

Ethnopharmacology of rhinoceros horn. II: antipyretic effects of prescriptions containing rhinoceros horn or water buffalo horn

Paul Pui-Hay But, Yan-Kit Tam and Lai-Ching Lung

Department of Biology and Chinese Medicinal Material Research Centre, The Chinese University of Hong Kong, Shatin, N.T. (Hong Kong)

(Accepted October 29, 1990)

Aqueous extracts of rhinoceros horn or water buffalo horn demonstrated significant antipyretic action at 2.5 g/ml i.p. (1 ml/animal) in rats with hyperthermia induced by subcutaneous injection of turpentine oil. Qingying Decoction, a classic compound prescription composed of rhinoceros horn and eight herbs, showed significant antipyretic action at dosages equivalent to 0.5 g/ml of rhinoceros horn extract. Comparable action was obtained by Qingying Decoction prepared with water buffalo horn. It is suggested that water buffalo horn can be used as a substitute for rhinoceros horn in treating hyperthermia, especially when prepared with other herbal materials according to the principles of compound prescriptions of Chinese medicine.

Key words: rhino horn; water buffalo horn; fever; compound prescription; antipyretic effect; Qingying decoction.

Introduction

Rhinoceros horn has been used in Chinese medicine for over two millennia to dispel *heat*, cool blood, relieve convulsions and counteract toxins (Anonymous, 1977; Bensky and Gamble, 1986). It is classified as a *cold* drug and indicated for *hot* diseases. More specifically, it is applied in cases associated with hyperthermia due to *heat* trapped deep in the body in the areas of *ying* (maintenance) and *xue* (blood). In a previous study (But et al., 1990), the antipyretic effects of aqueous extracts of rhinoceros horn were demonstrated at 5, 2.5 and 1 g/ml i.p., but not at 0.5 g/ml i.p., in rats with hyperthermia induced by the subcutaneous injection of turpentine oil. Similar assays with extracts of the horns of saiga antelope, water buffalo and cattle at 5 g/ml also caused significant drops in fever in the experimental animals. However, at 1 g/ml and 1 ml/rat, only saiga antelope horn showed a significant antipyretic effect.

Although we managed to confirm the antipyretic potential of rhinoceros horn in therapeutics, it should be noted that, in Chinese medicine, rhinoceros horn is most often prescribed in combination with other herbal materials in form of a compound prescription (multi-item prescription or formula). For example, in many classical compound prescriptions such as Qingying Decoction, Xijiao Dihuang Decoction, Zhibao Pill, Huaban Decoction, Suhexiang Pill, Shenxi Pill, Qingwen Baidu Decoction, Qinggong Decoction and Lingyang Baihu Pill, rhinoceros horn is a key ingredient. It is often used as an ingredient in proprietary preparations of Chinese medicines. In the *Catalogue of Proprietary Chinese Medicines in Mainland China* (Anonymous, 1985), which lists 3866 proprietary drugs produced by 529 manufacturers in mainland China, 31 preparations contain rhinoceros horn (But et al., 1988).

The rationale of prescribing a compound prescription over the use of a single drug is that the items in a compound prescription may (i) cover a multitude of physiologic targets to restore holistic balance in the body; (ii) interact with one another to enhance the potency of the main drugs, or synergistically to magnify their total activities, or

Correspondence to: Paul Pui-Hay But, Department of Biology and Chinese Medicinal Material Research Centre, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong.

to minimize or neutralise the toxicity and side-effects of some of the items; and (iii) avoid the potential lopsided effects of a large dose of a single drug.

Since the effects of rhinoceros horn might be better expressed in compound prescriptions, it would be relevant to evaluate its antipyretic property when combined with other herbal materials. Accordingly, we have chosen to check this activity using the Qingying Decoction prescription.

Qingying Decoction was first mentioned in the classic work on feverish diseases, *Wenbing Tiaobian (Itemized Dialectic Analysis of Feverish Diseases)* compiled by Wu in 1798. This prescription (Table 1) is composed of rhinoceros horn and eight herbs. This prescription is intended to cleanse the *ying* area and counteract toxins with rhinoceros horn and *Salvia*, to increase humor, nourish *yin* and relieve *heat* with *Ophiopogon*, *Rehmannia* and *Scrophularia* and to expel the disease via the *qi* area to the outside with *Bambusa*, *Lonicera*, *Forsythia* and *Coptis* (Anonymous, 1975; Ran, 1983). It is specified for cases of *heat* in the *shaojueyin (hand-absolute-yin)* stage of a dis-

ease, with the symptoms of vague or thready-speedy pulse, restless sleep, hyperthermia (especially at night), rashes, thirst, red tongue and delirium with closed or open eyes, but not in individuals with yellow wet or white wet and slippery tongue coatings (Wu, 1798; Yu, 1983). Very often, this decoction is applied in treating heat stroke, encephalitis B, epidemic meningitis, septicemia, bacterial endocarditis and other inflammatory diseases (Qin and Zhang, 1982; Li, 1983). Xu (1986) reported success in applying this decoction to treating a case of connective tissue disease and another of viral cephalitis which did not respond to antibiotics and other Western treatments.

The objective of this study is to evaluate the antipyretic effects of rhinoceros horn with and without other herbal materials, and to check if water buffalo horn can be used as a substitute.

Materials and Methods

Horns, herbs and preparation of extracts

Rhinoceros horn scraps confiscated by customs officials and identified by the Museum of Chinese

TABLE 1
ITEMS IN QINGYING DECOCTION PRESCRIPTION

Herb	Part used	Original animal/plant	Portion by weight
Rhinoceros	Horn	Rhinoceros species Rhinocerotidae	3
Bambusa	Leaf	<i>Bambusa tuldoidea</i> Munro Gramineae	1
Coptis	Rhizome	<i>Coptis chinensis</i> Franch. Ranunculaceae	1.5
Forsythia	Fruit	<i>Forsythia suspensa</i> (Thunb.) Vahl Oleaceae	2
Lonicera	Flower bud	<i>Lonicera japonica</i> Thunb. Caprifoliaceae	3
Ophiopogon	Root tuber	<i>Ophiopogon japonicus</i> (Thunb.) Ker-Gawl. Liliaceae	3
Rehmannia	Root tuber	<i>Rehmannia glutinosa</i> Libosch. Scrophulariaceae	5
Salvia	Root	<i>Salvia multiorrhiza</i> Bunge Labiatae	2
Scrophularia	Root	<i>Scrophularia ningpoensis</i> Hemsl. Scrophulariaceae	3

Medicines at our University to be from the African black rhinoceros (*Diceros bicornis*) were made available to this study from the Agriculture and Fisheries Department of the Hong Kong Government. Water buffalo horn was collected from butchers or meat markets; only the terminal portion above the bony core was used. The horns were filed into a fine powder. An aqueous extract was prepared by boiling the horn powder in hot water (40 ml/g) for 3 h twice and then pooling the supernatant together and concentrating it by heat to desirable concentrations.

Herbs specified in Qingying Decoction were purchased from commercial sources and their identity confirmed by the Museum of Chinese Medicines at our University. The herbs were cut into smaller pieces, then mixed together in standard proportions (Table 1). An aqueous extract was prepared by boiling the herb mixture in hot water (40 ml/g) for 3 h twice and then pooling the supernatant together and concentrating it by heat to desirable concentrations.

Experimental animals and procedures

The same experimental animals, pyrogen, thermometer and procedures described in our previous report (But et al., 1990) were employed. The Wistar albino rats (180–200 g) were divided randomly into four treatment groups: control, horn extract, herbs extract and horn-herbs extracts combined. In the last group, concentrations of the horn and herbs extracts were first doubled by reducing their volumes by one-half by heat and then pooling them together fresh at the beginning of each experiment. Each rat in the control group received 1 ml of saline i.p. Rats in the three experimental groups received an equal amount of the corresponding extracts via the same route of administration. Each set of experiments was repeated twice. Student's *t*-test was used for the statistical analyses.

Results

At the high dosage level, rhinoceros horn extract at 2.5 g/ml i.p. demonstrated significant antipyretic activities within 30 min after administration. The second injection again induced a sig-

nificant drop in rectal temperature. The herbs extract at 0.25 g/ml i.p. induced a gradual and persistent drop in rectal temperature in rats with hyperthermia. The combined extract of rhinoceros horn (2.5 g/0.5 ml) and herbs (0.25 g/0.5 ml) also showed a significant persistent antipyretic action (Fig. 1).

Under the same experimental conditions, when water buffalo horn was substituted for rhinoceros horn at the same high dosage level (2.5 g/ml), the second injection demonstrated significant antipyretic effects. The combined extract of water buffalo horn (2.5 g/0.5 ml) and herbs (0.25 g/0.5

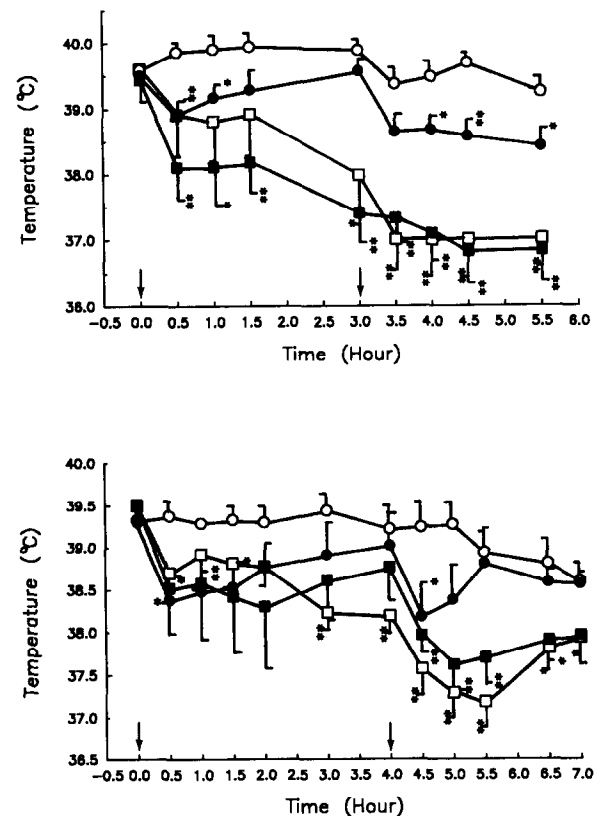


Fig. 1. Mean (\pm S.E.M.) antipyretic effects of Qingying Decoction prepared with or without rhinoceros horn extract in male rats (N /plotted point = 5). The top and bottom graphs represent duplicate runs. \circ , control; \bullet , rhinoceros horn 2.5 g/ml; \square , herbs 0.25 g/ml; \blacksquare , rhinoceros horn 2.5 g/0.5 ml plus herbs 0.25 g/0.5 ml. Arrows indicate the first and second administration of horn/herb extract or saline. Significant from the respective control data: * P < 0.05; ** P < 0.01.

ml) showed consistent antipyretic actions after both injections (Fig. 2).

However, at the low dosage levels, neither the horn extracts (0.5 g/ml) nor the herbs extract (0.1 g/ml) demonstrated antipyretic properties (Figs. 3 and 4). However, the combined horn-herbs extracts (0.5 g/0.5 ml and 0.1 g/0.5 ml, respectively), whether derived from rhinoceros horn or water buffalo horn, showed a significant antipyretic action (Figs. 3 and 4).

Discussion

The present study confirmed the antipyretic actions of rhinoceros horn extract at 2.5 g/ml i.p.

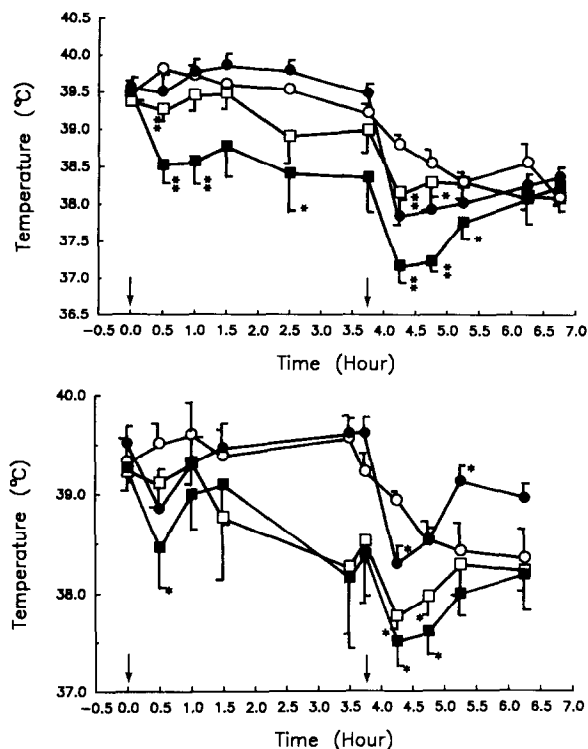


Fig. 2. Mean (\pm S.E.M.) antipyretic effects of Qingying Decoction prepared with or without water buffalo horn extract in male rats (N /plotted point = 5). The top and bottom graphs represent duplicate runs. \circ , control; \bullet , water buffalo horn 2.5 g/ml; \square , herbs 0.25 g/ml; \blacksquare , water buffalo horn 2.5 g/0.5 ml plus herbs 0.25 g/0.5 ml. Arrows indicate the first and second administration of horn/herb extract or saline. Significant from the respective control data: * P < 0.05; ** P < 0.01.

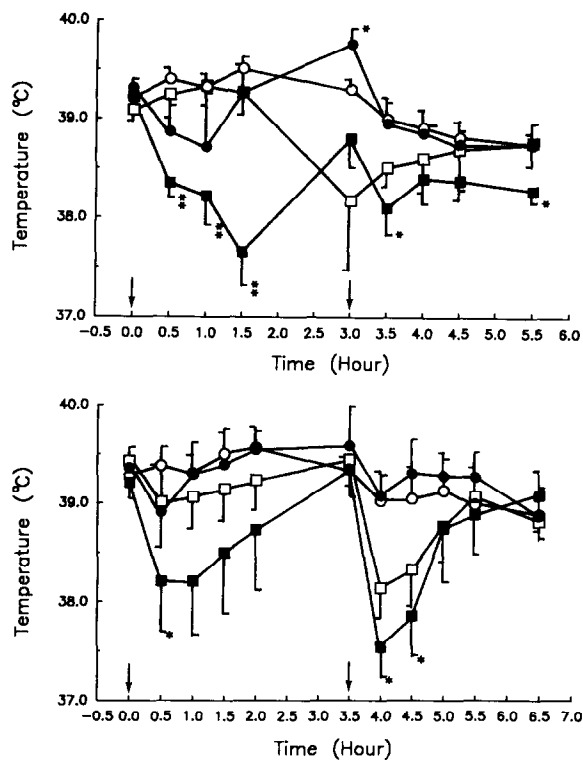


Fig. 3. Mean (\pm S.E.M.) antipyretic effects of Qingying Decoction prepared with or without rhinoceros horn extract in male rats (N /plotted point = 5). The top and bottom graphs represent duplicate runs. \circ , control; \bullet , rhinoceros horn 0.5 g/ml; \square , herbs 0.1 g/ml; \blacksquare , rhinoceros horn 0.5 g/0.5 ml plus herbs 0.1 g/0.5 ml. Arrows indicate the first and second administration of horn/herb extract or saline. Significant from the respective control data: * P < 0.05; ** P < 0.01.

(But et al., 1990). Water buffalo horn extract demonstrated similar actions at this same concentration. The present study also demonstrated that, at the high concentration (0.25 g/ml) the herbal materials in Qingying Decoction, without rhinoceros horn, could also induce a persistent drop in rectal temperature in rats with hyperthermia.

At the dosage levels, when the individual extracts of neither horn nor herbs could induce a drop in rectal temperature in rats with hyperthermia, the combined horn-herbs extracts of either rhinoceros or water buffalo horns demonstrated significant antipyretic actions. This result is highly significant in two directions. First,

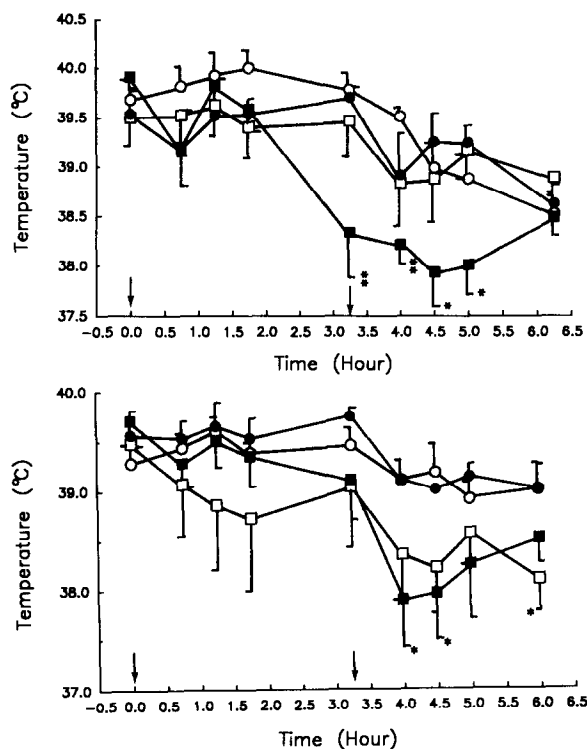


Fig. 4. Mean (\pm S.E.M.) antipyretic effects of Qingying Decoction prepared with or without water buffalo horn extract in male rats (N /plotted point = 5). The top and bottom graphs represent duplicate runs. \circ , control; \bullet , water buffalo horn 0.5 g/ml; \square , herbs 0.1 g/ml; \blacksquare , water buffalo horn 0.5 g/0.5 ml plus herbs 0.1 g/0.5 ml. Arrows indicate the first and second administration of horn/herb extract or saline. Significant from the respective control data: * P < 0.05; ** P < 0.01.

it clearly indicates that water buffalo horn can be used as a substitute for rhinoceros horn when prescribed in combination with other herbal materials. Second, it lends support to the rationale for the therapeutic use of compound prescriptions.

The present results offer a scientific rationale for substituting rhinoceros horn with water buffalo horn in treating hyperthermia, although a higher dosage of water buffalo horn may be necessary (Jiao, 1977). Amino acid and inorganic profiles of water buffalo horn have been shown to be similar to those of rhinoceros horn, except for a much lower calcium content in the former (Anonymous, 1975). Clinical studies (Anonymous, 1975) have al-

ready reported that water buffalo horn, both as a single item and in combination with other herbal materials, is effective in cases of hyperthermia of upper respiratory infections and of encephalitis B. The *Pharmacopoeia of the People's Republic of China* (Anonymous, 1985) has already registered water buffalo horn as an entry.

The enhancing or synergistic functions of multi-items appear to characterize Qingying Decoction. The various herbs in the prescription are known to have antibacterial, sedative, cardiotoxic, diuretic and immunopotentiating effects (Chang and But, 1986, 1987).

Acknowledgments

Partial support was received with gratitude from the World Wide Fund for Nature Hong Kong, Agriculture and Fisheries Department, and Chinese Medicinal Material Research Centre of The Chinese University of Hong Kong. Assistance from S.M. Fong, C.C. Wai and D.S. Melville is also deeply appreciated.

References

- Anonymous (1975) Clinical observation on 3871 cases treated with water buffalo horn and preliminary report on chemical analysis and pharmacology of the horn. *Zhongcaoyao Tongxun* 2, 107—109.
- Anonymous (1977) *Encyclopedia of Chinese Materia Medica (Zhongyao Daxidian)*, Vol. 2. Shanghai Science and Technology Press, Shanghai, pp. 2423—2425.
- Anonymous (1985) *Pharmacopoeia of the People's Republic of China*, Vol. 1. People's Medical Publishing House and Chemical Industry Press, Beijing, p. 62.
- Bensky, D. and Gamble, A. (1986) *Chinese Herbal Medicine Materia Medica*. Eastland Press, Seattle, pp. 93—95.
- But, P.P.H., Lung, L.C. and Tam, Y.K. (1988) Profiles of Chinese medicines. 4: Rhinoceros horn. *Abstracts of Chinese Medicines* 2 (3), 351—360.
- But, P.P.H., Lung, L.C. and Tam, Y.K. (1990) Ethnopharmacology of rhinoceros horn. I: Antipyretic effects of rhinoceros horn and other animal horns. *Journal of Ethnopharmacology* 30, 157—168.
- Chang, H.M. and But, P.P.H. (Eds.) (1986) *Pharmacology and Applications of Chinese Materia Medica*, Vol. I. World Scientific Publishing Co., Singapore, pp. 225—268, 424—427, 461—467, 543—549, 598—604.
- Chang, H.M. and But, P.P.H. (Eds.) (1987) *Pharmacology and Applications of Chinese Materia Medica*, Vol. II. World Scientific Publishing Co., Singapore, pp. 822—826, 1029—1040.

- Jiao, S.D. (1977) *Ten Lectures on Insight in Drug Application*. People's Medical Publishing House, Beijing, pp. 159—160.
- Li, Y.F. (1983) Classification and dialectic diagnosis of feverish diseases (II). *Guangxi Zhongyiyao* 2, 30—33.
- Qin, S.L. and Zhang, L. (1982) Simple explanations of theories of feverish diseases (first sequel). *Zhongyiyao Xuebao* 2, 31—36.
- Ran, X.D. (1983) Qingying Decoction. In: Ran, X.D. (Ed.) *Annotations to Good Prescriptions of Famous Physicians of All Dynasties*. Science and Technology Literature Press, Chongqing, pp. 274—275.
- Wu, J.T. (1798, typeset in 1972) *Itemized Dialectic Analysis of Feverish Diseases (Wenbing Tiaobian)*. People's Medical Publishing House, Beijing, p. 35.
- Xu, Z.Y. (1986) Clinical appreciation of Qingying Decoction in treating serious feverish diseases. *Zhejiang Journal of Traditional Chinese Medicine* 7, 297.
- Yu, L.W. (1983) Diagnosis and treatment of fever in Chinese medicine. *Jizhenyikan* 11, 2—4.