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The essence of *gyoku-daiou* and *shu-daiou*

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Abstract

In China, rhubarb has been mainly processed with liquor or by steaming to increase its medicinal effects or decrease its side effects. The modern Chinese Pharmacopoeia describes frying rhubarb after spraying with liquor as *shu-daiou* and steaming rhubarb after spraying with liquor as *gyoku-daiou*; however pharmacologic significance of processing has not been elucidated. In this article, the author examines *gyoku-daiou* and *shu-daiou* in herbological and chemical studies.

As for *gyoku-daiou*, in herbological study, the rhubarb which used as a remedy against poison was not steamed after liquor processed one but simply steamed one. However in chemical study, the rhubarb which soaked in a sufficient amount of liquor before being steamed expects to be used as a remedy against poison. In addition, the rhubarb is considered to have a decreased purgative effect.

Then as for *shu-daiou*, frying rhubarb after processed with liquor has been used to improve blood stasis since the Jin and Yuan Dynasties in China. The rhubarb with the effect should be processed as follows; sprayed with liquor before being heated.

Key words *gyoku-daiou*, *shu-daiou*, herbological study, chemical study, steaming, processed with liquor.

Introduction

Rhubarb is a crude drug derived from the rhizomes or roots of *Rheum* species. Rhubarb has a number of medicinal effects, e.g., it improves blood stasis, has a purgative effect, moistens the bowel, and counteracts the effects of poisons. In addition, heating or processing it with liquor can increase its medicinal effects or decrease its side effects. Rhubarb is mainly processed with liquor or by steaming. In ancient times, there were 3 methods that were used to process rhubarb with liquor; i.e., dipping in liquor (liquor-dipping), soaking in liquor (liquor-soaking), and frying after soaking in liquor

(liquor-frying). In addition, there were two methods of steaming rhubarb; i.e., subjecting to steaming alone, and soaking with liquor before steaming (liquor-steaming).^{1,2)} In addition, the author has elucidated that liquor-frying and liquor-steaming can be performed by different methods; i.e., frying after subjecting to liquor-dipping or liquor-soaking, and steaming after subjecting to liquor-dipping or liquor-soaking, respectively. The current version of the Chinese Pharmacopoeia³⁾ describes rhubarb processed with liquor as *shu-daiou* and steamed rhubarb as *gyoku-daiou*. *Shu-daiou* is produced by frying rhubarb after spraying with liquor, and *gyoku-daiou* is made by steaming rhubarb after spraying with liquor; however, these processing methods differ from the ancient methods (Table 1). *Shu-daiou* is considered to improve blood stasis, and *gyoku-daiou* is considered

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Table 1 Differences in rhubarb processing methods between ancient and modern times

	Processing with liquor		Steaming	
Ancient times	Liquor-dipping		Steaming	
	Liquor-soaking			
	Liquor-frying	Liquor-dipped and then fried	Liquor-steaming	Liquor-dipped and then steamed
		Liquor-soaked and then fried		Liquor-soaked and then steamed
Modern times	Liquor-frying	Sprayed with liquor and then fried (<i>Shu-daiou</i>)	Liquor-steaming	Sprayed with liquor and then soaked (<i>Jyuku-daiou</i>)

to act against poisons and to have a reduced purgative effect.³⁾ However, the scientific data about processed rhubarb are incomplete. In this article, the author examines *kyaku-daiou* and *shu-daiou* in herbological and chemical studies.

1-1 Herbological study of *kyaku-daiou*

Jyuku-daiou is described in the *Jinkuiyaolue*,⁴⁾ one of the oldest pieces of medical literature in China. According to this book, *kyaku-daiou* is produced by steaming rhubarb without liquor. Thus, ancient *kyaku-daiou* is not the same as the modern version. Surprisingly, in the ancient literature steamed rhubarb is referred to by different names depending on the type of literature. *Honzo-syo* (*Bencao-shu* in Chinese) refers to medicine that was mainly prescribed by herbologists, and *Iho-syo* (*Yifang-shu* in Chinese) refers to Kampo medicines that were administered by doctors. The processed rhubarb in *Honzo-syo* was called '*kyaku*', whereas it was called '*jyou*' (the sound of the character for steaming) in *Iho-syo*. In addition, most of the descriptions of medicines containing liquor-steamed rhubarb referred to *Iho-syo* medicines.²⁾ Therefore, it seems that liquor-steamed rhubarb tended to be used by doctors. Thus, the author concluded that modern *kyaku-daiou* took its name from the *kyaku-daiou* used by herbologists, whereas the liquor-steaming method used to produce it is derived from the method used by doctors to process rhubarb.

In addition, steamed rhubarb and liquor-steamed rhubarb were reported to have different medicinal effects; i.e., steamed rhubarb was used as a remedy against poisons, to improve blood stasis, and moisten the bowel, while there were no descriptions of liquor-steamed rhubarb being used against poisons.²⁾

1-2 Chemical study of *kyaku-daiou*

The differences between steamed rhubarb and various kinds of liquor-steamed rhubarb were investigated in chemical studies; i.e., by analyzing the concentrations of the main compounds of each form of processed rhubarb.²⁾ Three kinds of processed rhubarb were prepared with 16% ethanol as a substitute for *huangjiu* (Chinese fermented yellow wine)⁵⁾ as follows:

Steamed rhubarb: rhubarb chips were placed into a culture bottle, and the top was blocked with paper. Then, the chips were steamed by autoclaving (120°C, 2 atm) for 20 minutes, before being dried overnight in an oven set to 40°C;

Liquor-spraying of rhubarb before being steamed: 16% ethanol was sprayed onto rhubarb chips, which were then steamed;

Liquor-soaking of rhubarb before being steamed: rhubarb chips were soaked in 40 mL of 16% ethanol and stirred to ensure their thorough saturation with alcohol, left for 24 hours, and removed from the alcohol, and then the excess fluid was absorbed with paper. Then, the chips were steamed.

Rhubarb dried overnight in an oven was used as a control.

The sennoside (sennoside A and B), anthraquinone (aloe-emodin, rhein, emodin, chrysophanol, and physcion), lindleyin, and isolindleyin contents of the processed rhubarb samples were analyzed by high performance liquid chromatography (HPLC), and their total tannin contents were analyzed by the Folin-Ciocalteu method.⁵⁾

As a result, it was found that the sennoside (a purgative)^{6,7)} contents of all of the processed rhubarb samples were significantly decreased by 20% of the control value (Fig. 1). On the other hand, the lindleyin and

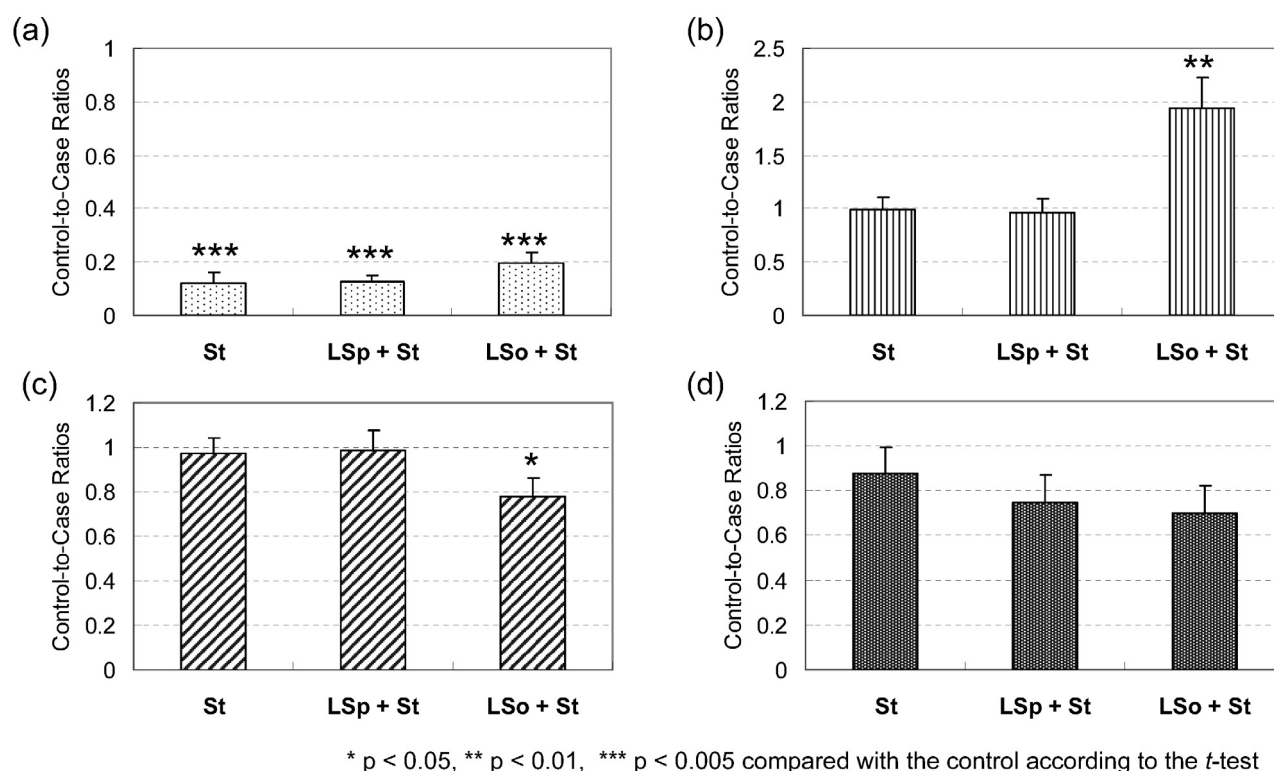


Fig. 1 Comparison of the principal compound concentrations of steamed (St) rhubarb, rhubarb that was sprayed with liquor before being steamed (LSp + St), and rhubarb that was soaked in liquor before being steamed (LSO + St) ($n = 3$) (a) Sennoside A and sennoside B, (b) anthraquinone, (c) lindleyin and isolindleyin, and (d) total tannin

tannin contents of the samples were almost unchanged or slightly decreased. However, the anthraquinone content of the rhubarb that was steamed after being soaked in alcohol was increased by two-fold relative to the control value, which suggests that the purgative effects of both steamed and liquor-steamed rhubarb are quite weak. The concentration of anthraquinones, which have anti-bacterial⁸⁾ and anti-inflammatory⁹⁾ effects linked to poison remedies, was only significantly increased in the rhubarb samples that were steamed after being soaked with alcohol; therefore, this type of rhubarb is expected to have an effect against poisons.

1-3 Discussion about *kyaku-daiou*

Although steamed rhubarb was said to be used as a remedy against poison in ancient times, the abovementioned chemical study suggested that rhubarb that has been soaked in alcohol before being steamed, rather than steamed rhubarb, can be used as a remedy against poisons. In addition, although modern *Jyuku-daiou* is prepared by spraying rhubarb with liquor before steaming,³⁾ the chemical study found that rhubarb has to be

soaked with sufficient liquor in order to have an effect against poisons.

In the herbological study, we found that both steamed rhubarb and liquor-steamed rhubarb were used as remedies for improving blood stasis and moistening the bowel. However, in the chemical study the rhubarb samples that were treated using these methods did not display any noticeable changes in their contents that could account for such effects. However, the observed decreases in the sennoside contents of the processed rhubarb samples might have increased their blood stasis-improving effects.

2-1 Herbological study of *shu-daiou*

The descriptions of the medicinal effects of three forms of liquor-processed rhubarb were researched in the medicinal literature published since the Jin and Yuan Dynasties in China. According to this study, liquor-dipped rhubarb was used as a purgative or digestive, liquor-soaked rhubarb was used to improve blood stasis, and liquor-fried rhubarb has the same effect as liquor-dipped and liquor-soaked rhubarb.¹⁾

2-2 Chemical study of *shu-daiou*

To investigate the medicinal effects of liquor-fried rhubarb, three kinds of liquor-fried rhubarb (rhubarb that had been dipped in liquor and then heated, rhubarb that had been soaked in liquor and then heated, and rhubarb that had been sprayed with alcohol and then heated) were produced, and then the differences in the concentrations of their main compounds were analyzed. The liquor-soaking and alcohol-spraying were performed in the same manner as for the liquor-steamed rhubarb. For the liquor-dipping,¹⁰⁾ the rhubarb was dipped in 16% ethanol for 30 seconds. After each liquor treatment, the rhubarb was dried overnight in an oven at 40°C, before being dried at 180°C for 40 minutes.¹¹⁾ Though the process of heating means roasting at low heat, oven was used to heat constant. Rhubarb dried overnight in an oven was used as a control.

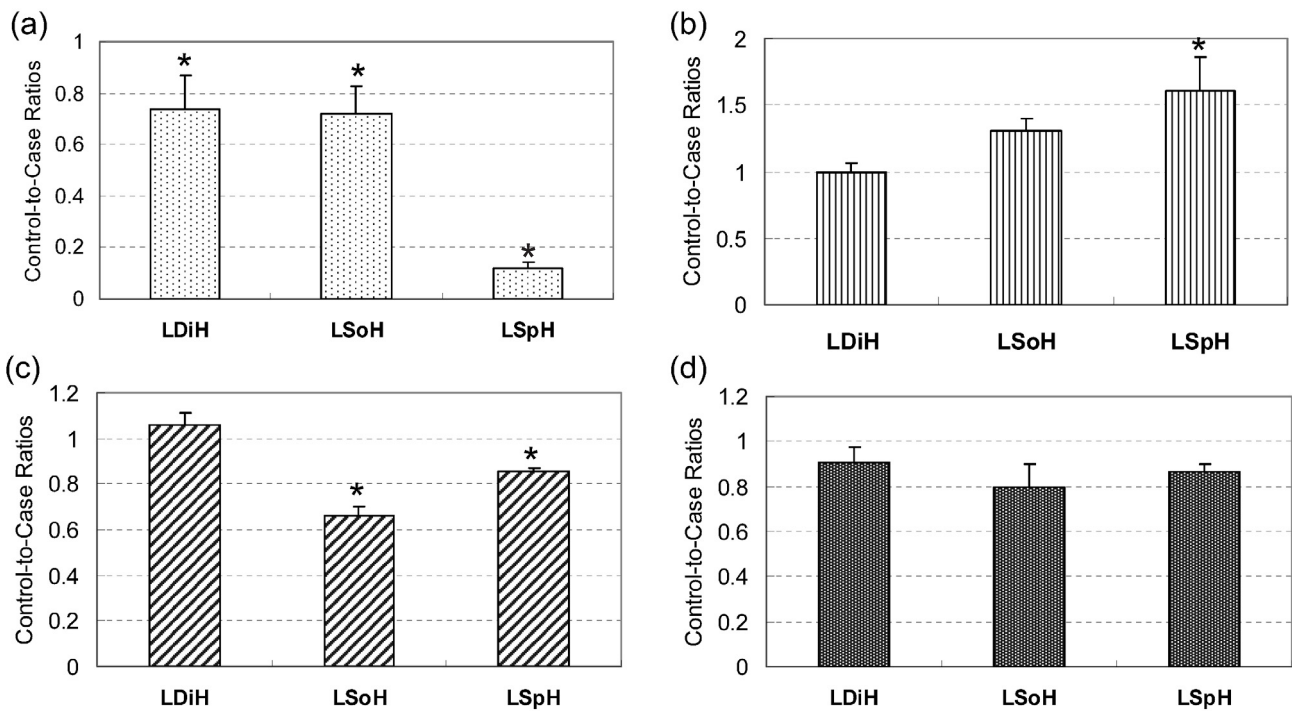
As a result, the sennoside contents of all of the liquor-fried rhubarb samples decreased, and their purgative effects also seemed to decrease. However, the sennoside contents of the rhubarb samples subjected to heating after liquor-dipping or liquor-soaking were significantly greater than that of the rhubarb samples subjected to

heating after being sprayed with alcohol. In addition, the anthraquinone content of the rhubarb that was subjected to liquor-soaking or alcohol-spraying before being heated was increased. Although the concentration of lindleyin, which has anti-inflammatory²¹⁾ effects, was decreased by the heating process, the lindleyin content of the rhubarb samples sprayed with alcohol before being heated was not decreased drastically (Fig. 2). Thus, the chemical study indicated that rhubarb that had been sprayed with alcohol before being heated had a stronger anti-inflammatory effect, which would make it useful for improving blood stasis.

2-3 Discussion about *shu-daiou*

In the herbological study, liquor-fried rhubarb was found to have purgative and blood stasis-improving effects. However, in the chemical study it was found that all of the liquor-fried rhubarb samples had reduced sennoside contents. Therefore, the author would not expect liquor-fried rhubarb to have a purgative effect.

Meanwhile, modern *shu-daiou* is expected to improve blood stasis. In the chemical study, the anthraquinone content of the rhubarb that was sprayed with alcohol



*p < 0.05 compared with the control according to Dunnett's method

Fig. 2 Comparison of principal compound concentrations of rhubarb samples that were dipped in liquor before being heated (LDiH), soaked in liquor before being heated (LSoH), or sprayed with liquor before being heated (LSpH). (n = 3)
(a) Sennoside A and sennoside B, (b) anthraquinone, (c) lindleyin and isolindleyin, and (d) total tannin

before being heated was increased, while the decrease in its lindleyin content was not drastic. Thus, the rhubarb might be expected to improve blood stasis. Therefore, the author determined that *shu-daiou*, which has a blood stasis-improving effect, should be sprayed with liquor before being heated, as is described in the current Chinese Pharmacopoeia.

Conclusion

Jyuku-daiou is considered to have a decreased purgative effect. In order to use rhubarb as a remedy against poisons, the author suggests that it should be soaked in a sufficient amount of liquor before being steamed. In addition, if *shu-daiou* is to be used to improve blood stasis, it is necessary to prepare it in the manner described in the Chinese Pharmacopoeia; i.e., the rhubarb should be sprayed with liquor before being heated.

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