University of Dhaka, from January to December of 2009.

Animals: Male Wistar rats weighing 130-150 gm obtained from Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. The rats were housed in polycarbonate cages at a regulated temperature of 22°C and humidity of 55.0% controlled room with a 12h light/12h dark cycle. The rats were fed on standard pellets of rat diet and allowed to drink water ad libitum.

Plant materials and ginger extraction: The fresh rhizomes of ginger (*Zingiber officinale*) obtained from local market and ginger juice was prepared using the method of Akhani et al.⁸. Fresh rhizomes of ginger (1kg) were crushed and then squeezed in muslin cloth to obtain the juice, which was stored in the refrigerator at 2-8°C centigrade in a well closed glass container.

This experimental animal study was divided into two parts, which were Experiment-1 and Experiment-2.

The experiments were designed to demonstrate the effect of ginger on blood glucose in non-diabetic and alloxan induced diabetes mellitus in rats. Body weight of all rats was recorded.

Experiment-1: This experiment comprises of 12 rats. Rats were divided into 2 groups each group having 6 rats. Groups were labeled as group-A and group-B. This part of the experiment was carried out to demonstrate, the effect of ginger extract on blood glucose of non-diabetic normal and ginger treated rats. Blood glucose was estimated on day 12.

Group-A: This group served as non-diabetic normal control group. The rats were treated with normal rat fed and water ad libitum for 11 days.

Group-B: The rats of this group were given ginger in a dose of 4ml/kg body weight orally through ryles tube from the 2nd day to 11th day along with normal rat fed and water.

On 12th day, fasting blood glucose was estimated.

Experiment-2: Comprised of total 12 rats and they were divided into 2 groups each containing 6 rats labeled as group C & group D.

Group-C: On the 1st day, fasting blood glucose and body weight of this group were estimated. Rats were administered alloxan 150 mg/kg intraperitoneally on the 2nd day of the study and after 3 days (72 hours) i.e. on the 5th day, blood glucose was estimated again (since alloxan increases blood glucose after 72 hours) and rats with blood glucose of >7 mmol/L were considered diabetic & selected for experiment and given standard rat fed and water for next 6 days and on the 12th day blood glucose was estimated.

Group-D: Rats of this group were administered alloxan 150mg /kg intraperitoneally and ginger (4ml/kg of body weight orally) on the 2nd day of the study and after 3 days (72 hours) blood glucose level estimated and ginger extract along with rat fed and water were continued for next 6 days and on the 12th day, blood glucose and body weight were estimated.

All the rats were sacrificed on 12th day by an overdose of diethyl ether, after measuring

fasting blood glucose. Blood glucose was measured by using a glucometer ('ACCU-CHEK', made by Roche Diagnostic GmbH, D-68298, Mannheim, Germany) and expressed as mmol/L.

Statistical analysis: The results were presented in tables and figures. Unpaired Student's t-test was performed. Level of significance was expressed as P value. P value of <0.05 was considered as significant.

Results:

At day 1 and day 12 mean fasting blood glucose level of group A were 5.40±0.76 and 5.45±0.76 mmol/L respectively. Percentage of improvement from day 1 to day 12 was 1.02±3.88. In group B, the mean fasting blood glucose level at day 1 and day 12 were 5.67±0.57 and 5.47±0.59 mmol/L respectively. Percentage of reduction from day 1 to day 12 was -3.38±7.06. The fasting blood glucose level at day 12, the rats treated with ginger extract 4ml/kg body weight orally daily for 12 days showed a small but not significant reduction in fasting blood glucose level as compared to control group. Hence, it can be concluded that ginger has no effect in lowering blood glucose of normal rats.

In group C, the mean blood glucose level at day 1, day 5 and day 12 were 5.57±0.12, 9.20±0.76 and 8.52±0.68 mmol/L respectively. Percentage of improvement from day 1 to day 12 was 52.92±10.67. In group D, the mean blood glucose level at day 1, day 5 and day 12 were 5.63±0.46, 7.92±0.48, 7.13±0.42 mmol/L respectively. Percentage of improvement from day 1 to day 12 was 27.34±13.02. In group E, the mean blood glucose level at day 1 and day 12 were 5.73±0.56, 7.50±0.42 mmol/L respectively. Percentage of improvement from day 1 to day 12 was 31.59±12.00. The fasting blood glucose levels at day 12 in the rats of group D showed highly significant reduction in fasting blood glucose level as compared to diabetic control group (p<0.002). Therefore, it can be concluded that ginger has effect in lowering blood glucose of diabetic rats. The fasting blood glucose level of the rats of group E showed significant reduction of fasting blood glucose level as compared to diabetic control group (p<0.01). Hence, it can be concluded that ginger extract has preventive role in lowering blood glucose of diabetic rats.

The results are shown in Table-I.

Table I

Effects of ginger extract and alloxan on blood glucose level of the different rats group at 1st day and 12th day

| Fasting blood glucose (mmol/L) | Group A | Group B | P value |
|--|-------------|-------------|---------------------|
| At 1 st day | 5.40±0.76 | 5.67±0.57 | 0.509 ^{ns} |
| At 12 th day | 5.45±0.76 | 5.47±0.59 | 0.967 ^{ns} |
| Percentage of improvement from day 1 to day 12 | 1.02±3.88 | -3.38±7.06 | 0.211 ^{ns} |
| Fasting blood glucose(mmol/L) | Group C | Group D | P value |
| At 1 st day | 5.57±0.12 | 5.63±0.46 | 0.740 ^{ns} |
| At 5 th day | 9.20±0.76 | 7.92±0.48 | 0.006 ^{**} |
| At 12 th day | 8.52±0.68 | 7.13±0.42 | 0.002 ^{**} |
| Percent of improvement from day 1 to day 12 | 52.92±10.67 | 27.34±13.02 | 0.004 ^{**} |

Here, data were expressed as mean±SD; comparisons were done by using unpaired Student's 't' test; */** = Significant, ns = Not significant.

Discussion:

The present study was carried out to evaluate the effects of ginger extract on blood glucose in alloxan induced diabetes mellitus in rats. Its blood glucose lowering effect was tested in normal and experimentally induced diabetic rats. The fresh juice of ginger was given for 10 consecutive days in both normal and alloxan-induced diabetic rats.

In the present study, diabetes was induced by alloxan. The dose and route of administration of alloxan was (150mg/kg of body weight) intraperitoneally, which produced significant increase in blood glucose in this study. In this study persistent hyperglycemia was observed 72 hours following administration of alloxan in a dose of 150mg/kg intraperitoneally. In this study, the antihyperglycemic effect of ginger was demonstrated in alloxan induced diabetic rats. The doses of ginger used in this study were selected in keeping conformity with the dose used in different research work⁷. In experimental group, there was statistically significant changes ($p < 0.002$) in the mean fasting blood glucose level of rats treated with ginger 4ml/kg body weight. Therefore, it may be concluded that ginger has antihyperglycemic action in experimentally induced diabetic rats. The present findings are in agreement with those previous works that are cited here. In this study pretreatment with ginger followed by induction of diabetes decreased significantly the mean fasting blood glucose when compared with the diabetic group. The results comply with the previously reported work of Akhane et al.⁸ as they reported that ginger pretreatment inhibited the induced hyperglycemia and hypoinsulinaemia. Majeed et al.⁹ and Jafri et al.¹⁰ also found the hypoglycemic effects of ginger in their experiments on rats. They found that post-treatment and pretreatment of streptozotocin-induced diabetic rats with ginger extract significantly decreased the blood glucose level and increased the insulin level.

In this study, it was observed that ginger has antihyperglycemic effect in Alloxan induced diabetic rats. The results suggested that ginger may be a useful agent in the treatment and prevention of diabetes mellitus. To validate this finding, further studies with toxicological testing are recommended^{7,10}.

Conclusion:

It could be concluded that ginger (*Zingiber officinale*) extract has antihyperglycemic effect in experimentally induced diabetic rats.

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