Effect of Packaging on Microbial Survival and Physicochemical Characteristics of Non-Thermally Preserved Green Spanish-Style Olives

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Trade Preparations

(Trade Standards Applying to Table Olives, COI/OT/NC no. 1, December 2004)

- Treated olives in brine (Spanish-style)
- Natural olives in brine (Greek-style)
- Olives darkened by oxidation (Californian style)
- Dehydrated and/or shriveled olives

Spanish-style green table olive processing

Harvest → Debittering (NaOH, 1.8-2.7%v/v, 12-24h) → Washing with water (2 or 3 times) → Fermentation in brine (6-10%) → Packaging - Storage

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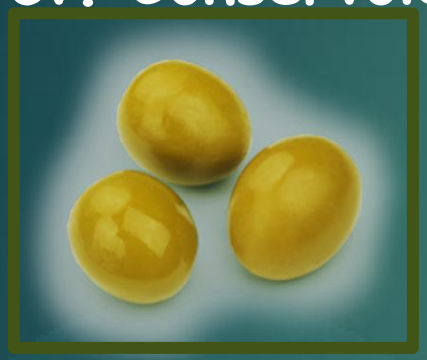
Greek varieties for Spanish-style processing

cv. Conservolea



cv. Halkidiki

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https://olivetreeroute.gr/wp-content/uploads/Studies_Publications_017a.pdf

Packaging of table olives

- Glass containers
- Plastic containers
- Cans
- Multi-laminated pouches
  - Reduced size and weight
  - Flexible
  - Low permeability in O_2 and water

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Aim of this study

Investigate the effect of modified atmosphere packaging of Spanish-style green olives (cvs. Halkidiki and Conservolea) in multi-laminated pouches on:

I. microbiological,

II. physicochemical and

III. sensory characteristics

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Materials and methods

Samples of cvs. Halkidiki and Conservolea pitted green olives processed by the Spanish-method were packaged in high barrier multi-laminated pouches under modified atmospheres (30% CO_2 / 70% N_2) and stored at room temperature for 12 months.

- **Microbiological analysis** (TVC, LAB, yeasts, *Enterobacteriaceae*)
- **Physicochemical analyses** (pH, titratable acidity, salinity, color, texture)
- **Sensory evaluation** (IOC. COI/OT/MO No.1/Rev.2 (International Olive Council), 2020

Microbiological results

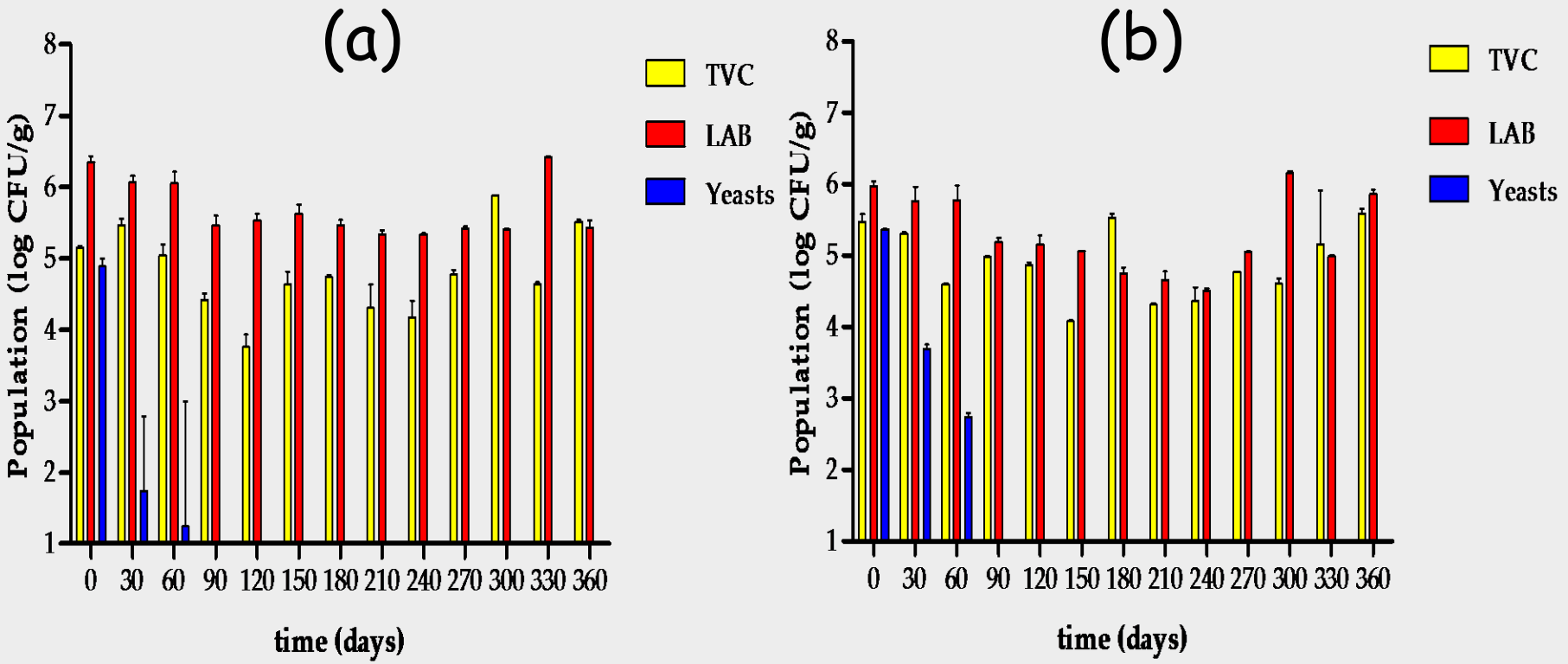

Figure 1. Changes in the population of total viable counts (TVC), lactic acid bacteria (LAB) and yeasts on olive drupes of cvs. Halkidiki (a) and Conservolea (b) during modified atmosphere packaging in multi-laminated pouches. Data represent average values of duplicate samples ± standard deviation.

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Microbiological results

- *Enterobacteriaceae* could not be enumerated during storage in all samples.
- LAB were the dominant microbiota and ranged between 5.4-6.4 log CFU/g and 4.5-6.2 log CFU/g for cvs. Halkidiki and Conservolea, respectively.
- Yeasts were detected within the first 60 days (maximum counts of 4.9 log CFU/g and 5.4 log CFU/g in cvs. Halkidiki and Conservolea, respectively)
- No yeasts could be detected on olives after 90 days of storage in both varieties.

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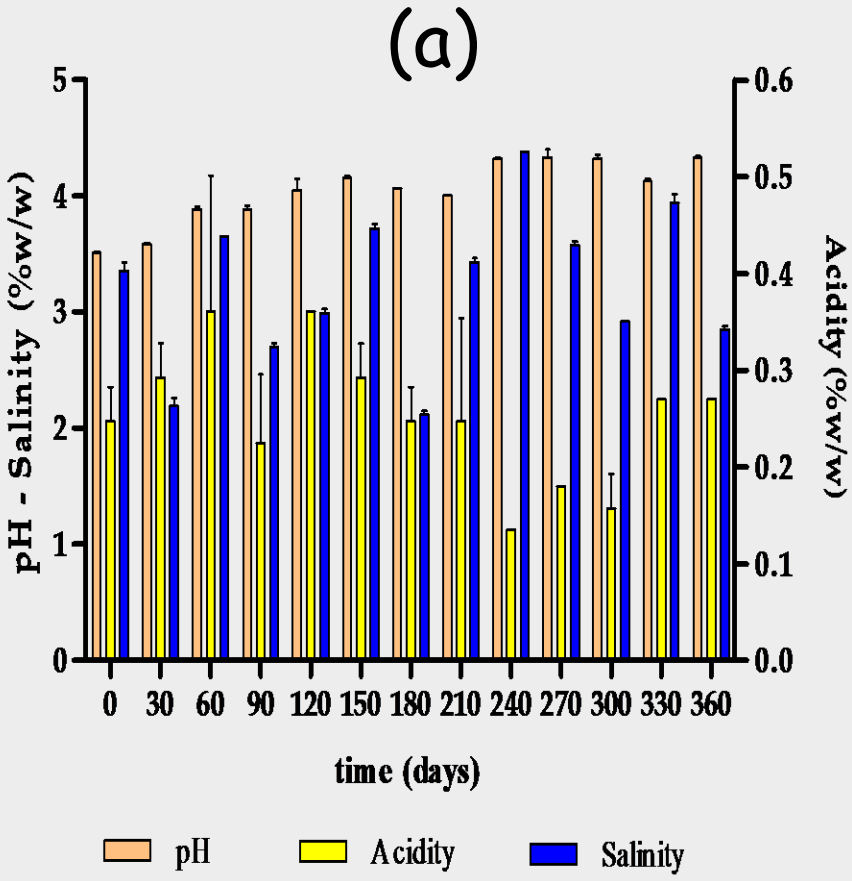
Physicochemical results



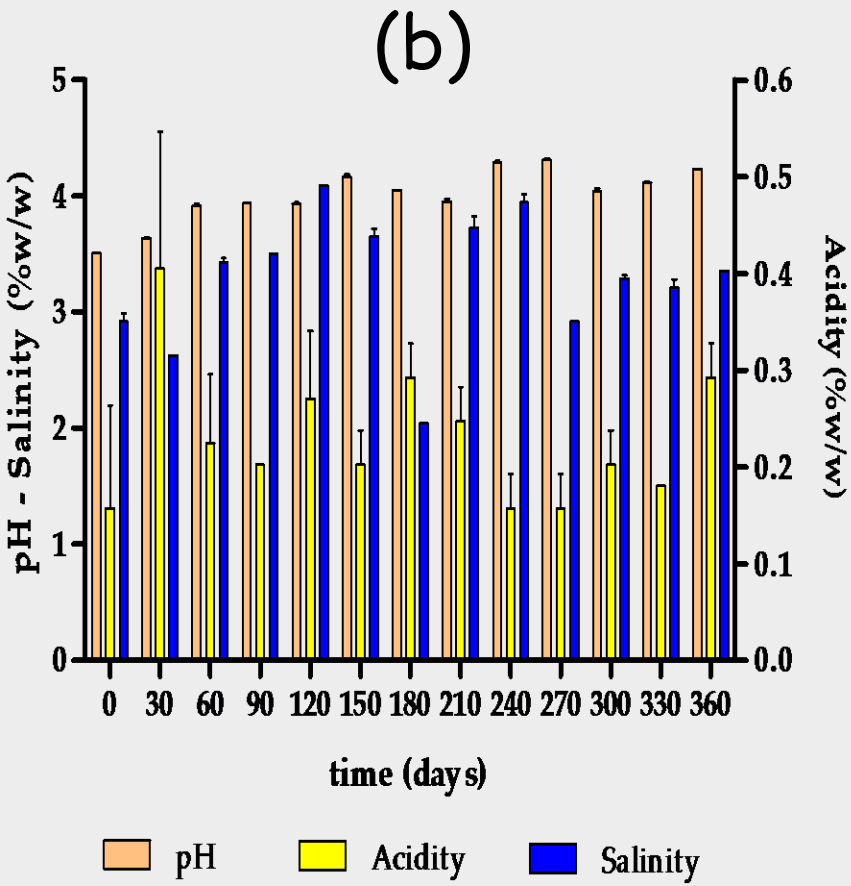


Figure 2. Changes in pH, salt content and titratable acidity during storage of packaged pitted green olives of cvs. Halkidiki (a) and Conservolea (b). Data represent average values of duplicate samples ± standard deviation

Physicochemical results

- Color parameters *L**, *a** and *b** did not change during storage in both varieties.
- No statistically significant differences could be established for *L** parameter.
- The values of *a** and *b** parameters indicated the prevalence of green and yellow tonalities among samples regardless of table olive variety.
- The force needed to penetrate the olive drupe was considered as a measure of the olive's hardness and varied according to table olive variety and storage time.
- The mean value of hardness was 15-20 N and after 360 days of storage it decreased to 8 N.

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Sensory evaluation

- The taste panel evaluated
  - negative attributes (e.g., abnormal fermentation),
  - gustatory attributes (salty, bitter and acid taste) and
  - kinesthetic sensations (hardness, fibrousness, crunchiness).
- No perception of abnormal fermentation (zapateria, putrid, butyric) was noticed throughout storage.

Sensory evaluation

- cv. Halkidiki's olives were bitter, acid, crisper and with increased fibrousness compared to cv. Conservolea.
- The majority of the sensory characteristics did not vary throughout storage in both varieties. After 10 months of storage all olive samples received approximately the same score with no important differences.
- The composition of the modified atmosphere is important since it affects the color and texture of olives.
- Overall, all samples were characterized as "Extra".

Conclusion

- Modified atmosphere packaging of Spanish-style green pitted olives in multi-laminated pouches revealed stability with minor changes in the microbiological and physicochemical characteristics of cvs. Halkidiki and Conservolea olives during 12-month storage.

- LAB dominated the olive surface from the beginning of storage whereas no yeasts could be detected after 3 months of storage.

- The absence of *Enterobacteriaceae* and the changes in the physicochemical parameters (within the acceptable limits) throughout packaging ensures the microbiological safety and stability of the product during storage.

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On-going work

- Investigate and characterize the dominant microbial species using molecular techniques

- Improve packaging conditions by testing different MAP composition and packaging materials

Thank you for your kind attention

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