

Table Olive Production and Processing

Patricia B. O'Hara Amherst College, Amherst, MA, USA
Zeynep Delen Nircan, Sabancı University Nanotechnology Center, İstanbul, Turkey Table Olive Production
Table Olive Processing
Oligophenols Lead to Bitterness (and health benefits)
Curing Olives Naturally - Hurma
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Table Olive Production



Olive fruit is processed for both Table Olives (14 %) and Olive Oil (16 %).

Table Olive Processing starts with whole fruit and " cures" it to transform bitter flavor compounds.

Olive Oil Processing involves grinding up the fruit, stirring the olive paste till the oil coalesces, and then separating out the solids, aqueous component (black water) and virgin oil.

Olive Oil and Table Olive Global Production 2020



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Table Olive Production and Consumption

- Egypt leads in consumption and production.
- Turkey, Spain and Algeria are a close second.



Table Olive Production and Consumption (2023/24)



Table Olive Consumption per Capita



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• All Mediterranean peoples consume table olives regularly. • Per capita, Albanians were the leader of the list by far in 2013!

World Table Olive Consumption

Source: IOC



Global Table Olive Consumption has more than doubled in the last 30 years.

Environmental threats to olive production





The oligophenol of the olive: Oleuropein





- https://www.thespruce.com/types-of-olive-trees-4164925
- Olives are too bitter to eat while on the tree.
- They need to be cured to become table olives.
- The bitterness and pungency come from polyphenols and the unique olive oligophenol called oleuropein.

Oleuropein Molecular Structure is Complex



Two molecular structures of oleuropein: At left, a shorthand stick model is shown where not all atoms are shown, and bonds are shown by either a single line to indicate a single bond or a double line to indicate a double bond. This model does not really capture the way the valence electrons are distributed because they can be delocalized throughout the system.

A more accurate model called a surface electronic charge distribution model, is shown at right showing areas that are slightly negatively charged regions that are electron-rich (red), slightly positively charged regions that are electron-poor (blue), and electronically neutral (green).

Image generated by Spartan program by Richard Blatchly

How do bitter olives become edible?





- Olives can be cured in many ways, including with brine, and using NaOH.
- Strong base (NaOH) chemically breaks down oleuropein.
- The brine treatment basically produces a suitable microbial environment.
- Some oleuropein leaves the fruit by osmosis, the rest is broken down by the microbial enzymes.
- The bitterness/pungency is reduced as oleuropein is broken down.

Spanish Method - Lye Curing: Lye (NaOH) is used to remove bitterness and pungency, followed by rinsing and brining.



"Mix together a setier of passum, two handfuls of well-sifted cinders, a trickle of old wine and some cypress leaves. Pile all the olives in this mixture, saturate them with this paste in garnishing them with several layers, until you see it reach the edges of the containers."

Rutilius Taurus Aemilianus Palladius i <u>De Re Rustica,</u> 300 AD

Curing (Brining)



Brine Preparation: Make a brine solution by dissolving salt in water. A common ratio is 10 % salt (100 g of salt per liter of water),

Soaking: Place the olives in a container and cover them with the brine.

Brine Changes: Change the brine regularly, usually every few days, for several weeks or months,

Testing: After a few weeks, taste an olive to check for bitterness. If it's still too bitter, continue brining.

Dry Brining Glass Jar or Crock Method 2/1 olive/salt



- Spread a 1/4-inch-thick layer of salt over the bottom of a large glass jar or ceramic crock. Add a layer of olives on top of the salt 2 olives or less deep.
- 2. Cover layer of olives with more salt. Add another layer of olives. Repeat until all the olives are completely covered.
- 3. Leave at room temperature, stirring olives or shaking the jar once a day and adding more salt if necessary to keep olives covered. The olives will start to exude their bitter juices, and salt will turn into a moist paste. If it becomes totally liquid, drain olives and return to the container with fresh layers of salt. Allow to set for 3 weeks.

Oligophenols Lead to Bitterness (and Health Benefits)

Figure 1

From: Protein suppresses both bitterness and oleocanthal-elicited pungency of extra virgin olive oil



bitter TAS2R14, TAS2R39

Chemical structures of endogenous compounds present in Extra-Virgin Olive Oil with their perceptual descriptors and the taste and sensory receptors by which the perceptions are mediated: oleocanthal (pungency in the throat, but not bitter), oleuropein (bitter, but not pungent), apigenin (bitter, but not pungent), and luteolin (bitter, but not pungent).

Four major oligophenols give rise to the bitter and pungent flavors of EVOO



Electronic Surface Charges of Oleuropein and. hydroxytyrosol

Why are polyphenols important?



Reactive Oxygen Species (ROS) are present in the body during inflammation, disease, and cancer.

Polyphenols can form stable free radicals that can reduce ROS.

This minimizes the damaging reaction of ROS with DNA and other cellular components and slows down aging, lowers cholesterol, decreases atherosclerosis, reduces the risk of heart disease and stroke, and slows down the progression of Alzheimer's disease.

Curing Olives Naturally - Hurma

Low Salt Olives: Hurma (sweet as a date) olive

First, we need the right olive

To date, at least 3 varietals of olives have been identified as showing a natural debittering:

- Greece Thrubolea
- Tunisia Dhokar
- Turkey *Erkence*



Photo by Rich Blatchly Yeni Foca

Low Salt Olives: Hurma (sweet as a date) olive

Second, we need to identify the debittering micro-organism, most likely a fungus

- A fungus, *Phoma oleae*, was originally thought to be the culprit but further research showed it is not the debittering agent and actually a pathogen and in 2016, it was renamed *Dothiora oleae*.
- Most likely culprit is still not convincingly identified several candidates and an area of active research.
- Fungi exposed to the right olive and the right microclimate can affect the debittering process without need for salt or lye.
- Identification, and perhaps genetic manipulation of fungus to make it more robust could be used in a large fermenter and totally avoid need for harsh chemical conditions of high salt or base.



Photo by Rich Blatchly Yeni Foca

Low salt table olives are healthier

- EU nutritional policy recommends daily sodium intake < 5 g.
- Low salt olives (3-4 % w/v NaCl) are healthier.
- How can we increase the shelf life of low salt table olives without preservatives?



Hurma olives from Karaburun Photo: Zeytin Okulu Selin Tunçer

Packaging Olives Sustainably - The OLIVEPACK Project

Low salt table olives

- How can we increase the shelf life of low salt table olives without preservatives?
- A novel food packaging material design: carbohydrate based natural polymer derived from olive tree wood waste and chitosan; natural non-toxic clay nanoparticles and antimicrobial agents extracted from table olive wastewater. (OLIVEPACK).



Hurma olives from Karaburun Photo: Zeytin Okulu Selin Tunçer

The OLIVEPACK Project

- OLIVEPACK suggests an economically viable, innovative and effective integrated process
- for the development of a biobased, biodegradable, bio-nanocomposite foam
- composed of natural components
- that will be placed into any table olive packaging as a packaging insert
- provide the release of an olive-based antimicrobial agent into the packaging environment.



Hayriye Ünal & Zeynep Delen Nircan Sabanci U.

Nanotechnology

Research Center (SUNUM) Türkiye

Şahnur Irmak Bornova Olive Research Institute (ORI) Türkiye Mohamed Bouaziz University of Sfax (USFAX) Tunisia Elsa Ramalhosa Polytechnic Institute of Bragan.a (IPB) Portugal Joaqu.n Bautista-Gallego University of Extremadura (UEX) Spain

Thank you for your attention!