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CYTOTOXIC EFFECT OF CRUDE AQUEOUS EXTRACT OF *PISTIA STRATIOTES* LEAVES (water lettuce) ON BODY WEIGHT AND RENAL CELLS OF ALBINO RATS

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ABSTRACT
Pistia stratiotes is a medicinal plant used traditionally to treat a various diseases such as skin infections, worm infections, tuberculosis, ulcer, diabetes etc. The present study was designed to investigate the effect this crude aqueous extract may have on body weight and renal cells function in albino rats. Twelve white Albino rats divided into 4 groups of 3 rats each were used. Groups 2, 3 and 4 were administered orally of 100, 200 and 300mgkg^{-1} body weight of the aqueous leaves extract of pistia stratiotes respectively, while group 1 served as control and was given the vehicle. Body weight and renal indices were significantly ($p<0.05$) altered at higher doses of the extract when compared to control. The study shows that aqueous extract of p. stratiotes leaves may have effect on body weight and renal cells of albino rats after 5 days. At the end of the study, body weight of the animals was 156.27±1.91g (group 1), 141.32±0.82g (group 2), 140.38±1.77g (group 3), and 161.29±0.97g (group 4) as against the body weight of 150.32±2.27g, 146.37±1.73g, 145.71±2.20g, and 165.32±1.75g, correspondingly before administration of the extract. There were significant differences (based on T-test and p-values 141.32±0.82g and 140.38±1.77g) in the body weight of group 3 and 4 before and after administration of the extract. Serum urea concentrations were 6.71±1.19 mmol/L, 18.57±2.98 mmol/L, 27.27±2.37 mmol/L in extract treated groups 2, 3 and 4 respectively, as against the concentration of 7.11±1.19 mmol/L before the administration of the extract. There were significant differences ($p<0.05$) (based on T-test and p-values 7.11±1.19 mmol/L, 18.57 mmol/L and 27.27±2.37 mmol/L) between urea concentration of group 1, 2 and 3 before and after the administration of the extract. Serum creatinine concentration was found to be 108.51±3.21 mmol/L in controls, before the administration of the extract as against the concentration of 102.21±7.67 mmol/L, 123.80±2.15 mmol/L, 129.20±7.15 mmol/L in treated groups 2, 3 and 4 after the administration of the extract respectively. There were significant differences (based on 108.51±3.21 mmol/L and 102.21±7.67mmol/L) between serum creatinine concentration of group 1 and 2 before and after the administration of the extract. Hence, results from this finding revealed that the aqueous extract of pitia stratiotes leaves could be associated with some levels of kidney toxicity.
Keywords: Pistia stratiotes, body weight, renal indices, extract, administration.

INTRODUCTION

Most plant-derived medicines have been developed on the basis of traditional knowledge in health care and in many cases there is a correlation between the indications of pure substances and those of respective crude extracts used in traditional medicine (Farnsworth *et al.*, 1985). Plant and plant extracts have been used since the dawn of civilization by man. The use of ethno botanical preparations for various reasons justified (Massond and Salehian 2002). Many medicinal plants have been in use by man without the actual knowledge of their toxic potentials.

Pistia stratiotes (Family *Araceae*) is commonly known as water cabbage or water lettuce. It floats on the surface of the water and its hanging roots submersed beneath floating leaves. The leaves can be up to 14cm long and have no stem. Plant parts of *Araceae* (usually above ground parts) have higher macro elements (Nitrogen, Phosphorous and Potassium) contents (Kilinc *et al.,* 2005).

The plant is distributed throughout the tropical regions of the world such as Africa (especially Nigeria) and South America etc. It is also found in China, Indo-China, Malaya, La Reunion and Brazil. For therapeutic purposes, *P. stratiotes*is is used to treat ringworm infection of the scalp, syphilitic eruptions skin infections, boils and wounds (Ali *et al.*, 2011; Premkumar and Shyamsundar 2005). Oil extract of *Pistia stratiotes* is used for the treatment of worm infections, tuberculosis, inflammation, piles, ulcer and burns (Kirtikar and Basu 2000). The plant is used as an anodyne for eye-wash in Gambia. The plant's juice is used by Mundar (Tribal people in India) as antihelmintic (Kumar *et al.*, 2010), antidermatophytic and antifugal (Premkumar and Shyamsundsr 2005),

diuretic (Pallavi *et al*., 2011) antiprotease (Jedinak *et al*., 2010), antitubercular emollient (Tripathi *et al*., 2010) antidiabetic (Joy *et al*., 2010), and antimicrobial effects (Abu-Zaidu *et al*., 2008). These diverse properties are attributable to the various contents found in the extract, which ascorbic acids, galactose, glycolate and other diverse components identifiedin the extract (Keates *et al*., 2000).

The kidney is known to be responsible for the maintenance of the constant extracellular environment through excretion of such catabolites as urea, creatinine, and uric acid and also in the regulation of water and electrolyte balance. Abnormal concentration of these catabolites in the plasma or serum serves as a clear indication of renal function impairment (Crook 2007; Zanna *et al*., 2008). Impairment of the renal functions may be caused by several diseased conditions and exposure to certain reactive or toxic metabolites, i.e., nephrotoxic substances (Chatterjea and Shinde, 2002; Crook 2007). Persistently increased serum creatinine is reported to be one of the risk factors for chronic kidney disease, which may results in renal failure (Mortada *et al*., 2001).

In this study, body weight was significantly ($p<0.05$) altered at higher doses of the extract when compared to control. This study shows that aqueous extract of *P. stratiotes* leaves may have detrimental effect on body weight as the body weight decreases with increased doses of the leaves extract.

The current study was therefore designed to evaluate the effect of crude extract of *Pistia stratiotes* 100, 200, 300 kg/mg administration on renal function and body weight of albino rats.

MATERIALS AND METHODS

Plant Material: *Pistia stratiotes* was obtained from Bankanu village in Sokoto, Nigeria. The plant samples were authenticated at the Herbarium, Botany unit, Usmanu Danfodiyo University, Sokoto, Nigeria. Voucher specimen was deposited in the Herbarium. The leaf of the plant was air-dried under the shade, pulverized (with a wooden pestle and mortar) into a coarse powder, sieved and stored in a sealed plastic container until utilized.

Extract and fractionation procedure: The plant extract was fractionated using activity-guided fractionation with ethanol-water (1:1) and chloroform as described by Morris and Aziz (1976). The powdered leaves (12g) extract was extracted with ethanol-water (1:1,1500ml) and separated at room temperature over night. The extract was filtered and partitioned in chloroform separately (750ml) and clarified by further filtration. Evaporation of chloroform to dryness in an ovum at 5°C yielded 7.5% (w/w) residue. The procedure was repeated to obtain more residues.

Animals and experimental treatment: Twelve white albino rats weighing between 150-164g were used for the experiment. The rats were divided into 4 groups of 3 rats each. Rats in group 2, 3 and 4 were administered orally a single dose of 100, 200 and 300mg/kg respectively for 5 days while rats in group 1 served as control and received the vehicle only. All the rats were kept under normal breeding condition at room temperature and were fed with normal diet (bended feeds limited, Benin city), tap water and libitum.

Rats were sacrificed 24hrs after the last treatment, by dropping in a jar, saturated with chloroform. Incision was made on blood collected through cardiac puncture and then allowed to clot and therefore the serum harvested by centrifugation would be used later.

Biochemical Analysis: Diacetylmonoxine and Jaffe's reactions as described by Wybenga *et al*., (1971) and Henry (1974) were used in assaying Urea and creatinine levels respectively. While sodium and potassium ions were determined using flame photometry method of Uriyo and singh (1974). Body weight of the animals was taken before and after the treatment by gravimetric method.

Statistical Analysis: Results are presented as Mean ± SD. Data of the study were subjected to one way analysis of variance (ANOVA) using Graph Paro Instant software.

RESULTS

Results of the current study were shown in tables 1 and 2. Body weight of the studied rats was found to be 150.32±2.27g, 146.37±1.73g, 145.71±2.20g and 165.34±1.75g in controls, group 2, 3 and 4, respectively before the administration of the extract. There was no significant difference (based on T-test and p-values 150.32±2.27g, 146.37±1.73g, 145.71±2.20g and 165.34±1.75g) between the weights of the animals in all the groups ($P>0.05$). After the extract administration for five days, the body weight of the animals was 156.27±1.91g, 141.32±0.82g, 140.38±1.77g and 161.29±0.97g in control, groups 2, 3 and 4, respectively. There were significant difference ($P<0.05$) using T- test between the body weight of the animals on group 3 and 4, when compared with corresponding weight before the treatment.

Table 2 shows renal indices of the rats administered with the extract. A serum creatinine level was 108.51±3.21 mmol/L in control groups before the treatment. There were no statistically significant difference ($P>0.05$) in the serum creatinine levels of the animals. After 5 days administration of the extract, serum creatinine was found to be 102.21±7.67 mmol/L, 123.80±2.15 mmol/L and 129.20±7.15 mmol/L for group 2, 3 and 4, respectively. There was no statistically significant difference ($P>0.05$) using T-test between serum creatinine levels of group 3 and 4 as compared to values obtained in control groups.

Serum urea level was discovered to be 7.11±1.19 mmol/L in control before the treatment. There were no statistically significant differrence ($P>0.05$) using T- test between serum urea levels of the animals before the treatment.

After 5 days of the extract administrations, serum urea levels rose to 18.57±2.98 mmol/L and 27.27±2.37 mmol/L in groups 3 and 4, respectively. There were statistically significant difference (P<0.05) in serum urea level in those groups when compared with values recorded in control groups.

Serum potassium level was 10.76±1.75 mml/L, 8.67±1.15 mmol/L, 11.33±1.15 mmol/L and 16.33±2.88 mmol/L incontrol, groups 2, 3 and 4, respectively.

Serum sodium level was recorded to be 52.00±3.46 mmol/L, 66.67±3.05 mmol/L, 50.67± 1.15 mmol/L and 47.67±8.32 mmol/L in control, group 2, 3 and 4, respectively.

Table 1: Mean body weight changes in rats administered with aqueous extract of *Pistia stratiotes* leaves.

Groups	Concentration (mg/kg)	WBT (g)	WAT (g)
1.	(Control)	150.32±2.27	156.27±1.91
2.	100(AQE)	146.37±1.73	141.32±0.82
3.	200(AQE)	145.71±2.20*	140.38±1.77
4.	300(AQE)	165.34±1.75*	161.29±0.97

WBT = weight of rats before administration of extract
WAT = weight of rats after administration of extract
AQE = aqueous leaves extract. Values are mean ± standard deviation, *significantly different (P<0.05) compared with weight of Rats after (5days) administration of extract by using the student t-test (n=3).

Table 2: Serum Kidney Function Indices in rats administered aqueous with extract of *Pistia stratiotes* leaves.

	Groups Conc. (Mg/kg)	Urea (mmol/ L)	Creatmine (mmol/ L)	Sodium (mmol/L)	Potassium (mmol/L)
1.	(Control)	7.11±1.19	108.51±3.21	52.00±3.46	10.76±1.75
2.	100(AQE)	6.71±1.37	102.21±7.67	66.67±3.05	8.67±1.15
3.	200(AQE)	18.57±2.98*	123.80±2.15*	50.67±1.15*	11.33±1.15*
4.	300(AQE)	27.27±2.37*	129.20±7.15*	47.67±8.32*	16.33±2.88*

Values are mean ± standard error of the mean *significantly different from control (P<0.05) by using the analysis of variance (ANOVA) (n=3), AQE = aqueous leaves extracts.

DISCUSSION

This study investigated the effect of crude aqueous extract of *Pistia stratiotes* leaves on the body weight and kidney functions in rats' model. The results above (Table 1) showed a dose dependent decrease in body weight loss in rats following the administration of the extract. There was significant (P<0.05) decrease in weight loss after 5 days of extract administered among and within test group when compared with control and this could be due to reduced feed and water intake observed from the animals. The presence of alkaloids and saponins may have caused loss of appetite resulting in decreasing weight gain as extract of *pistia stratiotes* contained the compounds (Muyibi *et al*., 2000).

In assessing the renal toxicity of *Pistia stratiotes*, the concentration of creatinine, urea, potassium as well as sodium in the serum were examined. In this study, elevated levels of serum creatinine, urea and potassium as well as decreased levels of serum sodium were observed to be associated with aqueous extract *P. stratiotes* at concentrations of 200mg/kg and 300mg/kg in rats. This is in agreement with the nephrotoxicity effects of *Hyphaenethebaica* in humans and experimental animals (Hassan *et al*., 2006).

The significant increase in the concentration of creatinine in the serum reported in this study might have resulted from its decreased excretion which in turn, is related to renal inefficiency. The concentration of creatinine in the blood is known to correlate inversely with the volume of glomerular filtration. Hence, creatinine is considered to be among the useful marker of the filtration function of kidneys, particularly as creatinine is excreted only via the kidneys (Appelton 1995). The increased in the levels of serum creatinine observed could be due to impaired urine formation or excretion irrespective of whether the causes are prerenal, renal or postrenal in origin (Kaplan *et al*., 1988).

The observed serum urea concentrations also indicates possible impaired renal function implicated in rats treated with *pistia stratiotes*. The high serum urea levels may result from a decrease in the rate of urea secretion into urine, which May likely result from renal insufficiency (Dioka *et al*., 2004). According to Appelton (1995), increase in serum urea concentration is a reflection of impaired renal function. However, the increase in the levels of potassium might be associated with none renal cause, such as weakness, neuromuscular, excitability and myocardial disorders. It might also results from disruption of ATPase activities in proximal and tubular membrane of kidneys (Nelson and Cox 2000). The low sodium ion levels following the administration of the aqueous extract of *Pistia stratiotes* leaf could be due to dilution of serum sodium or total body depletion of sodium (Odutola 1992). It is hereby suggested that the chemical constituents in *Pistia stratiotes*, like other known xenobiotics, might have been metabolically transformed into various metabolites in the body (Hu and Well 1994).

According to Page and Mehlman (1989) and Nygren *et al.*, (1994), some of these metabolites may be very reactive, interacting in various ways with the metabolizing and excreting tissues (mainly liver and kidneys) to express their toxicity. The interaction of these metabolites with the renal tissues may cause cellular injury, hence, damage to the tissues. Once the renal tissues are damaged, the overall functionality of the kidneys may be compromised. It was recorded in this study that, effect of *Pistia stratiotes* caused a significant increase in serum creatinine, urea and potassium as well as decrease in serum sodium compromising the integrity of the renal tissues in study animals.

CONCLUSION

The present research has shown the effect of aqueous extract of *P. stratiotes* leaves on kidneys. The plants must therefore, be used cautiously in small therapeutic doses, since some herbs that have higher toxicity can be used safely and effectively if taken in small doses (Klein 1996). We strongly recommend further research into the plants to provide more scientific and pharmacological basis of its components.

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