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Stoned olive pomace fermentation with *Pleurotus* species and its evaluation as a possible animal feed

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ABSTRACT

The use of stoned olive pomace (SOP) as an unconventional feedstuff for livestock is limited by its inherently low crude protein (CP) content and by the presence of anti-nutritional compounds such as phenols. Aim of this study was to assess whether solid-state fermentation of SOP with selective lignin-degrading fungi might ameliorate nutritional properties of the waste. Incubation of SOP, mixed (25%, w/w) with various conventional feedstuffs (*i.e.*, wheat bran, wheat middlings, barley grains, crimson clover, wheat flour shorts and field beans), with *Pleurotus ostreatus* and *Pleurotus pulmonarius* led to significant CP increases, ranging from 7 to 29%, and marked removal (from ca. 50–90%) of phenols after 6 weeks. Both species, however, led to moderate delignification associated with significant consumption of hemicelluloses. Consequently, no improvements of both organic matter digestibility (OMD) and net energy of SOP–feedstuff mixtures occurred after the fungal colonization.

1. Introduction

The bovine spongiform encephalopathy (BSE) epidemic has compelled the animal production compartment to search for alternative protein sources to replace the animal meals now forbidden at worldwide level. The problem is even more serious in the EU where only one-third of the protein used by the feedstuff factories is self-produced [1].

Among the proposed alternative protein sources, olive pomace has been used in livestock feeding with limited success due to the presence of anti-nutritional compounds, such as phenols, and the high lignin content hindering the action of both rumen microorganisms and hydrolytic enzymes [2–6]. Treatment of the waste by the addition of fibrolytic enzymes and/or baker's yeast did not ameliorate its properties as a feedstuff [5]; similarly, solvent extraction and partial stoning (*i.e.*, the removal of the drupe's endocarp) after olive oil extraction were unsuccessful [6].

Complete olive stoning prior to oil extraction has led to renewed interest in the use of pomace derived thereof due to the reduced lignin content [4,7]. Unfortunately, with stoning, the phenolic content of the olive paste increases during malaxation as a consequence of the reduced polyphenoloxidase activity mostly associated with the endocarp: thus, phenols are mainly retained by SOP [8].

Fungi belonging to the ecological group of white-rot basidiomycetes (WRB) have been shown to be able to degrade and transform lignin and lignin-derived components [2,9]. Among WRB, the genus *Pleurotus* comprises edible species that meet the GRAS (Generally Regarded As Safe) requirement, exhibit considerable lignin- and phenols-degrading ability [10,11] and enrich solid substrates with protein of high nutritional value [12]. Therefore, they might be putative candidates to perform the removal of anti-nutritional compounds from SOP and to increase its digestibility.

Objective of the present work was to assess whether the stoned olive pomace (SOP) might be upgraded by solid-state fermentation with *Pleurotus ostreatus* 3004 and *Pleurotus pulmonarius* CBS 664.97. To this aim, the SOP was mixed with conventional feedstuffs (*i.e.*, wheat bran, wheat middlings, barley grains, crimson clover, wheat flour shorts and field bean) and the impact of fungi on chemical composition, anti-nutritional compounds and organic matter digestibility of these mixtures is investigated. Although olive pomace derived from the conventional extraction processes has long been studied as a possible animal feed [2–6], to the best of our knowledge, this is the first attempt to assess the potentiality of fungal-treated stoned olive pomace in this sense.

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