EVALUATION OF THE DIURETIC EFFECT OF CONYZA DIOSCORIDES AND ALHAGI MAURORUM

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ABSTRACT

The present study aimed to evaluate the diuretic effects of methanol extracts of Conyza dioscorides and Alhagi maurorum in a single or repeated (1 x 5 days) oral dose of 500 or 1000 mg kg⁻¹ compared to furosemide 20 mg kg⁻¹, orally administered in albino rats. Oral administration of Conyza dioscorides significantly (P < 0.05) decreased serum and urine concentration of Na⁺, K⁺ and Cl⁻ concentration when was given in single or repeated doses. The small and large doses increased the sodium and potassium excretion rate (FENa and FEK). Alhagi maurorum in a single oral dose of 500 or 1000 mg kg⁻¹ significantly (P < 0.05) increased urine concentrations of Na⁺, K⁺ and Cl⁻. Repeated oral administration of Alhagi maurorum in doses of 500 or 1000 mg kg⁻¹ significantly (P < 0.05) increased urine volume, FENa and FEK rate. It could be concluded that methanol extracts of Alhagi maurorum have a significant diuretic effect while the extract of Conyza dioscoridis requires further investigation.

Keywords: Conyza dioscorides, Alhagi maurorum, Diuretics, Medicinal plants

INTRODUCTION

Medicinal plants are promising source of diuretic drugs.1-2,3 Diuretics, either alone or in combination with other drugs, are valuable in the treatment of hypertension, congestive heart failure, ascites, and pulmonary edema, chronic renal failure, hypercalcemia and cirrhosis of liver.4-6,7,8,9 Conyza dioscorides and Alhagi maurorum are common perennial herbaceous plants grown in the Nile region (Delta, valley and Faiyum) and in the Oases of the desert. Conyza dioscorides (Family Compositae) is a richly branched hairy shrub grown commonly in the Mediterranean region and tropical areas. Ibn El Bitar reported the use of Conyza discoridis in the treatment of epilepsy and as remedy for cold, diarrhea, colic and rheumatic pains.10 Alhagi maurorum (Boiss), a member of Family Leguminosae, is used in folk medicine as a remedy for rheumatic pains, bilharzias, liver and urinary tract inflammation and for various types of gastrointestinal discomforts.11 Recently these plants are proved to have antidiarreheal activity and induce relaxation of the smooth muscle2,12 and antinociceptive effect.13 Publics used to use the extracts of plants known to have sedative and/or diuretic effects without any scientific background. For this reason, we studied the diuretic effect of methanol extracts of Conyza dioscoridis, and Alhagi maurorum (Table 1).
The data were expressed as mean ± Standard deviation (S.D.). Differences between means in different groups were tested for significance using a one-way analysis of variance (ANOVA) followed by Duncan's Multiple Range Test. Differences were considered significant at level P < 0.05 according to Snedecor and Cochran. SPSS version 10 program was used.

RESULTS

Oral administration of furosemide in a single or repeated oral dose of 20 mg kg⁻¹ significantly decreased serum Na⁺, K⁺ and Cl⁻ concentrations, while it increased significantly the Na⁺, K⁺ and Cl⁻ level in urine (Fig. 1 and 2). Oral administration of furosemide in a single or repeated oral dose of 20 mg kg⁻¹ significantly decreased creatinine clearance but significantly increased FENa and FEK. It also significantly increased urine volume (Table 2 and 3).

Oral administration of methanol extracts of Conyza dioecoides in a single or repeated small or large dose (500 or 1000 mg kg⁻¹) significantly decreased serum and urine concentration of sodium, potassium and chloride. It decreased serum creatinine clearance but increased FENa and FEK rate and showed no effect on urine outflow (Fig. 1 and 2).

Oral administration of methanol extracts of Alhagi maurorum in a single oral dose of 500 mg kg⁻¹ significantly increased urine concentrations of sodium, potassium and chloride; however, it markedly decreased the levels of sodium, potassium but had no effect on chloride in serum (Fig. 1). Oral administration of methanol extracts of Alhagi maurorum in a single oral dose of 1000 mg kg⁻¹ significantly decreased serum and urine concentrations of sodium, potassium and chloride (Fig. 1). Its administration in a repeated oral dose of 500 mg kg⁻¹ significantly decreased serum and urine concentrations of sodium, had no effect on serum or urine potassium but significantly increased chloride concentration in urine (Fig. 2). Its administration in a repeated dose of 1000 mg/kg decreased sodium, potassium and chloride in serum and urine (Fig. 2).

Oral administration of methanol extracts of Alhagi maurorum in a single oral dose of 500 mg kg⁻¹ significantly decreased creatinine clearance and had no effect on FENa or FEK rate. It also significantly increased urine volume (Table 2). Its administration in a repeated oral dose of 500 or 1000 mg kg⁻¹ significantly decreased creatinine clearance but significantly increased FENa and FEK rate as well as urine volume (Table 3).

Means of different letters in the same column are significantly (P < 0.05) different

Table 2: Diuretic effect of single oral dose of methanol extract of Conyza dioecoides and Alhagi maurorum (mean ± SD, n = 6).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Doses mg/kg</th>
<th>Creatinine clearance μmol/min/100g</th>
<th>Sodium fractional excretion rate (%)</th>
<th>Potassium fractional excretion rate (%)</th>
<th>Volume ml/100g b.wt./24hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>102.13 ± 11.88</td>
<td>1.47 ± 0.32</td>
<td>39.09 ± 5.76</td>
<td>1.57 ± 0.35</td>
<td></td>
</tr>
<tr>
<td>Furosemide 20</td>
<td>80.07 ± 2.64</td>
<td>3.51 ± 0.65</td>
<td>128.39 ± 33.02</td>
<td>2.52 ± 0.73</td>
<td></td>
</tr>
<tr>
<td>Conyza 500</td>
<td>29.83 ± 4.09</td>
<td>4.90 ± 1.52</td>
<td>82.01 ± 1.682</td>
<td>1.68 ± 0.19</td>
<td></td>
</tr>
<tr>
<td>dioecoides 1000</td>
<td>53.00 ± 7.41</td>
<td>2.06 ± 0.63</td>
<td>79.29 ± 1.651</td>
<td>1.85 ± 0.52</td>
<td></td>
</tr>
<tr>
<td>Alhagi 500</td>
<td>50.15 ± 5.81</td>
<td>1.16 ± 0.56</td>
<td>47.30 ± 8.88</td>
<td>1.28 ± 0.31</td>
<td></td>
</tr>
<tr>
<td>maurorum 1000</td>
<td>50.73 ± 9.71</td>
<td>4.63 ± 1.76</td>
<td>156.66 ± 37.21</td>
<td>2.32 ± 0.31</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Diuretic effect of repeated oral dose of methanol extract of Conyza dioecoides and Alhagi maurorum (mean ± SD, n = 6).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Doses mg/kg</th>
<th>Creatinine clearance μmol/min/100g</th>
<th>Sodium fractional excretion rate (%)</th>
<th>Potassium fractional excretion rate (%)</th>
<th>Volume ml/100g b.wt./24 h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>107.03 ± 11.52</td>
<td>0.98 ± 0.26</td>
<td>30.57 ± 2.93</td>
<td>1.60 ± 0.20</td>
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</tr>
<tr>
<td>Furosemide 20</td>
<td>150.30 ± 16.4</td>
<td>2.06 ± 0.23</td>
<td>68.11 ± 9.36</td>
<td>2.67 ± 0.45</td>
<td></td>
</tr>
<tr>
<td>Conyza 500</td>
<td>30.43 ± 4.00</td>
<td>4.78 ± 0.69</td>
<td>140.36 ± 22.65</td>
<td>1.65 ± 0.40</td>
<td></td>
</tr>
<tr>
<td>dioecoides 1000</td>
<td>52.06 ± 9.88</td>
<td>0.97 ± 0.19</td>
<td>32.82 ± 5.27</td>
<td>1.56 ± 0.52</td>
<td></td>
</tr>
<tr>
<td>Alhagi 500</td>
<td>48.23 ± 3.2</td>
<td>2.78 ± 0.36</td>
<td>95.60 ± 6.06</td>
<td>2.20 ± 0.37</td>
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<tr>
<td>maurorum 1000</td>
<td>50.15 ± 5.81</td>
<td>2.58 ± 0.17</td>
<td>156.20 ± 30.25</td>
<td>2.63 ± 0.47</td>
<td></td>
</tr>
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</table>

Means of different letters in the same column are significantly (P < 0.05) different
DISCUSSION
The rate of FENa is a measure of the percentage of sodium excreted in the urine versus the sodium reabsorbed by the kidney [21, Bazari, 2007]. The calculated FENa was 0.98 to 1.47. These values are nearly similar to those of most normal subjects [22] who reported that the FENa rate is usually less than 1 percent but may be raised with an increase in salt intake. The present data clearly demonstrated the diuretic effect of the tested plant extracts. Diuresis is achieved by increased urinary electrolyte concentration with significant increase in both urine and electrolytes excretion qualitatively and significantly increased urine volume, FENa and FEK rate. However, small dose also has increased significantly the Cl− concentration in the ascending limb of the loop of Henle by inhibiting Na+/K+/2Cl−-symporter (co-transporter system) in the thick ascending limb of the Loop of Henle [23, 24].

In this study, furosemide increased the excretion of Na+, K+ and Cl−. Furosemide acts by inhibiting electrolytes re-absorption in the thick, ascending limb of the loop of Henle by inhibiting Na+/K+/2Cl−-symporter (co-transporter system) in the thick ascending limb of the Loop of Henle [25-27]. Oral administration of methanol extracts of Conyza dioscoridis in a single or repeated small or large dose (500 or 1000 mg kg−1) significantly decreased serum and urine concentration of sodium, potassium and chloride. It decreased serum creatinine clearance but increased FENa or FEK rate and showed no effect on urine outflow. The FENa is measured in terms of plasma and urine sodium, rather than by the interpretation of urinary Na+ concentration alone, as urinary sodium concentration can vary with water resorption. The increased values of FENa or FEK rate by methanol extract of Conyza dioscoridis may be due a high salt content of this extract. Similar conclusion have been postulated for other plant extracts [28].

Alhagi maurorum methanol extract produced a diuretic, kaluretic and saluretic effect. This was indicated by the increased urine output, urine concentration of Na+, K+ and Cl− increased FENa and FEK. It was observed that the increased urine concentration of sodium, potassium and chloride was clear after administration of the small dose (500 mg, kg−1), however small repeated and large dose single or repeated did not affect urine concentration of sodium or potassium concentration. This indicates that the saluretic effect of Alhagi maurorum was achieved by the small single dose only. The small dose also has increased significantly the Cl− concentration in urine but not in the serum.

Small or large dose of Alhagi maurorum either single or repeated significantly increased urine volume, FENa and FEK rate. However repeated administration for 5 days appeared more effective in increasing urine outflow. This indicates either a delayed diuretic effect or due to variation in the dose which may overcome a compensation mechanisms as it has been suggested for other plant extracts [29]. This delayed effect may be due to the slow release of the active principle, or due to slow changing the active component of the plant into active material or due to accumulation effect. The delayed diuretic effect was recognized for a number of other plant extracts [30]. However the difference in the dose could not be ruled out particularly in relation to the effect on the hydrostatic filtration pressure. Although there is no study on the effect of Alhagi maurorum on vascular smooth muscle, it has been found that methanol extract of Alhagi maurorum induced complete relaxation of gastrointestinal smooth muscle at low concentration and spasm at higher concentration [12]. Similar effect of Alhagi maurorum on the afferent arterioles may increase renal blood flow. The diuresis was apparent when the small dose was used. The diuretic effect of other plants was clear by small but not large doses [30].

It was noted that methanol extract of Alhagi maurorum caused increase in both urine and electrolytes excretion qualitatively similar to furosemide which is known by its potential saluretic and diuretic effects [31-32]. In a previous work in our laboratory the preliminary phytochemical analysis of the tested plants revealed the presence of flavonoids, tannins, unsaturated sterols/triterpenes, carbohydrates, lactones and proteins/amino acids in addition to traces of saponins. At present, it is not known which compounds are responsible for the diuretic, natriuretic and kaluretic activities of Conyza dioscoridis and Alhagi maurorum. In previous work, the diuretic properties of methanol extract of other plant extracts were attributed to their content of flavonoids [33-34]. Therefore, the diuretic effect could be attributed to their content of flavonoids.

The repeated administration of Conyza dioscoridis and Alhagi maurorum showed little effect on potassium excretion which is essential quality of a good diuretic with lesser hyperkalaemic side effect [35-36].

CONCLUSION
In conclusion, our results demonstrated that methanol extracts of Alhagi maurorum have a significant diuretic effect probably because of increased urinary electrolyte excretion with significant increase in the urinary output while the extract of Conyza dioscoridis requires further investigation.

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REFERENCES

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