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# PLANT POWER FOR HEALTH: PHYTO-PREPARATIONS AGAINST INFLAMMATORY DISEASES USES OF PLANTS AS A MEDICINE

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## ABSTRACT

This detailed review gives you the information about how certain natural compounds found in the plants can help with inflammation. And explores the application and impact of phytochemicals, whether isolated or within plant extracts and essential oils, in addressing inflammation. Through an investigation of medicinal plants with the potential for Phyto-preparation, the study clearly explains the nature's weapons against inflammatory diseases.

Readers will gain insight into a wide array of phytochemicals derived from plants, displaying (exposing) their potential for both temporary and permanent relief from various inflammatory conditions. Additionally, the review highlights plant-derived bioactive substances with antioxidant and anti-inflammatory effects, offering promise for individuals with inflammatory ailments.

Furthermore, the article goes through a comparative analysis between synthetic anti-inflammatory chemicals and those derived from medicinal plants, providing valuable insights into efficacy and safety considerations for patients. By examining anti-inflammatory drugs isolated from medicinal plants or synthesize by the synthetic processes both have same purpose, the study offers a comprehensive understanding of available treatment options. Finally, the review focus attention on the importance of systematic research on phytochemicals, suggesting their potential to uncover novel therapeutics for the management of inflammatory diseases.

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**keywords**

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

## INTRODCTION

### What is Inflammation?

Inflammation is a protective response that develops against tissue injury and infection. Inflammation is body's security system. When something harmful, like a virus or an injury, tries to get in, your body's defense team jumps into action. These defenders, called inflammatory cells and cytokines, rush to the scene to trap the intruder and start repairing any damage. You might notice signs like pain, swelling, or redness - these are like the alarms going off, telling you that your body is working to heal itself.

When everything is working as it should, inflammation is a good thing. It's your body's way of fighting off invaders and fixing any damage. For example, when you get a cut, the area around it might swell up a bit and feel tender. That's your body's way of sending help to the injured spot.

But sometimes, inflammation can get out of control (more inflammation). It might happen in healthy tissues, or it might stick around for too long. When this happens, it can actually harm you instead of helping.

***Imagine if the security system in your house went haywire and started attacking everything, even your own family - that's kind of what happens with inflammation sometimes.***

Inflammation can show up in different ways. Sometimes it's obvious, like when you sprain your ankle and it swells up. Other times, it's sneaky, happening inside your body where you can't see it.

It's important to pay attention to how you're feeling and talk to a doctor if you notice anything unusual, like persistent pain or swelling.

So, while inflammation is a natural and important part of your body's defense system, too much of it or in the wrong places can cause problems. It's all about finding the right balance between protecting yourself and not going overboard[1,2,3,4,5].

### What are the symptoms of inflammation?

- Discolored or flushed skin
- Pain or tenderness that should be mild and only in the area of the injury.
- Joint pain
- Skin that feels hot to the touch
- Anxiety

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- Skin rash
- Swelling (like, knee inflammation)
- Mood disorders
- Inability to use the part of your body as you normally would (For example, reduced range of motion)
- Skin problem (like, Skin rashes, Redness)
- Fever
- Memory Problems
- Digestive issues
- Difficulty Breathing (like, Shortness of breath)
- Muscle Stiffness
- Hair loss

**Which Diseases are associated with inflammation?**

- Autoimmune diseases, like lupus, rheumatoid arthritis (RA), psoriasis and ankylosing spondylitis (AS).
- Cardiovascular diseases, such as heart disease and high blood pressure.
- Certain cancers.
- Gastrointestinal diseases, like Crohn's disease and inflammatory bowel disease.
- Lung diseases, like asthma and chronic obstructive pulmonary disease (COPD).
- Mental health conditions, such as depression and anxiety.
- Metabolic diseases, like Type 2 diabetes.
- Neurodegenerative diseases, such as Alzheimer's disease and Parkinson's disease.

The acute inflammation is caused by sudden onset and easily get cured by body mechanism itself and does not cause any major effect on the body.

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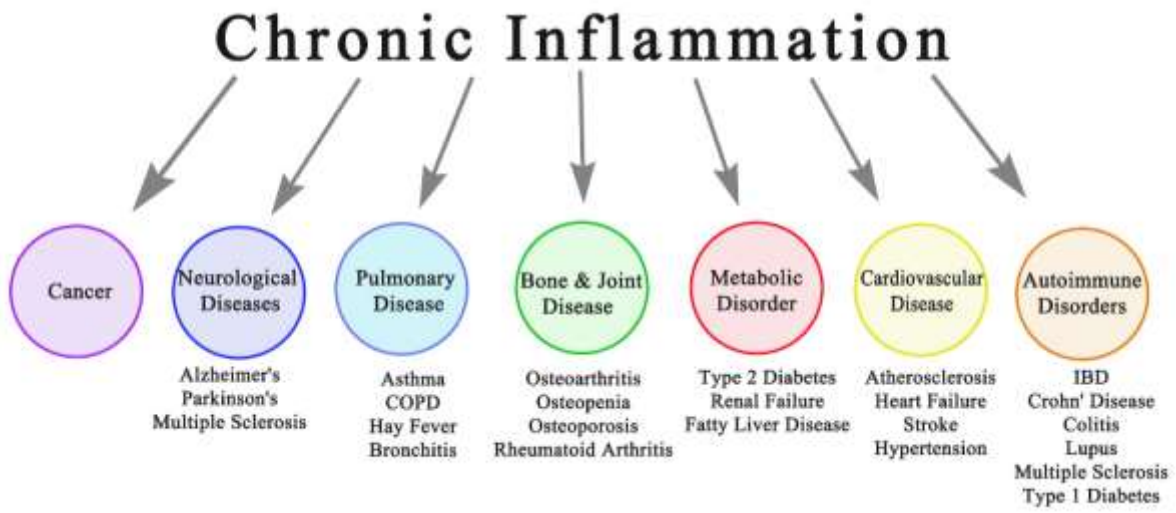


**Phyto-chemicals in anti-inflammatory drugs**

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.

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]

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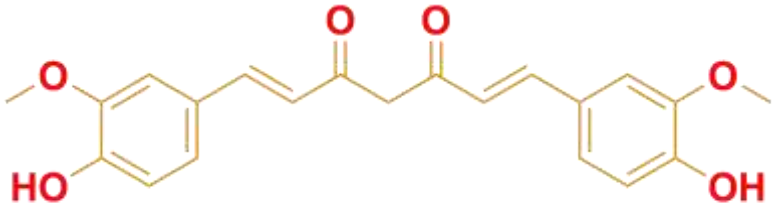
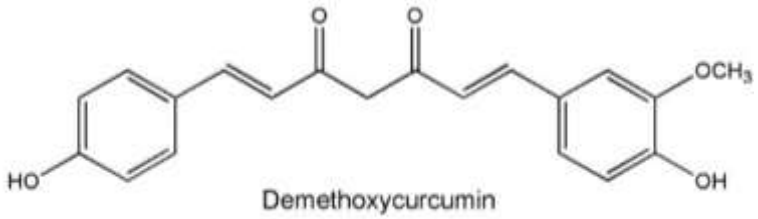
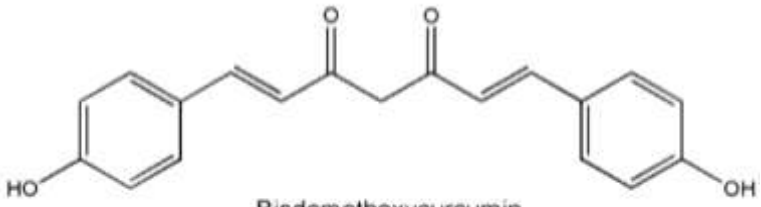



(1*E*,6*E*)-1,7-bis(4-hydroxy-3-methoxyphenyl)hepta-1,6-diene-3,5-dione




Demethoxycurcumin




Bisdemethoxycurcumin

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

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Crohn's disease (CD). UC affects the colon's lining, while CD can affect any part of the digestive tract. The causes of 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. [15,16,17,18,19,20,21]

**Effect of curcumin on Arthritis**

Arthritis comes in different forms like osteoarthritis (OA), rheumatoid arthritis (RA), and gouty arthritis. Osteoarthritis is common in older adults, especially women, and it's linked to joint inflammation. Curcumin, found in turmeric, can help by reducing inflammation and protecting cartilage in the joints. It works by blocking certain inflammatory molecules and protecting the joints from damage. [22,23,24,25]

RA is an autoimmune disease where the body's immune system attacks the joints, causing inflammation. Curcumin can help by calming down the immune response and reducing inflammation in the joints. It does this by targeting specific pathways involved in inflammation. [26,27,28,30]

Gouty arthritis happens when uric acid crystals build up in the joints, causing inflammation and pain. Curcumin can ease this by blocking pathways that lead to inflammation and reducing the activity of certain inflammatory molecules. [29-31]

Studies have shown that curcumin can improve symptoms in people with arthritis. For example, in one study, a combination of curcumin and a pain-relieving drug called diclofenac worked better than the drug alone in reducing arthritis symptoms. However, more research is needed before curcumin can be widely used as a treatment for arthritis. Currently, curcumin supplements are

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available and used by many for joint health, but it's important to consult with a healthcare professional before starting any new treatment. [32,33]

**Effect of curcumin on Depression**

Depression is a serious mental health condition affecting about 4% of people worldwide. [34] Its causes are complex, involving factors like inflammation, neurotransmitters, and stress. Stress can trigger inflammation in the body , which can affect brain function and lead to depression. [35,36]

Curcumin, found in certain traditional Chinese medicines, has properties that may help with depression. In studies on rats subjected to chronic stress, curcumin treatment improved mood and reduced inflammation. It did this by lowering levels of inflammatory molecules and activating pathways that protect brain cells.

Curcumin's benefits for depression have been seen in animal studies, but clinical trials in humans have had mixed results. Some studies suggest it may help with symptoms of depression and anxiety, while others haven't shown clear benefits. More research is needed, especially considering curcumin's low absorption in the body. Larger studies with standardized doses and assessment methods are necessary to confirm its effectiveness for depression.

- **Quercetin**


**Quercetin**

Quercetin, a natural compound found in various fruits and vegetables (like, onion, apple) has potent powerful anti-inflammatory properties. quercetin, along with another flavanol called galangin, can reduce inflammation in cells and animal models of atopic dermatitis. This combination lowers levels of inflammatory molecules like interleukin-6 and NF-kB, offering potential strategies for preventing atopic dermatitis.

Inhibiting the production of inflammatory molecules like tumour necrosis factor-α (TNF-α) and interleukin (IL)-1α, which are involved in the body's inflammatory response. Quercetin also suppresses the activity of inflammatory enzymes and regulates inflammation triggered by lipopolysaccharide (LPS), a bacterial component, by blocking specific signaling pathways.

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Additionally, quercetin can inhibit the release of pro-inflammatory cytokines and enzymes from immune cells, such as mast cells and macrophages. It modulates the balance of immune cells and cytokines, favouring anti-inflammatory responses over pro-inflammatory ones.

Quercetin has been found to inhibit the production of inflammatory molecules in various cells, including those involved in COVID-19-related inflammation. It also modulates immune responses by promoting the production of interferon-γ, which is anti-inflammatory, and reducing the levels of IL-4, which promotes inflammation.

Quercetin also targets molecules involved in the inflammatory process, such as cyclooxygenase-2 (COX-2), nuclear factor-kappa B (NF-κB), and activator protein 1 (AP-1).

Although quercetin has limited absorption when applied topically, certain derivatives like pentamethyl ether have shown promising anti-inflammatory activity through better skin absorption. Moreover, quercetin and its derivatives have demonstrated anti-inflammatory effects in various disease models, including non-alcoholic steatohepatitis (NASH), where they reduce inflammatory markers like TNF-α and IL-6.

While quercetin has limited effectiveness when applied topically due to poor skin absorption, certain derivatives like pentamethyl ether have shown strong anti-inflammatory properties. Overall, quercetin's diverse mechanisms make it a promising candidate for combating inflammation in various conditions, though further research is needed to fully understand its potential therapeutic applications.

- **Gingerol (Ginger contains)**

Ginger (Zingiber officinale Roscoe), a member of the Zingiberaceae family,

is one of the most popular spices worldwide, known since ancient times, and used both as a spice and a medicinal plant.

Gingerol, a bioactive compound with potent anti-inflammatory effects. It has been traditionally used to alleviate pain and inflammation associated issues. The phenolic compounds found in ginger are predominantly gingerols, shogaols, and paradols. Gingerols are the major phenolic compounds found in fresh ginger and contain mainly 6-gingerol as well as 4-, 5-, 8-, 10-, and 12-gingerols.

Gingerols can alleviate inflammation given their ability to inhibit the activation of protein kinase B (Akt) and nuclear factor kappa B (NF-κB) signaling pathways, causing a decrease in proinflammatory and an increase in anti-inflammatory cytokines. and its bioactive constituents include tannins, anthocyanins, terpenes (e.g., α-zingiberene, β-bisabolene, β-sesquiphellandrene, ar-

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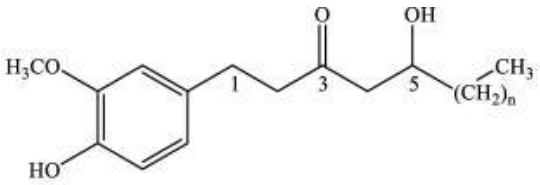
curcumene, or (E,E)-α-farnesene) and phenolic compounds (gingerols, paradols, shogaols, and zingerone) Gingerols are the major pungent compounds of ginger.

Ginger is a rich source of bioactive compounds, including over 200 identified compounds such as tannins, anthocyanins, terpenes, and phenolic compounds like gingerols, shogaols, and zingerone. Among these, gingerols stand out as the primary pungent compounds in ginger. Research has extensively investigated ginger extracts and isolated phenolic compounds, particularly 6-gingerol, revealing a wide range of pharmacological effects.

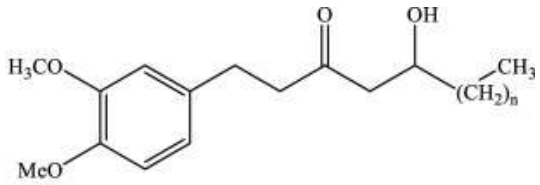
These effects include antiemetic (anti-nausea), anti-inflammatory, pain-relieving (antinociceptive), antioxidant, antimicrobial, anticancer, blood sugar-lowering (anti-hyperglycaemic), artery-protecting (anti-arteriosclerotic), skin-warming (rubefacient), digestive, and laxative properties.

**Overview of Gingerols**

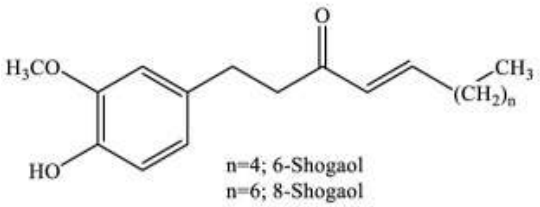
Gingerols (23–25%), shogaols (18–25%), and related ketone derivatives are bioactive constituents of ginger. Gingerols are aromatic phenolic structures composed of a series of structural analogs of 1-(3-methoxy-4-hydroxyphenyl) 3-oxo-5-hydroxy-hexane, bearing different lengths of the unbranched alkyl side chain. Derivatives of gingerols such as 4-, 6-, 7-, 8-, 10-, and 12-gingerols are differentiated based on their unbranched alkyl side chain length. [72]



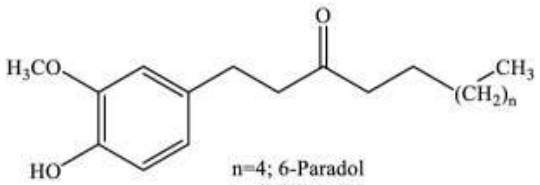

n=2; 4-Gingerol
n=5; 7-Gingerol
n=8; 10-Gingerol
n=4; 6-Gingerol
n=6; 8-Gingerol
n=10; 12-Gingerol



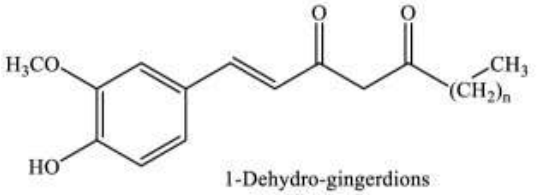

n=2; 4'-methoxy-4-Gingerol
n=4; 4'-methoxy-6-Gingerol



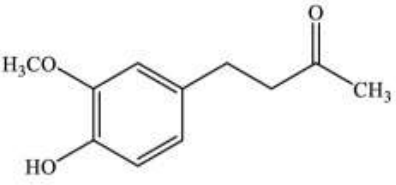

n=4; 6-Shogaol
n=6; 8-Shogaol
n=8; 10-Shogaol




n=4; 6-Paradol
n=6; 8-Paradol
n=8; 10-Paradol




1-Dehydro-gingerdions
n=1; 3-Gingerdione
n=4; 6-Gingerdione
n=6; 8-Gingerdione
n=8; 10-Gingerdione




Zingerone

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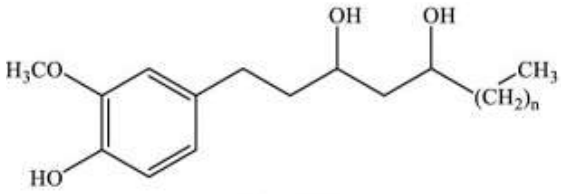
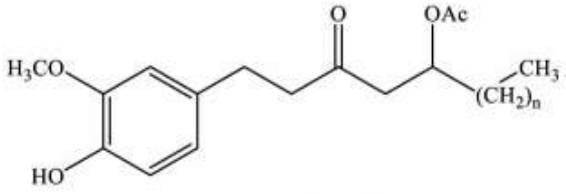


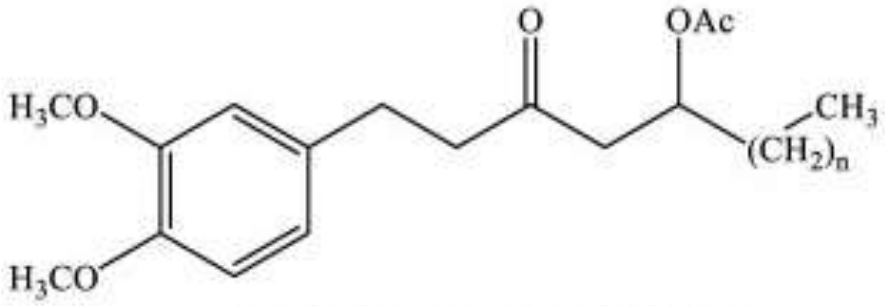

Gingerdiols

n=2; 4-Gingerdiol n=4; 6-Gingerdiol
n=6; 8-Gingerdiol n=8; 10-Gingerdiol




Acetoxy-gingerols

n=2; Acetoxy-4-Gingerol n=4; Acetoxy-6-Gingerol
n=6; Acetoxy-8-Gingerol n=8; Acetoxy-10-Gingerol




n=4; 4'-Methoxy-acetoxy-6-gingerol

**Antioxidant and Anti-inflammatory properties**

Ginger exhibits various beneficial properties, including antioxidant, anti-inflammatory, and potential neuroprotective effects. It helps combat oxidative stress by activating the Nrf2 signalling pathway and promoting the activity of antioxidant enzymes like catalase and SOD. Ginger also inhibits lipid peroxidation and promotes autophagy, which helps protect cells from damage. Compounds like 6-gingerol and 6-shogaol are particularly effective antioxidants, with 6-gingerol shown to regulate lipid metabolism and reduce oxidative stress in animal models.

Clinical trials have demonstrated that ginger supplementation increases the activity of antioxidant enzymes while reducing oxidative stress markers. It has also been found to alleviate symptoms of inflammatory conditions by inhibiting the production of inflammatory mediators and enzymes like COX-1 and COX-2. Ginger's antioxidant compounds, including gingerols and shogaols, may offer benefits for various health conditions characterized by inflammation and oxidative stress, such as obesity.

Moreover, ginger has been shown to decrease levels of inflammatory cytokines like TNF-α, suggesting its potential as an adjunct therapy for inflammatory disorders. Compounds like 6-gingerol and 6-shogaol exhibit anti-inflammatory effects by inhibiting the synthesis of inflammatory mediators like prostaglandin E2 and nitric oxide. Overall, ginger presents promising therapeutic potential for combating oxidative stress and inflammation in various diseases.

**Effect of Ginger on Inflammatory Diseases**

Many studies suggest that the active ingredients in ginger can help reduce symptoms of chronic inflammation.

**Rheumatoid Arthritis**

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Rheumatoid arthritis (RA) is a chronic autoimmune disease characterized by joint pain, swelling, and stiffness, primarily affecting the hands, feet, wrists, shoulders, elbows, hips, and knees. It involves complex interactions between cells and mediators of the immune system, leading to chronic inflammation. Although the exact cause of RA is unknown, it is influenced by genetic, epigenetic, and environmental factors. Chronic inflammation in RA can damage joints, surrounding tissues, and other organs, making it a systemic disease.

Current treatments for RA focus on immunomodulation, immunosuppression, and symptom management with anti-inflammatory medications, but they do not offer a cure. Given the influence of diet on RA development and progression, there is interest in exploring foods with anti-inflammatory and antioxidant properties as potential adjunct therapies.

Ginger, known for its antioxidant and anti-inflammatory properties, has been used historically in medicine for its anti-inflammatory effects. Its bioactive compounds inhibit pathways involved in inflammation, such as COX-2 and LOX. Studies using both laboratory and animal models have demonstrated ginger's antiarthritic effects. Among ginger's bioactive compounds, 6-shogaol has shown promising effects in protecting against cancer, inflammation, oxidative stress, and neurodegeneration. Research indicates that 6-shogaol can reduce paw edema, leukocyte infiltration, and arthritis symptoms in animal models. Similarly, zingerone, another compound in ginger, has been found to alleviate inflammation and oxidative stress in arthritis models.

Recent studies have highlighted the efficacy of specific ginger compounds in RA treatment. For instance, 8-shogaol has shown inhibitory effects against TNF-α, IL-1β, and IL-17-mediated inflammation in synovial cultures, as well as improvements in joint pathology and inflammatory biomarkers in animal models. Additionally, clinical trials have demonstrated reductions in inflammatory markers like IL-1B, hs-CRP, and TNF-α with ginger supplementation in RA patients.

Overall, ginger holds promise as a complementary therapy for RA due to its anti-inflammatory and antioxidant properties, offering potential benefits in managing symptoms and reducing inflammation associated with the disease.

- **Resveratrol**

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

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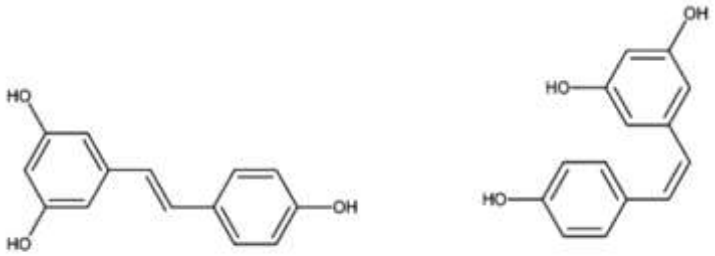
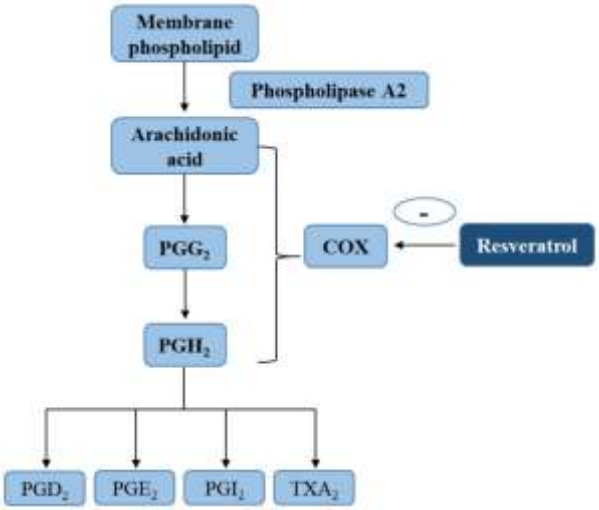
regulate this response by acting as an anti-inflammatory agent. Many studies, both in the lab and in animals, have shown how resveratrol can control inflammation and boost the immune system.

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.

**CONCLUSION**

By the research outcome in conclusion, research on Phyto preparations with anti-inflammatory properties shows promising potential for managing various diseases. Compounds like quercetin, galangin, gingerols, shogaols, and resveratrol

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have demonstrated significant anti-inflammatory effects in both lab studies and clinical trials.

These preparations work by modulating inflammatory mediators, suppressing inflammatory pathways, and enhancing antioxidant defences. They offer hope for conditions like atopic dermatitis, rheumatoid arthritis, inflammatory bowel disease, and neuroinflammatory disorders.

Their generally safe profiles make them attractive treatment options, either alone or alongside conventional therapies. However, more research is needed to determine the best dosages, treatment durations, and potential interactions with other medications.

Overall, Phyto preparations with anti-inflammatory properties present a promising path for developing new treatments for inflammatory diseases, with potential benefits for patient care and management.

**ACKNOWLEDMENT**

Creating awareness about the use of medicinal plants for Anti-inflammatory disease involves strategic communication and education campaigns. Here are some effective ways to promote awareness:

Educational Workshops and Seminars:

- Organize workshops and seminars in community centers, schools, or healthcare facilities.
- Invite healthcare professionals, herbalists, or experts to speak about the benefits of medicinal plants for heart health.
- Provide informative materials and resources.

Public Talks and Webinars:

- Conduct public talks in community spaces or online webinars accessible to a wider audience.
- Discuss the scientific basis of medicinal plants, their benefits, and how they can complement traditional treatments for Inflammatory disease.

Collaboration with Healthcare Providers:

- Collaborate with local healthcare providers to integrate information about medicinal plants into their patient education programs.
- Encourage healthcare professionals to discuss complementary approaches with patients.

Remember to use evidence-based information, consult with healthcare professionals, and emphasize the importance of integrating medicinal plant use with existing medical treatments. Ongoing campaigns and consistent messaging can contribute to increased awareness and acceptance within the population.

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