Phenolic content of olive oil is reduced in extraction and refining

Analysis of phenolic content of three grades of olive and ten seed oils.

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These grades of olive oil and ten vegetable cooking oils were analyzed for their phenolic content. It was hypothesised that as olive oil passed through the chemical extraction process, polyphenols would also be removed, thus reducing the antioxidant properties of olive oil. Other commonly used edible vegetable oils were analysed for comparative reasons. Extra virgin olive oil was found to have the greatest amount (48 μg/gram of oil) of polyphenols, when compared with other olive or vegetable oils. No polyphenols were detected in sunflower, walnut, peanut or almond oils. All other oils tested had a polyphenolic content between 2 and 10 μg/g of oil.

The results of the study confirm the above hypothesis that the phenolic content of olive oil is reduced by chemical extraction and refining.

Introduction

The Mediterranean diet, though it can be very high in fat, is associated with a low incidence of coronary heart disease (CHD)1. In the Seven Countries Study, it was found that in Crete 40% of the energy came from fat, yet the incidence of CHD was approximately one-third the incidence of Finland which had a similar level of fat intake2. The fat intake in Cretes was predominantly from olive oil, whereas the fat in Finland was predominantly from animal sources. Olive oil is rich in the monounsaturated fatty acids, oleic. In contrast, animal fat is rich in saturates such as palmitic, myristic and lauric acids.

The saturates from animal sources increase serum cholesterol, whereas unsaturates tend to lower serum cholesterol. An elevated serum cholesterol or more precisely an elevated low density lipoprotein (LDL) is the primary cause of atherosclerosis3. A diet rich in monounsaturated fat has similar efficacy to a diet rich in polyunsaturated fat with regard to lowering serum LDL. A diet rich in polyunsaturated fat may induce a decrease in high density lipoproteins (HDL), whereas monounsaturated fat maintains or increases HDL4.

Nativel olive oil is poorly absorbing, at least experimentally, unless it is modified. In vivo, the modification process appears to be predominantly oxidation5. A diet rich in monounsaturated fat from olive oil has been found to inhibit oxidation of the LDL6. However, Scaccini et al found that the antioxidant effect is not fully explained by the monounsaturated fatty acid content nor by the vitamin E and carotenoids which are in olive oil7.

Olive oil has other components apart from fatty acids, which effect taste, colour and may have significant biological actions. In the “polyfraction” of olive oil there are more than a hundred different compounds, a significant proportion being the phenolic compounds: polyphenols and tocopherols. Phenols are a large class of compounds seen in nature and are molecules with an hydroxyl group attached to a benzene ring. There are over 4000 different phenols found in plants. In olive oil the term “polyphenols” is used by convention because not all of them are polyhydroxy derivatives. There are at least ten polyphenols which are reported to occur frequently in olive oil. (Figure 1).

Figure 1. Common phenolic compounds in virgin olive oil.

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橄榄油经抽提和精制后酚含量减少：三个等级的橄榄油和十种植物种子油酚含量的分析

摘要

作者分析了三个等级的橄榄油和十种植物食用油的酚含量，并将其常用植物油分析的结果相比较。他们假定橄榄油经化学抽提后多酚被除去，因而降低了橄榄油的抗氧化性。作者发现特别纯的橄榄油，与其它橄榄油和植物油比较，含有最大量的多酚（每克含48毫克）。除茶花油、胡桃油、花生油和杏仁油检测不到多酚外，所有其它油酚含量每克在2～10毫克之间。作者证实了上述的假定，橄榄油经化学抽提和精制后酚含量减少。

引用


The polyphenolic content of olive oils affects the stability of the oil and there is a strong antioxidant effect according to the amount in the oil. They also have a significant effect on flavour.

Polyphenols also inhibit oxidation (lag phase) of LDL and may stimulate antioxidant enzymes such as catalase. Phenolic compounds may inhibit eicosanoid metabolism, have antiplatelet effects and may increase HDL. Antifungal and anticarcinogenic properties have also been reported. The phenols; Butylnated hydroxyanisole (BHA) and butylnated hydroxytoluene (BHT) which have significant anti-oxidant properties inhibit experimental atherosclerosis. Other phenolic compounds have been shown to have a vasodilator action and phenols may inhibit ischaemia and reperfusion arrhythmias. Recently, the Zutphen Elderly Study was reported to show flavonoid intake significantly inversely associated with mortality from CHD (p=0.015). The risk relative of CHD mortality in the highest versus the lowest tertile of flavonoid intake was 0.42 (95% CI 0.20-0.88). In olive oil 3,4-dihydroxyphenyl-ethanol (hydroxytyrosol) probably is the most important phenol responsible for the highest oxidation resistance of the oil. In addition, hydroxytyrosol purified from olive oil has been shown to inhibit oxidation of LDL in vitro.

### Methods

The oils were commercially produced. The polar fraction of the oils was extracted by a methanol-water mixture. This was evaporated in a rotary evaporator, the residual was dissolved in ethanol and spectrophotometric determination was made according to the method of Gutfinger.

### Results and discussion

There was a significant difference in polyphenolic content in the three grades of olive oil (Table 1). With refining, the polyphenolic content decreased significantly and there was also fewer polyphenols in the nut and seed oils. The extra virgin olive oil had significantly more polyphenols than the other oils and four of the other oils had no detectable phenols. Clearly, the phenolic content in commercially available edible oils varies considerably, with the highest content being in extra virgin olive oil in this study. The amount found in our study is considerably less than in the Papadopoulos study and this is not explained. The amount of polyphenol in oil depends upon the conditions in which the oil is extracted from the fruit. For example, a continuous centrifugal system of extraction may reduce the amount of phenols in the oil compared to classic pressing. Also in the refining process longer mixing times lower polyphenolic content of oils. In contrast higher temperatures increase polyphenolic content. The nut and seed oils analysed in our study had little or negligible polyphenolic content and this may relate to the extraction process rather than the presence in the nut itself.

### Table 1. Polyphenolic contents of olive oils and other seed oils

<table>
<thead>
<tr>
<th>Oil</th>
<th>Description</th>
<th>Total Polyphenol (µg/g oil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olive - extra virgin</td>
<td>Giralda, Spain</td>
<td>48</td>
</tr>
<tr>
<td>Olive - extra light</td>
<td>Giralda, Spain</td>
<td>11</td>
</tr>
<tr>
<td>Olive - cold pressed</td>
<td>Bertrolli, Italy</td>
<td>10</td>
</tr>
<tr>
<td>Macadamia</td>
<td>Aussie Mate, Aust.</td>
<td>9</td>
</tr>
<tr>
<td>Avocado</td>
<td>Australia</td>
<td>6</td>
</tr>
<tr>
<td>Sesame</td>
<td>Procto, Australia</td>
<td>4</td>
</tr>
<tr>
<td>Canola</td>
<td>Meadow Lea, Aust.</td>
<td>4</td>
</tr>
<tr>
<td>Soya</td>
<td>Top Cook, NZ</td>
<td>4</td>
</tr>
<tr>
<td>Grapeseed</td>
<td>Azalea, Italy</td>
<td>2</td>
</tr>
<tr>
<td>Sunflower</td>
<td>Meadow Lea, Aust.</td>
<td>0</td>
</tr>
<tr>
<td>Peanut</td>
<td>Chefol, Australia</td>
<td>0</td>
</tr>
<tr>
<td>Walnut</td>
<td>Rougie, France</td>
<td>0</td>
</tr>
<tr>
<td>Almond</td>
<td>Expeller pressed, Hain USA</td>
<td>0</td>
</tr>
</tbody>
</table>

### References


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### 橄欖油經抽提和精製後酚含量減少：

### 三個等級的橄欖油和十種植物種子油酚含量的分析

摘 要

作者分析了三個等級的橄欖油和十種植物食用油的酚含量，並與其它常用植物油分析的結果相比較。他們假定橄欖油經化學抽提後多酚被除去，因而降低了橄欖油的抗氧化性。作者發現特別純淨的橄欖油，與其它橄欖油和植物油比較，含有最大的多酚（每克油含 48 微克）。除茶花油、胡桃油、花生油和杏仁油測到不夠多外，所有其它油酚含量每克在 2～10 微克之間。作者證實了上述的假定，橄欖油經化學抽提和精製後酚含量減少。

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酚類指揮抽提和精製後酚含量的比較

### 參考資料