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Report of Health Care **Review Article**
Volume 5, Issue 2, 2019, p. 1- 8

A Review of Medicinal Properties of some Asteraceae Family Plants on Immune System

Morteza Jafarinia [1], Mojtaba Jafarinia [2*]
1. Department of Immunology, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran
2. Department of Biology, Marvdasht Branch, Islamic Azad University, Marvdasht, Iran

Received: 12 December 2018
Accepted: 10 April 2018
Published online: 30 May 2019
***Corresponding author:**
Mojtaba Jafarinia. Department of Biology, Marvdasht Branch, Islamic Azad University, Marvdasht, Iran.

Phone: +989173109311
Fax: +987143226404
Email: jafarinia33@gmail.com
Competing interests: The authors declare that no competing interests exist.

Citation: Jafarinia M, Jafarinia M. A Review of Medicinal Properties of some *Asteraceae* Family Plants on Immune System. Rep Health Care. 2019; 5 (2): 1- 8.

Abstract
Introduction: Traditional medicinal plants have gained increasing popularity in the last decades due to the natural origin, low price and fewer side effects. Herbal products are complex mixture of organic chemicals that may come from raw or processed part of plants.Studies have shown that lots of drugs have herbal bases.Over time, the effect of herbal medicines on the immune system has been paid lots of attention. *Asteraceae* or *Compositae* is an exceedingly large, annual and widespread family of flowering plants. They produce secondary metabolites, such as flavonoidsand terpenoids which have lots of effect on our body. Many of *Asteraceae*family are plants which have been used in traditional medicine.Many studies have shown the effect of *Asteraceae* family plants or their extract on immune-mediated diseases, especially their anti-inflammatory effect.
Methods: In this article, we reviewed the medicinal properties of fivegenuses of *Asteraceae* family plants which influence the immune system.
Keywords: Medicinal Properties, *Asteraceae* Family, Immune System

Introduction

Herbal medicines contain a range of pharmacologically active components and these ingredients may have therapeutic effects(1). Traditional herbal medicines have been widely used for thousands of years, because of their natural origin and fewer side effects (2). Written records mention that the use of herbal medicines dates back to more than 5000 years (3). Studies have shown that lots of drugs have herbal basis, such as morphine (from the opium poppy), aspirin (willow bark), quinine (from cinchona bark) and digitoxin (from foxglove) (4). In the developing countries, 75-80% of the world population uses herbal medicines for primary health care and the main reason is the general belief that herbal drugs are cheap, without side effects and locally available.In the developed countries, such as the United States of America, it is estimated that up to 25% of the total drugs are herbal drugs (5).Different studies have shown the effect of medicinal herbs on immune and non-immune diseases, such as reproductive system disorders (6), depression and anxiety disorders(7), Alzheimer's disease (8) anddiabetes (9). Asteraceae or Compositae is an exceedingly large and widespread family of flowering plants with more than 23,600 currently accepted species, spreading across 1,620 genera and 13 subfamilies (10). Most members of Asteraceae are annual or perennial herbs, but a significant number are also shrubs, vines, or trees. Many of them are plants which have beenused in traditional medicine to cure microbial infections. These plants produce secondary metabolites such as flavonoids and terpenoids. The pharmological effects of flavonoids on immune system have been studied in many studies (6, 7).The immune system is made up of a network of cells, tissues, and organs that work together to protect the body. One of the important cells

involved are white blood cells, also called leukocytes, which come in two basic types that combine to seek out and destroy disease-causing organisms or substances by producing cytokines or cell to cell contact.The leukocytes circulate through the body between the organs and nodes via lymphatic vessels and blood vessels. In this way, the immune system works in a coordinated manner to monitor the body for germs or substances that might cause problems(11, 12). Todays, the effect of medicinal plants on immune system is of great interest and has been reportedin many studies (13, 14). In this regard, we decided to review the medicinal properties of 5 genuses of Asteraceae(Compositae) family plants, including Artichoke (Cynarascolymus L.), Chichory (Cichoriumintybus L.),Calendula (Calendula officinalis L.),Burdock (Arctiumlappa L.)andFeverfew (Tanacetumparthenium L.) which influence the immune system.

Artichoke(Cynarascolymus L.)

Cynarascolymusis a perennial thistle originating in southern Europe around the Mediterranean, Greece and Egypt (northern Africa and the Canary Islands). This plants is one of the oldest medicinal plants in the world (15). It is 1.5-2 m tall, with arching, deeply lobed, silvery glaucous-green leaves which are 50–80 cm long. The flowers develop in a large head from an edible bud about 8–15 cm diameter with numerous triangular scales; the individual florets are purple. The edible portion of the buds consists primarily of the fleshy lower portions of the involucral bracts and the base, known as the "heart"; the mass of inedible immature florets in the center of the bud are called the "choke." Different studies have shown that Cynarascolymus is rich in flavonoids, vitamin C and other compounds especially caffeoylquinic derivatives (cynarin and chlorogenic acid) (16, 17). Many studies have reported that Cynarascolymushas a good antitumor, anti-inflammatory, antioxidant effect on animal models and stimulate the immune system (18-20). The hypoglycemic effect of Cynarascolymushave also shown in the study of Fantini et al.(20). Osama et al. evaluated the immunostimulant effects of Cynarascolymusagainst carbon tetrachloride (CCl4) induced immunetoxicity in rats, and in their results showed that treatment with Cynarascolymus significantly increased total leukocyte and lymphocyte counts as well as phagocyte activities and Interleukin (IL)-12 while tumor necrosis factor (TNF)-α and IL-6 were decreased (15). This data confirm the anti-inflammatory effect of Cynarascolymus.

Chichory (Cichoriumintybus L.)

Cichoriumintybusis biennial herb, glandular, erect with rosette leaves and a tuberous taproot which is widely distributed in Europe and Asia. It’s commonly known as chicory in English and kasani in Sanskrit (21). Green leafy part of chicory is often used in salads or cooking; the roots of chicory are commonly used for manufacturing coffee substitutes. Similar to other Asteraceae family plants, chicory is one of the important medicinal plants. All parts of this plant have medicinal importance due to the presence of some medicinally important compounds such as, alkaloids, coumarins, vitamins, inulin, flavonoids, saponins, unsaturated sterols and tannins (22-24). Chicory is mainly used for treatment of menstrual disorders, liver disorders, fever and inflammatory swellings (25, 26). It has also been used for treatment of other immune and non-immune mediated disease, such as jaundice, gout, gallstones, appetite loss and rheumatism (27, 28). Different studies have reported various medicinal properties for different parts of Cichoriumintybus. For instance, its roots are rich in dietary fibers which have been reported to possess anticarciogenic and diuretic activities(29). It also contains high amount of insulin which have biofidogenic property (30). Whole plants have also been shown to have antioxidant (28), antibacterial (31), anti-

diabetic (32), hepatoperotective (33) and cardioprotective properties (34). Anti-inflammatory effect of chicory have been reported in some studies (26, 27). Rizvi et al. have shown that chicory roots diminished the serum levels of inflammatory cytokines, TNF-α, IL-6 and IL-1(26). The effect of Cichoriuminty bus also has been investigated on dendritic cells (DCs). DCs are antigen-presenting cells of the mammalian immune system. Their main function is to process antigen material and present it on the cell surface to the T cells of the immune system. Karimi et al. have shown that treatment of DCs with extract of Cichoriumintybus increases the production IL-12 by these cells with no change in IL-10 release. They also demonstrated that higher concentrations of Cichoriumintybusinhibit proliferation of allogenic T cells and lower concentrations change the level of cytokines such that IL-4 decreases and interferon (IFN)-Ɣ increases(35). These results may suggest that Cichoriumintybusis a candidate for treatment of immune-mediated disorders.

Calendula(Calendula officinalis L.)

Calendula officinalis, commonly known marigold and calendula, is an annual plant which thrives in all types of soil and can be found in Eastern and Western Asia, the United States and Europe. Its branching stems can grow to a height of 30 to 60 cm (36). Calendula officinaliscontains active chemicals such astocophrrols, calendulin, bitters, resin, flavonoids, sterols, volatile oil, tritripenoidsaponins, triterpene alcohols and flavonol glycosides (37). Regarding medicinal properties, studies have shown that calendula may relieve inflammation and limit the infiltration of white blood cells into tissues. Wound healing properties is another probable effect of calendula (38).Calendula officinalisis widely used in traditional medicine as an anti-inflammatory agent, anti-bacterial, anti-fungal, anti-viral and anti-oxidant activities (39). In different parts of the world, calendula has been used in various diseases such as, pharyngitis, conjunctivitis, aphthous stomatitis, hemorrhoids, jaundice, stomach ulcer and liver complaints. Safdar et al. have demonstrated antimicrobial activity of Ethanolic extract of calendula against Escherichia coli (E. coli), Vibrio cholera and Candida albikans(36). Marina et al. have demonstrated that Calendula officinalisextraction induced gradually increasing specific humoral activity (40). Preethi et al. have shown that extract of Calendula officinalis inhibited increased level of proinflammatory cytokines TNF-α, IL-6, IL-1ß, IFN-Ɣ, acute phase protein and c-reactive protein (CRP) in mice produced by LPS injections (39).

Burdock(Arctiumlappa L.)

Arctiumlappa,commonly known as burdock,is a big-leaved plant related to sunflowers, dandelions, lettuce, and many, many others. It is found mostly throughout Europe(41). Arctiumlappahas been extensively studied due to its health promoting and pharmacological properties. Major active ingredients have been isolated from Arctiumlappainclude of inulin, caffeic acid, tannins, arctigenin, arctiin, lappaol, chlorogenic acid, glucopyranoside and diarctigenin(42). Tumor suppressing effect of bioactive molecules isolated fromArctiumlappa has been examined in different studies. Arctigenin is the most important bioactive molecules for this property (43, 44). Anti-diabetic effects of Arctiumlappa also have been shown in the study of Ahangarpour et al. that administration of different doses of the Arctiumlappa's extract reduced the level of alkaline phosphatase, glucose, very low density-lipoprotein (VLDL) and triglycerides while both leptin and high density-lipoprotein increased in the diabetic mice. They also have shown that Arctiumlappa's extract treated enhanced level of insulin (45). Yang et al. have demonstrated that oleamide , a bioactive molecule isolated from Arctiumlappa reduced

TNF-α and IL-4 production (46). Chlorogenic acid which is isolated from root extract of Arctiumlappahas been shown significant anti-microbial efficacy Klebsiellapeneumonia, Candida albicans and E.coli(47). Maghsoumi-Norouzabadet al. have shown that Arctiumlappa root tea reduced serum level of IL-6 and high sensitivity CRP, while serum levels of total antioxidant capacity (TAC) and superoxide dismutase activities were found to be enhanced (41). It suggests that Arctiumlappa root tea may be effective inflammatory diseases such as osteoarthritis. Gastro-protective activity and regulation of blood pressure are other diseases which Arctiumlappa may have positive effects (48, 49). Finally, Wu et al. have demonstrated that arctigenin reduced the expression levels of IL-17F, IL-17A, IL-21, IL-22, RORγT and IL-23R in CD4+ T cells and also repressed the number and percentage of IL-17+CD4+ T cells in ulcerative colitis (50). This data suggests that arctigenin inhibits T helper17 (Th17) differentiation which plays a crucial role in pathogenesis ulcerative colitis.

Feverfew(Tanacetumparthenium L.)

Tanacetumparthenium is a daisy-like perennial plant found commonly in Europe and Asia. It is a short, aromatic and bushy perennial that have 0.3-1 meter height. Its leaves are yellow-green and usually less than 8cm in length. The odor of this plant is strong and bitter (51). The most important biologically active ingredients of Tanacetumparthenium consist of sesquiterpenelactones, flavonoids, volatiles oils and coumarinisofraxidin (51, 52). Different studies have shown various medicinal effects for Tanacetumparthenium, such as treat dermatitis, asthma, fever, earache, headache, spasms, psoriasis, arthritis, inflammatory conditions, labor, menstrual disorders, potential miscarriage, stomachache, swelling, toothache, vertigo and worms (51, 53, 54). Studies have demonstrated that Tanacetumpartheniumexerted their anti-inflammatory effect by inhibiting the synthesis of prostaglandins or by cytotoxic effect on peripheral blood mononuclear cells. Lipophilic compounds of Tanacetumpartheniummay reduce human neutrophil oxidative burst activity (51). Chloroform extract of Tanacetumpartheniuminhibited histamine release from rat peritoneal mast cells. This data have suggested anti-allergic effect for Tanacetumparthenium. Parthenolide is one of the components of Tanacetumparthenium which have shown anti-microbial and anti-cancer property against several human cancer cell lines (51). Jannesaret al. have also demonstrated that flavonoid extract of Tanacetumpartheniumpollen grains has significant immunomodulatory activity (55).

Conclusion

The Asteraceae is the largest and most cosmopolitan family of flowering plants. Plants of this family were widely used in the past and are still used as medical herbs. Asteraceae family plants contain different components which flavonoids are the most important ingredient. Studies suggest that plant flavonoids may be health promoting, disease preventing dietary compounds. Using of Asteraceae family plants can influence the immune system. The most important effect which is observed in all Asteraceae family plants is their anti-inflammatory effect. Plants of this family reduce inflammatory cytokines such as TNF-α, IL-1, IL-6 and other acute phase proteins like CRP. It seems that Asteraceae family plants reviewed in this article are good candidates for studying in clinical trials of inflammatory diseases in which modulating the immune system is needed.

Ethical issues

Not applicable

Authors' contribution

All authors equally contributed to the writing and revision of this paper.

Acknowledgment

The present authors express their thanks and gratitude to the vice-chancellor of Research and Technology of Marvdasht branch, Islamic Azad University.

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