BETANIN INHIBITS MYELOPEROXIDASE/NITRITE-MEDIATED PEROXIDATION OF HUMAN LOW-DENSITY LIPOPROTEIN

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INTRODUCTION: Betanin, the betalain red pigment occurring in the Cariophyllaceae order plants, including cactus pear, has recently been reported to possess reducing properties and to behave as liperoxyl radical-scavenger in vitro (1). In addition, this phytochemical is bioavailable, accumulates in human LDL after ingestion of cactus pear fruits, and is able to protect LDL against copper-induced oxidation in vitro (2,3). Myeloperoxidase (MPO) has been implicated in the in vivo LDL modification and atherogenesis (4). The enzyme, in the presence of nitrite, generates two powerful oxidizing agents, the tyrosyl radical and the nitrosyl one, both of which promote LDL lipid oxidation (4). Taking all this into account, we decided to investigate whether betanin could counteract MPO/nitrite-induced oxidation of LDL.

MATERIALS AND METHODS: Human MPO was purchased from Calbiochem and Glucose oxidase from Sigma. All other chemical and solvents were purchased from Sigma Aldrich or Merck. Preparation of LDL: LDL was prepared from blood serum of healthy volunteers according to Kleinvedl et al. (5) with minor modifications and stored in the presence of 4mM EDTA at –80°C. Lipid peroxidation of LDL: Reactions were carried out according to Kostyuk et al. (6).

RESULTS: Our results, indicate that betanin is able to inhibit the MPO/nitrite-induced LDL lipid peroxidation, in a dose-dependent manner in the range 1 to 10 μM (Fig. 1). We have compared the effectiveness of betanin with that of two well-known physiological antioxidants: α-tocopherol and ascorbic acid. As reported (4), α-tocopherol, the most powerful liperoxyl radical-scavenger, is only able to partially protect LDL lipids from oxidation by the MPO/nitrite system and has scarce or no effect on the powerful hydrophilic oxidants generated by nitrite. On the contrary, vitamin C, which is able to scavenge the peroxidase-generated nitrating species, was very efficient in countering the MPO/nitrite-sustained lipid peroxidation. Betanin, was even more effective than vitamin C, at inhibiting the oxidative damage to LDL. The 1IC50 calculated for betanin (1.4 μM) was more than 10-fold lower than that for ascorbic acid (15.6 μM).

Nitrite, an oxidation product of nitric oxide metabolism, and MPO are considered mediators of the LDL oxidation process in vivo. Our study shows that betanin, a phytochemical occurring in the cactus pear fruit, is able to protect LDL, in an experimental set-up of physiological relevance. In addition, the molecule acts at micromolar concentrations, and appears much more effective than ascorbic acid. Our data collectively indicate a favourable modulation of the oxidation process of LDL and may contribute to the supposed beneficial effect of cactus pear fruits (2).

1. Livrea M.A. et al. (2003) in Herbal Medicines, Marcel Dekker, Inc. 537-556