DETERMINATION OF SOME CHEMICAL AND QUALITY PARAMETERS IN TURKISH SARI ULAK MONOCULTIVAR EXTRA VIRGIN OLIVE OIL DURING 12 MONTHS OF STORAGE

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Abstract. In this study Turkish monocultivar extra virgin olive oil (EVOO) "Sarı Ulak" was extracted by using the Mobile Olive Oil Processing Unit (TEM Oliomio 500-2GV, Italy). Changes in minor and major components and quality characteristics, free fatty acid content, peroxide value and UV absorbance value, were surveyed during a year's storage period. "Sarı Ulak" olive oil samples were classified as EVOO according to the trade standards of the International Olive Council (IOC) based on free fatty acid, peroxide value, K_{232} and ΔK values up to the eighth month of the storage period.

The results have shown that color values of EVOO changed from green to yellow slowly while UV absorbance values changed during storing. Total polyphenol content of extra virgin olive oil decreased from 205.17 ppm to 144.29 ppm during a year's storage. Luteolin was the most abundant phenolic compound, and its concentration changed from 184.33 ppm to 115.06 ppm. Apigenin concentration was differed from 2.67 to 1.06 ppm during storing. The initial level of α-tocopherol contents was 184.51 ppm, it decreased to 147 ppm at the end of storage time. After 12 months of storing, about 20 % of α-tocopherol content was destroyed. The amounts of phenolic and tocopherol isomers decreased during storage as expected.

Keywords: Olive oil, Sarı Ulak, Phenolic Compounds, Tocopherol, Storage.

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Introduction. Formulation of the problem

Besides fruit soundness, cultivar, agronomic conditions and harvesting techniques, extraction technology is another important factor that directly effects on olive oil quality. Olive trees originated in upper Mesopotamia and South Front Asia. Extra virgin olive oil (EVOO) is extracted from olive fruit by using mechanical or physical procedures. Sarı Ulak is a domestic cultivar in a south region (Mersin) of Turkey. Tarsus is one of the districts of Mersin Province, located in Eastern Mediterranea Region. The origin of the "Sarıulak" olive cultivar is Tarsus-Mersin. The number of olive trees of Sarı Ulak cvs. is about 600,000. Most of the trees are older than 100 years. Total yield is about 90,000 tons per year. The alternate bearing is strong level. The local plants are used mainly to produce green table olive, the rest are processed to obtain olive oil but for local consumption. While early-harvested fruit have 15% of olive oil, at the end of ripening, the content increases up to 26% [1]. Higher percentage of oleic acid, monounsaturated fatty acid, linoleic and linolenic acids as polyunsaturated fatty acids, distinct olive oil from other vegetable oils. People of Mediterranean countries have been consuming extra virgin olive oil (EVOO) for thousands of years. Phenolic compounds, vitamins, high oleic content, and other minor compounds make olive oil unique among other edible oils. EVOO's composition, depending on the cultivar, ripeness degree, ecological conditions, region of growing, processing techniques, and storage, varies greatly. Antioxidant compounds such as polyphenols and α-tocopherol make EVOO's shelf life longer than that of other oils. Unsaturated hydrocarbons, free fatty acids, enzymes, trace metals and pigments have negative effect on the oxidative stability of EVOO.

Analysis of recent research and publications

Storage of olive oil under nitrogen pressure in a dark place at a room temperature (25–30ºC or lower) increases its shelf life [2]. EVOO's major and minor components as well as oxidation indices of virgin olive oil change during storage. Some parameters, such as free fatty acid content, peroxide value, and oxidative rancidity, increase during storage. Up to 73 % of total polyphenols decrease, and this decline is significantly higher in the samples with a larger initial phenol content. Storage conditions are an important factor in olive oil quality. Tyrosol and hydroxytyrosol content show no change during storage at a room temperature. There is no change in aromatic hydrocarbons of frozen samples after storing for up to 12 months [3]. 79% of vitamin E (α-tocopherol) is destroyed in four months, whereas <45% of the phenols is lost under diffused light during storage [4]. There is a positive correlation between the age of oils and the tyrosol to total phenols ratio [5]. EVOO with high antioxidant contents is still excellent after 240 days of storage at 40C [6]. Commercial virgin olive oil extracted from the Arbequina cultivar is reported to lose significantly chlorophyll, carotenoids, and total phenol contents of after 12 months of storage, but its oleic acid content increases [7]. Psomiadou et al. [8] suggested that good handling is quite important for re-

taining high α-tocopherol levels of Greek VOO under domestic conditions for up to two years. Phenolic compounds of some Turkish olive oils including Sarı Ulak were evaluated by Yorulmaz et al. [9]. They reported that total phenol concentrations of Southeast Anatolia oils were lower than those of other regions.

In this study, a mobile olive oil processing unit (MOOPU) has been designed to produce "monovarietal boutique virgin olive oil" and used for producing olive oil from the "Sarı Ulak" cultivar. MOOPU was transferred into an orchard located in Mersin region of Turkey. That is why it was possible to obtain premium olive oil in the optimum conditions within two hours after harvesting. Olive oils were packaged, and quality parameters were monitored during storage every three month for 12 months.

In this study, an innovative project has been put into practice in Turkey, and a mobile olive oil processing unit (MOOPU) has been designed to obtain premium olive oil that reflects the quality of the variety and region. This research has shown that Sarı Ulak Monocultivar can be the best candidate in indicating a geographic location among minor varieties locally grown in Turkey.

Research Materials and Methods

Production of Extra Virgin Olive Oil (EVOO).

A "Mobile Olive Oil Processing Unit" (MOOPU) with state-of-the-art Olemio equipment was designed in order to produce premium quality EVOO. A special container was constructed and equipped with a knife crusher and a two-phase horizontal decanter (Oliomio D500, Italy). The mobile unit is a trailer-truck (an articulated lorry) with a special semi-trailer measuring 2438x12 192x2896 mm which is divided into three separate sections. The first section is the olive accepting unit including; bunker, leaf removers, washer and crusher units of the system. The second section is the processing unit including malaxer, decanter, filter, and bag-in-box filling machine. The third section is the support unit with a power plant and a water supply tank. The processing unit is a hygienic area protected from temperature changes, dust, and odor. This hygienic area is equipped with an air conditioner, isolation and filter ventilation systems. MOOPU was carried by a trailer truck to orchards in the season of 2014–2015. Olive fruits were harvested by hand in the early harvest period and processed into "cold press" EVOO in the MOOPU in a few hours. Olive paste was prepared after crushing with a hammer mill and the paste was mixed in the malaxer at 27ºC for 15 min (Cold press). After decantation, EVOO were packaged. Olive oil samples were filled in 250 ml amber glass bottles (headspace: 4cm) and filled with nitrogen. The bottles were stored at room temperature (18–24ºC) up to 12 months.

Chemical analysis.

A chemical analysis including determining the free fatty acid content, peroxide value, moisture content (MC) was performed according to the EC 2598/9, AOCS Cd 8-53 methods, and ISO 662, respectively [10-12]. Color values (*L*, *a*, *b* values) were measured with a spectrophotometer (Minolta, CM-3600d, Japan). *L* (lightness), *b* (yellowness), and *a* (redness) values were determined. UV absorbance was performed by the IOC method COI/T.20/Doc. No 19/Rev. 3. Data on UV absorbance was collected in 232, 266, 270, and 274 nm with a UV Spectrophotometer (Agilent 8453, USA). Δ K values were calculated by the following formula (1):

$$\Delta K = K270 - [\,(K266+K274)/2], \quad (1)$$

Where K270= Absorbance in 270 nm/C*S

C=concentration (g/100m), S= tube thickness (1cm)

K266= Absorbance in 266 nm/C*S

K274= Absorbance in 274 nm/C*S

Total Phenolic Content. A polar fraction was extracted and used for total phenolic and phenolic composition analyses. An olive oil sample (2.5 g) was weighed in a falcon tube. Hexane (6 ml) was added and shaken for 1 min. This solution was filtered through a solid phase extraction (SPE) cartridge (Superclean LC-Diol, USA) and collected in a glass tube. Then hexane (6 mL) and 4 mL hexane: ethyl acetate (85:15, v/v) passed through a SPE cartridge, respectively. The cartridge was washed with methanol:deionized water solution (1:1 v/v). The phenolic extract was evaporated (UniEquip Univapo 100 ECH, Canada). After addition of 2 mL of methanol:deionized water solution (1:1 v/v), the tubes were vortexed for 30 second. To determine total phenols, the Folin & Ciocalteu method was used, and the results were expressed in terms of a gallic acid equivalent (mg gallic acid/kg oil) [13-14].

Phenolic Composition.

Ultra high performance liquid chromatography (UHPLC, Thermo Scientific Dionex Ultimate 3000, USA) and C18 column (4.6 mm inner diameter x 250 mm length and 5 mm particle diameter; Thermo scientific acclaim 120) were used to determine the phenolic profile. A prepared phenolic extract (1 mL) for total phenolic content was passed through a 0.45 μm microfilter (Merck, PVDF, Millipore Millex-HV, Germany) and poured into an amber vial. The column temperature was fixed at 30ºC and acetic acid:deionized water (1:1) (A), methanol (B), acetonitril (C) were used in a gradient flow program as a mobile phase. In the gradient program, eluents were 2.5% B, 2.5% C, and 95% A in a solution up to 60 min. The flow rate was 1ml/min, and a diode array detector (DAD) was set in 280 nm, 320 nm, and 335 nm. Apigenin, cafeic acid, gallic acid, luteolin, m-cumaric acid, p-coumaric acid, oleuropein, syringic acid, trans-ferulic acid, vanilic acid, vanillin, tyrosol, 3-hydroxy tyrosol, 3.4-dihydroxy benzoic acid, 4-hydroxy benzoic acid, 4-hydroxy phenyl acetic acid were purchased from Sigma-Aldrich Co (Germany) and used as phenolic standards.

Tocopherol Composition.

The tocopherol composition was determined by using AOCS Official Method Ce 8-89 [15]. 2 g of EVOO sample was weighed into a 25 mL volumetric flask. A quantity of hexane was used to dissolve oil,

and then, the flask was topped to full volume. The solution was transferred with a syringe filter (0.45 μm) (PVDF, Millipore Millex-HV) into the HPLC vial. The samples (20 μL) were injected to HPLC (UHPLC: Ultra High Performance Liquid Chromatography (Dionex Ultimate 3000). LiChrosorb SI 60-5 column (4.6 mm I.D×250 mm length and 5 μm particle size) was used for analysis. The column temperature was fixed at 30°C during the process. The flow rate of the analysis was 1 mL/min. Isopropanol: hexane (0.5:99.5, v/v) isocratic mix was used for the mobile phase, and chromatograms were obtained at 292 nm wavelength. The analysis time and injection volume were 30 min and 100 μL, respectively. Tocopherol standards were used in determining α, β, ɣ and Δ tocopherols.

Sensory Evaluation.

Every month, olive oil samples were transferred to Ayvalık Olive Oil Tasting Laboratory accredited by International Olive Council and TURKAK (Turkish Accreditation Agency). The method for the organoleptic assessment of virgin olive oil (COI/T.20/Doc. No. 15/Rev. 8, November 2015) was used [16]. Eight trained tasting panels were able to assess the oils to determine the levels of positive attributes, such as fruitiness, bitterness, and pungency. Negative attributes arising due to poor quality fruit, incorrect processing or storaging, such as rancidity, mustiness and fustiness, were determined by the sensory panels. Descriptors were evaluated on a 0–10 intensity scale (a number between 0 and 10). Oils were served in coloured tasting glasses.

Statistical Analysis.

Statistical analysis was performed with SPSS 17 (SPSS Inc.Chicago, IL) statistical software and by the One-way ANOVA method. All analyses were performed at least two times. and differences among all groups were determined by the Duncan test.

Results of the research and their discussion

Chemical Analyses.

The free acidity, peroxide, UV absorbance, and color values of the olive oils produced in the Mobile Olive Oil Processing Unit (MOOPU) are shown in Table1. Sarı Ulak was classified as extra virgin olive oil up to the seventh month of storing according to the results of free acid content, peroxide value (International Olive Council standards), K232 value.

The free fatty acid content of EVOO samples of Sarı Ulak (Mersin) showed a little increase in the sixth month, and remained stable to end of storage. The free fatty acid content was under the IOC (International Olive Council standards) limitation for extra virgin olive oil. The results have shown that free acidity of EVOOs had significant differences during a year's storing ($P<0.01$). Some researchers showed that free acidity increased with storage depending on the packaging material, storage conditions, and time [4,6,17-19].

Peroxide values (PV) of the EVOO samples had a tendency to increase up to the eighth month. The PV reached the maximum values in the eighth month. After this month, the PV decreased and the minimum level of PV was observed in the twelfth month of storage. There was a significant difference among EVOO peroxide values during 12 months' storage ($P<0.01$). Significant increases were reported as to the PV of the olive oil samples during a short term (30 days) and a long term (sixth years) of storage in different packaging materials at different conditions [4,6,19,20].

UV absorbance values (K_{232} and K_{270}), which are indicators of oxidation, changed during storage significantly. The K_{232} value of Sarı Ulak (Mersin) EVOO decreased up to the third month. A sharp increase was observed in the fourth month. The K232 value of EVOOs showed stability up to the ninth month (except for the fifth month). This value showed an important increase in the ninth month and reached the maximum level. Towards the end of the storage, the K232 value decreased. The minimum level of K232 was observed in the first, second, and third months. Generally, there were significant differences among all EVOOs during storage ($P<0.01$).

Sarı Ulak (Mersin) EVOO had the highest and the lowest value of the K_{270} values in the second and first months, respectively (Table 1). Except the second, third, fifth, and ninth months of the storage period, the K270 values were under IOC (International Olive Council standards) limitation. The Δk values of the EVOO samples were zero or below zero (the results are not shown). These results are in agreement in the related literature [4,6,17,18]. Baiano et al. [18] reported that the K_{232} value of Coratina olive oil increased up to the sixth year, then it decreased, and at the end of final storage, an increase was observed. Gutiérrez and Fernández [21] showed that only two quality indices (K270 and sensory evaluation) of Picual and Hojiblanca olive oils decreased during storage at 2 ºC in darkness and 30 ºC in the light. Quality deterioration resulted in downgraded olive oils that were no longer extra virgin olive oils during storage, and there was an excellent correlation between the initial stability and the time to reach the limit of K270>0.25.

Color Analysis.

The color of virgin olive oils depends on olive maturity and process conditions. The results of the color test (*L*, *a* and *b* values) show that the color of the olive oil samples changed a little during storage (Table 1). It is related to decomposition of color pigments such as chlorophylls, pheophytins, xanthophylls, and carotenes (18). The lowest *L* values (lightness) were seen in the tenth month. The highest *L* values were observed in the eleventh month of storing. There was no significant difference among *a* values (redness) of the EVOO samples during storage ($P>0.05$). The highest *b* value (yellowness) was obtained in the eighth month. After this month, there was a decreasing tendency in the *b* values of the EVOO samples. The lowest *b* value was observed in the tenth month.

Table 1 – Oxidative stability parameters and color values of Sarı Ulak extra virgin olive oils during 12 months' storage

Storage period (Month)	Free Fatty Acid Content (%)	Peroxide Value, (meq O2/kg oil)	K232	K270	*L value*	*a value*	*b value*
0	0.2±0.00^{b}	14.56±0.039^{j}	1.4±0.00^{f}	0.08±0.00^{h}	33.08±0.035^{a}	1.85±0.007^{a}	8.72±0.120^{bc}
1	0.2±0.03^{b}	15.19±0.085^{h}	0.4±0.00^{h}	-0.19±0.00^{i}	33.08±0.035^{a}	1.70±0.113^{a}	8.77±0.049^{bc}
2	0.2±0.00^{b}	15.39±0.029^{g}	0.4±0.00^{h}	0.73±0.00^{a}	33.40±0.014^{a}	1.84±0.011^{a}	9.13±0.000^{bc}
3	0.2±0.00^{b}	15.85±0.021^{f}	0.4±0.00^{h}	0.32±0.00^{c}	33.30±0.007^{a}	1.86±0.004^{a}	8.97±0.007^{bc}
4	0.2±0.00^{b}	16.37±0.036^{e}	1.8±0.00^{d}	0.08±0.00^{h}	33.40±0.368^{a}	1.54±0.223^{a}	7.68±1.471^{c}
5	0.2±0.00^{b}	14.99±0.002^{i}	0.6±0.00^{g}	0.45±0.00^{b}	33.18±0.028^{a}	1.85±0.035^{a}	9.03±0.057^{bc}
6	0.3±0.00^{a}	17.81±0.055^{d}	1.8±0.00^{d}	0.14±0.00^{e}	31.85±3.295^{ab}	1.38±0.559^{a}	9.37±1.824^{bc}
7	0.3±0.00^{a}	17.94±0.025^{c}	1.8±0.00^{d}	0.08±0.00^{h}	33.92±0.297^{a}	2.09±0.039^{a}	10.26±0.042^{bc}
8	0.3±0.00^{a}	24.56±0.039^{a}	1.9±0.00^{c}	0.09±0.00^{f}	30.06±0.134^{b}	1.74±0.421^{a}	12.02±0.007^{a}
9	0.3±0.00^{a}	18.65±0.033^{b}	2.6±0.00^{a}	0.45±0.00^{b}	33.10±0.544^{a}	2.00±0.018^{a}	9.45±0.417^{bc}
10	0.3±0.00^{a}	15.95±0.006^{f}	2.1±0.00^{b}	0.17±0.00^{d}	25.50±0.580^{c}	1.03±0.078^{a}	3.35±0.778^{d}
11	0.3±0.00^{a}	14.56±0.039^{j}	1.8±0.00^{d}	0.08±0.00^{h}	34.40±1.082^{a}	2.03±0.095^{a}	9.55±1.549^{bc}
12	0.3±0.00^{a}	13.25±0.023^{k}	1.7±0.00^{e}	0.08±0.00^{g}	32.64±1.252^{a}	2.02±0.110^{a}	8.55±1.690^{bc}

.*Different superscript letters in the same column indicate a significant difference between mean values (P < 0.01)

Tocopherol Profile.

The tocopherol (α, β, ɣ) profile of Sarı Ulak (Mersin) EVOO was determined every three months during a year of storage (Table 2). The results show that the tocopherol content (α, β, ɣ) decreased with increasing storage time as expected. The lowest tocopherol contents were obtained at the end of storage. It means that 20.38% of α-tocopherol, 85.71% of β-tocopherol, and 22.22% of ɣ-tocopherol contents were decomposed in the EVOO samples during storage. Decreasing in α-tocopherol was lower than other tocopherol isomers. These results were in agreement with other researchers' results [4,8,19-22].

Table 2 – Tocopherol Content of Sarı Ulak (Mersin) monocultivar during 12 months' storage (ppm)

Storage period (Month)	A-Tocopherol (ppm)	β-Tocopherol (ppm)	ɣ-Tocopherol (ppm)
0	184.51±0.260^{a}	1.33±0.002^{a}	0.27±0.003^{a}
3	175.04±1.730^{b}	1.12±0.013^{b}	0.22±0.008^{b}
6	171.62±0.880^{b}	1.10±0.010^{b}	0.21±0.005^{b}
12	146.90±1.715^{c}	0.19±0.000^{c}	0.21±0.008^{b}

*Different superscript letters in the same column indicate a significant difference between mean values (P < 0.01)

Total Polyphenol.

Total polyphenols contents of the samples are presented in Table 3. The highest total polyphenol values were determined in fresh oils, and its amount decreased with time. But the decreases were not as dramatic as tocopherols, and after a year, 29.67% of total polyphenols were decomposed in the EVOO samples. After a short term or long term storage, significant decreases in total polyphenols were reported for the monocultivar and commercial olive oils by Clodoveo et al. [20], Morelló et al.[7], Abdalla et al. [19] and Baiano et al. [18] .

Phenolic Profiles.

A phenolic compounds test was performed every six months for Sarı Ulak (Mersin) EVOO samples. 4-hydroxy benzoic acid, trans-ferulic acid, luteolin, and apigenin were identified in Sarı Ulak (Mersin) EVOO during storage time. All phenolic comounds had the highest and lowest concentartion at the beginning and at the end of the storage time respectively. The results are shown in Table 4.

Table 3 – Changes in Total phenols of EVOOs during12 months of storage (ppm)

Storage Period (Month)	Sarı Ulak EVOO Total phenols (ppm)
0	205.17±0.348^{a}
3	196.00±0.524^{b}
6	173.38±0.721^{c}
9	159.12±0.344^{d}
12	144.29±0.115^{e}

*Different superscript letters in the same column indicate a significant difference between mean values (P < 0.01)

Table 4 – Changes in phenolic compounds of Sarı Ulak (Mersin) during 12 months of storage (ppm).

Phenolic Compounds	Month		
	0	6	12
4-hydroxy benzoic acid (ppm)	3.80±0.057^{a}	3.20±0.019^{b}	2.32±0.040^{c}
trans-ferulic acid (ppm)	0.67±0.012^{a}	0.62±0.010^{b}	0.54±0.058^{c}
luteolin (ppm)	184.33±1.194^{a}	157.42±0.192^{b}	115.06±0.675^{c}
apigenin (ppm)	2.67±0.084^{a}	2.04±0.003^{b}	1.06±0.080^{c}

*Different superscript letters in the same column indicate a significant difference between mean values (P < 0.05)

4-hydroxy benzoic acid was determined in 3.80±0.057 ppm in the zeroth month, its content decreased and reached 2.32±0.040 in the twelfth month. Amounts of trans-ferulic acid were 0.67±0.012 and 0.54±0.058 ppm in the zeroth and twelfth months, respectively. Luteolin was an abundant polyphenol among all phenolic compounds. The initial concentration of luteolin was 184.33±1.194 ppm in the zeroth month. Its amount significantly decreased to

115.06±0.675 ppm during storage. Apigenin was detected in 2.67±0.084 ppm in the zeroth month and decreased to 1.06±0.080 ppm at the end of storage. These results mean that storage caused changes in the phenolic profile confirmed by literature. Yorulmaz et al. [23] reported that luteolin was the most abundant phenolic compound following trans-cinnamic acid and luteolin-7-glucoside. They also quantified tyrosol, syringic acid, p-coumaric acid, luteolin-7-glucoside, trans cinnamic acid, luteolin, and apigenin in Turkish olive oils extracted from different olive varieties. Morello et al. [7] suggested that although storage did not appear to have any effect on vanilic acid or vanillin, which were present in a low concentration, there was a significant decrease in the concentration of the rest of the phenolic compounds quantified. That reduction was more marked in the secoiridoid derivatives such as 3,4-DHPEA-EDA, p-HPEA-EDA, and 3,4-DHPEA-EA indicating a more active participation in the oxidative processes as they were more easily oxidized. Among the most representative phenolic compounds in olive oil, lignans seem to be the most stable during oil storage. Mulinacci et al. [3], Gómez-Alonso et al. [24] and García et al. [25] showed an increase in tyrosol and hydroxytyrosol content over time due to hydrolytic processes of the secoiridoidic derivatives. Yorulmaz et al. [9] detected little amounts of luteolin, apigenin, *p*-coumaric acid, syringic acid, tyrosol, transcinnamic acid, and luteolin-7-o-glucoside in Sarı Ulak. Gómez-Alonso et al. [24] stated that the main phenols were the dialdehydic form of elenolic acid linked to tyrosol (p-HPEA-EDA), oleuropein aglycon, and the dialdehydic form of elenolic acid linked to hydroxytyrosol (3,4-DHPEA-EDA). Baiano et al. [18] reported that there were increasing and decreasing tendencies in phenolic compounds (3,4-DHPEA, *p*-HPEA, vanillin, *p*-coumaric acid, 3,4-DHPEA-AC, 3,4-DHPEA-EDA, *p*-HPEA-AC, *p*-HPEA-EDA, 1-acetoxipinoresinol + *trans*-cinnamic acid, *p*-HPEA-EA) content.

Sensory Evaluation.

Sarı Ulak is well-balanced as to its bitterness and fruitiness, receiving a score 4–2, and leaves a very fresh after taste in the mouth (Fig. 1). The pungency was 5.0, and it fell to 3 score during 12 months. This can be attributed to the decrease of phenolic compounds. As long as there is no mistake in the production process of natural extra virgin olive oil, olive oils with high scores, especially for pungency and bitterness, have a longer life. However, especially for olive oils with high bitterness and pungency, it is possible to store them for 12 months at a room temperature, which is not easy to do with high fruitiness olive oils. The olive oil obtained from an Oliomio olive oil processing machine due to the operation of the decanter did not accumulate much sediment. For this reason, there was no significant difference in sensory evaluation between filtered and unfiltered olive oils.

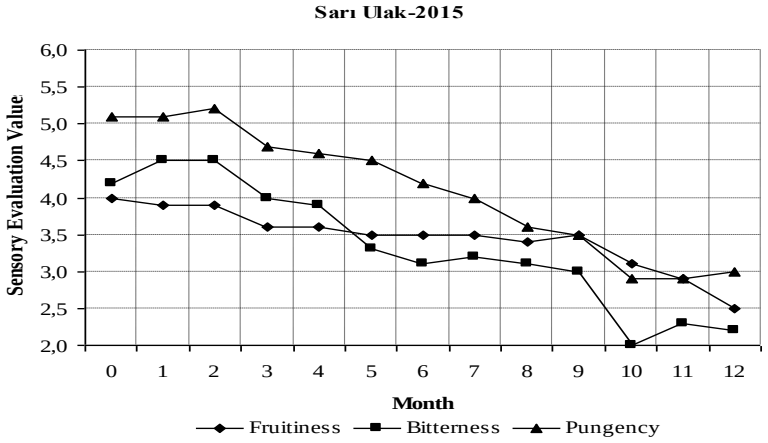

Fig. 1. Sensory evaluation of Sarı Ulak EVOO during 12 months' storage

Conclusion

Sarı Ulak EVOO is the major domestic olive cultivar in Mersin province of Turkey. Although there are some research works on the Sarı Ulak olive oils composition in scientific literature, the authors are not aware of a study about the effects of storage on Sarı Ulak olive oils. It has a very high potential for presentation as premium quality EVOO in Turkey and in the international marketing due to high total phenols, tocopherol isomers, and high oxidative stability. This is the first report on the chemical composition, sensory properties, and the effects of storage of Sarı Ulak olive oil produced in the mobile olive oil processing unit. The effects of storing for 12 months on the chemical features such as free acidity, peroxide value, color, UV absorbance, fatty acid composition, tocopherol content, total phenols, and phenolic compounds of monocultivar Extra Virgin Olive Oils (EVOOs) extracted from some Sarı Ulak (Mersin) produced in a mobile olive oil processing unit have been evaluated in this project. Free fatty acidity values were very low, and it was stable throughout the storage. It showed that from tree to bottle, the olive oil was produced in proper conditions. Peroxide values slightly exceeded the IOC limits (>20 meq O_2/kg oil) in the eighth month of storage. It has a unique taste with no defect, balanced fruitiness, bitterness, and pungency, and peppery finishing. The amount of total phenols in extra virgin olive oils normally ranges between 50 and 1000 mg kg^{-1}, depending on the cultivar, fruit's ripeness, processing, and storage. It can be said that Sarı Ulak olive oil has a

higher total phenol content which is uncommon in commercial ordinary Turkish olive oils. Luteolin, 4-hydroxy benzoic acid, and apigenin (flavonoids) which are major phenolics in Sarı Ulak olive oils, have multiple biological effects such as anti-inflammation, anti-allergy, and anticancer ones, and luteolin functions biochemically either as an antioxidant or as a pro-oxidant. The results showed that Sarı Ulak has high functional and healthy properties. This study as part of Turkish, Ministry of Science, Industry, and Technology project (SANTEZ- 0560-STZ-2013-2) also has revealed some important and effective features of Sarı Ulak EVOO to improve Olive oil production and programming in Turkey.

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