

Antioxidant and Chelating Properties of Flavonoids

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Opinion

Flavonoids are a class of naturally occurring, low molecular weight polyphenols derived from plants that are formally classified as benzo—pyrene derivatives. Flavonoids are powerful antioxidants *in vitro*, but their overall function *in vivo* is unknown, whether it is an antioxidant, anti-inflammatory, enzyme inhibitor, enzyme inducer, cell division inhibitor, or some other role. Flavonoids have been shown to have a variety of biological effects, including anti-inflammatory, ant allergic, antiviral, and anticancer properties. Flavonoids' effects on cellular and tissue damage, their toxicity on tumour cells, and their mutagenic and antimutagenic properties. It should also be noted that the reducing properties of flavonoids, independent of their antioxidant properties, may contribute to redox regulation in cells and thus protect against cell ageing, for example, by cooperating with the intracellular reductant network. As a result, flavonoids are present in the human diet. Within the major flavonoid classes, over 4000 different flavonoids have been identified, including flavonols, flavones, flavanones, catechins, anthocyanidins, isoflavones, dihydroflavonols, and chalcones.

Flavonoids have the potential to be antioxidants, metal chelators, and lipid peroxidation inhibitors. Flavonoids, due to their polyphenolic nature, can act as antioxidants. The number of hydroxyl groups on the flavonoid structure influences these properties. It is said that the number of hydroxyl groups in flavonoids increases their antioxidant capacity. Flavonoids are classified into eight groups: Flavonols (quercetin, myricetin, kaempferol, and rutin), flavanones (taxifolin), flavones (luteolin and apigenin), isoflavones (daidzein and genistein), catechins, anthocyanidins, dihydroflavones, and chalcones. Flavonoids are polyphenolic weak polybasic acids with a number of hydroxyl groups that can undergo protonation and deprotonation depending on their pK. Flavonoids are now used as active ingredients in many pharmaceuticals. It demonstrates that they are currently commercially available. For instance, quercetin, the most biologically active and widely used dietary flavonoid, is commonly used as a dietary supplement.

Chelation process of flavonoids

Chelation process of flavonoids Interactions of flavonoids with

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metal ions can lead to chelate formation. The chelation of metals can be crucial in the prevention of radical generation, which damage target biomolecules. Moreover, the using of natural chelators such as flavonoids is better than the synthetic ones due their toxicity effects.

Three potential coordination sites can be found in the structures of several flavonoids:

- Between the 5-hydroxy and 4-carbonyl groups,
- Between the 3-hydroxy and 4-carbonyl groups, and
- Between the 3', 4'-hydroxy groups in the B ring

Flavonoids can chelate metal ions and form complexes due to their unique chemical structure. Flavonoids have antioxidant activity in addition to direct free radical scavenging properties due to interactions between the reduced forms of transition metals, primarily iron and copper ions, which participate in the formation of free radicals. The first complex of flavonoids with aluminium as the central ion was discovered in 1962. Over 40 metal complexes of flavonoids have been studied by researchers since 1980. Flavonoids inhibit *in vitro* peroxidative processes such as linoleic acid autoxidation, low-density lipoprotein oxidation, phospholipid membrane peroxidation, microsomal and mitochondrial lipid peroxidation, erythrocyte ghost lipid peroxidation, rat brain homogenate autoxidation, and photooxidation and lipid peroxidation in chloroplasts. As a result, the overall antioxidant flavonoids appear to be a combination of direct reactions with free radicals and chelating properties that are responsible for the production of reactive oxygen species.