Hypotensive effect of crude root extract of *Solanum sisymbriifolium* (Solanaceae) in normo- and hypertensive rats

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Abstract

The hypotensive effect of the crude hydroalcoholic extract from root of *Solanum sisymbriifolium* Lam. (Solanaceae) was investigated both in normotensive and hypertensive rats. The intravenous administration of the extract (50 and 100 mg/kg) produced a significant decrease in blood pressure in anaesthetized hypertensive (adrenal regeneration hypertension + deoxycorticosterone acetate (ARH + DOCA)) rats. Oral administration of the extract (10, 50, 100 and 250 mg/kg) also produced a dose-dependent hypotensive effect in conscious hypertensive animals. In anaesthetized normotensive rats, the extract (50 and 100 mg/kg, i.v.) also induced hypotension in a dose-dependent manner. Lastly, no significant effect on blood pressure was produced by the extract when administered orally (10, 50, 100, 250, 500 and 1000 mg/kg) to conscious normotensive rats.

Keywords: *Solanum sisymbriifolium* Lam.: Antihypertensive agents: ARH + DOCA (adrenal regeneration hypertension + deoxycorticosterone acetate)

1. Introduction

The worldwide increasing demand for medicine from natural sources (Lapa, 1992) has motivated us to search for plants with potential hypotensive activity. The root of *Solanum sisymbriifolium* Lam. (Solanaceae), a perennial herb found in eastern Paraguay, is claimed to possess diuretic and antihypertensive properties, and it is used in Paraguayan traditional medicine (Gonzalez Torrez, 1992). The root of this plant has also been reported as an emenagogue (Martinez-Crovetto, 1981) and fertility regulator (Hnatyszyn et al., 1974). Intoxication of horses by the plant has been reported in Argentina, and a hemolytic gly-
coside from the fruit has also been found (Burkart, 1978). Several alkaloids have been isolated from the root, such as cuscohygrine (Evans and Somanabandhu, 1980), solacaproine (Maldoni, 1984), solamine, solasodiene and solasodine (Mazumdar, 1984). However, we have found no scientific references on any experimental evaluation of the hypotensive properties which traditional medicine ascribes to this plant.

Hypertension is a significant health problem because of the percentage of the population affected and the serious consequences of uncontrolled high blood pressure. In general terms, hypertension continues to be a major risk factor for stroke, congestive heart failure, and coronary artery disease (Gerber and Nies, 1990). Adrenal regeneration hypertension + deoxycorticosterone acetate (ARH + DOCA) is a form of experimental hypertension in the rat which may be a counterpart of some forms of human low renin essential hypertension (Gomez-Sanchez et al., 1977). In the present paper, we report on the hypotensive effects of S. sisymbriifolium Lam., both on normo- and hypertensive rats (anaesthetized and conscious animals).

2. Materials and methods

2.1. Preparation of extract

Samples of S. sisymbriifolium Lam. were collected from the eastern region of Paraguay in February 1991 and were identified at the herbarium of the Faculty of Chemical Sciences, where a voucher herbarium specimen has been deposited (Soria 5.248).

Fresh root samples (3 kg) were air-dried and ground, yielding 1.335 kg of powder. The powder was extracted with a mixture of ethanol:water (70:30) by a conventional reflux method for 1 h. The total volume of the mixture was 19.0 l. The extraction was repeated 3 times and the filtered hydro-ethanolic extract was mixed and evaporated under reduced pressure. The concentrated extract was frozen and finally freeze-dried to yield 126 g of powder. Thus, 1 mg of lyophilized extract was obtained from 10.6 g of dry root powder.

2.2. Animals

Albino normotensive rats (Wistar strain) of either sex, weighing 180–300 g, were used for the studies of effect on blood pressure, while young Wistar rats of either sex, weighing 70–80 g, were used to induce experimental hypertension. A 12 h dark-light cycle, 23–25°C temperature and 50%–60% humidity, was maintained inside the animal room. The animals received standard food and, prior to experimentation, were fasted overnight with access to water ad libitum.

2.3. Drugs

Heparin, atropine, acetylcholine, norepinephrine and deoxycorticosterone acetate (DOCA) were obtained from Sigma Chemical Company (St. Louis, MO, USA), pentobarbital (Nembutal) from Abbott (Japan), and propylene-glycol for pharmaceutical use was purchased locally.

2.4. Induction of experimental hypertension (ARH + DOCA)

Forty Wistar rats (80–100 g) of either sex were anesthetized with pentobarbital (35 mg/kg, i.p.). Unilateral nephrectomy and bilateral adrenal enucleation were performed, using a retroperitoneal approach through a flank incision, as described by Stanton (1975). Briefly, the medullary tissue, both right and left, was removed by incising the capsule and gently extruding the glandular tissue with forceps. After surgery, all animals were placed in individual cages with free access to food and 1% NaCl solution as drinking water. Both in the first and second week following recovery, all animals received DOCA (15 mg/animal, s.c.). The indirect blood pressure was determined weekly using the manometer unit KN-210-3 (Natsume-Japan).

2.5. Intact preparation of normo- and hypertensive rats

Wistar rats of either sex (150–300 g) were anesthetized with pentobarbital (35 mg/kg, i.p.). Surgery and cannulations were performed as de-
Fig. 1. Representative tracing on arterial blood pressure (BP) of S. sisymbriifolium Lam. extract in anesthetized normotensive rats (0.1, 1.0, 10.0, 50.0 and 100.0 mg/kg, i.v.); n = 4 for each dose.
administration of 50 and 100 mg of extract/kg, i.v., produced a significant decrease in blood pressure, and the effect was particularly strong at a dose of 100 mg/kg (Fig. 2). Both the systolic and diastolic blood pressure appeared to be affected proportionately (Fig. 3a,b).

3.2. Effect of the extract on conscious normotensive and hypertensive rats.

No significant effect on blood pressure was produced by the extract when administered to conscious normotensive rats at doses of 10, 50, 100, 250, 500 and 1000 mg/kg, p.o. When conscious hypertensive rats were used, the administration of 10, 50, 100 and 250 mg/kg, p.o., produced a remarkable hypotension in a dose-dependent fashion (Fig. 4a,b). At doses of 500 and 1000 mg/kg, p.o., the blood pressure decrease did not follow the same rate of dose dependency observed at lower doses. This may be due to absorption difficulties.

4. Discussion and conclusions

The present study shows the hypotensive effect produced by the crude hydro-alcoholic root extract of S. sisymbriifolium Lam. when administered to experimentally induced hypertensive rats by the oral route. This hypotensive effect lasted from 3.5 to 4.5 h and the animal did not show any toxic reaction. When this test was performed orally in normotensive rats, no hypotensive effect was detected; rather, a slight increase in blood pressure followed the administration of the extract. Usually, this type of effect is observed in some therapeutic hypotensive drugs and is probably due to vessel abnormalities in the hypertensive state (Godfraind et al., 1986). However, when administered intravenously, the hypotensive effect was observed both in normotensive and hypertensive rats, although it was more accentuated in the latter. The cardiovascular response of hypertensive rats to intravenous injection of 50 mg/kg of the extract showed an effect characterized by an
immediate and short lasting hypotension, followed by a transient rise in blood pressure 30 seconds after injection, and finally a slow and persistent hypotension. It took between 45 and 55 min to return the blood pressure to the initial value. In normotensive animals, the recovery time was less than 10 min.

In summary, our results show a very strong hypotensive activity of *S. sisymbriifolium* Lam root extract which may justify its extensive use in folk medicine. Studies are under way to isolate the active principle(s) of the plant and to determine the mechanism of its action.
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References


