Diuretic Action of Aqueous *Orthosiphon* Extract in Rats

J. Englert[1] *and G. Harnischfeger*[1,2]

[1] Schaper & Brümmer, D(W)-3320 Salzgitter 61, Federal Republic of Germany
[2] Address for correspondence

Received: April 26, 1991

Abstract

An aqueous extract of Orthosiphonis folium, given orally, enhances considerably ion excretion in rat to a level comparable to that obtained with furosemide. No aqueretic action is observed. The increased ion excretion is not due to the potassium content of the starting material.

Key words

Orthosiphon aristatus, diuretic activity, ion excretion, Orthosiphonis folium extract.

Introduction

The leaves and adjacent stems of the Southeast Asian Lamiacea *Orthosiphon aristatus* (Blume) Miquel, collected shortly before flowering and dried subsequently, provide the base for a widely used herbal tea reported to have diuretic and "blood-purifying" activity (1). The crude drug is monographed in the German Pharmacopoiea DAB 9 and evaluated as effective in man by the Commission E of the Federal Health Authority (BGA) (2).

Evidence for its diuretic activity derives mainly from case reports but also from some experimental data (3–5). They conclude that an aqueous extract of Orthosiphonis folium causes an increase of urinary excretion of potassium, sodium, and chloride ions, together with an increased urine volume and frequency of miction.

No clearcut quantitative data are, however, available, especially in comparison to standard, synthetic diuretics. Emphasizing this aspect in the experimental approach, the results of this study provide further evidence for the usefulness of Orthosiphonis folium.

Materials and Methods

Plant material

Orthosiphonis folium was obtained from the trading company P. Müggenburg, Hamburg (lot No. 2003-2). It was analyzed according to the German Pharmacopoiea DAB 9 and found to comply with all specifications.

The aqueous extract (tea) was obtained by macerating 20 kg of Orthosiphonis folium with 400 liters of boiling water. The filtrate was reduced to about 24 liters in vacuo at about 35 °C and freeze-dried afterwards. The yield was about 3 kg of freeze-dried extract (17 %).

Experimental animals

Male Wistar rats with body weights between 160 and 430 g were supplied by Lippische Versuchstieranstalt Extertal, Germany.

Experimental

Four to six rats were placed into each experimental group. To obtain similar physiological states of hydration in all animals a water bolus of 2.5 % body weight was administered by stomach tube 2 h before the actual experiment.

The extract, in a fixed dosage based on dry weight in relation to body weight of each individual animal, was redissolved in water and applied by stomach tube. In this way a preparation analogous to a tea of different but known strength and identical qualitative composition was used. The administration volume never exceeded 2.5 % of body weight.

After extract administration, urine was collected for the indicated period of time by placing each animal singly in a metabolism cage, allowing free access to water but not to food.

The parameters taken for each individual rat were: body weight before and after test period, total urine volume (corrected for water intake during the test period), urine concentration of Na^+, K^+, and Cl^-, urine pH, and total K^+ intake by extract administration. Where applicable, values were measured before and after the actual experiment.

Analytical procedures

Na^+ and K^+ concentrations were measured by flame photometry, Cl^- concentrations by titration with mercury nitrate $Hg(NO_3)_2$ using diphenylcarbazone as indicator.

Reference diuretic: Furosemide-sodium salt (Durafurid) was given by stomach tube. Optimal dose-activity relation was found to be 100 mg furosemide per kg body weight in a series of supportive experiments. As base line control, one group of animals was treated with water only in every experiment.

Table 1 Effects of *Orthosiphon* extract on excretory parameters.

Experimental Group / measured parameter	water control	furosemide control	Orthosiphon extract (125 mg/kg)	Orthosiphon extract (750 mg/kg)	Orthosiphon extract (1 g/kg)	K^+-aspartate (209 mg/kg)
total volume of urine (ml/kg)	26.8 ± 1.5	24.6 ± 13.5	29.3 ± 2.9	33.4 ± 3.1	25.9 ± 8.9	28.2 ± 0.7
total sodium (μmoles/kg)	592 ± 38.6	3417 ± 1179	775 ± 152	1196 ± 137	3516 ± 1697	676 ± 74.5
total potassium (μmoles/kg)	1632 ± 115	2092 ± 402	1850 ± 280	3316 ± 246	2798 ± 790	2104 ± 198
total chloride (μmoles/kg)	855 ± 335	3626 ± 1408	1718 ± 468	2392 ± 296	1435 ± 408	1692 ± 276

Results

The aqueous extract of *Orthosiphon aristatus* is active on the diuretic system in rodents. Dose/activity determination showed the optimum activity to be at a concentration of 750 mg extract per kg body weight.

The data in the Table allow the conclusion that the extract does not act as an aquaretic. The values of urine volume are only slightly elevated, if at all, and oscillate within the standard deviation given. This is also valid for the reference substance furosemide. However, the cation excretion is increased showing a maximum at the a.m. dose. Furosemide increased sodium excretion 6 times, Orthosiphon extract at 750 mg dose by a factor of about 2. Potassium excretion was stimulated twofold as well. A very high increase for the Cl^- excretion was also observed, *Orthosiphon* being in the same range as furosemide.

It has been suggested (7) that the increased ion excretion is due to the large amounts of potassium (1–3 %) in the extract. As shown in the Table we cannot confirm this opinion. When feeding rats with potassium aspartate in similar amounts to those ingested with the extract, potassium excretion remains below that of corresponding extract-fed rats.

Water control animals, however, showed the lowest potassium excretion rates.

Discussion

The results clearly show that an aqueous extract of *Orthosiphon* leaves does not act as an aquaretic, at least in rats, but enhances considerably ion excretion up to furosemide control values. The effect cannot be attributed to the potassium content of the extract only.

One can attempt to extrapolate the action of *Orthosiphon* from rat to man, using the activity of furosemide in both organisms as a guideline. The standard daily dose of furosemide in man is 40–80 mg for a 70 kg specimen, or 0.56–1.15 mg/kg body weight, respectively, while that in rat being measured as 100 mg/kg in the course of this study. Thus, the factor rat: man is roughly between 180 : 1 and 80 : 1 for furosemide.

The recommended daily dose for Orthosiphonis folium in man is 3–10 grams per day as a tea (2). This is equivalent to 42 mg drug per kg body weight in a 70 kg specimen or 9.2 mg extract per kg. The dose of 750 mg *Orthosiphon* extract/kg rat leads to a dose ratio rat : man of about 81 : 1, perfectly corresponding to that of furosemide.

It is, however, obvious from the experimental results with furosemide that the rat is a rather poor model for the known and considerably different action of this compound in man. Thus, the above calculation may only provide a lead for further investigations of the pharmacological action of Orthosiphonis folium in a more appropriate model, e.g. in dogs (6).

References

1 Harnischfeger, G., Stolze, H. (1983) in: Bewährte Pflanzendrogen in Wissenschaft und Medizin, (Harnischfeger, G., Stolze, H., eds.), pp. 172–180, Notamed, Melsungen.
2 (1986) BAnz 38, 3077, ergänzt (1990) BAnz 43, 1214.
3 Casadebeig-Lacton, J. (1989) Pharm. Acta Helv. 64, 220–224.
4 Chow, S. Y. (1979) J. Form. Med. Ass. 78, 953–960.
5 van der Veen, M., Malingre, Th., Zwaving, J. H. (1969) Pharmaceutisch Weekblad 114, 965–970.
6 Kirjutina, V. I., Drake, K. V. (1978) Lek sredstva in rastenij 292–296.
7 Biedermann, W. (1931) Dissertation, Jena.