Proceedings of the 2nd International Conference on Modern Medicine and Global Health
DOI: 10.54254/2753-8818/35/20240898

Research progress on the immunomodulatory effect of traditional Chinese medicine

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Abstract. China is a country with thousands of years of research history in traditional Chinese medicine. In ancient China, traditional Chinese medicine has been used to treat diseases and has been passed down to this day. It has gone through thousands of years of spring, summer, autumn, and winter, achieving today's history of traditional Chinese medicine. There are many traditional Chinese medicines that have good immunomodulatory effects. With the expansion of traditional Chinese medicine research, the broad prospects of traditional Chinese medicine in regulating the body's immune system have been gradually realized. This article provides a review of the research progress on the immune regulatory function of traditional Chinese medicine based on the medical experiments and clinical applications of traditional Chinese medicine in immune system regulation in recent years. On the one hand, traditional Chinese medicine can enhance the cellular and humoral immune functions of the body, promote the physiological functions of lymphocytes, monocytes, macrophages, and hematopoietic stem cells; On the other hand, traditional Chinese medicine also has immunosuppressive functions, which can reduce the release of inflammatory factors, inhibit or eliminate the production of antibodies, and inhibit the proliferation of T cells. Currently, research has found that most traditional Chinese medicine has a bidirectional immune regulatory function to restore normal immune responses to either high or low levels. This bidirectional immune regulatory effect actually reflects the theory of "holistic view" and "yin-yang balance" emphasized by traditional Chinese medicine.

Keywords: traditional Chinese medicine, immunoregulation, immunoenhancement.

1. Introduction

China is a country with a history of thousands of years of research on traditional Chinese medicine (TCM). TCM is the essence of Chinese medicine. TCM theory believes that as long as the human body's immunity is strong enough, ordinary diseases and pathogens cannot invade the human body, that is, as stated in the Yellow Emperor's Canon of Internal Medicine, "the healthy qi is stored inside, and the evil cannot be dried." It emphasizes that when the healthy qi of the human body is weak, the immunity is low, and external pathogens are easily invaded, that is, infected by pathogens, causing various diseases. Due to different constitutions and individual differences in immunity, not everyone's immunity is the same. Some people have strong immunity, while others have weak immunity. For people with weak or weakened immunity, it is necessary to improve their immunity in order to "feel at ease and not afraid" in an environment full of diseases and pathogens. In TCM, there are many ways to enhance the body's

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immune system. The use of natural therapies such as moxibustion can enhance the body's immune system, while the use of medication such as prescriptions can also enhance the body's immune system.

There are various types and quantities of TCM, which has been used to treat diseases in ancient China and has been passed down to this day. It has gone through thousands of years, achieving today's history of TCM. Many TCMs have good immune regulatory effects, and research has found that some of them regulate the human immune system

Mainly reflected in the impact on immune organs, enhancing macrophage function, regulating T lymphocytes, regulating B lymphocytes, regulating cytokines, etc. [1]. The regulation of immunity by some Chinese medicinal herbs is reflected in promoting the development of immune organs, promoting the immune function of monocytes, macrophages, and natural killer cells, promoting humoral immunity, promoting cellular immunity, influencing cytokines, red blood cell immunity, and mucosal immunity [2], which can effectively improve specific and non-specific immune function [2-3]. Some Chinese medicinal herbs can improve humoral immune function, promote NK cell activity and non-specific immune function, enhance red blood cell immune adhesion function, and inhibit lymphocyte apoptosis [4]. Moreover, some Chinese medicinal herbs have good immune regulatory effects [5-6], and have a significant enhancing effect on both non-specific and specific immunity [6].

Therefore, with the deepening of research, Chinese herbal medicine is likely to be a new way to improve the immune response of the human body. Based on the research on Chinese herbal medicine ingredients in recent years and its analysis of immunotherapy applications, article will summarize the main components of TCM that have immunomodulatory effects and the mechanism of their immunomodulatory effects.

2. Mechanism of Chinese traditional medicine promoting immune regulation

2.1. Immune organs

The immune organ is the organizational structure through which the body undergoes immune responses and performs immune functions, and the quality of immune organs is closely related to immune function. Immune organs include central and peripheral immune organs or tissues such as the thymus, bone marrow, and the bursa of birds. The central immune organs are the sites where immune cells such as lymphocytes produce and differentiate, while peripheral lymphoid organs or tissues such as the spleen, lymph nodes, and mucosal immune system are the sites where lymphocytes settle and undergo immune responses. The development status of immune organs directly affects the level of the body's immune ability. Research has found that various TCM immune enhancers have a significant promoting effect on the growth and development of immune organs and the performance of immune functions. The study by Wang Jue et al. showed that adding 1.5% bee pollen to the diet of broiler chickens can increase the weight and organ index of immune organs, promote the early development of thymus, bursa and spleen, delay the degeneration of bursa, enhance the immune response ability of the spleen, and thus improve the disease resistance of animal organs [7].

2.2. Cellular immunity

Cellular immunity is an important immune response mediated by T lymphocytes in the body. T lymphocytes mature in the thymus and are the most important immune cells. Their main function is to mediate cellular immunity and regulate the immune function of the body. In the process of cellular immune response, T cells play an important role in clearing intracellular pathogen infections, rejecting allografts, and anti-tumor immune responses by recognizing specific antigens for activation, proliferation, and differentiation, and generating different immune effects through different cell subpopulations. Modern research has shown that the effective ingredients in TCM can affect the differentiation and proliferation of T cells, form effector cells, and ultimately produce immune lymphokines, promoting an increase in the total number of lymphocytes [8]. Liang Chunmin et al. applied TCM serum pharmacology methods to observe the effect of "Yupingfeng Powder" on the immune response of mouse spleen T cells cultured in vitro. The results showed that "Yupingfeng

DOI: 10.54254/2753-8818/35/20240898

Powder" drug can promote the proliferation of mouse spleen T cells and enhance their ability to secrete IL-2 [9].

2.3. Humoral immunity

Humoral immunity is another important immune response mediated by B cells in the body. It can defend against extracellular microorganisms and their toxins. The measurement of humoral immune function often involves direct antibody level testing and the Plaque Free Cell (PFC) test. Mammalian B cells mature in the bone marrow and migrate to the periphery, activate and proliferate when encountering antigens, and ultimately differentiate into plasma cells, producing specific antibodies, It exists in bodily fluids and plays an important role in humoral immunity. Various tonifying TCM and heat clearing and detoxifying TCM all have the effect of promoting antibody generation. Gao Chunyan compared the effects of compound Huanghua decoction on the humoral immune function of normal mice, immunosuppressive mice, and mice infected with Candida albicans. This research found that the compound Huangqi decoction can significantly increase the level of serum hemolysin in normal mice, increase the number of spleen antibody forming cells (PFC), and significantly improve the humoral immune suppression caused by cyclophosphamide (Cy) and Candida albicans infection, it is suggested that compound Huangqi decoction has the function of improving humoral immunity [10].

2.4. White blood cells and system

White blood cells and system cells have strong phagocytic ability, which is an important part of the body's non-specific immunity and can participate in the body's specific immunity. Their functional improvement is mainly achieved by increasing the number of phagocytic cells and enhancing their phagocytic ability. Mononuclear macrophages are the main effector cells of the body's immunity. After the body is infected, monocytes and macrophages can recognize and engulf pathogens, kill and clear viruses and bacteria. They can also mediate and promote inflammatory reactions by secreting cytokines, chemokines, and other factors, enhancing the body's immune response. In addition, monocytes and giant cells can also clear damaged and aging cells in the body, playing an important role in immune monitoring. Dai Ling et al.'s study on the effect of Baitouweng glycoprotein on the immune function of macrophages showed that Baitouweng glycoprotein significantly enhances the ability of mouse peritoneal macrophages to phagocytose neutral red in vitro, induces the production of nitric oxide by macrophages, and has a certain promoting effect on the secretion of IL-1 by giant cells [11].

2.5. Natural killer cells

Natural killer cells (NKCs) are a type of lymphocytes in the body that participate in the immune response. They can kill tumor cells and virus infected cells both in vivo and in vitro, playing a role in immune monitoring and anti infection. They are a type of non-specific immunity in the body and play a crucial role in the immune response to anti-tumor, early antiviral, or intracellular parasitic infections. It exists in serum and tissues, with the spleen being the most abundant. Some effective ingredients in TCM can increase the number and activity of NK cells by inducing interferon production, thereby exerting the body's immune ability. Studies have shown that many complex TCM decoctions, such as Modified Sijunzi Tang and Lizhong Tang, can enhance the activity of NK cells in the immune organs and spleen to varying degrees, thereby enhancing the body's immunity [12]. The study by Wang Wenping et al. in a mouse model of lung metastasis from colorectal cancer showed that Chang'antai Jiaosai can induce an increase in the number of NK cells in the intestinal mucosal immune system, thereby effectively preventing the occurrence of lung metastasis from colorectal cancer [13].

2.6. Immune organs

Cytokines are a class of small molecule economic proteins produced by immune active cells (lymphocytes, monocytes, macrophages) and related cells that regulate the immune function of the body. They are important mediators for information transmission between immune cells, mainly regulating the immune response, hematopoietic function, and inflammatory response of the body. In recent years,

DOI: 10.54254/2753-8818/35/20240898

research has shown that various effective ingredients of TCM, such as Huangmao polysaccharides, shiitake mushroom polysaccharides, cordyceps polysaccharides, goji berry polysaccharides, as well as tonifying formulas such as Sijunzi Tang, Buzhong Yiqi Tang, Siwu Tang, Danggui Buxue Tang, Liuwei Dihuang Tang, and Jinyi Shenqi Wan, can promote the production of cytokines, regulate the immune function of the body, and maintain physiological balance. Sijunzi Tang is a representative formula for tonifying qi and strengthening the spleen. Research by Zhang Mei et al. found that Sijunzi Tang can regulate the levels and functions of cytokines in the plasma of patients with spleen deficiency through the effect of tonifying qi and strengthening the spleen, thereby achieving the effect of enhancing immunity. In patients with spleen deficiency, various cytokine secretions are disordered and dysfunctional, manifested as low cellular and humoral immune functions [14]. After treatment with Sijunzi Tang, all symptoms of the patients with spleen deficiency have been alleviated, and the patient's plasma IL-2, IL-4, IL-5, and TNF have also been improved α The expression of CD2mRNAIL-4mRNAIL-5mRNA in lymphocytes also increased with the increase of IgE secretion.

2.7. Bidirectional immunomodulatory

Many TCM or their active ingredients have a bidirectional regulatory effect on the immune function of the body. Some components of TCMs can exert immune enhancement effects, while others can also exert immune suppression effects. Jordan et al. found that Cordyceps sinensis can continuously stimulate macrophages to produce immune cytokines, thereby improving the immune capacity of immune cells. At the same time, some derivatives of Cordyceps sinensis, such as FTY720, play an immunosuppressive role [15].

3. Application of Traditional Chinese Medicine Immunization

With the expansion of research on TCM, it has been found that many drugs have immunomodulatory effects, such as sugars, glycosides, alkaloids, volatile oils, organic acids, and other effective active ingredients of TCM that have immunomodulatory effects; Enhance the body's immune system, regulate body balance, and correct immune dysfunction while treating diseases; TCM has a bidirectional regulatory effect on the immune system of the body, with some herbs promoting immune organs, immune cells, and immune factors; Some TCM has an immunosuppressive effect. In recent years, the immunomodulatory effect of TCM has been increasingly valued and reported by numerous scholars and literature. With the application of more modern scientific technologies and methods, TCM has a very broad prospect in immune regulation.

In terms of regulating the body's immune function, Western medicine mainly improves the patient's immune function by injecting exogenous immune substances into the body; However, its cost is expensive, and long-term use can easily lead to dependence, reduce sensitivity, and cause varying degrees of functional damage to the body. The development of TCM has a long history in the medical history of our country, and most traditional Chinese herbal preparations are made from natural plants and carefully processed through specific methods. With the help of multiple drugs, they exert comprehensive conditioning effects and have advantages such as small adverse reactions, weak side effects, cheap prices, abundant products, and stable and long-lasting effects [16]. However, there are still some issues that need to be addressed in the research and development and clinical application of TCM. Due to the extensive and complex pharmacological effects of TCM, the uncertainty of its mechanism of action, the lack of quality standard control, and the lack of scientific validation of its efficacy have long been challenges that have hindered the development and application of TCM. The research on the immunopharmacological effects of TCM is still immature in many aspects, and there are many issues to be elucidated at the cellular and molecular levels, which to some extent restricts the in-depth study of TCM immunology.

Although there are many kinds of traditional Chinese patent medicines and simple preparations that have been widely used in clinical practice, such as Bufei Decoction [17], Yiqi Recipe, Ziyin Recipe [18], Aidi Injection [19], Shenqi Fuzheng Injection [20], Kanglaite Injection [21], Shengmai Injection [22] can regulate immune function in different ways; However, whether it is in vitro cell experiments, animal

DOI: 10.54254/2753-8818/35/20240898

experiments, or clinical studies, the research on the mechanism of immune regulation is not yet in-depth enough; Moreover, TCM compound extracts have extremely complex chemical components; Some TCMs have a bidirectional immune regulatory effect [23]. When used in small doses, they have an immune enhancing effect, while when used in large doses, they have an immunosuppressive effect. It is difficult to establish a unified standard for their dosage during clinical use; The efficacy of TCM is also influenced by multiple factors; There is also a lack of multicenter, large sample, randomized double blind controlled trials in clinical research. Therefore, it is necessary to fully explore the treasure trove of TCM to the greatest extent possible, guided by the basic theoretical knowledge of TCM, using new modern medical technologies and methods, and combining multiple disciplines to conduct a systematic and in-depth objective evaluation of the immune regulation mechanism of TCM from multiple aspects, and to conduct in-depth research and exploration of its mechanism of action. Efficient, accurate, and scientific methods should be adopted in the production and consumption of TCM, and the sample size should be increased as much as possible, Conduct randomized double blind case observation studies across multiple centers to further evaluate the efficacy of TCM in immune regulation, in order to better reveal the role of TCM in immune regulation.

Only by gaining a deeper understanding of the immune pharmacological mechanisms of TCM can we provide assurance for clinical screening and rational use of drugs. The continuous progress of experimental technology in TCM research and the deepening of theoretical exploration of TCM pharmacological mechanisms will enable TCM to be widely applied in various aspects of medical practice at a faster pace. With the deepening of research, TCM with immune promoting effects will be screened and separated, Extracting effective ingredients has become an important research direction.

4. Conclusion

TCM, which plays a role in immune regulation, has important research value and broad application prospects. Based on the relationship between TCM theory and the immune system, the study of the immune regulatory effect of TCM on the body has demonstrated the important application value of TCM immune modulators in human health preservation, clinical prevention and treatment of diseases. Therefore, the exploration and verification of the bidirectional regulatory effect of TCM on the immune system will receive more widespread attention, and TCM immune modulators will become one of the most concerned products in the international pharmaceutical and healthcare fields due to their unique advantages.

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