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Property combination patterns of traditional Chinese medicines

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KEYWORDS

Property combination;
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Abstract *Objective:* In this study, the property combinations (PCs) of single herbs, two-herb combinations, and multi-herb prescriptions were studied to determine that the property-combination patterns will be associated with these three levels.

Method: By calculating the prescription PC weight, we analyzed the PCs of the single herb coptis rhizome, the two-herb combination of coptis rhizome and scutellaria root, and the classic prescriptions Coptis Decoction to Resolve Toxicity, White Tiger Decoction to Resolve Toxicity, and Peony Decoction, all three of which contain coptis and scutellaria.

Results: Calculated results show that cold-bitter-lung, cold-bitter-heart, and cold-bitter-stomach are present in both Coptis Decoction and White Tiger Decoction and have the highest PC weights. The weights of coptis and scutellaria in Peony Decoction differs from in their weights in Coptis Decoction and White Tiger Decoction, in that the PCs of highest weights in Peony Decoction are cold-bitter-spleen, cold-bitter-liver, cold-bitter-large intestine, cold-sour-liver, and cold-sour-spleen.

Conclusion: This novel method for exploring the properties and compatibilities of traditional Chinese herbs helps validate the combination theories of herbs. Application of this method may be valuable in designing new efficacious herbal prescriptions.

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Introduction

Property combination (PC) is an expression that refers to several principles related to traditional Chinese herbs and explain the synergistic relationship among a set of herbs in a formula (prescription).¹ Property-combination pattern (PP) refers to application of multiple combinations of herbs with equivalent or near-equivalent actions in traditional Chinese medicine (TCM) prescriptions.² Recent research on Chinese herbal theory has included theoretical analysis,^{3,4} experimental research,^{5–7} and data mining.^{8,9} We previously studied the PCs of single herbs, two-herb combinations, and multi-herb prescriptions.¹⁰ Because PCs exist in these three levels, it follows that PPs will be associated with these three levels as well. In this study, we analyzed the PCs of the single herb coptis rhizome (*Coptis chinensis* Franch.), the two-herb combination of coptis rhizome and scutellaria root (*Scutellaria baicalensis* Georgi), and the classic prescriptions Coptis Decoction to Resolve Toxicity (*huang lian jie du tang*), White Tiger Decoction to Resolve Toxicity (*bai hu jie du tang*), and Peony Decoction (*shaoyao tang*), all three of which contain coptis and scutellaria.

Methods

Property combination (PC) is a specific amalgamation of the characteristics, or properties, of herbs. These properties are the four natures, five tastes, and channel entered. The four natures are cold, hot, warm, cool, and neutral. The five tastes are sour, bitter, sweet, pungent, salty. Channels that herbs can enter are the heart, liver, spleen, lung, kidney, pericardium, stomach, bladder, large intestine, small intestine, gallbladder, and triple energizer. There are 420 possible PCs. Using the PC as a basic unit, we weighted assumptions of PCs from a single herb, a two-herb combination, and multi-herb prescriptions, and analyzed the relationship among PPs at these three levels.

Assumptions of prescription property combination weight

The integrity of an herbal prescription is based on TCM theory and PC is an inherent characteristic of prescriptions. The concept of prescription PC weight refers to the relative weight of PCs with in a prescription or a class of prescription. This metric can be calculated by adding the relative weights of the PCs. By comparing their values, the hierarchy of the PC in a prescription or class of prescriptions can be determined, which contributes to a better synergy among herbal compounds in a prescription.

Computational method for prescription property combination weight

To calculate the prescription PC weight, each herb in a prescription is represented by $X_1, X_2, X_3 \dots X_i$. The dose of each herb is represented by $Q_1, Q_2, Q_3 \dots Q_j$. The PCs in each prescription is represented by $Y_1, Y_2, Y_3 \dots Y_j$. A matrix is then created with i rows and j columns in an X, Y configuration. Using an arbitrary value of $X_m Y_n$, if the herb

X_m contains the PC Y_n , then it is assigned 1, if it does not contain Y_n , then it is assigned 0. The formula Z_n to calculate the weights of PC of the number Y_n is:

$$Z_n = (X_m Y_n \times Q_m) / Q_m,$$

where m ranges from 1 to i .

Data sources

The property data were sourced from *Divine Husbandman's Classic of the Materia Medica* (later Han dynasty) and *Chinese Pharmacopoeia (2010 edition)*.¹¹ Information on Coptis Decoction to Resolve Toxicity was sourced from *Arcane Essentials from the Imperial Library (752)*, information on White Tiger Decoction to Resolve Toxicity was from *Standards for Diagnosis and Treatment (1602)*; and information on Peony Decoction was from *Collection of Writings on the Mechanisms of Disease, Suitability of Qi, and the Safeguarding of Life as Discussed in Basic Questions (1186)*.

Results and discussion

Property combinations of herbs and prescriptions investigated

The PCs of the single herb, two-herb combination, and multi-herb prescriptions were calculated. The PCs of coptis were cold-bitter-heart, cold-bitter-spleen, cold-bitter-stomach, cold-bitter-liver, cold-bitter-gallbladder, and cold-bitter-large intestine (Fig. 1). The PCs of the two-herb combination of coptis and scutellaria included the PCs of coptis plus the PCs of scutellaria, which were cold-bitter-lung, cold-bitter-gallbladder, cold-bitter-spleen, cold-bitter-large intestine, cold-bitter-small intestine (Fig. 2). The weights of each PC in the prescriptions were added and divided by the sum of the total weight of the prescription. Then, the weight of each PC was obtained for each prescription (Figs. 1–5). Thus, cold-bitter-lung, cold-bitter-heart, and cold-bitter-stomach are present in both Coptis Decoction and White Tiger Decoction and have the highest PC weights. The weights of coptis and scutellaria in Peony Decoction differs from in their weights in Coptis Decoction and White Tiger Decoction, in that the PCs of highest weights in Peony Decoction are cold-bitter-spleen, cold-bitter-liver, cold-bitter-large intestine, cold-sour-liver, and cold-sour-spleen.

Actions of heat-clearing and toxicity-resolving property combinations of individual herbs and multi-herb prescriptions

The herb coptis is bitter, cold, and enters the heart, spleen, stomach, liver, gallbladder, and large intestine channels. Thus, it has the PCs of cold-bitter-heart, cold-bitter-spleen, cold-bitter-stomach, cold-bitter-liver, cold-bitter-gallbladder, and cold-bitter-large intestine (Fig. 1). Its bitter taste eliminates dampness and purges pathogenic fire, and its cold nature clears heat. The PC of cold-bitter-heart clears heat in the blood. The spleen governs upward

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