Summary of Chemical Analysis

Analysis	IOOC limit for EV	Average	Effect	Comments
Common Analysis				
Free fatty acidity	0.8%	0.192% [a] 0.162% [f]	Quality Culinary	• A general measure of oil quality. Oils *correctly processed quickly* after picking from sound fruit will have low FFA. • The higher the FFA > 0.5%, the higher the probability that the oil will have a taste defect. • Oils with low FFA smoke at a higher temperature. • FFA remains stable as the oil ages
Polyphenol level	n/a	260 ppm [a#] 195 ppm [b#] 240 ppm [g#]	Style Culinary Shelf life Health	• In general, the higher the polyphenol level the more bitter and/or pungent (robust) the oil. • Bitterness and pungency are primary determinants of the appropriateness of the oil in cooking. • High polyphenol levels improve shelf life of the oil. • Polyphenols are antioxidants, which are considered to be healthful. • Declines with oil age.
Peroxide Value	20 mEq /Kg	9 meq/kg [d] 6 meq/kg [f]	Shelf life	• Measurement of the active oxygen in the oil. • A high peroxide level in young oils suggests a short shelf life. • PV is difficult to interpret in older oils as its value reduces as the active oxygen is used up and the oil goes rancid. • PV can even reduce with oil age.

Analysis	IOOC limit for EV	Average	Effect	Comments
Fatty Acid Profile				
Major Monounsaturated Fatty Acids				
Oleic acid (C18:1)	55-83%	73.6% [d]	Health Shelf life	• The major fatty acid in olive oil • A high level of this monounsaturated fat considered healthful^ • A high level of this fat favours a good shelf life
Major Saturated fatty acids				
Stearic acid (C18:0)	0.5-5.0%	1.9% [d]	Health Shelf life	• The lower the level the better as this saturated fat is considered to be poor for health. • A very high level suggestive of adulteration with tallow and other animal fats. • A stable oil which positively contributes to shelf life of the oil. • A high level will reduce the melting point of the oil making it solidify in the refrigerator.
Palmitic acid (C16:0)	7.5-20%	12.7% [d]	Health Shelf life Other	• The lower the level the better as this saturated fat is considered to be poor for health. • A very high level suggestive of adulteration with palm oil. • A stable fatty acid which positively contributes to shelf life of the oil. • A high level will reduce the melting point of the oil assisting it to solidify in the refrigerator.
Major Polyunsaturated Fatty Acids				
Linoleic acid (C18:2)	3.5-21%	9.2% [d]	Health Shelf life Adulteration*	• Polyunsaturated fat considered good for health. • Also known as omega-6 fatty acid • Rather unstable fatty acid. High levels contribute to short shelf life. • High levels suggestive of* adulteration with sunflower oil.
Linolenic acid (C18:3)	<1.0%	0.7% [d]	Shelf life Health Adulteration*	• Polyunsaturated fat considered good for health. • Very unstable fatty acid. High levels strongly contribute to short shelf life. • High levels is suggestive of* adulteration with linseed oil.

Analysis	IOOC limit for EV	Average	Effect	Comments
Other Analysis				
Iodine Value		Typical value 80 [b]	Health Shelf life	• High iodine value means that the individual fatty acids that comprise the oil contain a higher average number of double bonds (and therefore a higher proportion of unsaturated fats). • Therefore a high iodine value suggests better healthfulness. • However a very high iodine value suggests a short shelf life.
Saponification value		Typical value 190 [b]	Health Shelf life	• Measures the number of ester bonds in the fatty acid. • A high number of ester bonds suggest that the fat molecule is intact, which suggests that the oil has been properly processed from sound fruit.
Induction Time	None	5.3 hours [b]	Shelf life	• The longer the induction time, the longer the expected shelf life of the oil. • However, as the actual shelf life is dependent on storage conditions no specific relationship between induction time and actual shelf life is possible. However in relative terms all else being equal, oils with longer induction times will have a longer shelf life.
Moisture content			Shelf life	• Oils with high moisture contents (>0.3%) are more prone to rancidity as one of the chemical pathways to oil oxidation relies on the presence of water.
UV absorption at 232nm and 270nm	<2.5 (232nm) <0.22 (270nm)		Quality Shelf life	• A high absorption value indicates that an oil contains high levels of oxidation products. Typified by old or poorly stored oils. Indicates a lack of freshness.
1,2 Diacylglycerides	(non IOC test) > 60% preferable	Fresh EVOO 79%[e] EU s/market 33%[e]	Quality Shelf life	A high proportion of 1,2 diacylglycerides/total diacylglycerides indicates that an oil was made with good manufacturing practice and has been stored correctly.

Analysis	IOOC limit for EV	Average in EVOO	Effect	Comments
Adulteration Analysis				High Levels are **suggestive of*** adulteration with:
Waxes	< 250 mg/kg	45mg/kg (cold climate) to 115mg/kg (hot) [d]	Adulteration*	Olive pomace oil, solvent extracted oil or high leaf content.
UV-absorption 270nm	<0.22		Adulteration*	Refined oil
Pyropheophytins			Adulteration	Refined oil and soft deodorized oil. Also can suggest that the oil was stored in a hot place.
Trans fatty acids	0.05%		Adulteration* Health	Refined oils, soft deodorised oils. Trans-fats are significant contributors to cardiovascular disease.
2-position palmitic acid			Adulteration*	Palm oil and re-esterified oils.
R1 value			Adulteration*	The ratio of campestadiene to stigmastadiene. A high level is indicative of* adulteration with refined seed oils.
Eicosenoic acid (C20:1)	<0.4%		Adulteration	Vegetable (soybean) oil and canola oil..
ECN42	<0.2		Adulteration*	Indicates oils with a high proportion of triacylglycerides containing three linoleic fatty acids i.e. sunflower oil.
Total aliphatic alcohols			Adulteration*	Pomace oil
Fatty acid alkyl esters			Adulteration Quality	High levels indicate that olives were not processed quickly into oil after harvesting. High levels of ethyl esters indicative of soft deodorization.
Stigmastadiene	<0.1 mg/kg		Adulteration*	Refined oils.
Sterols	(% of total)			
Cholesterol	<0.5%		Adulteration*	Animal based fats
Brassicasterol	<0.1%		Adulteration*	Canola oil
Campesterol	<4.0%	2.1-4.5% variety dependent [e]	Adulteration*	High oleic sunflower oil or other seed oils.
Stigmasterol	<campesterol			
δ-7-stigmasterol	<0.5%			
Other sterols^^	>93%			
Erythrodiol and uvaol	< 4.5%		Adulteration	Solvent extracted oils.
Total sterols	>1000 mg/kg			

All data with the exception of Source e 'fresh' samples are from commercially produced extra virgin olive oils.

A 2005-2010 Australian National, Royal Perth, Royal Canberra Extra Virgin Olive Oil Shows (n=2,356). Compiled by R. Gawel –unpublished.
b- 2005 data, New South Wales Department of Agriculture – unpublished (n>200).
c- Australian Olive Oil Association National Olive Oil Survey – unpublished (n>200).
d Mailer (2007) (n=1800)
e Mailer and Ayrton (2008) (n=21 fresh, n=6 EU supermarket)
f Anon (2010) Oli Extravirgini di Oliva di Firenze Selezione 2010 (n=33)
g Gawel and Rogers (2008) (n=327)

#- Measured as caffeic acid equivalents

^- 'unsaturated' refers to fats that contain more than one double bond somewhere in their chemical structure. Monounsaturated fats have health benefits over saturated fats (ones with no double bonds). However polyunsaturated fats (i.e. those with two or three double bonds) such as linoleic and linolenic acid are more prone to oxidation and therefore degrade (go rancid) more quickly.

^^ - β-sitosterol, δ-5-avenasterol, δ-5-23-stigmastadienol, Clerosterol, Sitostanol, δ-5-24- stigmastadienol

*- olive oil is a complex natural product. As such the amount of individual components in olive oil varies. As a result, unadulterated oils may be high in one or more components normally associated with adulteration practices. For example the varieties Barnea and Koroneiki often produce oils that contain naturally high levels of campesterol.

This table should be used only as a guide. While every care was taken in the compilation of this table, the author takes no responsibility for any inaccuracies.