Effect of added autochthonous yeasts on the volatile compounds of dry-cured hams

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A B S T R A C T
Three yeast strains belonging to Debaryomyces and Hyphopichia spp., isolated from dry-cured hams and previously tested for biocontrol activity against toxigenic Penicillium nordicum, were investigated for ability in colonising ham surface. Hams were twice yeast-inoculated onto the unskinned muscle surface during ripening and processed up to full maturation in two manufacturing plants. The yeast strains and the manufacturing plants differed (P < 0.05) in surface populations, volatile compounds and sensory descriptors of matured hams. Sensory scores for each of the yeast-inoculated groups were higher or similar to the non-inoculated ones (controls). Debaryomyces strains were regarded as those most fit to colonise the ham surface under the ecological conditions of dry-curing rooms, hence to qualify as biocontrol agents against the growth of undesired mould and preserve the typical sensory properties of dry-cured hams.

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1. Introduction

Typical Italian dry-cured ham is a traditional intermediate-moisture meat product made with thighs of domestic heavy pig and requiring at least 12 months for maturation and brand apposition (Parolari, 1996). During this time, ham undergoes treatments like salt addition, dehydration, washing with warm water (35–40 °C), drying, maturing at room temperature and spreading with a soft fat mince layer (sugna), to prevent a defective dehydration of outer regions. In manufacturing plants, abiotic factors such as environmental temperature, % relative humidity (RH) and air speed are regulated according to ham requirements in each ripening stage (Battilani et al., 2007; Simoncini et al., 2007). Other process variables like season, ratio of ham number-to-room volume, and position inside conditioned rooms can affect the ecological conditions during ripening (Battilani et al., 2007; Wang et al., 2006). The chemophysical properties of muscle surface in terms of water activity (aw), pH, salt and nutrient content are additional sources of variability. Above-mentioned parameters can influence microbial populations, in particular yeasts, developing in outer ham layers (Asefa et al., 2009; Purriños et al., 2013a; Simoncini et al., 2007). Several yeast species have been reported (Asefa et al., 2009; Núñez et al., 1996a; Purriños et al., 2013a; Simoncini et al., 2007).

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Some studies reported the ability of high populations of selected antagonist yeasts to prevent unwanted mould growth and accumulation of toxic substances like mycotoxins (Andrade et al., 2014; Comi and lacumin, 2013; Virgili et al., 2012). Furthermore, with the exception of Candida zeylanoides (Leverson et al., 1991), native yeasts isolated from dry-cured meat products were classified as non-pathogenic (EFSA Panel on Biological Hazards, 2012). Previous studies reported yeasts as the predominant microorganisms developing in outer ham layers still maintaining remarkable counts in the matured product, although water activity (aw), pH, salt and nutrient content enable micrococi, staphylococi and mould to grow in most of the processing stages (Battilani et al., 2007; Molina et al., 1990; Núñez et al., 1996b; Rodríguez et al., 1994; Silla et al., 1989). A contribution of aforementioned microbial groups to sensory profile of dry-cured hams can be taken into account, according to their proteolytic and lipolytic activities and, consequently, to the generation of precursors useful for flavour development (Hinrichsen and Pedersen, 1995; Martín et al., 2004; Molina et al., 1991; Ockerman, 2000; Rodríguez et al., 1998).

Yeasts proved being able to positively contribute to sensory quality of final outcome, thanks to the generation of molecules enriching the flavour profile of dry-cured meat products (Andrade et al., 2010; Fonseca et al., 2013; Martín et al., 2006; Pinna et al., 2009, 2012). The generation of volatile compounds depends on yeast species and strain; changes in volatile compounds of dry-cured meat products due to inoculated yeasts, have been reported in a meat model system (Andrade et al., 2009), in dry-cured lacón (Purriños et al., 2013a, 2013b), in dry

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