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Hypoglycaemic effect of *Lagerstroemia speciosa* in type 2 diabetic rats

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The objective of this study was to study the hypoglycaemic effect of the aqueous extract of *Lagerstroemia speciosa* in type 2 diabetic rats. Male albino Wistar rats (30) weighing 180 to 190 g were selected and divided into five groups, maintained six rats in each group. Groups I and II were served as normal and diabetic control. Group III was treated with standard drug as glibenclamide 0.25 mg/kg body weight, whereas groups IV and V were administered extract of 100 and 200 mg/kg body weight, respectively. Type 2 diabetes was induced by using streptozotocin (STZ)-nicotinamide (NIA) in rats. Treatment was carried out for 14 days and the fasting serum glucose level, body weight, glycosylated haemoglobin and lipid profile were measured. Data was collected and analysed statistically using one-way analysis of variance (ANOVA) followed by Student's t-test. The statistical data indicated the significant decrease in the fasting serum glucose level in diabetic rats. Glycosylated haemoglobin and lipid profile of diabetic rats also decreased. The aqueous extract of *L. speciosa* has shown hypoglycaemic effect in STZ- nicotinamide induced type 2 diabetic rats.

Key words: Type 2 diabetes, *Lagerstroemia speciosa*, streptozotocin, nicotinamide.

INTRODUCTION

Lagerstroemia speciosa (Lythraceae) is also known as Banaba found in India, Philippines, Southern China, Malaysia and tropical Australia. In recent years, it has been used as a folk medicine for the treatment of diabetes and kidney diseases (Quisumbing, 1978). In Manipur, *L. speciosa* is locally known as Jarol and found abundantly. In KK-Ay diabetic mice, corosolic acid which is present in this plant increased the plasma insulin level resulting in fall in blood glucose level (Kakuda et al., 1996; Miura et al., 2006) as well as stimulate glucose uptake in 3T3-L1 cells (Liu et al., 2001). Furthermore, ellagitannins which were also found in *L. speciosa* extract showed as an activator of the glucose transportation in fat cells (Hayashi et al., 2002). Some of the authors reported that *L. speciosa* found in different countries are equally effective in the treatment of diabetes is not clear (Klein et al., 2007). Furthermore, the antidiabetic effect of *L. speciosa* in different animal diabetic model has been reported, but none of the reports found in streptozotocin-nicotinamide induced type 2 diabetic rats. So, this study was aimed to evaluate the hypoglycaemic effect of *L. speciosa* in

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streptozotocin-nicotinamide induced type 2 diabetic rats.

MATERIALS AND METHODS

Collection of plant

The leaves of *L. speciosa* (Jarol) were collected by Dr. Kula from the hilly areas of Khonghampat, Manipur State, India. It was authenticated by the Department of Botany, Oriental College of Sciences, Manipur, India.

Preparation of extract

Leaves of *L. speciosa* were collected and shade dried avoiding sunlight contact. The leaves were crushed into powder by a mixer. Defatting was carried out by immersing the powdered leaves into petroleum ether for 12 h by regular shaking. Using decoction method, 25 g of defatted leaves were added into 500 ml beaker with 250 ml of water and was heated on a water bath for 30 minutes and filtered. The excess of solvent were removed by simple evaporation technique (Saraswathi et al., 2011).

Animal

Male albino Wistar rats (30) weighing 190 to 200 g were selected for the experiment. The study was conducted after taking the approval of Institutional Animal Ethical Committee of Regional Institute of Medical Sciences, Imphal, India.

Acute toxicity study

According to the OECD guidelines, acute oral toxicity study was performed at a dose of 5000 mg/kg body weight.

Induction of diabetes mellitus

Diabetes mellitus was induced by injecting Nicotinamide 110 mg/kg body weight in normal saline intraperitoneally, after 15 min followed by STZ 65 mg/kg body weight in citrate buffer (pH 4.5). Hyperglycemia was confirmed on day 7 after injection. Animals showing fasting serum glucose level more than 200 mg/dl were selected for the study (Masiello et al., 1998; Punitha et al., 2005).

Experimental design

Animals were divided into five groups of six animals each. Groups I and II were served as normal control and diabetic control. Group III was treated with standard drug as glibenclamide 0.25 mg/kg body weight, whereas groups IV and V were administered with extract of 100 and 200 mg/kg body weight, respectively. Treatment was carried out orally for 14 days. The fasting serum glucose level was estimated on days 7 and 14. Lipid profile, glycosylated haemoglobin and changes in body weight were also measured.

Statistical analysis

All results were expressed as the mean ± standard error of mean (SEM). The statistical significance was evaluated using one- way analysis of variance (ANOVA), followed by Student's t-test using SPSS 20 version software.

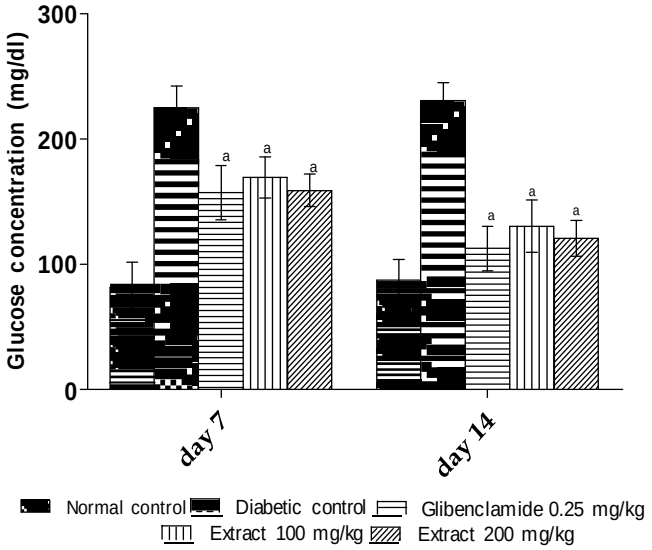

Figure 1. Serum glucose level. Each value is mean ± SEM of six rats in each group. [a]p<0.05 by comparison with diabetic control.

RESULTS

Acute toxicity study

The various observations showed the normal behaviour of the treated animals and no toxic effects. Hence, there was no lethal effect found.

Hypoglycaemic effect of extract

This study showed that at the end of 14 days of treatment, there was a significant decrease ($p<0.05$) of fasting serum glucose level in groups IV (43.51%, 130±21.00) and V (47.71%, 120.66±14.45); the extract had shown a dose dependent, significant decrease of glucose level versus diabetic rats of group II, as indicated in Figure 1. There was a significant fall (51.19%, 112.63±17.74) of the glucose level in standard drug treated group which is comparable with the highest dose of the extract. Thus, the study shows that the extract exhibited significant hypoglycaemic effect in diabetic animals.

Changes in body weight

Body weights were not increased significantly in all the treated groups as compared to diabetic control as shown in Figure 2.

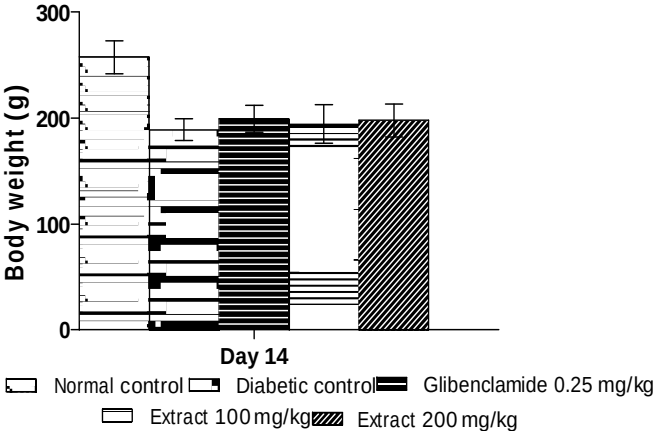

Figure 2. Body weight. Values are expressed as mean±SEM; n=6. The body weight of the treated animals did not improve significantly.

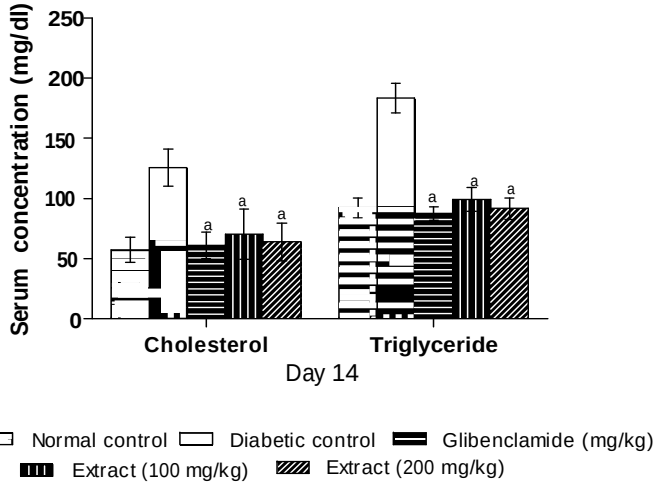

Figure 3. Cholesterol and triglyceride level. Each value is mean±SEM of six rats in each group.
[a]p<0.05 by comparison with diabetic control.

Changes of lipid profile

Both cholesterol and triglyceride level (Figure 3) were found to reduced significantly in extract treated groups IV and V. Percentage of reduction of cholesterol level in groups IV and V were (44.03%, 70.32±21.03) and (49.23%, 63.78±15.88) as compared to diabetic group, whereas triglyceride levels were 45.94% (99.26±10.11) and 50.11% (91.60±8.77), respectively.

Glycosylated haemoglobin level

Glycosylated haemoglobin level in group IV (40.27%, 4.3±0.66) and group V (43.05%, 4.1±0.52) was significantly decreased as compared to diabetic control as shown in Figure 4.

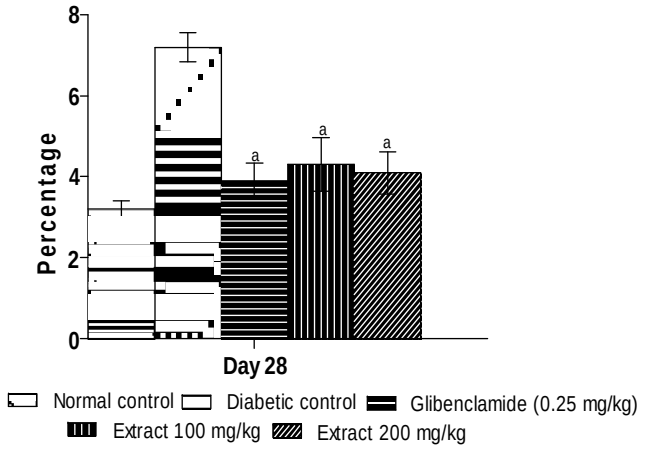

Figure 4. Glycosylated haemoglobin level. Each value is mean±SEM of six rats in each group. [a]p<0.05 by comparison with diabetic control.

DISCUSSION

The protective effect of nicotinamide against the cytotoxicity of STZ in pancreatic beta cells is dose dependent which act as a inhibitor of poly(ADP-ribose) synthetase, a NAD consuming enzyme. A suitable combined dose of nicotinamide and STZ induced a stable moderate hyperglycemia and reduced pancreatic insulin stores (Masiello et al., 1998).

This study showed significant differences in fasting serum glucose level between the diabetic treated group and untreated diabetic rats. However, the higher dose of extract showed more efficiency of hypoglycaemic activity in diabetic rats. It may be due to the influence of insulin release either by regenerating the pancreatic beta cells or by activating pancreatic granules where insulin is stored (Hayashi et al., 2002; Yoshio et al., 1999). It also potentiates translocation of glucose transporter 4 (GLUT4) from intracellular microsomal membrane to plasma membrane (Hattori et al., 2003). Ellagitannins acted as activators of hexose uptake in rat adipocytes like insulin (Judy et al., 2003; Swanston-Flat et al., 1990). The fall of glycosylated haemoglobin in treated diabetic groups may be due to glycaemic effect. Both serum cholesterol and triglyceride level were found to decrease in diabetic induced rats which may probably be due to deterioration of lipolysis as well as cholesterol biosynthesis (De Sereday et al., 2004; Sharma and Narir, 2003).

The aqueous extract of *L. speciosa* has also shown hypoglycaemic effect in STZ- Nicotinamide induced

diabetic rats. However, further study is required to elucidate in controlling diabetes mellitus.

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