

Review of the powder and decoction formulae in Traditional Chinese Medicine based on pharmacologically active substances and clinical evidence

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Abstract

Powder formulae are an indispensable part of prescription in Traditional Chinese Medicine. Powder formulae are characterized by good therapeutic efficacy and low dose used for their preparation. Analysis of the therapeutic application and material basis of pharmacological active substance in powder formulae can enable the development of new powder formulae. This in turn can contribute to reduction of wastage of drug material, relief of shortage of herbal medicinal resources and sustainable development of Traditional Chinese Medicine.

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INTRODUCTION

Most crude drugs used in Traditional Chinese Medicine (TCM) are natural products. Some come from endangered species, which means their supply is very limited and the supply of some crude drugs is constrained by their exhaustibility. The use of powder formulae is an effective way to conserve these crude drug resources. Study indicates that the use of powder formulae can save up to two-thirds of each drug used compared with decoction formulae, while achieving identical therapeutic efficacy. Cai *et al*¹ conducted a retrospective review on the dosages of 28 processed herbal medicines commonly used in powder and decoction formulae created by herbalists from the Song to the Qing Dynasty (AD 1644-1911). They found that for all 28 drugs, the dosages used in powder formulae were smaller than those in decoction formulae. For the same processed medicine, the dosages in terms of powder were 20.9%-41.9% those in decoction. The ratio of dosages of the medicines used in powder to those in decoction formulae is 1:5 to 2:5. Therefore, research on traditional powder formulae could allow for further development of TCM therapeutics.

HISTORY OF POWDER FORMULAE IN TCM

Powder formulae in TCM consist of single or a few medicinal materials, and are the basis of dosage forms in both traditional and modern Chinese medicine. For example, traditional honeyed pills, water pills, and contemporary tablets in chunk or capsule form are all based on medicinal powders.² As early as the Eastern

Han Dynasty (AD 25-220), the Treatise on Cold Pathogenic Diseases and Synopsis of Golden Chambers,³ compiled by Zhang Zhongjing, included more than 40 powder formulae. Powder formulae became more popular by the Five Dynasties (AD 907-979) and Song Dynasty (AD 960-1279), during which the use of powder formulae largely replaced that of decoction formulae. In the Shanghan Zongbing Lun,⁴ it was proposed that, "decoction formulae are prepared in powder form for direct consumption." The herbalist Li Shizhen of the Ming Dynasty (AD 1368-1644) compiled the compositions and indications of many medicinal formulae in the Compendium of Materia Medica.⁵ The book put great emphasis on the use of powder formulae, of which there are more than 3200 types.

The powder formulae proposed by Zhang Zhongjing are categorized as orally or externally administered medication.⁶ Orally administered formulae are divided into blended type and decocted one. External formulae are divided into topical forms and suppositories. In powder formulae for blending, the drug powder is mixed with different fluids according, which facilitates oral administration. The fluids suggested by Zhang's work include water, fermented vegetable infusion, wine, porridge, chicken egg yolk, and medicated infusion. In powder formulae for decoction, a suitable amount of drug powder is boiled with water before oral administration. This method proposed by Zhang combines the advantages of both powder and decoction formulae. Examples include decoction with Banxia (*Rhizoma Pinelliae*), Ganjiang (*Rhizoma Zingiberis*) powder, Yiyiren (*Semen Coicis*), Fuzi (*Radix Aconiti Lateralis Preparata*), Baijiangcao (*Herba Patriniae Scabiosaefoliae*) powder. Topical powders are directly applied or rubbed on lesion sites. For example, the indication for cowherb seed powder is for "spreading on minor sores." For suppositories, the drug powder is wrapped inside cotton and then plugged into the lesion site. An example is the common Cnidium fruit powder used for treating genital coldness in women.

RESEARCH ON POWDER FORMULAE BASED ON PHARMACOLOGICALLY ACTIVE SUBSTANCES AND CLINICAL EVIDENCE

Herbal medicines

Herbal medicines containing insoluble or sparingly soluble active substances are not suitable or contraindicated in decoctions. Instead, they are pulverized for medical use. Examples include Hupo (*Succinum*), Ruxiang (*Olibanum*), Moyao (*Myrrh*), Anxixiang (*Benzoinum*), Suhexiang (*Storax Liquidambaris Orientalis*), Awei (*Resina Ferulae*), and Xuejie (*Sanguis Draconis*). These medicines have main active ingredients like resins and volatile oils. Resins are insoluble in water, and oils are lost

during the decoction process. Qingdai (*Indigo Naturalis*) is a product formed by precipitation from water during processing, and nearly all constituents are insoluble in water. Bingpian (*Borneolum Synthcticum*) is the crystal obtained from the distillate of sambong leaves, and is volatile and labile in heat. Luhui (*Aloe*) are the concentrated and dried extracts of leaf fluid. Additionally, other herbal medicines that have volatile oils as their main active constituents are suitable for powder formulation for infusion. This is because the volatile components are largely evaporated during the decoction process, which diminishes their potency. Examples of these drugs include strongly fragrant herbs such as Doukou (*Fructus Amomi Rotundus*), Sharen (*Fructus Amomi*), Muxiang (*Radix Aucklandiae*), Jiangxiang (*Lignum Dalbergiae Odoriferae*), Tanxiang (*Lignum Santali Albi*), Rougui (*Cortex Cinnamomi Cassia*), Dingxiang (*Flos Syzygii Aromatici*), Xiaohuixiang (*Fructus Foeniculi*), and Hujiao (*Fructus Piperis Nigri*). Some herbal medicines that contain coumarins with low water solubility and small amounts of volatile components are suitable for both decoction and powder formulae. However, powder formulae are more advantageous than decoction formulae. Examples include Baizhu (*Rhizoma Atractylodis Macrocephalae*), Cangzhu (*Rhizoma Atractylodis Lanceae*), Houpu (*Cortex Magnoliae Officinalis*), Foshou (*Fructus Citri Sarcodactylis*), Qianghuo (*Rhizoma et Radix Notopterygii*), Duhuo (*Radix Angelicae Biserratae*), Baizhi (*Radix Angelicae Formosanae*), Fangfeng (*Radix Saposhnikoviae*), Wuzhuyu (*Fructus Evodiae Rutaecarpae*), Chuanxiong (*Rhizoma Chuanxiong*), and Jianghuang (*Rhizoma Curcumae Longae*). Naphthoquinones found in Zicao (*Radix Lithospermi*) possess hemostasis, anti-bacterial, anti-viral, and anti-tumor effects, and are largely insoluble in water. Danshen (*Radix Salviae Miltiorrhizae*) contains hydrophilic phenolic acids and lipophilic phenanthrenequinones. The phenanthrenequinone tanshinone has therapeutic effects on tumors, cardiovascular diseases, bacterial infections, and inflammation.⁷ The choice of herbal medicines with both hydrophilic and lipophilic components for powder or decoction formulae depends on the clinical indication and the exact composition of active ingredients. Some herbal medicines containing soluble active substances are also suitable for powder formulae. Huanglian (*Rhizoma Coptidis*) contains water-soluble alkaloids, berberine, coptisine, palmatine, and jatrorrhizine. Sun *et al*⁸ reported that when Huanglian (*Rhizoma Coptidis*) powders were dissolved in gastric juice, then berberine and jatrorrhizine dissolution was about 50% higher than that of its decoction. Wei *et al*⁹ found that oral administration of Huanglian (*Rhizoma Coptidis*) powder facilitates intestinal absorption of not berberine but jatrorrhizine. Sanqi (*Radix Notoginseng*) contains water-soluble Panax notoginseng saponins (PNS). Han *et al*¹⁰ found that PNS is poorly absorbed in small intestine after oral adminis-

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