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Evaluation of anti-diabetic and anti-hyperlipidemic activity of *Psidium guajava* seeds in type-2 diabetic rats

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ABSTRACT

The study was designed to evaluate the anti-diabetic and anti-hyperlipidemic activity of *Psidium guajava* seeds in normal and streptozotocin (STZ) induced type-2 diabetic rats. The ethanolic extract of *Psidium guajava* was characterized and tested in Wistar rats. The selected rats were divided into four groups. Type-2 diabetes was induced by STZ 30 mg/kg body weight through intravenous (i.v.) route. Oral administration of ethanolic extract of *Psidium guajava* seeds extract (400mg/kg body weight/day) for 4weeks to STZ induced diabetic rats significantly decreased the levels of blood glucose, HDL, LDL, triglycerides (TG) and cholesterol.

Key words: Diabetes mellitus, Hyperlipidemia, Psidium guajava (PG), Streptozotocin (STZ).

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INTRODUCTION

Diabetes mellitus (DM) is a type of metabolic disorder or chronic disorder. It is characterized by inadequate or inefficient insulin response and increasing the blood glucose levels [1]. It is also characterized by reduction in glucose utilization for energy purposes as well as impaired uptake and storage of glucose[2,3]. The constant blood glucose levels were maintained by glucose homeostasis and can be achieved by a balance in endogenous glucose production and utilization [4]. Insulin is a hormone produced by beta cells of the pancreas which helps transport the glucose (blood glucose) bloodstream into the cell so they can break it down and use it for fuel. Diabetes-induced hyperlipidemia is one of the major factors for cardiovascular and cerebrovascular diseases. Two important lipids such as triglycerides and cholesterol have been implicated in these disorders[5,6].

According to world health organization (WHO), about 80% of people in the world are depending on the herbal medicines or traditional medicines for their primary health care. In ancient literature, about 500 plants with medicinal use were mentioned but in India around 20,000 medicinal plant species were recorded recently and about 800 plants have been used in indigenous systems of medicines. Herbal medicines are also effective in boosting the mental health. Most of the herbal medicines are very good in decreasing the cholesterol levels in the blood and also glucose levels in blood. The herbal medicines do not have any side effects and any chemicals. The natural detoxification process of the body is effectively enhanced by herbal medicines. The present work is an effort to investigate the effect of ethanolic extract of the medicinal plant *Psidium guajava* seeds in STZ induced diabetic rats. *Psidium guajava Linn.(Guva)* is a medicinal plant and is commonly known as 'Peru'or 'Guva' in English. It grows in tropical and subtropical areas such as India, South America, Mexico, Bangladesh, Florida, and West indies. This tree is used traditionally because of its food and nutritional value. It has its own pharmacological activities such as anti-diabetic activity, hepatoprotective, anti-allergic, anti-spasmodic, anti-cough, diarrhoea, anti-fungal, anti-viral, anti-inflammatory, cardioactive, anti-fertility activities [7].

The plant *Psidium guajava* belongs to the family Myrtaceae and it is also known as amrood, amarut in hindi, pear in arabic, draksa, perlal, amartafalam in sanskrit, guayaba in spanish, arryan in mexico, jama in telugu [8].

Plant fruits, roots, leaves and bark are used for treatment of gastroenteritis, dysentery and diarrhoea. The leaves are also used for treatment of ulcers and rheumatic pain and toothache[9].The bark[10], fruit[11] and leaves of common guava shows the anti-diabetic effect. The selected fruits are well known for the use in traditional medicine due to the presence of secondary metabolites and phytochemical constituents such as flavanoids, saponins, antioxidants, phenols, steroids, amino acids, vitamins (that includes vit-C, vit-A), proteins, glycosides, alkaloids, carbohydrates etc. Based on the literature survey various research studies have been carried out to evaluate the therapeutic action of the medicinal plant *Psidium guajava* which has effective anti-hyperglycemic action. Therefore, the present study is to evaluate the use of the medicinal plant *Psidium guajava* which plays a significant role in reducing the blood glucose and lipid levels.

MATERIAL AND METHODS

Collection and authentication of plant material: The seeds of the medicinal plant *Psidium guajava* were collected from yadhadri-bhongiri, Telangana and which was taxonomically identified and authenticated by Dr. Manohar from Acharya N.G. Ranga Agricultural University, Hyderabad, India. The plant material is shade dried with occasional shifting and powdered with a mechanical grinder and sieved through 40 mesh. The powder is stored in an air-tight container.

Preparation of plant extract: The coarse powder of shade dried seeds of the medicinal plant *Psidium guajava* was subjected to Soxhlet extraction process with ethanol (1000ml). The obtained extracts were dried under reduced pressure by using rota flash evaporator.

Experimental animals: Healthy adult male Wistar rats weighing 200-250 g were used for the experiment. The animals were housed under conditions of controlled temperature and 12 h day-night cycle and fed with standard rodent pellet diet and provided water *ad libitum*. The animals were acclimatized for one week and then used for the experimental study. Prior to the experiments the approval was obtained from Institutional Animal Ethical Committee (IAEC).

Experimental procedure: The experimental animals were divided into four groups of six rats each. This proposed experimental design was planned as follows.

Group 1(Normal group): In this group of the rats received the normal drinking water.

Group 2(Diabetic group): Rats were treated with STZ (40mg/kg body weight) per i.v.

Group 3(Normal Treated group): Rats of this group received ethanolic extract of *Psidium guajava* seed (400mg/kg body weight) for 30 days per oral (p.o).

Group 4(Treatment group): Animals of this group were received streptozotocin (40mg/kg body weight) and ethanolic extract of *Psidium guajava* seeds (500mg/kg body weight) for 4 weeks.

Collection of blood samples:

Fasting blood sample were drawn from retro orbital plexus (eye) of rat at weekly intervals till the end of the study 0, 7, 15, and 31 days. After collection of blood samples by centrifuging at 1200rpm for 15 min, serum was prepared and stored at -20^0 until the biochemical parameters were studied**.**

RESULTS AND DISCUSSION

Results of preliminary phytochemical screening and pharmacological screening tests of various parameters were presented below.

Preliminary phytochemical screening: The preliminary phytochemical evaluation showed the presence of flavonoids, glycosides, alkaloids, flavonols, carbohydrates, proteins, steroids, vitamin-A, vitamin-C, tannins and phenolic compounds

Table 1: List of phytochemical constituents present in the ethanolic extraction of *Psidium guajava*

S.No.	Name of phytoconstituents	Ethanolic extract of *Psidium guajava*
1	Alkaloids	+
2	Saponins	+
3	Carbohydrates	+
4	Flavonoids	+
5	Glycosides	+
6	Proteins	+
7	Steroids	+
8	Tannins and phenolic compounds	+
9	Vitamin-A	+
10	Vitamin-C	+

(Where + = present)

Table 2: Effect of *Psidium guajava* seed extract on glucose and lipid profile in normal and STZ induced diabetic rats after 4 weeks.

Group/Parameter	Normal	Diabetic	Normal Treated	Diabetic Treated
Glucose (mg/dl)	92.11± 3.66*	199.15 ± 14.80*	90.69 ± 2.93*	152.52 ± 11.84*
HDL (mg/dl)	41.08± 0.55*	32.87 ± 1.70*	48.2 ± 0.44*	57.76 ± 1.36*
LDL (mg/dl)	46.99 ± 2.33*	87.00 ± 1.83*	51.59 ± 1.86*	65.6 ± 1.47*
Triglycerides (mg/dl)	147.13 ± 0.58*	197.41 ± 4.64*	127.71 ± 0.46*	157.92 ± 3.71*
Cholesterol (mg/dl)	150.96 ± 2.48	235.73 ± 2.37*	156.77 ± 1.98*	188.58 ± 1.90*

*P <0.05 Values are represented as Mean ± SEM. Statistical analysis performed using one way ANOVA

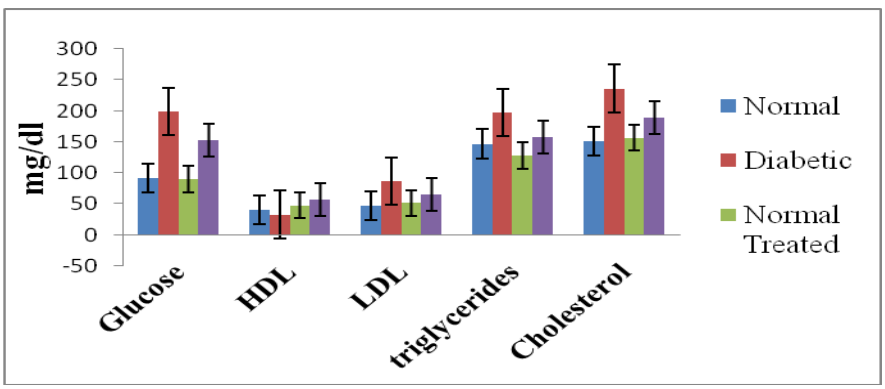

Figure 1: Effect of *Psidium guajava* seed extract on glucose and lipid profile in normal and STZ induced diabetic rats.

DISCUSSION

In the present study, administration of STZ caused a significant increase in the blood glucose levels and cholesterol level as well as significant increase in the serum LDL, HDL and triglycerides levels indicating the induction of diabetes in rats when compared to the normal control. Therefore, treatment with ethanolic extract of PG for 28 days have shown significant changes in levels of blood glucose, LDL, HDL, triglycerides and cholesterol in treatment groups when compare to diabetic control group.

The liver is a major organ and it plays a major role in regulating blood glucose levels. It absorbs glucose and stores it in the form of glycogen. The release of glucose by the liver helps to maintain blood glucose homeostasis. Glucose homeostasis helps to keep blood glucose levels constant, and it is achieved by a balance in endogenous glucose production and utilization.

The blood glucose level is a main parameter for the diagnosis of diabetes mellitus. During diabetes, the blood glucose levels are increased which results from reduced glucose utilization by various tissues. In the present study the results showed increased levels of blood glucose, LDL, HDL, triglycerides and cholesterol in diabetes induced group. Treatment with PG (500mg/kg b.w.) showed significant decrease in blood glucose levels and LDL, HDL, triglycerides and cholesterol in the diabetic treated when compared with normal treated (non diabetic) animals after 28 days.

SUMMARY AND CONCLUSION

In the present study, oral administration of PG seeds extract for a period of 28 days significantly decreases the blood glucose levels and also decreases the levels of LDL, triglycerides, cholesterol. The above results reveal that the anti-diabetic activity and anti-hyperlipidemic activity of flavonoid content in *Psidium guajava* seeds extract may be involved in the protective effect of the medicinal plant against the STZ induced diabetes. The presence of phytochemical constituents in *Psidium guajava* may attribute to produce anti-diabetic effect against the STZ induced diabetes.

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