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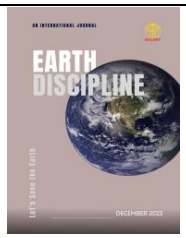

Review Article

Chalcones pharmacological significance: a review article

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ABSTRACT

Chalcones are abundant in edible plants and are thought to be the progenitors of isoflavonoids and flavonoids. The biological significance of chalcones and their equivalents is now a topic of intense investigation. Chalcones and its analogues exhibit a wide range of biological actions, such as anti-inflammatory, anticancer, antifungal, antiviral, antileishmanial, antimalarial antibacterial and antioxidant properties. Additionally, chalcones and their analogues have been shown to work in concert or as an additive to pharmaceutical effects due to their diverse biological activities.

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Introduction-

Chalcones, which are flavonoids and open-chain isoflavanoids that are found in a broad range of foods, including soy-based products, vegetables, tea and fruits had garnered significant attention due to their intriguing pharmacological properties1. The structurally most varied class of flavonoids are chalcones. They readily undergo ring closure to produce a flavonoid framework, an isomericly important stage in the skeletal change of chalcones. Chalcone is identified by its IUPAC designation, 1,3-diphenyl-2-propen-1-one. Chalcone's general structure consists of three carbon atoms with an α,β-unsaturated carbonyl system connecting two aromatic rings.Chalcone's inertness, low redox potential, electron transfer processes and—most importantly—its potentially beneficial biological activities3 are the reasons for its 2. Because of their open-chain structure and capacity for skeletal rearrangements, chalcones' chemistry has captivated organic pharmacists since the prehistoric era. These compounds include pyrazoles6, indole, isoxazoles5, and azachalcones, which are grounded chalcones. Among the best scaffolds available, chalcone had wide range of biological potencies, such as anti-inflammatory14, anti-inflammatory17, anti-cardiovascular16, antihypertensive15, anti-malerial13, antifungal11, antimicrobial12, anti-leishmanial10, anticancer9, antioxidant8, and many more. Due to their luminous qualities, chalcone materials are useful for a wide range of applications, including chemical probes, fluorescent dyes and dye preservative. The potential uses of fluorescent materials, such as chemical probes and electrochromic materials, have garnered significant interest.

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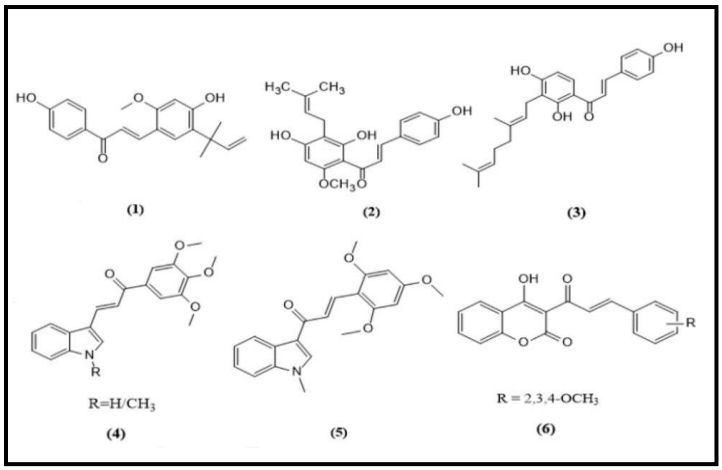
as an additive in dye-sensitized solar cells and notably in detection while developing novel medications18.Studying some of the medicinally relevant properties of chalcones and their analogues is the goal of assessment.

Essential therapeutic agents-

Due to their wide spectrum of medicinal properties and curative potential, chalcones and their analogues were great importance of the field of pharmaceutical chemistry. Chalcones are an essential family of phytochemicals that have garnered significant attention because of their broad range of biological activity, making them one of the currently recognized therapeutic candidates. In the paper below, the several pharmacologically significant characteristics of chalcones are summarized with an example.

Anticancer action-

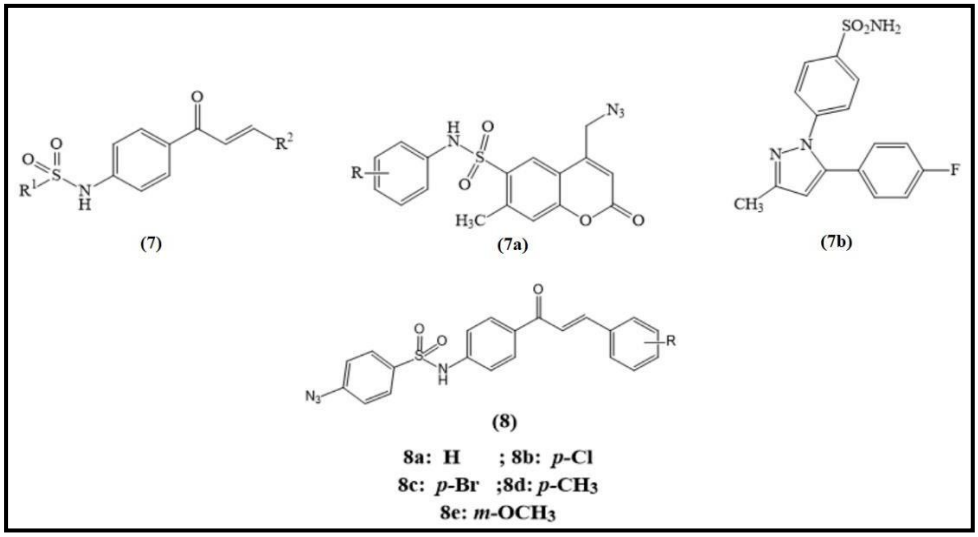
Through the prevention of superoxide formation and lipid peroxidation, chalcones derived from natural or synthetic sources shown potential efficacy against neoplasmic tissues in addition to antioxidant principles. Chalcones that occur naturally include xanthohumol, licochalcone, and xanthoangelol, among others. Licochalcone A (1) (LA), a chalcone present in the roots of chinese liquorice has been shown to possess a number of biologically active qualities, including antiparasitic, antimalerial, and anti-proliferative qualities19 and 21. In PC-3 prostate cancer tissues that are androgen-independent and p53-null, LA stimulates growth control and causes apoptosis in the infected cells 20 and 22. It has been proposed that Xanthohumol (2), a valuable chalcone that was extracted from hop cones (Humulus lupulus L.), has a broad range of anticancer properties that can kill various human cell lines that exhibit cancer by causing apoptosis in human cancer tissues and preventing the infection from spreading 22 and 23. A chalcone extract of Angelica keiskei's stem cells, xanthogelol (3) triggers apoptosis in tumor cells by starting caspase-3 in leukemia and malignant tumor tissues24.



Similar to chalcones found in nature, chalcones have enhanced anticancer properties when certain locations of hydroxy, methoxy, and other substituents are added to the phenyl rings. However, some research has shown that the anticancer activity is also altered by various substituents, such as dimethylamino and aryl/heteroaryl rings that are either joined or substituted. It has been shown that indolyl chalcones with phenyl ring A substituted with 3,4,5-trimethoxy group (4) are effective against cells that cause pancreatitis 25. When 1-(N-methylindolyl)-3-phenylpropenones (5) are methoxylated, Martel-Frachet and colleagues' synthetic version exhibits increased anticancer efficacy against bladder cancer 26. Several 4-hydroxy coumarinyl chalcones were analyzed by Patel and colleagues. Compound (6), which substitutes 2,3,4-trimethoxy in aryl ring B, was surprisingly more potent and selective against breast cancer cell lines than cisplatin.27

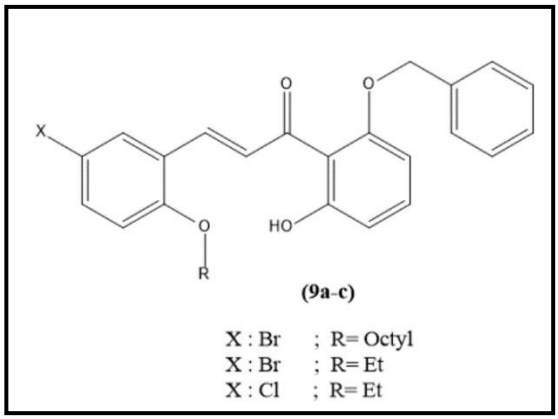
Antimicrobial activity-

This word refers to any biologically active substance that has the capacity to stop bacteria from growing, prevent them from creating microbial clusters, and maybe even kill microorganisms. Chalcone has been effectively utilized for many years as an anti-infective agent. Analysis demonstrates that the antibacterial activity of chalcone (7) and its analogues (7 a and b) is increased to a larger degree following the introduction of the sulfonamide moiety28, 29. Compounds (8a–e) were found to have excellent antibacterial action against M. luteus and S. aureus bacteria. Comparing the p-bromo analogues (8c) to the previously identified fluconazole (35) and another analogue (8d and e) with electron-donating groups attached, the former exhibits strong antifungal activity against T. rubrum. In conclusion, we can state that the antibacterial activity of the medication increases more when an electron-withdrawing group is inserted into the sulphonamide chalcone than when an electron-donating group is inserted (8d and e).



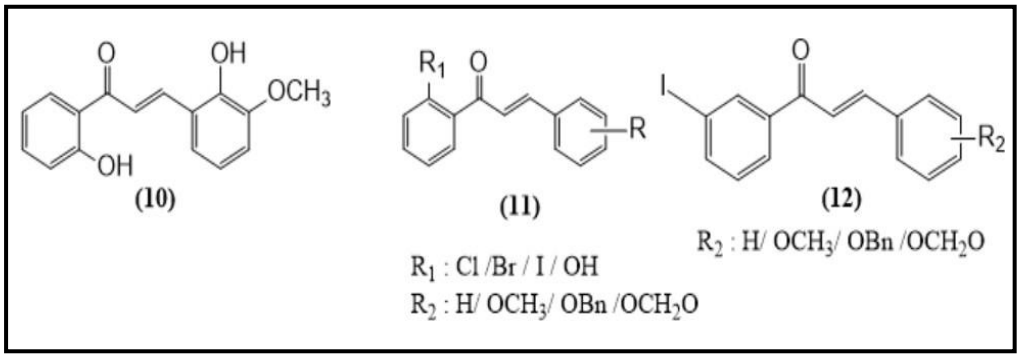
Anti-HIV Activity-

After successfully entering and replicating inside the host's body, HIV-1 is the primary cause of acquired immunodeficiency syndrome, which is caused by the destruction of T-cells31.Nakagawa and colleagues isolated a unique chalcone from the genus Desmos32. Many scientists are trying to create medications with strong anti-HIV1 activity. It has been shown that a group of chalcone scaffolds, 9a and c, are dominant against HIV–1 at lower concentrations and have been shown to be least lethal to healthy human tissues33.Additional research is necessary to determine the potential mechanism of action.



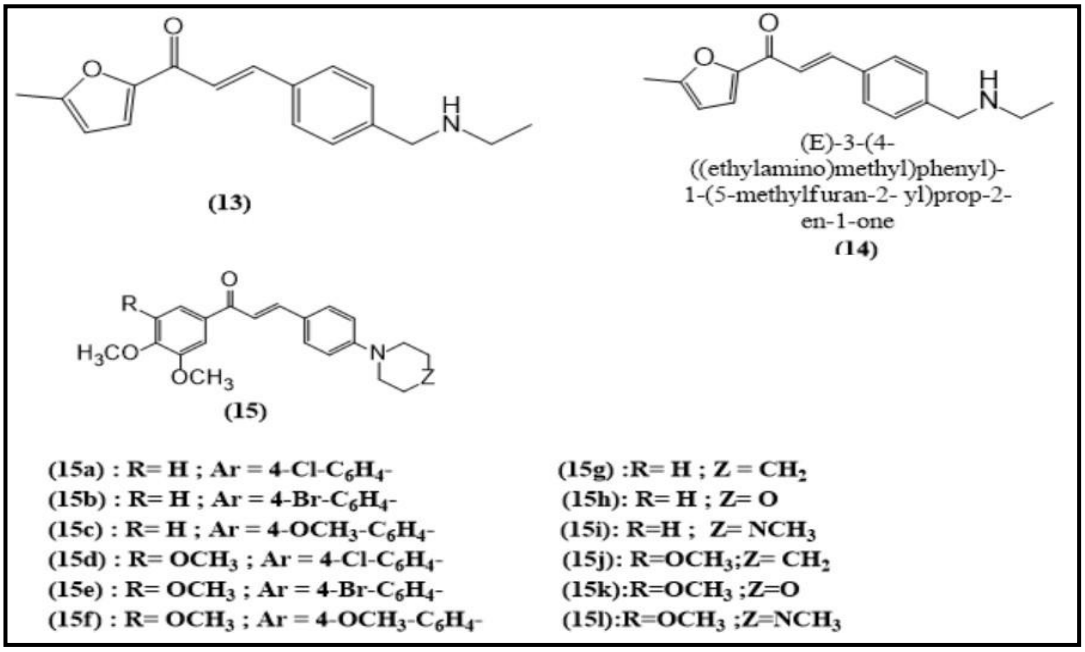
Antidiabetic activity:

Diabetes is a disease that is on the rise globally these days, and researchers are mercilessly working to find a treatment that works. According to a research, a dosage of 100 mg/kg (39%) results in a larger dose-dependent drop in blood glucose level (BGL) in (10)34. In comparison to pioglitazone and rosiglitazone (230 and 263 mg/dl, respectively), another study has demonstrated that the chalcone bearing electron withdrawing substituent, i.e., halogens, hydroxy group at ortho position on aromatic ring of chalcone, have highest efficiency with glucose medium concentration (210 to 236 mg/dl)(11).Chalcones with an iodo substituent at the aromatic ring's meta position (12) demonstrated a much higher level of activity (238 mg/dl).35

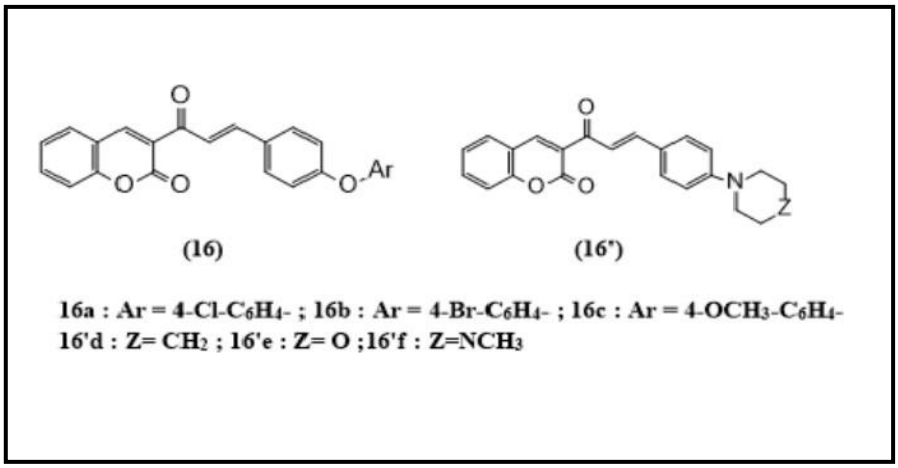


Anti-inflammatory activity:

Jantan and colleagues examined a number of 4-methlyamino ethanol substituted and methoxylated analogues of chalcone(13). The analysis's findings subsequently demonstrated that the synthesized analogues were effectively able to suppress the activity of inflammatory intermediaries, namely lipooxygenase (LOX) and cyclooxygenase (COX). Among these many substances, one is designated as (E)-3- (4-((ethylamino)methyl)phenyl).Among COX-1 and COX-2.37, -1-(5-methylfuran-2-yl)prop-2-en-1-one(14) was the most effective prohibitor. A different investigation was conducted, and the result shown in group of chalcones based on methylated phenyl (15 a-l) and coumarin (16 a-c) & (16'd-f) had superior inhibitory effect against the COX-2 enzyme and lower nitric oxide generation.



Methoxylated phenyl-based chalcones have been shown to have superior inhibitory and suppressive activities as compared to their coumarin-based chalcone equivalents when compared collectively37.



Current and Upcoming Developments:

Based on its adaptable actions against several syndrome types, chalcone continues to be an exceptional scaffold for a variety of disease-oriented developments, even after decades of extensive study. Chalcone's pharmacological potency is mostly determined by the substitutions made to its aromatic rings and the patterns of those substitutions (Fig. 2). Based on a review of the literature, it is possible to improve the pharmacological properties of chalcones by implementing three different strategies: altering the structure of both aromatic rings, substituting aromatic rings with groups that donate electrons or withdraw electrons, or using heterocyclic moiety, among others. The thorough study provided demonstrates that chalcone is an advantageous chemical for future drug development efforts targeting various illnesses. This suggests that in the near future, chalcone-based therapeutic agents with desired efficacy, selectivity and in-vivo potency will become available for clinical trial.

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