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MARINE NATURAL PRODUCTS AS ANTI-INFLAMMATORY AGENTS

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Abstract
Today, the majority of medications used to treat illnesses are natural compounds. Marine creatures, which offer enormous potential as a source of novel active chemicals, have been the subject of study that began with terrestrial organisms. Gorgonian octocorals are a well-known source of naturally occurring bioactive substances among marine organisms. Often present in octocorals, the diterpenes are a class of chemicals having a variety of biological actions, such as antibacterial, antiviral, antifungal, anticancer, anti-inflammatory, and antiprotozoal properties. The pseudopteranes, a family of about 30 diterpenes, are a special kind of diterpene that is only found in marine environments. Despite being common, nothing is known about the biological actions of the majority of these diterpenes. Though newer marine molecules do harbor many with very impressive biological activity, setting up definite mechanisms of action is not easy. Most marine natural products research inclines to determine activity against one specific target only. These approaches do not guarantee any target discovered to be the sole, or even the primary, mediator of the biological activity and only occasionally compounds are probed to an extent sufficient to elucidate the mechanisms of action of marine natural products or their analogues. Here, we outline the anti-inflammatory properties of variously structured diterpene molecules.
Keywords: Marine, Natural Products, Anti-Inflammatory, Agents

INTRODUCTION

The host's reaction to endogenous sterile damage stimuli or external stimuli like pathogens is inflammation. The recruitment and deposition of immune cells in injury sites, as well as the generation of soluble mediators such chemokines, lipid mediators, cytokines, and reactive oxygen and nitrogen species, are its defining characteristics. Although they can worsen tissue injury, these mediators are crucial for reducing inflammation and promoting tissue repair [1]. Cellular pattern recognition receptors (PRR), including Toll-like receptors (TLRs) and NOD-like receptors (NLRs), are responsible for detecting pathogens or damage-associated molecular patterns (DAMPs), which triggers the inflammatory response by activating particular pathways (Martinez et al. 2009). Depending on the triggers and the type of immune response triggered, macrophages are among the most important cells engaged in both the resolution and the exacerbation of inflammation. Inflammatory mediators such as nitric oxide (NO), TNF-α, IL-1β, IL-6, and cyclooxygenase (COX)-2 are produced when macrophages are activated by PRRs or by cytokine receptors, such as the tumor necrosis factor (TNF)-α and interleukin (IL)-1β receptors (TNFR and IL1R, respectively) [2]. Inducible nitric oxide synthase (iNOS) produces NO from macrophages, which may be advantageous because of its anti-tumoral, immunomodulatory, and anti-pathogenic qualities. Nonetheless,

persistent and excessive NO generation is detrimental to the host and plays a significant role in the etiology of numerous illnesses (Kleinert et al. 2004). TNF-α and IL-1β, which have an autocrine and paracrine action on immune cells that play an amplifying role in inflammation, are also enhanced in inflammatory diseases. In other cell types, such as macrophages, PRRs generate intracellular signaling cascades that activate and nuclear translocate nuclear factor-κB (NFκB), leading to the production of most of the mediators mentioned above [3]. The transcription of numerous genes involved in apoptosis, proliferation, cell adhesion, stress response, and tissue remodelling is also regulated by NFκB activation. Since NFκB plays a role in both acute and chronic inflammation as well as all other human clinical illnesses, it is a good target for the development of new anti-inflammatory medications [11]. Depending on the triggers and the pattern of the induced immune response, macrophages are among the most significant cells engaged in the resolution or worsening of inflammation. When macrophages are activated through PRRs or cytokine receptors, such as the TNFR and IL1R receptors for tumor necrosis factor (TNF)-α and IL-1β, respectively, inflammatory mediators such as nitric oxide (NO), TNF-α, IL-1β, IL-6, and cyclooxygenase (COX)-2 are produced. Inducible nitric oxide synthase (iNOS) produces macrophage-generated NO, which has anti-tumoral, immunomodulatory, and anti-pathogenic qualities that may make it beneficial. However, excessive and ongoing NO generation is detrimental to the host and contributes to the etiology of certain disorders (Kleinert et al. 2004). In inflammatory conditions, there is also an excess of TNF-α and IL-1β, which have an autocrine and paracrine influence on immune cells, intensifying the inflammatory process[15]. PRR-induced intracellular signalling cascades in many cell types, such as macrophages, activate and nuclear translocate nuclear factor-κB (NFκB), which results in the production of the majority of the mediators indicated above. Additionally, the expression of several genes involved in apoptosis, proliferation, cell adhesion, stress response, and tissue repair is regulated by NFκB activation. Since NFκB plays a role in both acute and chronic inflammation, among other human pathological processes, it is a legitimate target for the creation of novel anti-inflammatory medications[4].

MATERIALS AND METHODS

Vasodilation, increased blood flow, vascular permeability, and cellular extravasation are all components of inflammation, a complicated biological reaction to pathogens or tissue damage. Innate immune cells, including monocytes and polymorphonuclear cells, are drawn to the site of irritation and release inflammatory mediators, including cytokines, chemokines, and free radicals, which intensify the response[6]. This is known as acute inflammation. However, chronic inflammation describes the persistent inflammatory process that results from the dysregulation of acute inflammation, which is typically brought on by ongoing injury, autoimmune disease, or extended exposure to the causative irritant[5]. Numerous pathogenic illnesses, including cancer, autoimmune diseases, atherosclerosis, rheumatoid arthritis, asthma, and cardiovascular diseases, are linked to chronic inflammation [13].

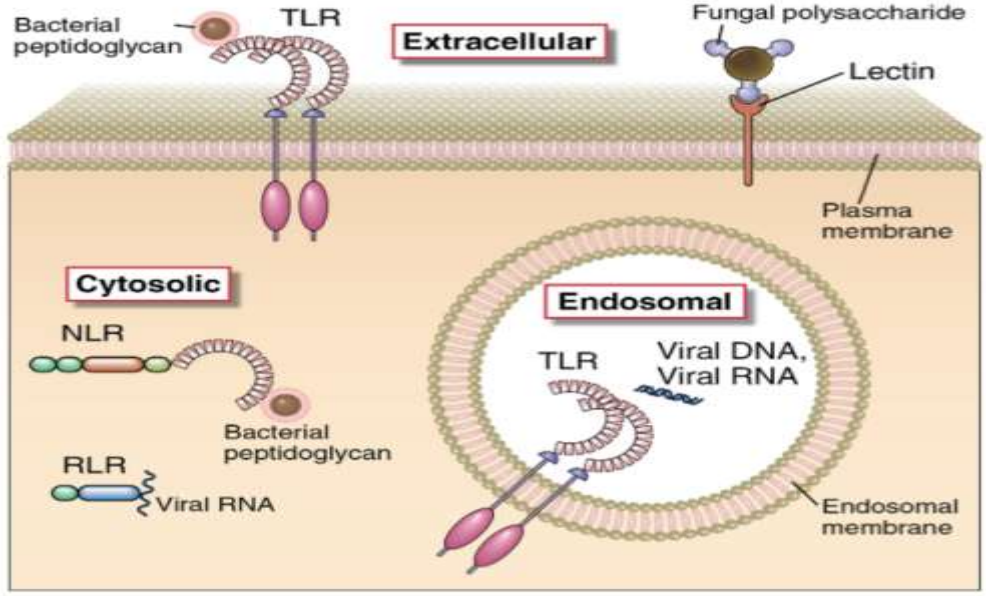

Figure 1: Pattern recognition molecules of innate immunity

The worth of medicinal herbs, spices and medicinal plants as medical herbs is being lost day by day because of deforestation and lack of awareness[9]. Because of this, loss and unavailability of many valuable medicinal herbs have been caused and hence the valuable information gets lost. Medicinal herbs have been used to treat diseases from ancient times. During ancient times when there was no practice of modern medicine, people got sick and

suffered from diseases. Without interference from modern medical therapies people were healed by herbal medicine. That is drawn from herbs and spices [14]. There is space for some medicinal spices and herbs in daily uses while a good number are taken as herbal medicine. Use of herbal medication in healing some of the minor illnesses like common cold, cough, etc. is widespread in relation to the traditional medicine. Enrollment of herbal industry in the production of herbal health care products, herbal based cosmetics and herbal nutritionals worldwide has raised industrial demand for the medicinally valued plant resources. The use of traditional medicine in the delivery of primary health care for rural societies in developing countries, developed countries, and where predominantly modern medicines are applied is approximately 60 per cent of the world population. The traditional medicine comes from medicinal plants, minerals, and organic substances, whereas the herbal medicines are prepared from medicinal plants.

RESULT AND DISCUSSION

The practice of using plants as medicine has been passed down through the generations in India and is a vital part of Indian healthcare. Since many practitioners in Indian traditional medical systems make and administer their own formulas, appropriate documentation and study are necessary. Nearly 40% of people in the western world have been found to utilize herbs to address medical conditions, indicating a growing trend in the usage of herbal medicine. The growth is exponential in public, academic and government sector in the use of traditional medicine due to reasons of adverse drug reaction and cost of modern system of medicine. Although the herbal products are not bearing drug regulatory clearance regarding efficacy and safety, but their conventional use will prove helpful for indications of selection, preparation and use of herbal formulation [12]. Subsequent efficiency of any medicine is established through common use. The historical facts provide source to identify and research some plant species with potentiality to be used in a specific disease. The plant that is known to be used in traditional medicine is tested in a scientific way through experimental and clinical testing for its efficacy as it is done under the practice of modern medicine. Studies in animal toxicology are also carried out to determine any possible negative consequences[7]. The primary active ingredient and suitable plant extract are determined by the efficacy tests used in experimental screening methods for both new and classic herbal remedies. To distinguish and evaluate the different preparations for potency, pharmacological activities must be demonstrated.

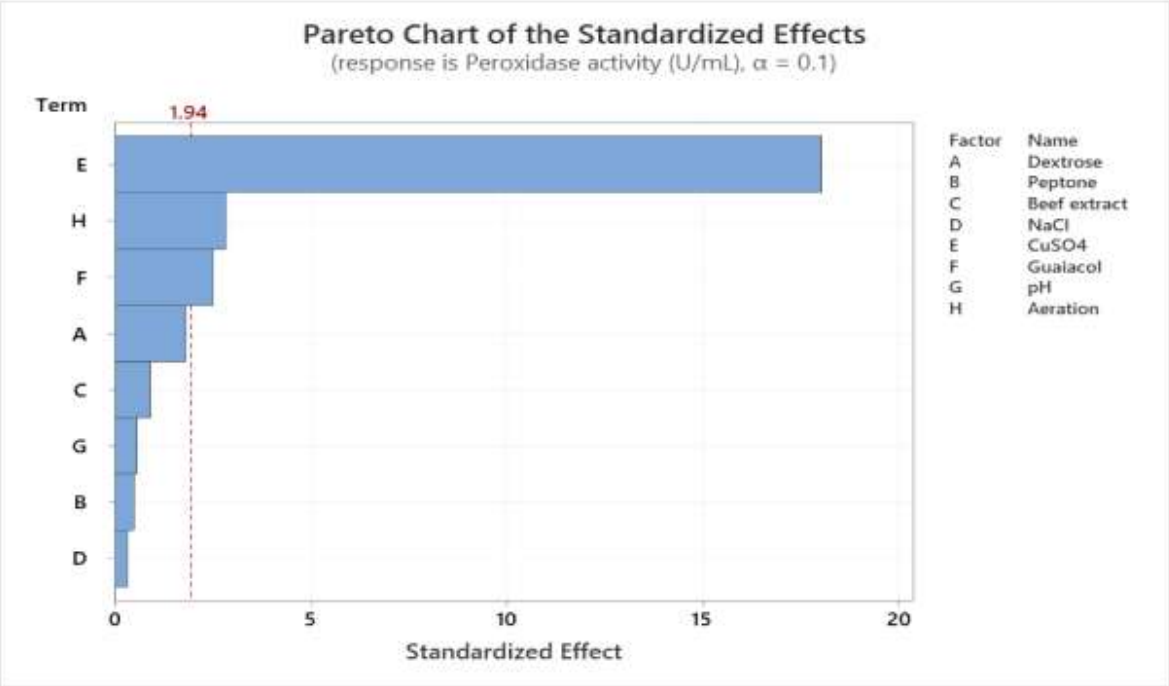

Figure 2: Pareto chart for peroxidase production using PB method

Although all of the synthetic medications are used to treat inflammatory illnesses, none of them are completely safe for human usage due to their serious adverse effects. Ninety percent of synthetic medications used to treat inflammation have been shown to cause iatrogenic effects, toxicities, and side effects that make therapy more difficult [8].

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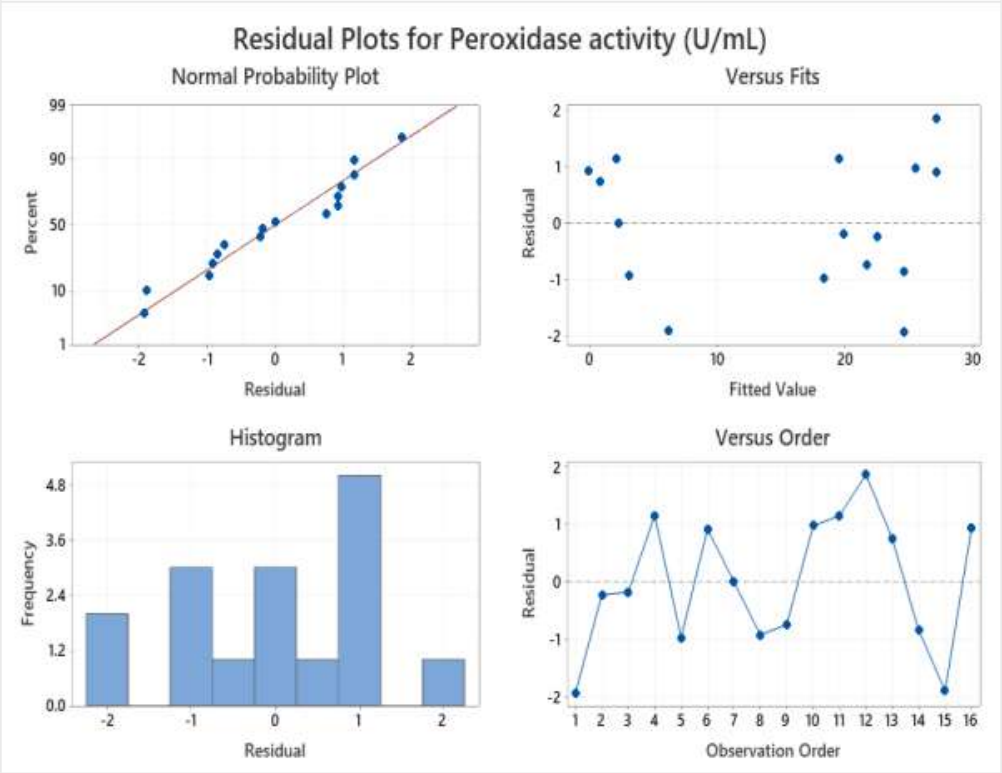

Figure 3: Residual plot of peroxidase production by PB method

Research has shown that the market shares 83% global usage of herbal medicines for treating inflammatory diseases and future value in the next couple of years is around over 95% due to fewer side effects and higher acceptability of these products. With this perspective, the present work was performed on Gentiana kurroo Royle and Artemisia amygdalina Decne to evaluate their anti-inflammatory activity. The present study may be very important to establish medicinal efficacy of the above-cultivated plants and thus look for some means out to heal inflammatory disorders with less side effect[10].

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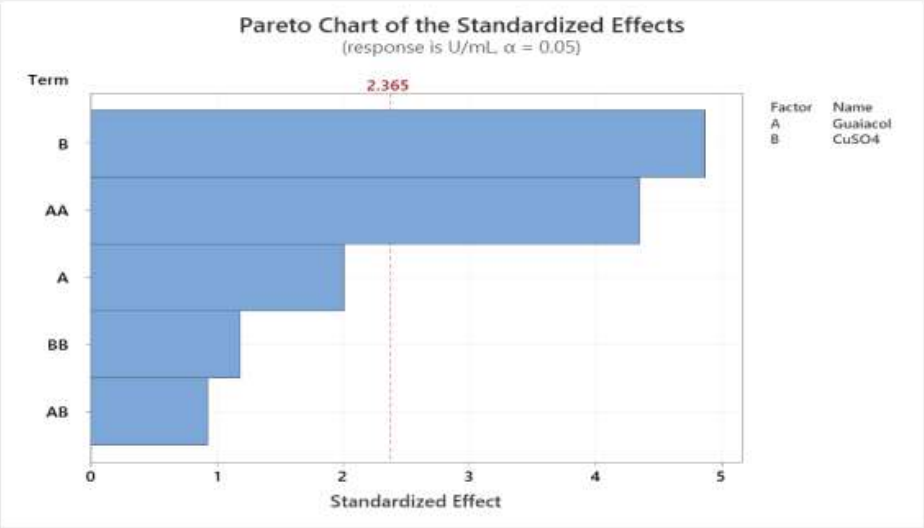

Figure 4: ANOVA table

The signals produced by damaged, stressed or otherwise hurt body tissues lead to inflammation. Since these signals are produced within the body, they are referred to as the endogenous inducers of inflammation.

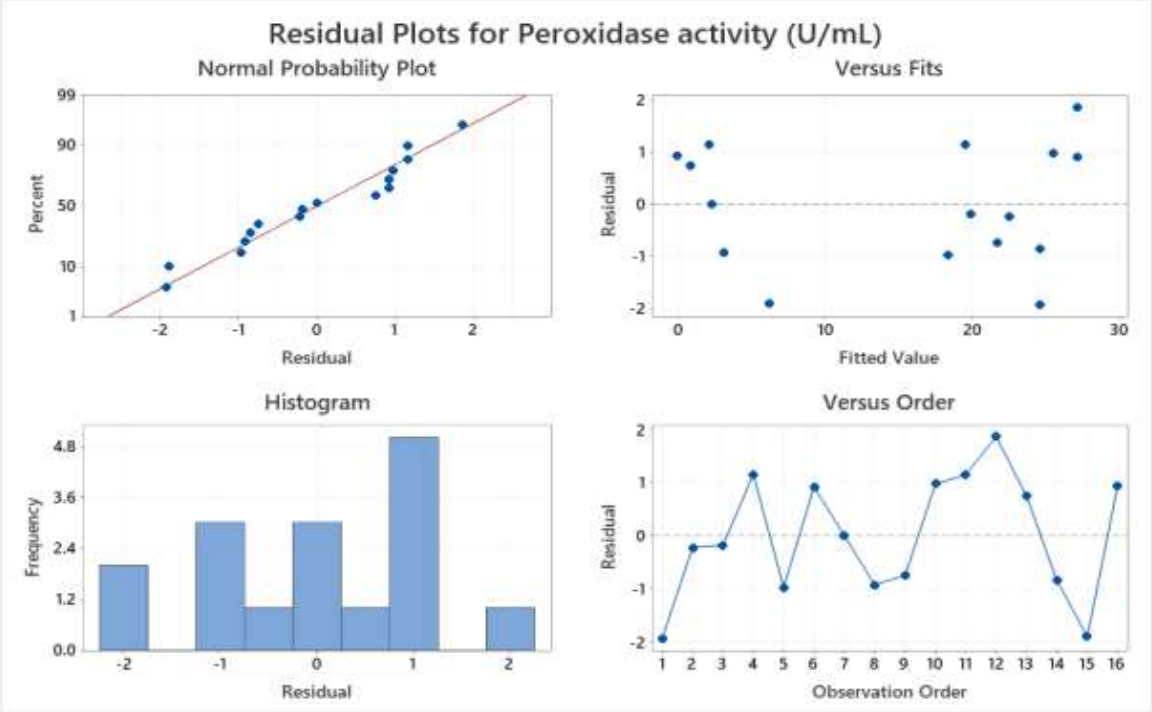

Figure 5: Residual plot of peroxidase production using RSM

These messages can be of various functional classes according to nature and degree of tissue abnormalities where they act but their detection and character are poorly known. One common mechanism of acute tissue damage is recognized by the detection of desequestration of molecules or cells that are kept in compartments in healthy tissues and cells.

CONCLUSION

Pharmaceutical as a pharmaceutical sciences discipline, is concerned with the application of nanotechnology in pharmaceutics and particularly drug delivery. Researchers from a variety of disciplines, including medicine, pharmaceutics, physics, chemistry, biochemistry, genetics, immunology, and toxicology, can collaborate to create novel drug delivery methods in the interdisciplinary field of pharmaceuticals. Nanoparticles are used in several sectors to cure cancer. Examples of nanodevices are tiny devices at the nanoscale, such as nano- and microelectromechanical systems (NEMS/MEM), microfluidics (managing and controlling micro or nanoliter of fluids), and microarrays (various types of biological assay, such as DNA, protein, cell, and antibody). A few examples include respirocytes, intelligent machines, and biosensors and detectors for the detection of symptoms of disease, biological hazards, and trace amounts of bacteria and airborne pathogens. From the perception that the world is developed by innovation, the drugs industry has been integrating nanotechnology into their drugs more and more because of the numerous benefits brought about by technology. Furthermore, nanotechnology has significantly enhanced the discovery and improvement of medications based on potentially advantageous active principles but with drawbacks that restrict their usage. The development of nano formulation holds new possibilities for the pharmaceutical business. High toxicity, active component degradation, fast release, lack of selectivity, reduced bioavailability, and poor solubility are a few of the main problems.

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