Effect of Acalypha wilkesiana Muell Arg on Plasma Sodium and Potassium Concentration of Normal Rabbits

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Abstract: The effect of Acalypha wilkesiana leaves on plasma levels of sodium and potassium were studied in normal rabbits given daily, by intra-gastric gavage, 1g/kg of the leaf, in the form of decoction prepared by mixing 5g of air-dried powdered leaves in 10 mL water. The treatment led to significant decreases (p<0.05) in plasma sodium concentrations and significant increases in potassium concentrations. These findings connote a therapeutic advantage in the use of A. wilkesiana for the treatment of hypertension, especially in managing the abnormal sodium and potassium metabolisms that accompany hypertension.

Key words: Acalypha wilkesiana, hypertension, potassium-sparing diuretic

Introduction
Acalypha wilkesiana Muell Arg, belongs to the Euphorbiaceae family. Relatively few studies have mentioned the phytochemical constituents of A. wilkesiana. Akinde (1986) reported the presence of sesquiterpenes, monoterpenes, triterpenoids and polyphenols, while Adesina et al. (2000) reported the presence of gallic acid, corilagin, geraniin, quercetin 3-0-rutinoside and kaempferol 3-0-rutinoside in the leaves of A. wilkesiana. In another study, Oladunmoye (2008) reported the presence of saponins, tannins, anthroquinone and glycoside in the leaves of A. wilkesiana.

A. wilkesiana has antibacterial and antifungal properties (Akinde, 1986; Alade and Irobi, 1993; Adesina et al., 2000; Ogundaini, 2005; Oladunmoye, 2006). The expressed juice or boiled decoction is used for the treatment of gastrointestinal disorders and fungal skin infections such as Pityriasis versicolor, impetigo contagiosa, Candida intertrigo, Tinea versicolor, Tinea corporis and Tinea pedis (Akinde, 1986; Ogundaini, 2005). In traditional medicine, the leaves of this diuretic plant are eaten as vegetables in the management of hypertension. In this study, the effect of A. wilkesiana on plasma sodium and potassium levels, was investigated for therapeutic benefits.

Materials and Methods
Eight, 3-month old New Zealand white rabbits weighing between 0.8-1.8 Kg were obtained from a breeder in Benin City. The animals were housed in clean, disinfected hutch and acclimatized on guinea growers mash (product of Bendel Feed and Flour Mills, Ltd, Ewu, Nigeria) for a week, after which they were weighed and randomly assigned into two groups (four per group), with an average weight difference of 0.2kg. The baseline plasma sodium and Potassium concentrations were determined prior to administration. The test group, orally received, each day, 1g/kg of the leaf in the form of a decoction prepared by mixing 5g of air-dried powdered leaves in 10 mL of water. The control group received appropriate volumes of water through the same route. Mash and water were provided ad libitum. The rabbits were weighed weekly to allow for adjustments in administration of the concoction. The treatment lasted for fifteen days and blood samples were collected on day 0 (baseline), 1, 8 and 15, for determination of plasma sodium and potassium levels.

The determination of plasma levels of sodium and potassium was done by flame photometry, at the Biochemistry department, Central Hospital Benin, Benin city, Nigeria. All values are quoted as the mean±S.E.M. Data were analyzed using the Student’s t test.

Results
Table 1 shows the effect of the aqueous concoction of A. wilkesiana on plasma sodium concentrations. There was a slight reduction (p<0.10) from baseline level on day 1, after which the reduction became significant (p<0.05) on day 8 and 15. At all times during the treatment, the plasma sodium concentrations of the treated group were always significantly lower (p<0.05) than that of the control. The effect of the concoction on plasma potassium concentrations is given in Table 2. The plasma potassium concentration of the treated animals, after receiving the treatment, were significantly higher (p<0.05) compared to the control and baseline values.
Table 1: Time course of the effect of the aqueous leaf preparations of *A. wilkesiana* on plasma sodium concentrations of normal rabbits

<table>
<thead>
<tr>
<th>Time</th>
<th>Control</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 0 (Baseline)</td>
<td>132.25±1.80</td>
<td>132.25±2.84</td>
</tr>
<tr>
<td>Day 1</td>
<td>130.25±1.11</td>
<td>128.00±1.00**</td>
</tr>
<tr>
<td>Day 8</td>
<td>128.00±2.71</td>
<td>117.00±1.73**</td>
</tr>
<tr>
<td>Day 15</td>
<td>124.75±1.43</td>
<td>121.25±0.85**</td>
</tr>
</tbody>
</table>

Sodium concentrations are expressed as mean±S.E.M. *P<0.05 compared to control, n = 4, per group, **P<0.05 compared to baseline, n = 4

Table 2: Time course of the effect of the aqueous leaf preparations of *A. wilkesiana* on plasma potassium concentrations of normal rabbits

<table>
<thead>
<tr>
<th>Time</th>
<th>Control</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 0 (Baseline)</td>
<td>3.75±0.21</td>
<td>3.80±0.14</td>
</tr>
<tr>
<td>Day 1</td>
<td>3.50±0.21</td>
<td>4.75±0.26**</td>
</tr>
<tr>
<td>Day 8</td>
<td>3.38±0.17</td>
<td>8.80±0.26**</td>
</tr>
<tr>
<td>Day 15</td>
<td>3.23±0.11</td>
<td>4.20±0.18**</td>
</tr>
</tbody>
</table>

Sodium concentrations are expressed as mean±S.E.M. *P<0.05 compared to control, n = 4, per group, **P<0.05 compared to baseline, n = 4

Discussion

Diuretics may be used to treat hypertension as well as edema (Kokko, 1984; Brater, 1998; Rang et al., 2005). They function primarily to induce a net negative balance of solute and water. Potassium-sparing diuretics inhibit either aldosterone directly or the Na+/K+ exchange mechanisms in the distal tubules and collecting ducts (Kokko, 1984; Rang et al., 2005; Crook, 2006; Burton and Theodore, 2007). The net effect is the loss of sodium in the urine and the retention of potassium in the blood, with the resultant decrease in plasma sodium and increase in plasma potassium levels. In this study, the leaf concoction reduced plasma sodium level and increased plasma potassium levels. This implies that it is a potassium-sparing diuretic and may either act by inhibiting aldosterone directly or the Na+/K+ exchange mechanisms in the distal tubules. According to Dmitrieva and Doris (2002), inhibition of Na+/K+ ATPases in the kidney, facilitates renal sodium excretion.

Earlier, Oladunmoye (2006) reported that the mechanism of antimicrobial activities of *A. wilkesiana* is the release of sodium and potassium ions. This surely points to the fact that the extract affects sodium and potassium pumps or Na+/K+ ATPases. This point is further strengthened by the fact that *A. wilkesiana* contains flavonoids, a family of compounds that are known to inhibit Na+/K+ ATPases (Hirano et al., 1989; Rouzaire-Dubois et al., 1993; Roufogalis et al., 1999; Middleton et al., 2000). All of these remain to be experimentally validated in this case.

Finally, the effect observed in this study may be beneficial in the management of hypertension, since hypertension is characterized by high plasma sodium and low plasma potassium levels (Luscher et al., 1987; Komiya et al., 1997; Coruzzi et al., 2001).

References


Ikewuchi et al.: Acalypha wilkesiana and Plasma Sodium and Potassium Levels


