

COMPARISON BETWEEN THE BIOLOGICAL ACTIVITY OF BETALAIN CACTUS PEAR (OPUNTIA FICUS INDICA MILL.) EXTRACTS AND THE MAIN ISOLATED BIOACTIVE COMPOUND

Clara De Francesco¹, Antonella Smeriglio¹, Marcella Denaro¹, Domenico Trombetta¹

¹Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, University of Messina, Messina - Italy

Introduction: In Mediterranean countries, cactus pears are widely consumed as functional foods due to the high nutritional value as well as for their high content of several secondary metabolites, which showed a wide range of biological activities. The fruit colour depends on the betalains content, water-soluble nitrogen pigments, which confer red-violet (betacyanins) and orange-yellow (betaxanthins) color. Recently, the antioxidant, cytoprotective, and anti-angiogenic properties of several cactus pear betalain extracts were investigated highlighting that the behavior of these molecules varies a lot according to their structure and physicochemical features.

Materials and methods: In light of this, the aim of study was to investigate the antioxidant and anti-inflammatory activity of different colors of cactus pear betalain extracts with respect to the main bioactive isolated compound, betanin. A QuEChERS extraction method was applied in order to obtain selective betalain extracts, whose phytochemical profile was investigated by RP-LC-DAD-MS/MS analysis. Antioxidant and free radical scavenging activity was evaluated by DPPH, TEAC, FRAP and ORAC assays. Moreover, a preliminary screening of their anti-inflammatory activity was carried out by bovine serum albumin (BSA) heat-induced denaturation assay. Finally, a comparison with the biological activity of the main bioactive compound commercially available (betanin), was carried out.

Results: The phytochemical investigation led to the identification of five betaxanthins and four betacyanins in all the extracts under examination with indicaxanthin and betanin, which are the most abundant compounds. The highest betaxanthins content was found in orange cactus pear pulp extracts (11.89 ± 1.050 mg/100 g DE) followed by yellow (9.47 ± 0.276 mg/100 g DE) and red ones (4.69 ± 0.359 mg/100 g DE). On the contrary, the highest betacyanins content was found in red cactus pear peel extracts (22.54 ± 2.162 mg/100 g DE) followed by orange (1.67 ± 0.070 mg/100 g DE) and yellow ones (0.948 ± 0.023 mg/100 g DE). Results showed that cactus pear peel extracts exert the best antioxidant activity (orange > red > yellow) with superimposable behaviour and order of potency for all extracts investigated (ORAC > FRAP > DPPH > TEAC). Comparing the antioxidant results of the red cactus pear peel extract, which showed the highest betanin content, with the pure isolated bioactive compound, tested at the same concentration found into the plant complex, it is possible to observe that betanin contributes weakly to the antioxidant activity ($\leq 10\%$). Similar results were found by BSA heat-induced denaturation assay using diclofenac sodium ($50 \mu\text{g/mL}$) as positive control (inhibitory activity 60.51%). Cactus pear peel extracts showed the best inhibitory activity but with a different order of potency expressed as half inhibitory concentration (IC_{50}): red (IC_{50} 0.261 mg/mL) > orange (IC_{50} 0.825 mg/mL) > yellow (IC_{50} 0.830 mg/mL). According to previous results, the contribution of betanin to the anti-inflammatory activity of red cactus pear peel extract is very limited (1.35%), showing an IC_{50} equal to 2.174 mg/mL.

Discussion and conclusion: Orange cactus pear peel extracts showed the best antioxidant activity while the red ones showed the best anti-inflammatory activity. Comparing the results of both biological activities investigated with that of the pure compound betanin it is possible to state that this isolated compound contributes limitedly to the observed antioxidant and anti-inflammatory activity. However, further investigations are in progress to isolate indicaxanthin from the extracts under examination in order to compare the activity of this betaxanthin, and of a mix of the two main betalains (betanin and indicaxanthin), with respect to plant complexes.