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Influence of the application of tea tree essential oil (*Melaleuca alternifolia*) on the sensory, microbiological and antioxidant quality of minimally processed anco squash

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INTRODUCTION & AIM

In recent decades, consumer trends have shifted toward smaller cultivars of curcubitaceae, such as Anco or "Anquito", which represent approximately 70% of the squash marketed in Argentina. This species is valued for its carotenoids, vitamins, fiber, and phenolic compounds, which promote health. The food industry is increasingly exploring plant-based essential oils for their antimicrobial activity and potential as natural preservatives. Among them, tea tree essential oil (*Melaleuca alternifolia*) (TTEO) exhibits broad antimicrobial effects.

The objective of this study was to evaluate the influence of TTEO on the sensory, microbiological, and antioxidant quality of grated *Curcubita moschata* produced in Santiago del Estero, Argentina.

METHOD

Pumpkin was obtained from Santiago del Estero producers, in Argentina.
The product was washed, sanitized, cut, peeled, grated and centrifuged
The TTEO was superficially incorporated in two concentrations (4 and 8 µL/mL), applied in three ways: sprayed (TS), immersion (TI) and strips embedded in TTEO adhered to the storage container (TV).
Samples were stored at 5 °C, in sealed polypropylene bags of 35 µm.
In addition, an immersion treatment with NaClO-100 ppm-3 min (TH) and a control without any additive were included (TC).

DETERMINATIONS

Sensory: 11 trained judges evaluated six attributes (appearance, color, aroma, exudate, wetness, flavor) on a 9-point scale (1: poor; 9: optimal; 5: acceptable) on days 1 and 8.

Microbiology: Mesophilic, psychrophilic, and enterobacteria counts (log CFU/g) determined at Days 1 and 8.

Bioactive compounds: Methanolic extracts analyzed for total phenols (Folin–Ciocalteu), antioxidant capacity (DPPH), and carotenoids (470 nm).

Statistics: ANOVA + LSD ($p < 0.05$) using Infostat (UNC, Argentina).

RESULTS & DISCUSSION

-Aroma and flavor decreased in all treatments during storage. TC and TH showed the highest initial values (~9) but declined by Day 8. TI4, TI8, and TS8 had the lowest final scores (<4). TV4 best preserved aroma (~5) and flavor (~6), indicating greater sensory stability.

Due to poor sensory performance, treatments TI4, TI8, and TV8 were excluded from further analyses.

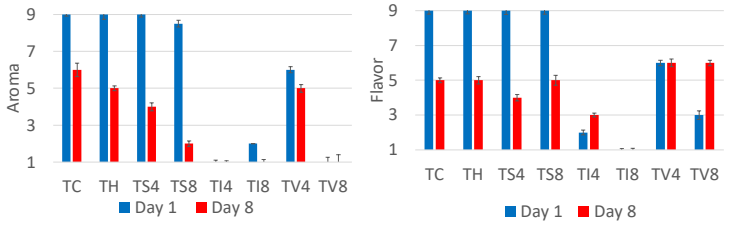

Fig. 1: Aroma (A) and flavor (B) attributes in grated pumpkin without treatment (TC), immersed in sodium hypochlorite (TH) and through the application of different TTEO methodologies and different concentrations at 1 and 8 days of storage at 5 ◦C.

-TS8 and TI8 reduced microbial counts initially, but only TS8 stayed below 7 log CFU/g by Day 8. Enterobacteria and psychrophiles increased over time, especially in TS8 and TV8. Overall, TTEO showed temporary antimicrobial effects, with TS8 providing the best control.
-%INH was highest on Day 3, especially in TV4, then declined by Day 8. TTEO showed a short-term antioxidant effect that decreased over time.

-Phenolic content remained stable during 8 days. Slight increases were seen on Day 3 (TV4 highest), but by Day 8 only TS4 increased. Overall, treatments preserved phenolic levels.
-Carotenoids increased during storage; TTEO treatments moderated this rise, with TV4 showing the most stable levels.

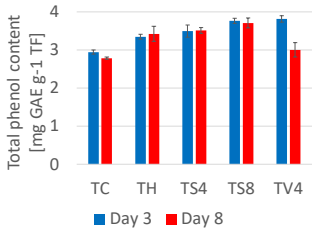

Fig. 2: Phenolic compounds of shredded AS stored at 5 °C for 8 days after different application methods and concentrations of treatment.

CONCLUSION

TTEO combined with MAP maintained squash quality for 4 days, suggesting potential for improving nutraceutical properties and extending shelf life when combined with complementary technologies.

FUTURE WORK / REFERENCES

Appropriate technologies to extend the shelf life of *Curcubita moschata* processed as a minimally processed vegetable.