



REVIEW ON FLAVONOIDS WHICH ACTS AS IMPORTANT MOIETY IN PHARMACEUTICAL SCIENCE

^{1*}Gajbhiye A.V., ²Bagul V.R., ³Palwe S.D., ⁴Kadam V.V. and ⁵Mahale B.N.

^{1,2,4,5} Department of Chemistry, MGV's Arts, Science and Commerce College, Surgana, Dist. Nashik

³Department of Botany, MGV's Arts, Science and Commerce College, Surgana, Dist. Nashik

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ABSTRACT

Flavonoids has been important constituents of plants and fruits. Its basic structure consists of C6—C3—C6 rings with different substitution patterns to produce a series of subclass compounds. Flavonoids acts as health promoting and disease preventing dietary supplements. Flavonoids are necessary for plant growth development and reproduction and also flavonoids are major class of plant secondary metabolites. Flavonoids has a biochemical effect on enzymes, hormones. Flavonoids acts as anti-oxidant, anti-bacterial, anti-viral, anti-inflammatory. Flavonoids has been an indispensable part of nutraceutical, pharmaceutical, medicinal, cosmetic and other applications Flavonoids act as a growth stimulating compound. This review highlight importance of flavonoids in terms of medicinal properties and also as dietary constituents which will help to redirect the use of flavonoids in the various sectors like medicine, food science and also agriculture.

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INTRODUCTION

Flavonoids represent a large group of polyphenolic compounds having benzo- γ -pyrone structure. Flavonoids occurs naturally in plants. Generally, flavonoids consist of 15 carbon skeleton which contains two benzene rings linked through a heterocyclic pyrene ring. Flavonoids plays a vital role in biological processes in plants, animals and bacteria. Thus, depending on the linking position of aromatic ring, they are classified as flavonoids (2-phenylbenzopyrans), isoflavonoids (3-phenylbenzopyrans) and neoflavonoids (4-phenylbenzopyrans). These contain common moiety i.e., chalcones and thus are structurally and biogenetically related. Flavonoids plays a vital role in biological processes in plants, animals and bacteria. Aroma and colour of the flower are due to the presence of flavonoids. This not only provide characteristics feature to the flowers but helps in attracting pollinators for seed and spore germination(1). Flavonoids also shows remarkable effects on human and animal health.

Dixon and Pasinetti (2) have given detail information on flavonoids and isoflavonoids. Flavonoids are the low molecular weight compound which play an essential role in photosynthesizing cells (3). Flavonoids are hydroxylated phenolic substances which are synthesized by plants in response to microbial infection (4). Flavonoids has gained much importance due to its multidimensional health effects on human and animal health (5). Flavonoids plays several biochemical and antioxidant effects associated with various diseases such as cancer, Alzheimer's disease, atherosclerosis (6,7,8). Kumar S and Pandey has focused on the protective roles of flavonoids against human diseases as well as their functions in plants (9).

Classification and Structure of various Flavonoids are as follows: Flavonoids are the part of the polyphenolic compounds and polyphenols have the record of having medicinal properties right from ancient times. These have medicinal use in Chinese and Ayurvedic medicines. Recently 4000 varieties of flavonoids have been identified (10). Basic structures of flavonoids are as follows: This structure contains 15-carbon atoms having two aromatic rings attached through a heterocyclic pyrene ring (B) (11). Generally, flavonoids contain basic skeleton i.e., C₆-C₃-C₆ with two aromatic rings and one heterocyclic ring mainly consisting of oxygen atom.

*Corresponding author: Gajbhiye A.V.,
Department of Chemistry, MGV's Arts, Science and Commerce
College, Surgana, Dist. Nashik.

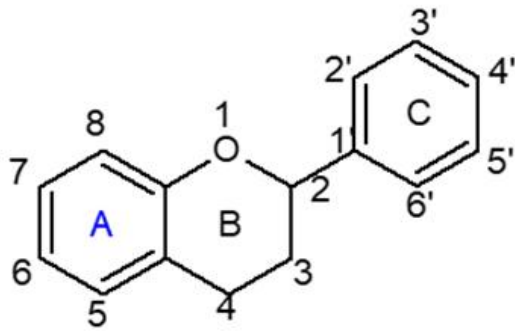


Fig. 1. Structure of Flavonoid

Flavonoids classification depends on the nature of B ring and degree of unsaturation (12) and it can be classified into six subclasses.

Flavanols:

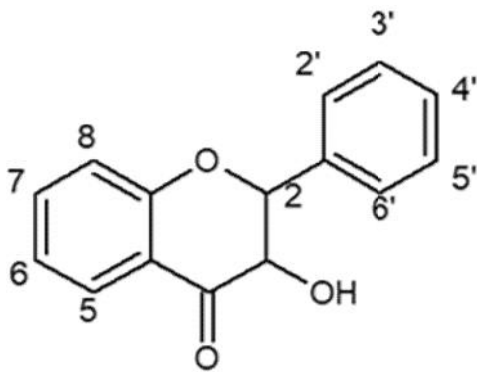


Fig. 2. Structure of Flavanols

It contains alpha hydroxy carbonyl group. It acts as building blocks of proanthocyanins. Flavanol's which have been frequently used are Kaempferol, Quercetin, Myricetin and Fisetin. These have difference in no. and position of hydroxyl group. Medicinally, it acts as antioxidant potential which reduces risk of vascular disease. Mostly, flavanols' are rich tea and red wine apart from fruits and vegetables.

Flavanone:

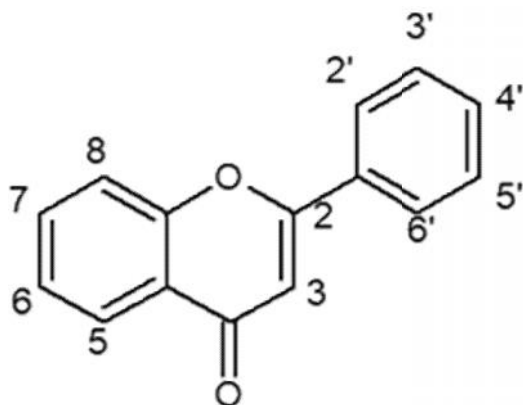


Fig. 3. Structure of Flavanone

It contains α, β -unsaturated carbonyl group. It acts as antioxidant, anti-inflammatory, blood lipid-lowering and cholesterol-lowering agents. These are also called as dihydroflavones. Flavanones are present in peel of citrus fruits and gives bitter taste to the juice. Over the past 15 years, the number of flavanones has significantly increased (13).

Flavones

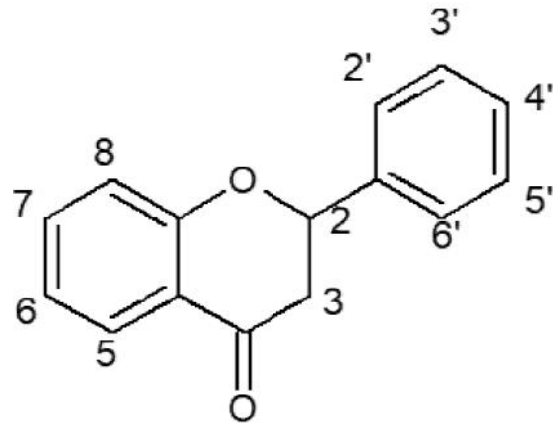


Fig. 4. Structure of Flavone

It contains ketonic group. Flavones which are used commonly are Luteolin, Apigenin and Tangeretin, Nobiletin and Sinensetin (14) depends on position and no. of hydroxyl groups. Flavones are commonly occurring in red peppers, mint, ginkgo biloba, chamomile.

Isoflavones:

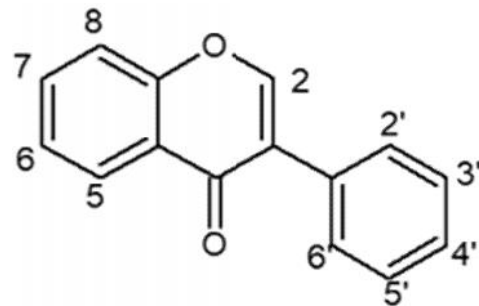


Fig. 5 Structure of Isoflavones

It contains α, β -unsaturated carbonyl group and presence of other aromatic ring at -position. It occurs mostly in soybeans and other leguminous plants. Isoflavonoids are also found in microbes (15). Commonly used isoflavones are Genistein and Daidzein are known because of their oestrogenic activity in certain animal models.

Flavan-3-ol:

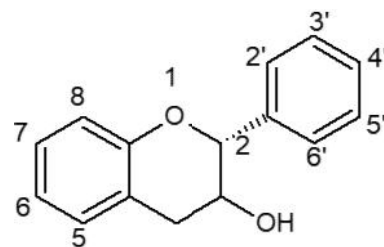


Fig. 6. Structure of Flavan-3-ol

It contains pyrene ring having hydroxyl group at 3-position attaching two aromatic rings. Commonly used flavan-3-ols are Catechin, Epicatechin and Epigallocatechin. It occurs abundantly in bananas, apples, blueberries, peaches and pears.

Biological Significance of Flavonoids: Flavonoids shows various biological properties because of their chemical structures (16,17). It acts as anti-inflammatory, antiviral, anticancer, anti-diabetics, cytotoxic and antiulcer.

Anti-bacterial activity: In response to microbial infection, plants are able to synthesize flavonoids which acts as effective antimicrobial substances against a wide variety of microorganisms. Galangin, Flavone, Apigenin and Flavonol glycosides, Chalcones and flavanones shows potent antimicrobial activities (3).

Anti-cancer activity: Flavonoids exhibit anticancer activity because of their multiple molecular mechanisms of action. It stimulates initiation and promotional stages of the carcinogenicity. Polyphenolic compound like phenolic acids, anthocyanidins, tannins and flavonoids show a broad spectrum of pharmacological activities (18,19).

Anti-viral activity: It shows antiviral activity as it has an ability to inhibit various enzymes associated with the life cycle of viruses. Flavon-3-ol shows anti-HIV property. Naringin, Hesperetin and Quercetin shows anti-dengue activity (20).

Anti-inflammatory activity: Inflammation occurs when body tissues responses to tissue injury, pathogen infection, damaged cells, molecular mediators. In this process, immune cells from blood vessels migrates and releases chemical mediators at the site of tissue damage. Quercetin, Hesperidin and Luteolin shows anti-inflammatory property.

Anti-oxidant Activity: Flavonoids act as antioxidants and thus inhibit the factors of disease causing. Some of the anti-oxidant acts as free radical scavenging [21]. Arrangement of functional group about the nuclear structure decides the antioxidant activity.[22]. Antioxidants are those compounds which protect human, animal and plant cells against the damage effect of free radicals.

CONCLUSION

Flavonoids are the compounds which occurs naturally in plants and fruits. Also, flavonoids play important role in the prevention of many diseases. Flavonoids are the phytochemical compounds which interact with the large number of cellular targets viz. antibacterial, anti-cancer, antiviral, anti-inflammatory. Thus, we tried to review the flavonoids and its various biological activities. It also brings the importance of sources which are rich in flavonoids. Hence helpful to bring out the importance of flavonoids in day-to-day life.

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-) Flavonoids as important moiety
-) Biological activity
-) Pharmaceutical science

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