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Role of Bioactive Components of Indigenous Herbs in Combating Inflammation

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ABSTRACT

Inflammation being a Biological process in which protective cells of our body like white blood cells as well as other substances safe guard us from infections with certain foreign substances such as bacteria or viruses etc which might act as antigens. It regulates secretion of certain hormone like substances like prostaglandins besides this other substances particularly enzyme fractions like cyclo oxygenase, Lipoxygenase etc that induce inflammation. However there are certain Bioactive components in food products especially certain herbs which help in modulating metabolic processes and help in reducing inflammation thereby ensuring better health. Thus by consuming a diet containing appropriate anti inflammatory bioactive compounds like curcumin, eugenol, anthocyanins etc we can stimulate our positive health and wellbeing.

KEYWORDS: Inflammation, anti inflammatory components, Bioactive compounds, Curcumin, Eugenol, Anthocyanins, Flavanoids, Polyphenols, saponins.

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1. INTRODUCTION

Our immune system initiates a protective mechanism to combat an injury to tissue or any kind of infection which includes signs of heat, redness, pain or swelling . Hence inflammation is associated with body's immune response. The inflammation pathway in our body is regulated by certain hormone like substances called Prostaglandins these substances are derived from arachidonic acid, secreted during a chemical reaction at the site of injury. Besides this during inflammation our body secretes certain other enzymes such as cyclooxygenase , lipoxygenase , nitrate oxide synthase and many other enzymes which further induces inflammation. Nowadays several researches have highlighted chronic inflammation resulting into heart complications diabetes, obesity as well as cancer [1].Inflammation is now recognized as a type of non-specific immune response. [2]

The resultant of acute inflammation can be summarized as acronym PRISH which includes Pain: An individual may experience pain in inflamed area on touching. Redness: At the inflamed point the capillaries are filled with more blood than normal. Immobility: Resulting from loss of functionality in a particular area. Swelling: This happens due to fluid retention in that area. Heat: In the effected area the blood supply increases this results in feeling of warmth[3].

Inflammation is result of reactions initiated by immune system resulting from certain physical injury or infection. Certain common causes of inflammation include Burns, Frostbite, hypersensitivity reactions, Physical injury, Blunt or penetrating Foreign bodies, tissue necrosis etc. Biological : Infection might be caused by Stress, toxins etc. Psychological : Embarrassment , depression, anxiety etc[4].

Besides this the othe causes of inflammation include certain diseases like Acne vulgaris, Diabetes, Asthma, certain cancers, celiac diseases, hypersensitivity , cardiovascular disease, Alzeimer's disease, Rheumatic fever, Rheumatoid arthritis, Transplant rejection, Vasculitis , Hidradenitis suppurativa , Diverticulitis , Interstitial cystitis[5]. Certain dietary components provide alternative tools for treating inflammatory diseases

Thus by consuming an anti-inflammatory diet which focuses on foods that help in maintaining optimal health and help fighting inflammation in the body by creating anti-inflammatory prostaglandins (PGE1 and PGE3) in body which in turn fights against inflammation can prove to be quiet beneficial [6]. Various food components such as polyphenols , flavanoids , saponins , anthocyanins , eugenol , Curcumin , helps in inhibiting inflammation causing enzymes and blocking their pathway which further reduces inflammation[7].

2. CURCUMIN

Curcumin being the principal Curcuminoid a phytochemical extracted from Indian spice turmeric a member of ginger family (Zingiberaceae). It has wide application as well as a topical ointment in treating of inflammation since ancient times[8]. Curcumin has potent anti inflammatory effect with specific lipoxygenase and COX-2 inhibiting properties [9]. Curcumin has been shown as a powerful scavenger of oxygen free radicals. Its antioxidant properties are comparable to vitamin C and E. It can protect lipids and haemoglobin from oxidation[10]. Several clinical trials in carcinogenic studies have proved that daily supplementation of 3.6g of curcumin is beneficial for cororectal cancers.

Commercial grade curcumin contains 10-20% curcuminoids, desmethoxycurcumin and bisdesmethoxycurcumin[11]. Anti inflammatory properties of curcuma longa are attributed to its ability to inhibit biosynthesis of inflammatory prostaglandins during inflammatory state. It also has topical application during allergic skin conditions [12].

3. EUGENOL

Eugenol is a natural bioactive compound obtained from Syzygium aromaticum ie clove . It has great therapeutic potential and is incorporated in treatment of ceratin cancers also used commonly as flavoring agent in dietary products, cosmetics and has specific application in dentistry. Eugneol can be extracted from ceratin plant sources like clove, basil, cinnamon, lemon as well as nutmeg. It is major component in drugs used in treatment of bacteria, fungal, viral as well as paracitic infections.It is used as an antiseptic , anti ulcer, an anesthetic and anti-inflammatory.Eugenol is used as flavor , irritant, sensitizer and provides instant relief from pain when applied to skin or any other injured part of body. It even possesses anti inflammatory as well as anaesthetic activity besides this several researchers have proved its membrane stabilizing properties on synaptosomes, eruthrocytes as well as mast cells[12].

Eugenol being primary component extracted from clove and is present in volatile oils prepared from it functions as an anti inflammatory agent. The anti inflammatory effect produced from essential oil of Eugenia matches to that of Etodolac at 0.025 and 0.1 ml/kg and to that of Indomethacin at 0.0.5 and 0.2 ml/kg [13].

Anti inflammatory effect of Eugenol is contributed to its inhibitory response to formation of prostaglandins by COX ie cyclo oxygenase released by membrane phospholipids in response to inflammation. The anti inflammatory effects of eugenol inhibits the release of these enzymes which reduces inflammation with reduced risk of several cancers ,degenerative diseases and various other consequences of inflammation[14] .

4. ANTHOCYANIN

Subgroup of flavanoids commonly distributed in nature include Anthocyanins. They are considered as universal plant colorant as they are responsible for red, purple and blue hues evident in several fruits as well as vegetables like berry fruits, red radishes, and spinach. Anthocyanins are known for several health benefits like protection against liver injuries, reduction in blood pressure, improvement in eye sight, strong anti inflammatory and anti microbial activities as well as inhibiting mutations and suppression of proliferation of human cancer cells[15].

Anthocyanins have proved to be potential replacement for synthetic colours in food industries owning to their health benefit as well as antioxidant effects which further helps in inhibiting oxidation of LDL chlosterol. Anthocyanins have proved to be beneficial in cardiovascular complications through their vasoprotective and anti inflammatory . Commercial products prepared from anthocyanin-rich extracts are sold commercially to treat microcirculation disease and for maintaining normal vascular permeability. Oral administration of berry anthocyanin have proved be a safe promising supplement for patients with open angle glaucoma it even has a protective effect on visual function at the time of inflammation [17].

5. FLAVANOIDS

Flavanoids occur naturally as major componenet of fruits, vegetables, grains, bark, roots etc and hence are widely distributed in plant kingdom. They are diverse group of phytonutrient with variable phenolic structures and are responsible for the vivid colors in fruits and vegetable[18]. Flavonoids and carotenoids are color pigments present in fruits and vegetables. They are the largest group of phytonutrients with more then 6,000 types. Most common flavanoids in nature is quercetin and kaempferol which display beneficial effect in inflammation the most important source of these flavanoids being apple, onion, broccoli etc[16].

Historically flavanoids had an application in Chinese as well as Ayurvedic medicine and are related to skin protection, brain functioning, blood sugar maintenance. Group of flavanoids include anthocyanidins, flavanols, flavones, flavanols etc. Several invitro clinical trials have proved that flavanoids like Quercetin inhibit production of nitric oxides. Several other researches have proved effect of flavanoids on variety of inflammatory processes as these phytochemicals inhibit series of enzymes activated during course of inflammation. Inflammation results in synthesis of prostaglandins and nitric oxide synthetase (Inos) and of cyclooxygnege (COX-2) but flavanoids have respond to have contradictory effect on all [19].

6. POLYPHENOLS

Polyphenols have antioxidant properties and are synthesized by plants for their antibiotic, antifungal and anti inflammatory features. Therefore these chemicals naturally occur in plants and there are more than 500 different types of polyphenols collectively known as phytochemicals. Plant products like grains , berries , legumes , tea , beer , grape , wine , olive oil etc are rich sources of polyphenols[20]. These are secondary metabolite of plants[21].

Several epidemiological researches have highlighted that consumption of diets rich in plant polyphenols protect us from several non communicable diseases like diabetes, osteoporosis as well as neuro degenerative diseases. Polyphenols present in red wine, beer etc are readily metabolized into phenolic acid and aldehydes by certain micro flora present in intestine and are further recognized for their anti inflammatory role[22].

The anti-inflammatory properties of polyphenols at multiple levels by modulating function of cyclooxygenase, lipoxygenase, nitric oxide synthases and NF-Kb helps in inhibition of production of certain inflammatory cytokines etc by suppressing the activity of Cyclooxygenase(COX) and Inducible nitric oxide synthase (INOS), Nitric oxide (NO), released by certain enzymes[23].

Hence Cyclooxygense inhibition caused due to polyphenols is the causal factor behind its anti inflammatory property which further reduces prostaglandins synthesis. Hence it is recommended to use polyphenols liberally[5]. Mitogen activated protein kinase (MAPKs) and Nuclear transcription factor(NF-κB) these are factors which are activated by inflammatory stimuli have important activities as mediators of cellular responses to extracellular signals and this contributes in controlling pro -inflammatory molecules produced in cellular responses and result in inflammation [14] Hence due to all these beneficial properties polyphenols have been investigated extensively targeting pharmacological treatments of inflammatory disorders [24].

7. SAPONINS

Saponins are classified as glycosides with one or more sugar chain on triterpene steroid aglycone skeleton. Sapogenin is a common term used for A glycone backbone of Saponin. Saponin are amorphous substances with high molecular weight, souable in water as well as alcohol, historically they are recognized for their biological activities like anti oxidant, immune stimulant, anti hepatotoxic, anti bacterial as well as anti carcinogenic. Their physiochemical and biological properties reflect their structural diversity which are further exploited for commercial[25].

Saponin being phytochemical are found in vegetables, beans and certain herbs. Among the best sources we have peas, soyabeans etc. However commercially saponins are extracted from Yucca Schidigera and Quillaja Saponaria. Saponins are usually found in oats, peppers, aubergine, tomato

seed, alliums, asparagus, yam, fenugreek, yucca and ginseng [26]. Several clinical trials have highlighted that a dose of 100 and 200 mg/kg shows significant ($p \leq 0.05$) anti-inflammatory property. Traditionally saponins in foods have been found to be bitter as well as unpleasant[27]. Therefore previous researches have emphasized in removing saponins from human condumption [28]. Recently focus has been shifted to saponins because of certain proven health benefits29. Saponins are major component present in many herbal medicines and major contributor to health benefits of humans[30].

8. FUTURE PROSPECTS

Inflammation is a natural protective mechanism of in individuals body which is triggered in response to an injury or infection and further activates our immune system . This inflammation pathway stimulates production of certain hormone like substances. Recent researches on several bioactive compounds present in food sources have emphasized on their anti inflammatory role and thereby certain health benefits which can be attained by their regular incorporation in diet. However a strong database need to be prepared by conducting human intervention trials to come up with a safe intake level on daily basis without any side effects.

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