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A Review on Role of Plants in Inflammation Regulation and its Mediatrors

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ABSTRACT

The inflammatory response is a crucial aspect of the tissues' responses to deleterious inflammogens. This complex response involves leukocytes cells such as macrophages, neutrophils, and lymphocytes, also known as inflammatory cells. In response to the inflammatory process, these cells release specialized substances which include vasoactive amines and peptides, eicosanoids, proinflammatory cytokines, and acute-phase proteins, which mediate the inflammatory process by preventing further tissue damage and ultimately resulting in healing and restoration of tissue function. This review aimed to reemphasize the importance on the knowledge of inflammatory processes with the addition of newest and current issues pertaining to this phenomenon.

Keywords: chemokines, cytokines, inflammatory mediators, inflammatory response

INTRODUCTION

ROLE OF PLANTS IN INFLAMMATION REGULATION

Unlike modern Allopathic drugs which are single active compounds that can specifically target one pathway, herbal remedies work in a way that depends on orchestral approach. A plant contains a multitude of several molecules that synergistically act on targeted elements of the cellular complex pathway [(3)]. Medicinal herbs have been source of wide range of biologically active compounds for many centuries and they have been used extensively as crude drugs or as pure components for treating varieties of disease conditions. When compared to synthetic ones, natural remedies are having less side effects and toxicity. So, now days the usages of herbal remedies are increased when compared to allopathic drugs [(4)]. In the development of potential therapeutic agents, medicinal plant plays an important role. There are over 1.5 million practitioners of traditional medicinal system using medicinal plants in preventive, promotional and curative applications [(5)]. India with its biggest repository of medicinal herbs in the world may maintain an important position in the production of raw materials either directly for crude drugs or as the bioactive components in the formulation of pharmaceuticals and cosmetics etc [(6)].

ACUTE INFLAMMATION

Acute inflammation is a short procedure, lasting from minutes to a few days, and its major features are leakage of plasma proteins or fluid and movement of leukocytes into an extravascular area. These cellular and vascular reactions are intermediated by chemical factors produced from cells or plasma and are responsible for the classic clinical symptoms ofinflammation such as swelling, redness, pain, warmth, and loss of function. Even though an inflammatory response can happen in any injurious stimulus, the characteristic of this process is the reaction of vascularized connective tissue[3].There are three main steps in acute inflammatory responses which include enhanced blood flow to inflame area, followed by vasodilatation and enhanced vascular permeability with leakage of plasma from the microcirculation, and phagocytic leukocyte migration to the surrounding tissue [(1,2,3)]

INFLAMMATORY MEDIATORS

Different types of inflammatory mediator's synthesis or activation leads to produce inflammation. Those inflammatory mediators include.

- Histamine
- Serotonin
- Prostaglandins
- Leukotrienes EICOSANOIDS
- Platelet activating factors

HISTAMINE

Histamine is naturally occurring imidazole derivative. It is widely distributed in skin, GIT, mucosa, lungs, brain, cerebrospinal fluid and bone marrow. It is also a component of some venoms and sting secretions. Histamine is present mostly within storage granules of *mast* cells.

Histamine is formed by the decarboxylation of the amino acid L-histidine. This reaction is catalysed by the enzyme histidine decarboxylase. Histidine decarboxylase has a wide distribution, eg., in most of the tissues, mast cells, GIT mucosa and in certain actively growing tumours. Activators of histidine decarboxylase enzyme are gastrine, nicotine, stress or even in function. Its selective inhibitor is *α-flouromethyl histidine.*

Mast cells are the predominant site of storage for histamine in most of the tissues. In these mast cells histamine is held in intracellular granules complexed with an acidic protein and heparin of high molecular weight. In blood, histamine is stored in basophils which resemble mast cells only. The non-mast cell histamine is stored in histaminocytes in the stomach and in histaminergic neuron in the brain. The stores of histamine from the mast cells can be released by any of the following mechanisms.[8]

IMMUNOLOGIC RELEASE

Initial exposure to allergen leads to the production of IgE antibodies which then bind to their respective IgE receptors present on tissue mast cells or blood basophils. Re-exposure to the allergen leads to cross-linking of mast cells membrane bound IgE. This union causes degranulation of cytoplasmic granules and release of histamine with other allergic mediators. This type of release requires energy and Ca^{2+}.

CHEMICAL AND MECHANICAL RELEASE[9]

Chemical or mechanical mast cell injury causes degranulation of mast cell and hictamine release. Certain drugs like morphine, succinylcholine, d-tubocurarine, and radiocontrast media directly replace histamine from heparin-protein complex, within the mast cells, by non receptor action. After exocytosis, the histamine- heparine-complex is exposed to extracellularcations (Na^+ or Ca^+) where histamine is displaced and released after cationic exchange with Na^+ or Ca^+.

ROLE OF HISTAMINE IN ACUTE INFLAMMATION

Histamine has been established to play a pathophysiological regulatory role in cellular events through binding to four types of G-protein coupled histamine receptors that are differentially expressed in various cell types. Histamine [2-(4-imidazolyl)-ethylamine] is an endogenous short acting biogenic amine synthesized from the basic amino acid histidine through the catalytic activity of the rate-limiting enzyme histidine decarboxylase and widely distributed throughout the body. One of the first described functions was its ability to mimic anaphylaxis and has since been demonstrated to play a major role in inflammatory processes[7].

Histamine biologically active substance found in a great variety of living organisms. It is distributed widely, albeit unevenly, throughout the animal kingdom and is present in many plants and bacteria and in insect venom.

Histamine is chemically classified as an amine, an organic molecule based on the structure of ammonia (NH3). It is formed by the decarboxylation (the removal of a carboxyl group) of theamino acid histamine. Histamine is a chemical neurotransmitter produced by the body during an allergic reaction, most noticeably causing skin, nose, and throat and lung irritation. These reactions are part of the inflammatory response, which is an important part of the overall immune response.[10]

PATHOPHYSIOLOGICAL ROLES

PAF has been implicated in many pathological states and some physiological processes by mediating cell-to-cell interaction.

These are:

Inflammation: Generated by leukocytes at the site of inflammation PAF appears to participate in the causation of vasodilatation, exudation, cellular infiltration and hyperalgesia.

Bronchial asthma: Along with LTC4 and LTD4, PAF appears to play a major role by causing broncho constriction, mucosal edema, recruiting eosinophils and provoking secretions. It is unique in producing prolonged airway hyper reactivity, so typical of bronchial asthma patient.

Anaphylactic (and other) shock conditions: are associated with high circulating PAF levels.

Haemostasis and thrombosis: PAF may participate by promoting platelet aggregation.

Rupture of mature graafian follicle and implantation: Early embryos which produce PAF have greater chance of implanting. However, PAF is not essential for reproduction.

CONCLUSION

The formalin and egg white albumin induced paw edema model is used to evaluate the anti inflammatory activity of rodents. Results obtained on the formalin and egg white induced paw edema model after treatment with MLELP (200mg/kg and 400mg/kg) revealed anti inflammatory activity. PAF has been implicated in many pathological states and some physiological processes by mediating cell-to-cell interaction.

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