

Behaviour of Olive Pomace Oil in frying and comparison with conventional and high-oleic sunflower oils

ICTAN - CSIC



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Report summary on the results of comparative research into Olive Pomace Oil and sunflower oils (conventional and high-oleic). Head of research: Dr. Gloria Márquez Ruiz, scientist research of the ICTAN – CSIC.

1. DESCRIPTION OF THE RESEARCH

Study

“Behaviour of Olive Pomace Oil in frying and comparison with conventional and high-oleic sunflower oils”.

Research Centre

Institute of Food Science, Technology and Nutrition (ICTAN) of the Higher Council for Scientific Research (CSIC).

Principal Investigator

Dr. Gloria Márquez, scientist research of the ICTAN – CSIC

Study Aim

To obtain scientific evidence of the advantages of Olive Pomace Oil in discontinuous (domestic) and continuous (industrial) frying in comparison with sunflower and high-oleic sunflower oils.

Rationale

- **Oil samples:** 9 oils from different batches were used:
 - 3 examples of Olive (O) Pomace Oil, hereinafter O1 (from the end of the 2017 campaign), O2 and O3 (each from the start of the 2018 campaign).
 - 3 conventional sunflower (G) oils, hereinafter G1, G2 and G3.
 - 3 high-oleic sunflower (GA) oils, hereinafter GAO1, GAO2 and GAO3.
- **Frying tests**
 - In one-litre and three-litre fryers
 - **Discontinuous frying** (domestic and catering): frying operations of 10 minutes' duration with intervals between fries of 20 minutes. The experiment was conducted on 3 successive days (7 fries a day).
 - **Continuous frying** (industrial): consecutive frying operations of 10 minutes' duration, replenishment with 250 millilitres of fresh oil in the twentieth fry. The experiment was conducted on the same day.
 - **Temperature:** controlled by a type K thermocouple attached to a recorder. This ensured that each fry began at $175 \pm 3^\circ\text{C}$.
- **Product used:** fresh new potatoes (Agrida variety) cut into stick shapes (1 x 1 x 6 cm). 150 grams of potatoes were used in each frying operation.

What was studied?

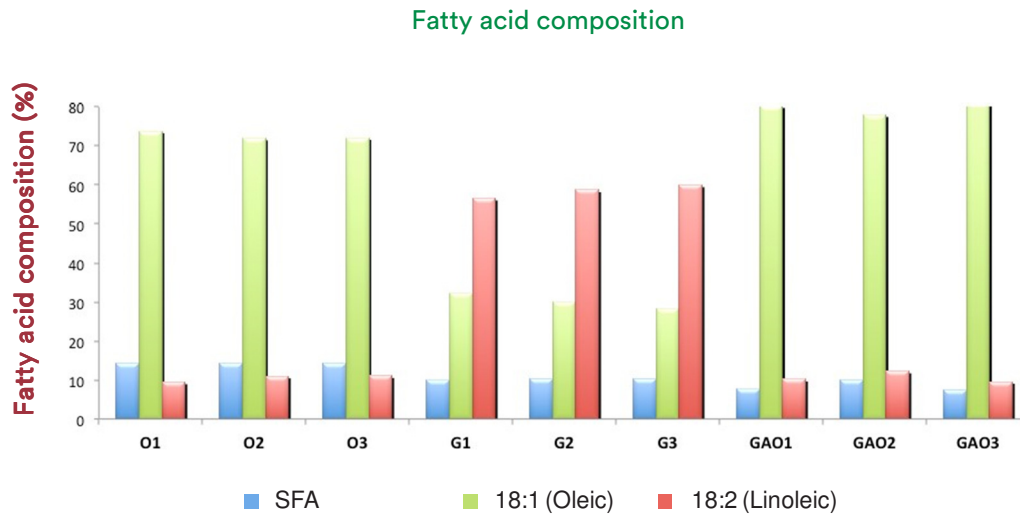
- **Quality and modifications in the potatoes:** absorption of oil, sensory assessment, measurements of colour.
- **Quality and modifications in the oils:** polar compounds, quality scores, Rancimat stability, fatty acid composition, hydrolysis and oxidation compounds, polymers, tocopherols, squalene, sterols, phenolic compounds, triterpenic compounds, aliphatic alcohols, acrylamide (potatoes).

2. RESULTS

Differential composition

The specific composition of Olive Pomace Oil, which is very rich in oleic acid and possesses exclusive bioactive compounds, largely explains its differential properties. These produce a protective effect both on the oil, making it more durable and stable, and on health, with beneficial effects on the body.

Better behaviour in frying in comparison to conventional sunflower oils is due to the differences in **oleic acid content**. With regard to high-oleic sunflower oils, the extra advantage of Olive Pomace Oil is the protective and combined action of **minority compounds**, especially the positive effect attributed to squalene and beta-setosterol.



Composition of minority compounds

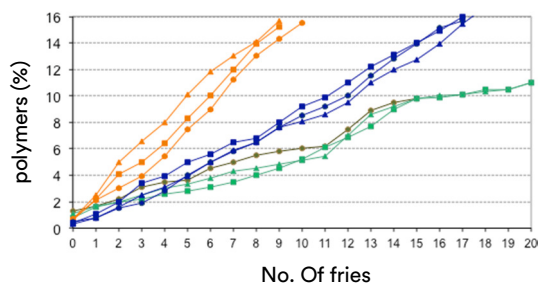
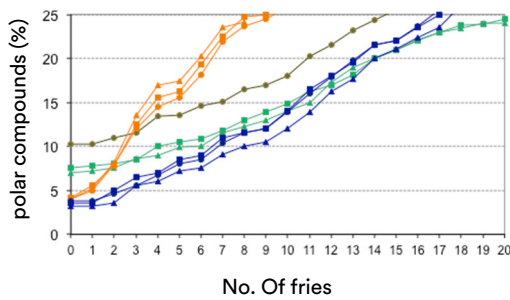
	Olive Pomace Oils	Sunflower Oils	High – Oleic Sunflower Oils
HEALTH Protective effect			
Tocopherols	301-446	519-536	453-474
Phytosterols	2373-3348	3136-3328	2982-3162
Squalene	742-2528	-	-
Phenolic compounds	16-32	-	-
Triterpenic acids	102-126	-	-
Triterpenic alcohols (Erythrodiol and Uvaol)	579-648	-	-
Aliphatic fatty alcohols	1677-2269	-	-
			OIL Protective effect

Durability

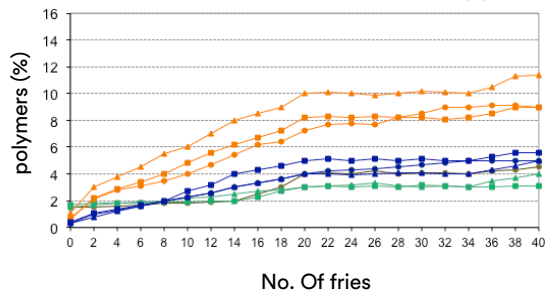
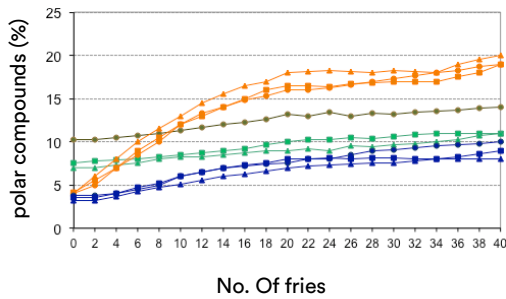
The tests revealed the high stability of Olive Pomace Oil. The comparative study in discontinuous frying showed that, in the oils tested and under the established conditions, conventional sunflower oils reached their maximum level of use, set by legislation at 25% of **polar compounds**, in the 9th-10th fry and high-oleic sunflower oils in the 17th-18th fry. However, two of the batches of Olive Pomace Oil reached the 21st fry and one of them (O1) the 15th. This good stability was also observed during 40 fries in the continuous frying trials.

The differences between the oils become clearer by analysing the evolution of **polymers** as these are oxidation compounds formed in the main in frying. All the oils start from similar polymer levels and it is evident that Olive Pomace Oils, including O1, are the ones that deteriorate more slowly.

Discontinuous frying



Continuous frying



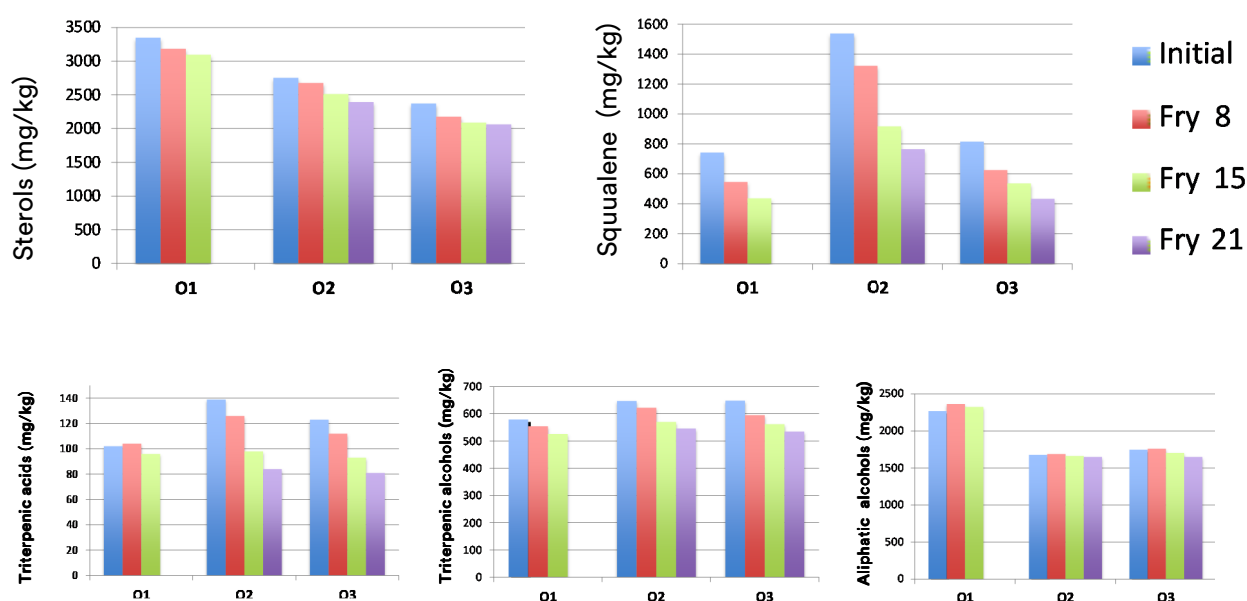
■ O1 O2 O3 Batches of OPO
 ■ G1 G2 G3 Batches of Sunflower Oil
 ■ GAO1 GAO2 GAO3 Batches of High – Oleic Sunflower Oil

Healthy properties (bioactive compounds)

Sterols, which are more plentiful in Olive Pomace Oil, improve the stability of oils during frying, especially beta-sitosterol. **Squalene** increases the stability of Olive Pomace Oil in frying conditions. In addition, this is a bioactive compound that helps to protect skin, eyes, cardiovascular health and prevent cancer.

Furthermore, Olive Pomace Oil possesses exclusive healthy bioactive compounds: **triterpenic acids and alcohols and aliphatic alcohols**. With regard to the latter, these suggest that they may play a protective role against the inflammatory damage inherent in any pathological process.

The research confirmed that **many of these bioactive compounds**, particularly those that are exclusive to Olive Pomace Oil, **are maintained in considerable amounts** during frying.



Acrylamide

There were no significant differences in the results between oils and all acrylamide values were beneath the reference level in ready-to-eat fried potatoes (500 parts per billion) established by European Commission Regulation EU 2017/2158, which has recently entered into force.

3. KEY CONCLUSIONS

- Olive Pomace Oil shows **much better behaviour in discontinuous and continuous frying** than conventional and similar sunflower oils and is even slightly better than high-oleic sunflower oils.
- Olive Pomace Oil shows better behaviour in comparison to conventional sunflower oils due to differences in **oleic acid** content. With regard to high-oleic sunflower oils, the extra advantage of Olive Pomace Oil is the **protective, combined action of minority compounds**, especially the positive effect attributed to squalene and beta-sitosterol.
- Olive Pomace Oil **maintains considerable amounts of bioactive compounds during frying**, especially those that are exclusive to this oil, i.e. triterpenic alcohols and aliphatic alcohols.
- Olive Pomace Oil has **neutral sensory characteristics** that enhance the original quality of the product being fried: taste, texture and color.

The results obtained from the oils used in this study demonstrate the excellent comparative behaviour of Olive Pomace Oils in frying.