Fitoterapia 81 (2010) 1147–1156

Contents lists available at ScienceDirect

Fitoterapia

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

Anti-thrombotic activity and chemical characterization of steroidal saponins from *Dioscorea zingiberensis* C.H. Wright

Hua Li [a], Wen Huang [a,*], Yanqing Wen [b], Guohua Gong [a], Qingbing Zhao [a], Gang Yu [b]

[a] *Institute for Nanobiomedical Technology and Membrane Biology, Laboratory of Ethnopharmacology, West China Hospital, West China Medical School, Sichuan University, No. 1, Keyuan 4lu, Gaopeng Avenue, Gaoxinqu, Chengdu 610041, China*

[b] *Sichuan Inspection and Quarantine Bureau, No. 28, South 4th Section, Yihuan Road, Wuhouqu, Chengdu 610041, China*

ARTICLE INFO

Article history:
Received 3 March 2010
Accepted in revised form 19 July 2010
Available online 23 July 2010

Keywords:
Dioscorea zingiberensis C.H. Wright
Steroidal saponins
Anti-thrombotic activity
High-performance liquid chromatography

ABSTRACT

Steroidal saponins have long attracted scientific attention, due to their structural diversity and significant biological activities. Total steroidal saponins (TSS) extracted from the rhizomes of *Dioscorea zingiberensis* C.H. Wright (DZW) constitute an effective treatment for cardiovascular disease. However, the active constituents contained in DZW rhizomes and their pharmacological properties are not fully understood. The aim of this work is to determine and quantify the active constituents in DZW rhizomes using fingerprint technique, and evaluate its anti-thrombotic activity using inferior vena cava ligation thrombosis rat model and pulmonary thrombosis mice model after being gavaged with TSS for 1 or 2 weeks. In the study, a chemical fingerprint method was firstly established and validated to quantify and standardize TSS from DZW rhizomes including parvifloside, protodeltonin, protodioscin, protogracillin, zingiberensis saponin, deltonin, dioscin and trillin. TSS extracted from DZW rhizomes were showed to have the inhibitions on platelet aggregation (PAG) and thrombosis, and prolong activated partial thromboplastin time (APTT), thrombin time (TT), and prothrombin time (PT) in a dose-dependent manner in rats. TSS also prolonged the bleeding time and clotting time in a dose-dependent manner in mice. The results indicate that TSS could inhibit thrombosis by both improving the anticoagulation activity and inhibiting PAG action, suggesting that TSS from DZW rhizomes have the potential to reduce the risk of cardiovascular diseases by anti-thrombotic action.

1. Introduction

Thrombosis, which is associated with blood coagulation and endothelial lesions, is a pathological condition appearing in post traumatic and postoperative periods as deposits of fibrin and erythrocytes in regions of stasis or low shear stress [1,2]. It is also a serious health care problem in the world, which plays an important role in the pathogenesis and progression of atherosclerosis, cardiovascular diseases and diabetic complications [3]. Some drugs with anti-coagulant and anti-thrombotic effects, especially heparin which is the primary drug of choice in the prevention of thromboembolic disorders, have been used in the therapy against these diseases. However, alternative drugs for heparin are in high demand due to its bad and long-term side effects such as bleeding and thrombocytopenia. Therefore, as an alternative source, traditional Chinese medicine is gaining more attention in the pharmaceutical industry to develop better and safer drugs with low or less side effects [4,5].

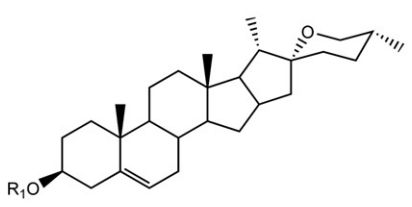
In recent years, steroidal saponins isolated from herbs have attracted scientific attention because of their structural diversity and significant biological activities [6,7]. *Dioscorea* extracts containing a high level of steroidal saponins have

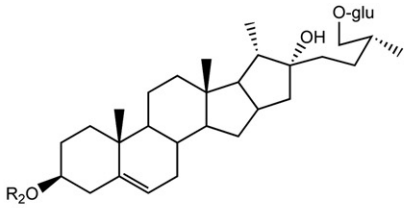
Abbreviations: PAG, platelet aggregation; APTT, activated partial thromboplastin time; PT, prothrombin time; TT, thrombin time; TSS, total steroidal saponins; DZW, *Dioscorea zingiberensis* C.H. Wright; XST, Xue-sai-tong; ADP, adenosine diphosphate.

* Corresponding author. Tel.: +86 028 85164076; fax: +86 028 85164073.
E-mail address: huangwen@scu.edu.cn (W. Huang).

0367-326X/$ – see front matter © 2010 Elsevier B.V. All rights reserved.
doi:10.1016/j.fitote.2010.07.016

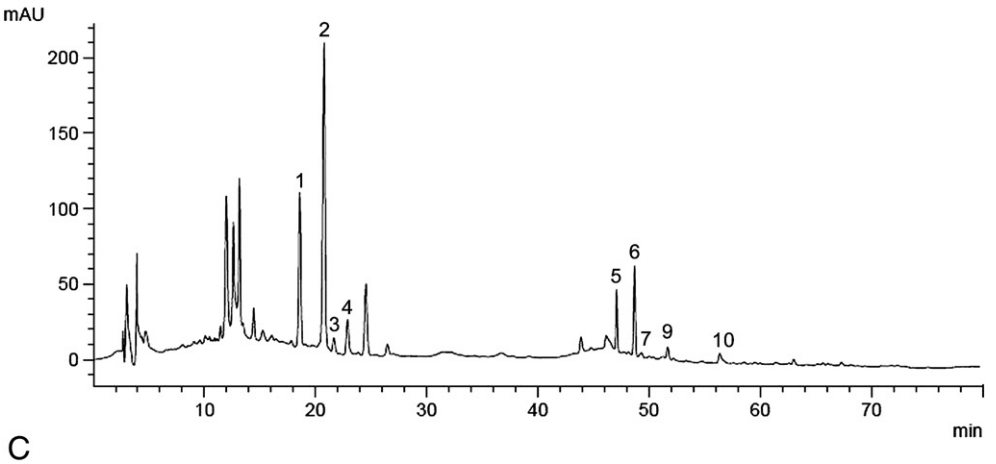
A





	R_1		R_2
diosgenin	H	protodioscin	-glu(2-1)rha (4-1)rha
trillin	-glu		
dioscin	-glu(2-1)rha (4-1)rha	protogracillin	-glu(2-1)rha (3-1)glu
gracillin	-glu(2-1)rha (3-1)glu		
deltonin	-glu(2-1)rha (4-1)glu	protodeltonin	-glu(2-1)rha (4-1)glu
diosgenin diglucoside	-glu(4-1)glu		
zingiberensis saponin	-glu(4-1)glu-(3-1)glu (2-1)rha	parvifloside	-glu(4-1)glu-(3-1)glu (2-1)rha

B



C