Journal of Ethnopharmacology 189 (2016) 61–80

Contents lists available at ScienceDirect

Journal of Ethnopharmacology

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

Review

Traditional Chinese medicine formulas for the treatment of osteoporosis: Implication for antiosteoporotic drug discovery

Nai-Dan Zhang [a,1], Ting Han [a,1], Bao-Kang Huang [a], Khalid Rahman [b], Yi-Ping Jiang [a], Hong-Tao Xu [a], Lu-Ping Qin [a], Hai-Liang Xin [a,*], Qiao-Yan Zhang [a,*], Yi-min Li [a]

[a] Department of Pharmacognosy, School of Pharmacy, Second Military Medical University, Shanghai 200433, China
[b] Faculty of Science, School of Pharmacy and Biomolecular Sciences, Liverpool John Moores University, Byrom Street, LiverpoolL3 3AF, UK

ARTICLE INFO

Article history:
Received 27 October 2015
Received in revised form
19 April 2016
Accepted 10 May 2016
Available online 11 May 2016

Keywords:
Osteoporosis
Traditional Chinese medicine formulas
Clinical use
Action mechanism
Active ingredients

Chemical compounds studied in this article:
Aucubin (PubChem CID: 91458)
Ecdysterone (PubChem CID: 271605)
Catalpol (PubChem CID: 91520)
Ferulic acid (PubChem CID: 445858)
Sweroside (PubChem CID: 161036)
Formononetin (PubChem CID: 5280378)
Cinnamaldehyde (PubChem CID: 637511)
AsperosaponinVI (PubChem CID: 71307450)
Emodin (PubChem CID: 3220)
Kaempferol (PubChem CID: 5280863)

ABSTRACT

Ethnopharmacological relevance: Osteoporosis is a chronic epidemic which can leads to enhanced bone fragility and consequent an increase in fracture risk. Traditional Chinese medicine (TCM) formulas have a long history of use in the prevention and treatment of osteoporosis. Antiosteoporotic TCM formulas have conspicuous advantage over single drugs. Systematic data mining of the existing antiosteoporotic TCM formulas database can certainly help the drug discovery processes and help the identification of safe candidates with synergistic formulations. In this review, the authors summarize the clinical use and animal experiments of TCM formulas and their mechanism of action, and discuss the potential anti-osteoporotic activity and the active constituents of commonly used herbs in TCM formulas for the therapy of osteoporosis.

Materials and methods: The literature was searched from Medline, Pubmed, ScienceDirect, Spring Link, Web of Science, CNKI and VIP database from 1989 to 2015, and also collected from Chinese traditional books and Chinese Pharmacopoeia with key words such as osteoporosis, osteoblast, osteoclast, traditional Chinese medicine formulas to identify studies on the antiosteoporotic effects of TCM formulas, herbs and chemical constituents, and also their possible mechanisms.

Results: Thirty-three TCM formulas were commonly used to treat osteoporosis, and showed significant antiosteoporotic effects in human and animal. The herb medicines and their chemical constituents in TCM formulas were summarized, the pharmacological effects and chemical constituents of commonly used herbs in TCM formulas were described in detail. The action mechanisms of TCM formulas and their chemical constituents were described. Finally, the implication for the discovery of antiosteoporotic leads and combinatory ingredients from TCM formulas were prospectively discussed.

Conclusions: Clinical practice and animal experiments indicate that TCM formulas provide a definite therapeutic effect on osteoporosis. The active constituents in TCM formulas are diverse in chemical structure, and include flavonoids, lignans, saponins and iridoid glycosides. Antiosteoporotic mechanism of TCM formulas and herbs involves multi regulatory pathways, such as Wnt/β-catenin, BMP/Smad, MAPK pathway and RANKL/OPG system. Phytochemicals from TCM formulas and their compositional herb medicines offer great potential for the development of novel antiosteoporotic drugs. The active ingredients in TCM formulas can be developed in combination as potent drugs, which may exhibit better antiosteoporotic effects compared to the individual compound.

© 2016 Elsevier Ireland Ltd. All rights reserved.

Contents

1. Introduction . . . 62
2. Methods . . . 62
3. Clinical efficacy of TCM therapy for osteoporosis . . . 63
4. Antiosteoporotic activity of TCM formulas in several important animal models . . . 66

* Corresponding authors.
E-mail addresses: hailiangxin@163.com (H.-L. Xin), zqy1965@163.com (Q.-Y. Zhang).
[1] These authors contributed equally to this study.

http://dx.doi.org/10.1016/j.jep.2016.05.025
0378-8741/© 2016 Elsevier Ireland Ltd. All rights reserved.

4.1. Castrated osteoporotic model . . . 66
4.2. Osteoporotic model induced by chemical drugs . . . 66
4.3. Disuse osteoporotic model . . . 68
5. The herb medicines and their chemical constituents in TCM formulas for the therapy of osteoporosis. . . . 69
5.1. *Eucommia ulmoides* Oliv. (Bark, Eucommiaceae) . . . 69
5.2. *Achyranthes bidentata* Bl. (Root, Amaranthaceae). . . . 69
5.3. *Rehmannia glutinosa* Libosch (Root, Scrophulariaceae) . . . 69
5.4. *Angelica sinensis* (Oliv.) Diels (Root, Apiaceae) . . . 73
5.5. *Cornus officinalis* Siebold and Zucc. (Fruit, Cornaceae). . . . 73
5.6. *Astragalus membranaceus* var. *mongholicus* (Bunge) P.K.Hsiao and *A. membranaceus* (Fisch.) Bunge (Root, Leguminosae). . . . 73
5.7. *Cinnamomum cassia* (L.) J.Presl and *Cinnamomum verum* J. Pres (Bark, Lauraceae) . . . 73
5.8. *Dipsacus asper* Wall. (Root, Dipsacaceae) . . . 74
5.9. *Polygonium multiflora* Thunb. (Root, Polygonaceae). . . . 74
5.10. *Cuscuta chinensis* Lam. and *Cuscuta australis* R.Br. (Seed, Convolvulaceae). . . . 74
5.11. *Cnidium monnieri* (L.) Cuss. (Fruit, Apiaceae) . . . 74
6. Antiosteoporotic mechanisms of TCM formulas and their chemical constituents . . . 74
6.1. Antiosteoporotic mechanisms of TCM formulas. . . . 74
6.1.1. Wnt/β-catenin pathway. . . . 74
6.1.2. MAPK pathway . . . 75
6.2. Antiosteoporotic mechanisms of herbs and their chemical constituents . . . 75
6.2.1. BMP/SMAD signaling pathway . . . 75
6.2.2. OPG/RANKL/RANK signaling pathway. . . . 75
6.2.3. MAPK signaling pathway. . . . 75
7. Comparison between the efficacy of TCM formulas and the efficacy of single herbs . . . 76
8. Conclusion . . . 76
Conflicts of interest . . . 76
Acknowledgments . . . 77
References . . . 77

1. Introduction

Osteoporosis, a chronic epidemic, is characterized by low bone mass and microarchitectural deterioration of bone tissues, leading to enhanced bone fragility and consequent increase in fracture risk (Appelman-Dijkstra and Papapoulos, 2015). Osteoporosis is a growing problem worldwide, with the greatest burden resulting from fractures. It is estimated that more than 200 million people worldwide suffer from osteoporosis (Lewiecki, 2011). These numbers are expected to steadily increase over time, with osteoporosis affecting an estimated 14 million people with over 47 million cases of low bone mass by the year 2020 (Ford et al., 2011). Treatment of osteoporosis consists of pharmacotherapy and lifestyle measures, including dietary changes, mineral supplementation, and exercise programs. Currently, the most commonly used agents for the treatment of osteoporosis include raloxifene; bisphosphonates alendronate, ibandronate, risedronate and zoledronic acid; agents derived from parathyroid hormone (PTH); denosumab and strontium ranelate, and also hormone replacement. However, due to adverse effects of the drugs, the uses of these medications on a long term basis are limited.

Traditional Chinese medicine (TCM) has been used in China and other Asian countries for thousands of years (Jin et al., 2013), either as mono-therapy or in combination with standard Western medical treatment, to manage the entire spectrum of medical disorders. TCM formulas are often composed of more than one herb, and the main principle underlying the use of herbal formulas is that complex interactions between herbs produce synergistic effects that can improve therapeutic efficacy, or reduce possible side-effects of individual herbs (Gao et al., 2013). In addition, TCM is rich in natural compounds and can be considered as a natural chemical library producing synergistic effects, which has been justified by the revealing function and synergistic mechanism of principle active ingredients, such as Fu Fang Qing Dai Pian. It also presents more diversity in chemical structure and bioactivity, and less toxicity. Therefore, TCM represents an attractive source of new active compounds in drug discovery, for example, derivatives of indirubin, a compound isolated from a TCM formulas Dang Gui Long Hui Wan displays antileukemic properties (Kim et al., 2013b). Our previous review has summarized the commonly used individual herbs and compounds used in the treatment of osteoporosis. In this review, we highlight the research on TCM formulas for osteoporosis from clinical use to their mechanism of action; this may be helpful in the application of TCM formulas in the treatment of osteoporosis and the discovery of antiosteoporotic lead compounds either on their own or in combination with other herbs.

2. Methods

The literatures were searched from Medline, Pubmed, ScienceDirect, Spring Link, Web of Science, CNKI and VIP database from 1989 to 2015, and also collected from Chinese traditional books and Chinese Pharmacopoeia to identify studies on the anti-osteoporotic effects of TCM formulas, herbs and chemical constituents, and also their possible mechanisms. The following keywords were used for the search: osteoporosis, osteoblast, osteoclast, and traditional Chinese medicine formulas. All of these keywords were searched for each plant and its constituents. All published studies in English or Chinese language were included in the review. The literature search was conducted by both authors independently, with no inconsistencies between the two authors. The review included the following steps: (1) the TCM formulas for the treatment of osteoporosis in human and animal were reviewed using the available literature. (2) The herb medicine and their chemical constituents in TCM formulas were summarized. (3) The possible mechanism of action of TCM formulas and their chemical constituents were reviewed.

Download English Version:

https://daneshyari.com/en/article/5834558

Download Persian Version:

https://daneshyari.com/article/5834558

Daneshyari.com