SCIENTIFIC NOTE

Hypoglycemic Potency of Selected Medicinal Plants in Nigeria

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Summary

A preliminary phytochemical screening and hypoglycemic activities of the ethanolic extracts of phyllanthus niruri*, fruits of* Solanum melogena var esculentus*, leaves and fruits of* Solanum Xanthocarpum *were investigated. All plant extracts were found to contain alkaloids and tannins, while saponin was found in all plants except* Phyllanthus niruri*. Coumarin was detected only in* Solanum xanthocarpum *(leaves), while anthrancenosides was detected in* Phyllanthus niruri Solanum xanthocarpum *(fruit) only. Hypoglycemic activity of all plants extracts were determined by postprandial glucose test after administration of extracts at 10mg/100g body weight to adult albino rats. Postprandial plasma glucose level was measured at 30 minutes intervals for 2 hours. The result of this study showed that all extracts had hypoglycemic activity with* Solanum melongena var esculentus *having the highest activity. Thus, the plants may be effective in the management of hyperglycemia may be attributed to the phytochemicals present in them plants..*

Keywords: *phytochemicals, hypoglycemic, postprandial, glucose*

Introduction

Diabetes mellitus is a metabolic disorder characterized by hyperglycemia, abnormal lipid and protein metabolism along with specific long-term complications affecting the retina, kidney and nervous system, defect in reactive oxygen species (ROS) scavenging enzymes (Kesavulu *et al*, 2000). Hyperglycemia is an important factor in the development and progression of the complications of diabetes mellitus (Scoppola *et al.,* 2001). Chronic hyperglycemia causes many of the major complications of diabetes, including nephropathy, retinopathy, macro vascular and micro vascular damage (Brownlee, 2001). In modern medicine, no satisfactory effective therapy is still available to cure diabetes mellitus (Sumana and Suryawashi, 2001). Several diseases have been effectively treated using extracts of different plants (Bailey and Day, 1989). The use of medicinal plants in the treatment of diabetes mellitus has flourished over the years because of the expensive nature and the many side effects associated with the use of synthetic hypoglycemic agent. The synthetic hypoglycemic agents used in clinical practices have serious side effects like hematological effects, coma, disturbances of liver and kidney (Larner, 1985). The World Health Organization has recommended and encouraged the use of herbs and medicinal plants in the treatment of diabetes especially in countries where access to the conventional treatment of diabetes is not adequate (WHO, 2002). Therefore, the search for more effective and safer antidiabetic agents has become an area of active research. It is to this end that the hypoglycemic potencies of whole plant of *phyllanthus niruri*, fruits of *Solanum melogena var esculentus*, leaves and fruits of *Solanum Xanthocarpum* were investigated in this study.

Phyllanthus niruri popularly called Chanca piedra by the Spanish, belongs to the family Euphorbiaceae. It is a small, erect, annual herb that grows 30–40 cm in height. It is indigenous to the rainforests of the Amazon and other tropical areas throughout the world, including the Bahamas, southern India, and China (Cauis 1986). *Phyllanthus niruri* has been shown to have several medicinal uses in Africa, Asia and South American (Mellinger *et al.,* 2005). The plant has demonstrated liver protective, antilithic (expels stones), pain-relieving, hypotensive, antispasmodic, antiviral, antibacterial, diuretic, antimutagenic, and hypoglycemic activities(Okoli et al 2010; Unander *et al.,* 1995; Paranjape, 2001; and Lin *et al*., 2003).

Egg plants occur in many different species and variety, some are edible example *Solanum melongena var esculentus* (L) Nees (white beauty) while others like *Solanum ovigerum dumal* (ornamental white egg plant) are not edible. The leaves, fruits and roots of *Solanum melongena* and *Solanum xanthocarpum* are used traditionally for medicinal purposes. *Solanum melongena* has been found to lower blood cholesterol level and can serve as a diet supplement in regulating high blood pressure (Chevallier, 1996).

Solanum xanthocarpum (Solanaceae), commonly known as Yellow berried night shade, is a prickly, diffusely bright-green, perennial shrub which grows abundantly in arid areas of India. The plant bears globular, berry type fruits, about 1.3 cm in diameter, which is yellow or white in color with green veins. The plants parts have been used traditionally for curing various ailments. The Fruits are eaten as an anthelmintic and for indigestion (Ghani, 1998). The root is an expectorant, used in Ayurvedic medicine for cough, asthma and chest pain. Also used for flatulence, sore throat, and toothache. Fruit juice is useful in sore throats and rheumatism; decoction of the plant is used in gonorrhea; paste of leaves is applied to relieve pains; seeds act as expectorant in cough and asthma; roots are expectorant and diuretic, useful in the treatment of catarrhal fever, coughs, asthma and chest pain (Ghani, 1998).

The present study was carried out to investigate the hypoglycemic potency of whole plant of *phyllanthus niruri*, fruits

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of *Solanum melogena var esculentus*, leaves and fruits of *Solanum Xanthocarpum*.

Materials and method

Collection of Plant materials

Phyllanthus niruri, Solanum xanthocarpum(fruits and leaves) and *Solanum melongena var esculentus*(fruits) were obtained from the premises of Federal Polytechnic Bida, Fadama area in Bida town and Bida market respectively and were authenticated by a Botanist at Federal University of Technology Minna. The leaves of *Solanum xanthocarpum* and whole plant of *phyllanthus niruri* were air dried at room temperature and pulverized using mortar and pestle while the the fruits of the two Solanum species were cut to small pieces, pulverized with a blender and was subjected to ethanolic extraction.

Preparation of Extract

Fifty grams (50g) of the pulverized samples were percolated in 99% ethanol for 24 hours in separate 500ml conical flasks for complete extraction. Thereafter the mixture was filtered using a thick layer of cotton wool in a funnel. The solvent was evaporated from the extract in an open shallow bowl placed in hot air oven at 40^0C for 24 hours and the resulting paste obtained from each of the plant was collected in different sample bottles, weighed and kept in the refrigerator.

Fresh fruits of the two different varieties of Solanum being used were cut to small pieces, pulverized with a blender and percolated separately in two different conical flasks in 99% ethanol at 200g/250 ml for 72 hours. Filtration was carried out using a thick layer of cotton wool in a funnel, the solvent was evaporated in an open shallow bowl in a hot air oven at 40^0C for 24hours and the liquid extract obtained from the two different containers were stored at -4^0C until use.

Preliminary Phytochemical screening

The following phytochemical were screened according to standard methods; saponins, tannins, alkaloids, phlobatannins, sterol glycosides, anthracenosides, coumarins. (Sofowora, 2000).

Experimental animals

Albino rats of wistar strain with a mean weight of 150±2.5g were obtained from the animal house of the Biochemistry Department of University of Illorin, Illorin, Kwara State and used for this study. They were fed on standard rat pellet diet and allowed to adapt for one week. They were provided water *ad libitum* and maintained under standard laboratory conditions of natural photo period of 12-hr light - dark cycle.

Experimental Design

Twenty five albino rats were divided into five groups of five rats each as follows;

Group I: normal saline (control)

Group II: *phyllanthus niruri* reconstituted in normal saline.

Group III: *Solanum xanthocarpum* leaf extract reconstituted in normal saline.

Group IV: *Solanum xanthocarpum* fruit extract reconstituted in normal saline.

Group V: *Solanum melongena var esculentus* fruit extract reconstituted in normal saline.

Postprandial Glucose Test

The animals were fasted overnight and the crude plant extracts were administered orally at 10mg /100g body weight. After 30 minutes, 1ml/100g- body weight of 40% glucose was given to each of the groups. The control group received equivalent volume of normal saline instead of crude extract of the plants. Blood was collected via the tail of the rats after every 30minutes for a period of 120 minutes and glucose concentration was determined using a glucometer (One Touch Lifescan Company).

Statistical Analysis

Statistical significance was established using One-Way analysis of variance (ANOVA) and data were reported as mean ± standard error. Statistical analyses were carried out using SPSS for Windows, version 14.0 (SPSS Inc. Chicago, IL.USA).

Results and discussion

Over the years, there have been growing interests on the health benefits of trace chemicals collectively called phytochemicals. These are biologically active compounds found in plants in small amounts (Dreosti, 2000). They are not established nutrients but, nevertheless, seem to contribute significantly to protection against degenerative disease.

The result of phytochemical screening of the medicinal plants use in this study is shown in table 1. The result showed

Table 1. Phytochemical constituents of phyllanthus niruri, fruits of *solanum melongena var.Esculentus,* leaves and fruits *of solanum xanthocarpum.*

Plants	Alkaloids	Tannins	Saponin	Phltobatannins	Aglycone	Anthracenosides	coumarins
Phyllanthus niruri	+	++	-	-	-	++	-
Solanum xanthocarpum(leaves)	+	+	+	-	-	-	+
Solanum xanthocarpum(fruits)	+	++	++	-	-	+	-
Solanum melongena var esculentus (fruits)	+	+	+	-	-	-	-

Key: *++ Detected in high concentration, + moderately present. -Not Detected.*

Table 2. Effect of crude ethanolic extract of whole plant of *Phyllanthus niruri*, fruits of *Solanum melogena*, leaves and fruits of *Solanum xanthocarpum* on postprandial glucose levels in Albino Rats

	Blood Glucose Concentration (mg/dl)				
Groups	0 minute	30 minutes	60 minutes	90 minutes	120 minutes
Group 1	51.37± 0.32^{d}	94.50 ±0.87^{a}	93.80 ± 0.58^{a}	71.00 ± 0.06^{a}	66.20 ± 0.12^{a}
Group 2	51.00 ± 0.58^{d}	71.70 ± 0.75^{d}	78.60 ±1.96^{b}	67.90 ±1.04 ^{b}	64.93 ± 1.07^{a}
Group 3	71.73 ± 0.15^{a}	82.10 ± 0.06 ^{b}	81.40 ± 0.23^{b}	62.47 ± 1.11^{c}	55.90 ±1.79^{c}
Group 4	69.00 ±0.23^{b}	78.60 ± 1.62^{c}	72.80 ±1.62^{c}	66.90 ±0.00^{b}	64.10 ± 1.73^{a}
Group 5	61.00 ± 0.58^{c}	70.20 ± 0.06^{d}	63.40 ±0.06^{d}	61.40±0.17^{c}	60.00 ± 0.58^{b}

Result is expressed as mean ± SEM where n = 5.Values on the same column with different letters as superscripts were significantly different from each other at 5% level of significance (p< 0.05) while those with the same letter were not significantly different from each other (p>0.05).

that *Phyllanthus niruri* contains alkaloids, tannin and anthracenosides with the absence of and saponin, coumarin, aglycone and phltobatannin. The presence of alkaloids and tannin in this plant is in agreement with previous work (Bagalkolkar et al., 2006; Rajeshkumar et al., 2002). Similarly the crude ethanolic extracts of leaves and fruits of *Solanum xanthocarpum* revealed the presence of alkaloids, tannins, saponin which is consistent with previous study on the phytochemicals of leaves of *Solanum xanthocarpum* (Mulchandani and Hassarajani 1984).

Coumarin and anthracenocides detection in the leaves and fruits of this plant respectively as found in this study was not comparable with any known study on the phytochemicals of this plant. Alkaloid and saponin was also detected in the fruits of *Solanum melongena* var esculentus. These phytochemicals have been reported to exhibit diverse pharmacological and biochemical actions when ingested by animals (Amadi et al., 2006) as well as exhibiting physiological activity (Sofowora, 1993). Their presences in many plants contribute to the medicinal values of such plant and specifically in this study the hypoglycemic activities of the studied plants.

In this study a general increase in the postprandial blood glucose concentration was observed in all groups after 30minutes of administration of glucose solution. This rise was significantly higher in the control group compared to the treatment groups. The glucose level was however, lowered after 60 minutes in all groups. This decrease in all the treated groups was significant ($p<0.05$) compared to the control. However, *Solanum melongena var esculentus* treatedt group showed a more significant ($p<0.05$) decrease in the glucose concentration in albino rats compared to the other treated groups. Similarly, there was a further significant ($p<0.05$) decrease in the postprandial blood glucose concentration in all treated groups compared to the control. Groups treated with *Solanum melongena* and fruits showed higher significant ($p<0.05$) decrease after 90 and 120 minutes respectively. Based on these results, it could be inferred that ethanolic extract of *Solanum melongena* fruit has the highest hypoglycemic properties. The observed hypoglycemic effect of phyllanthus niruri and *Solanum xanhocarpum* leaves is comparable to that of previous studies (Okoli *et al*. 2010; and Gupta *et al*., 2005) while that of *Solanum melongena* and *Solanum xanthocarpum* fruits was not comparable to any known study. These observed hypoglycemic properties of the ethanolic extract of the studied plants may be attributed to the presence of the phytochemicals from the preliminary phytochemical screening.

These phytochemicals have been reported to possess antioxidant properties which is protective against hyperglyceamia induced oxidative stress (Baynes and Thorpe, 1999). They have also been reported to be associated with improvement in the symptoms of diabetes mellitus.

Conclusion

This study therefore concludes that the ethanolic extract of whole palnt of *Phyllanthus niruri*, leaves and fruits of *Solanum xanthocarpum* and fruits of *Solanum melogena* may be useful in the treatment and management of diabetes mellitus.

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