Effect of Aqueous Whole Plant Extract of Selaginella Myosurus on Kidney Markers in Albino Rats

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Citation

Abstract
Despite the growing market demand for herbal medicines, there are still concerns associated with not only their use, but their safety. This study was designed to investigate the acute toxicity of aqueous whole plant extract of selaginella myosurus on the kidney markers of albino rats. A total of thirty six (36) albino rats of both sexes weighing between 100.5g-149.5g were divided into nine groups of four rats per group. Group 1 received distilled water, while groups 2-5 and 6-9 received 400, 600, 800, and 1000mg/kgBW of extract for 7 and 14 days respectively. Rats were sacrificed 24hours after the last treatment and blood samples collected for biochemical investigations (urea, creatinine, sodium ion (Na\(^{+}\)), potassium ion (K\(^{+}\)), chloride ion (Cl\(^{-}\), bicarbonate ion (HCO\(_{3}^{-}\))). Histology of the kidney tissue and photochemical screening of plant were done. Result revealed significant reduction (p<0.05) in Na\(^{+}\), K\(^{+}\), Cl\(^{-}\), urea and creatinine concentrations in groups 4, 5, 6 and 8; 3 and 4; 5; 2-9 and 2-4, 6-9 when compared to control value respectively. Non-significant difference (p>0.05) was observed in HCO\(_{3}^{-}\} concentration compared to control value. Phytochemical screening of plant revealed the presence of flavonoids, triterpenoids, saponins, tannin, steroid, cardiac glycoside and phenol in decreasing order (32.19 ± 0.23, 26.24 ± 0.12, 23.74 ± 0.20, 18.74 ± 0.17, 16.53 ± 0.12, 15.28 ± 0.23 and 13.10 ± 0.11 respectively). Non-significant increase (p>0.05) in weight of the kidney was observed. Histological observation of kidney tissue showed obliterated and occluded capillary spaces in glomeruli and normal tubes in some extract treated groups. In conclusion, the extract demonstrated some levels of toxicity to the kidney at these concentrations.

1. Introduction

Africa is blessed with enormous biodiversity resources and it is estimated to contain between 40 and 45,000 species of plant with a potential for development and out of which 5,000 species are used medicinally. This is not surprising since Africa is located within the tropical and subtropical climate and it is a known fact that plants accumulate important secondary metabolites through evolution as a natural means of surviving in a hostile environment (AAMPS, 2005). Nonetheless, the paradox is that in spite of this huge potential and diversity, the African continent has only few drugs commercialized globally (Okoro et al., 2011; Chintamunnee & Mahomoodally, 2012; Jain et al., 2012). The scientific literature has witnessed a growing number of publications geared towards evaluating the efficacy of medicinal plants from Africa which are believed to have an important contribution in the maintenance of health and in the introduction of new treatments. Nonetheless, there is still a dearth of updated comprehensive compilation of
promising medicinal plants from the African continent (Gurib-Fakim et al., 2010). Traditional medicine has developed in various communities in Nigeria in response to the health needs of the people. Many communities have, therefore, since creation, developed various traditional systems using locally-available resources for the alleviation of their health problems. It is important to stress the relevance of traditional medicine to the majority of Nigerians. Most Nigerians, especially those living in rural communities do not have access to orthodox medicine and it is estimated that about 75 per cent of the populace still prefer to solve their health problems consulting traditional healers (Sofowora, 1993). The surge in popularity and patronage of herbal medicines necessitate concern based on adverse effects of potentially toxic constituents in plants (e.g. aristolochic acids, pyrrolizidine alkaloids, benzophenanthrine alkaloids, lectins, viscositoxins, saponins, diterpenes, cyanogenetic glycosides and furonocoumarins) which can be fatal (Fennell et al., 2004). Pharmacological and toxicological evaluations of medicinal plants are essential for drug development (Ibarrola et al., 2000; Ahmed et al., 2006; Perera et al., 2010). The toxicity of herbs may also result from the generation of reactive intermediates through metabolic activation of herbal constituents via phases I and II reactions within the human body. The resultant reactive intermediates can bind covalently to DNA and proteins, leading to organ toxicity, mutagenicity, and even carcinogenicity. For instance, aristolochic acids in Aristolochia spp. used in a number of Chinese traditional medicines undergo reduction of the nitro group by hepatic CYP1A1/2 or peroxidases in extrahepatic tissues generating highly reactive cyclic nitrenium ions. The latter can react with DNA to form promutagenic DNA adducts such as 7-(deoxyadenosin-N6-yl) aristolactam I and 7-(deoxyguanosin-N2-yl) aristolactam I as well as protein, resulting in activation of H-ras and myc oncogenes and gene mutation in renal cells and finally carcinogenesis of the kidneys (Ioannides, 2002; Jeong et al., 2012). In vitro studies have also indicated the role of herbal reactive intermediates in irreversibly inhibiting various cytochrome enzymes (CYPs). However, the discrepancy of effects between in vitro, animal, and human studies reflects the significance of herbal dosing in the modulation of CYPs (Jeong et al., 2012). A number of studies still have reported the potentially toxic nature of herbal drugs. In 1992, in Belgium, consumers of a herbal weight-loss preparation containing Aristolochia spp. exhibited severe renal disease manifested by interstitial fibrosis, which rapidly progressed to renal failure (Haden et al., 2011). Moreover, Aristolochia spp. also used as an aphrodisiac, as an anticonvulsant, as an immune stimulant, and to treat arthritis, gout, rheumatism, eczema, wound treatment, allergic gastrointestinal colic, and gallbladder colic have been subsequently reported to impair renal function due to the presence of aristolochic acid (Chan et al., 2005; Jordan et al, 2010). Cardiac glycosides have been linked with hyperkalaemia, a side effect observed in a patient taking a long list of herbal medicinal drugs (Padiyara & Khan, 2004). In 2005, clinical problems arising from the use of herbal medicines were reported in Hong Kong and Aristolochia species was found responsible for acute renal failure, with aconite roots causing aconitine poisoning, the Datatura species causing anticholinergic poisoning, and “yulan” (Stephania sinica) causing tetrahydropalmatine poisoning (Chen et al., 2011). Similarly, licorice (Glycyrrhiza glabra) commonly used for inflammation of the upper respiratory tract and gastric and duodenal ulcers has been reported to cause suppression of the renin-aldosterone system, resulting in sodium and water retention, hypokalemia, hypertension, cardiac arrhythmias, and myopathy in cases of prolonged use (Henderson et al., 2002; Mills et al., 2004). Overall, it is seen that while, on one hand, the toxic effects of herbs have been widely reported in developed countries, the same has not received an equivalent depth of scrutiny in developing countries. In view of the foregoing this study was designed to investigate the toxicity of Selaginella myosurus on the kidney of albino rats with the view to ascertain the possible toxicological effect on human kidney. The kidneys are essential organs in the body which function to remove water and waste products. They also produce important hormones such as erythropoietin, Vitamin D, and rennin (Mitchell & Kline, 2006). By virtue of their biological function to remove water and waste products, they are exposed to toxicants from this waste. Nephrotoxic injury is damage to one or both of the kidneys that results from exposure to a toxic material, usually through ingestion (Faber et al., 1993). Nephrotoxic injury is most commonly caused by drugs, primarily antibiotics, analgesics, and contrast agents. The drug provokes an allergic reaction that destroys the kidneys. Some chemicals found in certain drugs and industrial agents damage the kidneys by converting the haemoglobin of red blood cells into methaemoglobin, thereby interfering with the blood's transport of oxygen.

Selaginella myosurus is a medicinal plant that has not been widely used, either traditional or in modern medicine (Jermy, 1990). Small amounts of the species are also used as ornamental plants and vegetables. All species of Nusa posterior have small leaves resembling scales, with two different sizes: the smaller median leaves in the inner row and the larger lateral leaves in the outer rows (Jermy, 1990; Camus, 1997). The family Selaginellaceae Reichb has only one genus, Selaginella Pal. Beauv, consisting of 700-750 species and widespread in a cosmopolitan way (Tryon & Tryon, 1982; Jermy, 1990). Selaginella can be found in the pharmacopoeia in Asia, Africa and Latin America, but not found in Europe and North America (Duke et al., 2002). Selaginella is traditionally used to treat several diseases such as: injury, treatment of post-childbirth, cancer, skin diseases, headaches, fever, respiratory infections, urinary tract infections, menstrual disorders, liver disorders, fractures and arthritis. The plants used are all parts of the plants. From field studies in Indonesia, it is known that Selaginella is use to treat wounds, and for treatments before, during, and after giving.
birth, and to improve fitness and endurance of the body
(Setyawan & Darusman, 2008). The result of the field study
also shows that the herb is commonly used to treat wounds
and bleeding, either external wounds or internal injuries such
as menstrual disorders and postpartum haemorrhage, and also
used as a tonic to improve fitness and stamina.

Selaginella contains a variety of secondary metabolites
such as alkaloids, phenol (flavonoids, tannins, sapogenins), and
terpenoids (triterpene, steroid) (Chikmawati & Setyawan,
2008). The main secondary metabolite of this plant is biflavonoid, whose type is various depending on the species.
Biflavonoid that has been identified from Selaginella, among
others amentoflavone, 2, 8-biapigenin, delicaflavone,
ginkgetin, heveaflavone, hinokiflavone, isocryptomerin,
kaayflavone, ochmaflavone, podocarpusflavone A,
robustaflavone, sumaflavone, and taiwaniaflavone. These
compounds act as antioxidants, anti-inflammatory, anti-
cancer, anti-allergic, antimicrobial, antifungal, antibacterial,
antiviral, protective against ultraviolet (UV) irradiation,
vasorelaxant, heart boosters, antihypertensive, anti-clotting,
and affect the metabolism enzymes (Setyawan & Darusman,
2008). Biflavonoid is a typical of secondary metabolites
which is found only in Selaginellales, Psilotales,
gymnosperms, and several species of Bryophytes and
Angiosperms (DNP, 1992).

2. Materials and Methods

2.1. Apparatus/Equipment

Spectrophotometer (BSA 3000), Ion Selective Electrode
(ISE 4000), SFRI France, Rotary evaporator, Centrifuge
(Universal laboratory century), Hettich Zentrifugen, Metlar
weighing balance.

2.2. Reagents/Chemicals

All reagents and chemicals are of analytical grade.

2.3. Collection/Identification of Plant

Selaginella myosurus was collected in the surrounding
bush of the University of Port Harcourt in Choba community
of Obio/Akpor Local Government Area of Rivers state.
A voucher specimen (UPH-NO. C-129) was authenticated by a
botanist, Dr. N. L. Edwin-Wosu and deposited at the
herbarium unit of the Department of Plant Science and
Biotechnology (PSB), University of Port Harcourt.

2.4. Extract Preparation

The whole plant of Selaginella myosurus was washed with
running tap water and air dried for 2 weeks before grinding
into powdered form. The coarsely powdered plant material
was macerated in a maceration jar for 24 hours, with distilled
water. Filtration was done using a glass funnel which was
placed in a retort stand, using a Whatman filter paper. The
filtrate was allowed for about 1-2 hours to observe any
residue or sediment. After having a clear filtrate, it was put in
a rotary evaporator which separated the water from the
extract, leaving the extract in a paste form. The extract was
then poured into a crucible plate for drying on a steam bath at
40°C to 50°C. The crude extract was stored in a refrigerator
pending usage.

2.5. Phytochemical Screening

Phytochemical screening of the whole plant of Selaginella
myosurus was done using standard procedure as described by
Sofoware (1993) in the Department of Pharmacognosy,
Faculty of Pharmacy, University of Port Harcourt.

2.6. Source of Animals

A total of thirty six (36) albino rats of both sexes weighing
between 100.5g-149.5g were purchased from an animal
breeding facility in Choba community, and were kept in the
Department of Biochemistry, University of Port Harcourt
Animal House, Choba park for one week acclimatization. The
rats were fed with normal feed and water ad libitum.

2.7. Determination of Lethal Dose (LD₅₀)

LD₅₀ was done using an “up-and-down” procedure
described by Bruce, (1985). Three dose-groups of
1000mg/kg, 3000mg/kg, and 5000mg/kg were orally
administered to 3 groups of rats (n=2 rats per group). The rats
were observed for 24 hours and for a period of 1 week. No
death was recorded; therefore, safe doses of 400, 600, 800
and 1000mg/kgBW were selected.

2.8. Experimental Design

The rats were divided into nine (9) groups (n=4 rats).
GROUP 1 (Control): 0.5 ml of distilled water was orally
given to the animals in this group daily for 14 days.
GROUP 2 (400mg/kg b.w extract): A single daily dose of
400mg/kg b.w of aqueous whole plant extract of Selaginella
myosurus was orally administered to rats in this group for 7
days.
GROUP 3 (600mg/kg b.w extract): A single daily dose of
600mg/kg b.w of aqueous whole plant extract of Selaginella
myosurus was orally administered to rats in this group for 7
days.
GROUP 4 (800mg/kg b.w extract): A single daily dose of
800mg/kg b.w of aqueous whole plant extract of Selaginella
myosurus was orally administered to rats in this group for 7
days.
GROUP 5 (1000mg/kg b.w extract): A single daily dose of
1000mg/kg b.w of aqueous whole plant extract of Selaginella
myosurus was orally administered to rats in this group for 7
days.
GROUP 6 (400mg/kg b.w extract): A single daily dose of
400mg/kg b.w of aqueous whole plant extract of Selaginella
myosurus was orally administered to rats in this group for 14
days.
GROUP 7 (600mg/kg b.w extract): A single daily dose of
600mg/kg b.w of aqueous whole plant extract of Selaginella
myosurus was orally administered to rats in this group for 14
GROUP 8 (800mg/kg b.w extract): A single daily dose of 800mg/kg b.w of aqueous whole plant extract of Selaginella myosurus was orally administered to rats in this group for 14 days.

GROUP 9 (1000mg/kg b.w extract): A single daily dose of 1000mg/kg b.w of aqueous whole plant extract of Selaginella myosurus was orally administered to rats in this group for 14 days.

2.9. Sacrifice, Collection and Preparation of Plasma

At the end of 7 and 14 days, all the animals were anaesthetized with chloroform before decapitated for collection of blood. The blood was stored in heparinised sample bottle, spun at 5000rpm using MSE centrifuge to obtain plasma for biochemical investigations.

3. Biochemical Investigation

Determination of Electrolyte:

The electrolytes (sodium ion Na⁺, potassium ion K⁺, Chloride ion Cl⁻ and bicarbonate ion HCO₃⁻) were carried out using Ion Selective Electrode (ISE) Humalyte machine (Human Germany). Creatinine and urea levels in plasma were determined by the method of Edmund and David, (2009).

3.1. Histopathogical Studies

The rats were dissected using a set of dissection kit and kidneys from control and extract treated groups were collected and fixed in 10% freshly prepared formalin for 48 hours and subsequently dehydrated in alcohol, cleared with xylene and embedded in paraffin wax. Sections of lobe at about 5µm were mounted on glass slides and stained with haematoxylin and eosin (Lillie, 1965).

3.2. Statistical Analysis

All the values were reported as mean ± standard error of mean (M ± SEM). Statistical analysis was performed using SPSS version 20.0 (IBM, U.S.A). The data were analyzed using one-way analysis of variance (ANOVA) and significant difference were determined using post Hoc Turkey’s test for multiple comparisons at p < 0.05.

### Table 1. Effect of aqueous whole plant extract of selaginella myosurus on kidney markers in albino rats.

<table>
<thead>
<tr>
<th>TREATMENT GROUPS</th>
<th>Na⁺ (g/l)</th>
<th>K⁺ (g/l)</th>
<th>HCO₃⁻ (Umol/L)</th>
<th>Cl⁻ (U/L)</th>
<th>Urea (U/L)</th>
<th>Creatinine (U/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CONTROL</td>
<td>141.50±0.65ᵃ</td>
<td>4.03±0.09ᵃ</td>
<td>21.50±0.64</td>
<td>100.25±1.11ᵃ</td>
<td>4.90±0.12ᵃ</td>
<td>111.25±1.11ᵃ</td>
</tr>
<tr>
<td>400mg/kgBW 7 days</td>
<td>139.00±1.08</td>
<td>3.90±0.07</td>
<td>20.75±0.48</td>
<td>97.50±0.65</td>
<td>3.28±0.11ᵃ</td>
<td>88.75±2.06ᵃ</td>
</tr>
<tr>
<td>600mg/kgBW 7 days</td>
<td>138.25±0.85</td>
<td>3.65±0.06ᵇ</td>
<td>20.50±0.65</td>
<td>95.25±1.38</td>
<td>2.68±0.04ᵇ</td>
<td>92.75±2.87ᵇ</td>
</tr>
<tr>
<td>800mg/kgBW 7 days</td>
<td>137.25±0.75ᵃ</td>
<td>3.65±0.06ᵇ</td>
<td>22.25±0.48</td>
<td>96.00±0.91</td>
<td>2.70±0.04ᵇ</td>
<td>100.25±1.31ᵇ</td>
</tr>
<tr>
<td>1000mg/kgBW 7 days</td>
<td>137.75±0.85ᵃ</td>
<td>3.70±0.07</td>
<td>21.75±0.48</td>
<td>95.00±0.71ᵃ</td>
<td>2.53±0.05ᵇ</td>
<td>104.75±1.38ᵇ</td>
</tr>
<tr>
<td>400mg/kgBW 14 days</td>
<td>137.50±0.65ᵃ</td>
<td>3.80±0.09</td>
<td>21.00±0.91</td>
<td>96.00±1.47</td>
<td>3.58±0.10ᵇ</td>
<td>89.00±1.47ᵇ</td>
</tr>
<tr>
<td>600mg/kgBW 14 days</td>
<td>138.50±0.65</td>
<td>3.80±0.91</td>
<td>21.00±0.71</td>
<td>95.75±1.25</td>
<td>3.10±0.10ᵇ</td>
<td>93.25±1.50ᵇ</td>
</tr>
<tr>
<td>800mg/kgBW 14 days</td>
<td>137.00±0.71ᵃ</td>
<td>3.70±0.91</td>
<td>20.50±0.65</td>
<td>96.75±1.25</td>
<td>2.88±0.11ᵇ</td>
<td>95.50±2.02ᵇ</td>
</tr>
<tr>
<td>1000mg/kgBW 14 days</td>
<td>138.00±0.71</td>
<td>3.80±0.04</td>
<td>21.25±0.63</td>
<td>97.50±0.65</td>
<td>2.78±0.09ᵇ</td>
<td>97.75±0.85ᵇ</td>
</tr>
</tbody>
</table>

Data are represented in Mean ± Standard Error of Mean (M±SEM)
Similar superscripts represent significant different (p<0.05) within the row

### Table 2. Effect of aqueous whole plant extract of selaginella myosurus on the weight of kidney in albino rats.

<table>
<thead>
<tr>
<th>TREATMENT GROUPS</th>
<th>KIDNEY WEIGHTS (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CONTROL</td>
<td>0.44±0.01ᵃ</td>
</tr>
<tr>
<td>400mg/kgBW 7 days</td>
<td>0.48±0.03</td>
</tr>
<tr>
<td>600mg/kgBW 7 days</td>
<td>0.49±0.03</td>
</tr>
<tr>
<td>800mg/kgBW 7 days</td>
<td>0.41±0.05</td>
</tr>
<tr>
<td>1000mg/kgBW 7 days</td>
<td>0.47±0.04</td>
</tr>
<tr>
<td>400mg/kgBW 14 days</td>
<td>0.62±0.04ᵇ</td>
</tr>
<tr>
<td>600mg/kgBW 14 days</td>
<td>0.51±0.01</td>
</tr>
<tr>
<td>800mg/kgBW 14 days</td>
<td>0.54±0.01</td>
</tr>
<tr>
<td>1000mg/kgBW 14 days</td>
<td>0.50±0.02</td>
</tr>
</tbody>
</table>

Data are represented in Mean ± Standard Error of Mean (M±SEM)
Similar superscripts represent significant different (p<0.05) in the same row
Table 3. Qualitative phytochemical screening of whole plant extract of Selaginella myosurus.

<table>
<thead>
<tr>
<th>SECONDARY METABOLITES</th>
<th>TEST</th>
<th>RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaloids</td>
<td>Dragedorff</td>
<td>-ve</td>
</tr>
<tr>
<td></td>
<td>Mayer</td>
<td>-ve</td>
</tr>
<tr>
<td></td>
<td>Hager</td>
<td>-ve</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>Shinoda</td>
<td>-ve</td>
</tr>
<tr>
<td></td>
<td>Lead acetate</td>
<td>-ve</td>
</tr>
<tr>
<td></td>
<td>Alkalii</td>
<td>+ve</td>
</tr>
<tr>
<td>Tannins</td>
<td>FeCl3</td>
<td>+ve</td>
</tr>
<tr>
<td></td>
<td>Phlobatannins</td>
<td>+ve</td>
</tr>
<tr>
<td>Anthraquinone</td>
<td>Gelatin</td>
<td>ND</td>
</tr>
<tr>
<td></td>
<td>Albumin</td>
<td>ND</td>
</tr>
<tr>
<td></td>
<td>Free Anthraquinone</td>
<td>-ve</td>
</tr>
<tr>
<td></td>
<td>Combined Anthraquinone</td>
<td>-ve</td>
</tr>
<tr>
<td>Triterpenoid/steroids</td>
<td>Liebermann-Buchard</td>
<td>+ve</td>
</tr>
<tr>
<td>Fixed oil</td>
<td>Salwoski</td>
<td>+ve</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>Molisch</td>
<td>+ve</td>
</tr>
<tr>
<td></td>
<td>Fehlings</td>
<td>+ve</td>
</tr>
<tr>
<td>Cardenolide</td>
<td>Keller Killani</td>
<td>+ve</td>
</tr>
<tr>
<td>Cyanogenic glycosides</td>
<td>Frothing</td>
<td>+ve</td>
</tr>
<tr>
<td></td>
<td>Frothing</td>
<td>-ve</td>
</tr>
<tr>
<td>Saponins</td>
<td>Haemolysis</td>
<td>-ve</td>
</tr>
<tr>
<td></td>
<td>Emulsion</td>
<td>+ve</td>
</tr>
</tbody>
</table>

Note: +ve = present, -ve = absent, while ND = Not Detected

Table 4. The Result of quantitative phytochemical analysis of whole plant extract of Selaginella myosurus.

<table>
<thead>
<tr>
<th>Secondary metabolite (mg/100g)</th>
<th>Mean ± standard error of mean (m ± SEM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flavonoid</td>
<td>32.19± 0.23</td>
</tr>
<tr>
<td>Saponins</td>
<td>23.74± 0.20</td>
</tr>
<tr>
<td>Cardiac glycoside</td>
<td>15.28± 0.23</td>
</tr>
<tr>
<td>Steroid</td>
<td>16.53± 0.12</td>
</tr>
<tr>
<td>Terpenoid</td>
<td>26.24± 0.12</td>
</tr>
<tr>
<td>Tannin</td>
<td>18.74± 0.17</td>
</tr>
<tr>
<td>Phenol</td>
<td>13.10± 0.11</td>
</tr>
</tbody>
</table>

Histological examination of kidney sections of rats treated with distilled water and varying doses of aqueous whole plant extract of *Selaginella myosurus* for 7 and 14 days.

Fig. 1. Kidney section of control rat showing Glomeruli with obliterated capsular spaces. Normal renal tubules (H&E, x 400).
Fig. 2. Kidney section of rat treated with 600mg/kgbw aqueous whole plant extract of Selaginella myosurus for 7days showing Glomeruli with obliterated capsular spaces. Normal renal tubules (H&E, x 400).

Fig. 3. Kidney section of rat treated with 800mg/kgbw aqueous whole plant extract of Selaginella myosurus for 7days showing Glomeruli with obliterated capsular spaces. Normal renal tubules (H&E, x 400).

Fig. 4. Kidney section of rat treated with 1000mg/kgbw aqueous whole plant extract of Selaginella myosurus for 7days showing Poor slide (H&E, x 400).
Fig. 5. Kidney section of rat treated with 600mg/kg bw aqueous whole plant extract of Selaginella myosurus for 14 days showing Glomeruli with occluded capsular spaces. (H&E, x 400).

Fig. 6. Kidney section of rat treated with 800mg/kg bw aqueous whole plant extract of Selaginella myosurus for 14 days showing Glomeruli with occluded capsular spaces. (H&E, x 400).

Fig. 7. Kidney section of rat treated with 1000mg/kg bw aqueous whole plant extract of Selaginella myosurus for 14 days showing Poor slide (H&E, x 400).
4. Discussion and Conclusion

Herbs and herb-derived medicines have played a crucial role in health and disease management for many centuries. The global demand for herbal medicinal products has increased significantly in recent years. In Africa, knowledge of traditional medicine as part of wholistic system was passed through generations by oral communication and indigenous practices. Despite the growing market demand for herbal medicines, there are still concerns associated with not only their use, but their safety. Less than 10% of herbal products in the world market are truly standardized to known active components and strict quality control measures are not always diligently adhered to (Winston, and Maimes, 2007).

For majority of these products in use, very little is known about their active and/or toxic constituents. This raises concern on their safety on the kidney considering the fact that it is a principal route of excretion for many chemical substances in their active and/or inactive forms (Abdulrahman et al., 2007).

Table 1 revealed significant reductions (p<0.05) in Na⁺, K⁺, Cl⁻, urea and creatinine concentrations in groups 4, 5, 6 and 8; 3 and 4; 5; 2-9 and 2-4, 6, -9 when compared to control value respectively. Non-significant difference (p>0.05) was observed in HCO₃⁻ concentration compared to control value. Non-significant increase (P>0.05) in weight of the kidney was observed.

Potassium is major intracellular cation present in a concentration higher than the concentration of potassium present in Extracellular fluid compartment. Reduction in plasma level results from excessive excretion or inadequate intake of K Beta agonist bronchodilators with thiazide/loop diuretics, GI losses (NGT, diarrhea), alkalosis, magnesium depletion, insulin excess, licorace hypokalemia occurs due to high intake of potassium or in kidney damage.

Plasma sodium is a reasonable indicator of plasma osmolarity under many conditions. When plasma sodium is reduced below normal level a person is said to have hyponatremia. Decreased plasma sodium concentration can result from loss of sodium chloride from the extracellular fluid. Conditions that cause hyponatremia owing to loss of sodium chloride include excessive sweating, diarrhea and vomiting and over use of diuretics that inhibit kidney to conserve sodium. Addison’s disease, which results from decreased secretion of hormone aldosterone (impairs the ability of kidneys to reabsorb sodium) can be one of the causes of hyponatremia (Myoomoona, 2007).

Chloride major extracellular anion is principally responsible for maintaining proper hydration, osmotic pressure, and normal cation anion balance in vascular and interstitial compartment. Decreased chloride concentration can be the result of salt losing nephritis, leading to lack of tubular reabsorption of chloride, metabolic acidosis such as found in diabetes mellitus, in renal failure and prolonged vomiting (Myoomoona, 2007).

Bicarbonate is the second most prevalent anion in extracellular fluid compartment. Along with carbonic acid it acts as body’s most important buffer system. Each day kidney filters about 4320 mEq/l of bicarbonate and under normal conditions all of this is reabsorbed from the tubules, thereby conserving the primary buffer system of the extracellular fluid (Myoomoona, 2007).

The decreased creatinine values are noticed with glomerulo nephritis, congestive heart failure, acute tubular necrosis, shock, polycystic kidney disease, and dehydration (Edmund and David, 2006).

Low levels of urea are seen in trauma, surgery, opioids, malnutrition, and anabolic steroid use and in defective liver obstructing urea cycle. (Edmund and David, 2006).

Weights of the animals showed Non-significant increases (p>0.05) in all extract treated groups except in group 6 (400mg/kgBW 14 days) which significantly increased (p<0.05) in Table 2.

Tables 3 and 4 represented phytochemical screening of plant which revealed the presence of flavonoids, triterpenoids, saponins, tannin, steroid, cyanogenetic glycosides and furonocoumarins) which can be fatal. The toxicity of herbs may also result from the generation of reactive intermediates through metabolic activation of herbal constituents via phases I and II reactions within the human body. The resultant reactive intermediates can bind covalently to DNA and proteins, leading to organ toxicity, mutagenicity, and even carcinogenicity. In 1992, in Belgium, consumers of a herbal weight-loss preparation containing Aristolochia spp. exhibited severe renal disease manifested by interstitial fibrosis, which rapidly progressed to renal failure (Haden et al., 2011). Moreover, Aristolochia spp. also used as an aphrodisiac, as an anticonvulsant, as an immune stimulant, and to treat arthritis, gout, rheumatism, eczema, wound treatment, allergic gastrointestinal colic, and gallbladder colic have been subsequently reported to impair renal function due to the presence of aristolochic acid (Chan et al., 2005; Jordan et al, 2010). Cardiac glycosides have been linked with hyperkalaemia, a side effect observed in a patient taking a long list of herbal medicinal drugs (Padiyara & Khan, 2004). In 2005, clinical problems arising from the use of herbal medicines were reported in Hong Kong and Aristolochia species was found responsible for acute renal failure, with aconite roots causing aconitine poisoning, the Datura species causing anticholinergic poisoning, and “yulan” (Stephania sinica) causing tetrahydroalpalmatine poisoning (Chen et al., 2011). Similarly, licorice (Glycyrrhiza glabra) commonly used for inflammation of the upper
respiratory tract and gastric and duodenal ulcers has been reported to cause suppression of the renin-aldosterone system, resulting in sodium and water retention, hypokalemia, hypertension, cardiac arrhythmias, and myopathy in cases of prolonged use (Henderson et al., 2002; Mills et al., 2004).

Disruption of the Na mineral balance in response to ingestion of diets rich is plant secondary metabolites (PSM) has been recorded in mice (Freeland et al., 1985). This effect has been attributed to PSM-induced Na wasting via the urine (perhaps a result of impaired kidney function in the mice), or to greater faecal loss following poor absorption or enhanced saliary or intestinal mucosal cycling of Na to the gut (Freeland et al., 1985). Foley et al., (1995, 1999) consider the Na loss in lagomorphs to be related to the general phenomenon of acidosis induced by the detoxification of PSM in many species. The phase I and II detoxification reactions generally lead to the formation of organic acids, the excretion of which may be associated with the loss of cations such as Na that accompanies the excretion of phosphate used to buffer the urinary pH.

Histological observation of kidney tissue showed obliterated and occluded carpulsar spaces in glomeruli and normal tubules in extract treated groups as revealed in Figs. 2-7.

Conclusively, aqueous whole plant extract of *Selaginella myosurus* may cause kidney toxicity at the concentrations considered in this study.

**References**


