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Review

Lonicera japonica Thunb.: Ethnopharmacology, phytochemistry and pharmacology of an important traditional Chinese medicine

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ABSTRACT

Ethnopharmacological relevance: Lonicera japonica Thunb. (*Caprifoliaceae*), a widely used traditional Chinese medicine, was known as *Jin Yin Hua* (Chinese: 金银花), *Ren Dong* and *Japanese honeysuckle*. It was taken to treat the exopathogenic wind-heat, epidemic febrile diseases, sores, carbuncles and some infectious diseases. At the same time, *Lonicera japonica* could be used as healthy food, cosmetics, ornamental groundcover, and so on.
Aim of the review: The present paper reviewed the ethnopharmacology, the biological activities, toxicology and phytochemistry of *Lonicera japonica*.
Materials and methods: Information on *Lonicera japonica* was gathered via the Internet (using Google Scholar, Baidu Scholar, Elsevier, ACS, Medline Plus, CNKI and Web of Science) and libraries. Additionally, information also was obtained from some local books and brilliant scholars on ethnopharmacology.
Results: More than 140 chemical compounds have been isolated, and the main compositions are essential oils, organic acids and flavones, etc. *Lonicera japonica* and its active principles possess wide pharmacological actions, such as anti-inflammatory, antibacterial, antiviral, antioxidative and hepatoprotective activities.
Conclusions: As an important traditional Chinese medicine, further studies on *Lonicera japonica* can lead to the development of new drugs and therapeutics for various diseases, and how to utilize it better should be paid more attentions.

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Abbreviations: ACV, acyclovir; AIV, avian influenza virus; ALT, alanine transarninase; AST, aspartate amino transferase; CAT, catalase; Cd, cadmium; CGN, carrageenan; COX, cycloxygenase; ConA, concanavalin A; CPE, cytopathologic effect; DAD, diode-array detection; DPPH, 1,1-diphenyl-2-picrylhydrazyl; ELSD, evaporative light scattering detectors; EtOAc, ethyl acetate; ERK, extracellular signal-regulated kinase; GC–MS, gas chromatography–mass spectrometry; GSH, glutathione; HDL-C, high density lipoprotein cholesterin; HIV-1, human immunodeficiency virus-1; HPLC, high performance liquid chromatography; HSV, Herpes simplex virus; HUVEC, Human Umbilical Vein Endothelial Cells; IC_{50}, 50% inhibition concentration; JNK, Jun nuclear kinase; LED, Least Effective Dose; *Lonicera japonica*, *Lonicera japonica* Thunb.; LPS, lipopolysaccharide; MAPK, mitogen activated protein kinase; MDA, malondialdehyde; MEC, minimum effective concentration; MeOH, methyl alcohol; MIC, minimum inhibitory concentration; MPO, myeloperoxidase; MTT, methyl thiazolyl tetrazolium; MUFA, monounsaturated fatty acid; NDV, newcastle disease virus; NO, nitric oxide; PAPR2, proteinase-activated receptor 2; PDT, photodynamic therapy; PMNs, polymorphonuclear leukocytes; PUFA, polyunsaturated fatty acid; ROS, reactive oxygen species; RSV, respiratory syncytial virus; SARS coronavirus, severe acute respiratory syndromes coronavirus; SFA, saturated fatty acid; SI, selectivity index; SOD, superoxide dismutase; TCM, traditional Chinese medicine; TEAC, Trolox equivalent antioxidant capacity; TI, therapeutic index; TLC, thin layer chromatography; TNF-α, tumor necrosis factor-α; TOF-MS, time-of-flight mass spectrometry.

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1. Introduction

Lonicera japonica Thunb. (*Caprifoliaceae*), also known as *Japanese honeysuckle*, *Jin Yin Hua* or *Ren Dong*, is native in the East Asian (He et al., 2010). Now as an ornamental groundcover, *Lonicera japonica* commonly planted in many areas for sprawling habit, numerous sweetly fragrant white flowers, attractive evergreen foliage, and become naturalized in Argentina, Brazil, Mexico, Australia, New Zealand and United States. Due to *Lonicera japonica* has escaped from cultivation in several places, becoming a major nuisance, and is restricted in parts of North America and New Zealand (Starr et al., 2003). But in China, 1500 years ago, *Lonicera japonica* has been planted largely in Fengqiu county of Henan province, and the flowers of *Lonicera japonica* have been used as the local and traditional medicine in clinical practice for the treatment of exopathogenic wind-heat, epidemic febrile diseases, sores, carbuncles, furuncles and some infection diseases. Scine 1995, *Lonicera japonica* has been listed in the Pharmacopoeia of the People's Republic of China and more than 500 prescriptions containing *Lonicera japonica* have been used to treat various diseases in China (http://www.zysj.com.cn). The modern pharmacological studies showed that *Lonicera japonica* and its active principles possessed wide pharmacological actions, such as antibacterial, anti-inflammatory, antiviral, antiendotoxin, blood fat reducing, antipyretic and other activities (Wang, 2008c). Most of these actions matched to those traditional uses seriously. At the same time, it was also used as food, healthy beverage in the world (Wang, 2010). Along with *Lonicera japonica* being used and cultivated in more and more countries, the chemical compounds have been extensively studied. Essential oils, organic acids, flavones, saponins, iridoids and inorganic elements as the main compositions were isolated and identified. Among of them, essential oils and chlorogenic acid have been proved with some good pharmacological effects, and were though as the active compounds of *Lonicera japonica*. In current Chinese Pharmacopoeia (Committee for the Pharmacopoeia of PR China, 2010), chlorogenic acid (**1**) has been officially used as the indicator compound to characterize the quality of this herb.

In this review, the advances in ethnopharmacology, phytochemistry, biological and pharmacological activities, and toxicology of *Lonicera japonica* are displayed, and the increasing data supports the utilization and the exploitation for new drug.

2. Botany and ethnopharmacology

2.1. Botany

According to the description of Wagner et al. (1999), *Lonicera japonica* is sprawling and twining lianas; young stems pubescent; leaves ovate, elliptic, oblong or broadly lanceolate, blades 3–8 cm long, 1–3.5 cm wide, pubescent, becoming glabrate above, entire or young lower leaves sometimes lobed; flowers 2 in axillary cymes, bracts 1–2 cm long, bracteoles suborbicular, ca. 1 mm long; corolla white, turning yellowish or tinged pink, 2-lipped, 2–3 cm long; berries bluish black, globose, 6–7 mm in diameter. The flowering duration of individual plant is usually 5–8 days, but the flowering period is from May to September in the field, can be divided into six stages, i.e. the juvenile bud stage, the third green stage, the second white stage, the complete white stage, the silver flowering stage and the gold flowering stage. *Lonicera japonica* often grows in hillside scrub, rocks pile and roadside, and the highest altitude is 1500 m. Due to its beautiful flowers and strong roots, *Lonicera japonica* was cultivated for people to watch, conserve water and soil in world. In traditional Chinese medicine, due to the outline form of sprawling and twining lianas, and the different flower colors, the dried flowers or flower buds of *Lonicera japonica* was named as *Jin Yin Hua* and *Ren Dong* in TCM. Both the chemical contents and compositions of *Lonicera japonica* flowers vary in a flowering-dependent characteristic with the collection time (Fig. 1) (Wang et al., 2009).