# The Chemical Composition of Spanish Olive Oil

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THE composition of representative samples of California, Italian, and Tunisian olive oils has been determined previously in this laboratory (OIL & FAT INDUSTRIES II, p. 40 and 110; IV, p. 63). A two-gallon sample of olive oil from the region of Borjas, Spain, which was received two years ago, has recently been examined so that a comparison can be made of the composition of oils obtained from olives grown in different parts of the world. Borjas olive oil is characterized as greenish in color, very sweet, and with a fruity taste; the sample examined having all these properties.

## Characteristics

The more important chemical and physical characteristics are recorded in Table I, and for comparison the characteristics of the other three oils also are given. The methods used were the same as those employed for the examination of the other three oils.

TABLE I

*Chemical and Physical Characteristics of Olive Oil*

| Samples | Spanish Oil | Italian Oil | Tunisian Oil | Californian Oil |
|---|---|---|---|---|
| Specific gravity 25°/25° | 0.9116 | 0.9120 | 0.9131 | 0.9119 |
| Refractive index at 20° | 1.4689 | 1.4690 | 1.4700 | 1.4690 |
| Acid value | 1.8 | 1.8 | 1.9 | 1.5 |
| Iodine number (Hanus) | 83.7 | 84.4 | 86.0 | 85.1 |
| Saponification value | 192.4 | 190.8 | 193.6 | 190.6 |
| Unsaponifiable matter (%) | 0.8* | 1.1 | 0.8 | 1.0 |
| Saturated acids (det'd) (%) | 11.7† | .... | .... | .... |
| Unsatur. acids + unsapon. (det'd) % | 83.4 | .... | .... | .... |
| Iodine No. of unsat. acids + unsapon. | 97.8 | .... | .... | .... |
| Iodine No. of unsat. acids | 97.2 | 94.2 | 103.6 | 94.8 |
| Saturated acids (corrected) (%) | 10.7 | 10.9 | 16.5 | 8.9 |
| Unsaturated acids (corrected) (%) | 83.6 | 83.3 | 77.6 | 85.2 |

*Iodine number 157.9.
†Iodine number 8.7.

The iodine number of the unsaturated acids (97.2) shows that this fraction of the fatty acids consists of oleic acid (iodine number 90.1) and linolic acid (iodine number 181.4). The following percentages were calculated, using these numbers.

| | Percentage composition of unsat. acid fraction | In original oil | Glycerides in original oil |
|---|---|---|---|
| Oleic acid | 92.09 | 77.0 | 80.5 |
| Linolic acid | 7.91 | 6.6 | 6.9 |

The saturated acids were separated by the lead salt ether method from the oil and were esterified in the usual manner with methyl alcohol and dry hydrochloric acid gas. The methyl esters (119.0 g.)

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TABLE II

*Spanish Olive Oil, Saturated Acids*

| | Acids in original oil Per cent | Glycerides in original oil Per cent |
|---|---|---|
| Myristic | 0.19 | 0.2 |
| Palmitic | 8.94 | 9.4 |
| Stearic | 1.34 | 1.4 |
| Arachidic | .23 | 0.2 |

were fractionally distilled under a 4 mm. pressure. The fractions were analyzed, and their compositions were determined as previously described (OIL & FAT INDUSTRIES 2, p. 40).

The results given in Table II were calculated from the analytical data obtained. The acids were recovered from some of the methyl ester fractions by saponifying with alcoholic potash and decomposing the resulting soap with hydrochloric acid. Palmitic, stearic, and arachidic acids were isolated from various fractions by fractional crystallization from alcohol. Their identity was established by their melting points and by observing whether or not these melting points were lowered when the acids were mixed with equal quantities of the respective acids which they were suspected of being, the purity of which had previously been established by elementary analysis. No depression of the melting points was observed in any case.

TABLE III

*Composition of Olive Oil*

| Glycerides of | Spanish oil Per cent | Italian oil Per cent | Tunisian oil Per cent | California oil Per cent |
|---|---|---|---|---|
| Oleic acid | 80.5 | 83.1 | 69.1 | 84.4 |
| Linolic acid | 6.9 | 3.9 | 12.0 | 4.6 |
| Myristic acid | 0.2 | trace | 0.1 | trace |
| Palmitic acid | 9.4 | 9.2 | 14.4 | 6.9 |
| Stearic acid | 1.4 | 2.0 | 2.4 | 2.3 |
| Arachidic acid | 0.2 | 0.2 | 0.3 | 0.1 |
| Unsaponifiable matter | 0.8 | 1.1 | 0.8 | 1.0 |

## Discussion of the Results

The results given in Table I show that the specific gravities, refractive indices, acid values, saponification values, and the percentages of unsaponifiable matter of the four oils differ but little. With the exception of the Tunisian oil, the percentages of the saturated acids range from 8.9 to 10.9; likewise the iodine numbers of these three oils show a maximum difference of only 1.4. The composition of the four oils in terms of glycerides is given in Table III. An examination of these results shows that there is much similarity in composition of the Californian and Italian oils. There has been considerable difference of opinion in regard to the presence of arachidic acid in olive oils from various localities. It will be observed that these four oils contain from 0.1 to 0.3 per cent of arachidic acid. Tänfel and Sari (Anales soc. espan. fis. quin. 1926, 24, 25) examined a Spanish olive oil but were unable to detect arachidic acid.