

**BIOLOGICAL ACTIVITIES AND ROLE OF FLAVONOIDS IN HUMAN HEALTH–A
REVIEW****SUSHIL CHANDRA TIWARI^{a1} AND NISREEN HUSAIN^b**^aPrincipal, Govt. Dr. W.W Patankar Girls' P.G. College, Durg, Chhattisgarh, India^bDepartment of Zoology, Govt. Dr. W.W Patankar Girls' P.G. College, Durg, Chhattisgarh, India**ABSTRACT**

Plants and herbs consumed by humans are the rich sources of phytochemical compounds, synthesized in plants itself. Such bioactive substances are responsible for the plant's antioxidant and medicinal values. The major content is formed by phenolic compounds. Flavonoids are the components of plant phenols, which are of great interest due to their antioxidative and many other biological activities. Thus flavonoids, directly associated with human dietary ingredients, play important role in disease prevention and exhibit versatile health benefits. Fruits and vegetable are the main dietary sources of flavonoids for humans, along with tea and wine. Microbial biotechnology, in recent years, have made possible the bulk production of different types of flavonoids useful for pharmaceutical purposes. This review highlights the various important biological activities of flavonoids that attributes to their beneficial roles in human health.

KEYWORDS: Phytochemical, Phenolic Compounds, Flavonoids, Biological Activites, Dietary Sources.

Flavonoids are the important groups of secondary metabolites in plants, and also the good sources of natural antioxidants in human diets (Kim *et al.*, 2003). Hence, flavonoids are known to play an important role in the control of different human diseases. The flavonoids have polyphenolic structure, that makes it responsible for the variety of pharmacological activities (Mahomoodally *et al.*, 2005). Functional hydroxyl groups in flavonoids show their antioxidant effects by scavenging free radicals or by chelating metal ions. This helps in the prevention of radical generation that damage the biomolecules leading to oxidative stress and many diseases (Kumar *et al.*, 2013; Leopoldini *et al.*, 2006). Flavonoids make security against the diseases such as cancer, cardiovascular and respiratory disorders, arthritis and early ageing. They contribute to the antioxidant defense system of the human body, and also induce human protective enzyme systems (Cook & Samman, 1996).

**BIOLOGICAL ACTIVITIES OF
FLAVONOIDS**

Besides possessing antioxidant property, flavonoids also posses diverse biological activities that owes to the health aspects for human (Vessal *et al.*, 2003 ; Ghasemzadeh & Jaafar, 2011). These activities are, for instance, anti-inflammatory, anti-ulcer, anti-viral, anti-cancer, anti-diabetic and cytotoxic.

Anti-oxidant Activity

Antioxidants are specific compounds that protect human, animal and plant cells against the damaging effects of free radicals. Flavonoids are best known phytochemicals that act as antioxidants, and thus inhibit the factors of disease-causing. This activity depends upon the arrangement of functional groups about the nuclear structure (Kelly *et al.*, 2002 ; Kukic *et al.*, 2006). The antioxidant action of flavonoids include suppression of ROS formation by inhibition of enzymes, by scavenging free radicals, and regulation of antioxidant defenses (Mishra *et al.*, 2013). Flavonoids also protect the lipids of the biomembranes which are damaged due to lipid peroxidation. Thus, the flavonoids contribute as antioxidants, in prevention of many diseases caused due to oxidative stress (Ramchoun *et al.*, 2009).

Anti-bacterial Activity

Flavonoids are synthesized by plants in response to microbial infection, and hence are very effective antimicrobial substances against a wide array of micro-organisms. Apigenin and Isoflavones are known to possess potent antibacterial activity. Their mode of anti-microbial action may be related to their ability to inactivate microbial adhesins, enzymes and cell transport proteins. Lipophilic flavonoids may also disrupt microbial membranes (Cushine & Lamb, 2005).

Anti-viral Activity

Naturally occurring flavonoids exhibit remarkable anti-viral activity. They help in inhibition of various enzymes associated with the life cycle of

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viruses. Flavon-3-ol was found to be more effective than flavones and flavonones in selective inhibition of HIV-1 & HIV-2. Baicalin, another flavonoid, isolated from *Scutellaria baicalensis*, also is known to inhibit immune-deficiency virus infections (Gerdin & Srenso, 1983). Anti-dengue virus properties of Quercetin, Hesperetin and Naringin, has also been reported (Zandi *et al.*, 2011).

Anti-Inflammatory Activity

Inflammation is a normal biological process in response to tissue injury, pathogen infection and chemical irritation. This is initiated by migration of immune cells from blood vessels and release of mediators at the site of damage. This process is followed by the action of inflammatory cells to eliminate foreign pathogens and repairing injured tissues of the immune system and inflammatory cells. Hesperidin, Luteolin and Quercetin are known to possess anti-inflammatory property. They function by affecting enzyme systems involved in generation of inflammatory processes. Flavonoids also inhibit phospho-di-esterases involved in cell activation.

Hepato-protective Activity

Different chronic diseases such as diabetes and metabolic disruptions, may lead to development of hepatic clinical manifestations. Flavonoids in form of C₃G treatment and Silymarin have been reported to lower hepatic lipid peroxidation and stimulate liver regeneration respectively (Zhu *et al.*, 2012).

Anti-cancer Activity

Prevention of cancers have been effective due to flavonoids. They affect on the initiation and promotion stages of the carcinogenicity, along with influences on development and hormonal activity. The other mechanisms of action are cell-cycle arrest, down regulation of mutant *p53* protein, inhibition of many cancer-triggering enzymes and expression of *Ras* proteins. Flavonoids such as Flavonols, Isoflavone and Quercetin are known to decline the incidences of many carcinogenesis conditions (Davis & Mathew, 2000).

ROLE OF FLAVONOIDS IN PROTECTION AGAINST HUMAN DISEASES

Flavonoids are the natural products of plant and anti-oxidant substances capable of scavenging free radicals. This way they protect biological

systems against the harmful effects of oxidative processes on macro molecules and DNA, thereby reducing the risk of dreadful diseases. Besides their anti-oxidant activity, the flavonoids possess different biological activities, that attribute to their role in protection against human diseases.

The Flavones and Catechins are the most powerful flavonoids for protecting the human body against the ill-effects of oxidative stress (Kim *et al.*, 1993). Quercetin, Morin, Myricetin etc. exhibit protective effects in prevention of cancer, liver and cardiovascular diseases.

Cardiovascular diseases include atherosclerosis, coronary heart disease, arterial hypertension and heart failure. The major reason behind CVS diseases and consequent deaths is oxidative stress. Hence, flavonoids as antioxidants, decrease oxidative stress, and thus attribute to all the beneficial health effects (Tiwari, 2001). Efficacy and safety of flavonoids in the treatment of hepatobiliary dysfunction and digestive complaints have been reported due to its hepto-protective activity (Spencer *et al.*, 2009).

Flavonoids help to fight the pathogenic micro-organisms that enter the body system and interfere with the physiology and metabolism of human body. Viruses and bacterial infections are thus prevented, which is due to the strong anti-bacterial and anti-viral activities of flavonoids. Anti-cancer activity of flavonoids make it the powerful phytochemicals to produce cell cycle inhibition in proliferating lymphoid cells, and exert growth-inhibitory effects on several malignant tumor cells. Thus, the risk of human breast cancer, ovarian & prostate cancer is reduced. Flavonoids have an array of health-promoting benefits that owes to their important biological, anti-oxidative and pharmacological activity (Zhou *et al.*, 1993).

DISCUSSION & CONCLUSION

The herbal drugs and natural products of many medicinal plants have been known since ages, in maintaining human health (Nayak *et al.*, 2011). This unusual contribution is due to the anti-oxidant activity of natural phytochemicals, that help in intensifying the anti-oxidant defenses (Herrera *et al.*, 2001). Flavonoids are such phytochemicals that play significant role in enhancing the human health benefits. They are good sources of Natural

antioxidants in human diets. Flavonoids neutralize the harmful effects of free radicals in best of ways, and thus help in prevention of diseases.

Flavonoids, occurring virtually, in all plant parts, particularly photo-synthesizing plants cells are a major coloring component of flowering plants. They are an integrated part of human and animal diet. Flavonoids are generally responsible for prevention of fat oxidation, and protection of vitamins and enzymes, thereby contributing in protection against diseases (Yao *et al.*, 2004). Flavonoids have extensive biological properties that promote human health and reduce the risk of diseases.

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