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Comparing and Evaluating the Oil Composition of Olive Oil of 85 Olive Varieties in the Liangshan Region, China

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Abstract: The main objective of this study was to evaluate the quality and select the best varieties from 85 olive varieties in the Liangshan region, China, from the perspective of oil content, fatty acid, and triacylglycerol compositions. Although 85 varieties of olive oil showed no difference in the type of fatty acid composition and the distribution of triglycerides, they varied greatly in the oil content, the relative proportion of fatty acids, and triglycerides. Principal component analysis (PCA) and cluster and heatmap analysis clearly divided the 85 samples into three groups. Group A included 36 varieties and was characterized by high oleic acid, mono-unsaturated fatty acids (MUFA), eicosenoic acid, OOO (glyceryl trioleate), and OOL (1-oleic acid-2-oleic acid-3-linoleic acid glycerides) contents, but rare palmitoleic acid, SFA (saturated fatty acid), and POP (1-palmitic acid-2-oleic acid-3-palmitic acid glycerides) levels. Group B contained 9 varieties of olive, with the main characteristics of high oleic acid, linolenic acid, MUFA, MUFA/PUFA, SFA, and OLnO (1-oleic acid-2-linolenic acid-3-oleic acid glycerides) content, but low in linoleic acid, PUFA (polyunsaturated fatty acid), PLL levels and ratio of omega-6 to omega-3 polyunsaturated fatty acids. Group C comprised 40 varieties, identified by high linoleic acid and PUFA levels but low ratios of oleic acid, MUFA, OOO, MUFA/PUFA, and the ratio of omega-6 to omega-3 polyunsaturated fatty acids. Combined with the oil content (FW) (%) of 85 varieties, we suggested four distinguished varieties in Group A, namely *Lechín*, *Coratina*, *Koroneiki*, and *Arbosana*; three distinguished varieties in Group B, namely *Picual*, *Ezhi*, *Cornicabra*; two distinguished varieties in Group C namely *Frantoio* and *Arbequina* as the objects of large-scale cultivation by Chinese cultivators. More importantly, the obtained data also demonstrated that some locally bred specific varieties, such as *Zhongze-3* and *Yuntai*, had interesting unsaturated fatty acids and had cultivation and popularization value in China.

Keywords: olive oil; fatty acid composition; triacylglycerol; principal component analysis

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Citation: Zhang, Z.; Tong, Z.; Shao, Y.; Su, G.; Li, K.; Li, C. Comparing and Evaluating the Oil Composition of Olive Oil of 85 Olive Varieties in the Liangshan Region, China. *Agronomy* **2024**, *14*, 304. https://doi.org/10.3390/agronomy14020304

Academic Editor: Milena Petriccione

Received: 9 January 2024
Revised: 27 January 2024
Accepted: 28 January 2024
Published: 30 January 2024

1. Introduction

Olive is a world-famous woody oil economic tree species with a planting history of more than 4000 years [1]. Extra-virgin olive oil (EVOO) is a natural pulp oil made directly from cold-pressed fresh olive fruit. As well as the unique sensory properties, the high nutritional value and the health benefits of olive oil make it a diet oil of great importance not only in Mediterranean countries but also throughout the world. Although not originating in China, more and more olives have been introduced to China since 1956. Now, the Liangshan region of the Sichuan province has become the most remarkable representation of olive introduction and cultivation in China. As the country with the world's largest population and the second largest GDP, China will become the world's largest olive oil consumer in the future, with a huge potential market.

Regular olive oil consumption has been reported to be associated with a lower risk of hypercholesterolemia, coronary heart disease, inflammation, cancer, and degenerative diseases. The health benefits of olive oil are attributed to its rich oleic acid composition, appropriate proportions of linoleic and linolenic acid, and a variety of bioactive small molecules such as phenols, phytosterols, squalene, and tocopherols [2,3]. These unique chemical compositions and organoleptic properties of olive oil are dependent on the cultivar, geographic origin, pedoclimatic conditions, and fruit ripeness [4–6]. The introduction and localization of olives in China started in the last century. Now, the Liangshan district of Sichuan province has become the most remarkable representation of olive cultivation in China, with more than 187 varieties of olives introduced from Israel, Greece, Spain, Italy, and other countries. It has been demonstrated that the geographical and climatic characteristics in which olive trees are grown, such as altitude, temperature, and rainfall, have a strong influence on the chemical compositions and properties of olive oil [7]. Therefore, after transplanting olive trees to a new environment with different soil and climatic characteristics, it is possible to cause great changes in the chemical compositions of olive oil, such as fatty acid compositions, trace accompaniments, and related bioactives. However, there is no report on how the regional conditions in the Liangshan region of China affect the oil characteristics, especially fatty acids, of these newly introduced olive varieties. Although the oil characteristics of a few olive varieties, such as Coratina, Leccino, and Frantoio, have been reported in China, most of them focus on a specific region and a small number of varieties [8–10].

It is of great significance for the actual production and development of the olive industry to select and breed suitable species in the Liangshan area to produce high-quality domestic olive oil and to define their composition characteristics for promotion and popularization. Therefore, this study evaluated and compared the oil characteristics of 85 olive cultivars grown in the Liangshan region of China from the perspective of oil content, fatty acid, and triacylglycerol composition and content.

2. Material and Methods

2.1. Materials and Reagents

Olive samples were kindly donated by the Liangshan Zhongze Olive Manor (Xichang, China), and samples were stored at −20 °C temperature until analysis. The study started with a total of 85 olive samples produced at Liangshan in Xichang in September-October 2021 and September 2022. The ripeness grade of the collected olive fruit was referred to as LY/T 1532-2021 [11]. The sample information regarding harvest year, maturity, and cultivar name are listed in Table 1.

Table 1. Relative information on 85 olive varieties.

Sample	Cultivar	Harvest Year	Maturity Index	Sample	Cultivar	Harvest Year	Maturity Index
1	*Picual*	2021	less than 1	44	*Yunza*	2021	3–4
2	*Biaocoline*	2021	3–4	45	*Ors*	2022	2–3
3	*Frantoio*	2021	1–2	46	*San Agostino*	2022	4–5
4	*Hojiblanca*	2021	4–5	47	*Telsmani*	2022	3–4
5	*Verdale*	2021	less than 1	48	*Cds*	2022	3–4
6	*Garsagvenio*	2021	less than 1	49	*Brintian*	2022	2–3
7	*Koroneiki*	2021	1–2	50	*Round Green*	2022	3–4
8	*Pizzacarroga*	2021	less than 1	51	*Nabli salfit*	2022	1–2
9	*Rama pendula*	2021	1–2	52	*Ezhi*	2022	1–2
10	*Nieda di gonno*	2021	2–3	53	*Zhongze-2*	2022	5–6
11	*Leccino*	2021	5–6	54	*Zhongshan-24*	2022	2–3
12	*Cornicabra*	2021	1–2	55	*Zhongze-3*	2022	3–4
13	*Jmperid*	2021	2–3	56	*Zhongze-11*	2022	4–5
14	*Sikitita*	2021	1–2	57	*Grossane*	2022	2–3
15	*Macho de jaen*	2021	3–4	58	*Royeta de asque*	2022	4–5
16	*Coratina*	2021	less than 1	59	*Gordal del somontano*	2022	3–4
17	*Barnea*	2021	1–2	60	*Albarate*	2022	3–4

Table 1. *Cont.*

Sample	Cultivar	Harvest Year	Maturity Index	Sample	Cultivar	Harvest Year	Maturity Index
18	*Frantoio de Corsini*	2021	1–2	61	*Alia*	2022	4–5
19	*Ottobratica*	2021	less than 1	62	*Manzanicco de bierge*	2022	3–4
20	*Dolce di Morocco*	2021	1–2	63	*Segoise*	2022	3–4
21	*Rol*	2021	less than 1	64	*Morisca*	2022	less than 1
22	*Lecln*	2021	1–2	65	*Tondn di caglan*	2022	1–2
23	*Acebuche*	2021	1–2	66	*Ganino*	2022	3–4
24	*Rvb*	2021	3–4	67	*Surani*	2022	3–4
25	*Canino*	2021	less than 1	68	*San fraciso*	2022	3–4
26	*Yuntai*	2021	1–2	69	*Misn*	2022	2–3
27	*Zhongze-7*	2021	2–3	70	*Azappa*	2022	less than 1
28	*Pico limon*	2021	4–5	71	*Giarffa*	2022	less than 1
29	*Chemlal de Kabylie*	2021	less than 1	72	*Piangent*	2022	3–3
30	*Lechín de Sevilla*	2021	1–2	73	*Gemlek*	2022	3–4
31	*Nevlbdly*	2021	1–2	74	*Amigdalolea Nana*	2022	1–2
32	*Arbequina*	2021	3–4	75	*Basta Morisca*	2022	2–3
33	*Kalamata*	2021	less than 1	76	*Uovo di Piccione*	2022	1–2
34	*Arbosana*	2021	less than 1	77	*Cuco*	2022	5–6
35	*Togisca*	2021	less than 1	78	*Memeli*	2022	2–3
36	*Picholine Languedoc*	2021	1–2	79	*Moraiolo*	2022	1–2
37	*XiYou-1*	2021	2–3	80	*Ascolana Tenera*	2022	2–3
38	*Cobrancosa*	2021	less than 1	81	*Jiufeng*	2022	1–2
39	*Pendolino*	2021	5–6	82	*Codovil*	2022	2–3
40	*Huyete*	2021	4–5	83	*Berat*	2022	3–4
41	*Mc ssoon*	2021	2–3	84	*Chenggu32*	2022	4–5
42	*Zhanglin*	2021	5–6	85	*Chenggu53*	2022	4–5
43	*Leucocarpa Ovoid*	2021	n.d				

Hexane and potassium hydroxide (KOH) were analytical-grade, and methanol and n-heptane were chromatographic-grade. Methyl palmitate, methyl palmitoleate, methyl heptadecanoate, methyl heptadecenoate, methyl stearate, methyl oleate, methyl linoleate, methyl linolenate, methyl eicosate, and methyl behenate were purchased from Yuanye Biotechnology Co., Ltd. (Shanghai, China). Methyl nonadecanoate and methyl eicosenoate were obtained from Aladdin Biochemical Technology Co., Ltd. (Shanghai, China). Methyl lignocerate was purchased from Maclean Biochemical Technology Co., Ltd. (Shanghai, China). All fatty acid methyl esters were chromatographic-grade. The triglyceride internal standard (trimyristin) was purchased from NU-CHEK-PREP, Inc. USA (Elysian, MN, USA).

2.2. Environmental Factors

The samples involved in this study were collected from Zhongze Olive Manor, Liangshan Yi Autonomous Prefecture, Sichuan (longitude: E102°14′36″, latitude: N27°44′39″, altitude: 953 m). The climate of Liangshan Yi Autonomous Prefecture belongs to the subtropical monsoon climate region, with distinct dry and wet seasons. In the dry season, precipitation is rare, the temperature difference is not large, the sun is sufficient, and the climate is warm. The wet season is warm, cool, humid, and rainy. Therefore, it has become an ideal olive-growing area. Considering the possible impact of climate change on olive oil properties, monthly information on rainfall and average temperatures was obtained during the harvest year (Figure 1). Although the temperature and precipitation of the two years were different, there were only slight differences, and all varieties were in the same climate region, so we ignored the influence of climate differences on varieties.

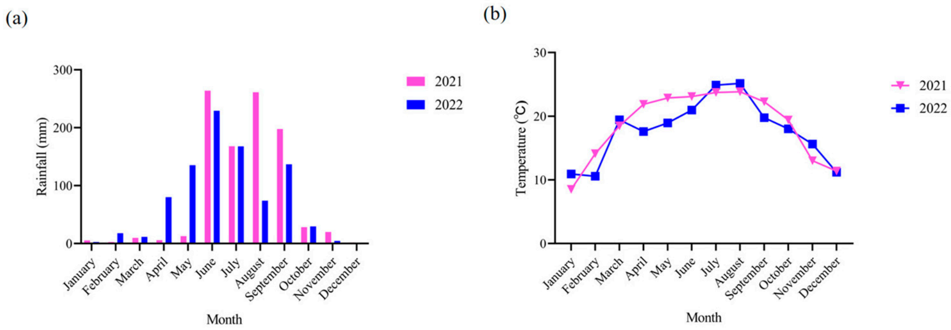

Figure 1. (**a**) The rainfall of the Liangshan region, China, in 2021 and 2022, which was expressed as an average for each month. (**b**) The temperature of the Liangshan region, China, in 2021 and 2022, expressed as an average for each month.

2.3. Oil Extraction

The olive sample was sliced, freeze-dried, and crushed into olive powder. We used an optimized ultrasonic-assisted solvent method to extract olive oil. The specific conditions are that the ratio of material to liquid is 1:15 (g/mL), and it is ultrasonicated for 30 min under the power of 280 W at 40 °C. The oil yield was similar to that of traditional Soxhlet extraction. Obtained samples were stored in the dark at −20 °C for further analysis.

2.4. Oil Content Analysis

Calculating the oil content of fresh weight and dry weight was carried out according to the following formula:

$$\text{Oil content (DW) (\%)} = m_1 \times 100/m_2$$

$$\text{Oil content (FW) (\%)} = \text{Oil content (DW)} \times (1 - \text{moisture (\%)})$$

m_1: extract (g)
m_2: olive powder (g)

2.5. Fatty Acid Composition Analysis

The analytical method used for fatty acid composition conformed to the (COI/T.20/Doc. No 33/Rev.1 2017) [12] with slight modification. Each fatty acid methyl ester standard was prepared into the mixed standard solution of 5 mg/mL, and retention time and the correction factor of each fatty acid methyl ester were determined, respectively. Fatty acid methyl esters (FAMEs) were prepared with KOH-methanol solution (0.4 M). FAMEs standard mixtures were analyzed by gas chromatography flame ionization detector (GC-FID) (Agilent 6890N, Santa Clara, CA, USA) fitted with a capillary column (HP-88 30 m × 0.25 mm i.d. × 0.2 μm). GC conditions were as follows: nitrogen was used as carrier gas at the flow of 1 mL/min; injection volume: 1 μL; split ratio: 1:50; temperature program: initial temperature 100 °C, hold for 0.5 min, then ramp to 194 °C at 30 °C/min and held for 3.5 min, and finally increased at 5 °C/min to 224 °C and held for 1 min. The temperatures of the injection port and detector were maintained at 250 °C.

2.6. Triacylglycerol (TAG) Analysis

A total of 5 mg of oil sample was dissolved in 1 mL n-hexane, a certain amount of MMM was added as internal standard, and then the sample and internal standard were diluted with methanol/acetonitrile (50/50, *v*/*v*) to 25 ug/mL and 5 ug/mL, respectively.

The Ultimate 3000 (Thermo Fisher Scientific, Waltham, MA, USA) equipped with TSQ Altis mass spectrometry (Thermo Fisher Scientific, Waltham, MA, USA) was used in this study. The separation process was conducted at 35 °C on the InfinityLab Poroshell 120 Phenyl Hexyl column (i.d. 150 × 3.0 mm, 2.7 μm, Agilent, Santa Clara, CA, USA) with the mobile phase consisting of Phases A and B (*v*/*v*). Solvent A is acetonitrile, and solvent

B is methanol. The gradient elution mode was as follows: starting at 50%B and holding for 2 min, then increasing linearly to 90%B at 7.2 min, then increasing linearly to 95%B at 9.8 min, and finally decreasing to 50%B at 11 min and holding for 5 min. The flow rate was maintained at 0.3 mL/min—injection volume: 5 μL.

The conditions of TSQ Altis (Thermo Fisher Scientific, Waltham, MA, USA) mass spectrometer are as follows: ESI mode, positive; collision energy, 3500 V; Ion Transfer Tube Temperature, 325 °C; Vaporizer Temperature, 350 °C; sheath gas, 50 Arb; mass range, 100–950 m/z; and the MRM mode was used for quantification of TAGs. The ion pair parameters of molecular ions and fragment ions of each compound to be tested were set. The compounds to be tested were identified as 13 kinds by pre-experiment. The maximum peak area of the corresponding ion pair of each compound was selected for quantitative analysis, and the peak area ratio (analyte area/I.S. area) was used for quantitative analysis of triacylglycerols. The abbreviations for fatty acids used on the glycerol skeleton were Po for palmitic acid, L for linoleic acid, Ln for linolenic acid, O for oleic acid, P for palmitic acid, and S for stearic acid.

2.7. Data Processing

GC data were obtained from 85 olive oil varieties and processed by Chemstation (Agilent). The obtained UPLC-ESI-MS/MS data were processed by Xcalibur (Thermo Fisher, Waltham, MA, USA). A total of 255 observations from 2021 to 2022 (from 85 samples in 3 replicates) were analyzed and compared by software that aligned the peaks of all observations based on retention time and masses of extraction. GC chromatogram and total ion chromatogram were plotted by OriginPro 2021 with data derived from Chemstation (Agilent) and Xcalibur (Thermo Fisher, Waltham, MA, USA), respectively. A data table containing the sample name, retention time, extracted mass, and peak area was generated. All fatty acids and triacylglycerols data were normalized. Principal component analysis (PCA) was performed to visualize the trends in the data. To ensure the integrity of the samples, no outlier detection was performed on the data. The relationship between samples was determined using Ward's hierarchical clustering method based on the Euclidean distance between varieties in the tree diagram. Heatmaps were used to further visualize differences between sample groups.

2.8. Statistical Methods

All experiments were repeated three times, expressed as mean ± standard deviation (SD). SPSS 26.0 software (IBM, Armonk, NY, USA) was used to process the data, and the Tukey test was evaluated. When $p < 0.05$, ANOVA test statistics showed significant differences. PCA was carried out by SIMCA 14.1 (Umetrics, Umea, Sweden). The hierarchical cluster analysis and heatmap were conducted by MetaboAnalyst 6.0 (https://www.metaboanalyst.ca/ accessed on 8 January 2024).

3. Results and Discussion

3.1. Oil Content

Table 2 describes the flesh oil content (fresh weight, FW) (%) and dry weight (DW) (%) of 85 olive species. The oil content on DW of 85 monovarietal olive oil ranged from 32.14% to 58.69%, and there was a significant difference between different varieties ($p < 0.05$). The oil content of most of the introduced varieties (except for a few self-developed hybrid varieties in China) for oil use is similar to that of the country of origin. Among them, the oil content of the dried fruit of the representative introduced varieties, such as Samples 16 (*Coratina*), 1 (*Picual*), 7 (*Koroneiki*), and 32 (*Arbequina*) are between 50% and 60%, which is higher than that of the results reported in the country of origin. The oil content of the fresh fruits is between 18% and 20%, which is similar to the results reported in the country of origin [13,14], but the oil content of dry weight is higher than the data reported in Longnan, Gansu [15]. This may be related to the difference in water content caused by regional and climatic conditions. It has been reported in the literature that higher water content is not conducive to the accumulation of oil [16]. Figure 1 shows the temperature and precipitation of Liangshan Prefecture in Xichang in 2021, which indicates that abundant precipitation and suitable temperature are conducive to the accumulation of water and indirectly reduce the oil content of olive fruit. The varieties such as Samples 13 (*Imperial*) (73.83%) and 4 (*Hojibulanca*) (70.72%) in this study have a higher water content and poorer oil content (FW%) compared with other varieties ($p < 0.05$). According to Chinese forestry standards (LY/T 1532-1999 [17] and LY/T 1532-2021 [11], China), fresh fruit of olives can be graded in 3 levels according to maturity and oil content, which can be used as a guidance for the suitable harvest time and potential oil extraction use of each variety. The fruit quality of the first-grade oil varieties was the best, and the fruit quality of the third-grade oil varieties was the worst. As shown in Table 2, Samples 32 (*Arbequina*), 45 (*ors*), and 48 (*cds*), which are the representatives of Grade 1 fruit, showed better quality of fresh fruit for oil use. It is worth noting that Samples 58 (*Royeta de asque*), 26 (*Yuntai*), 52 (*Ezhi*), and other varieties are excellent in oil content, and hybrid varieties such as Samples 37 (*XiYou-1*) and 26 (*Yuntai*) have good fresh fruit oil content. In particular, Sample 26 (*Yuntai*) (22.34%), native to Lianyungang, Jiangsu Province, shows good adaptability, which can be further explored and cultivated as a good variety. On the other hand, Samples 1 (*Picual*), 7 (*Koroneiki*), 16 (*Coratina*), and so on have less than a 2 maturity index among Grade 3 fruit, but the oil content of these varieties has reached the requirements of first-grade olive varieties. Therefore, crop managers must adjust the harvest time of these varieties to ensure the quality of olive fruit.

Table 2. Fresh fruit grade and oil content of 85 olive varieties.

Sample	Cultivar	Grade	DW (%)	FW (%)	Sample	Cultivar	Grade	DW (%)	FW (%)
1	*Picual*	3	52.89 ± 0.90	20.07 ± 0.90	44	*Yunza*	1	40.29 ± 0.20	15.81 ± 0.20
2	*Biaocoline*	3	50.02 ± 0.15	16.80 ± 0.15	45	*Ors*	1	52.95 ± 0.36	22.21 ± 0.88
3	*Frantoio*	3	54.31 ± 0.38	20.70 ± 0.38	46	*San agostino*	2	52.04 ± 0.72	20.37 ± 0.65
4	*Hojiblanca*	2	48.63 ± 0.51	14.24 ± 0.51	47	*Telsmani*	1	47.05 ± 0.26	17.49 ± 0.84
5	*Verdale*	3	47.11 ± 0.80	14.73 ± 0.80	48	*Cds*	1	42.14 ± 0.50	19.98 ± 0.26
6	*Garsagvenio*	3	42.82 ± 0.63	13.61 ± 0.63	49	*Brintian*	1	52.39 ± 0.33	18.54 ± 0.23
7	*Koroneiki*	3	51.29 ± 1.47	17.97 ± 1.47	50	*Round Green*	1	48.59 ± 0.54	18.72 ± 0.66
8	*Pizzacarroga*	3	41.78 ± 1.02	12.26 ± 1.02	51	*Nabli salfit*	3	47.67 ± 0.54	17.39 ± 0.14
9	*Rama pendula*	3	52.40 ± 0.65	19.99 ± 0.65	52	*Ezhi*	3	54.75 ± 0.56	21.81 ± 0.23
10	*Nieda di gonno*	1	49.87 ± 1.82	15.32 ± 1.82	53	*Zhongze-2*	2	34.74 ± 0.43	10.85 ± 0.15
11	*Leccino*	2	51.62 ± 0.27	21.20 ± 0.27	54	*Zhongshan-24*	3	45.57 ± 0.15	14.80 ± 0.33
12	*Cornicabra*	3	53.63 ± 0.27	19.39 ± 0.27	55	*Zhongze-3*	1	35.21 ± 0.55	10.34 ± 0.33
13	*Imperial*	2	51.47 ± 0.68	13.47 ± 0.68	56	*Zhongze-11*	2	35.21 ± 0.61	7.85 ± 0.59
14	*Sikitita*	3	49.50 ± 0.21	15.90 ± 0.21	57	*Grossane*	1	46.64 ± 0.50	18.37 ± 0.94
15	*Macho de jaen*	2	42.51 ± 0.44	12.66 ± 0.44	58	*Royeta de asque*	2	52.48 ± 0.49	31.57 ± 0.17
16	*Coratina*	3	54.49 ± 0.80	19.90 ± 0.80	59	*Gordal del somontano*	1	53.80 ± 0.38	22.45 ± 0.68
17	*Barnea*	3	51.67 ± 0.28	17.74 ± 0.28	60	*Albarate*	1	55.42 ± 0.46	27.96 ± 0.56
18	*Frantoio de Corsini*	3	42.42 ± 0.25	17.81 ± 0.25	61	*Alia*	2	51.13 ± 0.43	15.22 ± 0.39
19	*Ottobratica*	3	50.95 ± 0.16	16.68 ± 0.16	62	*Manzanicco de bierge*	1	50.67 ± 0.59	16.84 ± 0.54
20	*Dolce di Morocco*	3	45.94 ± 0.42	15.11 ± 0.42	63	*Segoise*	1	50.31 ± 0.69	18.18 ± 0.56
21	*Rol*	3	45.96 ± 0.20	15.20 ± 0.20	64	*Morisca*	3	43.87 ± 0.58	14.40 ± 0.29
22	*Lecln*	3	50.52 ± 0.98	13.48 ± 0.98	65	*Tondn di caglan*	3	45.65 ± 0.59	14.90 ± 0.45
23	*Acebuche*	3	35.78 ± 0.68	13.25 ± 0.68	66	*Ganino*	1	53.74 ± 0.39	18.02 ± 0.12
24	*Rvb*	1	44.47 ± 0.52	13.48 ± 0.52	67	*Surani*	1	37.68 ± 1.08	10.83 ± 0.48
25	*Canino*	3	47.64 ± 1.02	14.64 ± 1.02	68	*San fraciso*	1	45.17 ± 0.53	19.26 ± 0.78
26	*Yuntai*	3	53.03 ± 0.70	22.34 ± 0.70	69	*Misn*	1	41.69 ± 0.74	13.66 ± 0.43
27	*Zhongze-7*	1	43.97 ± 0.39	15.46 ± 0.39	70	*Azappa*	3	41.20 ± 0.92	14.56 ± 0.92
28	*Pico limon*	2	46.07 ± 0.02	16.08 ± 0.02	71	*Giarffa*	3	42.76 ± 1.04	14.59 ± 0.38
29	*Chemlal de Kabylie*	3	48.16 ± 0.89	16.86 ± 0.89	72	*Piangent*	1	56.45 ± 0.45	19.58 ± 0.40

Table 2. *Cont.*

Sample	Cultivar	Grade	DW (%)	FW (%)	Sample	Cultivar	Grade	DW (%)	FW (%)
30	*Lechín de Sevilla*	3	39.15 ± 1.01	15.33 ± 1.01	73	*Gemlek*	1	54.86 ± 0.61	25.38 ± 0.91
31	*Nevlbdly*	3	45.15 ± 0.63	13.33 ± 0.63	74	*Amigdalolea Nana*	3	41.24 ± 0.61	13.09 ± 0.13
32	*Arbequina*	1	58.69 ± 0.47	18.46 ± 0.47	75	*Basta Morisca*	1	52.83 ± 0.17	17.76 ± 0.82
33	*Kalamata*	3	50.42 ± 1.17	17.71 ± 1.17	76	*Uovo di Piccione*	3	50.70 ± 0.63	16.12 ± 0.42
34	*Arbosana*	3	53.76 ± 0.22	18.03 ± 0.22	77	*Cuco*	2	47.29 ± 0.24	12.53 ± 0.23
35	*Togisca*	3	49.36 ± 0.20	16.74 ± 0.20	78	*Memeli*	1	51.68 ± 0.38	20.73 ± 0.18
36	*Picholine Languedoc*	3	38.02 ± 0.34	12.69 ± 0.34	79	*Moraiolo*	3	49.77 ± 1.32	19.42 ± 0.31
37	*XiYou-1*	1	48.74 ± 0.39	18.02 ± 0.39	80	*Ascolana Tenera*	1	54.06 ± 0.61	24.98 ± 0.58
38	*Cobrancosa*	3	42.58 ± 0.46	14.39 ± 0.46	81	*Jiufeng*	3	45.91 ± 0.61	18.13 ± 0.37
39	*Pendolino*	2	37.35 ± 1.04	12.18 ± 1.04	82	*Codovil*	1	48.78 ± 0.47	13.89 ± 0.25
40	*Huyete*	2	41.30 ± 0.16	15.79 ± 0.16	83	*Berat*	1	52.61 ± 0.52	22.33 ± 0.43
41	*Mc ssoon*	1	40.10 ± 0.83	13.22 ± 0.83	84	*Chenggu32*	2	43.91 ± 0.42	15.58 ± 0.81
42	*Zhanglin*	1	32.14 ± 0.08	12.43 ± 0.08	85	*Chenggu53*	2	42.84 ± 0.69	12.84 ± 0.12
43	*Leucocarpa Ovoid*	n.d	46.50 ± 0.11	16.19 ± 0.11					

All the values in the table are mean ± standard deviation, and there are significant differences in the same column of data through the ANOVA test ($p < 0.05$).

3.2. Fatty Acid Composition

The fatty acid composition can be used as an essential index to evaluate the nutritional quality and stability of olive oil. This characteristic is commonly applied for building fingerprints, which provide a basis for the identification of olive varieties used in the production, quality evaluation, and detection of adulteration and fraud in olive oil. The distribution of fatty acids in olive oil is frequently influenced by a variety of factors, including fruit maturity, climate, latitude and origin, and genetic factors.

The results presented in Table 1, Appendix A illustrate significant differences in fatty acids between different varieties ($p < 0.05$), and Figure 2 illustrates the gas chromatogram of the olive oil sample. Twelve types of fatty acids were detected in oils from 85 olive cultivars. Oleic acid (C18:1), linoleic acid (C18:2), and palmitoleic acid (C16:1) are the major unsaturated fatty acids, palmitic acid (C16:0) and stearic acid (C18:0) are the main saturated fatty acids. Other fatty acids were present in low amounts (<1%), with heptadecenoic acid being the lowest. Except for the low oleic acid content in Samples 10 (*nieda di gonno*), 4 (*Yunza*) and 84 (*Chengu32*), the fatty acid compositions of all samples perfectly meet the norm established for EVOO (COI/T.15/NC.No.3/Rev.19/2022) [18]. The results of this study indicated that cultivars were an important factor affecting the composition of fatty acids in olive oil, which was consistent with the previous report [19]. The distribution and relative proportion of fatty acids of all varieties were consistent with previous reports [7,20,21]. α-linolenic acid exerts an inhibitory effect on the activation of immune cells in both innate and adaptive branches and can be used as a specific immune repressor to promote the immune function of immune cells [22]. It was worth noting that the linolenic acid content of Samples 55 and 56 (*Zhongze-3 and Zhongze-11*) was significantly higher than that of other varieties ($p < 0.05$), and these 3 varieties were native-bred. These varieties can be further explored because of their own specific functional components.

Mono-unsaturated fatty acids (MUFA) play an essential physiological function in preventing cancer, inhibiting chronic inflammation, and alleviating diet-induced insulin resistance and liver inflammation, while polyunsaturated fatty acids (PUFA) play an essential role in reducing fat accumulation, inhibiting inflammatory response, and improving insulin sensitivity [23–26]. The content of MUFA and PUFA has been regarded by scholars in many countries as an essential index to evaluate the quality of olive oil. As seen in Table 1, Samples 33 (*Kalamata*), 30 (*Lechín*), and 7 (*Koroneiki*) and the other six varieties have the highest MUFA content (more than 75%) but low PUFA content. The oleic acid content of sample 33 (*Kalamata*) (79.37%) was significantly higher than that of its Lebanon counterpart (68.08%) [27]. Samples 44 (*Yunza*), 84 (*Chenggu 32*), and 10 (*nieda di gonno*) showed high PUFA content (about 20%) but low MUFA content. As excellent foreign varieties and widely planted in China, Sample 32 (*Arbequina*) showed significantly lower oleic acid content (59.78%) than that of its California counterpart (69.10%), but its linoleic acid content (13.08%) was higher than that of California (10.80%) [28]. Compared with the provenance, oleic acid content (76.70%) and palmitic acid content (12.02%) of sample 7 (*Koroneiki*) were similar (76.70%), but linoleic acid content was slightly lower than that of the original origin (6.09%), indicating that sample 7 (*Koroneiki*) had good environmental adaptability. On the one hand, the ratio of MUFA to PUFA is a potential indicator to evaluate the stability of olive oil. In this study, the MUFA and PUFA ratios of oil from some varieties, including Samples 12 (*Cornicabra*), 31 (*Lechín*), 11 (*Leccino*) etc. were above 20, suggesting that they might have better oxidation stability than oils from other varieties [29]. This may be more conducive to the preservation of olive oil, prolonging its shelf life. On the other hand, omega-3 versus omega-6 polyunsaturated fatty acids have been reported to help reduce the risk of cardiovascular disease and relieve skin inflammation [30,31]. The optimal ratio of omega-6 to omega-3 polyunsaturated fatty acids recommended by the WHO was between 4:1 and 6:1. In this study, 11 kinds of olive oil, including Samples 31 (*nevlbdly*), 62 (*manzanicco de bierge*) and 1 (*Picual*) are in the optimum range, so they have potential in the development of functional oils. Moreover, long-chain saturated fatty acids have been identified as major contributors to diet-induced hypothalamic dysfunction, which leads to obesity [32,33]. Therefore, varieties such as Samples 42 (*Zhanglin*) and 10 (*Nieda di gonno*), which contain SFA more than 20%, are not recommended as high-quality olive oil.

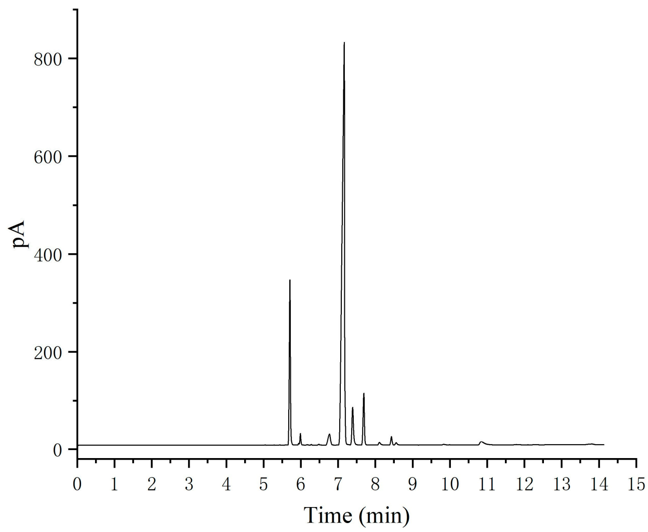

Figure 2. Gas chromatogram of olive oil Sample 7 (Koroneiki) after derivatization.

In addition to the imported varieties, we also found that the locally bred varieties, such as Samples 26 (*Yuntai*) and 37 (*XiYou-1*), had excellent characteristics. They have a higher ratio of MUFA to PUFA and MUFA content than other local varieties. The ratio of omega-6 to omega-3 polyunsaturated fatty acids of Samples 55 (*Zhongze-3*) and 52 (*Ezhi*) are in the optimum range, indicating that they might exert potential health benefits. From the perspective of health and germplasm resource cultivation, these varieties had cultivation and popularization values.

3.3. Triacylglycerol (TAG) Profiles

TAG is an important index for distinguishing different kinds of edible oils and determining the quality and purity of olive oils [34]. In the present study, the relative proportion of fragment ions in triacylglycerols and the steric hindrance effect of Sn-2 fatty acids were used to conduct the identification of triacylglycerols [35]. Here, quantitative results ignore the differences due to regional isomers. Table 2 listed the individual TAGs of the 85 samples, and 13 kinds of triacylglycerols were determined. Figure 3 demonstrates the separation of olive oil samples by UPLC-MS/MS. There was no difference in the distribution of triglycerides among 85 varieties of olive oil, but there were significant differences in the contents of triglycerides among all varieties ($p < 0.05$). OOO (glyceryl trioleate), OOP (1-oleic acid-2-oleic acid-3-palmitic acid glycerides), and OOL (1-oleic acid-2-oleic acid-3-linoleic acid glycerides) were the main three triacylglycerols with the content of 27.47–43.14%, 16.13–21.34%, and 5.70–15.12%, respectively. However, the contents of OLnO (1-oleic acid-2-linolenic acid-3-oleic acid glycerides), POLn (1-palmitic acid-2-oleic acid-3-linolenic acid glycerides), and POS (1-palmitic acid-2-oleic acid-3-stearic acid glycerides) were relatively low, with values of 0.54–4.47%, 0.96–3.28% and 1.07–3.69%, respectively. The content distribution of triacylglycerols was consistent with related literature reports [36,37]. The presence of a high 1,2,3-trioleylglycerol (OOO) level in olive oil is a favorable authenticity indicator [38]. Meanwhile, OOO roughly reflects the oleic acid and oil quality of the cultivars, which was closely associated with MUFA level and the potential health effects. Samples 30 (*Lechín*), 33 (*Kalamata*), and 7 (*Koroneiki*) have significantly higher OOO content than other varieties ($p < 0.05$), and the results of these varieties are similar to those reported in different regions [39,40]. The contents of OOP and OOL in these varieties were higher than that of other local varieties, such as Samples 52 (*Ezhi*) and 44 (*Yunza*) ($p < 0.05$), but lower than that of varieties in Morocco [41], which might be attributed to the different climatic and soil conditions in the two regions. However, some excellent varieties abroad, such as 16 (*Coratina*) and 19 (*Ottobratica*), showed poor performance in the Liangshan region. The content of OOO in both of them was much lower than that reported abroad (48.25%), but OOL was significantly higher than that reported abroad [42], indicating that the region affected the composition and content of TAGs significantly. In addition, it was reported that the oxidation stability of n-3 long-chain polyunsaturated fatty acids (LC-PUFA) at the Sn-2 position was better than that at the Sn-1,3 position or random distribution state [43]. The results showed that the OLnO of samples 55 (*Zhongze-3*), 1 (*Picual*), 12 (*Cornicabra*), and 30 (*Lechín*) had significantly higher LC-PUFA than that of other varieties ($p < 0.05$), suggesting the oxidation stability of these oils might be better.

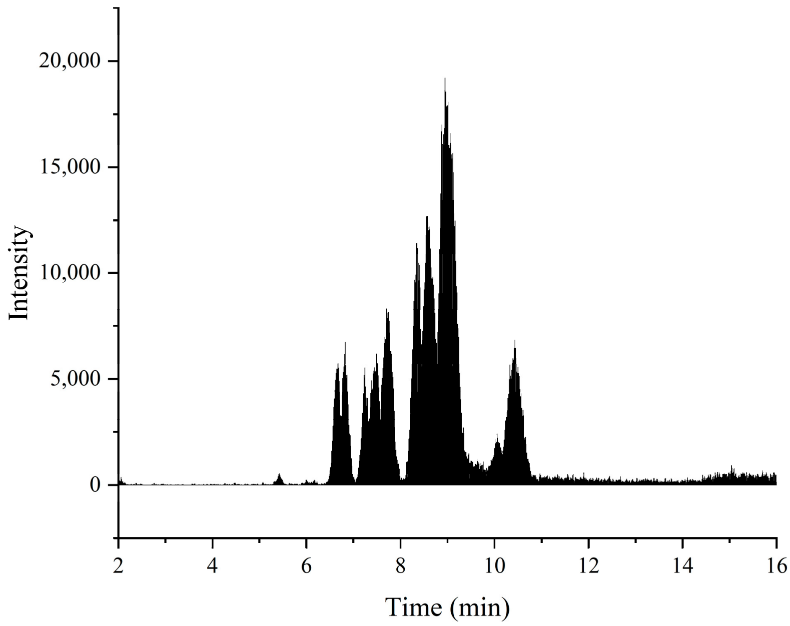

Figure 3. Total ion chromatogram of olive oil Sample 7 (Koroneiki) separated by UPLC-MS/MS.

Furthermore, it could be seen that unsaturated fatty acids were more likely to attach to the Sn-2 site of the glycerol skeleton, and saturated fatty acids were more likely to attach to the Sn-1(3) site of the glycerol skeleton in olive oil. This can provide a reference for the study of the position of fatty acids in the glycerol skeleton and the digestive and nutritional characteristics.

3.4. Principal Component Analysis

Because either fatty acids or triacylglycerols can only represent one aspect of the quality characteristics of oils, we further use principal component analysis to capture the main factors affecting quality indexes of olive oil and master the specificity of 85 samples macroscopically. PCA was performed based on the obtained data to reveal the distribution of the samples. It mainly included 30 quality indicators, including palmitic acid, oleic acid, linolenic acid, MUFA/PUFA, OLL, POL, etc. The bioplot of the principal component analysis of samples is shown in Figure 4. The first principal component (PC1) accounted for 63.9% of the variance, which presents high loadings for indicators MUFA, C18:1, MUFA/PUFA, and OOO; the second principal component (PC2) accounted for 14.0% of the variance, which presents high loadings for indicators OOL, n-6/n-3, PLL and PUFA. The two components with high variance contribution (i.e., PC1 and PC2) collectively explained 77.9% of the variance. The results of this study are consistent with previous reports in the Turkish region [44]. From the bioplot, the principal component scores of Samples 11 (*Leccino*), 12 (*Cornicabra*), 26 (*Yuntai*), and 30 (*Kalamata*) were mainly at the high level of PC1, indicating that the contents of C18:1, MUFA, and OOO were rich in the above varieties. The principal component scores of samples 8 (*pizzacarroga*), 28 (*Pico limon*), and 41 (Mc ssoon) appear to be more concentrated at high values of PC2, suggesting that a high level of PLL, OOL, and n-6/n-3 in the above breeds. In particular, high levels of PC1 and low levels of PC2 in samples 12 (*Cornicabra*), 31 (*nevlbdly*), and 52 (*Ezhi*) indicated rich contents of C18:1, MUFA, and OOO, but low levels of PLL, OOL, and n-6/n-3. We noticed that the prevailing MUFA and PUFA in these varieties showed a negative relationship, which is consistent with previous reports [45]. Some literature reported that oleic acid is formed first in the biosynthesis of fatty acids in olives and then converted into linoleic acid during fruit ripening [46]. In addition, MUFA, C18:1, OOO, and other indicators are in a compact position, indicating that the indicators are positively correlated. In addition, the positive correlation between palmitic acid and palmitoleic acid between heptadeconic acid and heptadecenoic acid found in most varieties can also be visualized in Figure 4.

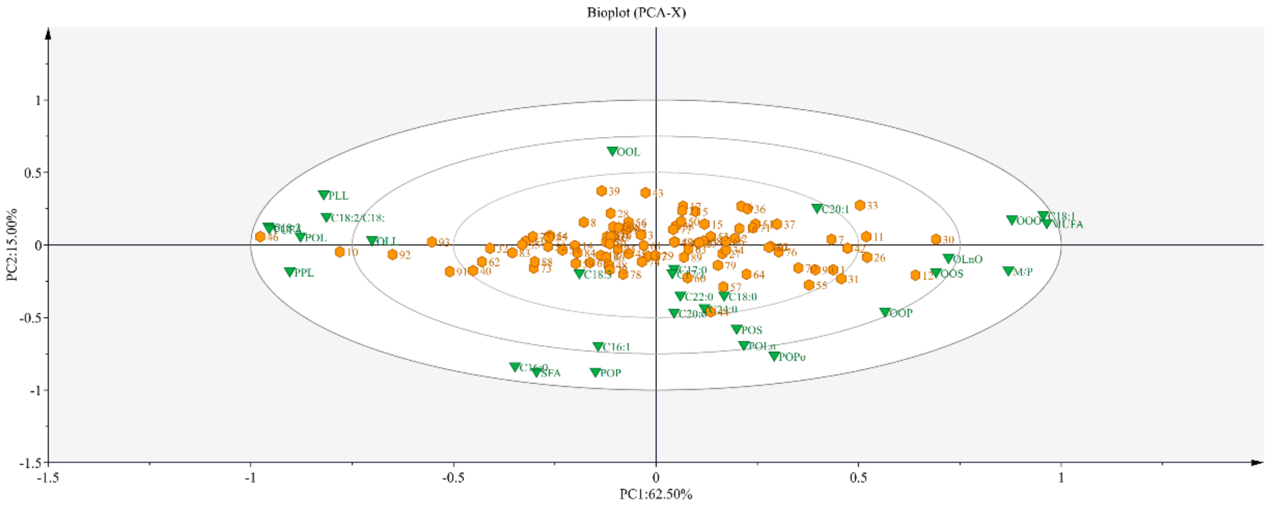

Figure 4. Biplot presentation of 85 samples scores on first 2 principal components, and the loadings of the 30 fatty acid and triacylglycerol indexes of olive oil samples, by varieties. Loadings and samples are distinguished by different colors, green triangles represents the loadings, the orange hexagon represents the varieties.

Although they were taken from the same origin, the maturity of each variety in the same harvest period was different. Therefore, this result only reflects the differences and similarities of functional components among different varieties [47].

3.5. Hierarchical Cluster Analysis and Heatmap

The above analysis was not able to categorize the different olive oils and clearly characterize the associations among the varieties. To further screen high-quality olive varieties, Ward clustering was used to group different varieties according to variable characteristics. The result is shown in Figure 5. When the Euclidean square distance is 30, the samples could be divided into three groups. There are 36 species in Group A, represented by Samples 7 (*Koroneiki*) and 33 (*Kalamata*); 9 species in Group B, represented by Samples 1 (*Picual*) and 26 (*Yuntai*); 40 species in Group C, represented by Samples 10 (*nieda di gonno*) and 42 (*Yunza*). To further visualize the differences between each group and refine the quality characteristics of each group of olive oil varieties, we make each group of data into a heatmap. As shown in Figure 6, hierarchical cluster analysis clearly divided the 85 samples into three groups: A, B, and C. The main characteristics of Class A, which clustered 36 varieties, were high oleic acid, MUFA, eicosenoic acid, OOO, and OOL contents ($p < 0.05$) but rare palmitoleic acid, SFA, and POP levels. Class B contained 9 species of olive, with the main characteristics of high oleic acid, linolenic acid, MUFA, MUFA/PUFA, SFA, and OLnO contents ($p < 0.05$), but low in linoleic acid, PUFA, and PLL levels and ratio of omega-6 to omega-3 polyunsaturated fatty acids. The main features of Class C, which clustered 40 varieties, are high linoleic acid and polyunsaturated fatty acid levels ($p < 0.05$) but low ratio of oleic acid, MUFA, OOO, MUFA/PUFA, and the ratio of omega-6 to omega-3 polyunsaturated fatty acids. Therefore, varieties of Class A have no significant deficiencies in fatty acid composition and ratio but a balanced overall quality index and are suitable for producing olive oil. Varieties in Class B have better oxidation stability, and although the PUFA is not outstanding, they are suitable for producing high-quality olive oil from the perspective of nutrition and health. Varieties in Class C possess rich polyunsaturated fatty acids. Although the ratio of omega-6 to omega-3 polyunsaturated fatty acids is not reasonable, we can use them as functional oils to develop the right ratio of fatty acids by combining them with other vegetable oils rich in polyunsaturated fatty acids.

Combined with the oil content (FW) (%) of 85 varieties, we suggested four distinguished varieties in Class A, including *Lechín*, *Coratina*, *Koroneiki*, and *Arbosana*; three distinguished varieties in Class B, including *Picual*, *Ezhi*, and *Cornicabra*; two distinguished varieties in Class C including *Frantoio* and *Arbequina* as the objects of large-scale cultivation by Chinese breeders.

It is worth noting that some locally bred specific varieties, such as *Zhongze-3* and *Zhongze-11*, have incomparable linolenic acid, and *Yunza* and *Chenggu32* have extremely prominent linoleic acid, etc. Due to the low oil content, their application is limited. From the point of view of functional oil, olive breeders can expand their production scale and develop unique formulas for olive oil to meet the needs of consumers.

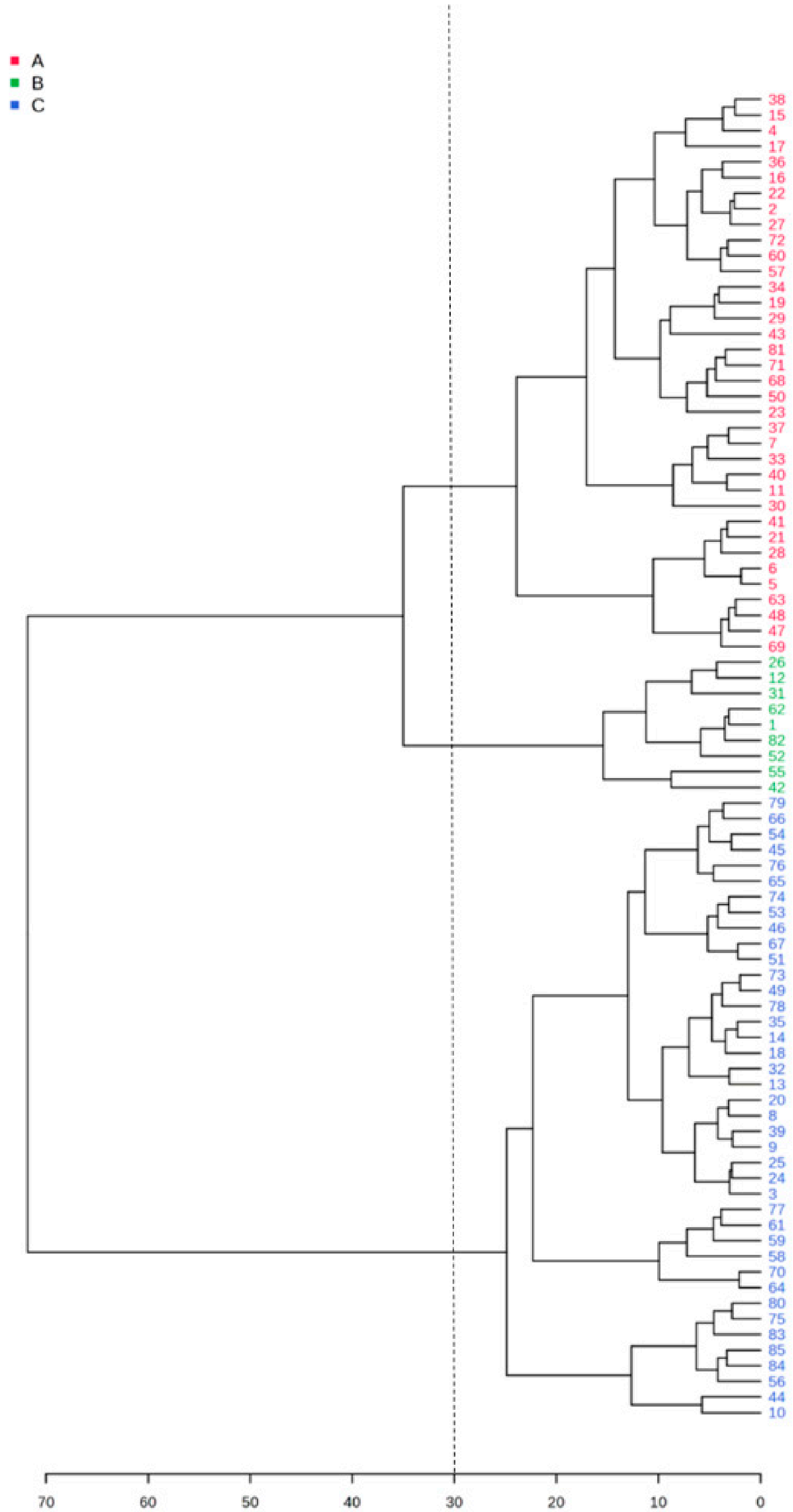

Figure 5. Dendrogram of the 85 × 30 sample matrix using the Euclidean distance as a similarity measure and the Ward clustering algorithm. The distance is positively correlated with the dissimilarity of samples.

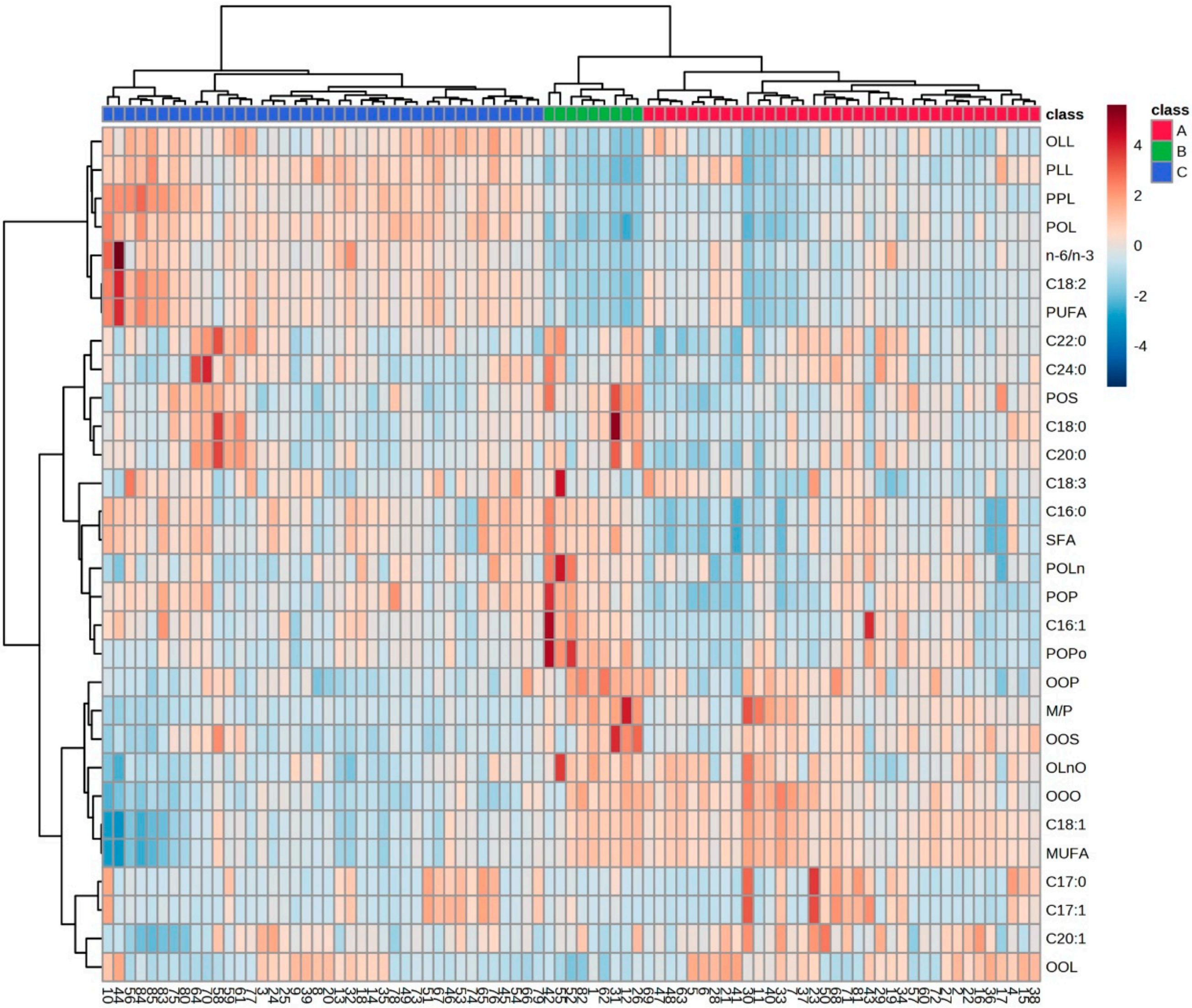

Figure 6. Heatmap for the 30 fatty acid and triacylglycerol indexes and HCA for selected 85 olive samples from Liangshan region, China, where the three groups correspond to the groups in the cluster analysis (Figure 5), respectively.

4. Conclusions

In summary, GC, UPLC-ESI-MS/MS, and chemometrics analysis were used to characterize the fatty acids and triacylglycerols of 85 olive oil varieties from the Liangshan region of China. The results showed that 85 varieties of olive oil showed no difference in the type of fatty acid compositions and distribution of triglycerides, but they varied greatly in the oil content relative to the proportion of fatty acids and triglycerides. This difference is mainly determined by the diversity of varieties. By combining PCA and cluster and heatmap analysis, 85 samples could be grouped into three categories with different characteristics. In brief, Group A included 36 varieties characterized by high oleic acid, MUFA, eicosenoic acid, OOO, and OOL contents but rare palmitoleic acid, SFA, and POP levels. Group B contained 9 species of olive, with the main characteristics of high oleic acid, linolenic acid, MUFA, MUFA/PUFA, SFA, and OLnO contents, but low in linoleic acid, PUFA, PLL levels and ratio of omega-6 to omega-3 polyunsaturated fatty acids. Group C comprised 40 varieties, identified by high linoleic acid and polyunsaturated fatty acid levels but the low ratio of oleic acid, MUFA, OOO, MUFA/PUFA, and the ratio of omega-6 to omega-3 polyunsaturated fatty acids. They were combined with the oil content (FW) (%) of 85 varieties. The results suggested four distinguished varieties in Group A, namely

Lechín, *Coratina*, *Koroneiki*, and *Arbosana*; three distinguished varieties in Group B, namely *Picual*, *Ezhi*, and *Cornicabra*; three distinguished varieties in Group C, namely *Frantoio* and *Arbequina*; and some locally bred specific varieties such as *Zhongze-3* and *Yuntai*, which had large-scale cultivation and popularization values in China. Studies on bioactive compounds such as polyphenols, tocopherols, and sterols need to be carried out in the future to further evaluate the quality of EVOO from multiple perspectives.

Author Contributions: Conceptualization, C.L. and K.L.; methodology, Z.Z.; software, Z.Z.; validation, Z.Z., Z.T. and Y.S.; formal analysis, Z.Z.; resources, G.S.; data curation, Z.Z.; writing—original draft preparation, Z.Z.; writing—review and editing, Z.Z.; visualization, Z.Z.; supervision, C.L.; project administration, C.L.; funding acquisition, C.L. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the National Key R&D Program of China (2019YFD1000600).

Data Availability Statement: The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

Conflicts of Interest: Author Guangcan Su were employed by the company Liangshan Zhongze New Technology Development Co., Ltd. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

Table 1. Fatty acid composition (%) of 85 oil samples from olive cultivars grown in Liangshan, China.

Sample	Cultivar	C16:0	C16:1	C17:0	C17:1	C18:0	C18:1	C18:2 (n-6)	C18:3 (n-3)	C20:0	C20:1	C22:0	C24:0	SFA	MUFA	PUFA	M/P	n-6/n-3
1	*Picual*	14.86 ± 0.49	1.18 ± 0.09	0.05 ± 0.00	0.08 ± 0.01	1.84 ± 0.04	74.78 ± 0.27	3.69 ± 0.11	0.70 ± 0.02	0.33 ± 0.01	0.24 ± 0.01	0.08 ± 0.01	0.06 ± 0.00	17.22 ± 0.62	76.29 ± 0.59	4.39 ± 0.03	17.37 ± 0.05	5.29 ± 0.03
2	*Biaocoline*	13.15 ± 0.57	0.79 ± 0.04	0.03 ± 0.00	0.07 ± 0.00	1.14 ± 0.02	72.85 ± 0.39	5.94 ± 0.16	0.64 ± 0.02	0.29 ± 0.01	0.31 ± 0.00	0.09 ± 0.01	0.06 ± 0.01	14.77 ± 0.20	74.02 ± 0.20	6.57 ± 0.01	11.26 ± 0.03	9.33 ± 0.07
3	*Frantoio*	14.06 ± 0.63	0.61 ± 0.06	0.04 ± 0.00	0.09 ± 0.00	1.22 ± 0.02	68.40 ± 0.26	9.23 ± 0.20	0.67 ± 0.01	0.35 ± 0.02	0.35 ± 0.01	0.10 ± 0.00	0.08 ± 0.01	15.85 ± 0.82	69.45 ± 0.70	9.90 ± 0.12	7.02 ± 0.00	13.69 ± 0.08
4	*Hojiblanca*	14.59 ± 0.33	0.66 ± 0.02	0.13 ± 0.00	0.22 ± 0.00	1.99 ± 0.02	70.57 ± 0.56	8.04 ± 0.06	0.90 ± 0.02	0.37 ± 0.01	0.27 ± 0.01	0.09 ± 0.01	0.06 ± 0.00	17.23 ± 0.40	71.72 ± 0.35	8.94 ± 0.05	8.02 ± 0.00	8.91 ± 0.04
5	*Verdale*	10.71 ± 0.02	0.49 ± 0.00	0.04 ± 0.00	0.07 ± 0.00	1.10 ± 0.01	71.43 ± 0.40	8.45 ± 0.05	0.96 ± 0.01	0.24 ± 0.01	0.28 ± 0.00	0.07 ± 0.00	0.06 ± 0.01	12.20 ± 0.83	72.26 ± 0.75	9.42 ± 0.08	7.68 ± 0.02	8.77 ± 0.01
6	*Garsagvenio*	9.54 ± 0.62	0.46 ± 0.03	0.03 ± 0.00	0.06 ± 0.01	1.10 ± 0.02	72.80 ± 1.09	7.17 ± 0.21	0.92 ± 0.03	0.23 ± 0.00	0.27 ± 0.00	0.06 ± 0.00	0.05 ± 0.00	11.01 ± 0.39	73.59 ± 0.36	8.09 ± 0.03	9.10 ± 0.02	7.82 ± 0.02
7	*Koroneiki*	12.26 ± 0.17	0.58 ± 0.01	0.05 ± 0.00	0.08 ± 0.00	1.85 ± 0.00	75.72 ± 0.28	4.40 ± 0.03	0.60 ± 0.01	0.39 ± 0.00	0.29 ± 0.00	0.11 ± 0.00	0.07 ± 0.00	14.72 ± 0.12	76.66 ± 0.12	5.00 ± 0.00	15.32 ± 0.02	7.35 ± 0.05
8	*Pizzacarroga*	11.44 ± 0.11	0.62 ± 0.02	0.04 ± 0.00	0.08 ± 0.00	1.09 ± 0.01	64.77 ± 0.47	10.73 ± 0.13	1.03 ± 0.02	0.31 ± 0.01	0.29 ± 0.00	0.08 ± 0.00	0.07 ± 0.00	13.03 ± 0.00	65.76 ± 0.03	11.75 ± 0.03	5.60 ± 0.01	10.44 ± 0.05
9	*Rama pendula*	12.92 ± 0.72	0.28 ± 0.01	0.05 ± 0.00	0.06 ± 0.00	1.31 ± 0.02	66.75 ± 1.14	9.83 ± 0.22	1.01 ± 0.03	0.27 ± 0.00	0.27 ± 0.00	0.06 ± 0.01	0.04 ± 0.00	14.64 ± 0.43	67.36 ± 0.37	10.84 ± 0.06	6.21 ± 0.01	9.77 ± 0.06
10	*Nieda di gonno*	16.15 ± 2.12	1.14 ± 0.17	0.12 ± 0.01	0.28 ± 0.02	1.38 ± 0.01	51.35 ± 0.72	18.73 ± 0.42	0.71 ± 0.02	0.35 ± 0.02	0.24 ± 0.01	0.10 ± 0.01	0.07 ± 0.01	18.16 ± 0.85	53.01 ± 0.62	19.45 ± 0.23	2.73 ± 0.01	26.31 ± 0.04
11	*Leccino*	10.47 ± 0.17	0.75 ± 0.01	0.03 ± 0.00	0.06 ± 0.00	1.00 ± 0.01	76.65 ± 0.60	3.22 ± 0.04	0.48 ± 0.01	0.23 ± 0.00	0.26 ± 0.01	0.06 ± 0.00	0.04 ± 0.00	11.84 ± 0.05	77.73 ± 0.06	3.70 ± 0.01	20.99 ± 0.04	6.72 ± 0.05
12	*Cornicabra*	13.29 ± 0.14	1.12 ± 0.02	0.04 ± 0.00	0.07 ± 0.00	2.08 ± 0.02	75.24 ± 0.59	2.14 ± 0.01	0.59 ± 0.01	0.37 ± 0.03	0.24 ± 0.00	0.12 ± 0.00	0.08 ± 0.00	15.98 ± 0.26	76.67 ± 0.26	2.73 ± 0.00	28.06 ± 0.08	3.63 ± 0.04
13	*Imperial*	13.00 ± 0.79	1.13 ± 0.08	0.08 ± 0.00	0.17 ± 0.01	1.39 ± 0.02	60.38 ± 0.69	10.98 ± 0.19	0.63 ± 0.01	0.36 ± 0.01	0.22 ± 0.00	0.09 ± 0.00	0.08 ± 0.01	15.00 ± 0.66	61.91 ± 0.52	11.61 ± 0.14	5.33 ± 0.00	17.54 ± 0.10
14	*Sikitita*	14.46 ± 0.13	0.83 ± 0.01	0.04 ± 0.00	0.08 ± 0.00	1.13 ± 0.02	63.66 ± 0.90	9.96 ± 0.21	0.77 ± 0.02	0.29 ± 0.01	0.28 ± 0.00	0.08 ± 0.00	0.06 ± 0.00	16.06 ± 0.44	64.85 ± 0.32	10.74 ± 0.11	6.04 ± 0.02	12.89 ± 0.08
15	*Macho de jaen*	11.31 ± 0.40	0.49 ± 0.02	0.11 ± 0.00	0.17 ± 0.01	1.81 ± 0.03	71.04 ± 1.06	7.11 ± 0.15	0.74 ± 0.02	0.34 ± 0.01	0.24 ± 0.01	0.08 ± 0.01	0.05 ± 0.00	13.70 ± 0.26	71.93 ± 0.24	7.85 ± 0.02	9.16 ± 0.01	9.60 ± 0.02
16	*Coratina*	11.45 ± 0.14	0.35 ± 0.01	0.04 ± 0.00	0.07 ± 0.00	1.20 ± 0.01	72.73 ± 0.58	6.24 ± 0.08	0.65 ± 0.02	0.32 ± 0.01	0.38 ± 0.00	0.09 ± 0.00	0.06 ± 0.00	13.17 ± 0.01	73.52 ± 0.03	6.88 ± 0.03	10.69 ± 0.03	9.67 ± 0.05
17	*Barnea*	8.65 ± 0.18	0.48 ± 0.01	0.04 ± 0.00	0.06 ± 0.00	1.35 ± 0.01	72.07 ± 0.25	7.40 ± 0.06	0.59 ± 0.01	0.31 ± 0.00	0.21 ± 0.00	0.10 ± 0.00	0.06 ± 0.00	10.51 ± 0.15	72.83 ± 0.15	7.99 ± 0.01	9.12 ± 0.02	12.58 ± 0.02
18	*Frantoio de Corsini*	15.17 ± 0.25	1.31 ± 0.02	0.04 ± 0.00	0.09 ± 0.00	1.09 ± 0.01	64.26 ± 0.72	9.30 ± 0.14	0.79 ± 0.02	0.30 ± 0.00	0.28 ± 0.00	0.09 ± 0.01	0.06 ± 0.00	16.76 ± 0.02	65.93 ± 0.03	10.09 ± 0.01	6.54 ± 0.00	11.80 ± 0.04
19	*Ottobratica*	12.42 ± 0.43	0.90 ± 0.04	0.10 ± 0.00	0.18 ± 0.00	1.27 ± 0.01	65.84 ± 0.37	8.44 ± 0.08	0.43 ± 0.00	0.34 ± 0.00	0.27 ± 0.01	0.12 ± 0.00	0.08 ± 0.01	14.33 ± 0.35	67.19 ± 0.31	8.87 ± 0.05	7.58 ± 0.00	19.49 ± 0.07
20	*Dolce di Morocco*	11.98 ± 0.23	0.61 ± 0.01	0.04 ± 0.00	0.08 ± 0.00	1.02 ± 0.00	66.35 ± 0.09	9.11 ± 0.00	0.64 ± 0.00	0.28 ± 0.00	0.30 ± 0.00	0.09 ± 0.00	0.05 ± 0.00	13.47 ± 1.33	67.33 ± 0.42	9.75 ± 0.91	6.91 ± 0.33	14.24 ± 0.08
21	*Rol*	11.31 ± 0.46	0.49 ± 0.02	0.04 ± 0.00	0.08 ± 0.01	1.35 ± 0.01	72.35 ± 0.46	10.63 ± 0.02	1.00 ± 0.00	0.27 ± 0.01	0.35 ± 0.01	0.07 ± 0.00	0.04 ± 0.00	13.07 ± 0.49	73.27 ± 0.47	11.63 ± 0.02	6.30 ± 0.03	10.63 ± 0.08
22	*Lecln*	13.12 ± 0.79	0.97 ± 0.07	0.04 ± 0.00	0.08 ± 0.00	1.27 ± 0.06	73.32 ± 1.08	5.43 ± 0.11	0.73 ± 0.02	0.30 ± 0.00	0.33 ± 0.01	0.08 ± 0.00	0.05 ± 0.00	14.86 ± 0.56	74.70 ± 0.52	6.17 ± 0.04	12.11 ± 0.02	7.40 ± 0.05
23	*Acebuche*	14.85 ± 0.59	0.53 ± 0.04	0.19 ± 0.00	0.41 ± 0.01	1.22 ± 0.00	69.25 ± 0.27	8.71 ± 0.06	1.33 ± 0.01	0.31 ± 0.01	0.38 ± 0.01	0.12 ± 0.01	0.08 ± 0.00	16.75 ± 0.58	70.57 ± 0.47	10.04 ± 0.11	7.03 ± 0.02	6.56 ± 0.09
24	*Rvb*	15.92 ± 0.84	0.81 ± 0.04	0.05 ± 0.00	0.12 ± 0.02	1.31 ± 0.02	62.96 ± 1.15	12.29 ± 0.28	0.97 ± 0.03	0.37 ± 0.01	0.36 ± 0.00	0.11 ± 0.00	0.07 ± 0.01	17.82 ± 0.43	64.25 ± 0.36	13.26 ± 0.06	4.85 ± 0.01	12.73 ± 0.00
25	*Canino*	14.45 ± 0.64	1.25 ± 0.06	0.05 ± 0.00	0.10 ± 0.00	1.40 ± 0.01	65.27 ± 0.64	10.36 ± 0.12	0.91 ± 0.01	0.35 ± 0.00	0.30 ± 0.00	0.10 ± 0.00	0.07 ± 0.00	16.43 ± 0.43	66.92 ± 0.35	11.26 ± 0.08	5.94 ± 0.00	11.43 ± 0.04
26	*Yuntai*	12.74 ± 0.42	0.74 ± 0.03	0.05 ± 0.00	0.07 ± 0.00	2.09 ± 0.01	75.96 ± 0.23	3.50 ± 0.01	0.74 ± 0.00	0.48 ± 0.01	0.34 ± 0.00	0.12 ± 0.01	0.08 ± 0.00	15.56 ± 0.45	77.11 ± 0.42	4.24 ± 0.03	18.18 ± 0.02	4.72 ± 0.00
27	*Zhongze-7*	14.75 ± 0.00	1.06 ± 0.01	0.04 ± 0.00	0.08 ± 0.00	1.45 ± 0.03	70.67 ± 0.47	6.86 ± 0.13	0.80 ± 0.02	0.36 ± 0.01	0.32 ± 0.01	0.08 ± 0.00	0.05 ± 0.00	16.74 ± 0.11	72.12 ± 0.01	7.66 ± 0.10	9.42 ± 0.09	8.59 ± 0.09
28	*Pico limon*	11.65 ± 0.10	0.54 ± 0.00	0.04 ± 0.00	0.07 ± 0.00	1.27 ± 0.01	67.65 ± 0.74	12.14 ± 0.16	0.79 ± 0.01	0.33 ± 0.01	0.29 ± 0.00	0.10 ± 0.00	0.05 ± 0.00	13.43 ± 0.10	68.56 ± 0.08	12.94 ± 0.02	5.30 ± 0.00	15.31 ± 0.08
29	*Chemlal de Kabylie*	14.42 ± 0.37	1.22 ± 0.03	0.04 ± 0.00	0.08 ± 0.00	1.52 ± 0.02	66.97 ± 0.79	7.80 ± 0.12	0.56 ± 0.01	0.43 ± 0.01	0.36 ± 0.00	0.14 ± 0.00	0.10 ± 0.00	16.65 ± 0.13	68.63 ± 0.12	8.36 ± 0.01	8.21 ± 0.00	13.98 ± 0.06
30	*Lechín de Sevilla*	10.85 ± 0.28	0.48 ± 0.01	0.16 ± 0.00	0.39 ± 0.01	1.27 ± 0.01	79.07 ± 0.62	2.56 ± 0.05	0.79 ± 0.02	0.34 ± 0.00	0.38 ± 0.00	0.11 ± 0.00	0.07 ± 0.00	12.80 ± 0.17	80.32 ± 0.19	3.34 ± 0.02	24.03 ± 0.17	3.26 ± 0.02
31	*Nevlbdly*	14.64 ± 0.42	1.18 ± 0.03	0.07 ± 0.00	0.11 ± 0.00	3.64 ± 0.04	73.45 ± 0.85	3.55 ± 0.04	0.80 ± 0.01	0.55 ± 0.01	0.24 ± 0.00	0.08 ± 0.00	0.06 ± 0.00	19.05 ± 0.17	74.99 ± 0.16	4.35 ± 0.01	17.23 ± 0.01	4.45 ± 0.00
32	*Arbequina*	15.69 ± 0.40	1.27 ± 0.04	0.09 ± 0.00	0.22 ± 0.00	1.27 ± 0.01	59.78 ± 0.16	13.08 ± 0.07	0.59 ± 0.01	0.39 ± 0.01	0.28 ± 0.01	0.11 ± 0.01	0.07 ± 0.00	17.62 ± 0.43	61.54 ± 0.30	13.67 ± 0.13	4.50 ± 0.01	22.29 ± 0.05
33	*Kalamata*	8.73 ± 0.06	0.40 ± 0.00	0.09 ± 0.00	0.23 ± 0.02	1.21 ± 0.01	79.37 ± 0.24	4.90 ± 0.00	0.56 ± 0.00	0.32 ± 0.01	0.37 ± 0.00	0.08 ± 0.00	0.07 ± 0.00	10.51 ± 5.91	80.37 ± 3.07	5.45 ± 0.16	14.75 ± 0.03	8.82 ± 0.08
34	*Arbosana*	13.04 ± 0.69	1.47 ± 0.13	0.09 ± 0.01	0.22 ± 0.02	1.40 ± 0.01	70.63 ± 0.58	6.30 ± 0.03	0.55 ± 0.00	0.39 ± 0.02	0.31 ± 0.02	0.12 ± 0.00	0.07 ± 0.00	15.10 ± 0.82	72.62 ± 0.75	6.86 ± 0.07	10.59 ± 0.02	11.44 ± 0.00
35	*Togisca*	14.40 ± 0.83	0.74 ± 0.05	0.04 ± 0.00	0.07 ± 0.00	1.08 ± 0.01	60.38 ± 0.45	11.97 ± 0.14	0.77 ± 0.01	0.28 ± 0.00	0.26 ± 0.01	0.08 ± 0.01	0.05 ± 0.00	15.91 ± 0.70	61.44 ± 0.55	12.74 ± 0.14	4.83 ± 0.00	15.63 ± 0.05
36	*Picholine Languedoc*	8.57 ± 0.48	0.41 ± 0.02	0.03 ± 0.00	0.05 ± 0.00	1.25 ± 0.01	73.03 ± 0.63	7.15 ± 0.10	0.97 ± 0.02	0.29 ± 0.00	0.30 ± 0.01	0.07 ± 0.00	0.05 ± 0.00	10.27 ± 0.43	73.79 ± 0.39	8.13 ± 0.04	9.08 ± 0.01	7.34 ± 0.03
37	*XiYou-1*	11.45 ± 0.51	0.52 ± 0.03	0.04 ± 0.00	0.07 ± 0.00	1.24 ± 0.01	74.81 ± 0.52	5.94 ± 0.02	0.56 ± 0.00	0.31 ± 0.02	0.31 ± 0.01	0.12 ± 0.00	0.07 ± 0.00	13.24 ± 0.64	75.71 ± 0.61	6.50 ± 0.03	11.65 ± 0.04	10.56 ± 0.02
38	*Cobrancosa*	11.19 ± 0.81	0.46 ± 0.04	0.09 ± 0.01	0.15 ± 0.01	1.71 ± 0.03	68.90 ± 0.65	8.53 ± 0.20	0.85 ± 0.02	0.36 ± 0.01	0.27 ± 0.00	0.09 ± 0.02	0.08 ± 0.00	13.51 ± 0.67	69.77 ± 0.68	9.38 ± 0.01	7.44 ± 0.06	10.00 ± 0.10
39	*Pendolino*	14.29 ± 0.48	0.84 ± 0.03	0.04 ± 0.00	0.09 ± 0.00	1.13 ± 0.01	65.71 ± 0.62	11.45 ± 0.16	1.06 ± 0.02	0.27 ± 0.00	0.29 ± 0.00	0.07 ± 0.00	0.06 ± 0.00	15.85 ± 0.28	66.93 ± 0.27	12.51 ± 0.01	5.35 ± 0.01	10.81 ± 0.08
40	*Huyete*	12.07 ± 0.24	1.05 ± 0.02	0.04 ± 0.00	0.10 ± 0.02	1.26 ± 0.00	74.55 ± 0.59	3.73 ± 0.02	0.71 ± 0.00	0.32 ± 0.02	0.28 ± 0.01	0.08 ± 0.00	0.07 ± 0.00	13.83 ± 0.10	75.98 ± 0.06	4.44 ± 0.04	17.13 ± 0.07	5.26 ± 0.10
41	*Mc ssoon*	8.12 ± 0.56	0.35 ± 0.02	0.03 ± 0.00	0.07 ± 0.02	1.08 ± 0.01	69.74 ± 0.65	11.21 ± 0.33	0.86 ± 0.02	0.23 ± 0.02	0.30 ± 0.01	0.05 ± 0.00	0.03 ± 0.00	9.54 ± 0.47	70.45 ± 0.60	12.08 ± 0.13	5.83 ± 0.07	13.01 ± 0.04
42	*Zhanglin*	18.12 ± 0.22	3.00 ± 0.03	0.04 ± 0.00	0.09 ± 0.00	1.51 ± 0.02	64.23 ± 0.63	4.87 ± 0.05	0.97 ± 0.01	0.40 ± 0.02	0.25 ± 0.00	0.14 ± 0.01	0.11 ± 0.00	20.32 ± 0.02	67.57 ± 0.02	5.84 ± 0.01	11.58 ± 0.01	5.02 ± 0.04
43	*Leucocarpa Ovoid*	15.98 ± 0.70	2.63 ± 0.13	0.09 ± 0.00	0.31 ± 0.01	1.04 ± 0.01	65.87 ± 0.44	10.78 ± 0.13	0.87 ± 0.01	0.26 ± 0.00	0.27 ± 0.01	0.07 ± 0.00	0.04 ± 0.00	17.48 ± 0.48	69.07 ± 0.43	11.64 ± 0.04	5.93 ± 0.02	12.43 ± 0.04

Table 1. *Cont.*

Sample	Cultivar	C16:0	C16:1	C17:0	C17:1	C18:0	C18:1	C18:2 (n-6)	C18:3 (n-3)	C20:0	C20:1	C22:0	C24:0	SFA	MUFA	PUFA	M/P	n-6/n-3
44	*Yunza*	15.41 ± 0.74	1.39 ± 0.07	0.04 ± 0.00	0.09 ± 0.00	1.69 ± 0.03	49.90 ± 0.93	24.84 ± 0.57	0.62 ± 0.02	0.35 ± 0.01	0.24 ± 0.00	0.07 ± 0.00	0.05 ± 0.00	17.62 ± 0.34	51.61 ± 0.24	25.46 ± 0.10	2.03 ± 0.00	39.93 ± 0.02
45	*Ors*	16.14 ± 0.08	0.72 ± 0.01	0.04 ± 0.00	0.08 ± 0.00	1.43 ± 0.00	67.30 ± 0.03	9.82 ± 0.01	0.89 ± 0.00	0.32 ± 0.00	0.25 ± 0.00	0.10 ± 0.00	0.09 ± 0.00	18.12 ± 0.08	68.35 ± 0.03	10.71 ± 0.01	6.39 ± 0.01	11.08 ± 0.03
46	*San agostino*	12.97 ± 0.12	1.00 ± 0.01	0.09 ± 0.00	0.25 ± 0.00	1.33 ± 0.01	71.77 ± 0.14	8.68 ± 0.03	0.70 ± 0.00	0.32 ± 0.00	0.28 ± 0.00	0.12 ± 0.00	0.05 ± 0.00	14.87 ± 0.12	73.31 ± 0.15	9.38 ± 0.03	7.82 ± 0.01	12.43 ± 0.04
47	*Telsmani*	10.38 ± 0.23	0.54 ± 0.00	0.04 ± 0.01	0.09 ± 0.02	1.40 ± 0.01	72.18 ± 0.39	10.10 ± 0.08	1.09 ± 0.01	0.25 ± 0.01	0.28 ± 0.00	0.04 ± 0.00	0.04 ± 0.00	12.15 ± 0.22	73.08 ± 0.38	11.19 ± 0.08	6.53 ± 0.01	9.26 ± 0.06
48	*Cds*	9.25 ± 0.13	0.49 ± 0.01	0.04 ± 0.00	0.07 ± 0.00	1.15 ± 0.00	73.85 ± 0.13	7.16 ± 0.01	1.04 ± 0.00	0.24 ± 0.00	0.23 ± 0.00	0.08 ± 0.00	0.04 ± 0.00	10.80 ± 0.14	74.64 ± 0.14	8.19 ± 0.02	9.11 ± 0.00	6.91 ± 0.05
49	*Brintian*	13.10 ± 0.03	0.86 ± 0.00	0.04 ± 0.00	0.08 ± 0.00	1.47 ± 0.00	63.72 ± 0.13	11.75 ± 0.02	0.80 ± 0.00	0.34 ± 0.00	0.26 ± 0.00	0.10 ± 0.00	0.05 ± 0.00	15.09 ± 0.03	64.92 ± 0.12	12.55 ± 0.02	5.17 ± 0.00	14.76 ± 0.01
50	*Round Green*	11.58 ± 0.32	0.55 ± 0.02	0.08 ± 0.00	0.19 ± 0.01	1.49 ± 0.01	72.17 ± 0.61	7.67 ± 0.08	0.70 ± 0.01	0.40 ± 0.00	0.41 ± 0.00	0.12 ± 0.00	0.08 ± 0.00	13.76 ± 0.34	73.32 ± 0.63	8.37 ± 0.09	8.76 ± 0.00	10.99 ± 0.10
51	*Nabli salfit*	12.68 ± 0.07	0.68 ± 0.00	0.12 ± 0.00	0.28 ± 0.00	1.27 ± 0.00	64.18 ± 0.16	13.22 ± 0.05	0.96 ± 0.00	0.30 ± 0.01	0.26 ± 0.00	0.10 ± 0.00	0.05 ± 0.00	14.52 ± 0.07	65.41 ± 0.16	14.18 ± 0.06	4.61 ± 0.00	13.77 ± 0.10
52	*Ezhi*	15.22 ± 0.20	1.81 ± 0.02	0.05 ± 0.00	0.16 ± 0.00	1.16 ± 0.01	72.18 ± 0.55	4.02 ± 0.04	0.77 ± 0.01	0.26 ± 0.00	0.27 ± 0.00	0.08 ± 0.00	0.04 ± 0.00	16.82 ± 0.21	74.42 ± 0.57	4.79 ± 0.04	15.54 ± 0.01	5.19 ± 0.02
53	*Zhongze-2*	10.64 ± 0.17	0.53 ± 0.01	0.11 ± 0.00	0.26 ± 0.00	1.20 ± 0.01	68.36 ± 0.37	11.50 ± 0.08	1.03 ± 0.01	0.31 ± 0.00	0.32 ± 0.00	0.09 ± 0.00	0.04 ± 0.00	12.39 ± 0.18	69.46 ± 0.38	12.53 ± 0.08	5.54 ± 0.00	11.14 ± 0.01
54	*Zhongshan-24*	15.31 ± 0.41	1.03 ± 0.03	0.04 ± 0.00	0.09 ± 0.00	1.65 ± 0.01	64.49 ± 0.58	12.07 ± 0.12	1.28 ± 0.01	0.35 ± 0.00	0.26 ± 0.00	0.08 ± 0.00	0.08 ± 0.00	17.52 ± 0.42	65.87 ± 0.61	13.35 ± 0.13	4.93 ± 0.00	9.43 ± 0.01
55	*Zhongze-3*	15.14 ± 0.22	1.47 ± 0.03	0.05 ± 0.00	0.12 ± 0.00	1.27 ± 0.00	67.52 ± 0.26	7.02 ± 0.03	1.88 ± 0.02	0.41 ± 0.01	0.27 ± 0.00	0.15 ± 0.00	0.09 ± 0.00	17.10 ± 0.24	69.38 ± 0.29	8.90 ± 0.05	7.80 ± 0.01	3.73 ± 0.08
56	*Zhongze-11*	14.85 ± 0.44	0.97 ± 0.03	0.05 ± 0.00	0.10 ± 0.00	1.34 ± 0.01	57.40 ± 0.48	14.35 ± 0.17	1.48 ± 0.02	0.36 ± 0.00	0.21 ± 0.00	0.11 ± 0.00	0.06 ± 0.00	16.76 ± 0.44	58.68 ± 0.51	15.83 ± 0.19	3.71 ± 0.00	9.70 ± 0.02
57	*Grossane*	11.79 ± 0.08	0.78 ± 0.01	0.05 ± 0.00	0.08 ± 0.00	1.85 ± 0.00	69.49 ± 0.11	7.26 ± 0.03	0.70 ± 0.00	0.32 ± 0.00	0.20 ± 0.00	0.07 ± 0.00	0.04 ± 0.00	14.13 ± 0.09	70.55 ± 0.12	7.96 ± 0.03	8.87 ± 0.01	10.34 ± 0.10
58	*Royeta de asque*	10.77 ± 0.45	0.57 ± 0.03	0.05 ± 0.00	0.07 ± 0.00	3.03 ± 0.03	72.78 ± 0.86	7.11 ± 0.11	0.60 ± 0.01	0.57 ± 0.00	0.33 ± 0.00	0.18 ± 0.00	0.07 ± 0.00	14.66 ± 0.48	73.75 ± 0.89	7.71 ± 0.12	9.57 ± 0.01	11.85 ± 0.03
59	*Gordal del somontano*	11.99 ± 0.08	0.54 ± 0.00	0.10 ± 0.00	0.16 ± 0.00	2.10 ± 0.01	66.70 ± 0.36	10.58 ± 0.08	0.70 ± 0.01	0.46 ± 0.00	0.25 ± 0.00	0.12 ± 0.00	0.10 ± 0.00	14.87 ± 0.09	67.66 ± 0.37	11.28 ± 0.08	6.00 ± 0.00	15.05 ± 0.07
60	*Albarate*	12.03 ± 0.29	0.67 ± 0.02	0.04 ± 0.00	0.08 ± 0.00	1.48 ± 0.01	72.46 ± 0.43	7.65 ± 0.06	0.70 ± 0.00	0.34 ± 0.00	0.28 ± 0.00	0.11 ± 0.00	0.05 ± 0.00	14.04 ± 0.30	73.48 ± 0.44	8.35 ± 0.06	8.80 ± 0.00	10.96 ± 0.03
61	*Alia*	11.15 ± 0.09	0.66 ± 0.01	0.05 ± 0.00	0.08 ± 0.00	2.44 ± 0.01	67.69 ± 0.13	11.22 ± 0.02	0.97 ± 0.00	0.48 ± 0.00	0.30 ± 0.00	0.13 ± 0.00	0.06 ± 0.00	14.31 ± 0.10	68.73 ± 0.14	12.19 ± 0.02	5.64 ± 0.00	11.53 ± 0.01
62	*Manzanicco de bierge*	13.51 ± 0.10	1.15 ± 0.01	0.05 ± 0.00	0.09 ± 0.00	1.86 ± 0.01	73.43 ± 0.29	4.96 ± 0.03	0.90 ± 0.00	0.34 ± 0.00	0.23 ± 0.00	0.11 ± 0.00	0.06 ± 0.00	15.92 ± 0.11	74.89 ± 0.30	5.86 ± 0.03	12.79 ± 0.00	5.51 ± 0.10
63	*Segoise*	10.74 ± 0.23	0.55 ± 0.01	0.04 ± 0.00	0.07 ± 0.01	1.38 ± 0.01	74.81 ± 0.79	8.18 ± 0.11	1.08 ± 0.02	0.28 ± 0.02	0.28 ± 0.01	0.05 ± 0.00	0.06 ± 0.01	12.54 ± 0.21	75.72 ± 0.82	9.25 ± 0.13	8.18 ± 0.02	7.58 ± 0.04
64	*Morisca*	14.96 ± 0.23	0.88 ± 0.01	0.05 ± 0.00	0.07 ± 0.00	2.09 ± 0.01	65.12 ± 0.37	9.60 ± 0.07	0.99 ± 0.01	0.48 ± 0.00	0.24 ± 0.00	0.13 ± 0.00	0.13 ± 0.00	17.84 ± 0.23	66.32 ± 0.38	10.60 ± 0.08	6.26 ± 0.00	9.68 ± 0.03
65	*Tondn di caglan*	16.98 ± 0.24	0.93 ± 0.02	0.13 ± 0.00	0.28 ± 0.00	1.54 ± 0.00	63.43 ± 0.24	12.84 ± 0.05	0.85 ± 0.01	0.38 ± 0.01	0.29 ± 0.01	0.08 ± 0.00	0.06 ± 0.00	19.16 ± 0.26	64.94 ± 0.26	13.69 ± 0.06	4.74 ± 0.00	15.07 ± 0.03
66	*Ganino*	14.32 ± 0.08	1.18 ± 0.02	0.06 ± 0.01	0.12 ± 0.03	1.45 ± 0.02	66.04 ± 0.39	9.69 ± 0.07	0.99 ± 0.01	0.39 ± 0.01	0.28 ± 0.00	0.08 ± 0.00	0.09 ± 0.00	16.39 ± 0.12	67.62 ± 0.34	10.67 ± 0.08	6.34 ± 0.01	9.82 ± 0.00
67	*Surani*	11.49 ± 0.09	0.70 ± 0.01	0.10 ± 0.00	0.24 ± 0.00	1.07 ± 0.00	61.23 ± 0.21	13.45 ± 0.08	1.19 ± 0.01	0.30 ± 0.01	0.24 ± 0.00	0.09 ± 0.00	0.05 ± 0.00	13.09 ± 0.10	62.41 ± 0.20	14.63 ± 0.09	4.27 ± 0.01	11.35 ± 0.02
68	*San fraciso*	12.38 ± 0.19	0.69 ± 0.01	0.13 ± 0.00	0.31 ± 0.00	1.45 ± 0.00	73.98 ± 0.12	5.93 ± 0.01	0.94 ± 0.00	0.31 ± 0.00	0.28 ± 0.00	0.09 ± 0.00	0.09 ± 0.00	14.45 ± 0.19	75.25 ± 0.14	6.87 ± 0.01	10.96 ± 0.00	6.29 ± 0.01
69	*Misn*	11.14 ± 0.05	0.52 ± 0.00	0.04 ± 0.00	0.08 ± 0.00	1.44 ± 0.00	69.45 ± 0.00	10.93 ± 0.01	1.32 ± 0.00	0.28 ± 0.00	0.26 ± 0.00	0.08 ± 0.00	0.04 ± 0.00	13.01 ± 0.04	70.31 ± 0.00	12.25 ± 0.01	5.74 ± 0.00	8.27 ± 0.04
70	*Azappa*	15.15 ± 0.48	1.05 ± 0.04	0.05 ± 0.00	0.07 ± 0.00	2.04 ± 0.02	64.68 ± 0.54	9.26 ± 0.10	1.01 ± 0.01	0.47 ± 0.00	0.24 ± 0.00	0.15 ± 0.00	0.15 ± 0.01	18.00 ± 0.50	66.04 ± 0.58	10.27 ± 0.11	6.43 ± 0.00	9.21 ± 0.04
71	*Giarffa*	14.36 ± 0.15	1.13 ± 0.01	0.09 ± 0.00	0.24 ± 0.01	1.61 ± 0.01	70.53 ± 0.33	7.23 ± 0.05	1.02 ± 0.01	0.42 ± 0.00	0.33 ± 0.00	0.12 ± 0.00	0.08 ± 0.00	16.67 ± 0.15	72.24 ± 0.34	8.24 ± 0.06	8.76 ± 0.02	7.10 ± 0.07
72	*Piangent*	12.48 ± 0.34	0.78 ± 0.02	0.03 ± 0.00	0.07 ± 0.00	1.51 ± 0.02	74.36 ± 0.79	6.31 ± 0.08	0.75 ± 0.01	0.30 ± 0.00	0.27 ± 0.00	0.07 ± 0.00	0.05 ± 0.00	14.44 ± 0.35	75.48 ± 0.82	7.07 ± 0.09	10.68 ± 0.01	8.37 ± 0.08
73	*Gemlek*	13.03 ± 0.20	0.83 ± 0.01	0.04 ± 0.00	0.09 ± 0.00	1.46 ± 0.01	67.51 ± 0.39	10.26 ± 0.07	0.75 ± 0.01	0.34 ± 0.01	0.27 ± 0.00	0.09 ± 0.00	0.05 ± 0.00	15.01 ± 0.20	68.70 ± 0.40	11.01 ± 0.08	6.24 ± 0.00	13.73 ± 0.05
74	*Amigdalolea Nana*	10.31 ± 0.05	0.41 ± 0.00	0.08 ± 0.00	0.17 ± 0.00	1.33 ± 0.01	67.79 ± 0.16	9.75 ± 0.04	0.84 ± 0.00	0.33 ± 0.00	0.26 ± 0.00	0.09 ± 0.00	0.06 ± 0.00	12.18 ± 0.06	68.63 ± 0.16	10.59 ± 0.04	6.48 ± 0.01	11.66 ± 0.01
75	*Basta Morisca*	13.24 ± 0.15	0.87 ± 0.01	0.05 ± 0.01	0.08 ± 0.00	2.02 ± 0.00	60.42 ± 0.04	12.70 ± 0.01	0.86 ± 0.00	0.37 ± 0.00	0.18 ± 0.00	0.11 ± 0.00	0.06 ± 0.00	15.85 ± 0.14	61.54 ± 0.05	13.56 ± 0.01	4.54 ± 0.00	14.75 ± 0.02
76	*Uovo di Piccione (Baruni)*	14.98 ± 0.06	0.76 ± 0.01	0.11 ± 0.00	0.24 ± 0.01	1.54 ± 0.01	66.71 ± 0.12	11.86 ± 0.02	1.12 ± 0.01	0.36 ± 0.01	0.31 ± 0.01	0.07 ± 0.00	0.08 ± 0.00	17.13 ± 0.08	68.02 ± 0.14	12.98 ± 0.03	5.24 ± 0.00	10.58 ± 0.00
77	*Cuco*	12.13 ± 0.12	0.75 ± 0.01	0.05 ± 0.00	0.09 ± 0.00	1.55 ± 0.00	63.36 ± 0.18	13.92 ± 0.04	1.22 ± 0.00	0.42 ± 0.00	0.29 ± 0.00	0.14 ± 0.00	0.07 ± 0.00	14.37 ± 0.12	64.49 ± 0.19	15.14 ± 0.04	4.26 ± 0.00	11.38 ± 0.06
78	*Memeli*	13.41 ± 0.04	0.79 ± 0.00	0.04 ± 0.00	0.07 ± 0.01	1.17 ± 0.00	65.03 ± 0.05	8.76 ± 0.00	0.80 ± 0.00	0.28 ± 0.00	0.21 ± 0.00	0.08 ± 0.00	0.04 ± 0.00	15.02 ± 0.04	66.10 ± 0.05	9.56 ± 0.00	6.91 ± 0.01	10.95 ± 0.07
79	*Moraiolo*	14.63 ± 0.29	0.86 ± 0.02	0.09 ± 0.00	0.21 ± 0.00	1.64 ± 0.04	68.15 ± 0.69	9.81 ± 0.11	0.85 ± 0.01	0.30 ± 0.01	0.23 ± 0.00	0.06 ± 0.00	0.06 ± 0.00	16.77 ± 0.32	69.45 ± 0.70	10.66 ± 0.12	6.51 ± 0.00	11.53 ± 0.03
80	*Ascolana Tenera*	14.74 ± 0.35	1.21 ± 0.03	0.04 ± 0.00	0.09 ± 0.00	1.61 ± 0.01	60.98 ± 0.48	12.45 ± 0.14	0.91 ± 0.01	0.31 ± 0.00	0.19 ± 0.00	0.09 ± 0.01	0.04 ± 0.00	16.84 ± 0.37	62.47 ± 0.51	13.36 ± 0.15	4.68 ± 0.00	13.76 ± 0.05
81	*Jiufeng*	14.52 ± 0.24	0.70 ± 0.01	0.13 ± 0.00	0.25 ± 0.01	1.74 ± 0.00	70.66 ± 0.24	8.72 ± 0.03	0.98 ± 0.00	0.36 ± 0.01	0.25 ± 0.00	0.12 ± 0.00	0.06 ± 0.00	16.93 ± 0.25	71.86 ± 0.26	9.70 ± 0.03	7.41 ± 0.00	8.94 ± 0.10
82	*Codovil*	14.68 ± 0.24	1.39 ± 0.02	0.04 ± 0.00	0.09 ± 0.00	1.41 ± 0.01	73.83 ± 0.93	4.83 ± 0.07	0.88 ± 0.01	0.36 ± 0.01	0.33 ± 0.01	0.07 ± 0.00	0.06 ± 0.00	16.62 ± 0.24	75.64 ± 0.95	5.71 ± 0.08	13.26 ± 0.00	5.50 ± 0.06
83	*Berat*	16.47 ± 0.50	1.81 ± 0.06	0.04 ± 0.01	0.10 ± 0.00	1.33 ± 0.01	56.22 ± 0.48	16.60 ± 0.18	1.06 ± 0.01	0.31 ± 0.00	0.18 ± 0.00	0.07 ± 0.00	0.04 ± 0.00	18.26 ± 0.51	58.31 ± 0.55	17.66 ± 0.20	3.30 ± 0.00	15.60 ± 0.02
84	*Chenggu32*	14.80 ± 0.41	0.88 ± 0.03	0.05 ± 0.00	0.09 ± 0.00	1.30 ± 0.01	53.56 ± 0.52	18.58 ± 0.23	1.16 ± 0.02	0.31 ± 0.00	0.18 ± 0.00	0.09 ± 0.00	0.04 ± 0.00	16.59 ± 0.42	54.71 ± 0.54	19.74 ± 0.25	2.77 ± 0.00	16.09 ± 0.05
85	*Chenggu53*	12.84 ± 0.12	0.63 ± 0.01	0.04 ± 0.00	0.07 ± 0.00	1.28 ± 0.00	55.69 ± 0.16	16.29 ± 0.07	0.95 ± 0.00	0.29 ± 0.01	0.17 ± 0.00	0.07 ± 0.00	0.04 ± 0.00	14.57 ± 0.17	56.57 ± 0.07	17.24 ± 0.00	3.28 ± 0.01	17.20 ± 0.06

All the values in the table are mean ± standard deviation, and there are significant differences in the same column of data through ANOVA test ($p < 0.05$). Significance is not indicated in the table due to the excessive data.

Table 2. Triglyceride profiles of 85 oil samples from olive cultivars grown in Liangshan, China.

		Triglycerides Profiles (%)												
Sample	**Cultivar**	**OLL**	**OLnO**	**PLL**	**POsLn**	**PLP**	**POPo**	**PLO**	**OOL**	**POP**	**OOP**	**OOO**	**POS**	**OOS**
	[M+Na]$^+$ Q1	903.742	903.742	877.77	877.726	853.726	853.726	879.742	905.757	855.74	881.757	907.773	883.773	909.789
	[DG]$^+$ Q3	601.52	603.535	575.504	573.488	551.503	549.488	577.519	603.535	551.503	577.196	603.535	579.535	603.535
	ECN	44	44	44	44	46	46	46	46	48	48	48	50	50
	DBs	5	5	4	4	2	2	3	4	1	2	3	1	2
1	*Picual*	1.73 ± 0.81	3.28 ± 0.55	1.91 ± 0.57	2.08 ± 0.22	0.91 ± 0.89	3.73 ± 0.79	4.70 ± 0.32	9.65 ± 0.44	5.50 ± 0.16	19.88 ± 0.57	36.97 ± 0.91	2.47 ± 0.82	7.19 ± 0.75
2	*Biaocoline*	2.93 ± 0.13	2.57 ± 0.98	3.65 ± 0.96	2.01 ± 0.02	1.47 ± 0.36	2.74 ± 0.19	6.70 ± 0.71	13.90 ± 0.26	5.34 ± 0.69	17.69 ± 0.27	34.28 ± 0.75	1.55 ± 0.85	5.17 ± 0.16
3	*Frantoio*	3.77 ± 0.75	1.75 ± 0.56	5.26 ± 0.01	1.41 ± 0.48	1.75 ± 0.30	1.64 ± 0.57	7.38 ± 0.07	12.82 ± 0.31	4.64 ± 0.18	18.31 ± 0.05	35.68 ± 0.29	1.29 ± 0.80	4.31 ± 0.13
4	*Hojiblanca*	2.80 ± 0.06	2.63 ± 0.24	4.85 ± 0.74	1.68 ± 0.03	1.16 ± 0.65	1.73 ± 0.91	6.40 ± 0.61	12.55 ± 0.79	4.13 ± 0.94	17.91 ± 0.31	36.49 ± 0.18	1.81 ± 0.87	5.87 ± 0.00
5	*Verdale*	3.25 ± 0.19	2.75 ± 0.13	5.83 ± 0.66	1.69 ± 0.85	1.42 ± 0.66	1.36 ± 0.79	6.64 ± 0.31	14.70 ± 0.59	3.54 ± 0.76	17.15 ± 0.82	36.04 ± 0.49	1.26 ± 0.58	4.36 ± 0.43
6	*Garsagvenio*	2.64 ± 0.17	2.81 ± 0.85	5.03 ± 0.19	1.91 ± 0.70	1.10 ± 0.67	1.55 ± 0.82	5.90 ± 0.25	14.32 ± 0.73	3.54 ± 0.03	16.79 ± 0.27	39.08 ± 0.33	1.07 ± 0.13	4.25 ± 0.01
7	*Koroneiki*	1.57 ± 0.76	2.51 ± 0.53	2.41 ± 0.43	1.50 ± 0.31	0.85 ± 0.84	2.07 ± 0.55	4.96 ± 0.27	10.97 ± 0.78	4.11 ± 0.95	19.33 ± 0.49	41.29 ± 0.95	1.83 ± 0.36	6.60 ± 0.74
8	*Pizzacarroga*	5.53 ± 0.59	2.41 ± 0.51	7.52 ± 0.15	1.89 ± 0.40	1.92 ± 0.69	1.84 ± 0.55	8.21 ± 0.40	13.35 ± 0.43	4.27 ± 0.34	16.13 ± 0.94	31.69 ± 0.26	1.24 ± 0.14	4.00 ± 0.49
9	*Rama pendula*	3.37 ± 0.84	2.50 ± 0.25	5.97 ± 0.89	1.56 ± 0.68	1.85 ± 0.41	0.98 ± 0.89	7.72 ± 0.92	13.72 ± 0.77	4.56 ± 0.72	17.37 ± 0.31	33.75 ± 0.89	1.68 ± 0.15	4.96 ± 0.81
10	*Nieda di gonno*	7.02 ± 0.27	0.90 ± 0.82	6.00 ± 0.42	1.39 ± 0.72	3.85 ± 0.09	1.80 ± 0.49	10.16 ± 0.89	13.12 ± 0.85	5.38 ± 0.37	17.77 ± 0.19	27.47 ± 0.11	1.49 ± 0.55	3.66 ± 0.95
11	*Leccino*	1.65 ± 0.75	2.95 ± 0.43	2.12 ± 0.70	1.87 ± 0.15	1.00 ± 0.62	3.34 ± 0.82	4.80 ± 0.41	10.91 ± 0.89	5.34 ± 0.55	18.87 ± 0.98	39.31 ± 0.41	1.88 ± 0.42	5.97 ± 0.75
12	*Cornicabra*	0.93 ± 0.32	3.15 ± 0.77	0.95 ± 0.62	1.91 ± 0.89	0.63 ± 0.87	4.04 ± 0.05	3.22 ± 0.53	7.89 ± 0.27	5.82 ± 0.23	20.02 ± 0.94	40.32 ± 0.60	2.93 ± 0.53	8.18 ± 0.79
13	*Imperial*	6.34 ± 0.10	1.17 ± 0.69	6.80 ± 0.06	1.80 ± 0.65	2.77 ± 0.43	2.80 ± 0.87	7.75 ± 0.29	11.55 ± 0.36	5.14 ± 0.09	16.76 ± 0.82	31.37 ± 0.76	1.65 ± 0.33	4.08 ± 0.79
14	*Sikitita*	5.30 ± 0.33	1.46 ± 0.90	6.21 ± 0.02	1.77 ± 0.91	2.60 ± 0.63	2.38 ± 0.82	7.92 ± 0.77	12.15 ± 0.55	5.42 ± 0.19	17.04 ± 0.82	32.40 ± 0.75	1.41 ± 0.35	3.95 ± 0.24
15	*Macho de jaen*	3.18 ± 0.21	2.28 ± 0.76	5.24 ± 0.29	1.69 ± 0.12	1.27 ± 0.24	1.62 ± 0.66	6.70 ± 0.37	14.17 ± 0.79	4.20 ± 0.68	16.85 ± 0.52	34.61 ± 0.13	2.07 ± 0.09	6.15 ± 0.37
16	*Coratina*	2.20 ± 0.63	2.22 ± 0.69	3.29 ± 0.67	1.69 ± 0.33	1.35 ± 0.03	1.46 ± 0.10	7.30 ± 0.05	13.25 ± 0.90	5.37 ± 0.57	17.83 ± 0.09	35.79 ± 0.82	2.08 ± 0.99	6.20 ± 0.69
17	*Barnea*	5.52 ± 0.79	1.40 ± 0.18	7.23 ± 0.38	0.96 ± 0.35	1.94 ± 0.69	1.44 ± 0.13	6.48 ± 0.36	13.30 ± 0.66	4.08 ± 0.74	16.20 ± 0.01	32.83 ± 0.37	3.08 ± 0.49	5.55 ± 0.67
18	*Frantoio de Corsini*	4.87 ± 0.63	1.70 ± 0.05	4.93 ± 0.72	2.25 ± 0.92	2.23 ± 0.59	2.90 ± 0.53	7.17 ± 0.36	12.09 ± 0.92	5.93 ± 0.45	17.20 ± 0.30	32.42 ± 0.29	1.80 ± 0.76	4.51 ± 0.07
19	*Ottobratica*	4.37 ± 0.07	1.17 ± 0.64	4.60 ± 0.68	1.70 ± 0.01	2.22 ± 0.75	2.36 ± 0.99	6.95 ± 0.18	12.12 ± 0.98	5.86 ± 0.71	17.03 ± 0.75	34.09 ± 0.02	2.08 ± 0.33	5.45 ± 0.96
20	*Dolce di morocco*	4.59 ± 0.63	1.85 ± 0.16	6.03 ± 0.97	1.71 ± 0.43	2.07 ± 0.09	1.77 ± 0.21	7.35 ± 0.23	13.52 ± 0.56	5.22 ± 0.14	16.51 ± 0.29	33.03 ± 0.15	1.78 ± 0.24	4.57 ± 0.90
21	*Rol*	2.79 ± 0.96	2.30 ± 0.55	5.57 ± 0.66	1.35 ± 0.26	1.20 ± 0.28	1.22 ± 0.36	6.08 ± 0.85	15.04 ± 0.59	3.72 ± 0.16	17.57 ± 0.69	36.42 ± 0.38	1.56 ± 0.75	5.18 ± 0.91
22	*Lecln*	2.34 ± 0.48	2.85 ± 0.37	2.87 ± 0.49	2.14 ± 0.74	1.23 ± 0.48	3.16 ± 0.34	5.56 ± 0.36	11.77 ± 0.03	5.76 ± 0.28	17.47 ± 0.04	36.86 ± 0.63	2.23 ± 0.34	5.75 ± 0.86
23	*Acebuche*	2.53 ± 0.90	2.85 ± 0.15	4.04 ± 0.94	1.61 ± 0.43	1.24 ± 0.72	1.23 ± 0.62	5.92 ± 0.04	12.09 ± 0.42	4.26 ± 0.71	18.51 ± 0.27	39.50 ± 0.77	1.56 ± 0.49	4.67 ± 0.78
24	*Rvb*	4.47 ± 0.25	1.68 ± 0.42	5.37 ± 0.62	1.38 ± 0.96	2.03 ± 0.94	1.51 ± 0.51	7.80 ± 0.74	12.28 ± 0.89	5.15 ± 0.54	18.26 ± 0.27	34.05 ± 0.80	1.66 ± 0.30	4.37 ± 0.85
25	*Canino*	3.92 ± 0.13	1.68 ± 0.72	4.68 ± 0.59	1.70 ± 0.08	1.86 ± 0.87	2.49 ± 0.64	6.82 ± 0.48	11.72 ± 0.41	4.90 ± 0.79	18.60 ± 0.86	34.81 ± 0.06	1.85 ± 0.00	4.98 ± 0.59
26	*Yuntai*	1.13 ± 0.42	2.59 ± 0.82	1.20 ± 0.88	1.88 ± 0.34	0.67 ± 0.34	2.49 ± 0.30	4.29 ± 0.54	9.32 ± 0.25	4.93 ± 0.93	19.72 ± 0.62	39.89 ± 0.65	2.95 ± 0.18	8.97 ± 0.41
27	*Zhongze-7*	2.73 ± 0.41	1.93 ± 0.05	2.92 ± 0.07	1.99 ± 0.20	1.31 ± 0.26	2.72 ± 0.74	5.85 ± 0.29	11.97 ± 0.97	5.32 ± 0.16	18.25 ± 0.15	36.64 ± 0.42	2.08 ± 0.57	6.30 ± 0.03
28	*Pico limon*	3.82 ± 0.29	1.46 ± 0.42	6.53 ± 0.30	1.07 ± 0.38	1.61 ± 0.61	1.09 ± 0.23	6.39 ± 0.96	13.78 ± 0.22	3.84 ± 0.40	17.71 ± 0.22	36.84 ± 0.59	1.40 ± 0.21	4.47 ± 0.28
29	*Chemlal de Kabylie*	3.44 ± 0.34	1.35 ± 0.13	3.72 ± 0.25	1.77 ± 0.05	1.63 ± 0.21	2.95 ± 0.08	6.77 ± 0.98	11.46 ± 0.57	5.54 ± 0.71	19.74 ± 0.26	34.04 ± 0.56	1.99 ± 0.91	5.61 ± 0.17
30	*Lechín de Sevilla*	0.69 ± 0.28	3.81 ± 0.60	1.08 ± 0.77	1.89 ± 0.77	0.50 ± 0.80	2.18 ± 0.32	3.61 ± 0.57	10.22 ± 0.50	4.36 ± 0.46	20.12 ± 0.39	43.14 ± 0.44	1.68 ± 0.09	6.71 ± 0.68
31	*Nevlbdly*	1.16 ± 0.50	2.42 ± 0.66	1.06 ± 0.21	1.85 ± 0.67	0.68 ± 0.67	2.80 ± 0.25	4.07 ± 0.73	8.99 ± 0.17	5.03 ± 0.76	20.08 ± 0.91	37.97 ± 0.89	3.69 ± 0.89	10.21 ± 0.74
32	*Arbequina*	5.00 ± 0.48	0.86 ± 0.14	6.29 ± 0.68	1.57 ± 0.81	2.98 ± 0.48	2.38 ± 0.69	7.42 ± 0.71	12.97 ± 0.17	5.59 ± 0.97	17.16 ± 0.58	31.90 ± 0.79	1.85 ± 0.77	4.02 ± 0.80
33	*Kalamata*	1.35 ± 0.39	2.22 ± 0.90	2.70 ± 0.59	1.18 ± 0.14	0.70 ± 0.35	1.35 ± 0.22	4.38 ± 0.97	13.15 ± 0.71	3.55 ± 0.44	19.11 ± 0.02	42.86 ± 0.18	1.42 ± 0.69	6.03 ± 0.58
34	*Arbosana*	2.91 ± 0.64	1.50 ± 0.88	3.08 ± 0.04	1.92 ± 0.35	1.38 ± 0.93	3.72 ± 0.88	5.30 ± 0.12	11.71 ± 0.78	5.82 ± 0.22	18.18 ± 0.92	35.93 ± 0.16	2.44 ± 0.31	6.13 ± 0.27
35	*Togisca*	5.24 ± 0.76	1.34 ± 0.13	5.86 ± 0.33	1.43 ± 0.59	3.05 ± 0.64	1.76 ± 0.01	7.94 ± 0.06	12.57 ± 0.56	5.88 ± 0.70	17.31 ± 0.06	31.46 ± 0.48	1.83 ± 0.28	4.33 ± 0.90
36	*Picholine Languedoc*	2.18 ± 0.65	2.55 ± 0.52	4.11 ± 0.37	1.64 ± 0.47	1.14 ± 0.08	1.39 ± 0.82	5.81 ± 0.23	14.65 ± 0.56	4.33 ± 0.62	17.38 ± 0.34	36.00 ± 0.29	1.78 ± 0.12	7.04 ± 0.08

Table 2. *Cont.*

		Triglycerides Profiles (%)												
Sample	**Cultivar**	**OLL**	**OLnO**	**PLL**	**POsLn**	**PLP**	**POPo**	**PLO**	**OOL**	**POP**	**OOP**	**OOO**	**POS**	**OOS**
37	*XiYou-1*	2.37 ± 0.06	1.65 ± 0.61	3.59 ± 0.27	1.32 ± 0.71	1.18 ± 0.80	1.51 ± 0.98	5.14 ± 0.59	12.60 ± 0.67	4.30 ± 0.68	19.03 ± 0.87	39.47 ± 0.26	1.61 ± 0.67	6.23 ± 0.46
38	*Cobrancosa*	2.99 ± 0.80	2.01 ± 0.04	5.14 ± 0.63	1.38 ± 0.42	1.30 ± 0.83	1.27 ± 0.84	6.36 ± 0.27	13.82 ± 0.57	4.53 ± 0.25	18.13 ± 0.98	34.08 ± 0.78	2.15 ± 0.97	6.85 ± 0.44
39	*Pendolino*	3.53 ± 0.07	1.90 ± 0.32	5.19 ± 0.96	1.44 ± 0.45	1.82 ± 0.06	1.56 ± 0.21	6.78 ± 0.02	14.03 ± 0.14	4.87 ± 0.51	18.26 ± 0.88	34.89 ± 0.19	1.61 ± 0.26	4.11 ± 0.88
40	*Huyete*	1.44 ± 0.29	2.84 ± 0.86	1.69 ± 0.11	1.79 ± 0.13	0.78 ± 0.89	2.97 ± 0.04	4.14 ± 0.24	10.35 ± 0.88	5.07 ± 0.10	19.98 ± 0.82	40.37 ± 0.25	1.89 ± 0.03	6.70 ± 0.60
41	*Mc ssoon*	3.30 ± 0.24	1.83 ± 0.84	6.91 ± 0.71	1.12 ± 0.16	1.33 ± 0.45	1.00 ± 0.66	6.46 ± 0.27	15.12 ± 0.88	3.69 ± 0.80	16.65 ± 0.26	35.40 ± 0.34	1.56 ± 0.82	5.64 ± 0.72
42	*Zhanglin*	2.29 ± 0.79	2.17 ± 0.95	1.70 ± 0.05	2.65 ± 0.89	1.25 ± 0.89	6.97 ± 0.87	4.34 ± 0.08	8.76 ± 0.54	8.67 ± 0.98	18.41 ± 0.95	33.15 ± 0.74	3.36 ± 0.28	6.28 ± 0.11
43	*Leucocarpa Ovoid*	3.43 ± 0.53	1.36 ± 0.44	4.36 ± 0.23	2.32 ± 0.12	1.58 ± 0.70	4.01 ± 0.11	5.39 ± 0.59	12.98 ± 0.32	4.43 ± 0.56	18.41 ± 0.04	36.48 ± 0.04	1.20 ± 0.13	4.05 ± 0.60
44	*Yunza*	4.77 ± 0.97	0.54 ± 0.12	5.86 ± 0.09	1.13 ± 0.03	3.84 ± 0.88	1.63 ± 0.34	8.83 ± 0.09	14.86 ± 0.02	5.58 ± 0.10	17.50 ± 0.23	28.94 ± 0.49	2.12 ± 0.93	4.42 ± 0.26
45	*Ors*	6.15 ± 0.23	2.04 ± 0.03	5.11 ± 0.20	2.01 ± 0.04	2.65 ± 0.04	2.07 ± 0.05	8.46 ± 0.33	8.12 ± 0.07	6.36 ± 0.02	18.26 ± 0.28	31.78 ± 0.66	2.00 ± 0.05	4.99 ± 0.15
46	*San agostino*	6.95 ± 0.06	2.09 ± 0.02	4.89 ± 0.02	2.02 ± 0.02	1.88 ± 0.02	3.01 ± 0.06	6.87 ± 0.21	8.36 ± 0.17	4.89 ± 0.28	17.66 ± 0.49	34.60 ± 0.25	1.63 ± 0.01	5.16 ± 0.08
47	*Telsmani*	8.08 ± 0.16	2.61 ± 0.14	4.06 ± 0.05	1.84 ± 0.02	1.38 ± 0.05	1.55 ± 0.01	6.72 ± 0.31	9.59 ± 0.16	3.91 ± 0.05	18.28 ± 0.34	35.62 ± 0.49	1.41 ± 0.10	4.95 ± 0.11
48	*Cds*	5.98 ± 0.12	2.98 ± 0.03	3.04 ± 0.17	1.88 ± 0.08	1.41 ± 0.08	1.94 ± 0.12	5.85 ± 0.38	8.50 ± 0.17	4.44 ± 0.12	18.87 ± 0.54	38.44 ± 0.93	1.59 ± 0.11	5.10 ± 0.29
49	*Brintian*	7.21 ± 0.05	1.71 ± 0.05	6.62 ± 0.22	1.96 ± 0.07	2.94 ± 0.11	2.31 ± 0.08	8.58 ± 0.42	8.40 ± 0.08	5.44 ± 0.11	17.33 ± 0.35	31.00 ± 0.57	1.98 ± 0.06	4.54 ± 0.22
50	*Round Green*	6.31 ± 0.22	2.23 ± 0.14	3.48 ± 0.35	1.68 ± 0.09	1.50 ± 0.05	2.03 ± 0.07	6.97 ± 0.19	8.39 ± 0.12	4.63 ± 0.08	18.85 ± 0.08	36.16 ± 0.97	1.78 ± 0.13	6.01 ± 0.09
51	*Nabli salfit*	8.08 ± 0.28	1.90 ± 0.03	6.16 ± 0.21	1.54 ± 0.04	2.67 ± 0.08	1.84 ± 0.11	8.27 ± 0.31	8.95 ± 0.23	4.62 ± 0.20	17.43 ± 0.30	33.30 ± 0.30	1.33 ± 0.05	3.92 ± 0.18
52	*Ezhi*	1.87 ± 0.07	2.77 ± 0.06	2.18 ± 0.07	2.70 ± 0.14	1.20 ± 0.05	6.05 ± 0.13	4.78 ± 0.25	5.70 ± 0.07	6.80 ± 0.26	20.37 ± 0.44	38.77 ± 0.61	1.95 ± 0.03	4.86 ± 0.20
53	*Zhongze-2*	8.25 ± 0.39	2.26 ± 0.12	4.96 ± 0.06	1.70 ± 0.06	1.85 ± 0.16	1.59 ± 0.09	6.89 ± 0.05	9.17 ± 0.18	4.19 ± 0.08	17.14 ± 0.53	36.43 ± 0.21	1.40 ± 0.09	4.19 ± 0.08
54	*Zhongshan-24*	7.05 ± 0.11	2.21 ± 0.01	5.42 ± 0.14	2.06 ± 0.03	2.74 ± 0.15	2.40 ± 0.12	7.44 ± 0.16	7.70 ± 0.15	5.91 ± 0.06	17.81 ± 0.20	32.41 ± 0.15	2.18 ± 0.06	4.68 ± 0.16
55	*Zhongze-3*	4.42 ± 0.10	4.47 ± 0.12	3.77 ± 0.10	3.28 ± 0.07	1.86 ± 0.10	4.46 ± 0.32	6.37 ± 0.24	7.40 ± 0.14	6.62 ± 0.07	17.86 ± 0.40	33.02 ± 0.71	2.07 ± 0.07	4.41 ± 0.08
56	*Zhongze-11*	8.12 ± 0.15	1.65 ± 0.01	7.17 ± 0.05	2.01 ± 0.11	3.92 ± 0.19	1.83 ± 0.08	7.83 ± 0.43	7.59 ± 0.27	5.89 ± 0.20	17.44 ± 0.61	30.86 ± 0.84	1.79 ± 0.03	3.90 ± 0.24
57	*Grossane*	5.45 ± 0.06	2.17 ± 0.11	4.24 ± 0.29	2.01 ± 0.03	1.78 ± 0.19	2.63 ± 0.18	6.88 ± 0.16	7.74 ± 0.21	5.68 ± 0.11	18.17 ± 0.40	33.81 ± 0.39	2.78 ± 0.13	6.64 ± 0.23
58	*Royeta de asque*	5.66 ± 0.20	1.96 ± 0.19	3.83 ± 0.03	1.41 ± 0.07	1.40 ± 0.13	1.82 ± 0.18	6.14 ± 0.01	7.99 ± 0.09	4.44 ± 0.16	19.11 ± 0.75	35.27 ± 0.10	2.81 ± 0.05	8.17 ± 0.23
59	*Gordal del somontano*	7.34 ± 0.38	1.51 ± 0.08	4.32 ± 0.16	1.42 ± 0.06	1.79 ± 0.19	1.51 ± 0.15	7.94 ± 0.52	8.61 ± 0.18	5.11 ± 0.09	19.17 ± 0.52	32.96 ± 0.71	2.35 ± 0.10	5.96 ± 0.35
60	*Albarate*	6.31 ± 0.03	1.78 ± 0.05	3.50 ± 0.09	2.01 ± 0.04	1.92 ± 0.08	2.65 ± 0.04	7.13 ± 0.18	8.43 ± 0.06	5.12 ± 0.04	18.62 ± 0.30	35.48 ± 0.28	1.91 ± 0.13	5.14 ± 0.01
61	*Alia*	8.44 ± 0.55	2.13 ± 0.20	5.50 ± 0.50	1.45 ± 0.13	2.07 ± 0.06	2.08 ± 0.09	7.09 ± 0.33	8.83 ± 0.17	4.51 ± 0.16	17.09 ± 0.21	31.76 ± 0.74	2.46 ± 0.06	6.59 ± 0.48
62	*Manzanicco de bierge*	2.87 ± 0.07	2.70 ± 0.06	2.20 ± 0.03	1.86 ± 0.03	1.18 ± 0.02	3.57 ± 0.05	5.16 ± 0.05	6.53 ± 0.25	6.01 ± 0.17	21.34 ± 0.42	37.96 ± 0.23	2.26 ± 0.23	6.36 ± 0.60
63	*Segoise*	5.58 ± 0.14	2.86 ± 0.21	2.46 ± 0.08	1.68 ± 0.04	1.26 ± 0.12	1.81 ± 0.28	5.96 ± 0.04	9.04 ± 0.26	4.22 ± 0.32	19.28 ± 0.62	39.31 ± 0.32	1.35 ± 0.01	5.21 ± 0.26
64	*Morisca*	5.53 ± 0.11	1.85 ± 0.09	4.45 ± 0.21	2.09 ± 0.08	3.02 ± 0.26	2.71 ± 0.22	7.67 ± 0.26	7.70 ± 0.25	6.08 ± 0.26	17.71 ± 0.66	32.18 ± 0.07	2.80 ± 0.07	6.20 ± 0.22
65	*Tondn di caglan*	6.76 ± 0.22	1.38 ± 0.04	5.30 ± 0.09	1.60 ± 0.09	3.01 ± 0.10	2.23 ± 0.07	8.79 ± 0.24	8.36 ± 0.08	6.26 ± 0.17	18.05 ± 0.37	31.21 ± 0.74	2.23 ± 0.12	4.83 ± 0.07
66	*Ganino*	5.04 ± 0.28	1.74 ± 0.10	3.82 ± 0.45	1.74 ± 0.11	2.17 ± 0.00	2.50 ± 0.04	6.60 ± 0.38	7.33 ± 0.19	5.84 ± 0.01	20.36 ± 0.09	36.15 ± 0.96	1.92 ± 0.09	4.79 ± 0.02
67	*Surani*	7.54 ± 0.27	2.02 ± 0.10	6.99 ± 0.13	1.59 ± 0.06	2.91 ± 0.40	1.75 ± 0.21	8.10 ± 0.17	8.57 ± 0.08	5.13 ± 0.15	18.29 ± 0.20	32.29 ± 0.50	1.50 ± 0.18	3.98 ± 0.32
68	*San fraciso*	3.28 ± 0.17	2.57 ± 0.18	2.49 ± 0.17	1.84 ± 0.08	1.43 ± 0.04	2.29 ± 0.00	6.02 ± 0.12	7.81 ± 0.19	5.65 ± 0.19	20.78 ± 0.43	37.66 ± 0.18	2.11 ± 0.03	6.07 ± 0.56
69	*Misn*	6.00 ± 0.15	2.02 ± 0.11	3.75 ± 0.28	1.36 ± 0.07	1.49 ± 0.08	1.24 ± 0.03	6.13 ± 0.31	8.71 ± 0.14	4.25 ± 0.18	20.01 ± 0.52	38.86 ± 0.94	1.51 ± 0.09	4.69 ± 0.16
70	*Azappa*	4.51 ± 0.28	1.62 ± 0.04	4.28 ± 0.26	1.96 ± 0.14	2.41 ± 0.13	2.61 ± 0.07	7.36 ± 0.40	7.34 ± 0.11	6.54 ± 0.24	19.38 ± 0.53	33.13 ± 0.96	2.80 ± 0.09	6.09 ± 0.23
71	*Giarffa*	3.86 ± 0.14	2.31 ± 0.06	3.19 ± 0.20	2.15 ± 0.12	1.42 ± 0.06	3.34 ± 0.04	6.49 ± 0.42	7.75 ± 0.35	6.00 ± 0.09	19.44 ± 0.15	35.56 ± 0.78	2.35 ± 0.14	6.15 ± 0.08
72	*Piangent*	3.51 ± 0.07	1.94 ± 0.06	2.73 ± 0.14	1.64 ± 0.13	1.41 ± 0.07	2.37 ± 0.08	6.13 ± 0.08	8.10 ± 0.20	5.67 ± 0.05	20.11 ± 0.19	38.76 ± 0.38	2.02 ± 0.14	5.62 ± 0.14
73	*Gemlek*	6.43 ± 0.10	1.65 ± 0.02	5.25 ± 0.07	1.75 ± 0.08	2.32 ± 0.06	2.32 ± 0.02	8.20 ± 0.05	9.05 ± 0.12	5.51 ± 0.17	18.02 ± 0.16	33.04 ± 0.04	1.86 ± 0.00	4.60 ± 0.14
74	*Amigdalolea Nana*	6.96 ± 0.07	1.85 ± 0.05	5.03 ± 0.07	1.56 ± 0.03	2.36 ± 0.04	1.43 ± 0.02	8.33 ± 0.29	9.39 ± 0.09	4.75 ± 0.15	17.91 ± 0.12	33.71 ± 0.50	1.80 ± 0.05	4.92 ± 0.41
75	*Basta Morisca*	7.33 ± 0.35	1.33 ± 0.04	6.50 ± 0.40	1.53 ± 0.10	3.36 ± 0.24	1.96 ± 0.08	8.32 ± 0.36	8.38 ± 0.14	5.73 ± 0.20	17.02 ± 0.43	30.01 ± 0.74	2.84 ± 0.06	5.71 ± 0.23

Table 2. *Cont.*

		Triglycerides Profiles (%)												
Sample	**Cultivar**	**OLL**	**OLnO**	**PLL**	**POsLn**	**PLP**	**POPo**	**PLO**	**OOL**	**POP**	**OOP**	**OOO**	**POS**	**OOS**
76	*Uovo di Piccione (Baruni)*	8.78 ± 0.34	2.58 ± 0.02	7.17 ± 0.05	2.43 ± 0.11	2.05 ± 0.13	2.00 ± 0.13	7.38 ± 0.33	8.46 ± 0.54	5.42 ± 0.29	16.88 ± 0.39	30.75 ± 0.07	1.81 ± 0.16	4.32 ± 0.80
77	*Cuco*	7.59 ± 0.48	1.58 ± 0.14	5.98 ± 0.15	1.55 ± 0.05	2.50 ± 0.18	1.56 ± 0.09	7.97 ± 0.30	8.91 ± 0.21	4.92 ± 0.10	17.45 ± 0.48	33.18 ± 0.61	1.84 ± 0.17	4.96 ± 0.27
78	*Memeli*	5.41 ± 0.41	1.55 ± 0.19	5.30 ± 0.12	1.94 ± 0.11	2.72 ± 0.08	2.29 ± 0.04	8.68 ± 0.24	8.33 ± 0.07	7.15 ± 0.29	17.76 ± 0.53	31.15 ± 0.34	2.53 ± 0.09	5.20 ± 0.03
79	*Moraiolo*	5.27 ± 0.16	1.82 ± 0.08	3.61 ± 0.09	1.56 ± 0.03	2.06 ± 0.13	2.00 ± 0.12	6.98 ± 0.18	8.25 ± 0.23	5.67 ± 0.14	18.84 ± 0.08	36.06 ± 0.52	2.37 ± 0.07	5.51 ± 0.11
80	*Ascolana Tenera*	6.88 ± 0.18	1.41 ± 0.05	5.80 ± 0.27	1.79 ± 0.09	2.91 ± 0.06	2.45 ± 0.04	7.52 ± 0.35	7.70 ± 0.11	5.95 ± 0.03	17.76 ± 0.22	32.21 ± 0.63	2.42 ± 0.11	5.21 ± 0.20
81	*Jiufeng*	5.00 ± 0.20	2.51 ± 0.19	3.37 ± 0.03	1.80 ± 0.03	2.02 ± 0.20	2.10 ± 0.20	7.13 ± 0.11	8.28 ± 0.04	5.70 ± 0.06	18.06 ± 0.69	35.06 ± 0.30	2.54 ± 0.06	6.44 ± 0.18
82	*Codovil*	2.56 ± 0.15	2.58 ± 0.10	2.21 ± 0.09	1.92 ± 0.04	0.95 ± 0.02	3.49 ± 0.10	4.17 ± 0.12	6.18 ± 0.04	5.83 ± 0.06	20.90 ± 0.18	40.87 ± 0.03	2.03 ± 0.11	6.34 ± 0.38
83	*Berat*	5.93 ± 0.01	1.32 ± 0.00	5.55 ± 0.28	1.85 ± 0.01	3.72 ± 0.11	2.88 ± 0.02	8.41 ± 0.12	8.24 ± 0.11	6.71 ± 0.02	17.50 ± 0.16	30.92 ± 0.35	2.34 ± 0.05	4.62 ± 0.09
84	*Chenggu32*	7.21 ± 0.13	1.34 ± 0.03	6.62 ± 0.16	1.46 ± 0.13	4.44 ± 0.24	1.74 ± 0.08	9.79 ± 0.51	9.19 ± 0.43	5.67 ± 0.15	17.52 ± 0.40	29.41 ± 0.63	1.77 ± 0.01	3.87 ± 0.10
85	*Chenggu53*	8.50 ± 0.01	1.53 ± 0.10	8.42 ± 0.17	1.78 ± 0.05	3.73 ± 0.21	1.52 ± 0.01	8.01 ± 0.79	7.78 ± 0.21	5.38 ± 0.03	16.61 ± 0.46	31.53 ± 0.51	1.74 ± 0.14	3.48 ± 0.25

All the values in the table are mean ± standard deviation, and there are significant differences in the same column of data through ANOVA test ($p < 0.05$). Significance is not indicated in the table due to the excessive data. P, palmitic; S, stearic; O, oleic; L, linoleic; Ln, linolenic; Po, palm oleic.

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