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Full Length Research Paper

Anti-diabetic activities of *Fleurya aestuans* (L.) Gaudich in alloxan induced rats

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Diabetes mellitus is becoming an increasing concern all over the world and such people especially in some communities have used medicinal plants to treat diabetes and its complications. This investigation aimed to examine the hypoglycemic potential of the methanol extract of *Fleurya aestuans* leaves in normal and alloxan induced diabetic rats. Thirty five Wistar albino rats were grouped into seven different groups of five per group where diabetes was induced in the rats by intra peritoneal administration of alloxan monohydrate (150 mg/kg) except a control group. *F. aestuans* methanol extract at a dose of 100, 200, 300 and 400 mg/kg of body weight were administered at a single dose per day for a period of 10 days to the diabetic rats, respectively. Five mg/kg of standard drug, glibenclamide (a positive control) was given to one of the groups. The effects of *F. aestuans* methanol extract of whole plant, on blood glucose was measured in the diabetic rats. This activity is not dose dependent.

Key words: *Fleurya aestuans* leaves, antidiabetic activity, alloxan, glibenclimide, Wistar rats.

INTRODUCTION

The human population has always been plagued by diseases that have adversely affected health and well-being (Pramodh, 2003). For hundreds of years these ailments were caused by infectious agents and non-communicable diseases which have become the main public health concern in the 21st century (Zimmet et al., 2001). Of these, one particular disease that is increasingly causing greater morbidity and mortality, in both young and old is diabetes mellitus (World Health Organization, 2006).

Diabetes mellitus is a metabolic disease characterized by hyperglycaemia resulting from defects in insulin resistance, secretion and/or action. Several forms of diabetes mellitus are known to occur but type I and II are predominant. Type I diabetes is the auto-immune mediated form of the disease and is characterized by the destruction of the pancreatic beta-cell islets resulting in absolute insulin deficiency resistance while type II diabetes is characterized by insulin resistance of the secreted insulin.

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In comparison, people inflicted with type I diabetes are wholly dependent on exogenous insulin for survival, while people with type II produce insufficient amount of endogenous insulin and sometimes require insulin supplementation for the control of blood glucose concentration either directly or indirectly through the use of hypoglycaemic medications (Shafrir, 1997).

Recently, there has also been a surge in the use of botanicals to manage and control diabetes, due to the common perception that the pharmaceutical products on the market induce severe complications following long term uses (Hanefeld, 1998). Presently, several studies have been dedicated to surveys of these botanicals from across the globe. The African continent has an enormous wealth of plant resources and plants used in traditional medicines which plays a vital role in the life of millions of people throughout Africa (Botha et al., 2001).

In developing nations, many people are still heavily reliant on traditional healers and medicinal plants to meet their daily primary health care needs (Ojewole, 2002), because they presume that these plants are safe based on their long term usage in the treatment of diseases according to the knowledge accumulated over centuries (Fennell et al., 2004).

With much of this documentation being obtained through formal and informal discussions with local communities and traditional medical practitioners, many of the identified remedies need to be ascertained using validated scientific methods to confirm their efficacy.

Fleurya aestuans (L.) Gaudich is an erect annual monoecious herb commonly called the West indian woodnettle, tropical nettleweed and stinging nettle. *F. aestuans* has great medicinal potential and has been reported to treat rheumatism (Alford, 2007) and arthritis (Randall et al., 1999). It has also been reported to have antioxidant, antimicrobial, antiulcer and analgesic properties. Its extract showed *in vitro* inhibition of several key inflammatory events that cause the symptoms of seasonal allergies (Roschek et al., 2009).

Also, *F. aestuans* increases the flow of urine, shrinks inflamed tissues, helps blood circulation and purifies the blood. It is popularly cooked green in many areas due to its high protein content although these have not been scientifically proven.

F. aestuans has been used in various ways in traditional medical practice as a palliative, though they have been no scientific report on the anti-diabetic properties of the plant. Thus, this motivated the present study on the anti-diabetic activity of the leaf extract of *F. aestuans*.

MATERIALS AND METHODS

Plant materials

Fresh plants of *F. aestuans* were collected and authenticated at the Forestry Research Institute of Nigeria (FRIN), Ibadan, Oyo State Nigeria where voucher specimens with voucher number 109710 were prepared and deposited.

Plant extraction

The leaves of *F. aestuans* were carefully separated, air dried to reduce the moisture content for a period of 21 days and powdered and then 150 g of the powdered sample of the plant was extracted with methanol for three days by maceration procedure.

This process was repeated thrice and the whole extract was filtered, concentrated under reduced pressure using rotatory evaporator and dried to a constant weight and stored in a desiccator prior to analysis.

Phytochemical screening

Phytochemical screening was carried out on the powdered sample of the *F. aestuans* to identify the various phyto-constituents. The methods for the screening were carried out following standard procedures (Trease and Evans, 1998).

Experimental animals

Thirty five albino Wistar rats weighing between 120 and 170 g of both sexes were obtained from the Department of Clinical Pharmacy, Faculty of Pharmacy, Olabisi Onabanjo University, Sagamu, Ogun State/ Nigeria. The animals were maintained in cages and fed with water and standard pellets obtained from premier feed, Sagamu, Ogun State/ Nigeria.

The baseline weights and blood glucose levels of the animals were carried out before inducing diabetes in the rats. The rats were divided into seven groups of five rats in a group.

Induction of diabetes

Diabetes was induced in thirty rats that have been fasted for 12 h by a single intra peritoneal administration of freshly dissolved 150 mg/kg alloxan monohydrate in normal saline solution (Szkudelski, 2001). The blood glucose levels (BGL) were monitored daily using the glucometer and touch strips.

Experimental design

The 30 diabetic rats were divided into six groups of five rats each. Group 1 to 4 received 100, 200, 300 and 400 mg/kg methanol extract of *F. aestuans,* respectively. Group five which served as positive control received 5 mg/kg glibenclamide while group six (negative control) received neither extract nor the standard drug. Group seven contained five rats that were dose with 150 mg/kg normal saline only

Statistical analysis

All the values of fasting blood sugar were expressed as mean ± standard error of mean (S.E.M) and analyzed using ANOVA and post hoc Dunnet's test. Differences between groups were considered to be significant at $p<0.05$ levels.

RESULTS

The plant materials (150 g) were extracted and the obtained yield was found to be 12.73%.

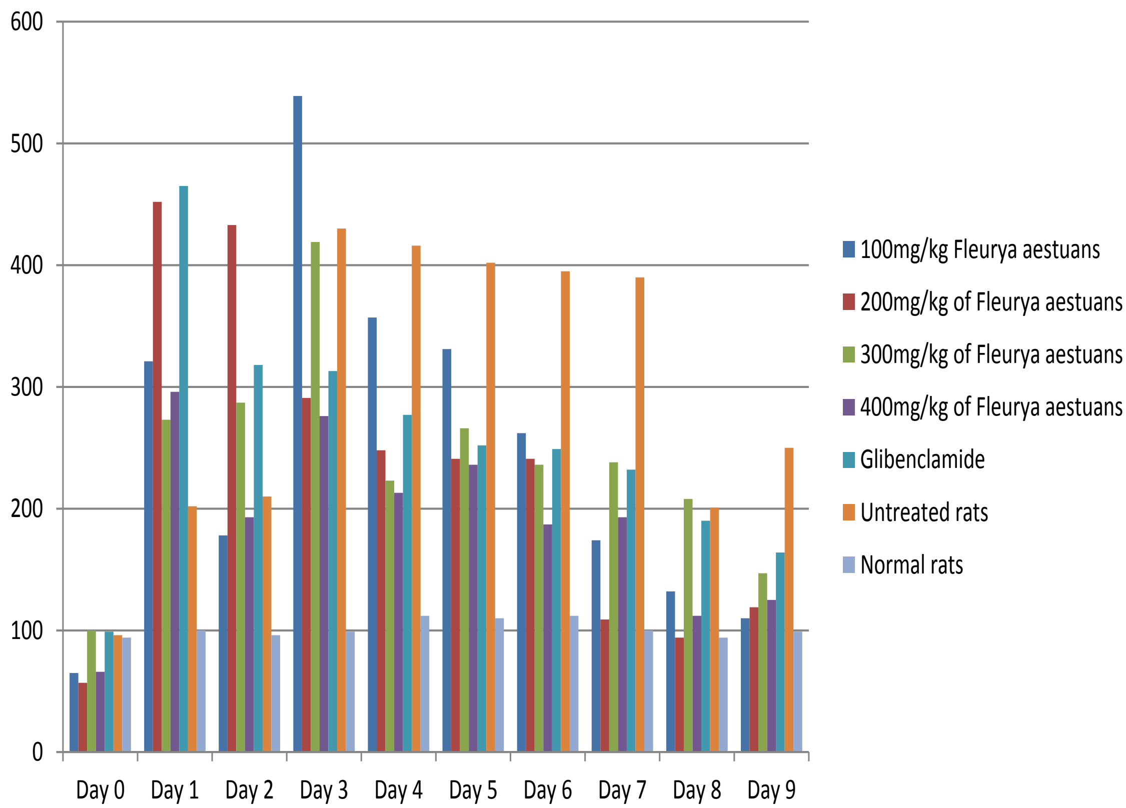

Figure 1. Effect of the 100, 200, 300 and 400 mg/kg methanolic extract of *F. aestuans* on blood glucose level in hyperglycaemic rats compared with the standard drug (5 mg/kg glibenclamide), diabetic untreated rats and normal rats.

DISCUSSION

Alloxan induces diabetes by destroying the beta-cells of islets of langerhans in the pancreas leading to reduction in synthesis and release insulin (Szkudelski, 2001). This model has been used in several studies of anti-diabetic effect of several products (Babu et al., 2002). Phytochemical test carried out on the powdered leaves samples of *F. aestuans* showed that the plant contained tannins, flavonoids, saponin, cyanogenetic glycosides and terpennoids as shown in Table 1. Table 2 depicts the anti-diabetic activities of *F. aestuans*.Oral administrations of methanolic extract of *F. aestuans* caused a significant reduction in the blood glucose levels of the diabetic rats from the 5th day as seen in 100 mg/kg with the value (mean ± SEM) of 539±0.88 to 357±0.33; the group with 200 mg/kg showed a significant reduction in blood glucose levels from the 4th day with the value (mean ± SEM) of 433±85.13 to 291±41.33, the group with 300 mg/kg showed a significant reduction in blood glucose levels from the 5th day with the value (mean ± sem) of 419±77.34 to 223±49.41, the group with 400mg/kg showed a significant reduction in blood glucose levels from the 6th day with the value (mean ± sem) of 236±1.11 to 187±47.41.41 as shown in Figure 1.

The group five which represent the positive control (5 mg/ml of glibenclamide) showed a geometrical reduction in blood glucose from the 2nd day as shown in Table 2. Group six which represent diabetic untreated rats showed a reduction in the blood glucose levels from the 9th day with the value of 390±22.84 to 20±9.82, although no treatment was given. This showed that dietary modification can help in the reduction of blood glucose levels.

Obtained result showed that *F. aestuans* demonstrated a reasonable anti-diabetic activity at concentration between 100 and 200 mg/kg. At these concentrations, the blood sugar levels were drastically reduced especially from day 5 upward. This implied that the activity exerted by the plant was best noticed after the 4th day. These activities (100 and 200 mg/kg) were statistically significant (P<0.05). However, at concentrations more than 200 mg/kg, the anti-diabetic attributes of the plant were not significant as the blood sugar reduction was marked by an intermittent low and high levels. Control drug (5 mg/kg glibenclimide) was found to be efficacious in the treatment of induced diabetes but the efficacy of its anti-diabetic activity was not statistically significant among the days (P<0.05). Evidence from Table 2 for group six disclosed that controlled diet can lead to

Table 1. Phytochemical screening of *Fleurya aestuans* leaves.

Test	Result
Alkaloids	-
Tannins	+
Flavonoids	+
Saponin glycoside	+
Cardiac glycosides	+
Anthraquinone	-
Cyanogenetic glycoside	+
Terpenoids	+

-, Absent; +, Present.

Table 2. Antidiabetic activity of *F. aestuans* leaves in alloxan induced diabetic rats.

Group	Mean value (%)										
	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	F value	P value
100 mg/kg *Fleurya aeustrans*	65±15.4	321±0.00 (0)	178±1.20 (44.5)	539±0.88 (67.9)*	357±0.33 (11.2)*	331±0.58 (3.1)*	262±28.5 (18.4)	174±1.45 (45.8)	132±2.30 (58.9)	110±10.3 (65.7)	109.4	<0.05
200 mg/kg *Fleurya aestuans*	57±2.88	452±73.1 (0)	433±85.1 (4.2)	291±41.3 (35.6)	248±81.8 (45.1)	241±72.2 (46.7)	241±72.2 (46.7)	109±34.0 (75.9)	94±27.2 (79.2)	119±11.0 (73.7)	7.22	<0.05
300 mg/kg Fleurya aestuans	100±7.44	273±61.6 (0)	287±63.0 (5.1)*	419±77.3 (53.5)*	223±49.4 (18.3)	266±25.2 (2.6)	236±53.2 (13.6)	238±99.7 (12.8)	208±78.4 (23.8)	147±80.7 (46.2)	1.95	>0.05
400 mg/kg *Fleurya aestuans*	66±4.48	296±87.4 (0)	193±61.8 (34.8)	276±1.08 (6.8)	213±76.8 (28.0)	236±1.11 (20.3)	187±47.4 (36.8)	193±51.3 (34.8)	112±4.33 (62.2)	125±25.3 (57.8)	1.13	>0.05
Glibenclamide (5 mg/kg)	99±7.46	465±20.8 (0)	318±81.3 (31.6)	313±77.2 (32.7)	277±85.7 (40.4)	252±64.4 (45.8)	249±63.4 (46.5)	232±42.4 (50.1)	190±76.7 (59.1)	164±80.2 (64.7)	2.08	>0.05
Untreated	96±1.15	202±1.08 (0)	210±79.8 (4.0)*	430±22.4 (11.3)*	416±22.2 (105.9)*	402±24.7 (99.0)*	395±16.8 (95.5)*	390±22.89 (3.1)*	201±79.8 (0.5)	250±1.02 (23.8)*	4.96	<0.05
Normal rats	94±9.44	100±7.44 (0)	96±1.15 (4)	99±7.46 (1)	112±4.33 (12)*	110±10.3 (10)*	112±4.33 (12)*	100±7.44 (0)	94±22.7 (6)	99±7.46 (1)	19.4	<0.05

* Percentage increase in blood glucose level.

reduction of blood glucose levels, while group seven further stressed that in non-diabetic rats with inappropriate balanced diet may also lead to diabetes. Partial restoration of the pancreatic islet cells after treatment with the extract indicate that the possible mechanism by which the methanolic extract of *F. aestuans* reduced blood glucose levels of the diabetic rats may be either by increasing the pancreatic secretion of insulin from the islet of Langerhan's or it is released from bound insulin. Similar result has been reported (Pari et al., 2004).

Recently, Mgbeje et al. (2016) found that there was a significant reduction in the blood glucose levels of rats treated with n-hexane fraction of *Heinsia crinite* whencompared with the diabetic control (Mgbeje et al., 2016). Also, this significant reduction was found in the administration of n-hexane and methanol leaf fractions of *Nauclea latifolia* to the diabetic rats which were dose dependent in both the n-hexane and the methanol fractions (Effiong et al., 2014). However, Momoh et al. (2014) and Momoh et al. (2014) showed that there was statistically significant reduction ($P<0.05$) of *Vernonia amygdaline* not only in the glucose levels but also in the association of polytriads symptoms (Momoh et al., 2014). Methanolic leaves extract of *Jatropha curcas* showed that different concentrations exhibited a profound reduction ($P<0.005$) in the blood sugar levels of the diabetic albino rats (Momoh et al., 2014). All these results agree with the obtained results regarding the methanol extract of *F. aestuans* on the alloxan-induced diabetic rats.

Conclusion

In conclusion, *F. aestuans* is more effective at lower concentration in the treatment of diabetic rats. Further studies can be carried out to investigate the lethal dose and isolate the active compounds with the structural elucidation of the isolated compounds.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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