Isolated chemical compounds from natural origin with anti-inflammatory effect

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Received (11\03\2022), **Accepted** (23\03\2022)

ABSTRACT

A common condition regard as risk inflammatory state like, arthritis, cancer and obesity. NSAIDs widely prescribed for patients but safety concerns must be considered. For a long time, folk medicine has been regarded as a primary source of treatment for a variety diseases, with a great number of medications developed from natural sources. This review focus on chemical compounds isolated from natural ,which possess anti-inflammatory effect and used for treat joint , skin disorders and cardiovascular inflammation and other Inflammatory diseases. These isolated chemical compounds introduce and their biological activity has been evaluated in clinical and experimental studies. This work includes a brief and easy overview of the role of medicinal plants and their primary ingredients in the treatment of inflammatory conditions.

Keywords: anti-inflammatory, folk medicine, natural sources, chemical compounds, medicinal plants

الخلاصة

ظروف شائعة يعتبر فيها حالة الالتهاب خطير مثل التهاب المفاصل والسرطان والسمنة. توصف مضادات الالتهاب غير الستيروئيدية على نطاق واسع للمرضى ولكن يجب مراعاة مخاوف السلامة. لطالما اعتُبِر الطب الشعبي كمصدر أساسي لعلاج مجموعة متنوعة من الأمراض ، مع وجود عدد كبير من الأدوية التي تم تطويرها من مصادر طبيعية.

تركز هذه الورقة البحثية الضوء على المركبات الكيميائية المعزولة من الطبيعية ، والتي لها تأثير مضاد للالتهابات وتستخدم في علاج المفاصل ، واضطرابات الجلد والتهاب القلب والأوعية الدموية وغيرها من الأمراض الالتهابية.

حيث ان هذه المركبات الكيميائية المعزولة قد تم تقييم نشاطها البيولوجي في الدراسات السريرية والتجريبية و يتضمن هذا العمل لمحة موجزة وسهلة عن دور النباتات الطبية ومكوناتها الأساسية في علاج الحالات الالتهابية.

1. Introduction

Human being has defense mechanism against any agent has hazardous stimulate like injury and /or allergens which call inflammation, where inflammation is derived from Latin word – inflammer, mean burn, from other side a huge response of inflammation due to diverted disorder like autoimmune diseases, allergies, cancer and metabolic syndrome lead to the large economic burden on the society [1-3]. the most popular inflammatory causing agent is Immunological agent, Infective agent, Physical agent and Chemical agent. The main character of acute inflammation is pain, heat, redness, swelling and loss of function. Where Inflammation can be divided in to acute, chronic inflammation and repair [4-7]. rheumatoid arthritis and systemic lupus erythematosus are examples of inflammatory diseases. Where there are numerous medications available to treat inflammatory crisis, including immunosuppressant ,NSAIDs and cortisone to name a few examples of these drugs in practice [8].

Pharmacological effect of anti-inflammatory drugs through their inhibition of arachidonic acid path way metabolism ,where COX enzyme is target for NSAIDs that lead to inhibition the production of prostaglandins . Prostaglandins are powerful vasodilators and hyperalgesics that lead to erythema, edema, and discomfort. As a result, analgesics and anti-inflammatory drugs are required to treat inflammatory illnesses [9,10]. The cyclooxygenase enzyme is found in two isomer COX-1 and COX-2,where COX-1is found in kidney,gastric & blood vessel while COX-2 is found in kidney and brain [11].

Cyclooxygenase -1 is responsible for normal physiological function and inhibition of it lead to occur the side effect of the drugs ,while cyclooxygenase -II is responsible for mediation of inflammation ,where inhibition of COX-II is targeting for control of inflammation [12].

According to recent information, there is a third form of COX enzyme termed COX3 that evolved in the heart, brain, and spinal cord. Acetaminophen's major possible target location for controlling pain and fever is the COX3 enzyme [13].

2. Side effects of NSAIDs

Ulcers of the stomach, anemia, uncomfortable stomach, gastrointestinal bleeding, edema due to salt and water retention in the kidneys, antihypertensive drug efficacy has decreased, the effectiveness of diuretic medications has been reduced, urate excretion is reduced, hyperkalemia, headaches, vertigo, dizziness, disorientation, sadness, seizure threshold reduction, hyperventilation , extend the gestation in the uterus to prevent labor, hypersensitivity - vasomotor rhinitis, asthma, urticaria, hypotension and shock, where all above side effects are summarized in figure (1) [14-18].

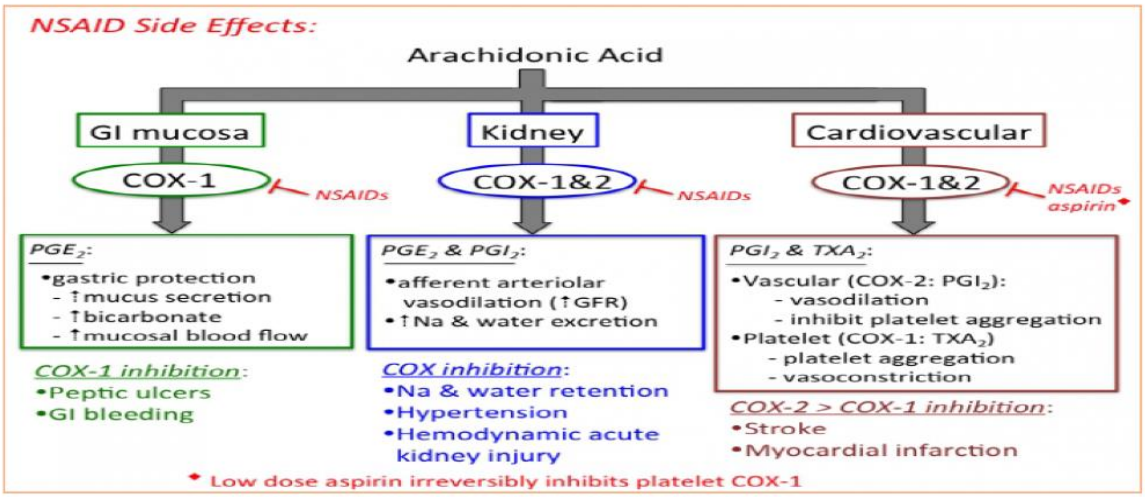


Figure 1: skim summarized side effects of NSAIDs.

3. The aim of study

The potency and learnability of traditional NSAIDs and analgesics might be eclipsed by their unpleasant side effects, despite fast evolution in the creation of numerous medications for inflammation. Our goal in practice is to employ the minimum effective dose with the highest efficacy and fewest negative effects. Natural compound research based on ethnopharmacological data has made significant contributions to medication development and opened the path for novel pharmacological approaches. As a result, natural anti-inflammatory agents must be used in conjunction with prescription therapy in order to gain enhanced responsiveness while minimizing undesired side effects. Plants, their components, or extracts have been used as anti-inflammatory agents since ancient times. For example, in Arab traditional medicine, a concentrated, viscous aqueous extract of ripe carob (Ceratonia siliqua L.) For decades, it has been used to treat mouth inflammations [19]. Many of review articles have been written in the last few decades. Remarkably, a significant proportion of them were about a wide range of therapeutic herbs. Our review focuses on some of the chemical compounds isolated from natural sources mentioned in these papers, it enumerates the anti-inflammatory properties of a wide range of plants and natural ingredients that can be used as remedies, the biological and therapeutic properties attributed to these plants, and the most important bioactive principles in these plants.

4. Medicinal plants and natural ingredients with anti-inflammatory effect

Natural ingredients have been used as cures since the beginning of time. Salicylate-containing plants were used therapeutically for many years, leading to the development of Aspirin, a key anti-inflammatory medication. Aspirin, an anti-inflammatory drug produced from natural sources, is widely utilized in present clinical practice [20]. Natural materials have inspired public and scientific interest in the treatment of human

diseases such as cardiovascular disease, cancer, and inflammatory disease. Despite important scientific and technological advancements in combinatorial chemistry, Natural-product medicines remain to play an essential role in medication development [21-25]. Numerous aspirin-like medications, including non-steroid anti-inflammatory agents, are now available, where anti-inflammatory natural products have been used to treat inflammatory conditions in traditional medicine for a long time like fevers, pain, migraines, and arthritis [20]. Also anti-inflammatory foods and food items are becoming more popular as the inflammatory foundation of disease becomes clearer. Terpenoids, flavonoids, and related phenolic and polyphenolic substances, as well as sulphur-containing compounds, are all classified in the British Nutrition Foundation report on phytochemicals [26].

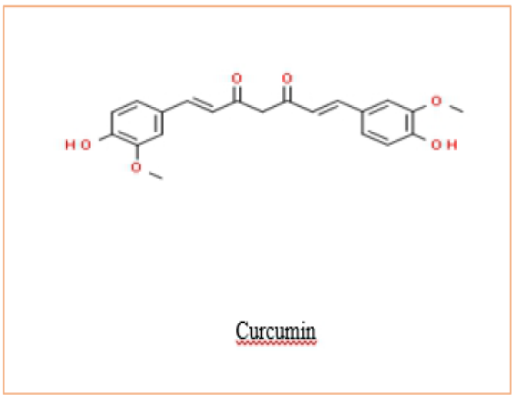
The recognition that one (or more) chemical entities from plant matter are involved for biological effects and can be separated for use as single agents first appeared in the nineteenth century as part of the evolving natural science based clinical medicine [27]. During this historical period, plant-derived compounds like morphine, quinine, colchicine, atropine, and pilocarpine were discovered and used to treat pain-related inflammatory disorders in humans and animals. Secondary metabolites like phenolic chemicals (curcumins, flavonoids, and tannins), saponins, terpenoids, and alkaloids have been linked to these plant species' bioactive principles [27].

5. The most popular isolated chemical compounds from natural origin that show anti-inflammatory activities

5.1. Curcumin:

It's taken from the Curcumaceae family's Turmeric rhizome. It's a native to India plant. Curcumin as appear in figure (2). It is a secondary metabolite of Curcuma longa that possesses anti-inflammatory, antioxidant, and anti-platelet properties [28]. Curcumin inhibits inflammation by decreasing NF-kB, restricting different NF-kB activators, and inhibiting its expression. Colitis, chronic neurological disorders, arthritis, and cancer have all been linked to curcumin. It also inhibits COX-1 and COX-2, which affects the activity of numerous enzymes and cytokines [29].

A

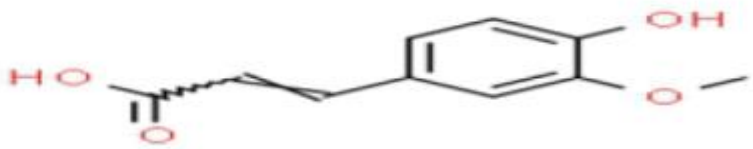


B

Figure 2:2A: Chemical structure of curcumin,
1B: Curcuma longa plant.

5.2. Tetracosanol:

It was isolated from Oenothera biennis (Evening Primrose) as appear in figure (3), a Central American native of the Onagraceae family. Evening primrose oil contains anti-inflammatory actions, according to studies, where Sterols like β-Sitosterol and Campesterol are found in this oil, which have been shown to decrease COX-2 gene expression through



Tetracosanol

Modulating nitric oxide , tumor necrosis factor , interleukin-1 and thromboxane B2 [30].
In multiple sclerosis (MS) patients, the efficacy of this oil combined with oil hemp seed has been clinically studied [31].

Figure 3: Extract and chemical structure of Tetracosanol (Evening Primrose oil)

5.3. AKBA (3-acetyl-11- keto-beta-boswellic acid):

It's taken from the oleo gum resin of the Boswellia tree (Indian Olibanum) as appear in figure (4), which belongs to the Burseraceaeis family and plant endemic to India. The effectiveness of AKBA has been proven; there was a considerable decrease in the recurrence of joint swelling and pain [32]. By inhibiting 5-LOX, it can prevent leukotriene production in neutrophilic granulocytes, impacting a variety of inflammatory disorders caused by leukotrienes [32].

Figure 4: Boswellia serrata plant and AKBA chemical structure .

5.4. β-carotene and its derivatives:

β-carotene and its derivatives were discovered in nettle leaves and are terpenoids from the Urticaceae family. Urtica dioica as appear in figure (5) is a plant that belongs to the genus Urtica. nettle leaf's anti-inflammatory effects were investigated. In a randomized controlled trial, in osteoarthritis of the thumb, the topical effect of nettle leaf was examined; decrease in pain, rigidity, and analgesic treatment needs were reported. As a result of this medication, the level of CRP has been dramatically lowered [33-35].

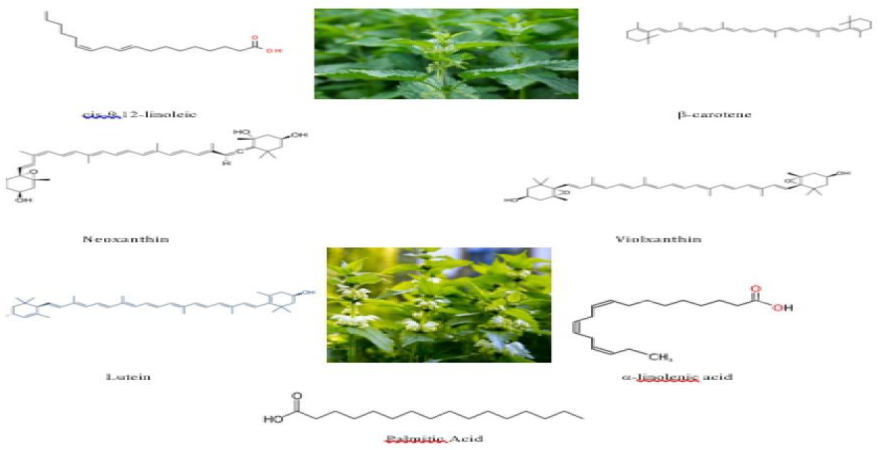


Figure 5: Urtica dioica plant and chemical structure of its active constituents

5.5. Tryptanthrin:

It was extracted from the leaves of Isatis tinctoria (dyer's woad) as appear in figure (6), a Brassicaceae plant whose extract is widely used as a traditional medicine for a number of inflammatory disorders by tropical rain forest indigenous peoples. The anti-inflammatory properties of tryptanthrin have lately been evaluated [36].

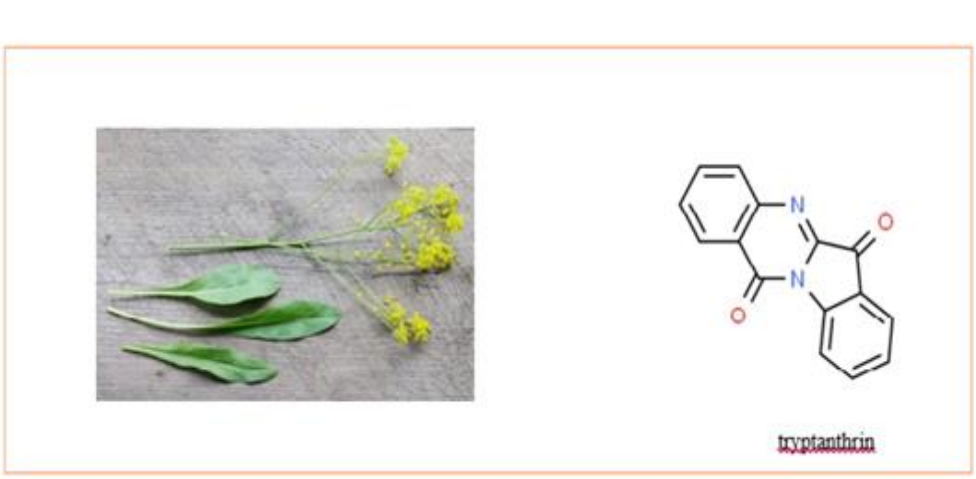


Figure 6: Isatis tinctoria and its chemical structure of active constituent

5.6. stigmasterol and its secondary metabolites :

It was taken from the Costaceae family's Costus speciosus as appear in figure (7), often known as Crepe Ginger. Bitter, astringent, anthelmintic, expectorant, tonic, and aphrodisiac, its rhizomes are aphrodisiac. Because of its powerful effectiveness against bronchitis, asthma, rheumatisms, inflammation, and fever, it is a commonly used medicinal plant. Its secondary metabolites 22,23-dihydrospinasterone were studied for their anti-inflammatory properties. [37-39].

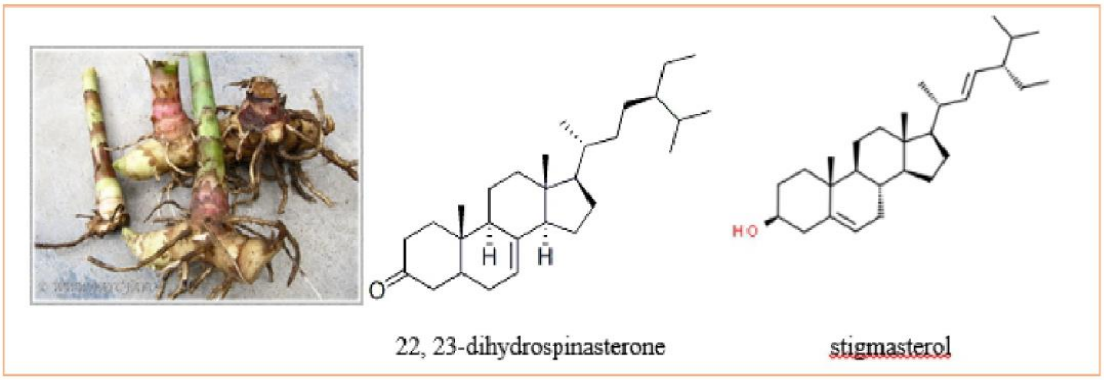


Figure 7: Costus speciosus plant and its chemical structure of active constituent

5.7. cyclomargenyl-3-O- caffeoyl ester:

It was obtained from Krameria pauciflora as appear in figure (8) and has been used as a traditional medicine against inflammation for hundreds of years. The anti-inflammatory properties of Krameria pauciflora root components were investigated. Of all the compounds identified, the cyclomargenyl-3-O-caffeoyl ester was shown to be the most effective [40].

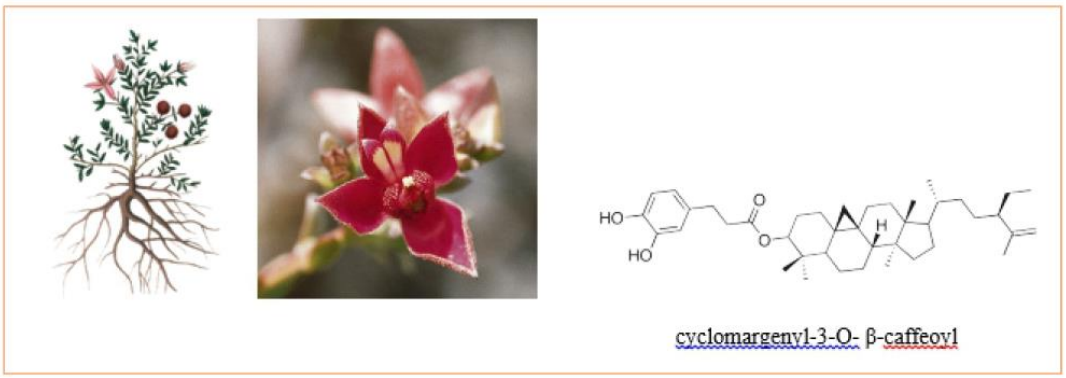


Figure 8: Krameria pauciflora plant and its chemical structure of active constituent

5.8. α-cyperone:

α -cyperones were isolated from Cyperus rotundus as appear in figure (9), a member of the Cyperaceae family. In Chinese traditional medicine, it is an Asian medicinal plant used to treat inflammatory conditions. The anti-inflammatory activity of α -cyperone significantly lowered inflammatory levels [41].

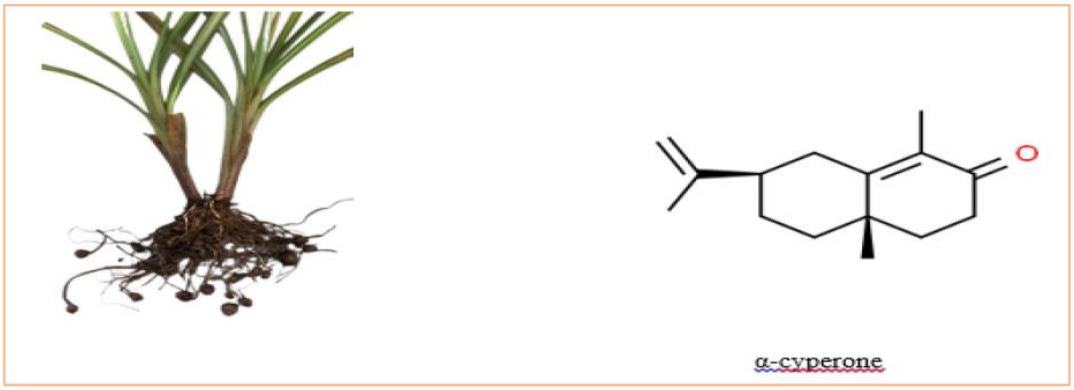


Figure 9: Cyperus rotundus plant and its chemical structure of active constituent

5.9. 7-angeloyl-12-acetyl-8-methoxyindol:

It is derived from Euphorbia nivulia as appear in figure (10), a member of the Euphorbiaceae family with therapeutic characteristics used in Ayurvedic medicine to treat rheumatism and bronchitis. The anti-inflammatory properties of 7-angeloyl-12-acetyl-8-methoxyindol have been demonstrated [42].

Figure 10: Euphorbia nivulia plant and its chemical structure of active constituents

5.10. Resveratrol:

It was taken from a natural polyphenol found in over 70 plant species, including grapes (Vitis vinifera), cranberries (Vaccinium macrocarpon) from the Ericaceae family, and peanuts (Arachis hypogaea) from the Fabaceae family. Resveratrol as appear in figure (11) has anti-inflammatory qualities because it inhibits COX-2 production by inhibiting NF-kB activation[43,44] .

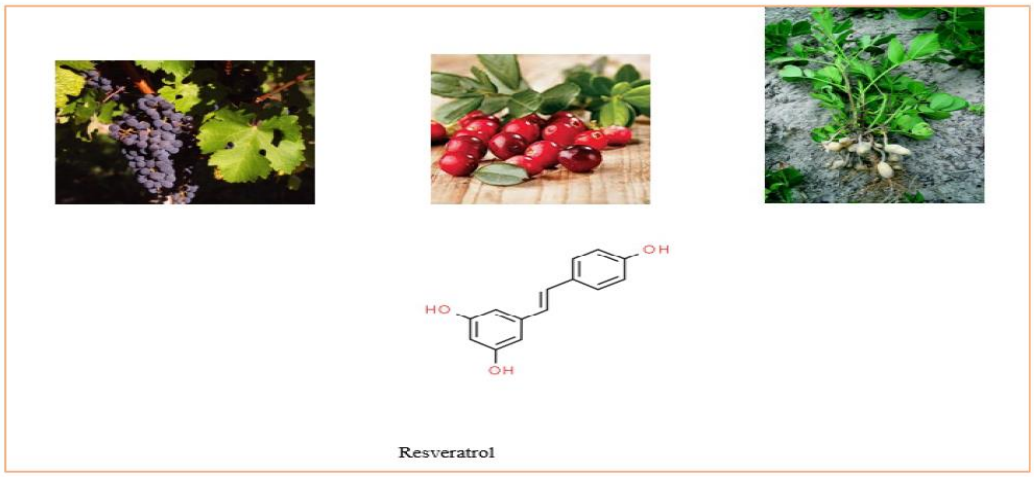


Figure 11: grapes, cranberry and peanut plants and its chemical structure of active constituents

5.11. aiphanol and isorhapontigenin:

It was taken from the Arecaceae family's Aiphanes aculeata and tested for its advantages. Aiphanol and isorhapontigenin as appear in figure (12) which significantly decreased inflammation. As inflammatory enzymes increased expression plays a crucial role in cancer genesis and progression, this is an alternate treatment strategy for cancer [45].

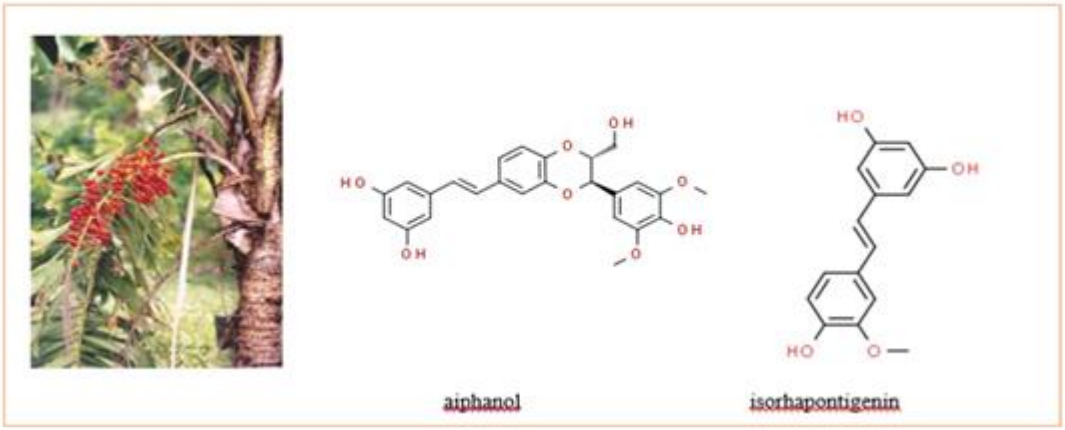


Figure 12: Aiphanes aculeate plant and its chemical structure of active constituent

5.12. oxyresveratrol and artocarpesin:

Oxyresveratrol and artocarpesin, both derived from the Moraceae family's Artocarpus heterophyllus as appear in figure (13), demonstrated remarkable anti-inflammatory action by suppressing inflammatory mediators and enzymes, indicating their potential as a treatment candidate for inflammation-related disorders [46].

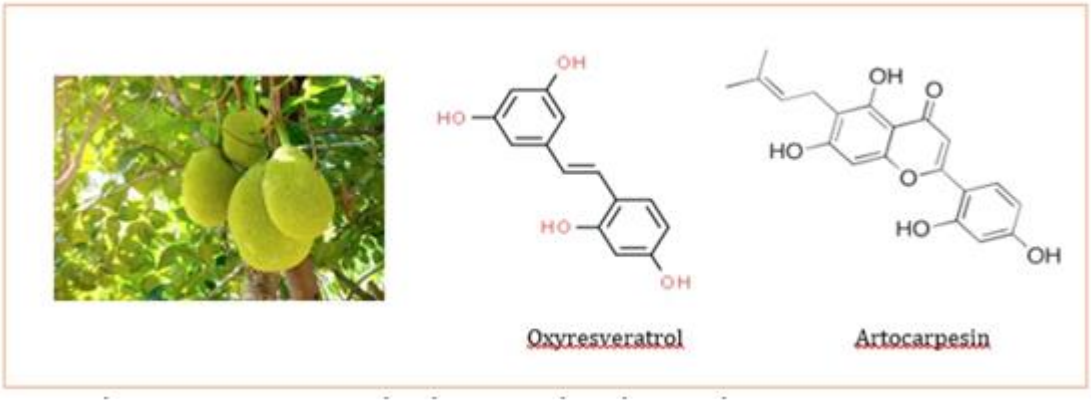


Figure 13: Artocarpus heterophyllus plant and its chemical structure of active constituent

5.13. pinosylvin:

It was taken from the roots and leaves of Hovenia dulcis, a Rhamnaceae plant as appear in figure (14) was used for centuries to cure gastric ulcers, liver toxicity, and inflammation. Anti-inflammatory studies on H. dulcis secondary metabolites to prove their usefulness. Pinosylvin was primarily responsible for the anti-inflammatory effects of the methanolic extract of H. dulcis. [47].

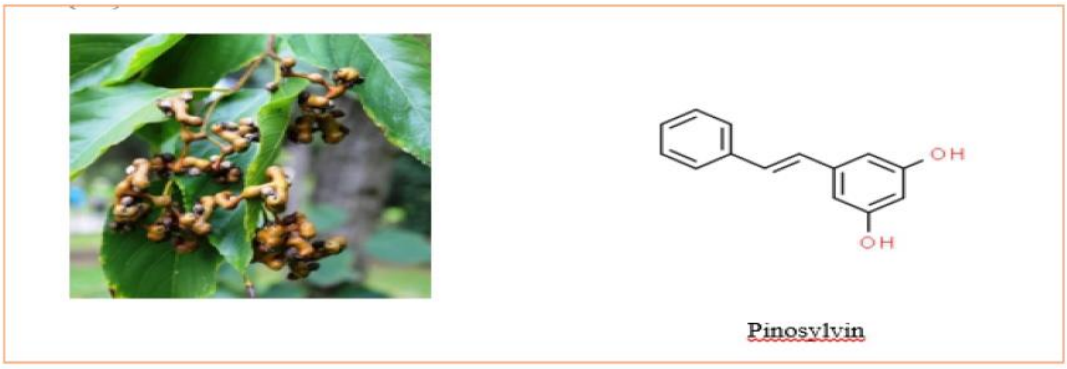


Figure 14: Hovenia dulcis plant and its chemical structure of active constituents

5.14. epigallocatechin and its derivatives :

It was taken from Green Tea (Camellia sinensis), a member of the Theaceae family native to Asia and India as appear in figure (15). All of these compounds are the most important polyphenolic chemicals extracted from this NP, all of which have been shown to have substantial antioxidant properties. Anti-inflammatory, anti-mutagenic, anti-cancer, anti-obesity, antidiabetic, anti-viral, anti-bacterial, neuroprotection, and immunomodulatory effects of epigallocatechin have been documented. Its use as an anti-inflammatory drug in the treatment of arthritic disease has just now been recognized [48-50].

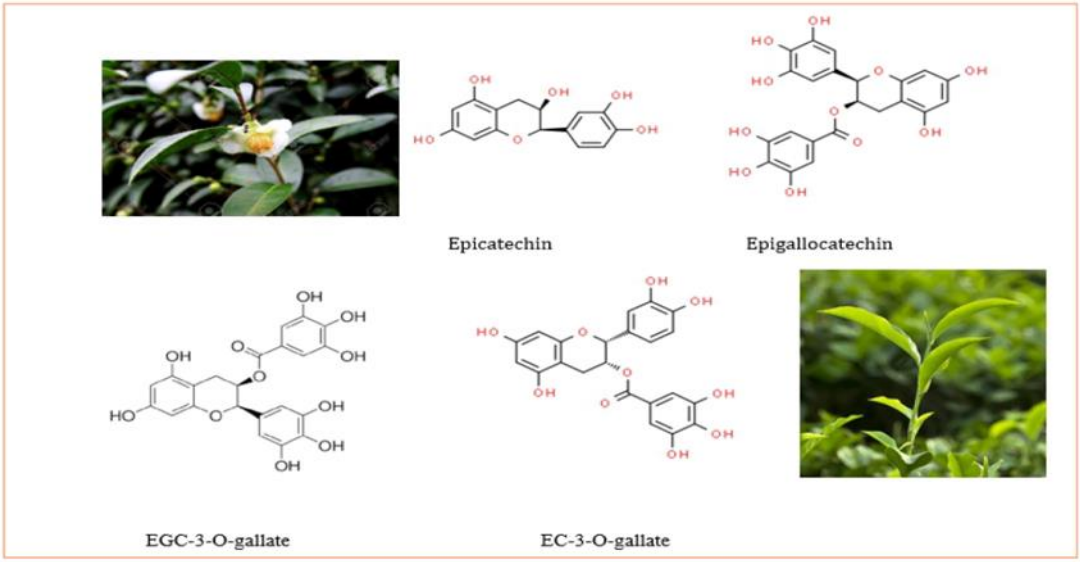


Figure 15: Green Tea (Camellia sinensis) plant and its chemical structure active constituents

5.15. harpagoside and its derivatives :

Devil's claw (Harpagophytum procumbens) is a perennial herbaceous plant native to the Kalahari deserts of Namibia, South Africa, Botswana, Zambia, Angola, and Zimbabwe. Analgesic for fevers and the treatment of rheumatic disorders. Harpagoside, harpagide, 8-p-coumaroyl harpagide, and acteoside as appear in figure (16), it's the major active components in devil's claw extract, reduce lipid peroxidation, contributing to its antioxidant action and helping to suppress inflammatory mediators [51-53].

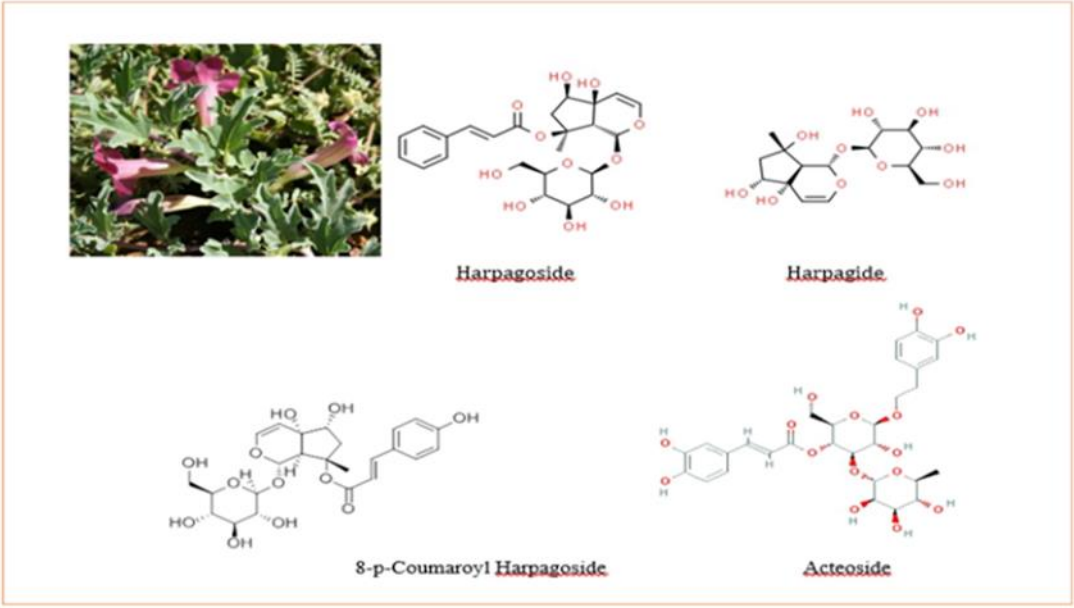


Figure 16: Harpagophytum procumbens plant and its chemical

5.16. zingiberene and its derivatives :

It was taken from the Zingiber officinale plant (ginger in English), contain mixture of components. Zingiberene, β-bisabolene, β-sesquiphellandrene, and α-curcumene are terpene components of ginger as appear in figure (17). By suppressing the cyclooxygenase and lipoxygenase pathways in the synovial fluid, ginger powder has been demonstrated to aid people with musculoskeletal and rheumatoid arthritis [54,55].

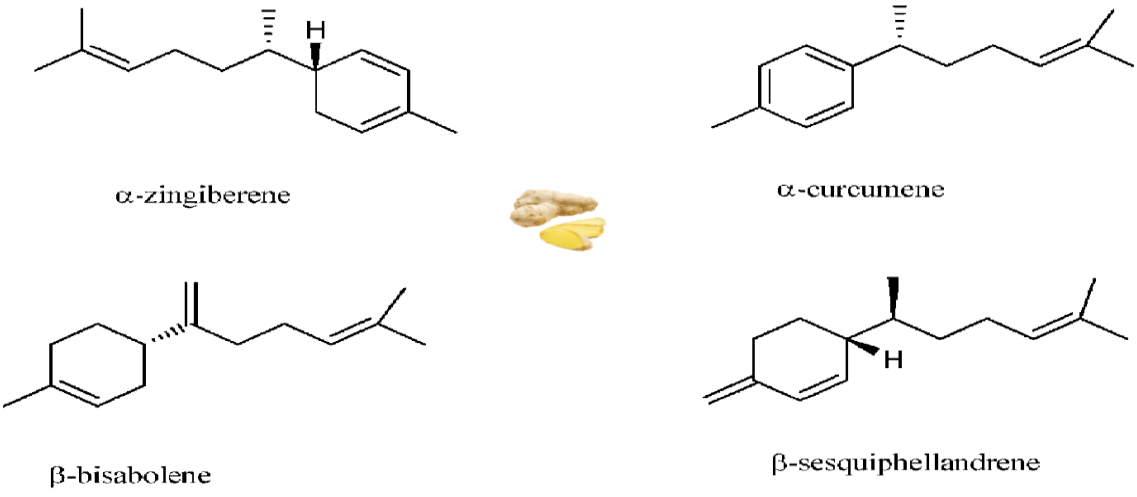


Figure 17: Zingiber officinale plant and its chemical structure of active constituents

5.17. rosmarinic acid:

Rosmarinus officinalis was used to isolate rosmarinic acid as appear in figure (18). Which are the most potent active components in different types of rosemary extracts, based on a lab testing the benefits of rosemary extract were studied in patients with osteoarthritis, rheumatoid arthritis, and fibromyalgia for four weeks [56, 57].

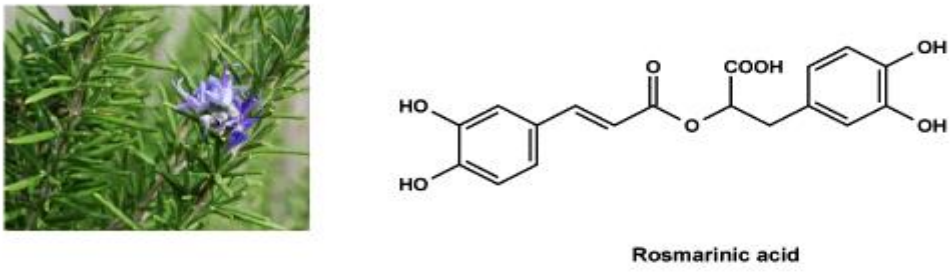


Figure 18: Rosmarinus officinalis plants and its chemical structure of active constituent.

5.18. Oleuropein:

It was taken from the Oleaceae family's Olea europaea (Olive). Bioactive phenolic chemicals abound in O. europaea. Oleuropein is a phenolic component of the O. europaea plant as appear in figure (19) which has a wide range of pharmacological properties, anti-inflammatory effect has been proved [58].

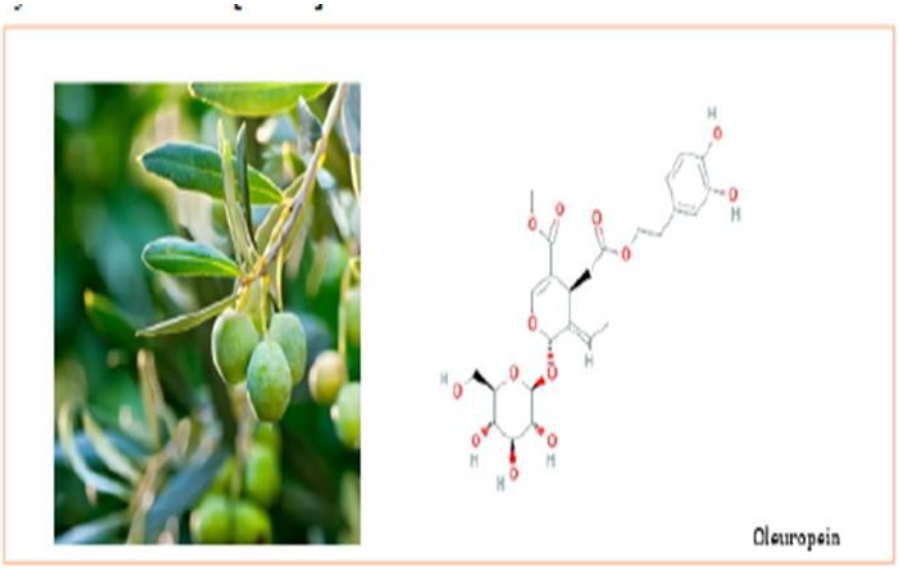
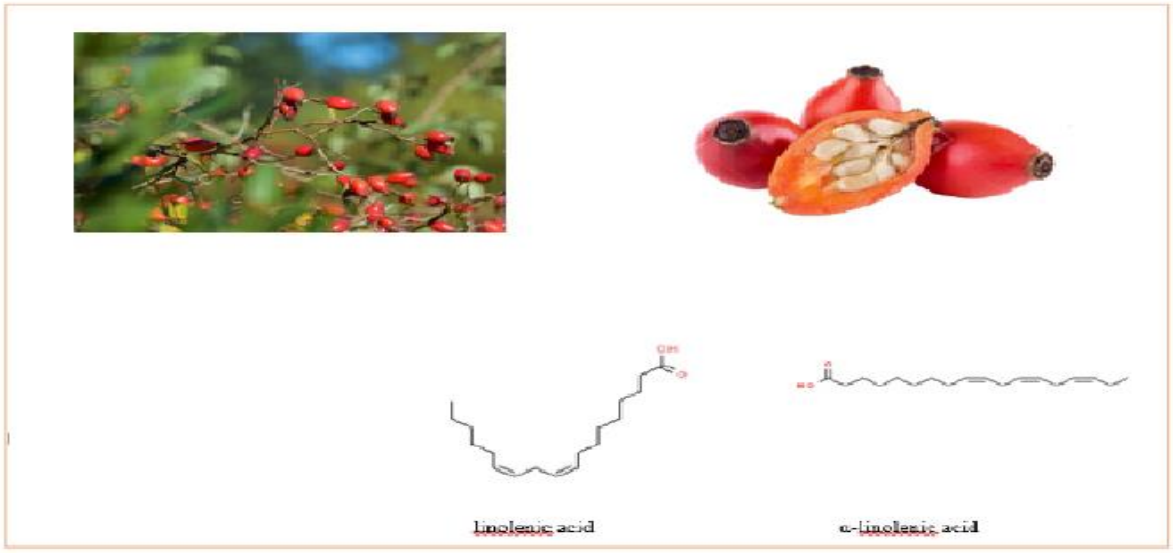


Figure 19: Olea europaea plant and its chemical structure of active constituent

5.19. linoleic acid and its derivatives:

It was extracted from Rosa canina (often known as Dog Rose in English), a Rosaceae family member. linoleic acid (a ω-6 polyunsaturated FA [PUFA]) and α-linolenic acid (a ω-3 PUFA) as appear in figure (20) which have been identified as important bioactive substances. The anti-inflammatory capabilities of all substances have been demonstrated. Furthermore, Rosehip's efficacy has been tested in patients with OA and RA. These studies yielded the following results: Patients with OA have reported relief from pain, reduced use of rescue



medications, and reduced stiffness, as well as a significant reduction in CRP, following therapy with this plant [59-62].

Figure 20: Rosa canina plant and its chemical structure of active constituent

5.20. carnosic acid and its derivative :

Salvia officinalis (sage in English) is a Lamiaceae family member from which it was isolated. Carnosic acid and carnosol as appear in figure (21) are phenolic diterpenes with anti-inflammatory properties. In mice, a chloroform extract of sage leaves had an anti-inflammatory impact on atopic inflammation [63].

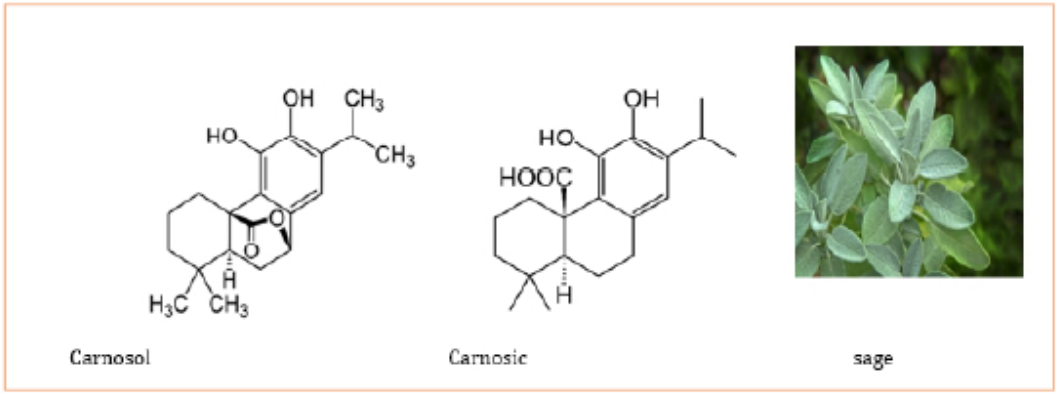


Figure 21: Salvia officinalis plants and its chemical structure of active constituents

5.21. eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA):

It's derived from Omega-3 (fish oil), which include eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) as appear in figure (22), Fish oil is being used to treat muscular& skeletal illnesses [64].

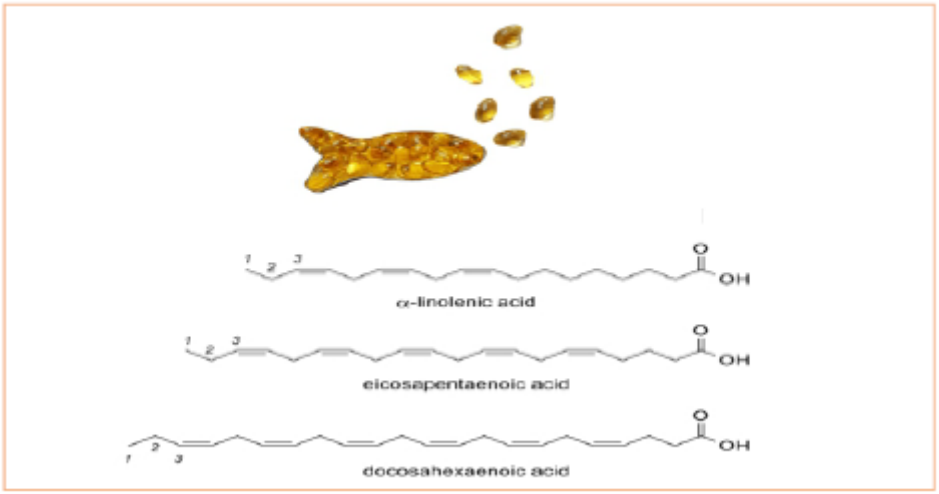


Figure 22: Omega-3 EFAs active ingredient

5.22. hydroxybenzoic acids and hydroxycinnamic acids:

Polyphenols (flavonoids, proanthocyanidins, and tannins), alkaloids, and sterols appear to be the active constituents in Uncaria tomentosa (cat's claw) from the Rubiaceae family as appear in figure (23). Additional research showed that the cat's claw's potent radical scavenging and anti-inflammatory activities were due to hydroxybenzoic acids and hydroxycinnamic acids. Arthritis, bursitis, and digestive ailments are all treated using cat's claw bark. A Peruvian herb causes a drop in pro-inflammatory mediators across the board [65].

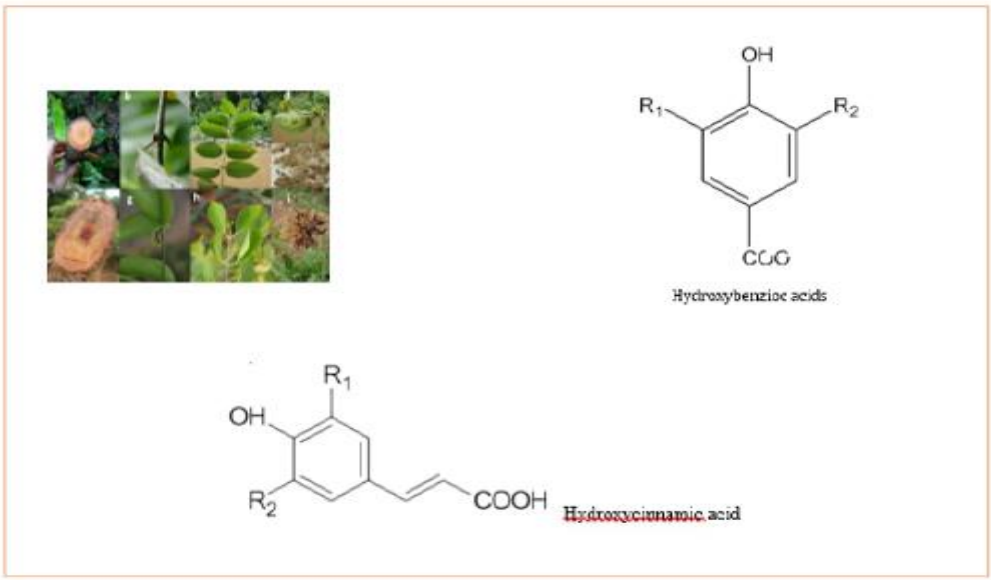


Figure 23: Uncaria tomentosa plants and its chemical structure of active constituents

5.23. salicin and its derivatives :

Salicin is an element found in willow bark, where the body converts into another chemical substance called salicylic acid as appear in figure (24). It was identified from Salix alba (White willow bark), family name salicaceae, as a pain reliever and antipyretic agent. White willow bark works in a similar way to acetylsalicylic acid, which regarded a prototype of NSAIDs [66].

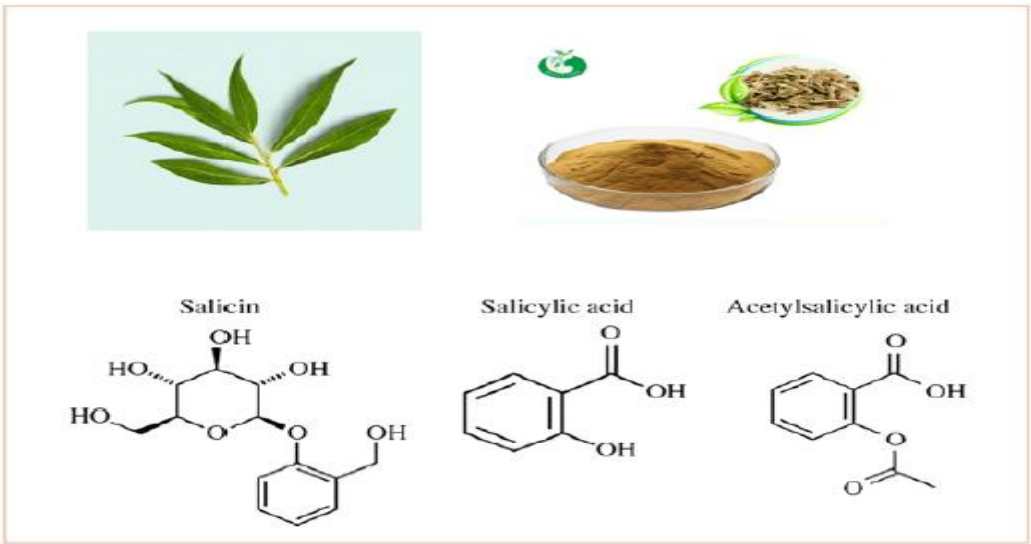


Figure 24: White willow bark plants and its chemical structure of active constituents

5.24. catechin and derivatives:

It's derived from the bark of the maritime pine tree (Pinusmaritima) as appear in figure (25) and recently, it was discovered that pycnogenol reduced NF-kB activation in lipopolysaccharide-stimulated monocytes, lowering the inflammatory response [67]

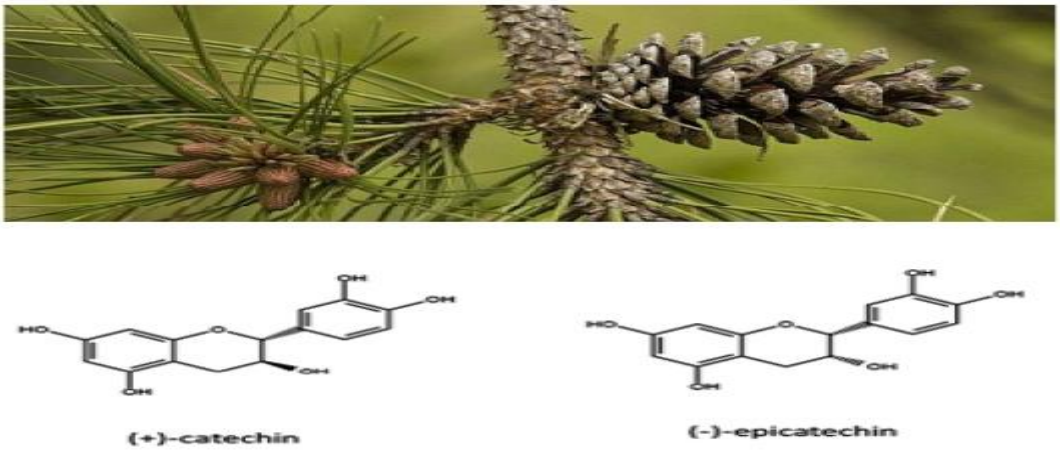


Figure 25: maritime pine bark plant and its chemical structure of active constituent

5.25. baicalin and its derivative :

Acacia catechu (Fabaceae), a traditional medicinal plant found predominantly on the Indian subcontinent and in Southeast Asia, contains catechin as its main chemical constituent as appear in figure (26). Flavocoxid is made up of the flavonoid molecules catechin and baicalin together. Flavocoxid is a root extract that helps to reduce joint stiffness and improve joint comfort and mobility [68,69].

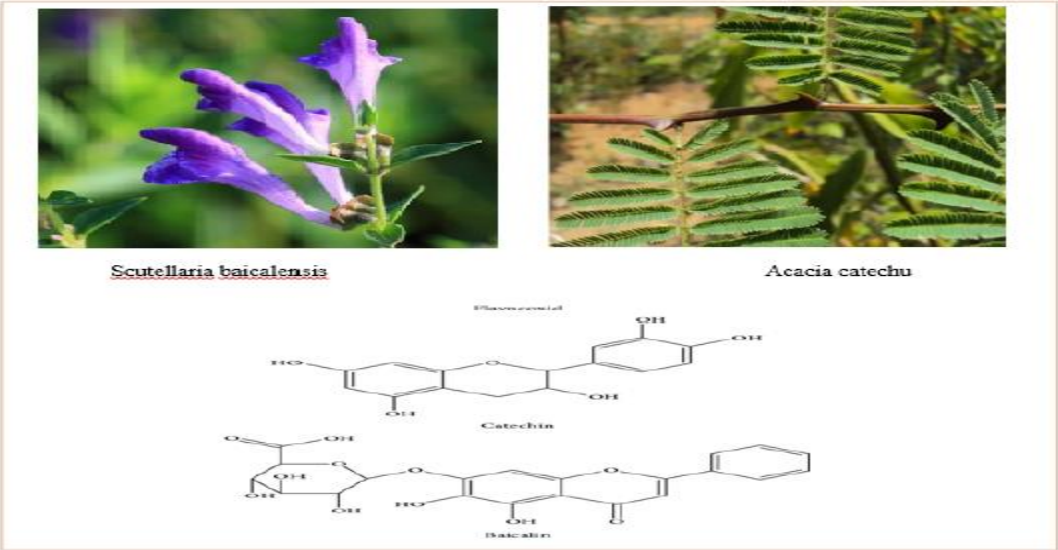


Figure 26: Acacia catechu and Scutellaria baicalensis plant and chemical structure of catechin and baicalin

5.26. azulene and bisabolol:

It's produced from Matricaria chamomilla, also known as chamomile, which has been used for centuries to treat joint pain. Rheumatic pain and inflammation have traditionally been treated with the dried floral section of the plant. The flowers contain rich essential oils, including azulene and bisabolol as appear in figure (27), which are the two major active components. The essential oil of chamomile flowers is used to make azulene, which is a deep blue color. For inflamed, reddish, and irritated skin, it contains anti-inflammatory and regenerative properties. Chamomile comes in two varieties: German chamomile and Roman chamomile, both of which are members of the Asteraceae; Compositae family. Herbal Tea is the most popular chamomile preparation [70].

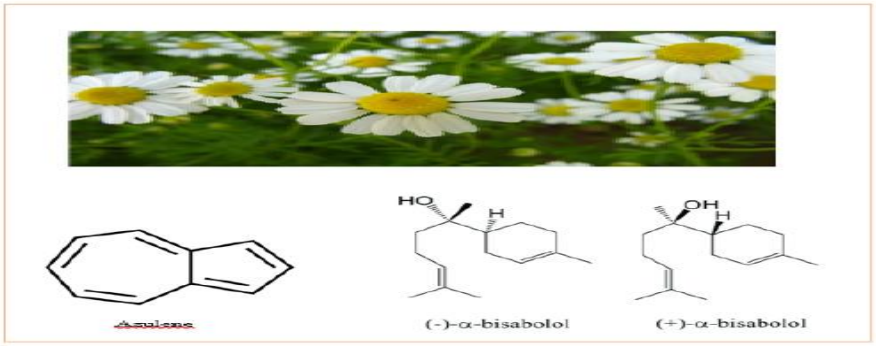
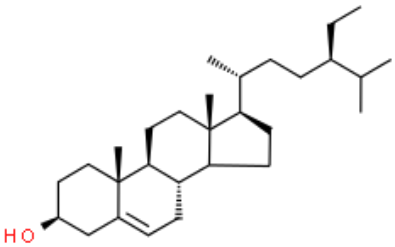


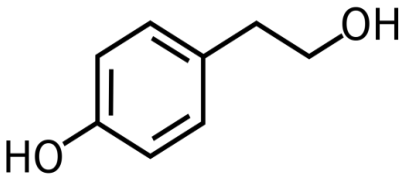
Figure 27: Matricaria chamomilla plant and its chemical structure of active constituent.

5.27. phenylethanoids and phytosterols:

It's derived from the Iranian herb Eremostachys laciniata, which belongs to the Lamiaceae family. Decoctions of Eremostachys laciniata's roots and blossoms are commonly used to treat inflammatory disorders like arthritis. The extract from the rhizomes of EL contained iridoid glucosides, two phenylethanoids, and two phytosterols as appear in figure (28). In one study, the effects of external E. laciniata administration on arthritic pain and symptoms were investigated [71].



Phytosterols



phenylethanoids

Figure 28: Eremostachys laciniata plant and chemical structure of Phytosterols and phenylethanoids

5.28. Withaferin A (WFA):

It's isolated from Withania somnifera (Ashwagandha) family name is Nightshade as appear in figure (29), where Anti-inflammatory and analgesic properties have been investigated. [72,73].

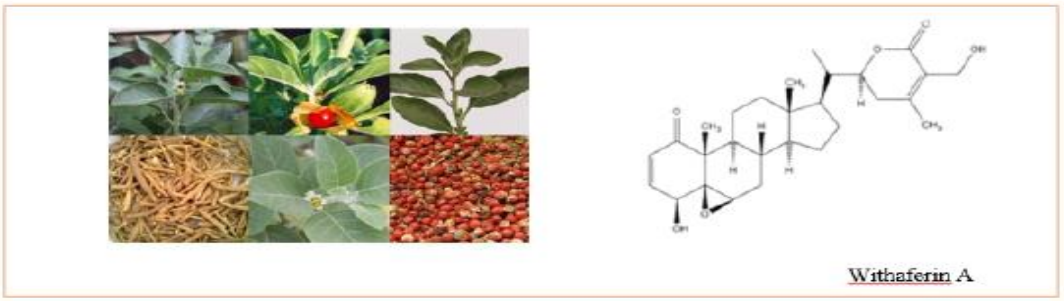


Figure 29: Withania somnifera plants and its chemical structure of active constituents

5.29. Paeoniflorin:

The dried root of Paeonia lactiflora Pallas has a long history of usage in Chinese medicine. It was isolated from Paeonia lactiflora as appear in figure (30), which belongs to the Paeoniaceae family. Radix Paeoniae decoctions have been used to treat RA and other inflammatory/autoimmune illnesses. Paeoniflorin, the main active component isolated from the roots of PL, has been shown to be effective against gynecological diseases, pain, and liver-yang hyperactivity, among other conditions. In animal models of acute and sub-acute inflammation, Paeonia lactiflora root extracts were found to have anti-inflammatory effects [74].

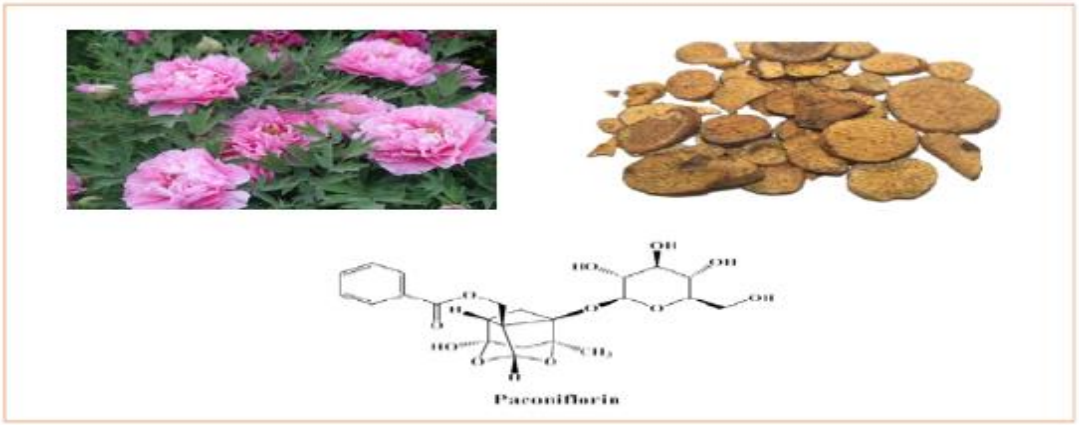


Figure 30: Paeonia lactiflora plant and its chemical structure of active constituent

5.30. triptolide:

Staff vien, has been obtained from Tripterygium wilfordii Hook F as appear in figure (31), which is a Chinese herb with immunosuppressive properties that has previously been used to treat RA. In multiple laboratory studies, extracts from the root of Tripterygium wilfordii Hook F, which contain triptolide, were shown to reduce the expression of pro-inflammatory cytokines and mediators, adhesion molecules, and matrix metalloproteinases by macrophages, lymphocytes, synovial fibroblasts, and chondrocytes [75].

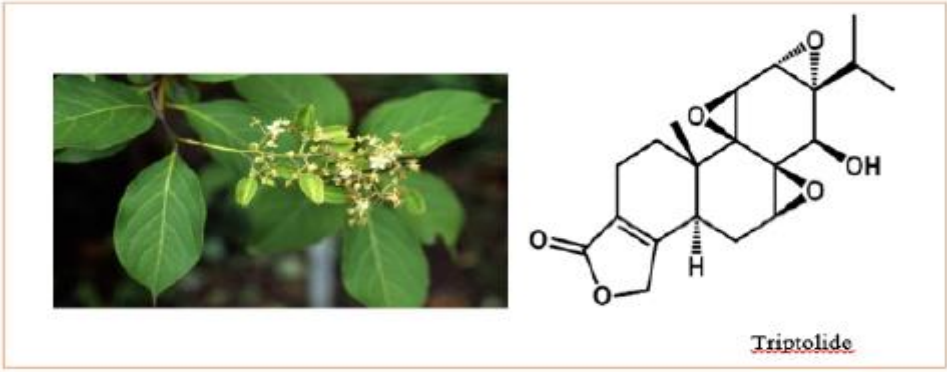


Figure 31: Tripterygium wilfordii Hook F plant and its chemical structure active constituent

5.31. Capsaicin:

It is derived from Capsicum annum as appear in figure (32). The chemical capsaicin is responsible for the stinging pungency of the little red fruit typically used to enhance chili. It also suppresses NF-kB, which has anti-inflammatory properties [76].

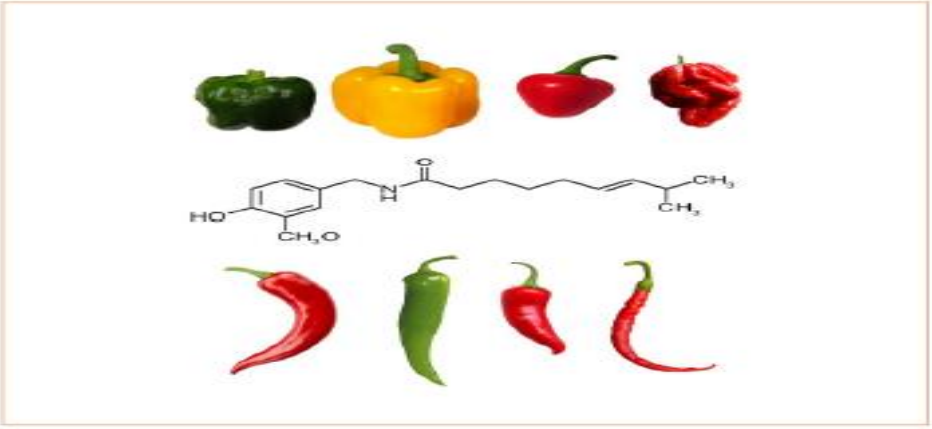


Figure 32: Capsicum annum and chemical structure of Capsaicin

6. Conclusion

As a normal response to injury, inflammation causes pain, swelling, and erythema in the human body. Anti-inflammatory medicines, such as NSAIDs, reduce pain by acting on several inflammatory pathways. But they can have unfavorable side effects such as stomach ulcers, less frequently myocardial infarction and stroke. To control the inflammatory process with fewer adverse effects, natural anti-inflammatory substances have been employed. Natural products' ability to cover a wide range of pharmacological effects as pharmaceutical sources is now being recognized. It is likely that novel anti-inflammatory medications derived from natural sources will be available in the commercial market within a few years.
Inflammation is still a complicated process that is necessary for the host's protection. One of the most essential components of supplemental medicine is herbal medicine. Numerous studies have been conducted to support the use of different herbs in inflammatory response. The authors discuss a few plants that have been examined in experimental and clinical settings for their anti-inflammatory properties. The principal classes of COX-2 inhibiting chemicals are flavonoids, terpinoids, alkaloids, and stilbenoids. Even though the majority of flavonoids prefer COX-1 isoenzymes ,However, multiple investigations have found that the same chemicals can dramatically decrease COX-2 activity in in-vivo rate models, indicating that flavonoids have a different mechanism of COX-2 inhibition. Alkaloids and flavonoids are a powerful class of bioactive chemicals with anti-inflammatory properties. Furthermore, all of the listed substances have the potential to be a future therapeutic option for treating inflammation-related disorders such as neurological diseases, rheumatism, and different malignancies.Among our research findings, Curcuma longa had the most clinical evidence for inflammatory disorders such RA, uveitis, and IBD. Other herbs on the list have also shown promise in anti-inflammatory clinical and experimental studies. We've gone over a few of the most popular plant-derived natural compounds that may have similar efficacy in treating the inflammatory response seen in both chronic and sub-acute pain disorders that are treated with conventional neurosurgical treatment. Experiments and clinical trials that are now being conducted should be continued in order to guide and demonstrate their scientifically backed utility in lowering inflammation.

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