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Research Article

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AOC Installation for protecting olive oil from "CHEMCHALI" cultivar grown in Gafsa province

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ABSTRACT

This study focused on the Gafsa's olive oils characterization in order to install AOC. 84 samples of extra virgin olive oils extracted from two different varieties of olives grown in Gafsa area: chemchali (57 samples) and Arbaquina were used. Chlorophylls, carotenoids, penols, tocopherols contents and fatty acid composition of all oils samples were analyzed. Quality parameters such as Free Fatty Acids (FFAs), Peroxide Value (PV), UV absorption at 232 and 270 nm (K_{270} and K_{232}) and organoleptic profile were determined to evaluate olive oils oxidative stability. The results demonstrated that Chemchali olive oil samples were richer in antioxidant compounds such as tocopherols (179 ppm), and biophenols (288 ppm) than olive oil from arbaquina varietie. Moreover, fatty acid composition and sensory analysis of the olive oils belonging to the Chemchali variety are balanced and very specific.

Keywords: Olive oil, Chemchali, Arbaquina, geographical area, tocopherols, biophenols, sensory analysis.

INTRODUCTION

Tunisian oleiculture constitutes one of the principal economical and agricultural strategic sectors that are known for their varieties richness [1]. Indeed, Tunisian oliverie is essentially dominated by two varieties namely the Chetoui variety (Northern Tunisia) and Chemlali variety (southern Tunisia). [2] Nevertheless there is other very specific variety named Chemchali that characterize the Tunisian oleioculture in southern Tunisia and more specifically in the region of Gafsa. Tunisian olive oil is a strategic product so installing quality labels (IGP, AOC....) could protect on one hand the variety and on another hand promote the marketing of the Tunisian olive oil on the international market. In this context, the current study was carried out to determine chemical composition of the two varieties belonging to Gafsa area: Chemchali and Arbaquina, in order to install an AOC label.

EXPERIMENTAL SECTION

Sampling

84 samples of extra virgin olive oils were obtained after cold extraction of two different varieties of olive fruits (*Olea europaea* L.) collected from three successive campaigns in the region of Gafsa: Chemchali and Arbaquina (introduced variety grown in the region of Gafsa).

Methods

Oxidative stability determination

To characterize olive oils of the Gafsa region, Free Acidity (FA), Peroxide Value (PV) and UV absorption (K_{270}, K_{232}) were determined according to the method described by European Community Regulation [3].

Fatty Acid Methyl Esters Preparation and Analysis

Oil fatty acids were transformed after a transmethylation into their fatty acid methyl esters (FAMEs) according to the method described by COI [4] . The methyl esters were prepared by vigorous shaking of an olive oil solution in heptane (0.5 g in 4 mL) with 0.5 mL of 2 N methanolic KOH in a test tube with a screw cap. The mixture was centrifuged and the supernatant layer containing the methyl esters was used for gas chromatography (GC) analysis. FAMEs were analyzed by GC-FID chromatograph (model 6820 Agilent Technologies, Wilmington, DE, USA), equipped with a Carbowax (30 m × 0.32 mm × 0.32 µm) capillary column. The carrier gas was helium, with a flow of 1 mL/ min. Injector and detector temperatures were set at 230 and 250 °C, respectively. The injection volume was 5 µl.

Tocopherols contents determination

Tocopherols contents were determined by high-performance liquid chromatography (HPLC) according to the standard method [5]. Oils were diluted in acetone and injected directly onto C_{18} column. The mobile phase was constituted by 96 % Methanol/ acetonitril (50/50) and 4 % water/ phosphoric acid (99:1) mixture. Tocopherols were detected at 294 nm by the UVvis detector.

Phenols contents identification and quantification

Phenols identification and quantification was determinate by HPLC [6] equipped with a UV detector at 280 nm, with C18 reverse-phase column (4.6 mm x 25 cm) type ODS-2 5mm.

Sensory analysis

Panel test was used to distinguish olive oil from other edible vegetal oils evaluating positive and negative descriptors. According to the method described in COI regalements, the odor or taste attributes (fruity, bitter and piquant intensities) were quantified using a dix-point intensity ordinal rating scale from 0 (no perception) to 10 (extreme). [7]

RESULTS AND DISCUSSION

Oxidative stability determination

Physicochemical parameters (FA, K_{270}, K_{232} and PV) of olive oils samples were analyzed to determine their oxidative stability. PV is a widely used measure of primary lipid oxidation, indicating the amount of peroxides formed during oil oxidation. In addition, FFAs formation might be an important measure of rancidity of foods. In fact, FFAs content, resulting from the triacylglycerides hydrolysis and decomposition, is one of the most important indicators of oil deterioration. Moreover, changes in UV absorption at 232 and 270 nm are associated with changes in conjugated dienes and trienes produced by the polyunsaturated fatty acids oxidation. The higher the proportion of polyunsaturated fatty acids in the oil is, the higher are the levels of conjugated dienes and trienes formed. [8]

Table 1 showed low values for the regulated physicochemical parameters evaluated (FA $\leq$ 0.8%, $K_{270} \leq 0.220$ and PV $\leq$ 20 meq. O_2. Kg^{-1}). All samples belonged to the ranges established for "extra virgin olive oil" (EVOO) category, as required by the European Community Regulation [3]. Samples extracted from Chemchali variety were characterized by a low K_{270} (0.129±0.01) than that observed in the samples extracted from Arbaquina variety (160±0.01) indicating a low presence of conjugated trienes and by consequence a better oxidative stability. This difference can be related to the variety.

Table 1. Oxidative stability parameters

	Olive oil samples	
Parameters	**Chemchali**	**Arbaquina**
FA (% C18:1)	0.30 ± 0.04	0.26 ± 0.06
PV (meq.O_2.kg^{-1})	9.02 ± 0.78	8.70 ± 0.96
K_{232}	2.16 ± 0.18	1.82 ± 0.06
K_{270}	0.129 ± 0.01	0.160± 0.01

Fatty acids composition

Fatty acids composition is an important criterion for virgin olive oils. In fact, it is considered as a key for purity and authentication control. The high oxidative stability of virgin olive oil is related to its high monounsaturated/polyunsaturated ratio. Results (Table 2) showed that olive oils were characterized by low linoleic and palmitic acids contents. The average of palmitic acid was of 14.60 % ± 0.51and 16.94 % ±1.18 , respectively for Chemchali and Arbaquina varieties. Linolenic acid percentage was 13.13 % ± 0.98 and 13.78 % ± 1.92 respectively for Chemchali and Arbaquina varieties. It is worth noting that samples belong to Chamchali were characterized by a very balanced fatty acids composition. Similar results revealing a relation between fatty acids composition of olive oils and cultivars, was found by Mannina et al. [9] Studding olive oil in a well-limited

geographical region, with no consideration of the pedoclimatic factor (soil characteristics such as temperature and humidity).

Table 2. Fatty acids composition as determined by Gas Chromatography (% m/m methyl esters)

	Chemchali Gafsa	Arbaquina "introduced variaty"
Fatty acids (%)		
C16:0 (P)	14.60±0.51	16.94±1.18
C16:1ω7	1.55±0.16	2.05±0.31
C17:0	0.08±0.11	0.10±0.02
C17:1ω8	0.10±0.02	0.18±0.05
C18:0 (S)	2.44±0.17	1.96±0.11
C18:1ω9 (O)	66.76±1.3	61.39±9.4
C18:2ω6 (L)	13.13±0.98	13.78±1.92
C18:3ω3 (Ln)	0.62±0.07	0.66±0.07
C20:0 (A)	0.40±0.04	0.39±0.03
C20:1ω9	0.27±0.04	0.24±0.03

Tocopherols and phenols contents

α-tocopherol is considered as the major antioxidant of virgin olive oil [10] also phenols from olive fight various reactive oxygen species and counter act the damage caused by free radicals to cells (lipid peroxidation) [11]. According to Table 3, higher amounts of α-tocopherol and phenols were observed in the samples from Chemchali variety. Indeed, olive oils from Chemchali variety were characterized by tocopherols and phenols contents ranging from 152 to 192 mg/kg and from 200 to 356, respectively. While samples Arbaquina presented lower tocopherols (142 – 188 mg/kg) and phenols contents (145 – 192 mg/kg).

These results permitted to conclude that oils from Chemchali variety were characterized by higher oxidative stability then those from Arbaquina one. The richness, of samples from Chamchali variety, in antioxidant substances offers to this variety a very interesting specificity.

Table 3. Tocoperols and phenols contents

	Olive oil samples	
Parameters	**Chemchali**	**Arbaquina**
Tocopherols(ppm)	179± 8.93	162±10.32
Biophenols(ppm)	288± 32.42	167± 11.74

Sensory analysis

Sensory profiles of oil samples were represented in Table 4. A large variability in monovarietal oils sensory characteristics, according to geographical growing areas, was noted. Indeed, oils from Chemchali variety were more bitter, more pungent and more grassy/herbaceous in aroma and flavour than that extracted from Arbaquina variety grown in the same geographical area. Furthermore, oils from Chemchali variety were much equilibrated.

Table 4. Main descriptors intensities of olive oils samples

Olive oil samples	**Fruity intensity**	**Bitter intensity**	**Piquant intensity**
Chemchali	4.674±0.37	3.85±4.9	2.70±0.30
Abaquina	3.30±0.48	2.28±0.41	1.92±0.51

CONCLUSION

The main goal of this work was to characterize oils belonging to the region of Gafsa in order to install an AOC. Indeed, the geographical specificity of this area, the productive capacity and quality of its olives varieties requires protection and also a valorisation. The study of 84 samples from three successive campaigns permitted to conclude that the cultivated variety Chemchali was characterized by a very specific organoleptic profile and a balanced fatty acids composition. In addition, these oils were characterized by higher oxidative stability and higher contents of antioxidant compounds. These results are very interesting to install AOC for protecting oil from “Chemchali” variety growing in Gafsa province. Furthermore, the AOC is a guarantee of quality and specificity of this oil.

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