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PHYTOPREPARATIONS AGAINST INFLAMMATORY DISEASES

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ABSTRACT: This literature review explores how natural compounds found in plants can help combat inflammation. It investigates the role and therapeutic impact of phytochemicals, whether isolated or present in plant extracts and essential oils, in managing inflammatory conditions. Through the analysis of medicinal plants with phytotherapeutic potential, this study outlines nature's powerful tools against inflammatory diseases. Readers will gain insight into a wide variety of plant-derived phytochemicals that show promise in providing both short-term and long-term relief from inflammation. Additionally, the review highlights the antioxidant and anti-inflammatory properties of bioactive plant compounds, which hold potential for treating various inflammatory disorders. The paper also presents a comparative analysis between synthetic anti-inflammatory drugs and those obtained from plants, evaluating their efficacy and safety profiles. By examining both natural and synthetic options for inflammation management, the review offers a comprehensive overview of current treatment possibilities. Finally, it emphasizes the importance of systematic research into phytochemicals, underscoring their potential to lead to the development of novel anti-inflammatory therapies.

Keywords: Inflammation, Phytochemicals, Anti-inflammatory, Curcumin, Quercetin, Gingerol, Resveratrol

INTRODUCTION

Inflammation is a natural protective response to tissue injury or infection—essentially, the body's internal defense system. When something harmful, such as a pathogen or injury, threatens the body, immune cells and inflammatory mediators (like cytokines) rapidly respond to eliminate the threat and begin the healing process. Visible signs such as redness, swelling, pain, or heat are indicators of the immune system at work.

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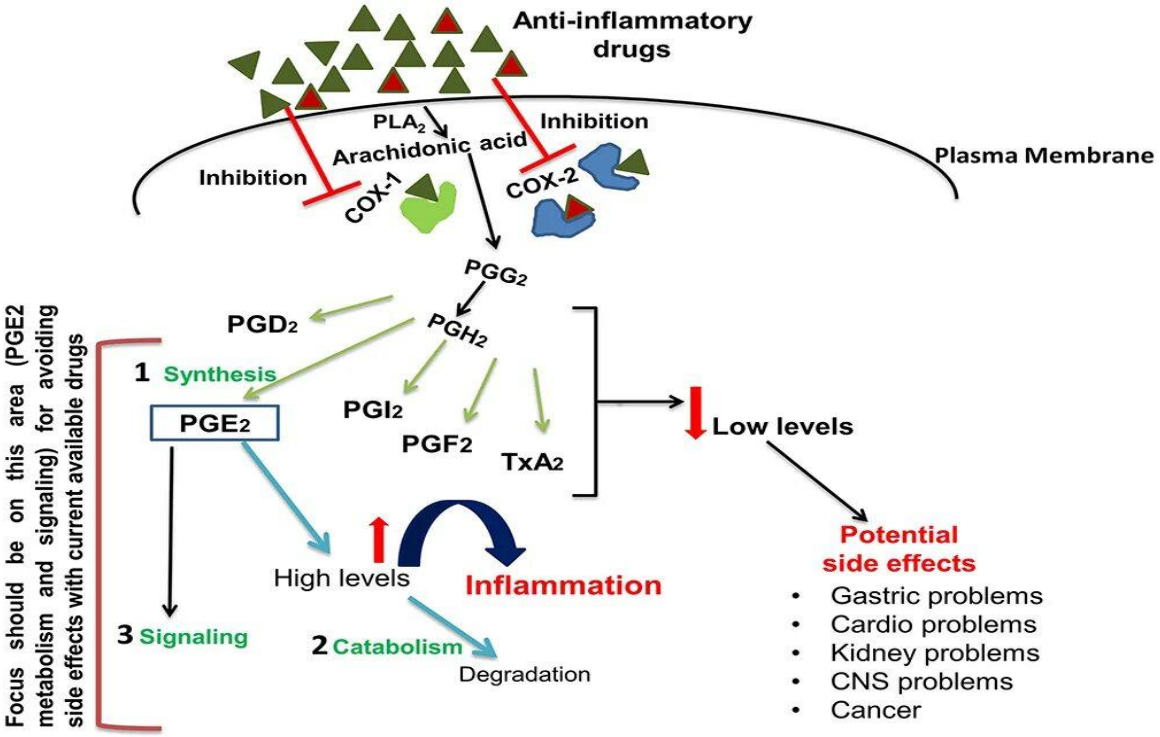
While inflammation is crucial for healing and recovery, it can sometimes become excessive or persist beyond its useful phase. This chronic or uncontrolled inflammation can cause harm to healthy tissues and contribute to the development of many diseases. For example, when inflammation occurs without injury or infection, or if it remains active for too long, it may lead to tissue damage instead of healing—much like a malfunctioning alarm system that starts targeting innocent bystanders.

Inflammation may manifest either externally, such as with swollen joints or skin irritation, or internally, where symptoms are less obvious. Recognizing these signs and consulting medical professionals is essential, especially in cases of persistent or unexplained inflammation.

In summary, inflammation is a vital part of the immune response, but it must be tightly regulated to avoid unintended damage to the body.



Phyto-chemicals in anti-inflammatory drugs

Anti-inflammatory drugs, both steroidal and non-steroidal, are commonly used to treat against various inflammatory conditions. However, long-term use can lead to harmful side effects, sometimes even life-threatening ones.

That's why it's important to develop the drugs for chronic inflammation that are safer, more effective and achieve better therapeutic management without or with a fewer side effect.

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Plants are very well-known for the medicinal use and have been used for their medicinal properties for centuries because they contain natural compounds called phytochemicals. These phytochemicals come from different chemical groups and many of them have strong anti-inflammatory effects.

For example, Curcumin (found in turmeric), Gingerol (Ginger contains) gingerol, a bioactive compound with potent anti-inflammatory effects. It has been traditionally used to alleviate pain and inflammation associated issues. colchicine (alkaloid) works against inflammation, bicyclol (lignan), Resveratrol (found in grapes, berries, and red wine), borneol (monoterpene), and Quercetin (flavonoid) found in foods like apple, onion, and berries.

These substances or phytochemicals often work by adjusting the body's molecular processes to reduce inflammation, either by increasing anti-inflammatory signals or by decreasing pro-inflammatory ones. This helps to improve the underlying health condition without causing as many sides' effects.

Biochemical structure of Anti-inflammatory phytochemicals

- **Curcumin:**

Curcumin, chemically known as 1,7-bis(4-hydroxy-3-methoxyphenyl)-1, 6-heptadiene-3, 5-dione, has anti-inflammatory, anti-oxidant, anti-tumor and other biological activities. [6,7,8]

The anti-inflammatory properties of curcumin (found in turmeric) are considered to be the basis of its various biological activities and play an important role in the treatment of diseases. It's used in many different treatments of disease.

Curcumin is mainly derived from the root tuber of *Curcuma aromatica* Salisb and the rhizome of *C. longa* L. (Turmeric) of *Zingiberaceae*.

Ayurveda have long used of certain herbs to improve blood circulation and remove blood stasis, which can help with pain, inflammation and other health diseases. Turmeric, for example is a common spice in India and has been described in Ayurveda, as a treatment for inflammatory diseases.

Effect of Curcumin on Inflammatory Bowel Disease

Inflammatory bowel disease (IBD) is a chronic condition characterized by inflammation in the digestive tract, which includes ulcerative colitis (UC) and Crohn's disease (CD). UC affects the colon's lining, while CD can affect any part of the digestive tract. The causes of

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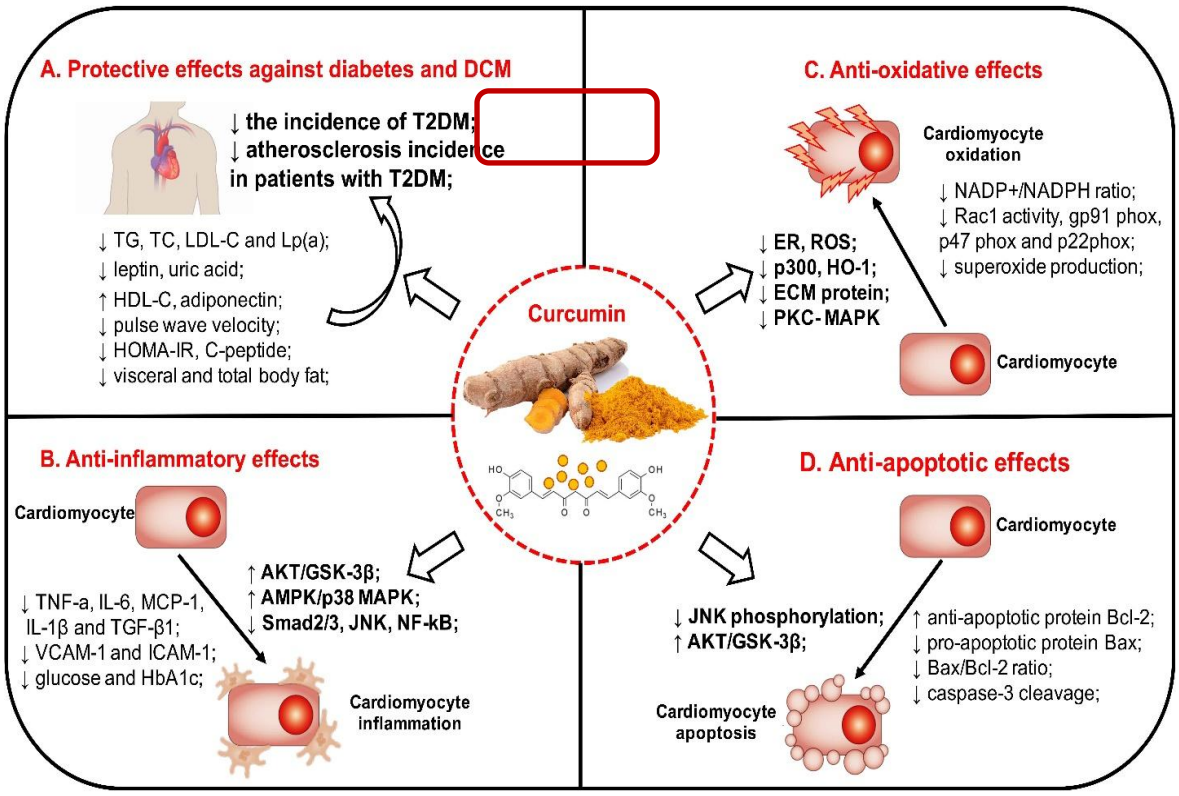
IBD are not fully understood but are thought to involve genetics, environment, and the immune system.

Curcumin, found in turmeric, has shown promise in treating IBD. It works by reducing inflammation and protecting the intestinal barrier. In animal studies, curcumin has been found to inhibit the activation of NLRP3 inflammasomes, which are involved in inflammatory processes . This leads to a decrease in the production of pro-inflammatory cytokines like IL-1β. Additionally, curcumin can regulate the TLR4/NF-κB/AP-1 signalling pathway, reducing the production of inflammatory factors such as IL-1, IL-6, IL-8, and TNF-α.



Furthermore, curcumin has been shown to have a positive effect on symptoms and quality of life in patients with UC. It has also demonstrated efficacy in treating mild to moderate Crohn's disease. Additionally, curcumin may benefit patients with irritable bowel syndrome (IBS) by reducing symptoms like abdominal pain and improving overall quality of life. [8,9,10,11,12,13,14]

Although curcumin is generally safe and effective, more research is needed to establish standardized dosages and administration methods. While some studies have shown mixed results, many researchers believe that curcumin can complement traditional treatments for IBD and IBS, enhancing their effectiveness. [15,16,17]

- **Resveratrol**

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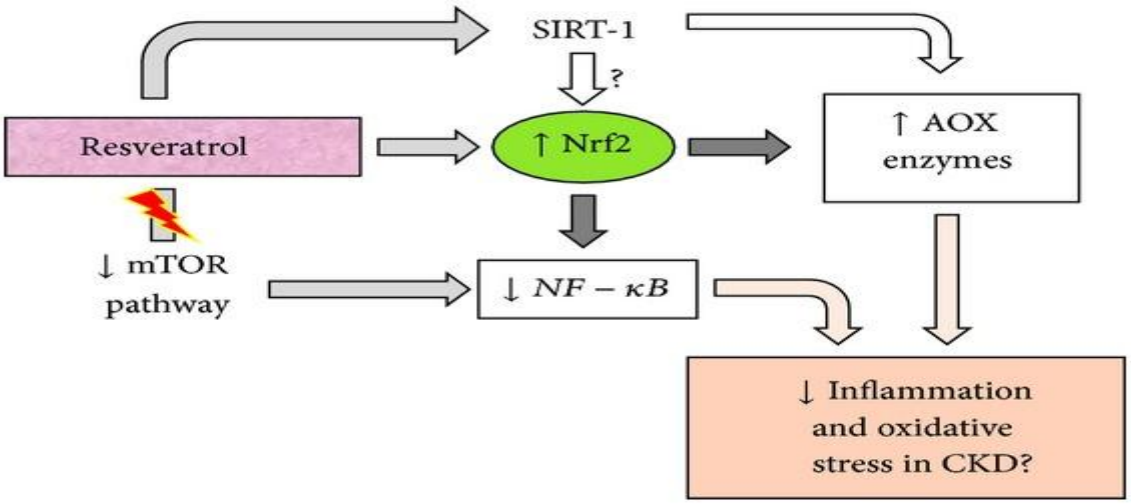
Resveratrol (3,4′,5-trihy- droxystilbene) is a natural compound found in plants like grapes and berries.

A natural phytoalexin polyphenol, **exhibits anti-oxidant**, **anti-inflammatory** , and anti-carcinogenic properties. It's known for its ability to fight inflammation, reduce oxidative stress, and even help prevent cancer. When you consume resveratrol, your body quickly absorbs it and breaks it down. Inflammation is the body's way of responding to threats like infections or injuries. Resveratrol can help regulate this response by acting as an anti-inflammatory agent. Many studies, both in the lab and in animals, have shown how resveratrol can control inflammation and boost the immune system.

In Initially1976, resveratrol (3,4'5-trihy-droxy-stilbene) discovered as a phytoalexin, resveratrol was believed to be produced by plants in response to stress. However, further research revealed its diverse range of bioactivities, including antioxidant, anti-inflammatory, cardiovascular protective, and anti-aging properties in animals. Resveratrol is found in various plant species, including mulberries, peanuts, and grapes, and exists in different forms, such as trans- and cis-isomers, as well as their glucosides, trans- and cis-piceids.

Structure of trans-resveratrol(a) and cis-resveratrol(b).

Anti-Inflammatory Pathways of Resveratrol



Inhibition of arachidonic acid metabolic pathway by resveratrol. Key abbreviations: COX, cyclooxygenase; PGD2, prostaglandin D2; PGE2, prostaglandin E2; PGI2, prostaglandin I2; TXA2, thromboxane A2.

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CONCLUSION

Based on the findings of this review, phytopreparations with anti-inflammatory properties hold great promise for the management of various diseases. Natural compounds such **as** quercetin**,** galangin**,** gingerols**,** shogaols**,** and resveratrol have demonstrated significant anti-inflammatory activity in both preclinical and clinical studies. These agents exert their effects by modulating key inflammatory mediators, inhibiting pro-inflammatory signaling pathways, and enhancing the body's antioxidant defense mechanisms. They offer potential therapeutic value for managing conditions such as atopic dermatitis, rheumatoid arthritis, inflammatory bowel disease, and neuroinflammatory disorders. Due to their generally favorable safety profiles, plant-based preparations may be used alone or in combination with conventional pharmacological treatments. However, further research is necessary to determine optimal dosages, treatment durations, and potential interactions with other medications. In summary, anti-inflammatory phytochemicals represent a promising avenue for the development of novel treatment strategies, with considerable potential for improving patient outcomes and contributing to the future of integrative medicine.

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