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SHORT COMMUNICATION

Hypoglycemic Effect of Ginger (*Zingiber officinale)* in Alloxan Induced Diabetic Rats (*Rattus norvagicus*)

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ABSTRACT

A study was conducted to evaluate the hypoglycemic effect of *Zingiber officinale* (Ginger) aqueous extract at a dose of 500mg/kg body weight (BW) once a day for six weeks. The rats were made diabetic by intraperitoneal injection of alloxan (65mg/kg BW once) which induced diabetes in albino rats after 8 days. Albino rats (n=24) each weighing 150-180g were divided in 3 equal groups. Group A served as control, group B was diabetic and was not given ginger whereas group C rats were diabetic and given ginger extract (500mg/kg BW). Serum of each rat was analyzed by enzymatic kits to estimate serum glucose on 1st day (after making them diabetic), 21st and 42nd day. Blood glucose level remained unaltered in group A and B over time. However, group C, given ginger extract, showed significant ($P<0.05$) reduction in serum glucose level after day 21 and 42 post treatment. It may be concluded that ginger extract has hypoglycemic effect on diabetic rats.

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INTRODUCTION

Diabetes mellitus is a chronic disease marked by hyperglycemia and urinary glucose excretion. Blood glucose concentration is maintained within homeostatic limits by a variety of biochemical and physiological control mechanisms. Insulin is the hormone that regulates carbohydrate metabolism in the body and maintains passage of glucose across the cell membrane (Sekar *et al.,* 1990)

Alloxan a glucose analogue and is toxic by selectively destroying insulin-producing cells in the pancreas (that is beta cells) of many animal species. This causes an insulin-dependent diabetes mellitus (called "Alloxan Diabetes") in these animals, with characteristics similar to type 1diabetes in humans. Alloxan is selectively toxic to insulin-producing pancreatic beta cells because it preferentially accumulates in beta cells through uptake via the GLUT2 glucose transporter. Alloxan, in the presence of intracellular thiols, generates reactive oxygen species (ROS) which initiate toxicity by its redox reaction (Lenzen, 2008).

There are several allopathic hypoglycemic drugs available in human beings; however, they long term side effects. There is dire need to explore hypoglycemic drugs that have less or no side effects at all. The *Zingiber officinale* is an alternative. Rats genomically resemble humans more than 90% and the rat model experiment may prove beneficial for diabetic human population. The present study was planned to see the effects of ginger extract on serum glucose level in alloxan induced diabetic rats.

MATERIALS AND METHODS

The experiment was conducted at the Institute of Molecular Biology and Biotechnology, The University of Lahore. Twenty four Albino rats (n=24) were included in the study and divided into 3 groups of 8 rats each, with a live-weight ranging from150-180g. The rats were acclimatized under standard rat house conditions for 21 days before the trial was initiated. These rats were housed in steel wire cages and maintained in controlled temperature at 27°C with light cycle of 12h light and 12h dark. Isonitrogenous and isocaloric chick feed and tap water was available to all rats round the clock (Shanmugam *et al.,* 2009).

Aqueous ginger extract was prepared from locally available ginger roots. Ginger roots (500g) were peeled on crushed ice and was cut in to small pieces and homogenized in 750ml cold, sterile 0.9% NaCl solution and 250ml ice cold water to make the volume 1000ml. The homogenization was carried out in a blender for 12 minutes. The homogenized mixture was filtered three

times through cheese cloth. The filtrate was centrifuged at 2000rpm for 10 min and the clear supernatant fraction was separated and volume made up to 1000ml with normal saline. The concentration of this ginger preparation was considered to have 500mg/ml on the basis of the weight of the starting material according to the formula of (Majeed *et al*., 2003). The extract was stored in sample tubes at -20°C until fed to rats. All the rats received ginger extract 500mg/kg BW/day orally for six weeks as this duration was tested to be effective as hypoglycemic effect as reported earlier (Majeed *et al*., 2003).

After overnight fasting, diabetes was induced in each rat by intra-peritoneal injection of Alloxan (Sigma-Aldrich, Cat # A7413, USA) prepared one hour before injection dissolved in 1ml distilled water at a dose of 65mg/ kg BW (Sekar *et al.*, 1990). After a week of alloxan injection, blood was collected (1ml) from coccygial vein of each rat and serum was obtained by centrifuging each blood sample at 3000rpm for 10 minutes. Procured serum was used for the estimation of serum glucose of rats by enzymatic kits (Merck, Germany) using spectrophotometer.The rats having serum glucose above 150mg/dl were considered diabetic (Sathishsekar and Subramanian, 2005). The treatment with *Zingiber officinale* extract was started on 8th day after alloxan injection and this was considered as the first day of treatment because the serum glucose level increased much above normal limits. The treatment continued for 42 days. Serum samples were also collected from each rat on 1st, 21st and 42nd day of the experiment for the determination of serum glucose.

The data was subjected to statistical analysis using Analysis of Variance (ANOVA) to check over all significance and individual variations and least significant difference (LSD) test for finding out differences between treatments.

RESULTS AND DISCUSSION

After induction of alloxan, Group B and C became diabetic on 8th day as determined by serum glucose levels. The group A (Control) showed almost similar serum glucose levels on day 1, 14, 21 and 42. Since Group B was not supplemented with ginger extract, therefore, the serum glucose levels did not differ at different time periods (Table 1). The Group C was diabetic and given ginger extract at the prescribed dose and showed significant decrease ($P<0.05$) in serum glucose levels. The serum glucose level before alloxan induction was similar in all the three groups before giving treatments (Table 1).

Due to the uncertain allergic reactions and side effects of allopathic drugs, the attempts are being made to revert to herbal treatments all over the world. Hundreds of herbs, spices, fruits and vegetables have been shown to have remedial effects on certain diseases in humans. The experiments on laboratory animals, mostly rats, has led to considerable success in the treatment of diseases such as diabetes, hypertension and hyperlipidemia. With the same idea and previous evidence in other countries the ginger supplementation to rats was attempted which showed significant reduction in serum glucose levels which has been proved in the present trial and the findings are similar with those of Akhani *et al*. (2004). Who reported that Ginger exhibits hypoglycemic activity in both normal and diabetic rats. They further reported that ginger contains magnesium, calcium and phosphorus which play important roles in bone formation, curbing muscle spasm, depression, hypertension, convulsion, nausea, gastro-intestinal disorders, paralysis, kidney damage and several other bio-functions necessary for keeping body in homeostatic condition (Kikuzaki and Nakatani, 1993). The active compounds of ginger are 6-gingerol, tannins, polyphenolic compounds, flavonoids and triterpenoids of hypoglycemic that maintain cell function related to receptors and membrane transport (Young *et al.*, 2005).

The supplementation of ginger extract with diet to diabetic rats significantly ($P<0.05$) reduced serum glucose level which revealed the hypoglycemic activity of ginger in diabetic rats. The present findings are in agreement with the results of so many past workers who conducted similar studies (Ajit *et al.*, 1999).

It may be concluded from the present study that the aqueous extract of *Zingiber officinale* at an oral dose of 0.5ml of ginger extract/ rat / day or 500mg/kg adjusted according to the weight of rat has hypoglycemic effect in alloxan induced diabetic rats and may be helpful in control of diabetes.

Table 1: Serum glucose levels (mg/dL) in apparently healthy, diabetic and ginger treated rats

Days	Groups		
	A (Control)	B (Diabetic)	C (Diabetic+Ginger)
0	107.1±1.2	106.7±1.0	107.1±1.5
1	106.2±0.7	181.1±2.7*	183.6±3.5*
14	107.2±0.7	181.6±3.0*	162.5±1.8*
21	106.5±0.9	183.5±2.7*	143.5±1.3*
42	107.0±1.0	184.3±2.6*	118.2±1.6*

Figures bearing asterisk in a row differ significantly ($P<0.05$) than control. Day 8th was 1st day after alloxan when the rats became diabetic.

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