Journal of Pharmaceutical and Biomedical Analysis 48 (2008) 1462–1466

Contents lists available at ScienceDirect

Journal of Pharmaceutical and Biomedical Analysis

journal homepage: www.elsevier.com/locate/jpba

Short communication

Simultaneous determination of 12 chemical constituents in the traditional Chinese Medicinal Prescription Xiao-Yao-San-Jia-Wei by HPLC coupled with photodiode array detection

Hongmin Zhang [b,c], Shiwei Chen [d], Feng Qin [a], Xi Huang [a,c,*], Ping Ren [a,**], Xinqi Gu [c]

[a] Laboratory of Ethnopharmacology and Institute of Integrated Traditional Medicine and Western Medicine, Xiangya Hospital, Central South University, Changsha 410008, PR China
[b] Henan Eye Institute and Department of Ophthalmology, Henan Provincial People's Hospital, Zhengzhou 450003, PR China
[c] Laboratory of Ethnopharmacology and Department of Integrated Chinese and Western Medicine, West China Hospital, Sichuan University, Chengdu 610041, PR China
[d] Henan Food and Drug Administration, Zhengzhou 450012, PR China

ARTICLE INFO

Article history:
Received 21 May 2008
Received in revised form
15 September 2008
Accepted 15 September 2008
Available online 24 September 2008

Keywords:
Xiao-Yao-San-Jia-Wei
Traditional Chinese Medicinal Prescription
Chemical constituents
HPLC-PDA

ABSTRACT

An HPLC-photodiode array (PDA) detection method was established for the simultaneous determination of 12 components in Xiao-Yao-San-Jia-Wei (XYSJW): geniposide, puerarin, paeoniflorin, ferulic acid, liquiritin, hesperidin, naringin, paeonol, daidzein, glycyrrhizic acid, honokiol, and magnolol. These were separated in less than 70 min using a Waters Symmetry Shield RP 18 column with gradient elution using (A) acetonitrile, (B) water, and (C) acetic acid at a flow rate of 1 ml/min, and with a PDA detector. All calibration curves showed good linear regression ($r^2 > 0.9992$) within the test ranges. The method was validated for specificity, accuracy, precision, and limits of detection. The proposed method enables in a single run the simultaneous identification and determination for quality control of 12 multi-structural components of XYSJW forming the basis of its therapeutic effect.

1. Introduction

Xiao-Yao-San-Jia-Wei (XYSJW) is an effective Chinese Medicinal Prescription used in the treatment of functional dyspepsia associated with the syndrome of liver stagnation and spleen deficiency and the symptoms of abdominal distention, hiccup, sultriness, poor appetite, dry mouth, and bitter taste in the mouth [1,2]. The preparation is developed from Xiao-Yao-San, which is a classic Chinese formula that has been used in China for approximately one thousand years. Many papers have described the relationship between functional dyspepsia and gastric motility and depression and that XYSJW could improve gastrointestinal movement and had an antidepressant-like effect [3–5].

XYSJW contains the following 14 Chinese herbs: Radix Bupleuri, Radix Angelicae sinensis, Radix Paeoniae alba, Rhizoma Atractylodis macrocephalae, Poria, Rhizoma Zingiberis recens, Radix Glycyrrhizae, Herba Menthae, Cortex Moutan, Fructus Gardeniae, Cortex Magnoliae officinalis, Fructus Aurantii, Radix Puerariae, and Fructus Jujubae. However, it is not clear which of the chemical constituents of XYSJW is medicinally effective.

It is widely accepted that one or even a few marker constituents in a traditional Chinese medicine (TCM) does/do not reflect its overall efficacy. The combined action of multiple constituents is considered to be crucial for the therapeutic effect of a TCM [6]. Furthermore, the bioactive components in a TCM prescription must be absorbable components [7–9]. 12 constituents in XYSJW are as follows: ferulic acid from *Radix Angelicae sinensis*, puerarin and daidzein from *Radix Puerariae*, honokiol and magnolol from *Cortex Magnoliae officinalis*, liquiritin and glycyrrhizic acid from *Radix Glycyrrhizae*, hesperidin and naringin from *Fructus Aurantii*, paeonol from *Cortex Moutan*, paeoniflorin from *Radix Paeoniae alba*, and geniposide from *Fructus Gardeniae* (Fig. 1). Recent pharmacological studies have indicated that ferulic acid, honokiol, and magnolol could improve gastrointestinal motility [10,11]; puerarin has a protective effect on stress-induced gastric mucosal injury [12]; honokiol, magnolol, liquiritin, glycyrrhizic acid, and paeonol have antidepressant-like effect [13–16], and that naringin has an anti-ulcer effect on gastric lesions [17]. The above data demonstrate that the multiple absorbed constituents in XYSJW are responsible for its therapeutic effect.

* Corresponding author at: Laboratory of Ethnopharmacology and Institute of Integrated Traditional Medicine and Western Medicine, Xiangya Hospital, Central South University, Changsha 410008, PR China. Tel.: +86 731 4327222 fax: +86 731 4328386.
** Corresponding author. Tel.: +86 731 4327222; fax: +86 731 4328386.
E-mail addresses: tcmhuangx59@163.com (X. Huang), renping3@163.com (P. Ren).

0731-7085/$ – see front matter © 2008 Elsevier B.V. All rights reserved.
doi:10.1016/j.jpba.2008.09.023

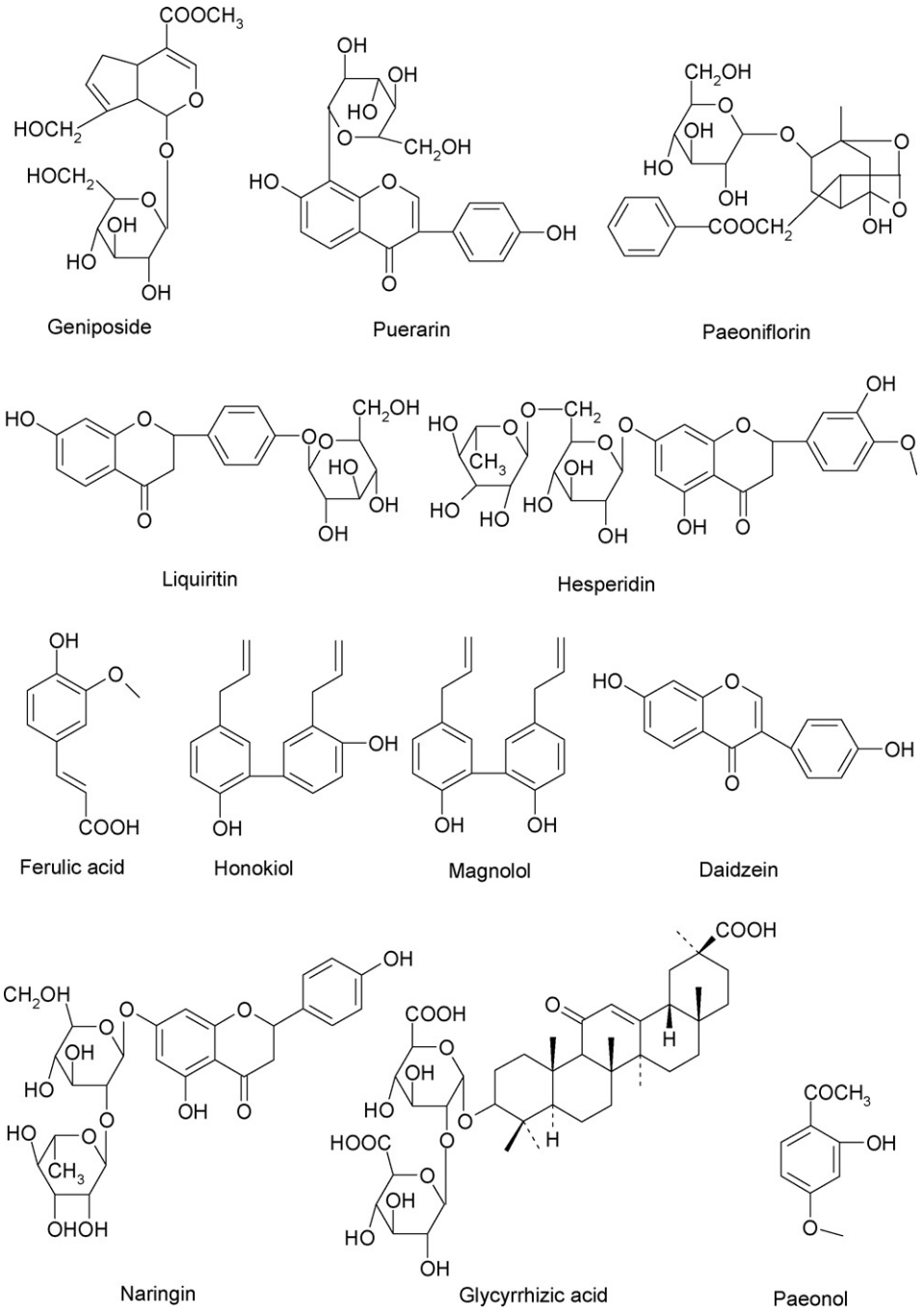

Fig. 1. The structures of 12 constituents in Xiao-Yao-San-Jia-Wei.

Therefore, quantitative determination of the above mentioned 12 components in XYSJW is considered to be necessary for quality control and also for determination of the chemical constituent basis of the therapeutic effect. In order to determine the 12 constituents, a convenient and reliable method that is capable of rapidly and simultaneously separating and identifying these 12 active components in XYSJW is urgently needed.

High-performance liquid chromatography (HPLC) and its coupling with other techniques, particularly photodiode array (PDA) detection, is a convenient, widely used, and powerful approach for the rapid identification of the constituents in botanic extracts and TCM [18]. Therefore, in the present study, we focused on quantitative determination of the effective components in XYSJW and investigated HPLC-PDA coupled methods for the simultaneous determination of 12 constituents.

2. Experimental

2.1. Materials and reagents

2.1.1. Materials

The fourteen Chinese herbs that comprise XYSJW were purchased from a TCM dispensary store in the West China Hospital (Chengdu, China) and identified. Voucher specimens (No. 200505) were deposited at the Laboratory of Ethnopharmacology in Xiangya Hospital.