Bioprotection of Nocellara del Belice table olives: the effect of *Candida boidinii* LC1 and *Candida norvegica* OC10 in different thermal storage conditions.

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Background.

The Castelvetrano method for processing Nocellara del Belice table olives is a well-established Sicilian agrifood tradition, celebrated for producing olives with a distinctive sweet taste and bright green colour. This method has achieved notable commercial success both at national and international level. However, it faces challenges, particularly during warmer months, when the shelf life of the product is compromised due to the growth of spoilage and pathogenic microorganisms. To mitigate these issues, producers often rely on refrigerated storage. While effective to some extent, refrigeration significantly increases energy consumption and operational costs. To address these limitations and reduce the energy costs associated with cold storage, this study investigated the bio-protective potential of two yeast strains, *Candida boidinii* LC1 and *Candida norvegica* OC10, previously selected for their technological and antimicrobial properties (https://doi.org/10.1016/j.fm.2024.104477).

Methods.

Experimental batches of olives were processed using the traditional Castelvetrano method and inoculated with the selected yeast strains. These batches were then stored under three thermal regimes: constant refrigeration (8±1 °C); ambient temperature; and combined regime, involving 90 days at ambient temperature followed by 90 days at 8±1 °C. Over a 180-day period various aspects were monitored, including: dynamics of microbial groups such as lactic acid bacteria, yeasts, Enterobacteriaceae, Pseudomonadaceae, and Staphylococcaceae; kinetics of physicochemical parameters such as pH, salinity, temperature, pulp firmness, drupe colour; and finally sensory attributes evaluated by a trained panel using a structured profile method in accordance with ISO standards. Additionally, the presence of mycotoxigenic fungi was assessed to ensure food safety.

Results.

Yeast inoculation had a significant impact on controlling spoilage and pathogenic microorganisms, particularly under refrigerated and combined storage conditions. In these

treatments, microbial populations such as Enterobacteriaceae and Staphylococcaceae were considerably reduced compared to uninoculated controls, and no Clostridia were detected. Conversely, olives stored solely at ambient temperature exhibited increased levels of pathogen, including *Salmonella spp.* and *Escherichia coli*, especially toward the end of the storage period. The inoculated batches also exhibited: more stable pH values, better retention of green colour, and improved pulp firmness. Sensory evaluation revealed enhanced organoleptic qualities in inoculated batches, with *C. norvegica* OC10 outperforming in terms of colour intensity, texture, and overall appreciation. Importantly, no significant presence of mycotoxigenic fungi was detected, confirming the microbiological safety of the batches inoculated with the selected strains.

Conclusions.

This study confirms the effectiveness of bioprotective yeasts, particularly *C. norvegica* OC10, in enhancing both the microbiological safety and sensory quality of Castelvetrano-style olives. Notably, reducing the refrigeration period from 180 to 90 days, when combined with yeast inoculation, led to a 50% reduction in energy costs without compromising product quality. This approach offers a sustainable and cost-effective alternative for the olive processing industry, while also supporting the preservation and enhancement of traditional food products. Further research is recommended to explore the application of these yeasts in other processing styles and under extended ambient storage, with the aim of developing safe, functional table olives with a reduced environmental footprint.

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