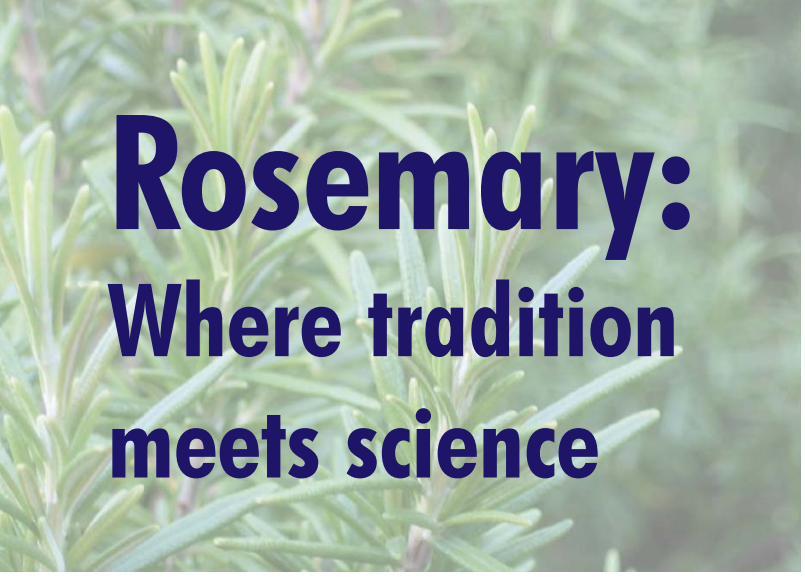

Rosemary: Where tradition meets science

Rosemary is a bushy shrub with whitish blue flowers that grows wildly along the coasts of the Mediterranean.[1] It has been cultivated since ancient days in Europe, Central America, and other regions[2]. Now it is a common household plant that is used for flavoring and in cosmetics, and whose fragrant needle-like leaves are used in cooking.[3] Rosemary has been used in folk medicine as an antispasmodic, for relief of respiratory disorders, and for stimulating hair growth. It has also been used as a pain killer, a diuretic, and for human fertility. Its extracts relax the smooth muscles of the trachea and intestine and have antioxidant, liver protective and tumour fighting activities.[2] One of the ancient cult plants, it is closely associated with love and marriage, birth and death, and is still used in bridal bouquets in England and Germany as a symbol of remembrance. Rosemary was also traditionally put in the cradles of infants to guard against harm.[2] Modern science is now showing that rosemary extracts can indeed guard against certain kinds of harm, including the damage caused by allergies and inflammation.

Dealing with Allergies

Studies of rosemary have found that its major chemical components are polyphenolics with antioxidant activities. These substances include rosmarinic acid, caffeic acid, carnosolic acid, rosmanol and carnosol.[4] Besides acting as antioxidants to prevent cell damage, several of rosemary's components also serve to block inflammation. Allergies are inextricably linked with inflammatory processes since inflammation is the mechanism behind most of the unpleasant and potentially dangerous allergic symptoms. Inflammatory events involve very complex pathways, and can be blocked at a number of steps in a variety of ways. The initiation and continuation of inflammation is caused by inflammatory signaling mediators such as prostaglandins, leukotrienes, chemokines and cytokines. Histamine is another signaling molecule whose effects contribute to a number of allergic symptoms. Anti-inflammatory compounds often work by blocking such mediators. Immune cells such as macrophages, eosinophils and basophils play an important part in the pathogenesis of allergic disease by releasing inflammatory mediators. Mast cells are particularly detrimental because they store histamine and other agents of allergy inside granules, all ready to be released as soon as the signal is given.

Blocking the activation of these cells can reduce allergic responses. Inflammation can also be modulated by preventing the recruitment of inflammatory cells to the tissues being targeted for an allergic response, and blocking their infiltration into these tissues.[5]

Rosemary's Anti-inflammatory Team

One of rosemary's key components, rosmarinic acid, is a substance that is well absorbed from the gastrointestinal tract and that has therapeutic potential in the treatment and prevention of bronchial asthma, spasmogenic disorders, peptic ulcers, inflammatory diseases, liver toxicity, atherosclerosis, ischemic heart disease, and even cancer.[2] In the inflammatory process, rosmarinic acid increases the production of anti-inflammatory signaling molecules while reducing the production of pro-inflammatory leukotrienes. It also inhibits a key step of the complement system.[6] This system is a biological cascade that provides an alternate pathway of inflammation, eventually leading to increased blood vessel permeability, recruitment of inflammatory cells, enhancement of platelet activation and aggregation, and an enhancement of proinflammatory signal molecule production.[2]

Another of rosemary's main components, caffeic acid, also has benefits in inflammatory conditions. When tested against various anti-inflammatory plant polyphenols, caffeic acid showed the most potent inhibition of tumour necrosis factor alpha, a major pro-inflammatory cytokine.[7]

Carnosic acid also has anti-inflammatory actions. In chronic inflammation, cytokines induce the production of nitric oxide (NO), which shifts the balance of the immune system to favor inflammation. Elevated levels of NO are found in patients with allergic diseases such as asthma.[8] A study of rosemary extract found that it was able to suppress the production of NO. This activity was attributed to carnosic acid and carnosol.[3]

Furthermore, the antioxidant properties of rosemary's extracts can help reduce the cellular damage caused by free radicals that are released during the inflammatory process.[2]

Outside the Test Tube

While the anti-allergic and anti-inflammatory properties of rosemary's components have been well tested in cell studies, they also hold up *in vivo*. One study found that rosemary's volatile oil inhibited the contraction of tracheal smooth muscle induced by acetylcholine and histamine in rabbits and guinea pigs.[9] Rosemary also blocked the complement system in various animal models[6], and inhibited cutaneous anaphylaxis (a severe allergic reaction) in rats, blocked the activation of macrophages in mice, and reduced paw swelling in rats.[2]

Another study tested the effects of a rosemary extract in mice that were exposed to diesel exhaust particles. These pollutants exaggerate the severity of allergic conditions and are involved in increased morbidity and mortality from lung diseases[10]. In this study, lung inflammation in mice was characterized by the infiltration of immune cells into lung tissue, by the cellular profile of bronchoalveolar lavage fluid, and by histological examination. Mice that were exposed to diesel exhaust particles and given rosemary extract had significantly less lung inflammation and suppressed expression of proinflammatory signaling molecules compared to mice that were only exposed to the exhaust. Rosemary also inhibited the increase in numbers of inflammatory cells.[11]

Rosmarinus is Latin for "dew of the sea". While not quite accurate, the name evokes entirely appropriate images of refreshment. By blocking inflammation at a number of levels, rosemary helps to cool the heat of inflammation and sooth the irritation of allergies.

Therapeutic Potentials of the Rosemary Plant[2]

Pharmacological Actions	Therapeutic Potential
1. Relaxation of bronchial smooth muscle	Bronchial asthma
2. Relaxation of intestinal smooth muscle	Antispasmodic
3. Reduction of leukotrienes and increased PGE2 production	Bronchial asthma, Peptic ulcer, Inflammatory diseases
4. Inhibition of lipid peroxidation	Hepatotoxicity, Atherosclerosis and Ischaemic heart disease, Inflammatory diseases, Asthenozoospermia
5. Inhibition of the complement pathway	Inflammatory diseases
6. Prevention of carcinogen-DNA adduct formation	Cancer (protection)

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