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Abstract

Chemical and Nutritional Characterization of By-Products from the Wine Industry—Source of Healthy Ingredients for the Formulation of Nutraceuticals and Functional Foods †

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Abstract: The food industry generates large amounts of organic waste, which generally accumulates in landfills or is burned, causing environmental problems. However, many studies indicate that this waste is rich in bioactive compounds, so it could be revalued for transformation purposes into high-value-added products, thus favoring the circular and sustainable economy, while also reducing environmental impact and climate change. It is estimated that the wine industry (*Vitis vinifera* L.), in terms of weight, produces up to 30% of waste in relation to the material used, including the stems, skins, seeds, and pomace, i.e., dietary sources rich in phenolic compounds, minerals, acids fatty acids, and dietary fiber, which have had beneficial effects on health, including antioxidant, antimicrobial, anti-inflammatory, and even anticancer activities, both in vitro and in vivo. In this sense, chemical characterization (minerals, phenolic compounds, and fatty acid profiles) was carried out in dehydrated and ground seeds of *Vitis vinifera* L., and in the oily extract, obtained by supercritical fluids (SCFEs) at 20 MPa. Minerals were quantified by inductively coupled plasma optical emission spectrometry (ICP-OES), the phenolic profile was identified and quantified by liquid chromatography–mass spectrometry (LC-MS/MS), and the profile of fatty acids was studied by gas chromatography coupled with a flame ionization detector (GC-FID). The main minerals found were calcium, potassium, and magnesium. The total calcium concentration (22.66 g/kg) in the oily extract should be emphasized in comparison to that of seeds (7.8 g/kg). The potassium concentration was 3.9 g/kg in seeds and 1.53 g/kg in the extract, while magnesium values of 1.4 g/kg and 0.59 g/kg corresponded to the seeds and extract, respectively. Regarding the polyphenol profile, the seeds mainly contained dihydroxybenzoic acid (42.580 mg/kg), catechin (81.05 mg/kg), quercetin (4856 mg/kg), and resveratrol (1 mg/kg) as the main phenols, while the oily extract mainly included oleacein (156.942 mg/kg), hydroxytyrosol (10.226 mg/kg), and Tyrosol (8644 mg/kg). Additionally, a profile of healthy fatty acids was obtained, with polyunsaturated fatty acids (PUFAs) representing the majority (71.4%), including oleic acids (16.868 mg/kg) and linoleic acid (82.606 mg/kg). The results obtained show that these by-products could be applied as part of the formulation of functional foods, nutraceuticals, and cosmetics, aimed at a broad yet niche population, for the prevention of different diseases.

Keywords: *Vitis vinifera* L.; grape pomace; phytochemicals; bioactivity; extraction; food industry; pharmaceutical; phenolic compounds

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