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EVALUATION OF ANTI-DIABETIC EFFECT OF ETHANOL LEAF-EXTRACT OF *PTEROCARPUS SANTALINOIDES* IN ALLOXAN- INDUCED DIABETIC ALBINO RATS.

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ABSTRACT

This study was carried out to evaluate the anti-diabetic effect of ethanol leaf-extract of *Pterocarpus santalinoides* in alloxan-induced diabetic albino rats using a glucometer. Twenty-five Wister albino rats weighing between 100 – 200g were used. The animals were randomly assigned into five different groups of five rats each. The animals in group E served as negative control while those in group D served as the positive control. Groups A, B and C were induced with diabetes and treated with 200, 400 and 600 mg/kg body weight of the *Pterocarpus santalinoides* leaf-extract respectively. The treatment was done twice daily through oral intubation for twelve days. The glucose levels were determined using glucometer. The results revealed that there were dose dependent and significant ($p<0.05$) reductions in glucose levels of the rats treated with ethanol leaf-extract of *P. santalinoides.* The extract also significantly increased the body weights of the animals. This indicated that ethanol leaf-extract of *Pterocarpus santalinoides* could be encouraged for management of diabetes mellitus.

Keywords: Diabetes, Leaf-extract, Alloxan, *Pterocarpus santalinoides* and Albino rats.

INTRODUCTION

Plant medicine is the most widely used and oldest form of health care known to mankind. Eighty five percent of the world population employs herb as the primary medicine [1]. Plants have been very useful sources of drugs in the treatment of many diseases or ailments for decades of years [2]. In the last few years there has been an exponential growth in the field of herbal medicine and these drugs are gaining popularity both in developing and developed countries because of their natural origin and less side effects. Many traditional medicines in use are derived from medicinal plants, minerals and organic matter [3]. WHO has listed 21,000 plants, which are used for medicinal purposes around the world [4]. Modern approaches to determine the medicinal properties of plants involve collaborative efforts that can include ethno-botanists, anthropologists pharmaceutical chemists and physicians. Many modern medicines had their origin in medicinal plants such as aspirin from willow bark *(Salix* spp), digitalis from foxglove *(Digitalis purpurea)* and viriblastme from Madagascar periwinkle *(Viricarosea)* for the treatment of childhood leukemia [5]. Plants used as natural medicine are seen to be in three ways. Firstly, may be used directly as teas or in other extracted form for their natural chemical constituents. Secondly, they may be used as agents in the synthesis of drug. Finally, the organic molecules found in plants may be used as models for synthetic drugs [2].

Pterocarpus santalinoides (Family:*Fabaceae-papilnoideae*) has been described as a shade tolerant tree 9-12m tall, with low straggling branches, commonly found along riverine forests in Africa and tropical South America [6]. The plant is commonly referred to as Red Sandal wood in English, Gundurugyadar Kurmi in Hausa, Uturukpa in Igbo and Gbenghe in Yoruba. Various morphological parts of *P. santalinoides* are used in ethno-medicine

in many African countries to treat an array of human ailments. Phytochemical analyses of the leaves of the plant show the presence of saponins, flavonoids, phenols, triterpenoids, and tannins [7]. The ethno-medical use of leaves of *P.santalinoides* in the treatment of diarrhoea and other gastrointestinal disorders has been scientifically proved [7]. The triglyceride and glucose lowering properties of *P.santalinoides* have been ascertained, as such lending credence to its folkloric use in management of diabetic syndrome. It has been documented that the bark and leaves of the plant possess anti-malarial, anti infective and anti abortive properties [8].

Diabetes is a chronic metabolic disorder with impaired glucose tolerance and high risk of cardiovascular disease [9]. Diabetes is a condition where the blood sugar level is higher than normal; it is a chronic disease of carbohydrate, fat and protein metabolism. The impairment of insulin secretory hormone causes a disorder (diabetes), although the causal factor is characterized by lifestyle and genetic factors [10]. Symptoms of diabetes include body weight loss although appetite often increases (especially in type I diabetes), itching especially around the genitals recurrent infections on the skin e.g. boils. Diagnosis of diabetes is by measuring glucose levels in blood samples using random glucose test or fasting glucose test. Treatment of diabetes has been achieved by a combination of health diet and exercise, also by recommended proper medication with tablets or insulin [11]. Diabetes mellitus is described as metabolic disorder which results from defects in insulin secretion or insulin action or both. It could cause long-term damage, dysfunction and failure in many organs. Patients with diabetes can develop heart disease, kidney disease, and blindness, vascular or neurological problems that can lead to amputation. Moreover, the death rate in patients with diabetes is much higher than in persons without the disease. According to the estimation of the International Diabetes Federation (IDF), one among ten adults would have diabetes by

2030. There were 366 million people having diabetes in 2011; this will increase to 552 million people by 2030 [12].

Alloxan is an organic compound based on a pyrimidine heterocyclic skeleton that has a high affinity for water and therefore shows or used to induce diabetes in experimental animals. Alloxan acts on the insulin producing pancreatic beta-cell and selectively kills these cells [13].

In view of the fore-going, there is need for continuous research to find better drugs for the control and treatment of diabetes; hence this research was aimed at investigating the effect of ethanol leaf-extract of *Pterocarpus santalinoides* in alloxan-induced diabetic rats.

MATERIALS AND METHODS

Materials

The leaves of *Pterocarpus Santalinoides* were collected from Aguluzigbo in Anaocha Local Government Area of Anambra State in the month of December. The albino rats were gotten from an animal house in Abakaliki.

METHODS

ADMINISTRATION OF ALLOXAN

Alloxan solution was administered intraperitoneally to the rats in groups A, B, C, and D at the dose of 80mg/kg body weight

EXTRACTION OF PLANT MATERIAL

The leaves were rinsed in clean water and air dried under room temperature. The dried leaves were pulverized to fine powder using a grinding machine. Powdered plant leaves (400g) were macerated in 1200ml of 95% ethanol at room temperature for 48 hours. Clean muslin cloth was used to filter out the solution. The filtrate was allowed to stay under mild sunlight until the ethanol evaporated to obtain the sticky extract of *Pterocarpus Santalinoides* leaves.

ADMINISTRATION OF THE PLANT EXTRACT

The rats in group A were given 200mg of the plant extract per kg of body weights, those in group B were given 400mg of the extract per kg of body weights, those in group C were given 600mg of the plant extract per kg of body weights, while those in group D did not receive the extract. Administration was through oral intubation and was done twice daily for 12days.

COLLECTION OF BLOOD SAMPLES

The blood samples were collected through the tail from each of the animals.

DETERMINATION OF FASTING PLASMA GLUCOSE LEVEL OF THE ANIMALS

The plasma glucose level of each animal was daily determined using a glucometer.

MEASUREMENT OF BODY WEIGHTS OF THE ANIMALS

The body weights of the animals were measured using a weighing balance.

STATISTICAL ANALYSIS

All the values in the test were expressed as Mean± SEM (Standard Error of Mean). Statistical differences between the means of the various groups were analyzed by using ANOVA test. P values < 0.05 were considered significant.

RESULTS

Percentage Yield of Extract of *Pterocarpus santalinoides* Leaves

The yield of ethanol extract of *Pterocarpus santalinoides* leaves was 15%.

Figure 1: Plasma glucose level of alloxan-induced diabetic albino rats treated with ethanol leaf-extract of *Pterocarpus santalinoides*

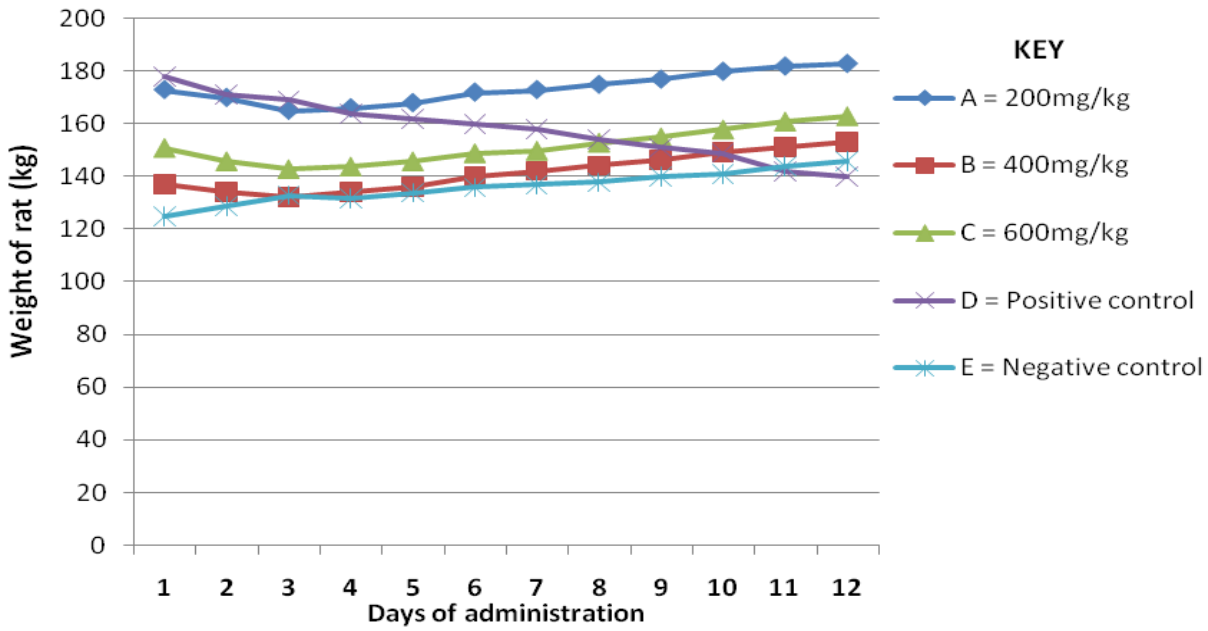

Figure 1:Mean body weights of alloxan-induced albino rats within the twelve days of administration of ethanol leaf-extract of *Pterocarpus santalinoides.*

DISCUSSION AND CONCLUSION

The use of ethanol in the extraction of plant materials from the leaves of *Pterocarpus santalinoides* gave a percentage yield of 15. In a similar work conducted by Njoku and Edeogu (2013), [14], on the blood sugar lowering effect of *Moringa oleifera*, the percentage yield was 20. Nworu *et al.* (2009), [7], reported 18% yield in a work on *Pterocarpus marsupium*. The differences in the yield of the extracts could be as a result of the different species of plant leaves. It could however be as a result of the different geographical areas where the plant leaves were harvested. It was observed

that the administration of alloxan to the rats caused a change in their physiological states such as polyuria, increase in water intake, weight loss and weakness while food intake was slightly normal. The changes in the physiological activities of the animals were due to alloxan efficiency to deplete and alter certain homeostatic actions such as increased thirst due to stimulation of thirst receptor center of the brain, and polyuria, due to inability to secrete anti-diuretic hormone [15].

The ethanol extract of *Pterocarpus santalinoides* leaves significantly ($p<0.05$) decreased the blood glucose levels (Fig. 1). A work by Shetti *et al.* (2012), [16], indicated that the ethanolic leaf-extract of *Phyllanthus amarus* significantly and dose-dependently reduced the blood sugar levels in alloxan induced diabetic mice. However the intraperitoneal induction of alloxan in the rats showed significantly ($p<0.05$) increased the blood glucose level [17]. The ethanol leaf-extract extract of *Allium sativum* significantly ($p<0.05$) reduced plasma glucose concentrations and could be beneficial in the management of diabetes mellitus [18]. The result of this experiment validates the anti-diabetic effects of *Pterocarpus santalinoides* and as such giving credence to its glucose lowering properties as ascertained by [8].

Furthermore, there was an initial reduction in mean body weights of all the groups after induction except in the normal control. After treatment the mean body weights of the treated groups were restored to near that of the normal group while that of the untreated diabetic group was drastically reduced (Fig. 2). This shows that as the glucose level decreased, the body weights improved also. The administration of ethanol extract of *Allium sativum* also increases significantly the body weights of the rats [19].
In conclusion, the results showed that ethanol leaf-extract of *Pterocarpus santalinoides* could be encouraged for management of diabetes mellitus.

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