Abstract: Flavonoids are present in mainly plant foods and have attracted much attention in relation to disease prevention. Their antioxidant activity at least partly accounts for their potential health effect, because oxidative stress leads to a variety of pathological events. It is essential to know the bioavailability of flavonoids involving intestinal absorption, metabolic conversion and urinary excretion, in order to evaluate their in vivo antioxidant activity after intake. Here (-)-epicatechin and quercetin were selected as typical flavanol- and flavonol-flavonoids present in vegetables, fruits and tea. Our rat study suggests that their metabolic conversion begins in the intestinal mucosa where the activity of uridine-5’-diphosphoglucuronosyltransferase (UGT) is at its highest. Both flavonoids accumulated mostly as glucuronide and sulfate conjugates in blood plasma after oral administration. No intact quercetin was found in the circulation. However, on the oral administration of these flavonoids, the antioxidative ability of rat plasma was enhanced indicating that conjugated metabolites participate in the antioxidant defense in blood plasma. Therefore, the intake of vegetables, fruits and tea rich in flavonoids may help to prevent oxidative damages in the blood. J. Med. Invest. 46: 159-168, 1999

Keywords: flavonoid, quercetin, (-)-epicatechin, antioxidant, glucuronidation
In vivo antioxidants

Flavonoids as in vivo antioxidants

(-)-Epicatechin

Quercetin

J. Terao.
Dose 10 mg

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Dose 50 mg

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![Graph A](image1)

![Graph B](image2)

In vivo experiments were conducted to investigate the effect of α-Tocopherol on the lipid peroxidation of liposomes. The results showed that α-Tocopherol significantly inhibited the formation of CE-OH (μM) in liposomes. The graph above illustrates the residual α-Tocopherol (%) over a period of incubation time (hr). The inhibition was dose-dependent, with higher concentrations of α-Tocopherol leading to a greater reduction in CE-OH formation.

The data suggest that α-Tocopherol can act as a powerful antioxidant, protecting liposomes from lipid peroxidation. Further studies are needed to elucidate the mechanisms underlying this effect and to determine the clinical relevance of these findings.

References:
I. propylene glycol

![Graph A: Total conjugates](image1)

- quercetin
- isorhamnetin

![Graph B: Glucuronides](image2)

II. water

![Graph A: Total conjugates](image3)

- quercetin
- isorhamnetin

![Graph B: Glucuronides](image4)

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The relationship between the metabolism and the pharmacokinetics of Quercetin and Isoquercetin is illustrated in the diagrams below.

Quercetin

![Quercetin Metabolism Diagram]

Isoquercetin

![Isoquercetin Metabolism Diagram]
### Flavonoids as in vivo antioxidants

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J. Terao. Flavonoids as in vivo antioxidants

β-carotene, β-cryptoxanthin, and lutein have been shown to function in vivo as antioxidants.

L-ascorbic acid, lycopene, and natural 
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L-ascorbic acid, lycopene, and natural