Evaluation of the Anti-diabetic Potential of Ethanol Extract of *Persea americana* Fruit Peel (Pericarp)

Abstract

The aim of this study was to evaluate the anti-diabetic potential of ethanol extract of *P. americana* fruit peel (Pericarp).Peel obtained from ripe avocado fruits was thoroughly washed with clean tap water, dried at room temperature before being ground to fine powder and extract developed. Fifteen (15) adult male wistar rats were divided into three (3) groups of five (5) rats each. **Group I** was the normal control fed rat chow and water *ad-libtum*, **Group II** was the diabetic control and was not treated with the extract, while **Group III** was diabetic rats treated with 100 mg/kg of *P. americana* fruit peel extract for 21 days. Blood glucose level was determined weekly through standard procedures. The result obtained revealed that administration of alloxan monohydrate significantly ($P<0.05$) raised blood glucose level in rats. However, administration of *P. americana* fruit peel extract significantly ($P<0.05$) reduced blood glucose level in diabetic rats. In conclusion, this works establishes the anti-diabetic potential of the fruit peel of *P. Americana*.

Keywords: *Persea americana*, Glucose, Pericarp, Fruit, Diabetes Mellitus

Introduction

The inability of the pancrease to secrete insulin and or insulin's incapacitation defines a complex metabolic disorder known as diabetes mellitus characteristically identified by the high blood sugar levels among sufferers [1]. Micro and macro vascular problems can result from complication arising from the disorder [2]. WHO reports affirms that an estimated 300 million adults would suffer from diabetes by 2025 globally implying that diabetes mellitus is the nightmare of the 21st century as well as the 5th leading cause of death in many developed nations of the world [3]. Conventionally, treatment options have mainly been by insulin therapy as well as pharmacothereapy which are characterised by pitfalls such as exorbitant cost of medication, decreased pharmacological efficacy resulting from drug resistance, adverse drug reactions and toxicity [4].

The use of plant in the treatment of human ailment is justified owing to their possession of phytochemicals of immense health benefits in addition to being affordable, readily available and relatively less toxic than their synthetic counterparts [5].

Persea americana also known as avocado and a member of the *Lauraceae* family is a polymorphic tree species which is known to originate from the Eastern and Central highlands of Mexico through Guatemala to the Pacific coast of Central America [6]. Botanically, its fruit i.e. avocado or alligator pear is a large berry containing a single large seed known as stone, the pulp which is the edible portion and the pericarp or peel usually considered valueless [7].

The seed of *P. americana* is a therapeutic option for the treatment of diarrehea and dysentery etc [8] and diabetes mellitus [9]. Considering the high prevalence of diabetes mellitius and the possibility of over dependence on the *P. americana* seed, a vegetative part of the tree as a treatment option, predictions abound that the said tree may go extinct in the nearest future.

Therefore, scientific efforts to find more alternatives should as a matter necessity pay attention to the fruit peel (pericarp) which is neither edible nor vegetative but has shown promise an anti-diabetic option through its α-amylase and α-glucosidase inhibitory activity [10].

Materials and Methods

Collection of *Persea americana* Fruit Peel (pericarp)

Persea america fruits purchased from a local market in Ebonyi South Senatorial District of Ebonyi State were identified and authenticated at the herbarium unit of the Department of Forestry, Micheal Okpara University of Agriculture Umudike, Abia State. The fruits which were held in a sack bag were placed in the dark for 7 days to ripe after which the peel was obtained.

Extraction of Plant Material

Exactly 2000 g of pericarp (peel) from ripe *P. americana* fruit was sliced into smaller sizes and dried at room temperature for 8 days and thereafter ground to fine powder which was subsequently sieved with a suitable wire mesh. Extraction of the peel powder was done in a Soxhlet apparatus with ethanol as the solvent and subsequently, concentrated to dryness in a water bath to yield 300 g of extract [11].

Animals

The rats which weighed 160-180 g were housed in plastic cages in the animal house of Abia State University Uturu, Abia State. The animals which were acclimatized for two weeks were fed rat chow and water *ad libitium*. The stipulated guidelines in the care and use of laboratory animals were strictly followed [12].

Median Lethal dose 50% (LD50%)

The median lethal dose 50% of the ethanol extract *P. americana* fruit peel was established as was described by Lorke [13] in which nine (9) adult male wistar rats were divided into three groups of three rats and administered separately with 10, 100 and 1000 mg/kg of the said extract orally. The rats were studied for 24 hr for signs of toxicity. In the absence of which the second phase of the trial was initiated and involved three (3) rats divided into three groups of one rat each and were administered with 1600, 2900 and 5000 mg/kg of extract orally. The animals were observed for 48 hr for signs of toxicity.

Induction of diabetes

Precisely 1.25 g of alloxan monohydrate (Sigma St. Louis, M.O., USA) was dissolved 25 ml of distilled water to make alloxan monohydrate used in the study.The experimental rats were subjected to fasting overnight after which 150 mg/kg of alloxan monohydrate solution was administered by intraperitoneally to induce diabetes [14]. Diabetes was confirmed in animals with blood sugar levels ≥ 200mg/dl after 48 hrs of alloxan injection with the aid of a glucometer (Bioland glucometer, Germany).

Animal grouping

Group I: was fed with rat chow and water *ad libitum*.

Group II: diabetic induced rat without treatment

Group III: diabetic rat administered with 100 mg/kg of *P. americana fruit peel* extract.

Oral administration of extract was continuous for 21 days. Blood glucose level was determined using a glucometer after every seven days from the day of induction by 6 am throughout the treatment period with blood obtained by prickling the tail vein of the animals.

Statistical analysis

Data was analysed using one-way ANOVA and difference between groups compared using Duncan multiple test range. Data were expressed as mean ± standard deviation. $P<0.05$ was considered significant.

Table 1: Blood glucose level of diabetic rats treated with ethanol extract of *P. americana* peel

		Blood glucose levels (mg/dL)			
Grouping	**Treatment**	**Day 0**	**Day 7**	**Day 14**	**Day 21**
Group I	Normal CTRL	76.00 ± 2.36^{a}	76.02 ± 3.27^{a}	76.25 ± 3.35^{a}	76.78 ± 4.25^{a}
Group II	Diabetic	245.00 ± 3.97^{a}	310.00 ± 3.37^{b}	336.25 ± 3.13^{c}	343.75 ± 3.09^{cd}
Group III	100 mg/kg	79.00 ± 2.68^{c}	77.01 ± 1.65^{ab}	77.28 ± 2.28^{ab}	76.25 ± 1.79^{a}

Results are expressed as mean ± standard deviation of three determinations. Values with different superscript are significantly different at $P\leq0.05$

Result and Discussion

Diabetes when improperly managed has the potential to orchestrate debilitating health conditions such micro and macro vascular problem [2]. Complications such as blindness renal failure and heart disease are reportedly linked to diabetes mellitus [15]. Table 1 shows the blood glucose levels of diabetic rats treated with ethanol extract of *P. americana* peel (pericarp). Administration of alloxan monohydrate progressively and significantly ($P<0.05$) raised blood glucose levels in rats. However, administration of *P. americana* peel extract significantly ($P<0.05$) reduced blood glucose level in diabetic rats. This could possibly be as a result of the phytochemicals inherent in the said plant part. The result is consistent with the finding of Umoh *et al*. [9] which showed that daily oral administration of doses of ethanol fruit pulp extract of *P. americana* significantly ($P<0.05$) reduced blood glucose levels in alloxan induced diabetes rats close to normal. It is also in tandem with the outcome of the work carried out by Alhassan *et al*. [16]who reported that consumption of aqueous seed extract of *P. americana* caused a significant hypoglycaemic effects on alloxan induced diabetic rats.

Conclusion

Through this study, it has been shown that ethanol peel extract of *P. americana* has anti-diabetic potential and thus should be screened to further unveil the bioactive compound (s) specifically responsible for the reported anti-diabetic potential of the said plant extract.

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