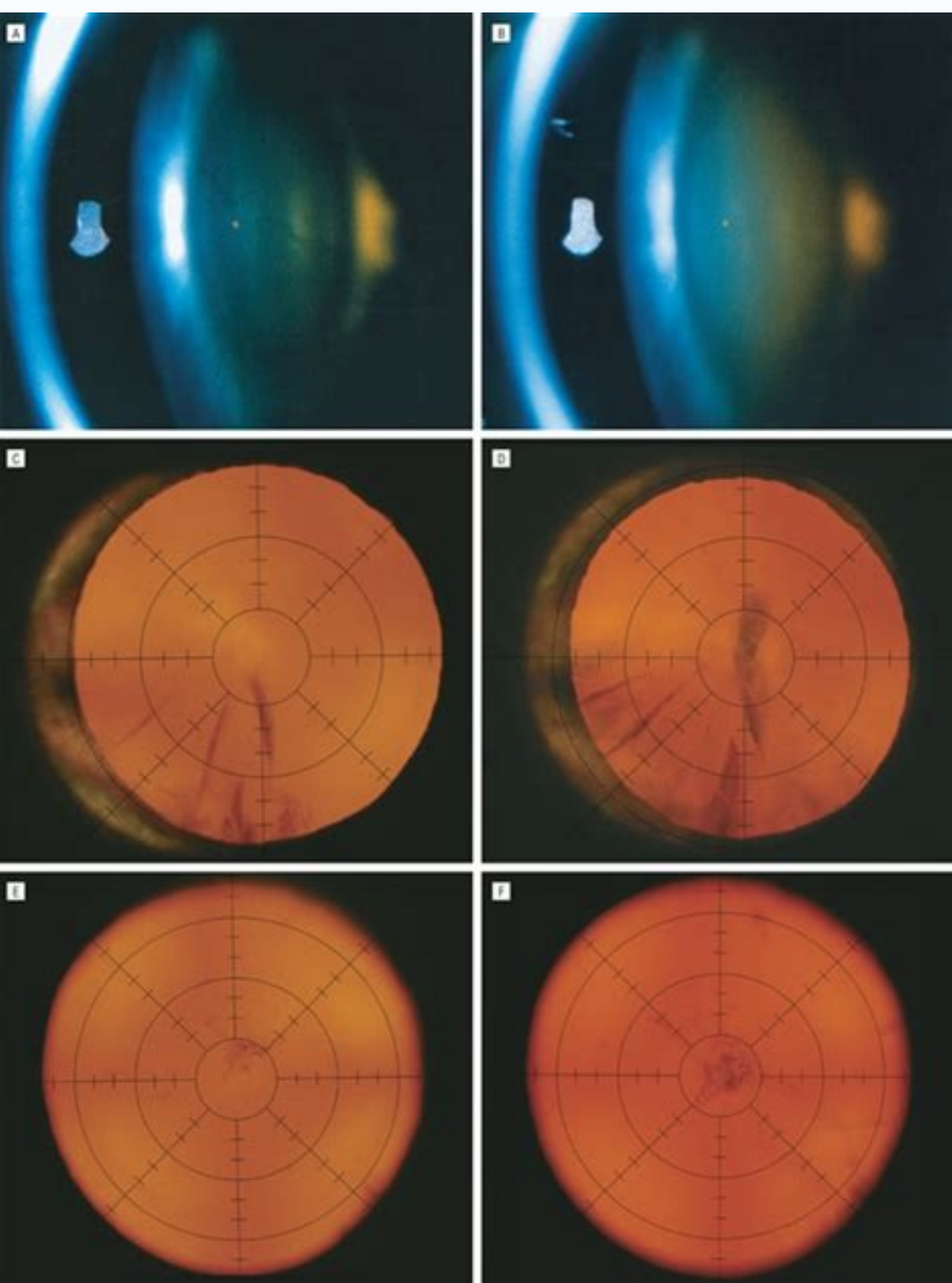
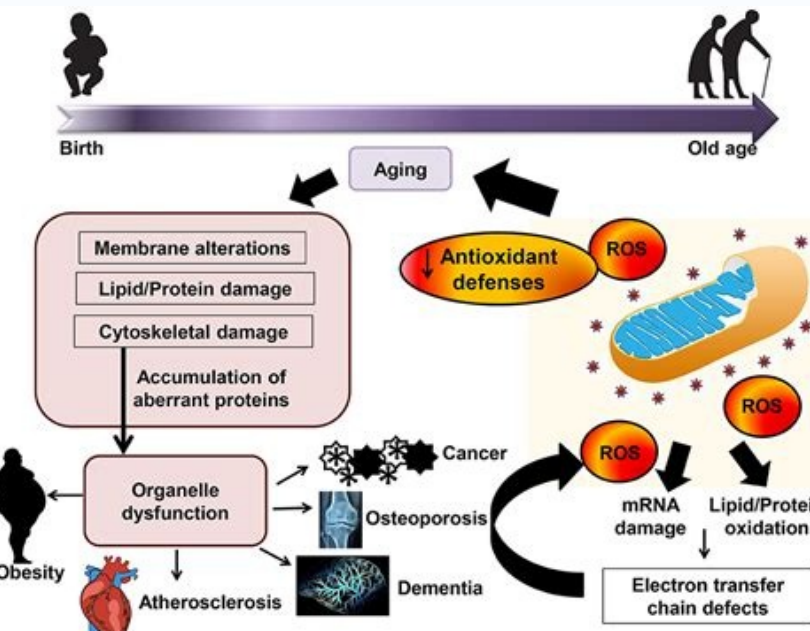


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## Major flavonoids with antioxidant activity from *Teucrium polium* L.

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### ABSTRACT

*Teucrium polium* L. (Lamiaceae) aerial parts are used widely in the daily diet and for medicinal purposes. This plant is used also as a spice and refreshing beverage. Phytochemical and bioactivity studies of this plant have been carried out. Aerial parts of the plant were extracted with petroleum ether, chloroform, methanol and water successively. Fractionation of the methanol extract yielded four major flavonoids. The crude extracts and isolated compounds were screened for their antioxidant and free radical scavenging activities using DPPH radical-scavenging, beta-carotene/linoleic acid and ammonium thiocyanate methods. Methanol extract, rutin and apigenin were found to be the most active fractions as radical-scavengers with IC<sub>50</sub> values of 20.1 ± 1.7, 23.7 ± 1.9 and 30.3 ± 2.1 µg/ml, respectively. The samples with the highest inhibition of oxidation of beta-carotene and lipid peroxidation in ammonium thiocyanate methods were also found to be methanol extract, rutin and apigenin. Methoxylated flavonoids exhibited a lesser antioxidant activity.

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### 1. Introduction

Reactive free radicals, such as superoxide anion (O<sub>2</sub><sup>-</sup>), hydroxyl radical (·OH), and peroxyl radical (ROO·), are particularly reactive and are known to be a biological product in reducing molecular oxygen (Williams & Jeffrey, 2000). Damages mediated by free radicals result in the disruption of membrane fluidity, protein denaturation, lipid peroxidation, oxidative DNA and alteration of platelet functions (Kinsella, Frankel, German, & Kanner, 1993), which have generally been considered to be linked with many chronic health problems such as cancers, inflammation, aging and atherosclerosis. An antioxidant, which can quench reactive free radicals, can prevent the oxidation of other molecules and may therefore have health-promoting effects in the prevention of degenerative diseases (Shahidi, 1997). The interest in antioxidants has been increasing because of their high capacity in scavenging free radicals related to various diseases (Silva, Souza, Rogez, Rees, & Larondelle, 2007). There is a growing interest in natural antioxidants, present in medicinal and dietary plants that might help attenuate oxidative damage (Silva, Ferreres, Malva, & Dias, 2005). These natural antioxidants not only protect food lipids from oxidation, but may also provide health benefits associated with preventing damages due to biological degeneration (Hu & Kitts, 2005; Shahidi & Wanasundara, 1992). As part of our efforts to find antioxidants from edible herbs, we have investigated the antioxidant

potential of *Teucrium polium* L., a plant which belongs to the Lamiaceae. This family is composed of species with exploitable antioxidant activity (del Baño et al., 2003). The genus of *Teucrium* (Lamiaceae) is represented by 12 species in the flora of Iran (Mozaffarian, 1997). *Teucrium polium* L. is one of the wild-growing flowering species from this genus and is found abundantly in Iran. This plant is used to prepare herbal tea and as traditional medicine. The tea of *T. polium* is used as an appetizer especially in children and also as a spice. An infusion of the leaves and flowers of the plant is consumed as a refreshing beverage (Facciola, 1990). The biological activities of *T. polium* is widely reported and it has been shown to possess anti-inflammatory, anti-nociceptive, anti-bacterial, anti-hypertensive, hypolipidemic, anti-rheumatoid, and hypoglycemic effects (Abdollahi, Karimpour, & Monsef-Esfehani, 2003; Rasekh, Khoshnood-Mansourkhani, & Kamalnejad, 2001; Tariq, Ageel, Al-Yahya, Mossa, & Al-Said, 1989). Recently, the high insulinotropic and anti-hyperglycemic activity of its crude extract using both animal and/or isolated rat pancreatic islets has been evaluated (Esmaili & Yazdanparast, 2004). There are also some reports in the literature for antioxidant effects of crude extract of *T. polium* (Ljubuncic et al., 2006). Two known phenylethanoid glycosides, verbascoside and polyinoside have been reported from the aerial parts of this plant (Bedir, Tasdemir, Çalis, Zerbe, & Sticher, 1999). As far as we know, this is the first report concerning the antioxidant flavonoids of this plant from Iran. In the present work, we wish to report the isolation and structural elucidation of four flavonoids from the aerial parts of *T. polium*, together with their antioxidant and free radical scavenging activity.

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