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Improving safety in a traditional Portuguese dry-cured sausage using autochthonous starter cultures (#527)

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Introduction

The manufacture of dry-cured sausages represents an important part of the European meat industry in Mediterranean countries, such as Portugal, Spain, France, Italy and Greece. These type of meat products are considered of high sensory quality and are highly appreciated by consumers.

The main aim of this work was to characterise the effect of starter cultures in the food safety of traditional Portuguese dry-cured sausages. The specific objective of the hereby presented study was to evaluate the effectiveness of autochthonous starter cultures in solving an unidentified technological problem that occurred in the processing.

Methods

Sausages were made in a Portuguese traditional factory, using meat and fat from Alentejano pig breed and cured during 18 days in the presence of smoke from *Quercus rotundifolia* wood.

Four treatments (control, inoculation with *Staphylococcus xylosus*, inoculation with *Lactobacillus sakei*, and co-inoculation of *S. xylosus* and *L. sakei*) and five replicates per treatment were considered.

Sausage casings were removed for all determinations. pH was determined in accordance with the ISO 2917 (1999) using a pH-meter (Crison 507, Barcelona, Spain). Water activity (a_w) measurements were carried out using a hygrometer (Hygroskop Rotronic DT, Zurich, Switzerland) with a WA-40 probe at 25 °C.

For microbial counts, 10 g of each sample were homogenized for 90 s in a Stomacher Masticator (IUL Instruments, Spain) with 90 mL peptone water (Scharlau, Spain) and serial tenfold dilutions were made and pour-plated. All microbial counts were performed according to the corresponding international standard (ISO) methods or other well established methods: total mesophilic bacteria ISO 4833-1 (2013), psychrotrophic bacteria ISO 17410 (2001), enterobacteria ISO 21528-2 (2017b), and streptococci in Kanamycin Aesculin Azide Agar. The number of coliforms and *E. coli* was estimated by the Most Probable Number (MPN) method in Brilliant Green Bile Lactose Broth.

The presence of *Salmonella* spp. was detected through the automated enzyme-linked fluorescent assay-based system (VIDAS) developed by BioMérieux (France).

For all microbial counts, the results were expressed as log cfu g⁻¹ means ± standard deviation.

All data are presented as means ± standard deviation. Statistical analysis was performed using Statistica 12.0. from Statsoft (StatSoft Inc, Palo Alto,

CA, USA, 1984–2007). Significant differences ($P < 0.05$) were identified based on Tukey Honest Significant Difference (HSD) test.

Results

The effect of starters was notorious in decreasing pH values, particularly in the treatments with *L. sakei*.

The sausages inoculated with a mixed culture of *S. xylosus* and *L. sakei* showed lower a_w values (0.803) and significantly different from those of the control treatment (0.873).

Mesophiles and psychrotrophic bacteria counts were higher in the control treatment when compared to all other treatments.

The control treatment showed significantly higher numbers of enterobacteria, while significantly lower counts were recorded in the mixed inoculation treatment.

Streptococci, coliforms and *E. coli* counts were significantly higher in the control treatment. On the other hand, these bacterial groups were always present in lower numbers in the mixed co-inoculation treatment.

The presence of *Salmonella* spp. was not detected in any of the sampled sausages.

Table 1. One-Way ANOVA results for the parameters under study, regarding inoculation treatment.

PARAMETER	TREATMENT				F	p
	L. sakei	S. xylosus	control			
S. xylosus x L. sakei						
pH	5.62 ab ± 0.02	5.55 b ± 0.02	5.68 a ± 0.04	6.11 c ± 0.06	3.8654	0.0170*
a_w	0.803 a ± 0.032	0.839 ab ± 0.039	0.854 b ± 0.029	0.873 b ± 0.019	0.2472	0.8628
mesophiles	7.21 ab ± 0.23	6.44 a ± 0.33	7.50 ab ± 0.13	7.91 b ± 0.10	5.6717	0.0021**
psychrotrophic bacteria	3.95 a ± 0.51	4.87 a ± 0.43	4.99 a ± 0.74	6.89 b ± 0.36	32.8000	0.0000***
enterobacteria	1.65 a ± 1.11	3.75 b ± 0.67	2.32 a ± 1.56	5.71 c ± 0.26	33.9718	0.0000***
streptococci	3.09 a ± 0.53	3.93 b ± 0.72	3.78 ab ± 0.78	4.76 c ± 0.58	10.6336	0.0000***
coliforms	1.75 a ± 0.96	2.50 a ± 1.00	2.00 a ± 0.82	4.50 b ± 1.00	10.7664	0.0000***
E. coli	1.00 a ± 0.00	1.75 a ± 0.50	1.50 a ± 0.58	3.75 b ± 0.96	18.3798	0.0000***

Notes

In the same row different lower case represent significantly different means.

Conclusion

The tested starter cultures, particularly the mixed starter culture of *S. xyloso* and *L. sakei* was able to significantly reduce the microbiota, including potential pathogenic microorganisms, of traditional Portuguese dry-cured sausages even under adverse processing conditions and in the presence of smoke.

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Notes