Review Article

ERA'S JOURNAL OF MEDICAL RESEARCH VOL.7 NO.1

DOI:10.24041/ejmr2020.13

FLAVANOIDS: A REVIEW ON CHEMISTRY AND VERSATILE BIOLOGICAL ACTIVITY

Jyoti Yadav, Mohini Chaurasia, Bidhyut K. Dubey

Era College of Pharmacy

Era University, Lucknow, U.P., India-226003

Received on : 12-03-2019
Accepted on : 30-06-2020

Address for correspondence

Miss. Jyoti Yadav
Era College of Pharmacy
Era University, Lucknow,
U.P., India-226003
Email: Jyoti_2me@yahoo.com
Contact no: +91-8318571725

ABSTRACT

Flavonoids represent a class of low molecular weight polyphenolic secondary metabolites, which are broadly distributed in plants. They have shown various bioactive effects with basic C6—C3—C6 ring system and substitution patterns which lead a series of subcategory compounds. This review paper summarizes various biological effects of extracts from natural products from traditionally used medicinal plants.

KEYWORDS: Flavonoid, Medicinal plant, Biological Activity.

INTRODUCTION

Flavanoid, the largest group of common and naturally occurring polyphenolic compounds that are abundantly found in fruits, vegetables and beverages. These pervsive plant secondary products are best known as characteristic colored anthocyanin pigments of plants (1).

Flavanoids are structurally derived from parent 'Flavone' substance which occurs as a white mealy farina on *Primula* plants. Flavanoids are commonly present in all the vascular plants, attached to sugar as glycosides and only one flavanoid aglycone may be present in a single plant in many glycosidic combinations (2). Flavanoids represent a relatively diverse family of aromatic molecules that are derived from Phenyl and malonyl-coenzyme A (CoA; via fatty acid pathway) (3).

Chemistry of Flavanoids

The flavonoid, a class of plant secondary metabolite, are polyphenolic α, β- unsaturated compounds having 15 carbon atoms i.e. two benzene rings joined by a linear three carbon atom chain which may or may not be a part of third ring. The skeleton may be shown as the C_6 - C_3 - C_6 system (diphenyl propanes) (4).

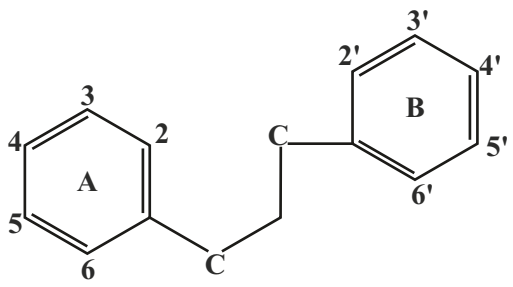


Fig 1: Diphenyl Propanes

In nature, they occur in free state and as glycoside; most are O-glyocside but C-glycosides are also known are present as glycosidal form. The chemical structures of flavonoids are based on a C_{15} skeleton having a Chromone ring or benzo-γ – pyrone ring attached to a second aromatic ring 'B' in position 2, 3 or 4 (5). The individual carbon atom is based on a numbering system, with general numeral for 'A' and 'C' but primed numerals for 'B' ring. Primed modified numbering system is not used for chalcones and isoflavone derivatives (6).

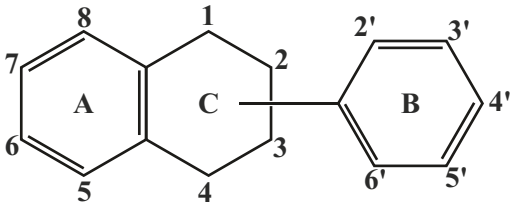


Fig 2 Basic Structure of Flavonoid

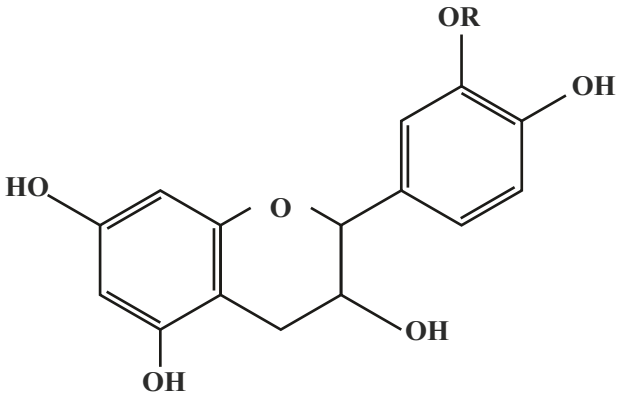
All flavanoid aglycons have a benzene ring 'A' condensed with a six member ring 'C' which in position -2 carries a phenyl ring 'B' as a substituent. The six membered ring condensed with benzene ring is either a γ-pyrone (flavonols and flavonones) or their di hydro derivatives (Flavanols and Flavanones) The 'B' ring comes from Shikimate pathway and is often hydroxylated in position 3,5,7,3',4'and 5' (7).

1. Classification of Flavanoids

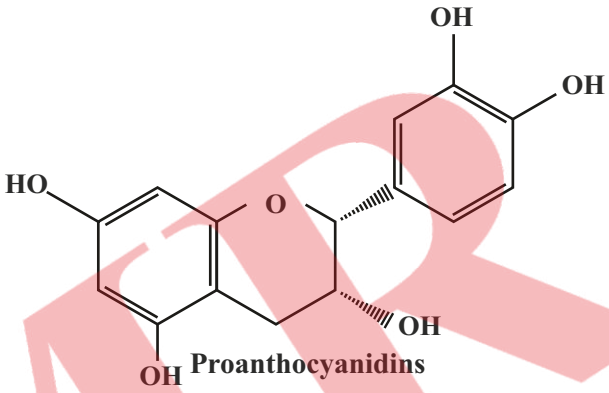
More than 5000 identified flavanoids, can be broadly classified as (2,8) -

1. Anthocyanins

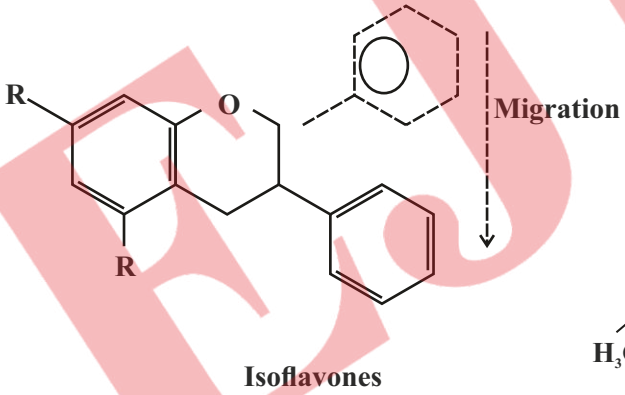
2. Proanthocyanidins
4. Flavones
5. Glycoflavones
6. Biflavonyls
7. Isoflavones
8. Minor Flavanoids (chalcones, aurones)



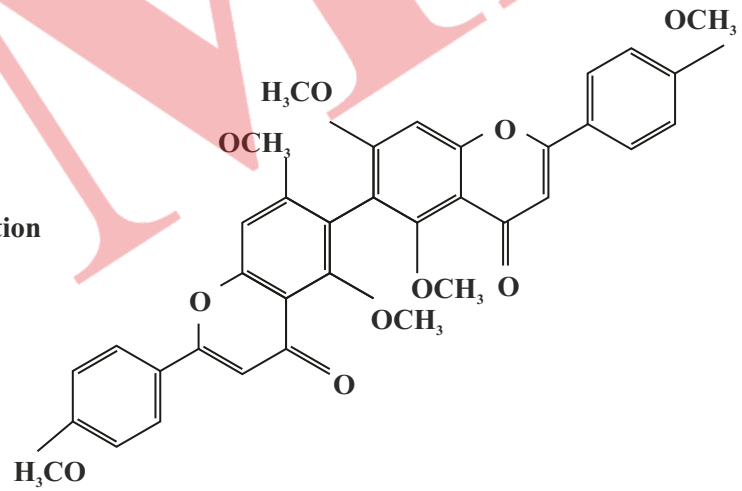
Anthocyanin



Proanthocyanidins



Isoflavones



Biflavonyls

Biosynthesis of Flavanoids

Biosynthesis of most flavanoids starts from condensation of p-coumaroyl-CoA molecule with malonyl-Co A to form chalcone in the presence of Enzyme chalcone synthetase (9). Chalcone is then isomerized by enzyme isomerase to flavanone which serves as intermediate to yield different classes of flavanoids (10). Their biosynthesis is ubiquitous in plants and evolved from plant evolution involved in plant protection and signaling (3).

Versatile activity of Flavanoids

Besides their physiological role in plants, they have shown to possess a large array of biological activity like anti-oxidant, anti-inflammatory, anti-viral (11), anxiolytic, anti-protozoal, anti-mitotic, anti-tumoral (12), anti-tubercular, anti-diabetic (13), cytotoxic activity against a multi-drug resistant cell line, tranquillizers, vaso relaxant activity (14), immunomodulator (15), Skin Protective Effect from UV Radiation (16). Few of them have been summarized in table 1 showing biological effects of extracts from natural products from traditionally used medicinal plants.

Name of Plant	Family	Flavanoid	Active part of plant	Biological Activity
Azadirachta indica	Meliaceae	Quercetin	Flower extract	Anti-cancerous (17)
Glyccheriza glabra	Leguminoseae	Liquiritin	Root extract	Antioxidant (18)
Butea monospermea	Fabaceae	Genistein	bark extract	Antibacterial, Antidiarrhoeal (19)
Aloe vera	Asphodelaceae	Luteolin	Leaf gel exract	Antioxidant (20)
Bacopa moneirra	Planataginaceae	Luteolin	Plant extract	Antioxidant (21)
Oroxylumindicum	Bignoniaceaea	Chrysin	Seed extract	Antibacterial, Antioxidant (22)
Momordica charantia	Curcurbitaceae	Luteolin	Leaf extract	Antidiabetic (23)
Tiliacordata	Tiliaceae	Hyperoside	Leaf extract	Anxiolytic (24)
Mimosa pudica	Mimosoideae	Isoquercetin	Leaf and stem extract	Antibacterial (25)
Cannabis sativa	Compositae	Luteolin	Leaf extract	Anti-inflammatory (26)
Andrographis paniculata	Compositae	5-hydroxy-7,8-dimethoxyflavone	Aerial part extract	Antibacterial (27)
Limnophila indica	Scrophulariaceae	Methoxyflavone	Whole plant extract	Antioxidant (28)
Brysonima crassa	Malphigaceae	Catechin	Leaf extract	Antiulcer (29)
Mentha longifolia	Lamiaceae	Apigenin-7-O-glycoside	Leaf extract	Antibacterial (30)

Table 1: List Of Flavanoid Content Rich Medicinal Plants

CONCLUSION

Flavonoids having the low molecular weight medicinally active phytoconstituent. Chemically flavonoids containing benzo-γ-pyrone structure, which are a subdivision of a polyphenolic type natural products. Flavonoids are established as functional ingredients and health promoting biomolecules. Various naturally occurring chemical constituents have been proven for prevention and cure of several diseases. Due to structural diversity of flavonoids, it becomes epitome of major pharmacological activities in the era of phytoconstituents. The present review highlights the biological sources, various types of flavonoids and different specific pharmacological activities as antioxidant, anxiolytic, antibacterial, hepatoprotective, anti-inflammatory, anticancer, antiulcer and antiviral.

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How to cite this article : Yadav J., Chaurasia M., Dubey B.K. Flavanoids: A Review On Chemistry And Versatile Biological Activity Era J. Med. Res. 2020; 7(1): 75-78.