Chapter 25

Polyphenol Oxidase and Oleuropein in Olives and their Changes During Olive Ripening

Francisca Ortega-García[1], Santos Blanco[2], M. Ángeles Peinado[2] and Juan Peragón[1]
[1]*Biochemistry and Molecular Biology Section, Department of Experimental Biology, University of Jaén, Spain*
[2]*Cell Biology Section, Department of Experimental Biology, University of Jaén, Spain*

25.1 INTRODUCTION

25.1.1 Phenols, Types, Biological Significance and Presence in Olive

Phenols are secondary metabolites of plants widely distributed throughout all plant organs and have important functions in the metabolism and physiology of plants. This complex group of substances has structures that vary from single phenolic molecules such as hydroxytyrosol [2-(3,4-dihydroxyphenyl)ethanol] to highly polymerized compounds such as lignins. These compounds have diverse and important functions such as: the maintenance of plant integrity (lignins), floral pigmentation (flavonoids), antibiotics (phytoalexins), and plant defense against pathogens or symbionts (Dixon and Paiva, 1995; Yedidia et al., 2003; Ververidis et al., 2007). The occurrence of these substances in food is broadly variable and reaches high levels in the olive fruit and oil (Brenes et al., 1999). Currently, there is keen interest in dietary polyphenols due to their antioxidant capacity and consequent benefits to human health (Galli and Visioli, 1999; Dixon, 2004; Ververidis et al., 2007). Oleuropein, the main phenol of the olive, is a heterosidic ester of β-glucosylated elenolic acid and hydroxytyrosol (Table 25.1). Many of the nutritional and organoleptic properties of olive oil depend on the content of phenols in general and of oleuropein and hydroxytyrosol in particular. Oleuropein and hydroxytyrosol have a high antioxidant capacity with high free-radical scavenging activity (Visioli et al., 2002). The amount of phenols in olive oil is considered as an index of the quality of this product (Angerosa et al., 2004).

TABLE 25.1 Key features of polyphenol oxidase and oleuropein.

1. Polyphenol oxidase (PPO) is an enzyme that contains copper and catalyzes the hydroxylation of monophenols and the oxidation of *o*-diphenols to *o*-diquinones that accompany fruit ripening
2. Different isoforms of PPO have been found in different species of plants and seem to result from conformational changes, association–dissociation phenomena, covalent attachment of phenolic or carbohydrates
3. PPO has also been associated with the resistance of the plant against biotic and abiotic stress
4. Oleuropein is a heterosidic ester of β-glucosylated elenolic acid and hydroxytyrosol
5. Oleuropein is the main phenolic compound found in the olive and responsible for some of the nutritional properties of olive and olive oil
6. Oleuropein and hydroxytyrosol present a high antioxidant capacity with high free-radical scavenging
7. PPO and oleuropein have been linked to the chemical defense of the plant

25.1.2 Ripening, Polyphenol Oxidase, Structure and Biological Properties

Fruit ripening brings major changes in the content and composition of phenols. In this process, phenols oxidize to quinones. These compounds are highly reactive and

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