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ANTI DIABETIC EFFECTS OF THE *COCOS NUCIFERA (COCONUT) HUSK EXTRACT*

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ABSTRACT

The Anti-diabetic effects of Cocos Nucifera (Coconut) Husk was studied on 21 alloxan-induced diabetic rats which were randomly grouped into three (n=7). Group I served as control while group II and III served as experimental groups. The rats were made diabetic by intraperitoneal administration of 150 mg/kg of alloxan. The extract was obtained by cooking the husk in boiling water for 45 minutes in a gas stove flame at a 100 degree Celsius and the fluid was filtered out and kept as the tea for the experiment. The control group was given 2 ml of 0.9% (normal) saline daily, group II was given 2 ml of the coconut husk tea only daily, group III was given 1g of Daonil and 4g of Mephomine daily by Oro-gastric tube and random blood sugar was measured daily in the rats. The weights of the rats were checked daily using a digital electronic weighing balance. At the end of the experiments the animals were sacrificed and the pancreas harvested and histopathological slides made. In the treated diabetic rats, blood glucose levels were significantly reduced ($p < 0.05$) on consumption of the extracts and the drugs with greatest effect exhibited by the Cocos Nucifera (Coconut) Husk extract. The Histopathological study showed same regenerative ability in the rats that received the extracts (coconut husk tea) and those that received Daonil and Metformine. It was therefore concluded that *cocos nucifera (coconut) husk tea* has a significant hypoglycemic and anti-diabetic effects in alloxan-induced diabetes. This effect is comparable to that of the combination of Daonil and Metformine, and could serve as an effective adjunct in the management of diabetes mellitus. It is therefore recommended that a study of this nature be done using human subjects.

Keywords: *Diabetics mellitus, coconut husk, Cocos Nucifera, alloxan*

INTRODUCTION

Diabetes mellitus (DM) is an endocrine /metabolic syndrome resulting from absolute or relative deficiency of insulin and characterized by hyperglycemia, polyuria, polyphagia and polydipsia (Edward *et al*., 1996). Associated with acute metabolic decomposition that may lead to permanent and irreversible functional and structural changes in the cells of the body (Edward *et al*., 1996). Complications of diabetes' characteristically affect the eyes, kidneys, nervous system, reproductive organs etc (Nwangwa, 2012). Diabetes mellitus is a serious lifelong condition that affects an estimated population of about 15 millions and a third of these goes about undiagnosed until many years after the onset (Nwangwa, 2012). It is a group of metabolic disorders with a common biochemical manifestation; hyperglycaemia, hence, it is thus a derangement of carbohydrate metabolism (Murray, 2000). Uncontrolled diabetes mellitus causes varied histopathological changes in different organs (Harold, 1978;

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Thomas, 1999), and incidences of diabeticneuropathy has been on the increase (Adewole *et al*., 2006; Carrington and Litchfield, 1999; Clements and Bell, 1982). The underlying causes of diabetic complications have been attributed to hyperglycemia which results in oxidative stress, alterations in enzyme activities, protein glycosylation and several structural changes (Akpan et al., 2007). Alloxan induces diabetes in experimental animals through beta cells destruction (Singh and Gupta, 2007). It has been shown that beta cell apoptosis is related to alloxaninduced inhibition of pancreatic glucokinase function and there is selective beta cell loss, leading to insulinopaenic diabetes, analogous to type I diabetes (Gao et al.,2007; Fernandes et al., 2007; Kavitha et al., 2007; Salihu *et al* 2009). Plant medicine or phytomedicine (the sum total of practices, using herbal preparations produced by physical or biological processes, to treat diseases relying on past experience/ observations handed down from generation to generation) has been used in healthcare delivery in many parts of Africa and the rest of the world (Edem, 2009). Today, medicinal plants are increasingly being used in most parts of the world as: hypolipidemic (Ugochukwu *et al*, 2003; Ogbonnia *et al*, 2008; Yadav *et al*, 2008); contraceptive, abortifacients, emmenagogues or oxytocic (Ritchie 2001);
Among the usefulness of plants in medicine are the uses in the treatment of diabetes mellitus.

Diabetes is a major degenerative disease in the world today (Ogbonnia *et al*, 2008), affecting at least 15 million people and having complications which include hypertension, atherosclerosis and microcirculatory disorders. There has been increasing demand for the use of plant products with antidiabetic activity. The high cost, low availability, uncertainty of use during pregnancy and undesirable side effects of synthetic drugs have been some of the factors leading to a strong preference for hypoglycaemic drugs of plant origin, which are believed to be suitable for chronic treatments (Berger; 1985; Okigbo & Mmeka, 2006). Plants which have been shown to have hypoglycaemic action, act on blood glucose through different mechanisms. Some of them may inhibit endogenous glucose production (Eddouks *et al*, 2003) or interfere with gastrointestinal glucose absorption (Musabayane *et al* 2006); some may have insulin -like substances (Collier *et al* 1987; Gray and Flatt, 1999); some may inhibit insulinase activity and some may increase secretion of insulin from the β cells of the pancreas i.e. pancreatotrophic action (Khan *et al*,1990; Trivedi *et al*., 2004; Yadav *et al*, 2008), while others may increase beta cells in pancreas by activating regeneration of these cells (Shanmugasundaram *et al*, 1990; Jelodar *et al*, 2007).
Very few traditional treatments for DM have been scientifically scrutinized hence this study.

The coconut husk being the combination of the exocarp and the mesocarp of the coconut fruit has never been attributed with any medical value. But have been said to have the following industrial, commercial, household and agricultural uses. It covers about 35% of the coconut fruit.

Nature and composition of coconut husk: The coconut husk is that 5-10 cm thick fibrous covering of the coconut fruit which envelops the hard shell structure of 3.5 mm thickness. The external appearance of the husk varies from decidedly dull brown when fully ripe to bright green when immature. There are other varieties whose husks are golden yellow or yellow brown. The husk is full of long, coarse fibres, all running in one direction. The fibres are embedded in a matrix of material called coir dust. Since husks are porous, they absorb or retain water (***Tejano 1985***).

METHODOLOGY

Preparation of the coconut husk tea: A dry coconut husk was cooked for 45 minutes in a gas stove flame at a 100 degree Celsius. After cooking, the fluid if filtered out and kept as the tea for the experiment

The Animal Procedure was carried out according to the guidelines of Delta state university, Abraka, Nigeria, and Medical Ethics Committee for the use of experimental animals in research. Twenty one (21) Male Wistar rats weighing between 170 - 200 g were randomly divided into three (n=7) groups after allowing the rats to acclimatize for seven days in the animal house of the Department of Anatomy. Each group were kept in separate cages which were cleaned daily and washed weekly with proper identification with 12:12 hour light and dark cycle, at $25^0C \pm 2^0C$. They were allowed access to water ad libitum and normal rat chow with standard composition supplied by Pfizer Nigeria Ltd. Warri. All the rats in the experimental groups were made diabetic by intraperitoneal administration of 150 mg/kg of alloxan (Katsumata et al., 1992; Katsumata et al., 1993) and 48 h later, blood glucose oxidase strip was used to confirm the diabetic levels of the rats using blood samples collected from the tails of the rats. The control group was given 2 ml of 0.9% (normal) saline daily, group II was given 2 ml of the coconut husk tea only daily while group III was given 1g of Daonil and 4g of Mephomine daily. At the end of the experiments the animals were sacrificed and the pancreas was extracted and histopathological slides were prepared. All the substances were given for five days by Oro-gastric tube. The random blood sugar was measured daily in the rats and values recorded using the strip testing method and The weight of the rats were checked daily and documented using a digital electronic weighing balance. Histological slides prepared according to the international research standard. For statistical data comparisons, data were evaluated by one way ANOVA and Student *paired t*-Test. All values are given in tables with n values indicating the number of subjects analyzed. $P<0.05$ are considered significant.

RESULTS

There was an initial inactivity in the rats following administration of the extract mixture and their appetite was low except for the control group. There were weight changes within the experimental groups and the control (Table 1). The blood glucose levels of the rats at the start to the end of the experiment for the groups are given in Table 2. The histopathology of

the pancreas is shown in figure 1, 2 and 3 and 4 with figure 1 showing the normal non-diabetic pancreas

Table 1

Weight (g) in control and diabetic rats before and after experiment (Mean ±SD)

	Before experiment	After experiment	Paired t test
Normal saline solution	182 ± 1.5	83 ±2.0	0.61
Coconut husk tea	185 ± 2.6	174 ±1.0*	4.10
Glibencamide + metformin	196 ± 3.2	187 ±3.8*	2.81
ANOVA test	67	7.23	

*Significant compare to the mean from the control group (P<0.05)

Table 2: Mean glycaemia (mmol/L) daily registered in diabetic rats According to experimental group

Group	Initial level	Day 1	Day 2	Day 3	Day 4	Day 5
Normal saline solution (n=7)	10.2	9.3	9.8	9.4	9.2	8.5
Coconut husk tea (n=7)	11.1	8,2	6.4	3.8	2.2	1.9 (n=5)
Glibencamide+metformin **(n=7)**	10.3	7.2	6.9	4.8	3.1	2.6

Normal range for blood glucose: 2.5 to 5.0mmol/L. The hypoglycaemia noticed in the group treated with the extract was so high that two of the rats died at the Day five of the experiment as a result of the effects of the extract. Paired t test was used to compared mean of initial glycaemia values and Day five glycaemia values

Histopathology

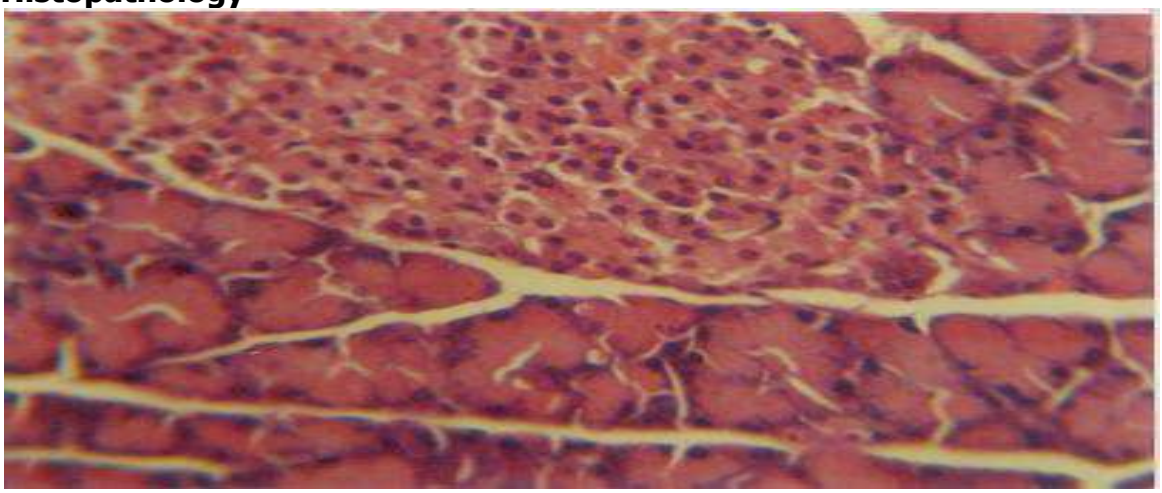

Figure 1: Histology of Pancreas of Normal Healthy Rat, H & E Staining (x40)
This figure shows the various cell of the normal non diabetic pancreas

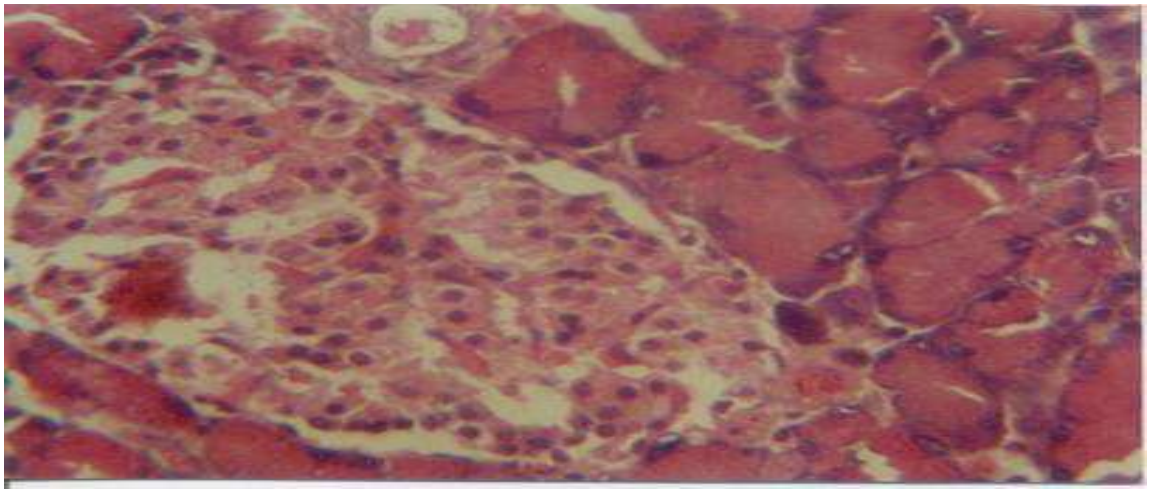

Figure 2: Histology of Pancreas of Diabetic Control Rat, H & E Staining (x 40)
This figure showed degeneration of pancreatic cells, which was due to the effects of the alloxan used in this study

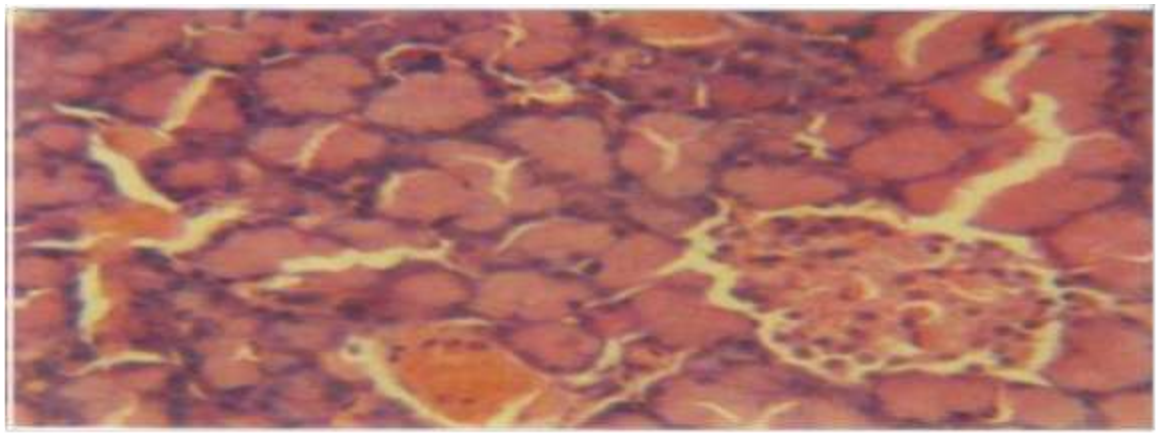

Figure 3: Histology of diabetic Rats treated with coconut husk tea. H & E Staining (x 40)
As shown in the figure, there is a great regeneration of the pancreatic cells, which was due to the healing ability of the *cocos nucifera (coconut) husk*

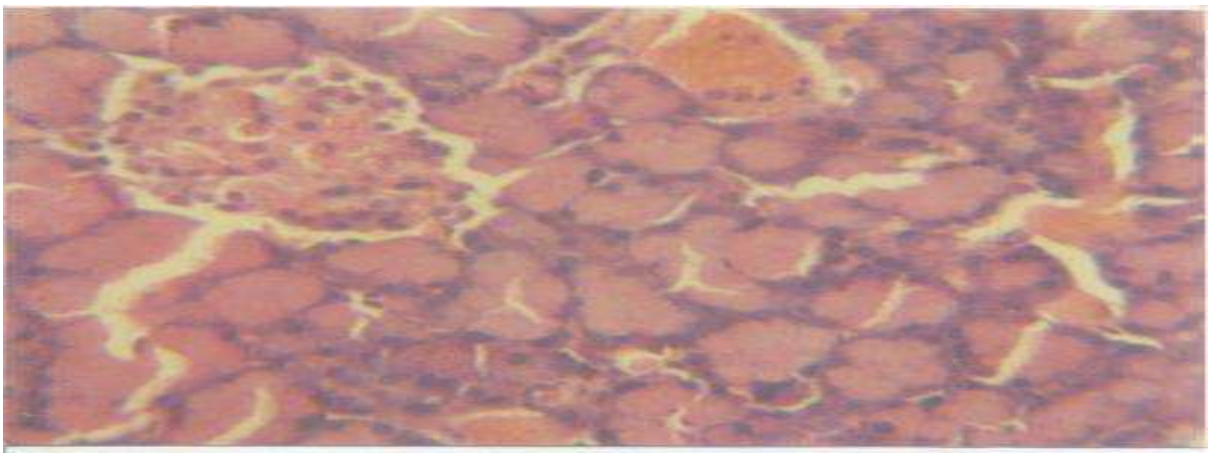

Figure 4: Histology of diabetic rats treated with Daonil and Metformine. H & E Staining (x 40)

This also showed regeneration of the pancreatic cells as with that of figure 3. This was due to the healing effect of the Daonil and Metformine

DISCUSSION

Diabetes mellitus has no cure presently; hence, the objectives of any treatment are long-life controlled of blood sugar and preventions of complications. Majority of the modalities available for it treatment are diets, exercise, use of hypoglycemic agents/drugs, and some cases, insulin therapy. The results indicate a drastic decrease in the diabetic levels of the rats for all the groups except for the control group. The decrease in the ***cocos nucifera (coconut) husk tea*** group was so fast and drastic to the extent that it caused hypoglycaemia that led to the death of two of the rats by the Day 5 of administration. The mechanism by which it does this may be independent of the availability of insulin from pancreatic cells (Inya-Agha, 1999). More also, the coconut extract also produced a significant hypoglycaemia in the rats comparable to that of the combination Daonil and Metformin, and the mechanism of action to reduce the blood glucose may be due to stimulation of influx of glucose into the cells for metabolism or by providing an enabling medium that facilitate the glucose uptake in the rats. As shown in Table 2, there was death of two rats as a result of the hypoglycaemia provoked by the coconut husk tea. This means that a long duration treatment with extract should not be encouraged and daily glucose test should be done when using the extract. In this study also, the Histopathological study of diabetic untreated rats (Figure 2) showed degeneration of pancreatic islet cells, which was due to alloxan used in this study. This probably gave rise to insulin deficiency which causes excessive elevation of blood glucose and underutilization leading to hyperglycaemia (Standl *et al*, 2003). The histopathological study of diabetic treated group indicated increased volume density of islets and increased percentage of beta cells, in the diabetic rats that received the extracts (**coconut husk tea**) and the drugs, which may be a sign of regeneration of ß cells and potentiation of **insulin** secretion from surviving ß cells of the islets of Langerhans.

CONCLUSION

It is therefore concluded that ***cocos nucifera (coconut) husk tea*** has significant hypoglycemic and anti-diabetic effects in alloxan-induced diabetes. This effect is comparable to that of the combination of Daonil and Meformine, and could serve as an effective adjunct in the management of diabetes mellitus. It is therefore recommended that a study of this nature be done using human subjects

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