Assessment of Renal and Haematological Effects of Aspilia africana Leaf Extracts in New Zealand Rabbits

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ABSTRACT

Aspilia africana is an indigenous medicinal plant known for its haemostatic property in African folklore medicine. In this study, the renal and haematological effects of Aspilia africana leaf extracts in experimental rodents were investigated. Fifteen male rabbits of the New Zealand strain were equally assigned into three groups: Group 1, the control received normal saline; group 2 received 100 mg/kg body weight Aspilia africana aqueous extract while group 3 received 100 mg/kg body weight Aspilia africana chloroform extract for 14 consecutive days. Renal parameters (creatinine, urea, Na⁺, K⁺, HCO₃⁻) were determined in serum samples while haematological parameters: packed cell volume (PCV), white blood cell count (WBC), red blood cell count (RBC) and mean cell volume (MCV) were determined in whole blood samples. Oral administration of the aqueous extract of Aspilia africana induced a significant decline (p<0.05) of urea, sodium, potassium concentrations in serum of test animals relative to control. The chloroform extract did not significantly alter (p>0.05) the parameters of renal function except serum bicarbonate value which was significantly elevated. Erythropoiesis represented by red blood cell count (RBC) was significantly suppressed (p<0.05) in groups treated with both extracts relative to the control. Proliferation of white blood cells occurred in test groups compared to the control (p<0.05) after administration of both extracts. PCV and MCV were not significantly different (p>0.05) among the groups. The results indicate that the aqueous extract caused elevation in white blood cells count but induced different effects on kidney parameters depending on the extracting solvent.

Keywords: Aspilia africana, haematological parameters, aqueous extract, chloroform extract.

Introduction

Medicinal plants as sources of bioactive agents continue to exhibit fascinating ability in terms of human health management since ancient times with more than half of modern therapeutics in circulation being of natural product origin.¹ The vital role of medicinal herbs in the treatment and prevention of diseases is not by itself an assurance of safety if not properly used by an uninformed public.² Aspilia Africana, is a tropical, semi-woody perennial herb belonging to the family, asteraceae. It is used by traditional communities in Africa and Asia as a bactericidal, anti-inflammatory, astringent and wound-healing agent.³,⁴ Oral consumption of the decoction of the leaves is reportedly able to relieve febrile headache, quicken delivery and cure lumbago, sciatica and stomach disorders.⁵,⁶ Besides management of stomach disorder, others have reported that in folklore medical practice, Aspilia africana herbal preparations can be used for the treatment of stomach aches, dysmenorrhea, tuberculosis, rheumatoid arthritis, gonococcal infection, corneal opacity, cough and insect bites.⁷ The kidney performs functions such as urine formation, regulation of acid-base balance, excretion of waste products of protein metabolism, protein conservation and hormonal function. Chronic renal failure and end-stage renal diseases constitute a huge global health challenge in developing and developed countries.⁸ Treatment modalities for these ailments typically require rigorous and expensive medical procedures such as dialysis or kidney transplants.⁹ Diagnosis and prognosis of renal failure in hospital patients are established by determination of serum of biochemical parameters such as urea, creatinine and electrolytes.¹⁰,¹¹ In experimental rodents, analysis of serum biochemical parameters gives adequate information about organ damage, particularly the liver and kidney.¹²,¹³ Studies on the toxicological and beneficial effects of Aspilia africana extracts on renal and haematological parameters in experimental models have not been sufficiently documented in literature. This study was therefore designed to provide scientific information on the beneficial or toxic effects on renal and haematological indices in New Zealand rabbits that would be occasioned by oral consumption of aqueous and chloroform leaf extracts of Aspilia africana.

Materials and Methods

Experimental animals

Fifteen male rabbits (New Zealand breed) were housed in rabbit cages in the Animal House of Faculty of Life Sciences, University of Benin, Benin City under suitable environmental conditions (24 ± 2°C, 12-h light and dark cycles) and were allowed to acclimatize for two weeks with free access to food and clean water before the study commenced. Ethical clearance for animal experimentation was obtained from the Animal

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Ethics Committee of the Faculty of Life Sciences, University of Benin, Benin City.

Preparation of extract
Fresh leaves of *Aspilia africana* were collected in April 2016 from a farmland in OvWoige, Benin City, Edo State, Nigeria. The leaves were identified by a taxonomist, Dr. Odaro Timothy of the Department of Plant Biology and Biotechnology, University of Benin, Benin City. The collected samples were washed with running tap water, dried under shade and pulverized into fine powder. The aqueous and chloroform extracts were prepared by soaking 250 g each of the powdered leaves in 500 mL of distilled H2O and 500 mL of chloroform, respectively for 72 h. The extracts were filtered with muslin cloth. Subsequently, the filtrate of the aqueous extract was freeze dried while the filtrate of the chloroform extract was evaporated to dryness with rotary evaporator under reduced pressure. The crude extracts were reconstituted in normal saline and stored in a refrigerator at 4°C until they were required for use.

Experimental Design
The animals were randomly assigned into three groups of five animals each. Group 1 animals, the control were administered normal saline solution. The animals in group 2 were administered 100 mg kg⁻¹ body weight of *Aspilia africana* aqueous extract while group 3 received the same dose of the chloroform extract. Oral administration of saline or extract occurred once daily for 14 consecutive days.

Analysis of Haematological and Biochemical Parameters
At the end of the treatment period, the rabbits were anaesthetized after an overnight fast by chloroform inhalation in a closed chamber. Blood samples (5 mL) were collected by cardiac puncture and separated into two lots for biochemical assay and haematological measurements. For the haematological measurements, 2.5 mL of whole blood was taken from each sample into labeled sterile EDTA universal bottle. Haematological parameters (PCV, RBC, WBC, MCV) were then determined using a Medonic M32M Haematology Blood Analyzer. For evaluation of serum biochemical parameters, 2.5 mL of the 5 mL blood were put in anti-coagulant free bottles. The blood was allowed to clot at room temperature and serum separated by centrifuging each sample within three hours of collection at 2000 x g for 10 min. The concentrations of creatinine and urea were determined in serum based on extant methods. Serum electrolytes were also assessed as described by Kinsley and Schaffert.

Statistical analysis
Data were presented as mean ± standard error of mean (Mean ± S.E.M). Statistical analyses were performed with SPSS 11.5 software. Group comparisons were made using one way analysis of variance (ANOVA) and Duncan Multiple Comparison Test. A p-value of < 0.05 was considered significant.

Results and Discussion
In developing countries, the use of herbal preparations which is an age-long practice remains widespread. End-users of these formulations consume it indiscriminately unaware of attendant health risks. To protect the uninformed public from the adverse effects of arbitrary application of herbal medicine, health policies grounded on scientific research on the systemic effects of plant extracts is imperative. *Aspilia africana* has been traditionally used to treat wounds. Its effects on kidney functions are undocumented as far as we know. Thus, we investigated the effects of the aqueous and chloroform extracts on urea, creatinine, electrolyte profile and haematological parameters in New Zealand rabbits. Urea is a major constituent of urine which is excreted in urine by the kidneys. Creatinine, a waste product of muscle energy metabolism and urea are used clinically to assess the filtration capacity of the kidneys in organisms. However, creatinine is a better index of renal function because it is relatively constant and closely varies with glomerular filtration rate unlike urea which fluctuates according to protein intake. In this study, urea level in the aqueous extract-treated group (31.00 ± 1.30 mg/dL) was significantly lower (p<0.05) than control value (41.80 ± 2.68 mg/dL) and chloroform-treated group (39.00 ± 2.07 mg/dL) which was similar to the control (Table 1).

<table>
<thead>
<tr>
<th>Group</th>
<th>Urea (mg/dL)</th>
<th>Creatinine (mg/dL)</th>
<th>Na⁺(mmol/dL)</th>
<th>K⁺(mmol/L)</th>
<th>HCO₃⁻(mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41.80 ± 2.68ₕ</td>
<td>0.720 ± 0.07ₜᵇ</td>
<td>157.20 ± 4.49ᵇ</td>
<td>8.62 ± 0.84ᵇ</td>
<td>21.60 ± 1.47ᵇ</td>
</tr>
<tr>
<td>2</td>
<td>31.00 ± 1.30ᵇ</td>
<td>0.780 ± 0.05ᵇ</td>
<td>140.00 ± 11.18ᵇ</td>
<td>6.40 ± 0.32ᵇ</td>
<td>21.40 ± 0.51ᵇ</td>
</tr>
<tr>
<td>3</td>
<td>39.00 ± 2.07ₕ</td>
<td>0.560 ± 0.16ᵇ</td>
<td>155.60 ± 2.02ᵇ</td>
<td>9.76 ± 1.33ᵇ</td>
<td>24.80 ± 1.07ₜᵇ</td>
</tr>
</tbody>
</table>

Values within the same column bearing different superscripts are statistically significant different from each other (p<0.05).

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Table 2: Haematological profile.

<table>
<thead>
<tr>
<th>Group</th>
<th>WBC count (x 10^12 Cell/L)</th>
<th>RBC count (x 10^12 Cell/L)</th>
<th>PCV(%)</th>
<th>MCV (fL/Cell)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.90 ± 1.34a</td>
<td>7.70 ± 0.23b</td>
<td>39.62 ± 1.60b</td>
<td>66.88 ± 0.55a</td>
</tr>
<tr>
<td>2</td>
<td>14.34 ± 2.88b</td>
<td>5.11 ± 0.32a</td>
<td>37.48 ± 0.93a</td>
<td>62.92 ± 1.68a</td>
</tr>
<tr>
<td>3</td>
<td>11.54 ± 0.48b</td>
<td>5.55 ± 0.37b</td>
<td>40.70 ± 0.83b</td>
<td>64.42 ± 1.26b</td>
</tr>
</tbody>
</table>

Values within the same column bearing different superscripts are statistically significant different from each other (p<0.05). WBC = White Blood Cell Count (x 10^12 Cell/L), RBC = Red Blood Cell Count (x 10^12 Cell/L), PCV = Packed Cell Volume %, MCV = Mean Cell Volume (fL/Cell).

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References
