Improvement of Pro-Oxidant Capacity of Protocatechuic Acid by Esterification

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Abstract

Pro-oxidant effects of phenolic compounds are usually correlated to the one-electron redox potential of the phenoxyl radicals. Here we demonstrated that, besides their oxidizability, hydrophobicity can also be a decisive factor. We found that esterification of protocatechuic acid (P0) provoked a profound influence in its pro-oxidant capacity. The esters bearing alkyl chains containing two (P2), four (P4) and seven (P7) carbons, but not the acid precursor (P0), were able to exacerbate the oxidation of trolox, -tocopherol and rifampicin. This effect was also dependent on the catechol moiety, since neither gallic acid nor butyl gallate showed any pro-oxidant effects. A comparison was also made with apocynin, which is well-characterized regarding its pro-oxidant properties. P7 was more efficient than apocynin regarding co-oxidation of trolox. However, P7 was not able to co-oxidize glutathione and NADH, which are targets of the apocynin radical. A correlation was found between pro-oxidant capacity and the stability of the radicals, as suggested by the intensity of the peak current in the differential pulse voltammetry experiments. In conclusion, taking into account that hydroquinone and related moieties are frequently found in biomolecules and quinone-based chemotherapeutics, our demonstration that esters of protocatechuic acid are specific and potent co-catalysts in their oxidations may be very relevant as a pathway to exacerbate redox cycling reactions, which are usually involved in their biological and pharmacological mechanisms of action.

Full article

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