INTERPROFESIONAL DEL ACEITE DE ORUJO DE OLIVA

Characterization and evaluation of the bioactive components of Olive Pomace Oil in fried foods

IG - CSIC

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Summary of the report of the results of the IG - CSIC research on "Characterization and evaluation of the bioactive components of Olive Pomace Oil in fried foods".

1. DESCRIPTION OF THE RESEARCH

Study

"Characterization and evaluation of the bioactive components of Olive Pomace Oil in fried foods"

Research Center

Instituto de la Grasa (IG) Food and Technology Research Centre of the Spanish National Research Council (CSIC).

Lead Researcher
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Aim of the study
To evaluate the resistance to alteration of compounds of nutritional interest present in olive pomace oil and the contents of bioactive components of the oil that pass into fried foods.

Experimental design

- **Oil samples:** The frying behaviour of the following oils in food frying has been compared:
  - Olive pomace oil (3 samples).
  - o Conventional sunflower oil.
  - o High oleic sunflower oil.
  - o High oleic sunflower oil with dimethylpolysiloxane (E900).
  - o Special seed oil for frying (blend of refined high oleic sunflower oil, refined sunflower oil and refined grapeseed oil) with dimethylpolysiloxane (E900).

- **Frying tests**
  - o **In 3-litre deep fryers**.
  - o **Discontinuous frying** (domestic and catering): 12 frying operations of 4 minutes with intervals between frying of 2 hours and experiment carried out on 3 consecutive days (4 frying sessions/day).
  - o **Continuous frying** (industrial): 60 consecutive 4-minute frying operations, replenishment with 250 millilitres of fresh oil in the 20th frying operation and 40 experiments carried out on the same day.
  - o **Temperature**: controlled by a type K thermocouple coupled to a temperature recorder, so that each frying operation started at 175 ± 3°C.

- **Thermoxidation tests (in the absence of food)**
  - Block thermostated 175°C for 20 hours.
  - Sampling: 0.5 g.
  - Triplicate: 2, 5, 8 and 10 hours. Duplicate: 15 and 20 hours.

- **Products used**
  - Frozen pre-fried potatoes (approx. 4% fat), vegetable product.
  - Chicken croquettes: Frozen breaded products (without pre-frying fat).
  - Chicken nuggets: Frozen products in batter (pre-fried).

What has been studied?

- Quality and modifications in oils and fried foods: polar compounds, Rancimat stability, fatty acid composition, hydrolysis and oxidation compounds, polymers, tocopherols, squalene, sterols, triterpenic compounds and aliphatic alcohols.

2. FINDINGS

Olive pomace oil resistance to alteration:

- The findings of this study have demonstrated the good frying performance of olive pomace oil. Olive pomace oil showed levels of polar compounds well below the regulatory limit (25%) in frying tests and in fried foods. These values are even lower in terms of actual alteration, i.e. subtracting the content of diglycerides, compounds naturally present in considerable levels in the polar fraction of olive pomace oil and not in seed oils.

- Olive pomace oil has shown intermediate stability compared to sunflower and other seed oils. It should be noted that it was achieved without the addition of the synthetic compound dimethylpolysiloxane (E900), which is present in most of the seed oils marketed for frying.

Evolution of bioactive compounds during frying:

- The results of this study have demonstrated the high thermal stability of sterols.

- Although the results of this study show that squalene degrades under frying conditions, the remaining levels are sufficiently high to ensure that, in the case of olive pomace oils, with initial quantities much higher than those of seed oils, the squalene content in pomace oils in use remains very high.

- The results of this study have shown the high thermal stability of the bioactive compounds characteristic of olive pomace oils: triterpenic alcohols (erythrodiol and uvaol), triterpenic acids (oleanolic, maslinic and ursolic) and aliphatic or fatty alcohols (C22, C24, C26 and C28). Therefore, the remaining amounts of these compounds are estimated to be high, as shown in the following table.

COMPOUNDS	Units	*EU Reg. 2568/92*	OPO* (n=15) Average value	Var. Coef	*Max.*	*Min.*	Remanent in AOO P C.≈30%
SterolsTot.	mg/Kg oil	*≥ 1600*	3694	21	*4388*	*2559*	76.1%
Triterpenic alcohols.	% Sterols	*> 4,5*	18,3	8	*20,1*	*16,4*	80.3%
Content	*mg/Kg oil*	*72*	*667*	*15*	*768*	*514*	
Linear alcohols	mg/Kg oil	*≥350*	1462	7	*1582*	*1341*	100%
Squalene	mg/Kg oil	-	493	54	*856*	*211*	15.6%
Triterpenic acids	mg/Kg oil	-	171	30	*271*	*122*	57.5%

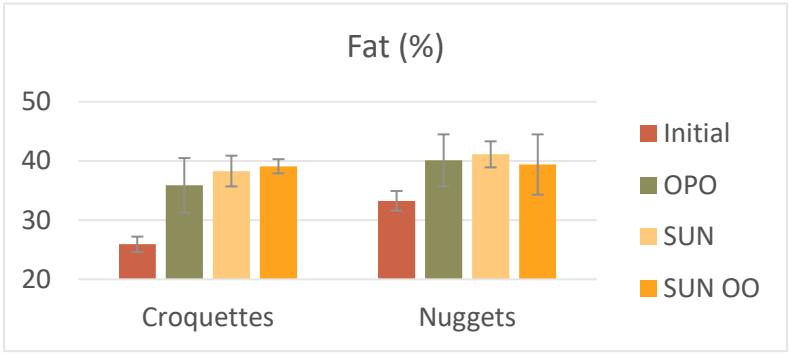
(Abbreviations, OPO*, Olive Pomace Oils analysed;.PC., Polar or Altered Compounds)

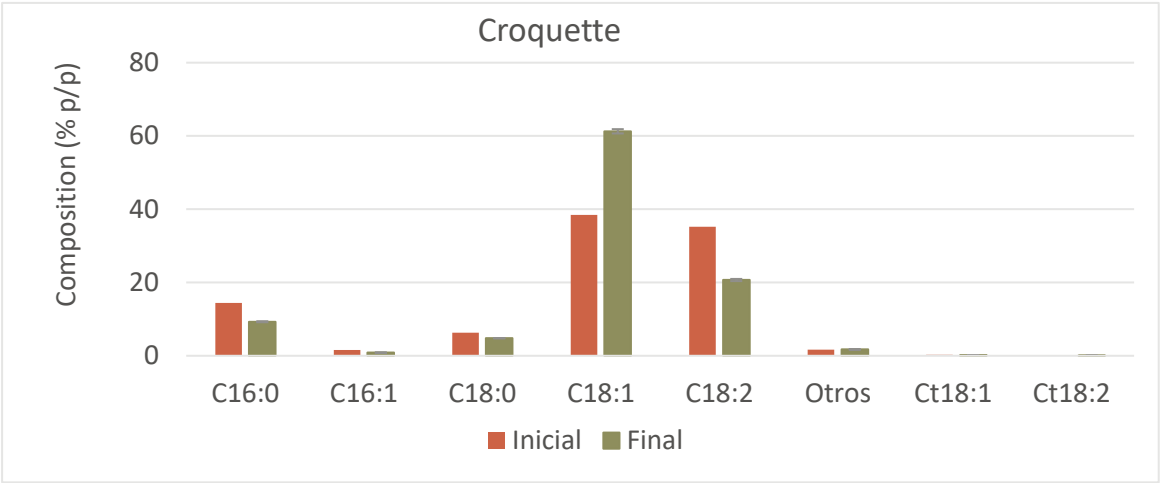
Changes in lipid profile and bioactive compound content in fried products:

- Changes in the lipid profile of fried foods are a consequence of oil absorption and lipid exchange between the fat of the initial food and the frying oil. The fat composition of the fried food resembles that of the oil as the number of times it is fried increases.

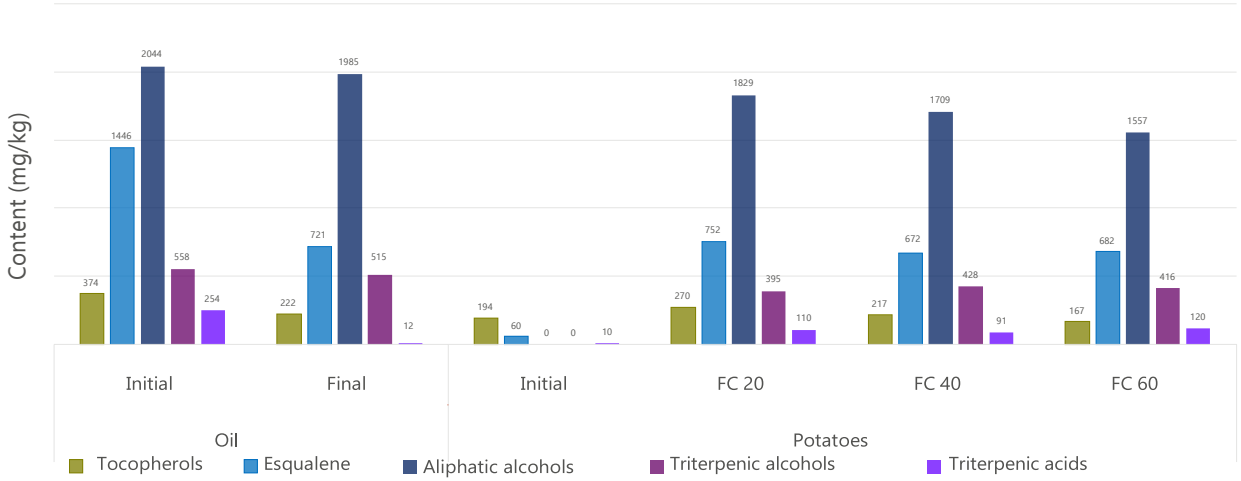
- Although the fat content increases in the products due to frying, the changes observed in the fried products show a considerable improvement in quality with the fat content, i.e. a decrease in the saturated fatty acid content and a decrease in cholesterol content in samples of animal origin. In the case of olive pomace oil, squalene, triterpenic alcohols and acids, and aliphatic alcohols are also incorporated.

Potatoes	Fat (%)
Sunflower	23,9 ± 2,7
Sunflower OO	21,9 ± 0,8
Sunflower OO-DMPS	23,5 ± 0,9
Seads-DMPS	23,0 ± 1,4
Olive Pomace	23,1 ± 1,0





- The high levels of bioactive compounds incorporated in products fried using olive pomace oil should be highlighted, especially in pre-fried potatoes due to their higher proportion of incorporated oil.



3. KEYCONCLUSIONS

Under test conditions of continuous and batch frying and thermoxidation tests, the following tests were conducted:

- High thermal stability of triterpenic alcohols (erythrodiol and uvaol), triterpenic acids (oleanolic) and aliphatic or fatty alcohols (C22, C24, C26 and C28) present in olive pomace oil has been found.

- Although frying increases the fat content of the food, there is an improvement in the fatty acid profile when monounsaturated oils are used, as well as a reduction in cholesterol by dilution in those of animal origin.

- In the case of frying with olive pomace oil, minor components characteristic of olive pomace oil are also incorporated, such as squalene, triterpenic alcohols and acids and aliphatic alcohols.