

# Contribution of wild strains of lactic acid bacteria to the typical aroma of an artisanal cheese



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## Rationale

Artisanal cheeses → Raw milk → Indigenous flora

Aroma of Serra da Estrela cheese → Mainly volatile fatty acids (VFAs)  
Tavoria et al. (2004)

Consumers' perception → Slightly acidic, sweaty, "sheepy-like"

## Materials and Methods

### Experimental cheeses

- Control – without starter addition
- With addition of *Lactobacillus plantarum*
- With addition of *Lactococcus lactis*
- With addition of *Lactobacillus plantarum* and *Lactococcus lactis*



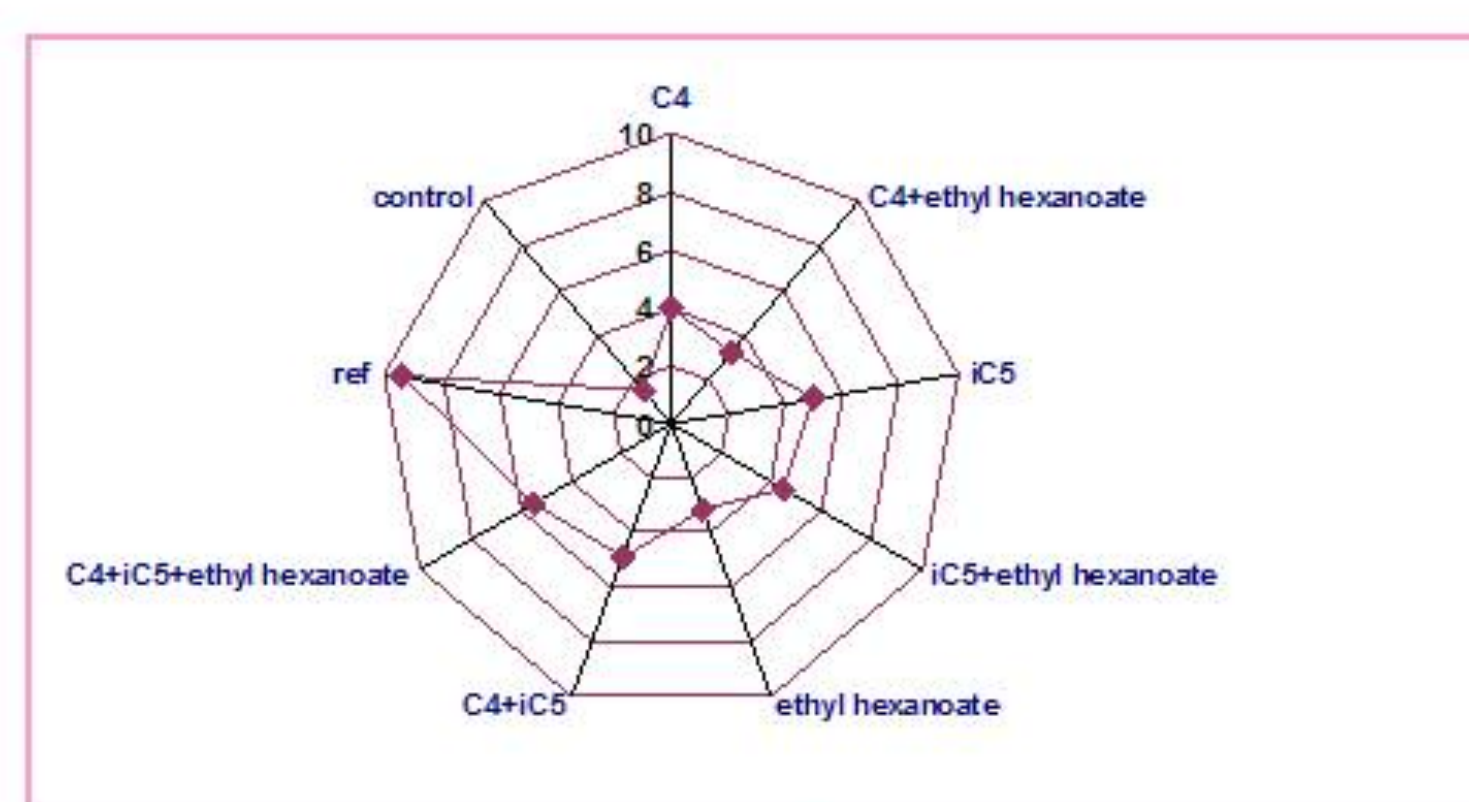
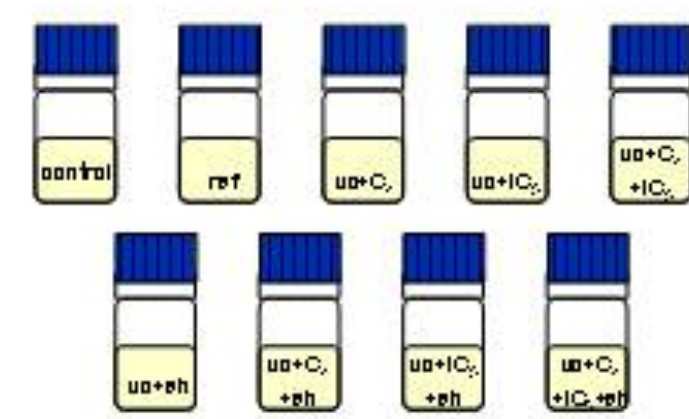
### Volatile and free amino acid analysis

Volatiles → SPME/GC-MS  
Amino acids → Pico-Tag method (Alonso et al., 1994)

### Sensory analysis

VFAs with highest OAV → Butyric and iso-valeric acids  
added to unripened (uc) cheese matrix → odour → assessment by panel

Reference = (ripened cheese); Control = (unripened cheese); eh = ethyl hexanoate (no impact on aroma of this cheese)



The panel rated the reconstituted matrix (C4 + C5 + ethyl hexanoate) and samples with both acids closest to the reference, suggesting that addition of C4 and C5 can explain aroma of Serra da Estrela cheese to a great extent.

Valine and leucine were the major amino acids in all cheeses, representing ca. 50% of the total pool; differences between cheeses not statistically significant.

Leucine catabolism originates iso-valeric acid (Yvon & Rijnen, 2001), which has a rancid, cheesy, sweaty, putrid odour that probably contributes to the long-ripened, harsh, piquant cheese aroma characteristic of this cheese (and of others manufactured from small ruminants' milk).

Butyric (C<sub>4</sub>), iso-valeric (iC<sub>5</sub>) and caproic (C<sub>6</sub>) acids were the most abundant VFAs; however, cheeses manufactured with *Lb. plantarum* produced the highest amounts of VFAs in a given ripening time.

Butyric and caproic acids arise mainly from lipolysis; C<sub>4</sub> accounts for an aroma very similar to that of iso-butyric acid — which arises from valine catabolism, conferring a cheesy, sweaty and sour odour (Dacremont & Vickers, 1994).

## Results

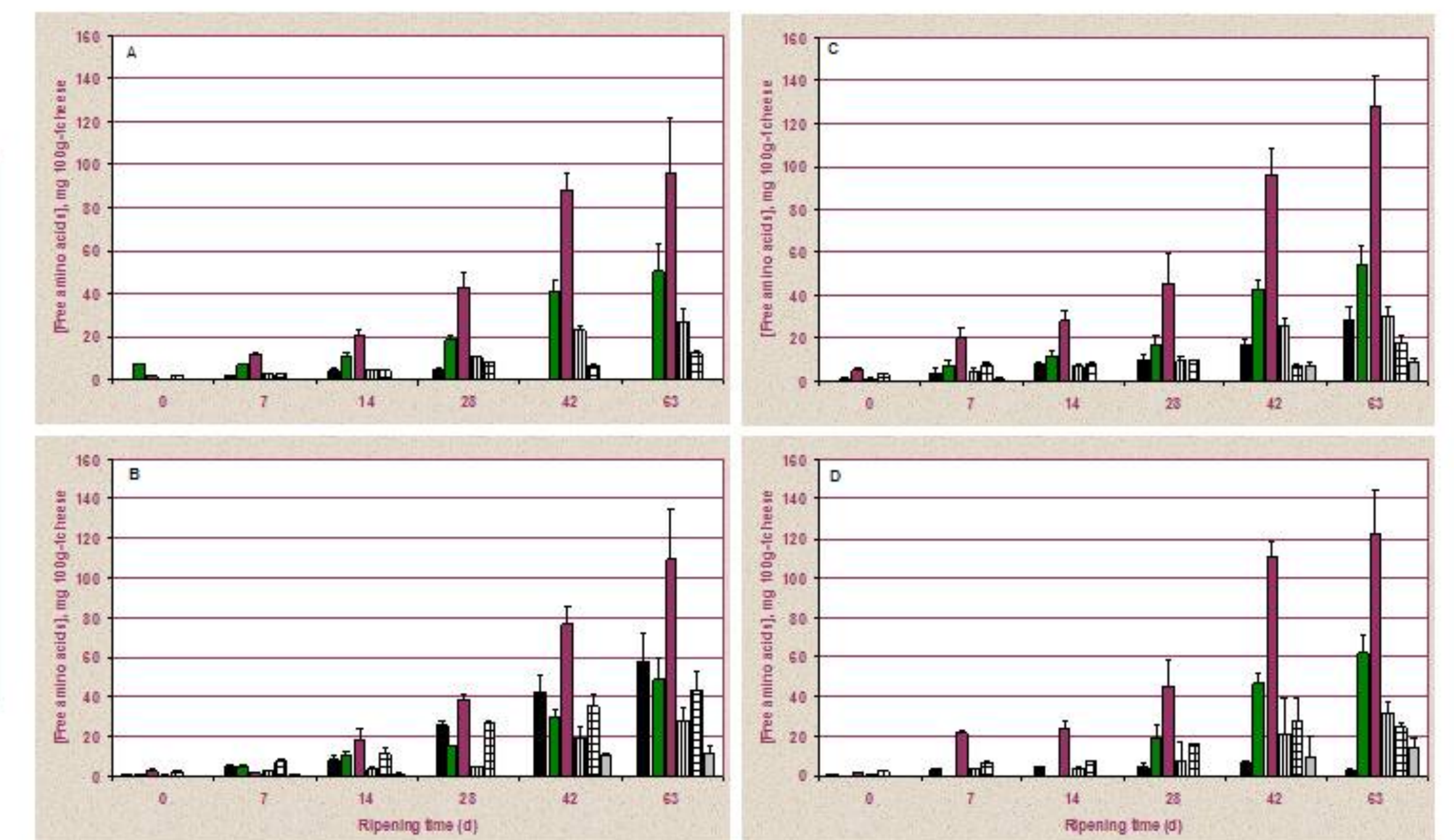


Figure 1. Concentration of major amino acids [Glu (-■-), Val (-■-), Leu (-■-), Phe (-■-), Trp (-■-) and Lys (-■-)] in cheeses manufactured without starter (A) and with addition of *Lactobacillus plantarum* (B), *Lactococcus lactis* (C) and *Lactobacillus plantarum* + *Lactococcus lactis* (1:1) (D), throughout ripening time.

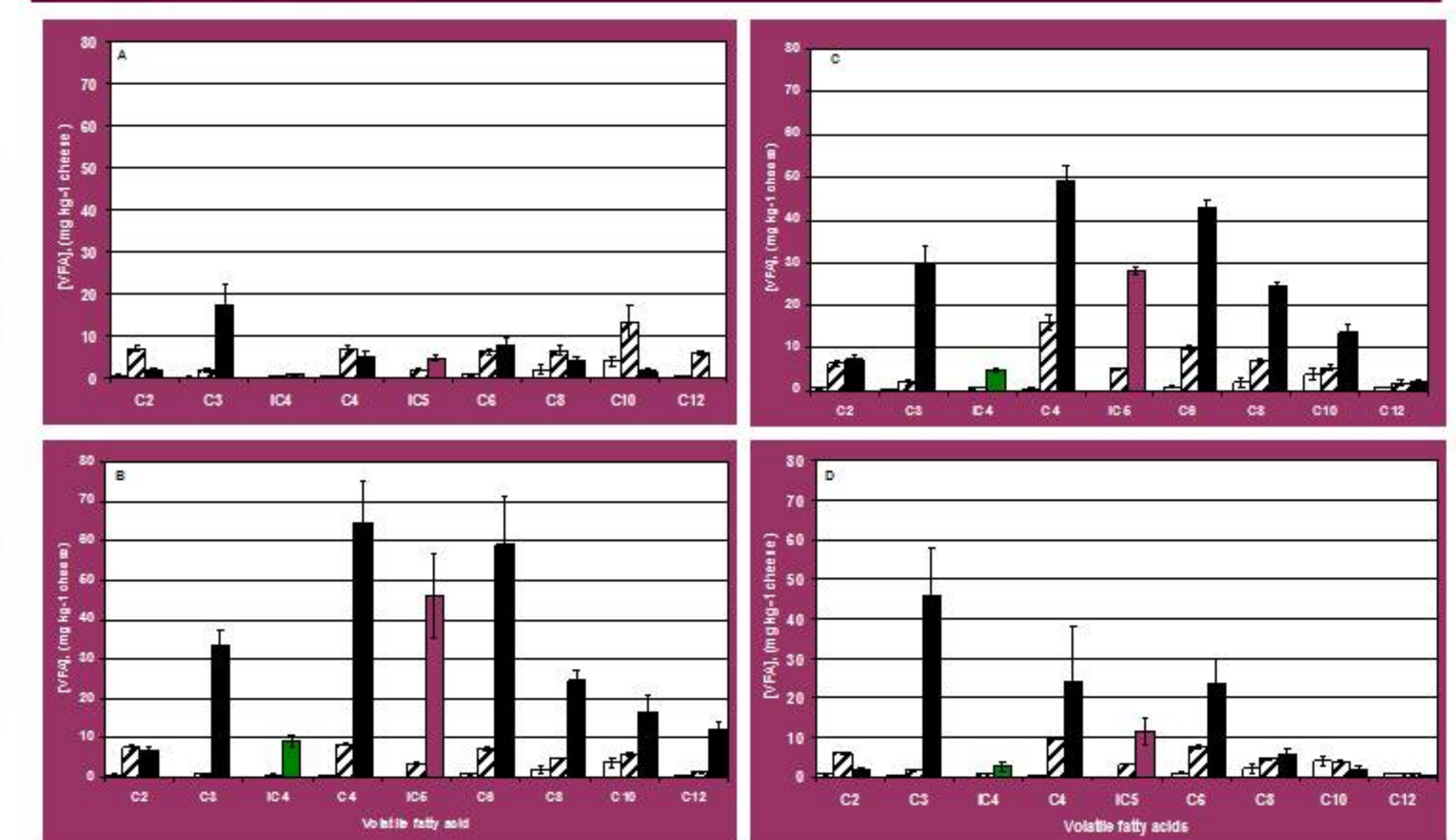


Figure 2. Volatile fatty acids in cheeses manufactured without starter (A) and with addition of *Lactobacillus plantarum* (B), *Lactococcus lactis* (C) and *Lactobacillus plantarum* + *Lactococcus lactis* (1:1) (D), by 0 (-□), 28 (-■) and 63 (-■) d of ripening.

## Conclusions

Experimental cheeses manufactured with the addition of *Lactobacillus plantarum* yielded high sensory scores (Macedo et al., 2004), and higher amounts of volatiles (for similar ripening time) than those manufactured without starter addition — hence suggesting that addition of this culture favours the overall flavour profile and helps reducing ripening time of Serra da Estrela cheese.

## ACKNOWLEDGMENTS

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## References

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