



Review

The immunoregulatory effects of Chinese herbal medicine on the maturation and function of dendritic cells



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ABSTRACT

Ethnopharmacological relevance: Traditional Chinese herbal medicine (CHM) has a long-history for treatment of various human diseases including tumors, infection, autoimmune diseases in Asian countries, especially in China, Japan, Korea and India. CHM was traditionally used as water extracts and many Chinese herbs were considered to be good for health, which can regulate immune system to protect host from diseases. With the progress of technology, the components of CHM were identified and purified, which included polysaccharides, saponins, phenolic compounds, flavonoids and so on. Recently, accumulating evidence indicates that CHM and its components can regulate immune system through targeting dendritic cells (DCs). We hereby reviewed the immunoregulatory effects of CHM on the maturation, cytokine production and function of DCs. This should help to shed light on the potential mechanism of CHM to improve the usage and clinical efficacy of CHM.

Materials and methods: Literatures about the effects of CHM on DCs were searched in electronic databases such as Pubmed, Google Scholar and Scopus from 2000 to 2014. 'CHM', 'DC' or 'immune' were used as keywords for the searches. We only reviewed literatures published in English.

Results: Over 600 publications were found about 'CHM&immune' and around 120 literatures about 'CHM&DC' were selected and reviewed in this paper. All publications are backed by preclinical or clinical evidences both *in vitro* and *in vivo*. Some CHM and its components promote the maturation, pro-inflammatory cytokine production and function of DCs and as the adjuvant enhance immune responses against tumor and infection. In contrast, other CHM and its components suppress the activation status of DCs to induce regulatory T cells, inhibit allergic and inflammatory responses, ameliorate autoimmune diseases, and prolong the allograft survival. A large body of evidence shows that CHM and its components regulate the activation status of DCs through TLRs, NF- κ B, MAPK signaling pathways.

Conclusion: This review provides useful information for understanding the mechanism of CHM on the treatment of diseases, which facilitates to improve the efficacy of CHM. Based on the immunoregulatory effects of CHM on DCs, it indicated that some CHM and its components could be use to develop adjuvant to enhance antigen-specific immune responses or tolerogenic adjuvant to generate antigen-specific immune tolerance.

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1. Introduction

Dendritic cells (DCs) are most potent antigen presenting cells (APCs) and link the innate and adaptive immune responses. DCs recognize, capture, process and present antigen to naïve T cells and determine the nature of the adaptive immune response through regulating the maturation state of DCs (Garg et al., 2012). Immature DCs (iDCs) resided in periphery have a high ability to endocytose antigens and become to mature DCs (mDCs) upon a variety of stimuli through binding to pattern recognition receptors (PRRs) (O’Neill et al., 2013), which are characterized by increased surface expression of co-stimulatory (CD40, CD80 and CD86) and MHC molecules and secretion of several pro-inflammatory cytokines (Reis e Sousa, 2006). iDCs facilitate immune tolerance, while fully mDCs can strongly promote immune responses.

Chinese herbal medicine (CHM) has a long history for the treatment of variety of human diseases. Accumulating evidence shows that the clinical effects of CHM are related to the up- or down-regulation of immune responses, especially regulation of DC maturation (Chen et al., 2006; Jiang et al., 2010; Zhang and Dai, 2012). Some CHM could promote the activation status of DC to enhance immune responses against tumor or infection, while some immunosuppressive CHM could suppress the maturation and function of DC to inhibit allergic or inflammatory responses (Fig. 1). CHM might regulate the activation status of DCs via binding to PRRs. It has been reported that several plant lectins act as Toll-like receptor (TLR) agonists, such as soybean agglutinin from *Glycine max* (L.) Merr. for TLR4, peanut agglutinin from *Arachis hypogaea* L. for TLR4, Concanavalin A for TLR-2/6, and phytohaemagglutinin from *Phaseolus vulgaris* L. for TLR-2/6 and -4

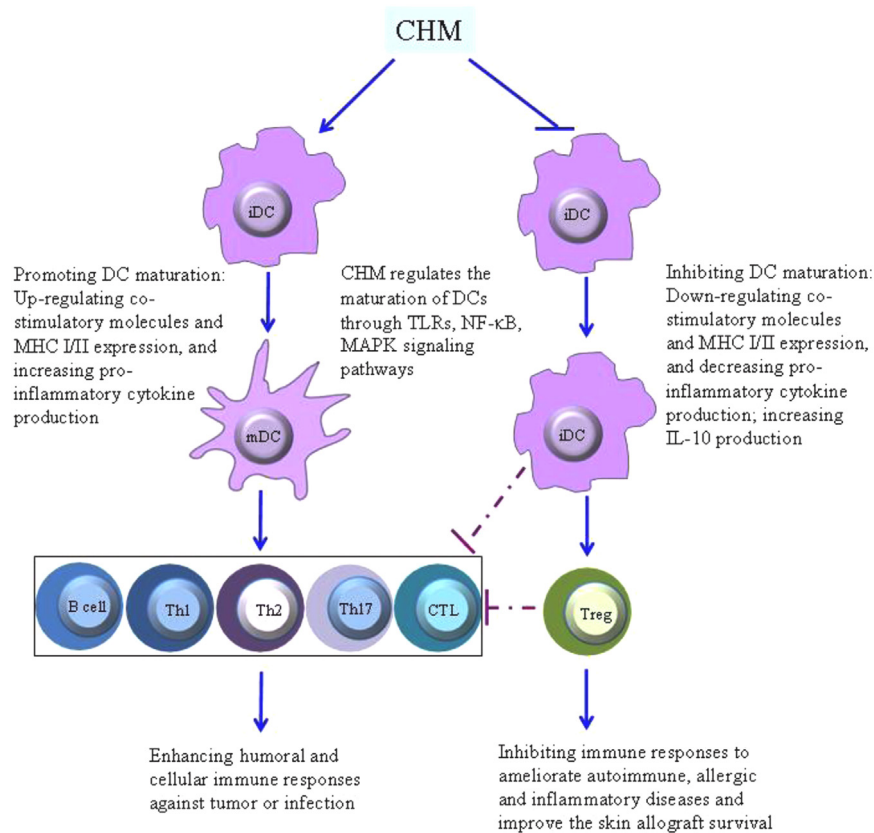


Fig. 1. The maturation status of DCs upon CHM treatment. CHM could promote or inhibit the maturation and function of DCs through TLRs, NF-κB, MAPK signaling pathways. Some CHM could promote iDCs to be mDCs characterized by up-regulating co-stimulatory molecules (CD40, CD80 and CD86) and MHC I/II and increasing pro-inflammatory cytokine production including IL-6, IL-12, IL-1β and TNF-α, which enhance humoral and cellular immune responses, especially CTL, against tumor or infection. In contrast, some immunosuppressive CHM could inhibit the DC maturation and pro-inflammatory cytokine production, and increase IL-10 production to promote the generation of Tregs to inhibit allergic or inflammatory responses.

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