

Rooibos Extract Antioxidants: In vitro Models to Assess Their Bioavailability

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Abstract : Oxidative stress contributes to the pathogenesis of many diseases and consequently antioxidant therapy has attracted much attention as a potential therapeutic strategy. Regardless of the quantities ingested, antioxidants need to reach the diseased tissues at concentrations sufficient to combat oxidative stress. Bioavailability is thus a defining criterion for the therapeutic efficacy of antioxidants. In addition, therapeutic antioxidants must possess biologically relevant characteristics which can target the specific molecular mechanisms responsible for disease related oxidative stress. While many chemical antioxidant assays are available to quantify antioxidant capacity, they relate poorly to the biological environment and provide no information as to the bioavailability. The present comparative study thus aims to characterise green and fermented rooibos extracts, well recognized for their exceptional antioxidant capacity, in terms of antioxidant bioavailability and efficacy in a disease relevant cellular setting. Chinese green tea antioxidant activity was also evaluated. Chemical antioxidant assays (FRAP, DPPH and ORAC) confirmed the potent antioxidant capacity of both green and fermented rooibos, with green rooibos possessing antioxidant activity superior to that of fermented rooibos and Chinese green tea. Bioavailability was assessed using the PAMPA assay and the results indicate that green and fermented rooibos have a permeation coefficient of 5.7×10^{-6} and 6.9×10^{-6} cm/s, respectively. Chinese green tea permeability coefficient was 8.5×10^{-6} cm/s. These values were comparable to those of rifampicin, which is known to have a high permeability across intestinal epithelium with a permeability coefficient of 5×10^{-6} cm/s. To assess the antioxidant efficacy in a cellular context, U937 and red blood cells were pre-treated with rooibos and Chinese green tea extracts in the presence of a dye DCFH-DA and then exposed to oxidative stress. Green rooibos exhibited highest activity with an IC₅₀ value of 29 µg/ml and 70 µg/ml, when U937 and red blood cells were exposed oxidative stress, respectively. Fermented rooibos and Chinese green tea had IC₅₀ values of 61 µg/ml and 57 µg/ml for U937, respectively, and 221 µg/ml and 405 µg/ml for red blood cells, respectively. These results indicate that fermented and green rooibos extracts were able to permeate the U937 cells and red blood cell membrane and inhibited oxidation of DCFH-DA to a fluorescent DCF within the cells.

Keywords : rooibos, antioxidants, permeability, bioavailability

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