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Research Article

ANTIHYPERGLYCEMIC AND ANTIHYPERLIPIDEMIC POTENTIALS OF PSIDIUM GUAJAVA IN ALLOXAN-INDUCED DIABETIC RATS

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ABSTRACT

This study was undertaken to evaluate the hypoglycemic and hypolipidemic potential of ethanolic extract of *Psidium guajava* leaf on normal and alloxan induced diabetic rats. The ethanolic extract of *Psidium guajava* leaf was prepared. Male 6-8 week old albino rats were selected for the experiments and these were divided into four groups. Diabetes was induced by alloxan. Blood glucose and lipid profile levels were measured. A significant decrease in blood glucose, total cholesterol (TC), triglycerides (TG), low-density lipoprotein (LDL) cholesterol, very low-density lipoprotein (VLDL) cholesterol, and a significant increase in high-density lipoprotein (HDL) cholesterol, were observed after 21 days treatment of ethanolic extract *Psidium guajava* leaf. Diabetic rat models had shown hypoglycaemic and hypolipidemic effect ethanolic leaf extract of *Psidium guajava*.

Keywords: *Psidium guajava,* diabetes, hypoglycaemic, hypolipidemic

INTRODUCTION

Diabetes mellitus is the commonest endocrine disorder that affects more than 100 million people worldwide (6% of the population) and in the next 10 years it may affect about five times more people than it does now [1]. In India, the prevalence rate of diabetes is estimated to be 1-5% [2, 3]. Chronic hyperglycemia during diabetes causes glycation of body proteins that in turn leads to secondary complications affecting eyes, kidneys, nerves and arteries [4]. The most common pattern of dyslipidemia in patients with diabetes is elevated triglyceride (TG) levels and decreased high-density lipoprotein (HDL) cholesterol levels. Patients with diabetes tend to have a higher proportion of smaller and denser LDL particles, which are more susceptible to oxidation and may thereby increase the risk of cardiovascular events [5].

Herbs are staging a comeback and herbal 'renaissance' is happening all over the globe. The blind dependence on synthetics is over and people are returning to the naturals with hope of safety and security. *Psidium guajava* Linn. (Guava) is a semi-deciduous tropical tree and is widely grown throughout India for its fruit called Guava. The extract of the whole plant of *Psidium guajava* excluding roots was reported to be devoid of any antibacterial, antifungal, antiviral, antifertility, hypoglycaemic, diuretic and anti-inflammatory activities [6]. The leaves of *Psidium guajava* inhibit the increase of plasma sugar level in alloxan induced diabetic rats, during glucose tolerance test [7]. Thus, the present study was carried out to evaluate the antihyperglycemic and antihyperlipidemic potentials of *Psidium guajava* leaf extract on toxin induced diabetic rat models.

MATERIALS AND METHODS

Preparation of the extract

Fresh leaves of *Psidium guajava* were collected in Coimbatore. Plant material was dried under shade at room temperature, pulverized by a mechanical grinder and sieved through 40 meshes. The powdered material (100 g) was extracted with 95% ethanol by hot continuous percolation method in a Soxhlet apparatus. The extract was then concentrated and dried under reduced pressure. The ethanol free semi solid mass obtained (13.65 g) was used for the experiment.

Animals

Male albino rats of 6-8 weeks age, weighing 150-180 g, were used. The animals were kept in clean and dry plastic cages, with 12h: 12h light-dark cycle at 25 ± 2ºC temperature and 45 - 55 % relative humidity. The animals were fed with standard pellet diet and water was given *ad libitum*. This study was carried out in the animal house of Karpagam University, Coimbatore (Regd. No. 739/03/abc/CPCSEA) and this study was approved by the Institutional Ethical Committee.

Collection of blood and experimental setup

Animals were classified into four groups of six rats each. Group I served as control and received normal saline (2 ml/kg body weight). Group II treated with alloxan monohydrate 150 mg/kg served as diabetic control. Group III treated with ethanolic leaf extract of *Psidium guajava* (500 mg/kg body weight). Group IV treated alloxan monohydrate and ethanolic leaf extract of *Psidium guajava*. Sugar and lipid profile was estimated at the end of the study (21 day).

Statistical analysis

Data represent the mean ± standard deviation (S.D.) of the indicated number of experiments. Statistical analysis was performed using one way analysis of variance (ANOVA) followed by Duncan's multiple range test (DMRT) by using statistical package of social science (SPSS) version 12.0 for windows. *P* values <0.05 were considered as level of significance.

RESULTS

The hypoglycemic and hypolipidemic activity of Psidium guajava leaf extract was shown in Table 1. The concentration of glucose was significantly higher (P<0.001) in alloxan treated rats (Group II), as compared to normal control animals (Group I). These constituents were found to attain a near normal level in plasma of Psidium guajava treated rats (Group III, P<0.001) and alloxan plus Psidium guajava (Group IV), treated rats (P<0.001). The concentration of total cholesterol (TC) was significantly (P<0.001) higher in alloxan treated rats, as compared to normal control animals. These constituents were found to attain a near normal level in liver of Psidium guajava treated rats (P<0.002) and alloxan plus Psidium guajava treated rats (P<0.001). The concentration of triglycerides (TG) was significantly (P<0.03) higher in alloxan treated rats, as compared to normal control animals. These constituents were found to attain a near normal level in liver of Psidium guajava treated rats (P<0.01) and alloxan plus Psidium guajava treated rats (P<0.001).
The levels of low-density lipoprotein (LDL) cholesterol and very low-density lipoprotein (VLDL) cholesterol recorded a significant decline (P<0.001) in alloxan administered rats, when compared with normal controls. In Psidium guajava treated rats (P<0.002) and alloxan plus Psidium guajava, treated rats, the activities of these enzymes attained a near-normalcy (P<0.001). The concentration of

high-density lipoprotein (HDL) cholesterol was significantly (P<0.001) decreased in alloxan treated rats, as compared to normal control animals. These constituents were found to attain a near normal level in liver of *Psidium guajava* treated rats and alloxan plus *Psidium guajava* treated rats (P<0.01).

Table 1: Effect of ethanolic leaf extract of *Psidium guajava* on glucose and lipid profile in alloxan-induced diabetic rats

Groups	Total cholesterol (mg/dl)	Triglycerides (mg/dl)	High-density lipoprotein cholesterol(mg/dl)	Low-density lipoprotein cholesterol (mg/dl)	Very low-density lipoprotein cholesterol (mg/dl)
Group I	149.1±29.8[a]	101.8±11.6[b]	36.5±4.6[b]	92.2±30.2[a]	20.3±2.3[b]
Group II	231.1±28.3[b]	133.3±17.5[c]	18.0±3.5[a]	186.5±29.8[c]	26.6±3.5[c]
Group III	166.1±14.3[a]	87.8±13.2[b]	33.3±3.4[b]	114.5±13.5[a, b]	17.5±2.6[b]
Group IV	163.3±9.7[a]	69.3±8.1[a]	22.8±4.0[a]	126.6±10.4[b]	13.8±1.6[a]

Values are expressed as means ± S.D. for six albino rats in each group.
Values not sharing a common marking (a, b, c,..) differ significantly at P<0.05 (DMRT)

DISCUSSION

The experimental data shows increased plasma concentrations of glucose in alloxan treated albino rats in the study. The most common pattern of atherogenic dyslipidemia, expressed as hypercholesterolemia, hypertriglyceridemia, and/or low-HDL cholesterolemia was also noted in alloxan treated diabetic models.

Alloxan is the most prominent diabetogenic chemicals in diabetes research [8]. In the present study alloxan at a concentration of 150mg/kg body weight successfully caused diabetes in albino rats. The diabetic animals showed the following signs of the condition: polydipsia (abnormal thirst), polyuria (increased urine volume) and weight loss.

The present study revealed that the *Psidium guajava* leaf extract had marked hypoglycaemic as well as hypolipidemic effect in alloxan-induced diabetes. This extract, therefore, could be used for lowering glucose, TC, TG, LDL and VLDL levels and reducing thereby the risk of CVD by increasing HDL cholesterol level.

Mechanistically, in the current investigation the antidiabetic activity of ethanolic leaf extract of *Psidium guajava* may be due to the inhibitory activity of alpha-glucosidase. Deguchi *et al.* [9] demonstrated that aqueous *Psidium guajava* leaf extract, inhibited the *in vitro* activities of maltase, sucrase, and alpha-amylase in a dose-dependent manner. Furthermore, Wang *et al.* [10] also observed that the extract inhibited both sucrase and maltase activities.

The leaf extract of *Psidium guajava* stimulated glucose metabolic enzymes in liver tissues [11, 12]. Treatment with freshly prepared leaf extracts of *Psidium guajava* significantly reduced blood glucose and lipid profile levels in diabetic albino rats and having similar effect in diabetic patients [13, 14, 15, 16].

CONCLUSION

From overall study it is concluded that the presence of anti–hyperglycaemic potential of the extract of *Psidium guajava* leaf provided a new therapeutic avenue against diabetes and diabetes related complications. Further characterizations of active components of *Psidium guajava* leaf for diabetes are warranted.

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