INFLUENCE OF STORAGE ON QUALITY PARAMETERS AND HEALTH PROTECTING COMPONENTS OF EXTRA VIRGIN OLIVE OIL FROM DIFFERENT ORIGINS

Purcărea Cornelia[*], Chiş Adriana[*], Stanca Bianca* Borbély Maria[**],

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail:neli_oradea@yahoo.com
[**]University of Debrecen, Centre for Agricultural and Applied Economic Sciences, Faculty of Agricultural and Food Sciences and Environmental Sciences, Central Laboratory 4032 Debrecen, Böszörményi u. 138 e-mail: mborbely@agr.unideb.hu

Abstract

Olive oil is a very important agricultural product of the Mediterranean region,There are different important quality characteristics for virgin olive oils and the benefits of olive oil are recognized since ancient time. Olive oil's characteristic aroma, taste, color and nutritive properties, stability distinguish it from other edible vegetable oils. Therefore there is very important to preserve extra virgin olive oil (EVOO) without loss of these positive characteristics.

Here we are presenting our results regarding the storage influence on quality parameters and health protecting components of 3 different origin (Italia, Spain, Greece), EVOO.

Key words: extra virgin olive oil, quality parameters, storage, polyphenols, chlorophyll.

INTRODUCTION

Olive oil is the pure oil obtained from the fruit of olive trees. No oil obtained using solvents, re-esterification processes, or mixed with other vegetable oils qualifies under this description.There are many different kinds of olive varieties from which oil can be produced, and each brings a unique flavor and quality to the oil www.oliveoiltimes.com/olive-oil.

Virgin olive oil, an excellent natural food, is obtained from olive fruit (*Olea europaea*, L.) by mechanical or physical procedures, such as milling, beating, centrifugation, and decantation, (Gandul-Rojas et al, 2000). Its composition varies widely, depending on fruit variety, degree of fruit ripeness, environmental conditions, growing region, and techniques of processing and storage (Barranco et al. 1996; Mínguez-Mosquera et al, 1990; 1991).

Extra Virgin olive oil is the highest quality virgin olive oil. According to current trade standards, it must have no organoleptic defects and must meet the analytical criteria, established by IOOC. Some of the minor components of olive oil accelerate the oil oxidation (pigments,etc) and others act as antioxidants (polyphenols, tocopherol, etc).

Virgin olive oils are known to be more resistant to oxidation than other edible oils because of their natural antioxidant content, particularly polyphenols and relatively low content of polyunsaturated fatty acids

(Garcia *et al.*, 2002; Cinquanta *et al.*, 2001; Okogeri and Tasioula-Margari, 2002). In addition, phenolic compounds provide the pungent sensory characteristics in olive oil (Ayton et al., 2012).

Predicting the shelf life of the olive oil is a complex process because of the influence of several factors such as temperature, light, oxygen availability, enzymes and microorganisms (Stefanoudaki, 2010).

Olive oil quality and stability are principally affected by lipid oxidation. The process is complex because of the influence of multiple factors, such as light, temperature, enzymes, and metals. This deterioration is characterized by physicochemical changes, a marked decrease in the nutritional value, an unpleasant flavor called "rancid," and even some toxicity (Yildirim, 2009).

There are different important quality characteristics for virgin olive oils, like: peroxide value, free fatty acid, spectrophotometric indices at wavelength 232 and 270 nm, namely K232 and K270, (Aman et al, 2008; Agilent, 2013).

Photooxidation of olive oil in the presence of naturally occurring chlorophyll pigments produces singlet oxygen, which acts with unsaturated fatty acids and produces fatty acid hydroperoxides. This photooxidation results in a change in color and because of the formation of hydroperoxide decomposition products, develops undesirable odor and flavor constituents (Rahmani and Csallany 1998).

The aim of this study is to investigate the influence of storage time on some quality parameters and health protecting components of olive of originated from different regions (Italia, Spain, Greece).

MATERIAL AND METHOD

The experiments were performed in 2012 - 2013, at the Laboratory of Agrifood Biochemistry, Faculty for Environmental Protection, University of Oradea.

For this study, 3 extravirgin oliv oil samples originated from Italy, Spain and Greece, were analysed. For each type of oil were performed 4 samples, analyzed immediately after opening (I), at 3month (II), 6 month (III) and 12 month (IV) after opening of bottle.

Quality parameters (peroxide value PV, free fatty acid - FFA, K232 and K270) were evaluated following the methodology proposed by EC 2568/91 regulation (EC, 1991).

Total Phenolic content - *Sample preparation* – the polyphenols were extracted from the oils according to the method described by Vazquez-Roncero et al 1973. 10 g of oil was dissolved in 50 ml hexan and the solution was extracted successively with 3x 20ml portions of 60% aqueous

methanol. The mixture was shaken each time for 2 min. The combined extracts were brought to dryness in a vacuum rotary evaporator at 40ºC. The residue was dissolved in 1ml methanol and stored at -20ºC until it was used.

The total polyphenol content of the methanol extracts was evaluated colorimetrically using the Folin-Ciocâlteau reagent. The method was adapted from Singleton and Rossi (Singleton et al.,1965). A diluted extract (0.5 ml of 1:10. v/v) or phenolic standard was mixed with Folin- Ciocâlteau reagent (5 ml diluted 1:10 with Nanopure water) and aqueous 4ml.1M Na_2CO_3. Solutions were maintained at room temperature for 60 minutes and the total polyphenols were determined colorimetrically at 725 nm. Gallic acid standard solutions were used to calibrate the method.

Pigments were extracted from the virgin olive oil samples and the total contents of chloropylls were determined spectrophotometrically according to the method proposed by Mínguez-Mosquera et al. (1990).

The content of chlorophyll pigments in vegetable oils is expressed as mg of pheophytin a in 1 kg of oil. Chlorophyll pigments are determined by measuring the absorbance at 670 nm, correcting the result for the background absorption, and calculating the content with use of the absorptivity of pheophytin a, which is the main chlorophyll pigment in crude vegetable oils seed.

The liquid sample is homogenized, and if turbid, filtered immediately before the analysis, using a medium-pore size filter paper.

The sample is measured at 630 nm, 670 nm and 710 nm wavelength in a 5 mm or a 10 mm spectrophotometer cell against air instead of a reference cell (Pokorny et al, 1995).

The content of chlorophyll pigments is expressed in mg of pheophytin a, which is equal to:

$C = 345.3 \times (A670 - 0.5 \times A630 - 0.5 \times A710) / L$

where: C = content of chlorophyll pigments in mg of pheophytin a in 1 kg of oil,

A = absorbance at the respective wavelength (nm),

L = thickness of the spectrophotometer cell (mm).

RESULTS AND DISSCUSIONS

Results of the determination for quality parameters, respectively, peroxide value PV, free fatty acid - FFA, K232 and K270, were represented in Fig.1-4. The total polyphenols and chlorophyll pigments content were inserted in table 1.

The parameters for peroxide value and free faty acid were within the limits fixed by IOOC, regardless of origin of oil in first 6 month of storage.

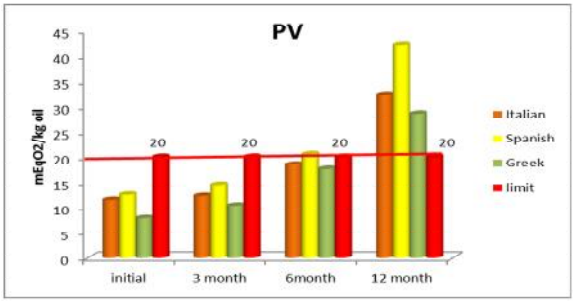

Fig. 1 Peroxide value of the olive oil samples during 12 month of storage

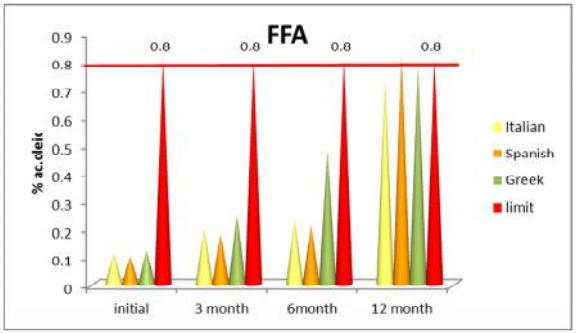

Fig. 2 Free faty acid value of the olive oil samples during 12 month of storage

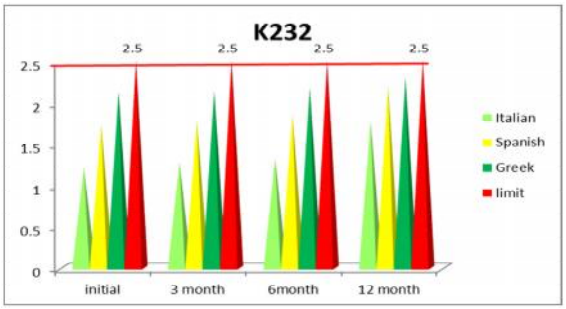

Fig.3. K232 of the olive oil samples during 12 month of storage

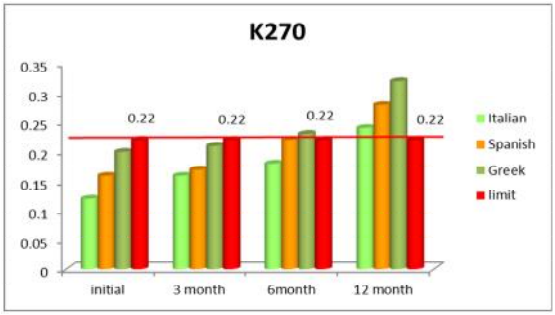

Fig.4. K270 of the olive oil samples during 12 month of storage

After 12 month of storage at room temperature, for all the EVVO samples, the values for PV were significantly higher that the limits fixed by IOOC, the biggest value was for Spanish olive oil (42.3 mEq O_2/kg oil).

The values for FFA after 12 month o f storage were unsignificantly higher for Spanish olive oil, and for the rest were equal or under the limit.

Regarding the K232 value, none of the oil samples exceeded the upper limit of 2.5 during 12-month storage. The results for PV and FFA , were consistent with those obtained by Vekiari et al., 2002 and Kiritsakis (1998). They reported that the values of K232 in samples of Greek olive oils stored in dark showed that values of these samples did not exceed the upper limit value for K232.

K270 values increased during the storage and after 12 month storage values were higher than the legal limit, 0.22, fixed by IOOC. The highest values were obtained for Spanih and Greek oil samples. Caro et al (2006) reported the K270 values of the Bosana oil samples stored in dark and at room temperature for 16 months, and observed a significance increase in K270 values.

Results of the determination of total phenolic content and chlorophyll pigments are inserted in table 1, and prove that these parameters decreased during storage period. A very significant decrease was registered after 12 month storage at room temperature of olive oil.

Table 1.

Estimative mean values for minor compounds of different analysed olive oil samples

Type of oil	Sample nr.	Polypheols mg gallic acid/kg oil	Statistic signif.	Chlorrophyll pigment mg pheophitin a /kg oil	Statistic signif.
EVOO Italy	**I**	114.6±1.6	-	19.06±0.36	-
	II	113.3±0.8	ns	18.7±0.2	ns
	III	112.7±1.2	ns	17.9.±0.1	*
	IV	108.2±0.32	***	17.1±0.23	***
EVOO Spain	**I**	146±1.27	-	21.85±0.72	-
	II	145.3±1.34	ns	21.4±0.2	ns
	III	143,3±1.15	**	20.8±0.18	ns
	IV	117.2±1.34	***	18.5±0.2	***
EVOO Greece	**I**	183.16±3.17	-	25.17±0.8	-
	II	180.2±1.12	ns	25.03±0.2	ns
	III	178.6±2.23	ns	24.22±0.1	ns
	IV	156.2±0.6	***	22.14±0.2	**

This reduction of the total phenol content of oils during storage is a result of the decomposition processes that occur in the oxidation activities. The presence of pigments not only determines the colour of the product but also plays an important role in the oxidative activity of processed foodstuff, due

to their antioxidant nature in the dark and pro-oxidant activity in the light (Oueslati et al., 2009).

CONCLUSIONS

During storage at room temperature has been an increase in the values of quality parameters PV, UV absorbance values (K232 and K270). That are the measure of oxidative degradation of oils. Significant differences were registered for Spanish oil followed by Greek and Italian oil.

Free fatty acid, were within the limit (< 0.8 %) and no significance increase were observed in this value during storage period.

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