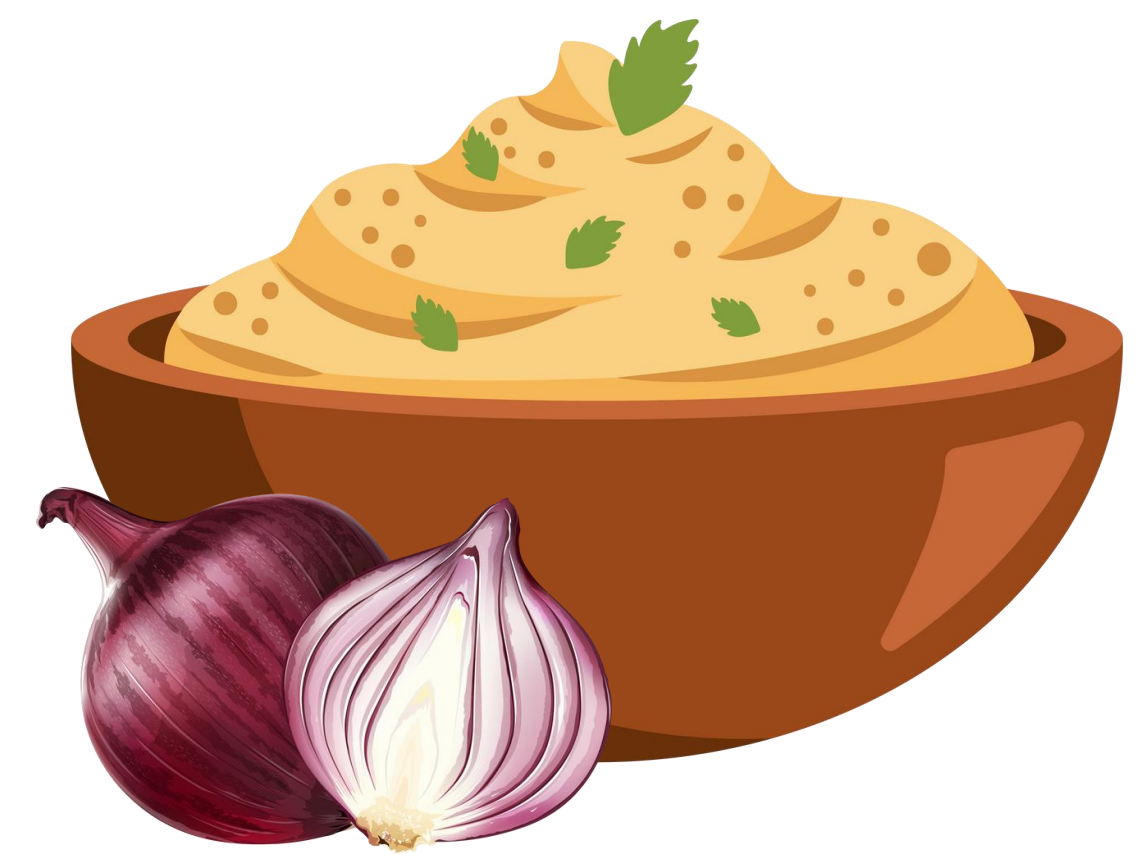


INTRODUCTION

The growing consumer demand for minimally processed ready-to-eat (RTE) foods has driven the need for natural alternatives to synthetic preservatives. Mediterranean-style products like hummus are increasingly popular but remain highly perishable due to their moisture content and neutral pH.

Onion (*Allium cepa*) contains organosulfur compounds mainly thiosulfates with broad-spectrum antimicrobial activity. Yet, their use as natural, clean-label preservatives in real food systems is still limited.

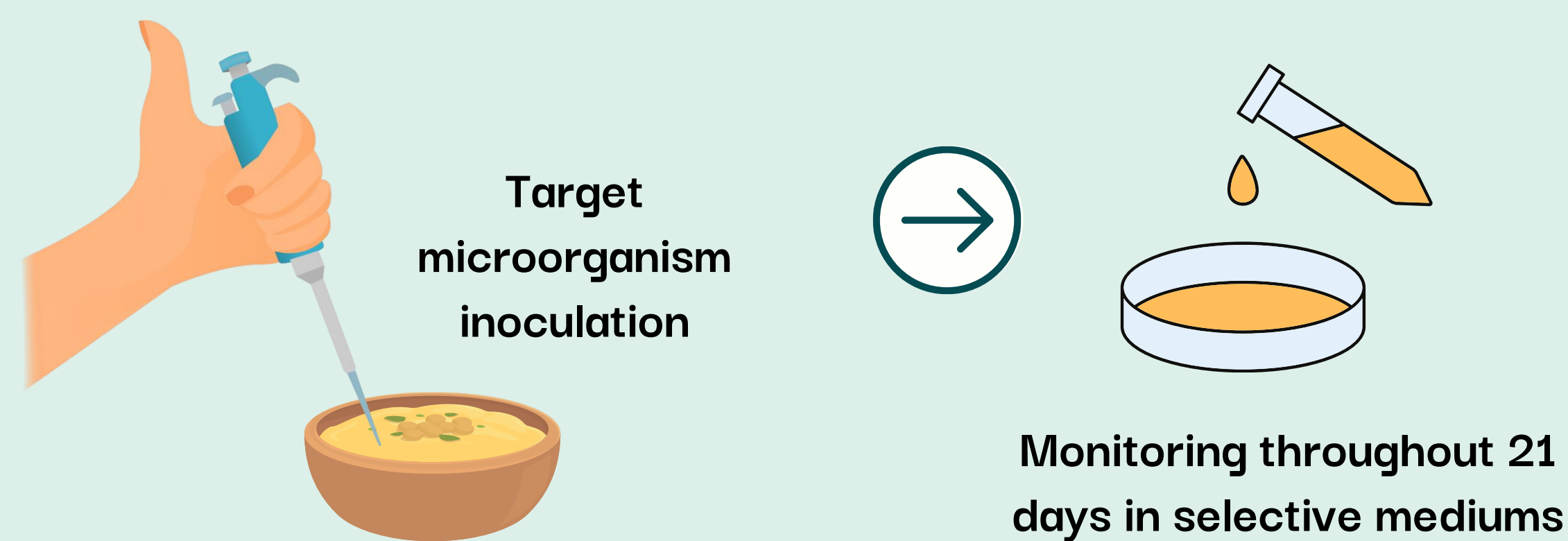
In this study, we evaluated a standardized onion extract (8% organosulfur compounds) against key food-borne pathogens or spoilage microorganisms (*Listeria monocytogenes*, *Escherichia coli*, yeasts and filamentous fungi). Its effectiveness was further tested in RTE-hummus.



MATERIALS AND METHODS:

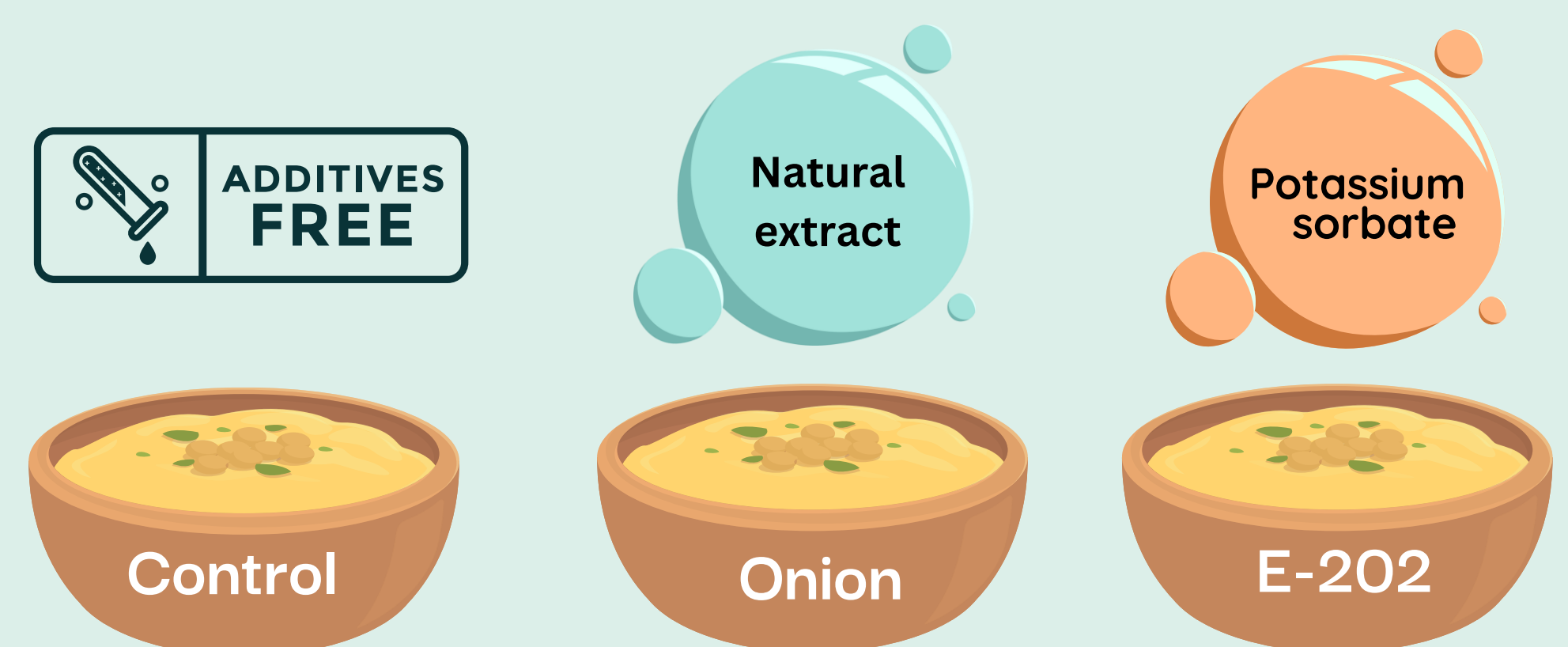
Challenge test:

RTE-hummus samples were inoculated at an initial level of 4 log CFU/g with *L. monocytogenes* CECT 4032, *E. coli* CECT 516 and the spoilage yeast *Zygosaccharomyces bailii* CECT 19977. Treatments included onion extract, a positive control (inoculated without treatment), and a reference batch containing potassium sorbate. Microbial counts were monitored throughout 28 days of storage at 4°C. All assays were performed in duplicate.



Shelf-Life Evaluation:

For the shelf-life study, three batches were prepared and stored at 4°C for 21 days. Microbial quality was periodically evaluated by enumerating aerobic mesophilic bacteria, enterobacteria, yeasts, and filamentous fungi, in order to determine the preservative effect of the onion extract under typical refrigerated conditions. All assays were performed in duplicate.



RESULTS:

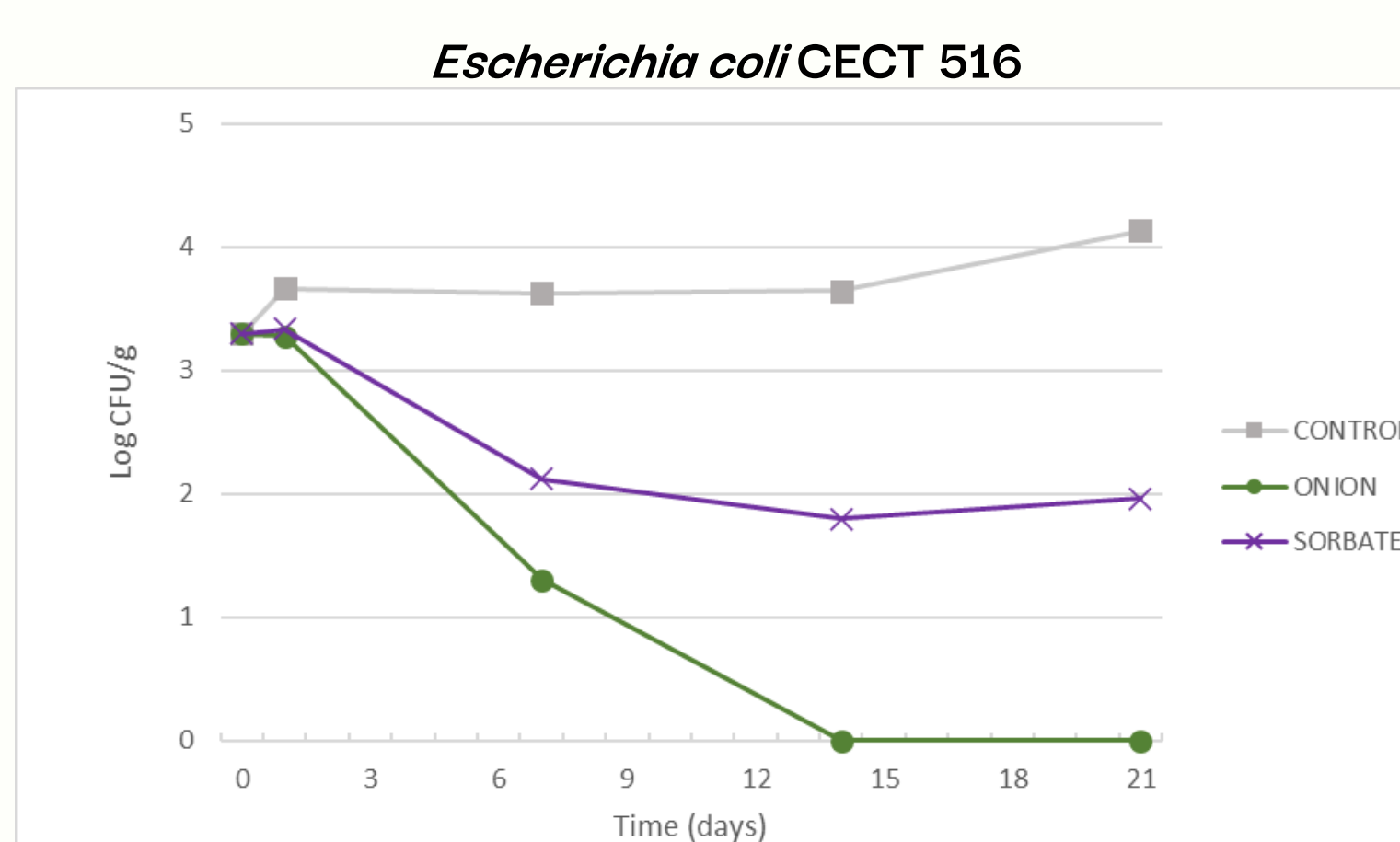


Fig. 1 Challenge test of *Escherichia coli* CECT 516 growth over 21 days of storage at 6°C in hummus across various treatments

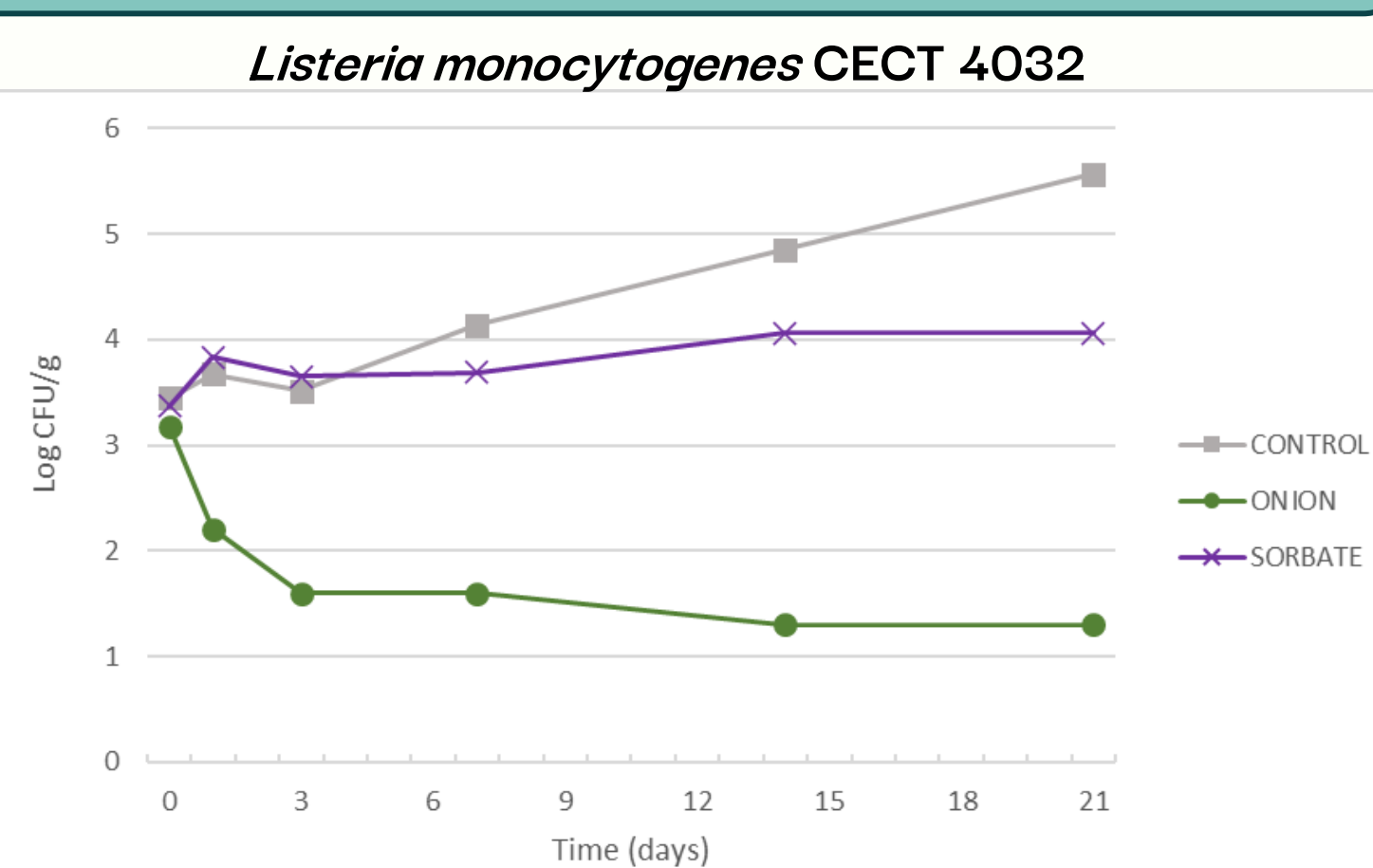


Fig. 2 Challenge test of *Listeria monocytogenes* CECT 4032 growth over 21 days of storage at 6°C in hummus across various treatments

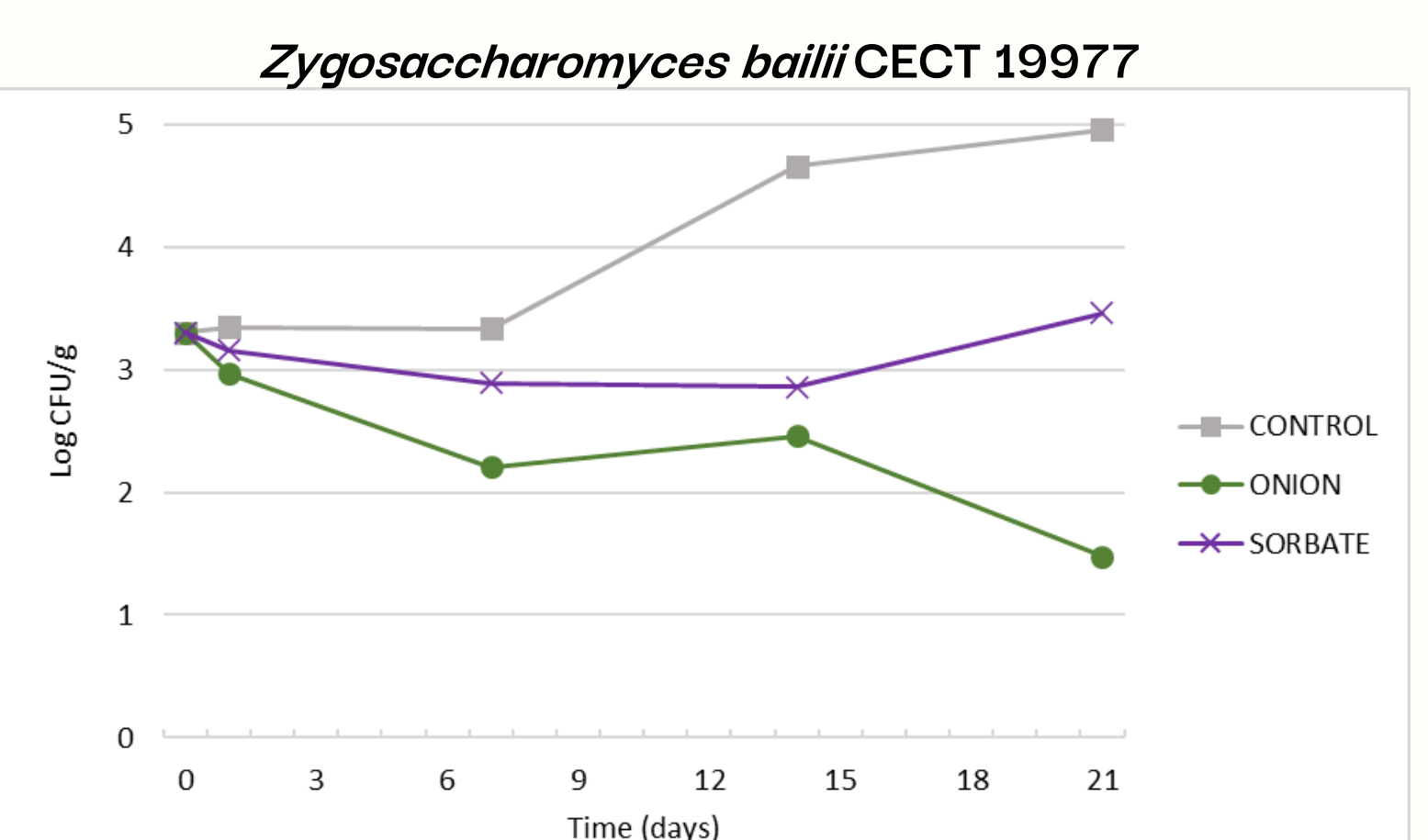


Fig. 3 Challenge test of *Zygosaccharomyces bailii* CECT 19977 growth over 21 days of storage at 6°C in hummus across various treatments

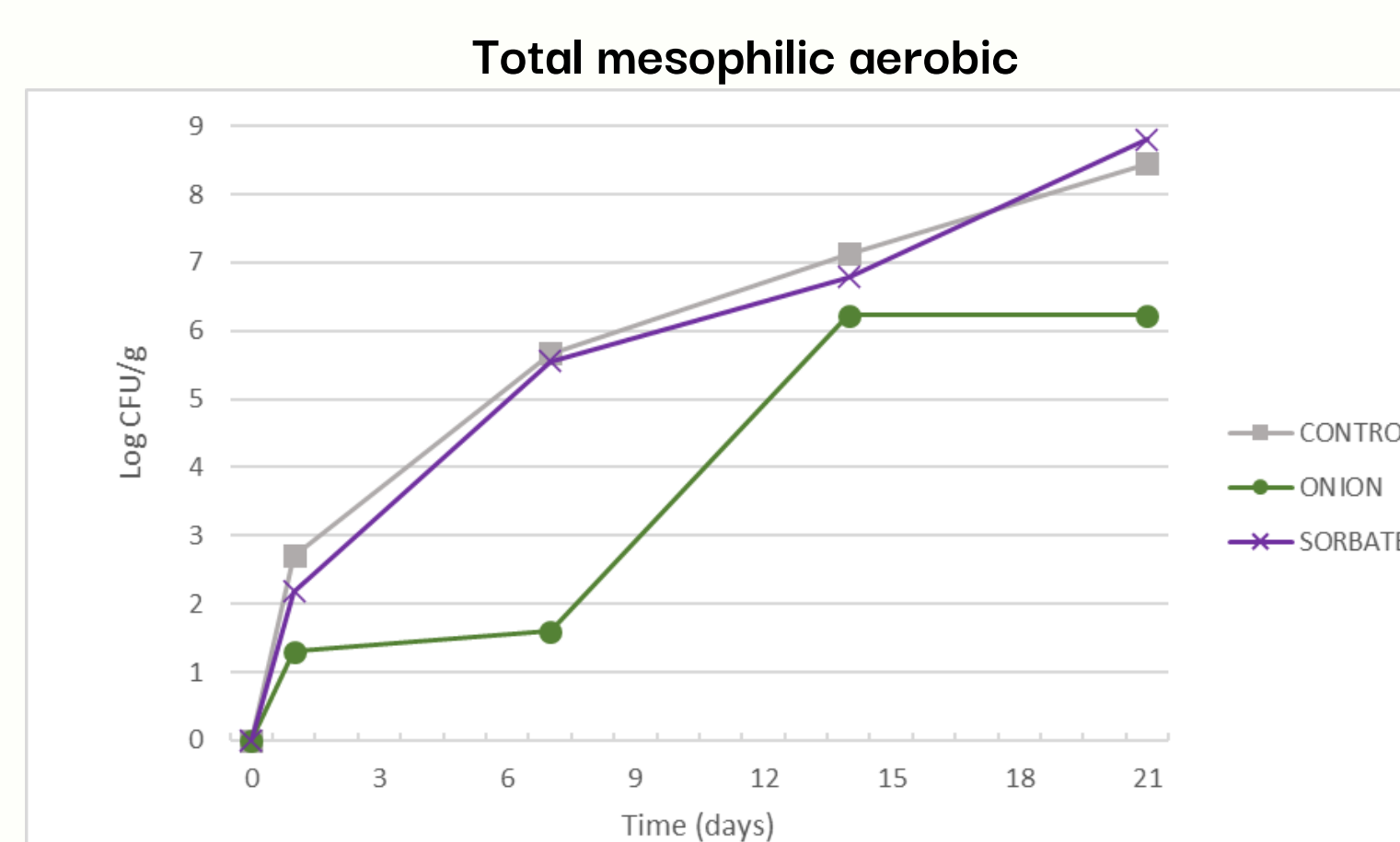


Fig. 4: Assessment of mesophilic microbial growth in control, onion, and sorbate treatment conditions during a 21-day shelf-life test

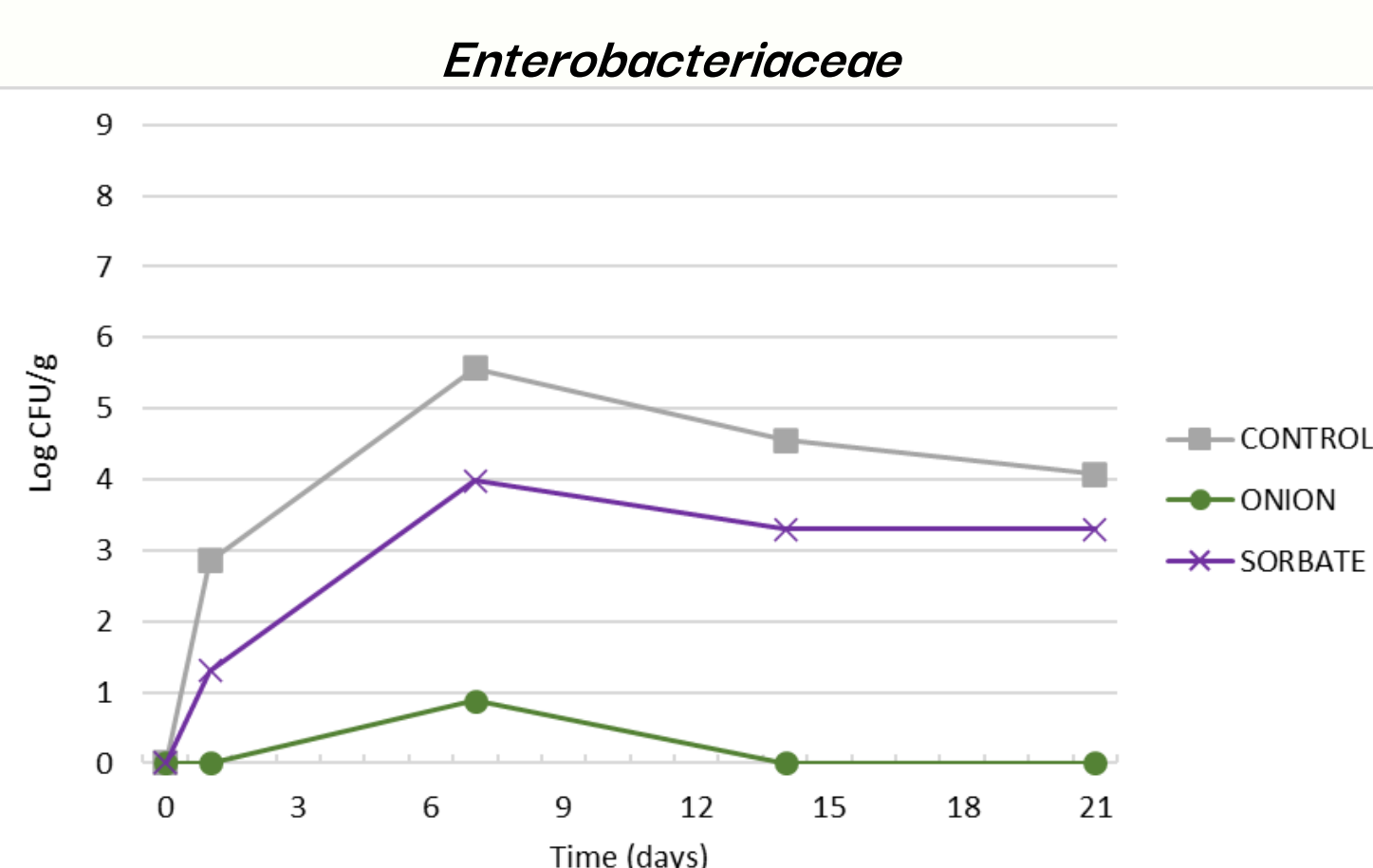


Fig. 5: Assessment of enterobacterial growth in control, onion, and sorbate treatment conditions during a 21-day shelf-life test

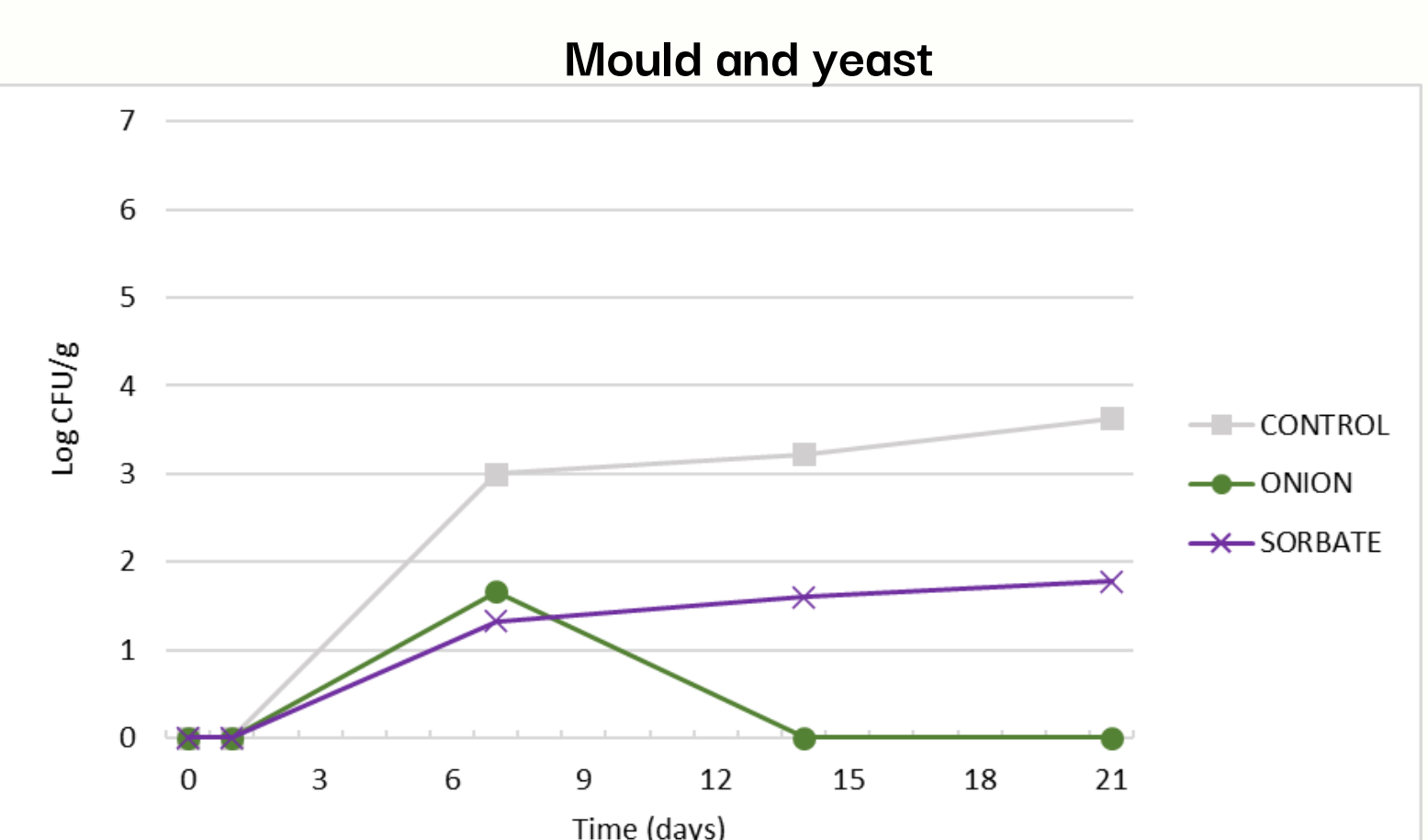


Fig. 6: Assessment of mould and yeast growth in control, onion, and sorbate treatment conditions during a 21-day shelf-life test

CONCLUSIONS

These findings highlight onion extract as a promising clean-label preservative, capable of enhancing the microbial quality and safety of RTE foods. Future research should explore how these solutions affect functionality and sensory properties to support their use in the food industry.