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**“CITRUS FLAVONOIDS AS BIOACTIVE COMPOUNDS: ROLE,
BIOAVAILABILITY SOCIO-ECONOMIC IMPACT AND
BIOTECHNOLOGICAL APPROACH FOR THEIR MODIFICATION”**

Federica De Leo¹, Sergio Fatta Del Bosco²

1 Dipartimento di Studi Aziendali, Giuridici ed Economici, Facoltà di Economia, Università di Lecce, Via per Monteroni, 73100 Lecce; e-mail address: fedeleo@economia.unile.it

2 Istituto di Genetica Vegetale, sez. di Palermo – CNR - Corso Calatafimi, 414, 90100Palermo; e-mail address: sergio.fatta@igv.cnr.it

ABSTRACT

Flavonoids are a large class of low molecular weight polyphenolic compounds that occur ubiquitously in plants. Polyphenols were traditionally employed as natural food colouring agents but a number of new studies have recently found potent antioxidative properties in polyphenol extracts, prompting the food industry to market them as functional ingredients. A functional ingredient can be defined as: ‘a dietary ingredient that affects its host in a targeted manner so as to exert positive effects that may, in due course, justify certain health claims’. Food containing these ingredient is named “functional food”. The term “functional food” has never achieved an official definition but most experts would agree in the following definition: A food can be regarded as functional if it is satisfactorily demonstrated to affect beneficially one or more target functions in the body, beyond adequate nutritional effects, in a way that is relevant to either improved stage of health and well-being and/or reduction of disease risk.

In the European Union, it is already recognized that in order to improve the competitive position of the European food and drink industry, European research expertise must be at the forefront in understanding the role of food components in modulating body functions, maintaining and improving well-being and health, and reducing the risk of major diseases. However, before being considered an economic challenge, it is and must remain a challenge for the health authorities because they need to elaborate new rules and new procedures for giving consumers guarantees that these new food products not only are safe but also are products that will allow consumers to better control their health.

A great number of epidemiological studies indicate the remarkable role of flavonoids in human health due to their antioxidant properties and their involvement in antiproliferation processes, cell

cycle arrest and apoptosis, antioxidation, induction of detoxification enzymes, regulation of host immune functions and other mechanisms. There is strong and consistent evidence that consumption of food rich in flavonoids may prevent against several degenerative pathologies, including cardiovascular diseases, atherosclerosis, cataract and several forms of cancer.

The genus *Citrus* is overall characterized by a substantial accumulation of flavonoids; their presence is, however, highly variable among the different species and varieties and each genotype is characterized by a particular flavonoid pattern. A large study has been undertaken in our lab in order to investigate the availability of these compounds in the *Citrus* germplasm; peculiar attention has been spent with regard to the most important commercial species, in which we have confirmed a huge variability in terms of compounds profile and concentration. The *Citrus* species showing the highest quantitative values (mg/100ml of juice) have been sweet orange and grapefruit. The high variability has been revealed also between different varieties of the same species.

Some of the health protective properties of citrus flavonoids are under investigation in our lab; the analysis of the *in vitro* antiproliferative effect of fresh juice on three different cell culture models of human cancer have confirmed that citrus juice exhibits a strong antiproliferative activity, based on the high level of cellular growth inhibitions percentages. The antiproliferative effect is, however, strongly associated with the citrus species analyzed, being much higher in grapefruit and pigmented sweet oranges as compared to other species, at all the juice concentrations studied.

Attempts to obtain a biotechnological modification of the flavonoid profile are underway in our lab. Following protoplast fusion and regeneration of somatic hybrids have been obtained several new citrus genotypes that are, at the moment, under analysis for their flavonoid content and profile.