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ORAL COMMUNICATIONS

Food composition and Authenticity

A comprehensive study on the nutritional, chemical and bioactive properties of lovage (*Levisticum officinale* W.D.J. Koch)

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Plants are a considerable source of natural products and are often used by man for their aromatic, medicinal and flavouring abilities. Aromatic herbs, in particular, have been used for centuries in gastronomy but also in traditional medicine. Considering that a growing number of consumer's associate products containing natural ingredients to a higher quality, the food industry is also giving a greater importance to the possible use of plant extracts and/or essential oils as alternatives to synthetic additives in foods. Lovage (*Levisticum officinale* W.D.J. Koch) is an aromatic plant used as a condiment in several regions of Europe that is also used as an ingredient of commercial food seasonings. So far, studies on lovage mainly focused on its essential oil composition, but there is still a scarcity of information regarding its nutritional and chemical composition as well as its bioactive properties. To help start bridging this gap, and to explore alternative uses of this plant species, the present work reports a comprehensive study on lovage composition and bioactivity.

Fresh plant specimens were commercially acquired in October 2018 at Porto, Portugal. After lyophilization, the aerial parts of the plant were further analyzed. The proximate composition (moisture, fat, proteins, ash, carbohydrates and energy) was evaluated by AOAC official procedures, free sugars and tocopherols were determined using liquid chromatography coupled to a refraction index (HPLC-RI) and fluorescence (HPLC-FL) detectors, respectively. Fatty acids were determined by gas chromatography coupled to a flame ionization detector (GC-FID), organic acids by ultra-fast liquid chromatography coupled to a diode detector (UPLC-DAD) and phenolic compounds by HPLC coupled to a DAD and mass spectrometry (MS) using the electrospray ionization interface (ESI). Multi-resistant clinical bacterial strains were used to screen the antimicrobial activity of aqueous (decoction) and hydroethanolic extracts. The antioxidant activity was evaluated through five different *in vitro* assays: DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging activity, reducing power, inhibition of β -carotene bleaching, inhibition of lipid peroxidation in brain homogenates by thiobarbituric acid reactive substances (TBARS) and oxidative hemolysis inhibition assay (OxHLIA). The cytotoxic activity was assayed using MCF-7 (breast adenocarcinoma), NCI-H460 (non-small cell lung carcinoma), HeLa (cervical carcinoma) and HepG2 (hepatocellular carcinoma) human tumor cell lines, and also a non-tumor cell line (porcine liver primary cells, PLP2).

L. officinale presented a high percentage of moisture with proteins being the predominant macronutrient. In what concerns the chemical composition of the plant, lovage showed a predominance of polyunsaturated fatty acids with alpha-linolenic acid being the major compound; alpha tocopherol stands out among the other isoforms of vitamin E; oxalic acid has a prominence among the identified organic acids, and glucose was the main free sugar present in the plant. Regarding phenolic compounds' composition, a total of 7 compounds, including phenolic acids and flavonoids, were identified and quantified, with 5-O-caffeoylquinic acid being the predominant one. Both extracts presented interesting antioxidant properties, and in general, were more active against Gram-negative bacteria, while only decoction extract showed cytotoxicity against a HepG2 cell line. In brief, an extensive and detailed study was performed revealing that lovage has an interesting composition from the nutritional point of view being also a source of several bioactive compounds, therefore its inclusion as a seasoning/flavoring agent in different dishes should be promoted.

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