In The Name Of GOD
The benefits of quercetin and features

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The flavonoids are polyphenolic compounds possessing 15 carbon atoms; (1)

two benzene rings joined by a linear three carbon chain having the carbon skeleton C6 - C3 - C6 (1)

they are the plant pigments and they are having polar nature and is soluable in methanol and water. (2)
Polyphenolic compounds that ubiquitous in nature (3)
Flavonoids

- Delays or Prevents the onset of diseases caused by FREE Radicals
- Best Anti-oxidant
- Anti-inflammatory Activity
- Improvement of Endothelial Functions
- Blood Pressure Reduction due to its Vasodilatory Effect
- Inhibits LDL oxidation by FREE Radicals
- Inhibits Platelet Aggregation
- Anti-viral/Anti-bacterial
- Reduced Risk of Cardiovascular diseases
Phenolics have been attributed with positive pharmacological properties. (4)

having antimitagenic and anticancerogenic effects as well as being antioxidants. (5)
Bioavailability Problems (6)

✓ Poor absorption of flavonoids!!!

✓ 1- Bacterial degradation of the phenol moiety of the molecule and a complex formation.

✓ 2- Flavonoid molecules have poor miscibility with lipids, which limited their ability to pass across the lipid-rich outer membranes of the small intestine.
FLAVONOIDs

- constitute one of the most characteristic classes of compounds in higher plants. (7)

- Many flavonoids are easily recognised as flower pigments in most angiosperm families (flowering plants). (7)
FLAVONOIDS

- However, their occurrence is not restricted to flowers but include all parts of the plant.

- They are secondary metabolite and effective in CNS disorders. (8)
Some flavonoids in hops and beer have been found to have better antioxidant effects than tea or red wine.

Most flavonoids are found in fruits, vegetables, teas, and other drinks. (9)
Flavonoids

(10)

antiviral
anti-allergic
antioxidant
antitumor
anti-platelet
anti-inflammatory
Boiological Sources: Quercetin occurs in the bark of Quercus tinctoria belonging to family Hippocastanaceae. (11)

Quercetin is a bioflavonoid (or flavonoid), which is a type pigment found in almost all herbs, fruits, and vegetables. (12)
• Used for treating conditions of the heart and blood vessels, including:
  - Atherosclerosis (13)
  - high cholesterol (14)
  - heart disease (15)
  - circulation problems. (16)

➢ **Sources:** onions, apples, green and black teas and fruit skins
➢ Baking onions increases amount of quercetin.
➢ Boiling decreases amount of quercetin (17)
The most abundant dietary flavonol, is a potent antioxidant. (18)

It has all the right structural features for free radical scavenging activity. (19)
Quercetin (3,3',4',5,7-pentahydroxyflavone). (20)

This compound can be considered as a good candidate for anticancer therapy. (21)
Behaving as antioxidant and/or prooxidant as well as modulating different intracellular signalling cascades may all play a certain role. (22)

It has been suggested that these prooxidant capacities of quercetin could contribute to cancer chemotherapy and the inhibition of tumor growth. (23)
stimulate immune system

scavenge free radicals

modulate enzyme activities (24)

alter the mitotic cycle

modify gene expression and induce apoptosis (25)
Chan C-Y et al IN 2016: Quercetin treatment with 10 μM (half concentration of IC50) suppressed cell migration and invasion in EGFR-overexpressing HSC-3 and FaDu HNSCC cells. (26)

Srivastava S et al IN 2016: Quercetin treatment in mice leads to lower tumor load, increased survival and minimal side effects. (27)
Ranganathan S et al IN 2015: investigated the anti-proliferative effect of quercetin in two breast cancer cell lines (MCF-7 and MDA-MB-231). (28)

Srinivasan A et al IN 2015: IC50 value (37μM) of quercetin showed significant cytotoxicity in MCF-7 cells, which was not observed in MDA-MB-231 cells even at 100μM of quercetin treatment. (29)
IN 2013, 2012: **Quercetin** inhibits OSCC cell proliferation in a dose-dependent manner. Three doses (25, 50, and 75µm) were chosen as test concentrations for the remainder of the experiments. (30,31)
Giri S et al IN 2011: Total quercetin derived from the diet is present in plasma at the nanomolar range (<100 nM).

- but can be increased to micromolar concentrations after supplementation.
- For example, 28 days of supplementation with 1 g/day of quercetin increased plasma concentrations to 1.5 µM. (32)
Quercetin degraded the nuclear b-catenin and led to the inactivation of b-catenin downstream signaling. (32)

Kawahara T et al in 2009: Quercetin Suppress the Growth of Leukemia and Lymphoma Cells.

Cells were cultured in methylcellulose with 50 μM quercetin.

Quercetin colonization in cell lines HL-60 3% and Daudi cell lines was 0 %. (33)
In this study, concentrations of 25, 50 and 100 mg per kg of quercetin that injected via intra peritoneally into mice, and observed that increasing drug concentration can reduce the growth and proliferation. (33)

Goya L et al IN 2006: Quercetin Induces Apoptosis via Caspase Activation, Regulation of Bcl-2, and Inhibition of PI-3-Kinase/Akt and ERK Pathways in a Human Hepatoma Cell Line (HepG2). (34)
Incubation with quercetin for 18 h displayed a dramatic cell mortality (68% with the highest concentration, 100 mmol/L, P < 0.05) with an estimated 50% of cell death (IC50) value of 87 mmol/L. (34)

Walle T et al IN 2005: this study examined Antiproliferative effects of quercetin in SCC-9 cells,

Observed that the growth of SCC-9 cells at a concentration of 100 µmol per liter quercetin more decrease with compared to concentrations of 10 µm per liter. (35)
Elattar TM et al IN 1999: Quercetin exhibited a biphasic effect, stimulation at 1.0 and 10 µmol and minimal inhibition at 100 µmol in cell growth and DNA synthesis. (36)

Combining 50 µmol of resveratrol with 10, 25 and 50 µmol of quercetin resulted in gradual and significant increase in the inhibitory effect of the two compounds. (36)
Flavonoids are widely distributed among various plants and in foodstuffs; consequently, they constitute an unavoidable component of the diet.

Flavonoids like *quercetin* have potential as starting material in drug development programmes.
the development of experimental *anticancer* flavonoid derivatives.

A similar approach could result in the development of effective *antiplatelet, antiviral and anti-inflammatory* agents.


• 7. McKay DL, Chen C-YO, Zampariello CA, Blumberg JB. Flavonoids and phenolic acids from cranberry juice are bioavailable and bioactive in healthy older adults. Food chemistry. 2015;168:233-40.


