COMPARATIVE STUDY OF QUALITY PARAMETERS AND HEALTH PROTECTING COMPONENTS OF EXTRA VIRGIN OLIVE OIL FROM DIFFERENT ORIGINS

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Abstract

There are different important quality characteristics for virgin olive oils.The benefits of olive oil are recognized since ancient time. The favourable effects of some components of olives and olive oil have been studied by several scientists all around the world. Researchers focused on those components that have beneficial effect on different organs of the human body. Chlorophyll pigments (mainly chlorophyll a) are indicators of the quality of oilseeds and oil. Polyphenols are products of the secondary metabolism of plants. These compounds are reported to exhibit anticarcinogenic, anti-inflammatory, anti-atherogenic, antithrombotic, immune modulating and analgesic activities, among others and exert these functions as antioxidants. Here we are presenting our results regarding the quality parameters and health protecting components of 3 different origin (Italia, Spain, Greece), extravirgine olive oil (EVOO).

Key words: olive oil, quality parameters, polyphenols, chlorophyll and carotenoids

INTRODUCTION

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. These factors influence oil color, which is one of the basic quality characteristics of virgin olive oil (Barranco et al. 1996; Mínguez-Mosquera et al, 1990; 1991).

International standards define virgin olive oil as obtained exclusively from olives, using mechanical or other physical means in conditions that do not alter the oil in any way, specifically excluding heating and chemical processing.

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.

It is known that the quality of virgin olive oils, above all concerning product, technological and nutritional aspects, is a function of the

characteristics of the composition and, more specifically, of the concentration of antioxidants (Del Carlo et al, 2006) .

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, (Amany et al, 2008; Agilent, 2013).

Free fatty acids are formed by the hydrolysis of the triacylglycerols in oils during extraction, processing, and storage.

Peroxides are primary oxidation products that are formed when oils are exposed to oxygen, producing undesirable flavors and odors.

UV absorbtion specific for conjugated double bonds formed from natural nonconjugated unsaturation in oils upon oxidation.

Olive oil is greatly assimilated by the human body. The assimilation of this oil by our body is mainly attributed to the high percentage of triolein. Also, the pigments - chlorophyll and pheophytin and the aroma components present, facilitate its absorption from the human body (Kiritsakis, 2013).

It is well accepted that the high mono-unsaturation of olive oil and the presence of several other constituents such as phenols and tocopherols, chlorophyll and pheophytin, sterols, squalene, aroma and flavour compounds and others exhibit a significant role on the health. Olive oil, as a highly monounsaturated oil, is resistant to oxidation (Iconomou et al, 2010).

The accumulation of free radicals, as a result of oxidation in the body, causes serious problems on human health. Our body is protected from the free radicals by free radicals scavengers such as vitamin-E and phenols. The latter, present in significant amounts in olive oil, prevents the human's cell destruction.

Polyphenols are products of the secondary metabolism of plants. These compounds are reported to exhibit anticarcinogenic, anti-inflammatory, anti-atherogenic, antithrombotic, immune modulating and analgesic activities, among others and exert these functions as antioxidants (Gomez-Caravaca, 2006).

Olive oil contains polyphenols such as eter of tyrosol and hydroxytyrosol, including oleocanthal and oleuropein (Tripoli et al, 2005), having acidic properties that give extra-virgin unprocessed olive oil its bitter and pungent taste. Olive oil is a source of at least 30 phenolic compounds (Kellie and Hayball, 2002). Other phenolic constituents include, flavonoids and lignans (acetoxypinoresinol, pinoresinol) (Owen et al, 2000a). The latter two compounds are only present in extra virgin oil, (Owen et al 2000b).

The presence of natural pigments (chlorophylls, pheophytins, carotene) is relevant both with respect to the product and technological characteristics and with respect to the stability of the product. Moreover a

green colour is often appreciated by consumers. It is known, in fact, that these substances can have a remarkable influence on the preservability of the product as pro-oxidants in synergy with possibly present metals (Capella et al 1991).

The aim of this study is to investigate some of the quality parameters and health protecting components of olive of originated from 3 different regions (Italia, Spain, Greece).

MATERIAL AND METHOD

The experiments were performed in 2013, at the Laboratory of Secondary Metabolits in Food Industry, of 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 3 samples.

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 **-**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 4ml aqueous,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. 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 10 mm spectrophotometer cell against air instead of a reference cell (Pokorny et al, 1995).

The content of chlorophyll pigments is equal to:

C = 345.3 x (A670 - 0.5 x A630 - 0.5 x 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, are inserted in table 1. For all the Extra Virgin olive Oil samples, the values for these parameters were within the limits fixed by IOOC, regardless of origin of oil.

Table 1.

Estimative mean values for quality parameters of different analysed olive oil samples

Type of oil	Sample nr.	PV	FFA	K232	K270
	Limit	**≤20 mEqO_2/kg oil**	**≤0.8 % ac.oleic**	**≤2.5**	**≤0.22**
EVOO Italy	**I1**	9.67	0.12	1.15	0.11
	I2	10.5	0.1	1.21	0.13
	I3	12.4	0.13	1.27	0.14
	Mean ± sd	**11.52±0.86**	**0.11±0.015**	**1.21±0.06**	**0.12±0.015**
EVOO Spain	**S1**	13.4	0.09	1.66	0.17
	S2	11.5	0.11	1.75	0.15
	S3	12.8	0.12	1.8	0.16
	Mean ± sd	**12.56±0.97**	**0.10±0.015**	**1.73±0.06**	**0.16±0.01**
EVOO Greece	**G1**	7.9	0.13	2.1	0.2
	G2	8.3	0.14	2.22	0.19
	G3	7.5	0.11	2.09	0.21
	Mean ± sd	**7.9±0.4**	**0.12±0.015**	**2.13±0.07**	**0.2±0.01**

Results of the determination of total phenolic content are shown in Fig1, and prove that the extravirgin olive oil contains polyphenolic compounds and their content depends on the region where the olives are harvested and on their botanycal variety. Environmental conditions also influence oil properties such as phenolic compounds (Kiralan et al., 2009).

Evaluating our results we can say that the analysed olive oil samples are good source of polyphenols (between 109–190 mg of gallic acid equivalents/1kg oil). Similar results were obtained by Bayano et al, 2009; Del Carlo et al., 2006.

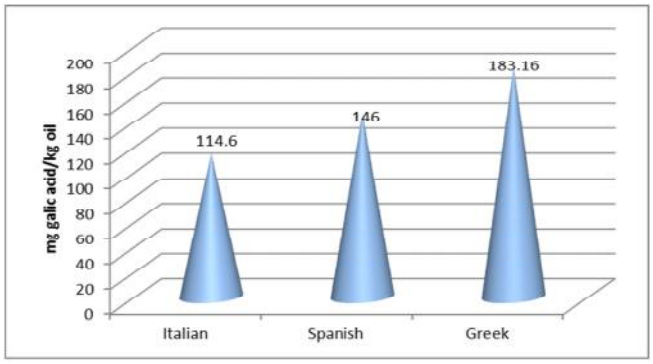

Fig. 1 Total phenolic compound content of the olive oil samples

Recent literature shows that the chlorophylls contribute to the evaluation of the intrinsic quality, the authenticity, and the geographical origin of EVOO, in the same way as other minor compounds of olive oil such as phenol compounds and volatile substances (Cerretani et al., 2008; Aparicio-Ruiz et al., 2009).

Results of the determination of chlorophyll pigments content are shown in Fig2.

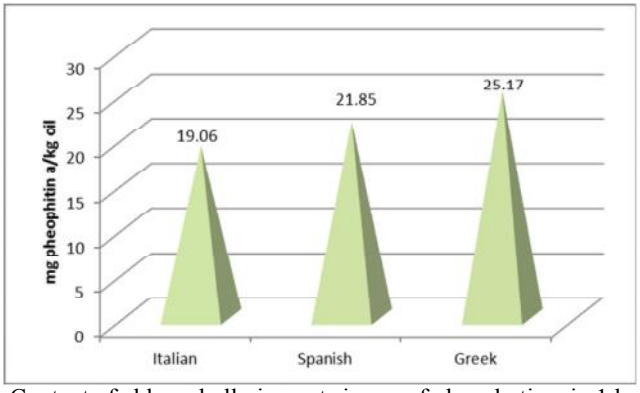

Fig. 2 Content of chlorophyll pigments in mg of pheophytin a in 1 kg of oil

Evaluating the chlorophyll contents of different olive oil samples we can find, that there are very little differences between samples regarding the contents of Chlorophyll a, the concentrations ranging from 19.06 to 25.17 mg pheophytin a /kg oil.

CONCLUSIONS

Summarising the results we can establish that quality parameters of all the analysed olive oil samples were within the limits fixed by IOOC.

Phenolic compounds have strong antioxidant activity, inhibit lipid oxidation, thus contributing to the stability of olive oil and have beneficial effect on different organs of the human body.

The green hue of the oil depends above all on the type and quantity of chlorophyll pigments. The determination of the chlorophyll pigment of EVOO, are of great importance given the commercial, technological, and sensorial value attributed to these compounds.

Among the analyzed products, the Greek olive oil has the highest content in antioxidant compounds and chlorophyll.

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