

CHARACTERIZATION OF SOME NEW OLIVE OIL GENOTYPES GROWING IN EL-KHATATBA ZONE - EGYPT

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Abstract

This investigation was aimed to characterize virgin olive oil from four olive oil cultivars (Koroniki, Arbequina and new cultivars No.1 and No.138) cultivated in El-Khatatba zone, Egypt during two successive seasons 2010/2011 and 2011/2012. The quality indices (Free acidity , Peroxide value, K232 , K270 and ΔK moreover , the fatty acids , minor components beside oxidative stability and sterol composition of the obtained olive oils (VOO) were analyzed to obtain a more complete characterization of these varietal oils. Results revealed that, all the analyzed VOOs were classified into "Extra virgin" category according to the regulated physicochemical parameters. In addition , Koroniki olive oil cultivar was the only one complied with IOC, 2011(Trade Standard for Olive Oil) during evaluation period if fatty acid and sterols compositions were taken into account and it represented the highest oxidative stability during the two seasons (24.81 and 26.5 hr at the 1st and 2nd seasons , respectively) while, Arbequina cultivar was the lowest one (9.80 and 12.99 hr at the 1st and 2nd seasons, respectively) which, attributed to the content of minor components (polyphenols, α -tocopherols , chlorophyll and carotenoids) and monounsaturated fatty acid. Also, the main sterols found in Koroniki VOO were β -sitosterol (82.10 and 83.33 at the 1st and 2nd seasons , respectively) , $\Delta 5$ -avenasterol, campesterol and stigmasterol. The new cultivar No.1 or No.138 had the highest mean oil contents (20.25 and 18.75%, respectively) and good oxidative stability virgin olive oil but they, were stood out of IOC limits during evaluation period due to its non-compliance in fatty acid composition. The minor components, fatty acids and sterol compositions are mainly affected by olive cultivars (genotype) and climatic conditions.

Keywords: New olive oil cultivars, olive oil quality, minor components, fatty acids , sterols .

INTRODUCTION

The olive tree (*Olea europaea*) has an important social and economical significance in the Mediterranean basin, which occupies 98% of the world's cultivated olive trees (Alfonso and Owen, 2002). Olive oil is one of the oldest known vegetable oils mainly produced in the countries surrounding the Mediterranean Sea. It is a natural fruit juice, obtained from the fruit of tree *Olea europaea* L., with a unique composition and quality. Olive oil is one of the very few oils that can be consumed in its natural form, thus preserving all its natural constituents. Several methods of analysis have been proposed and are affected by several factors, including packaging (Kiritsakis, 1998).

The consumption of extra virgin olive oil, the most characteristic component of the Mediterranean diet, is currently increasing because of its nutritional and health-promoting effects, which have been related to the optimal balance between saturated, monounsaturated (MUFA), and polyunsaturated fatty acids (PUFA), as well as to minor components such as sterols, chlorophyll, polyphenols and tocopherols (Cercaci, *et. al.*, 2007 and Lazzez *et. al.*, 2008) .

The chemical composition and quality of virgin olive oil are influenced by a variety of factors, among them geographical production area (altitude and soil composition), climatic conditions prevailing in the production year, cultivar, and extraction process, Baccouri *et. al.*, 2007 and Dag *et. al.*, 2009, harvesting time. All of these parameters influence fruit firmness, ease of oil extraction and sensory characteristics Menz and Vriesekoop, 2010. The composition of fatty acids, and the levels of polyphenols, tocopherols, sterols and pigment. The magnitude of these changes depends on the cultivar, climate and growing conditions. The changes are reflected in the quality grade, sensory characteristics, oxidative stability and nutritional value of the product. These differences are the "added-value" offered by the protected designation of origin (PDO) Lopez-feria *et. al.*, 2008 and Koprivnjak *et. al.*, 2009.

Olive oil is mainly made up of triglycerides (more than 98%), whereas the unsaponifiable fraction of virgin olive oil (VOO) represents 1–2% of the oil. This fraction is made up of minor constituents, which may vary both qualitatively and quantitatively depending on vegetal species, climatic conditions, extraction and refining procedures, and storage conditions (Canabate-Diaz *et. al.*, 2007). These also greatly influence the organoleptic quality and stability of the oil. VOO may contain up to 0.7% hydrocarbons, which is mainly constituted by squalene, a precursor of other sterols and triterpenic alcohols (Bortolomeazzi, *et. al.*, 2001). Besides squalene, the

hydrocarbon fraction of olive oil comprises of low quantities of epoxy-squalene isomers and alkanes (C16–C35).

The nutritional quality of virgin olive oil has been related to its composition, in particular the high concentration of oleic acid, which accounts for about 55–83% of the total fatty acids (Codex Alimentarius and IOC). This monounsaturated fatty acid favours the reduction of LDL cholesterol and is related to the prevention of cardiovascular diseases.

Virgin olive oil (VOO) nutritional quality has also been associated with its minor components, mainly antioxidants such as tocopherols (chiefly α -tocopherol) and polar phenols, but also sterols (mainly β -sitosterol), and pigments (chlorophylls, carotenoids), which also play a role in the stability of the oil and the prevention of cardiovascular diseases, tumors and degenerative diseases of aging (Visioli & Galli, 2002). Minor compounds are of great importance in the final composition of olive oil because they influence the stability and overall acceptability as well as the nutritional and health related properties of the olive oil. Compounds such as sterols, squalene, and tocopherols are of great interest as high value added products because of their nutraceutical activities (Ibaneza *et. al.*, 2002).

Fatty acids and Sterols are nutritionally important lipids that need to be routinely determined in foods. In olive oil, content and composition of fatty acids and sterols can vary due to the agronomic and climatic conditions, fruit or seed quality, oil extraction and refining procedures and storage conditions Plant sterols or phytosterols make up the main part of the unsaponifiable fraction of olive oil. The International Olive Council (IOC) imposes limits or ranges for each type of fatty acids and sterol based on the natural levels found in traditional olive oil types. Fatty acids and sterol profiles outside these ranges could suggest that the olive oil is not genuine.

New cultivars today are required to adopt for the olive oil industry to suit with modern intensive mechanized orchards. Narrow erect trees for mechanical harvesting, adaptability to irrigation, uniform maturation, minimal alternate bearing, and resistance to leaf and root diseases are the goals of most present olive breeding program. The development of new olive products and freezing resistance are also considered (Dabbous, *et. al.*, 2010)

The aim of this study was to evaluate the effect of geographical area and different cultivars (Koroniki, Arbequina, and new cultivars No.1 and No.138 which are growing in El-Khatatba zone, Egypt) during two consecutive harvesting seasons on the characteristics of produced virgin olive oil, quality indices, minor components, sterols and fatty acid composition.

MATERIALS AND METHODS

Materials

Source of virgin olive Oils samples

Olive's fruits (Koroniki, Arbequina, and new cultivars No.1 and No.138) were harvested during seasons of 2010/2011 and 2011/2012 from research olive orchards in El-Khatatba zone, Egypt. Koroniki and Arbequina cultivars are well known cultivars originated from Greece and Spain and they are growing under Egyptian conditions in different areas. The new cultivar No.1 produced from the open pollination of Arbequina cultivar and cv No. 138 produced from pollination of Arbequina X Hamed cultivars. The harvesting date was at the first of November. The oil was immediately extracted by means of the continuous extraction system two-phases in Agricultural Research Center. The oil percent was calculated on fresh weight basis directly after oil extraction. The samples were then kept in dark glasses at -18 °C, until analysis.

Analytical Methods

physicochemical and Quality indices of virgin olive oil

Quality parameters (free acidity, peroxide value and UV absorption characteristic, K_{232} , K_{270} , and ΔK), were carried out, following the analytical methods described by Regulation EEC/2568/91 of the Commission of the European Union (EEC, 1991). Unsaponifiable matter percent was determined using AOAC (2005).

Free acidity, given as % of oleic acid. Peroxide value, expressed in milliequivalents of active oxygen per kg of oil (meq/kg).

K_{270} and K_{232} extinction coefficients were calculated from absorbance at 270 and 232 nm, respectively, with a UV spectrophotometer (JENWAY 6405 UV/Vis Spectrophotometer, England) using a 1% solution of oil in cyclohexane and a path length of 1 cm.

Oxidative stability

Oxidative stability was evaluated by the Rancimat method (Gutierrez *et. al.*, 2002). Stability was expressed as the induction time (hours), measured with the Rancimat 679 apparatus (Metrohm Co., Switzerland), using an oil sample of 5 g heated to 100°C and air flow of 20 L/h

Minor components determination

A- Total phenols

Olive oil samples were extracted three times with 10 ml of a methanol/water mixture (60: 40 V/V). The pooled extracts were washed with 10 ml of n-hexane and solvents were removed with a rotary evaporator. Total phenols (TP) content of the methanolic extract of olive oil were calorimetrically determined using the Folin-

Ciocalteu method (Gamez-Meza *et. al.*, 1999) where an aliquot (1 ml) of methanolic extract was mixed with diluted ethanol amine (1 ml) at room temperature. After 5 min the absorbance was measured at 750 nm using a spectrophotometer (JENWAY 6405 UV/Vis., England). Results were expressed as caffeic acid.

B- Total Tocopherols

The total tocopherols content was determined in virgin olive oils samples according to the method of Wong *et. al.*, (1991). Result were expressed as α -tocopherols (mg/kg).

C- Chlorophyll and carotenoids pigments

Oil (7.5 g) was accurately weighed and dissolved in cyclohexane up to a final volume of 25 ml. Chlorophyll and carotenoids were then determined by their absorption at 670 and 472 nm, respectively, using a spectrophotometer (JENWAY 6405 UV/Vis., England) Minguéz-Mosquera *et. al.*, (1991) . Results were expressed (mg/kg oil) as pheophytin and β -carotene for chlorophyll and carotenoids, respectively.

Gas chromatography analysis

Methylation of fatty acids

An aliquot of fatty acids, about 10 mg, was dissolved in 2ml hexane and then 0.4 ml of 2N KOH in anhydrous methanol was added (Cossignani *et. al.*, 2005), after 3 min, 3 ml water was added. The organic layer, separated by centrifugation, was dried over anhydrous sodium sulfate, and then concentrated, with a N₂ stream to around 0.5 ml for GC analysis of fatty acids methyl esters (FAME) as described below.

GC analysis of FAME

Agilent 6890 series GC apparatus provided with a DB-23 column (60 m \times 0.32 mm \times 0.25 μ m) was used. Oven temperatures were 150°C ramped to 195°C at 5°C min⁻¹, ramped to 220°C at 10°C min⁻¹ and flow rate was 1.5 min⁻¹ . Fatty acids results after the previous procedures steps were transformed into methyl esters and directly injected into the GC.

sterols composition

A sample of 5 grams oil was dissolved in 3 ml of hexane. The mixture was saponified with sodium hydroxide solution in methanol (2N) at water bath for 1-2 h. Then, unsaponifiable matters were extracted. Then 1 μ l of the sample was injected into a Agilent 6890 series GC apparatus (setup:DB-5 capillary column, A N₂ carrier gas at 0.9 ml min⁻¹ constant flow rate, split/splitless injector at 230°C in the splitless mode. Oven temperature: 50°C holds for 2 min, ramped to 230°C at 15°C min⁻¹,

ramped to 310°C at 3°C min⁻¹, hold for 10 min. The relative percent of each sterol was calculated using GC Chemstation software (Szterk *et. al.*, 2010).

RESULTS AND DISCUSSION

The chemical composition of virgin olive oils may be influenced by genotype, and different agronomic, environmental and technological factors Dag *et. al.*, 2009, therefore we studied the effect of geographical area and different cultivars (genotypes) (Koroniki, Arbequina, and new cultivars No.1 and No.138 which were growing in El-Khatatba zone, Egypt) during two consecutive harvesting seasons on the characteristics of produced virgin olive oil, quality indices, minor components, sterols and fatty acid composition.

Olive oil quality

Table 1 shows the changes in quality parameters, the % free fatty acids (FFA) as oleic acid, Peroxide values meq O₂/kg oil, Ultra violet absorbency and oil content of the oils obtained from olive oil cultivars during two successive seasons. The FFA values of the oils from all different cultivars were lower than 0.8%, which is met the limits set for 'extra' virgin olive oil quality in IOC, Trade Standard for Olive Oil (2011). The acidity values in cvs Arbequina and No.1 were increased in the second harvesting time, however, they were approximately the same in the other two cultivars. These changes in FFA may be due to not follow the same good manufactures practices during extraction process or changes in climatic conditions.

The peroxide value (PV) is a measure of primary oxidation process. The PV of the oils was measured immediately after the harvesting time. The highest PV values were observed in oils obtained from cv No.1 in the second harvesting season and in

cv No.138 in the first whereas, the lowest PV was observed in Arbequina cultivar. None of the oils analyzed exceeded the maximum peroxide value for extra virgin olive oil limits (20 meq O₂/kg), which established by IOC, Trade Standard for Olive Oil 2011.

Table 1. Quality characteristics of olive oil cultivars during two consecutive seasons

Characteristics	Koroniki		Arbequina		1		138	
	2010/2011	2011/2012	2010/2011	2011/2012	2010/2011	2011/2012	2010/2011	2011/2012
% FFA (as Oleic acid)	0.78	0.75	0.52	0.80	0.28	0.61	0.41	0.42
Peroxide value (meq O ₂ /kg oil)	6.33	8	4.47	8	4.20	10.11	10.04	7.78
K ₂₃₂	1.62	1.13	1.91	1.47	1.52	1.19	0.89	1.99
K ₂₇₀	0.11	0.08	0.17	0.12	0.10	0.08	0.06	0.14
Δk	0.003	0.001	0.0005	0.003	0.002	0.002	0.003	0.002
Oil content (% Fresh weighbasis)	17	16.50	18.44	19	20.5	20	18	19.50

Regarding to K₂₃₂ and K₂₇₀ (Second oxidation index) are mainly indicating the conjugation of trienes and also of the presence of carbonylic compounds. The maximum permitted values of K₂₃₂, K₂₇₀ and ΔK for extra virgin olive oils are 2.50, 0.22 and ≥ 0.01 respectively (IOC, 2011). Table (1) shows the changes in K₂₃₂, K₂₇₀ and ΔK of oils obtained from olives oil cultivars at the two successive seasons. Results revealed for K₂₃₂, K₂₇₀ and ΔK values for all cultivars were not exceeded the limits established by IOC, 2011 which mean that the low values for quality indices of the obtained oils including the two new cultivars (No.1 and No.138) were classified into "Extra virgin" olive oil. These results are in agreement with the results obtained by Eid *et. al.*, 2012 for Koroniki and Arbequina cultivars which cultivated in Giza zone.

Concerning to oil content, results showed that, the highest oil content was found in the two successive season in cv No.1 (20.5 and 20%) and cv No. 138 (18 and 19.5%) compared with Arbequina (18.44 and 19%) and the lowest oil content was found in Koroniki cultivar (17 and 16.50%). The chemical composition and quality of virgin olive oil are influenced by a variety of factors, among them geographical production area (altitude and soil composition), climatic conditions prevailing in the production year, cultivar, and extraction process (Baccouri *et. al.*, 2007 and Dag *et. al.*, 2009)

Minor components and oxidative stability of olive oil cultivars

Table (2) shows the minor components (polyphenols, tocopherols, chlorophyll and carotenoids) of the olive oils cultivars. The bioactive components of

extra virgin olive oil are result of a number of variables acting before extraction (such as variety, environmental , climatic, soil and cultivation conditions , olive ripeness and olive healthy) and during olive oil extraction and storage (Velasco and Dobarganes, 2002). The total phenolic compound in the virgin olive oil of the four varieties showing higher values in the cv no.138 (174.20 ppm in the first season) and cv No.1 (115.6 ppm in the second season) however, oil extracted from Arbequina variety had the lowest values (60.4 and 90.7 ppm) . The same results for Arbequinat variety had obtained by Eid *et. al.*, 2012 when compared with Coratina , Koroniki and Siwi cultivars which cultivated in Giza zone. Extra-virgin olive oil contains a considerable amount of phenolic compounds that are responsible for its peculiar taste and for its high stability. Recent findings demonstrate that olive oil phenolics are powerful antioxidants, both in vitro and in vivo, and possess other potent biological activities that could partially account for the observed healthful effects of the Mediterranean diet (Visioli & Galli, 2002).

Table 2. Minor components (mg/kg oil) and oxidative stability of olive oil cultivars during two consecutive seasons

Characteristics (mg/kg)	Koroniki		Arbequina		1		138	
	2010/2011	2011/2012	2010/2011	2011/2012	2010/2011	2011/2012	2010/2011	2011/2012
Total poly-phenols	71.7	109.8	60.40	90.7	86.40	115.6	174.20	122.1
Total Tocopherols	115.60	140.20	121.32	133.60	44.66	112.40	290.82	107.30
Chlorophyll I	3.28	3.01	1.20	1.61	2.40	7.45	0.84	2.18
Carotenoids	18.20	21.25	15.50	16.08	5.56	3.37	4.20	7.46
*Oxidative stability (h)	24.81	26.50	9.80	12.99	15.50	20.40	17.68	13.70

*Oxidative stability was determined using Rancimat Methods at 100°C.

The tocopherols content of virgin olive oil are important to protect lipids against autoxidation and thereby to increase its storage life and value as some whole life food. The α -tocopherol content varied among 44.66 ppm in cv No.1 in first season and 290.82 ppm in cultivar 138. Results showed fluctuation in the values of α -tocopherols and polyphenols in the two successive seasons, these may be due to affect by varieties and climatic conditions also, the antioxidant activity of these substances during the autoxidation process especially in the early stage of oxidation also, carotene and α -tocopherols may undergo similar oxidative modification with loss of vitamin activity and color, and thus of nutritive value Gutierrez *et. al.*, 2002.

The total pigments content of olive oils is an important quality parameter because it correlates with color, which is a basic attribute for evaluating olive oil quality. Furthermore, pigments are also, involved in autoxidation and photooxidation mechanisms (Minguez-Mosquera *et. al.*, 1991). They have also demonstrated that chlorophyll act as prooxidant under light storage ,whereas β -carotene minimizing lipid oxidation by its light filtering effect. Pigment content varied from 2.18 ppm (cv No.138 in 2nd season) and 7.45 (cv No.1 in 2nd season). On the other hand, the β - carotenen content had the highest values for Koroniki (21.25 ppm) and Arbequina (16.08 ppm) cultivars in the second season, respectively.

With respect to oxidative stability Data in Table 2 shows that Koroniki olive oil cultivar had the highest oxidative stability (24.81 and 26.50 hr in the first and second seasons, respectively) among the other varieties. However, Arbquina cultivar had the lowest oxidative stability during the first and second season (9.80 and 12.99 h and for cv NO.138 and No.1 the oxidative stability come in between the two abovementioned cultivars. These results are in agreement with the result of Eid *et. al.*, 2012 for Koroniki and Arbequina cultivars which cultivated in Giza zone. In addition, One can conclude from result (Table 2) that the oxidative stability increased in the second season with the increase of bioactive components mostly with total polyphenols , α -tocopherols and β -carotene for Koroniki, Arbequina and No. 1 cultivars, respectively and vice versa with cv No. 138 which mean the direct proportion correlation between the oxidative stability and bioactive component Basuny *et. al.*, (2008) had found correlation between stability and the bioactive components and the quality indices and their results indicated that the compound most related to oxidative stability were the phenolic compounds and pigments . The fatty acids of virgin olive oil are mainly monounsaturated (Table 3), these fact and the presence of tocopherol, carotenoids , pigments compounds make virgin olive oil more stable than other oils Gutierrez *et. al.*, 2002.

Fatty acid profiles

The fatty acids profile for olive oil cultivars in El-Khataba region during the two seasons beside, total saturated fatty acids (SFA), polyunsaturated fatty acids (PUFA), monounsaturated fatty acids (MUFA), and MUFA/PUFA ratio are shown in Table 3.

The distribution of fatty acid composition revealed that the highest content of palmitic acid as saturated fatty acid (22.07% in the first season) was found in Arbequina VOO. The palmitoleic acid content was also higher in Arbequina VOO (4.49% in the second season) than in the others cultivars. The above-mentioned values for palmitic and palmitoleic are considered out accepted limits of IOC, 2011

(palmitic 7.5 - 20 and palmitoleic 0.3 - 3.5%) for olive oil. The oleic (which has great importance because of their nutritional implication and effect on oxidative stability of oil) and linoleic acids (which is susceptible to oxidation) contents were the most useful and significant parameters for differentiating varieties, only Koroniki cultivar had highest accepted oleic value in the two seasons as established by IOC, 2011 (55-83%) followed by cv No.1 only in the second season which had the nearly boarder limits (57.88%) of oleic acid compared with cv Arbequina (44.14 and 45.37%) which had the lowest oleic content , and also cv No.1 in the first season and No.138 in both seasons. . whereas the highest linoleic acid was found in cv No.138 (28.64 and 31.08% in the first and second seasons ,respectively) followed by Arbequina VOO (25.99%) and cv No.1 (24.91% in the 1st season) these values out of the accepted range stated by IOC,2011 for linoleic acid (3.5 -21 %) . Also, high linolenic acid contents were shown by cvs No.138 and Arbequina, VOO they were out of accepted limits established by IOC, 2011 for linolenic acid ($\leq 1\%$) and it seemed to contribute to their low oxidative stability, since this leads to a low mono/polyunsaturated ratio (Beltran, 2000).

One can conclude that, Koroniki variety produced oils with excellent fatty acid (FA) composition, i.e., a high level of oleic acid, low palmitic and linoleic acid content which is accepted against IOC, 2011(Trade Standard for Olive Oil) followed by cv No. 1 only in 2nd season which mean that it need more evaluation for many next seasons .

Also, evaluation in different zone areas to enhancement the fatty acid profile or to ensure the stability of fatty acids profile. However, Arbequina and cv NO. 138 VOO was found to be out of the legal ranges stated by the IOC for fatty acids (IOC, 2011). These results are in agreement with Eid *et. al.*, 2012 for Koroniki and Arbequina varieties which cultivated in Giza zone. The fatty acids compositions has relatively wide range due to the genetic and climatic environmental factors Lopez-feria *et. al.*, 2008 and Koprivnjak *et. al.*, 2009.

Table 3. Fatty acids composition of olive oil cultivars during two consecutive seasons

Fatty acid	Koroniki		Arbequina		1		138	
	2010/2011	2011/2012	2010/2011	2011/2012	2010/2011	2011/2012	2010/2011	2011/2012
C _{16:0}	15	12.45	22.07	21.58	18.53	16.21	16.30	14.54
C _{16:1}	1.24	1.04	3.77	4.49	2.36	1.78	1.51	1.35
C _{17:0}	0.04	0.06	0.15	0.20	0.12	0.14	0.04	0.05
C _{17:1}	0.07	0.10	0.20	0.25	0.20	0.23	0.06	0.07
C _{18:0}	2.47	2.50	1.79	1.62	2.43	2.41	1.85	1.92
C _{18:1}	68.18	73.06	44.14	45.37	49.77	57.88	49.39	48.99
C _{18:2}	10.92	8.12	25.99	24.40	24.91	19.23	28.64	31.03
C _{18:3}	0.95	0.90	1.06	1.17	0.75	0.83	1.21	1.10
C _{20:0}	0.51	0.57	0.38	0.43	0.47	0.51	0.42	0.40
C _{20:1}	0.36	0.43	0.22	0.26	0.22	0.27	0.37	0.40
C _{22:0}	0.14	0.15	0.11	0.09	0.12	0.14	0.09	Nd
C _{24:0}	0.07	0.56	0.07	0.11	0.06	0.34	0.06	0.12
Σ SFA	18.23	16.22	24.57	16.94	21.73	19.75	18.76	17.03
Σ USFA	81.69	83.65	75.38	75.94	78.21	80.16	81.18	82.94
MUSFA	69.58	74.63	48.33	50.37	52.55	60.16	51.33	50.81
PUSFA	11.87	9.02	27.05	25.57	25.66	20.06	29.85	32.13
MUSFA / PUSFA	5.88	8.27	1.78	1.96	2.04	2.99	1.72	1.58

Nd= not detected

The same results revealed that, Arbequina VOO showed the highest mean value for SFA (20.7), while Koroniki VOO showed the highest mean value for MUSFA (70.62%) and lowest PUFA (10.44%).

The MUSFA / PUSFA were also different among the oils, cv No.138 and Arbequina VOO had the lowest mean value (1.65 and 1.87, respectively) and Koroniki had the highest mean value (7.07). In Siwi and Coratina VOOs, the values were intermediate (6.46, 6.08 and 4.80, 4.55 for the ratios C_{18:1}/ C_{18:2} and MUSFA / PUSFA, respectively) Eid *et. al.*, 2012. The MUSFA/PUSFA ratio is frequently used as a stability parameter and, in previous studies, the cultivars with higher ratios were those with higher oxidative stability (Beltran, 2000). Koroniki and cv No.1 VOOs had the highest average values for (7.07 and 2.51, respectively) in accordance with their higher oxidative stability indices. cv No.138 had the lowest ratio 1.65 but, it had a high mean oxidative stability (15.69 hr) than Arbequina cultivar 11.39 hr Table 2).

This is due to the fact that oxidative stability is related not only to fatty-acid composition, but also to several other factors, pro- and/or anti-oxidant substances and concentration of natural antioxidants, such as polyphenols, in the oil (Ceci and Carelli., 2007). In fact, this sample had the highest mean values for phenols and α -tocopherols content.

Sterols composition

Sterols are major constituents of the unsaponifiable fraction. The sterol composition is very important in the evaluation of the nutritional value, but also in the quality control of olive oils, since it can be used to detect adulteration. Also, they are important components for the stability of the oil since at high temperature they act as inhibitors of polymerization reactions (Velasco & Dobarganes, 2002). The obtained results of sterols profile for korniki cultivar which, is meet the accepted range of fatty acids profile in the two seasons according to IOC, 2011 are determined and displayed in Table (4).

The predominant sterols in Koroniki variety olive oil were β -sitosterol (82.10 and 83.33% at the 1st and 2nd seasons, respectively), Δ -5-avenasterol(6.10 and 6.14% at the 1st and 2nd seasons, respectively) Campesterol (2.88 and 2.91% at the 1st and 2nd seasons, respectively). The sterols composition of these components was slightly increased at the second season. The results of Eid *et al.*, 2012 for Koroniki cultivar which cultivated in Giza zone were close to our findings and it was 83.63 % for β - sitosterol and 50.63% for Arbequina cultivar. Moreover, the contents of apparent β -sitosterol was more than 93 % in the two seasons which met the IOC, 2011 and also for all sterols components.

Table 4. Sterols and Unsaponifiable matter (%) of Koroniki cultivar during two successive seasons

Sterols (%)	Koroniki	
	2010/2011	2011/2012
Cholesterol	0.11	0.30
Campesterol	2.88	2.91
Stigmasterol	0.40	0.63
β -sitosterol	82.10	83.33
Δ -5-avenasterol	6.10	6.14
Δ -7-stigmastenol	0.24	0.44
Others	8.17	6.25
Campesterol / Stigmasterol	7.20	4.61
Unsaponifiable matter (%)	1.21	1.24

The unsaponifiable matter (%) of Koroniki olive oil represented 1.21 and 1.24 at the 1st and 2nd seasons, respectively. The percent of unsaponifiable matter also, slightly increased at the second seasons. The composition of the unsaponifiable fraction of VOO is affected by several factors such as olive cultivar, altitude, climatology, agronomic factors, time of harvest, and olive storage after harvest and oil extraction system.

Finally, it can be concluded that through the characterization of different olive oil cultivars under investigation in El-Khatatba zone that, all the analysed VOOs were classified into "Extra virgin" category according to the regulated physicochemical parameters, but only Koroniki cultivar is complied with IOC, 2011(Trade Standard for Olive Oil) during evaluation period.

If the fatty acid and sterols compositions were also taken into account Arbequina and new cultivar No.1 or No.138 virgin olive oils were stood out of IOC limits during evaluation period due to its non-compliance in fatty acid composition.

It is recommended for the new cultivars to do more evaluation for many seasons also, in different zone areas to enhancement the fatty acid profile or to ensure the stability of fatty acids profile and chemical compositions which agree with the olive oil international standards to increase the competitiveness of Egyptian olive oil in international markets. The study was emphasized that, the minor components, fatty acids and sterol compositions are mainly affected by olive cultivars (genotype) and climatic conditions.

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خصائص بعض اصناف زيتون الزيت الجديدة المنزرعة فى منطقة الخطاطبة - مصر

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يهدف هذا البحث إلى التعرف على خصائص زيت الزيتون البكر لإربعة اصناف زيتون (كروناكي - اريبكويين - وصنفان جديان وهما صنف رقم 1 و 138) والمنزرعة فى منطقة الخطاطبة- مصر وذلك خلال موسمين متاليين 2011/2010 و 2012/2011. حيث تمت دراسة خصائص الجودة (الحموضة ، و رقم البيروكسيد ، K232 ، K270 ، ΔK) ، مؤشر الثبات التأكسدي، المركبات الصغرى ، تركيب الاحماض الدهنية ، والاستيرولات) . وقد أوضحت نتائج خصائص الجودة ان جميع الزيوت للأصناف المحللة تعتبر "Extra virgin" طبقا لمقاييس الجودة ، كما اوضحت النتائج ان زيت الزيتون لصنف الكروناكي هو الوحيد المطابق للمواصفة التجارية للمجلس الدولى لزيت الزيتون سنة 2011 خلال الموسمين من ناحية تركيب الأحماض الدهنية ومحتوى الأستيرولات له ، علاوة على انه كان اعلى الأصناف من ناحية الثبات الأكسيدى خلال الموسمين (24.81 و 26.5 ساعة على التوالي) بينما صنف اريبكويين كان اقلها (9.8 و 12.99 ساعة على التوالي) ويرجع ذلك لنسبة المركبات الصغرى (البولى فينولات، الفا-توكوفيرول ، الكلوروفيل والكاروتينات) والأحماض الدهنية وحيدة عـدم التشبع .

كما اشارت النتائج ان
الأسـتيرولات الأساسـية
لـزيت صنف

الكروناكي هي β -sitosterol (82.10 و 83.33 % للموسم الأول والثانى على التوالي) ، campesterol ، stigmasterol و $\Delta 5$ -avenasterol. اما بالنسبة للأصناف الجديدة صنف 1 أو 138 فكانت اعلى الأصناف فى نسبة الزيت 20.25 و 18.75 على التوالي وكان لها ثبات ضد التاكسد جيد الا انها غير مطابقة لحدود المواصفة من ناحية الأحماض الدهنية خلال الموسمين ، هذا وقد اشارت النتائج ان تركيب المركبات الصغرى ، الأحماض الدهنية والأستيرولات يرجع اساسا الى الصنف والظروف المناخية المحيطة.