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Effect of Decoction Water Volumes on Paeonol Elution from Moutan Cortex

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Studies were performed on the effect of the initial volume of decoction water on the paeonol elution from several Chinese medicinal prescriptions containing Moutan Cortex. The result showed that 700–900 ml of water is enough for the paeonol extraction from any of these prescriptions containing Moutan Cortex.

Keywords——Moutan Cortex; paeonol; decoction water; prescription; pharmaceutical analysis

In the previous works, we investigated the behavior of paeonol, a volatile phenolic compound, in Moutan Cortex during the decoction of this crude drug,[1] and the influence of co-existing crude drugs on the efficiency of paeonol extraction from Moutan Cortex.[2] As reported in the preceding paper,[2] the treatment of decocted solutions with Amberlite XAD-2 resin is useful for the identification and quantification of paeonol in the decoctions of such prescriptions. Therefore, in this paper, the effect of the volume of decoction water on the paeonol content of the infused solutions from several Chinese medicinal prescriptions containing Moutan Cortex was examined by utilizing this resin procedure.

Experimental

Materials——Chopped crude drugs[2] were purchased from Nakaikohshindo (Kobe). Paeonol was prepared from a chloroform extract of Moutan barks by silica gel column chromatography using dichloromethane as eluent and recrystallized from dichloromethane-methanol (mp. 49–49.5°C). It was identified as paeonol by the comparison of the IR spectrum and TLC *Rf* value with those of authentic paeonol (purchased from nacalai tesque).

Prescriptions——The following crude drug prescriptions were used[3]: Kami-syoyo-san (加味逍遙散), Angelicae Radix (当帰) 3 g, Atractylodis Lanceae Rhizoma (蒼朮) 3 g, Bupleuri Radix (柴胡) 3 g, Hoelen (茯苓) 3 g, Paeoniae Radix (芍薬) 3 g, Gardeniae Fructus (山梔子) 2 g, Moutan Cortex (牡丹皮) 2 g, Glycyrrhizae Radix (甘草) 1.5 g, Menthae Herba (薄荷) 1 g, Zingiberis Rhizoma (生姜) 1 g; Keisi-bukuryo-gan Ryo (桂枝茯苓丸料), Cinnamomi Cortex (桂皮) 3 g, Hoelen 3 g, Moutan Cortex 3 g, Paeoniae Radix 3 g, Persicae Semen (桃仁) 3 g; Hatimi-zio-gan Ryo (八味地黄丸料), Rehmanniae Radix (地黄) 6 g, Alismatis Rhizoma (澤瀉) 3 g, Corni Fructus (山茱萸) 3 g, Dioscoreae Rhizoma (山薬) 3 g, Hoelen 3 g, Moutan Cortex 2.5 g, Cinnamomi Cortex 1 g, Aconiti Tuber Praeparata (炮附子) 0.5 g; Saiko-sokan-to (柴胡疎肝湯), Angelicae Radix 3 g, Aurantii Nobilis Pericarpium (陳皮) 3 g, Bupleuri Radix 3 g, Cinnamomi Cortex 3 g, Cnidii Rhizoma (川芎) 3 g, Moutan Cortex 3 g, Paeoniae Radix 3 g, Persicae Semen 3 g, Rehmanniae Radix 3 g, Aurantii Fructus Immaturus (枳実) 1.5 g, Carthami Flos (紅花) 1.5 g, Glycyrrhizae Radix 1.5 g, Natrii Sulfas (芒硝) 1.5 g, Rhei Rhizoma (大黄) 1.5 g; Unkei-to (温経湯), Ophiopogonis Tuber (麦門冬) 4 g, Pinelliae Tuber (半夏) 4 g, Angelicae Radix 3 g, Asini Gelatinum (阿膠) 2 g, Cinnamomi Cortex 2 g, Cnidii Rhizoma 2 g, Ginseng Radix (人参) 2 g, Glycyrrhizae Radix 2 g, Moutan Cortex 2 g, Paeoniae Radix 2 g, Evodiae Fructus (呉茱萸) 1 g, Zingiberis Rhizoma 1 g.

Gas-liquid chromatography——The experimental apparatus and conditions used were the same as those described in the preceding paper.[2]

Assay procedure——Each prescription (one day dose) was decocted in a beaker with each volume of water by

boiling for 30 min using an electric heater (600 W) and the extract was filtered. 2 g of Moutan bark was decocted also by boiling for 10 min (as the paeonol content in a 10 min infused solution is higher than that in a 30 min infused solution,[1] it is avoidable Fig. 1 being illegible and consequently easy to discriminate the change in contents among the prescriptions) under the same conditions. After cooling, a half volume of the filtrate was applied to an Amberlite XAD-2 column (80 ml), and the column was washed with water (200 ml) and methanol (100 ml) successively, and then eluted with acetone (200 ml). The acetone eluate was concentrated *in vacuo* and the concentrated solution was put into a 5 ml measuring flask to be made to 5 ml with acetone. 5 μl of the solution was subjected to gas-liquid chromatography (GLC). The paeonol content in each sample was calculated by employing the calibration curve prepared by the regression equation: $y=5648.935x+3237.307$ ($r=0.999$) [x is the amount (μg) of paeonol and y is the peak area, expressed as the count number on the chromatogram]. The quantity of the Amberlite XAD-2 used was found to be appropriate as only a trace amount of paeonol was detected in the water eluate and the methanol eluate.

Results and Discussion

Few papers[4-7] so far have reported the effect of the volume of water used for the preparation of decoctions on the amounts of constituents extracted in the decoctions from crude drugs or Chinese medicinal prescriptions.

When Moutan Cortex was singly boiled in water, the paeonol content in the infused solutions reached the maximum within 10 min.[1] The change of the paeonol content in the extracts, when 2 g of Moutan Cortex was decocted for 10 min with various amounts of water is shown in Fig. 1. The paeonol content reached the maximum when the amount of water used was 400 ml. On the other hand, more water was needed for the sufficient paeonol extraction from prescriptions. The initial volumes of water needed for the efficient paeonol extractions from prescriptions were as follows (Fig. 1); Keisi-bukuryo-gan Ryo (total weight 15 g, 5 g/1 g of Moutan Cortex), 700 ml; Hatimi-zio-gan Ryo (total weight 22 g, 8.8 g/1 g of Moutan Cortex), 800 ml; Unkei-to (total weight 27 g, 13.5 g/1 g of Moutan Cortex), 800 ml; Saiko-sokan-to (total weight 34.5 g, one of the prescriptions whose one dose weight is the heaviest, 11.5 g/1 g of Moutan Cortex), 900 ml. These results imply that the amount of water needed for the efficient extraction of paeonol from prescriptions is related more to the total weight of the prescriptions than to the prescription weight per 1 g of Moutan Cortex contained in the prescriptions to be decocted. However, 900 ml of water seems to be almost enough for the paeonol decoction from any of these prescriptions containing Moutan Cortex.

In Fig. 2, the paeonol contents (mg) in decoctions derived from 1 g of Moutan Cortex contained in prescriptions are plotted against the weights of prescriptions (g) containing 1 g of Moutan Cortex, when the decoctions were prepared by boiling with 600 ml water for 30 min. In Fig. 3, the paeonol contents (mg) in decoctions derived from 1 g of Moutan Cortex in prescriptions are plotted against the volumes of decoction water (ml) per 1 g of prescription weight, when the decoctions were prepared under the

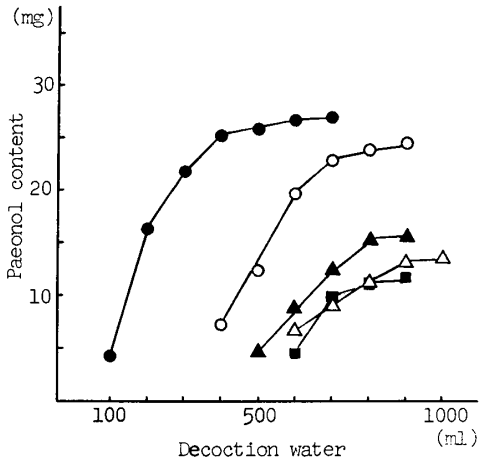

Fig. 1. Effect of Initial Volume of Decoction Water on Paeonol Content

●, Moutan cortex; ○, Keisi-bukuryo-gan Ryo; ▲, Hatimi-zio-gan Ryo; △, Saiko-sokan-to; ■, Unkei-to.

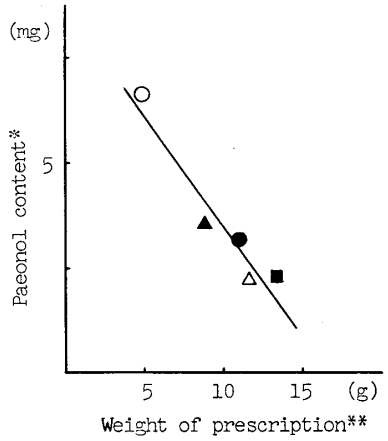

Fig. 2. Relation between Paeonol Contents and Weights of Prescriptions

Water used, 600 ml; 30 min decoction; *, mg per 1 g of Moutan Cortex; **, g per 1 g of Moutan Cortex; ○, Keisi-bukuryo-gan Ryo; ▲, Hatimi-zio-gan Ryo; ●, Kami-syoyo-san; △, Saiko-sokan-to; ■, Unkei-to.

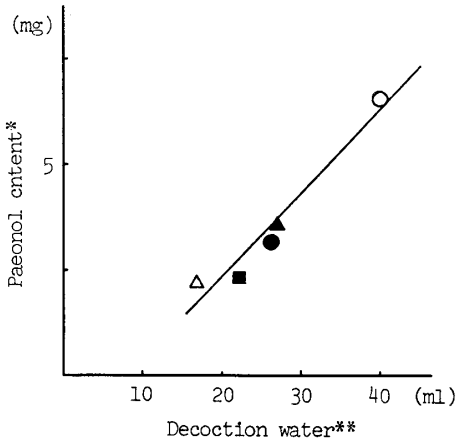

Fig. 3. Relationship between Paeonol Contents and Quantity of Decoction Water

Water used, 600 ml; 30 min decoction; *, mg per 1 g of Moutan Cortex; **, ml per 1 g of prescription weight; ○, Keisi-bukuryo-gan Ryo; ▲, Hatimi-zio-gan Ryo; ●, Kami-syoyo-san; ■, Unkei-to; △, Saiko-sokan-to.

same conditions as in Fig. 2. As the weight increases, the paeonol content decreases proportionally. As the volume of water used for the preparation of decoction increases, the paeonol content in the extract also increases proportionally. These phenomena observed in the 5 prescriptions are in accord with common expectations, and may support the conclusion given in the preceding paper[2] that no crude drug co-infused with Moutan Cortex seriously affects the paeonol elution into the decoction.

References and Notes

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