Monitoring changes in antioxidants compounds in Olive oil related to ahead and after heat treatment and adding Vitamin E

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Abstract

The goal of this study is to compare different samples of olive oil (extra virgin olive oil, virgin olive oil), monitoring changes in the antioxidant compounds content ahead and after heating treatment in 180^0C. There are 10 samples of olive oil that are analyzed, primarily control samples, the samples after heating at 180^0C and the third group of samples are olive oil samples added vitamin E and heated at the same temperature and the same time for around 4 hours. The data shows that samples of heat treatment have meaningful differences in the content of antioxidants in olive oil. A corresponding trend of differences is found between samples of heat treatment and samples of added vitamin E and heated also. The most changes are observed between the control samples and the heated (at 180°C) samples of virgin olive oil than extra virgin olive oil. Furthermore, the study indicated that adding vitamin E in samples before heating treatment increase the concentration of antioxidant compounds by oxidative stability of vitamin E.

Keywords: antioxidants, extra virgin olive oil, virgin olive oil, vitamin E.

Introduction

Olive oil, especially extra virgin olive oil, is the major source of fat in the Mediterranean diet that has appreciative healthiness benefits. The reason for this attribution is predominantly the lower content of saturated fatty acids (SFAs) and the higher content of polyphenolic compounds.

Different conditions, especially the temperature and the time of heat processing, can influence the quality of olive oil as fatty acid composition, polyphenols, tocopherols, and carotenoids [2, 3]. The type of oil correspondingly influences the changes in oil and its stability during heat treatment due to difference in quality. Saturated fatty acids are more stable than unsaturated fatty acids, and similarly mono-unsaturated fatty acids (MUFAs) are more stable when compared to poly-unsaturated fatty acids (PUFAs) [4]. The advantage of olive oil is the higher content of oleic acid (MUFA), and this property gives olive oil a advanced position of oxidative stability than that of other edible oils with a higher content of PUFAs. Extra virgin olive oil has the additional advantage of high levels of polyphenols, tocopherols, and carotenoids than refined olive oil [1, 5, 6]. Their content is influenced by olive variety, climate, and crop conditions, as well as agronomic and technologic factors [7, 8]. Olive oil, especially extra virgin olive oil, is considered beneficial for the health of consumers due to the presence of phenolic compounds, such as hydroxytyrosol (which improves radical stability) and oleuropein.

Method

Heat treatment of olive oil samples

The samples (n = 10) used in the test corresponding of extra virgin olive oils and (n = 7) and virgin olive oils (n = 3). The olive oil samples are packed in glass bottles. Part of the olive oil sample are taken to serve as a control sample without heat treatment. The remainder of the olive oil sample (20 mL) was heated in open glass tubes at 180°C, in a professional oven. The other group of samples are control samples added vitamin E (400unite\10ml olive oil).The heat treatment lasted for 4 hours. The samples are allowed to cool for 20 min and then assaying antioxidants compounds as polyphenols, chlorophyll and carotenoids.

Antioxidant profile

Chlorophyll, carotenoid, and polyphenol contents are measured in the samples of olive oil before (control samples), after heating at 180°C and after adding vitamin E plus heating at 180°C\4 hours.

Carotenoid, polyphenol, and chlorophyll contents are estimated on an Instrument spectrophotometer. The wavelength for calculating carotenoids is 481 nm. The cuvettes are rinsed with n-hexane to avoid mixing of samples. The carotenoid contents are expressed as β-carotene. The quantification is done according to the extinction coefficient and the results were expressed as mg/kg [9].

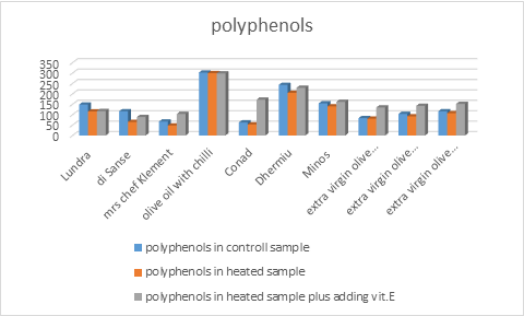
The polyphenol contents are determined by method using the Folin–Ciocalteu reagent at a reading absorbance of 765 nm. The procedure included the use of the Folin–Ciocalteu reagent preliminarily diluted with distilled water and sodium carbonate. The incubation of the olive oil sample mentioned chemicals, and distilled water is done in the dark and lasted for 2 hours. Results are expressed as caffeic acid coequals (mg/kg) [10].

Chlorophyll contents are measured and calculated at the wavelengths of 668 nm. The samples are not diluted, and the cuvettes are rinsed with n-hexane. Results are expressed as pheophytin (mg/kg) [11].

Results and decisions

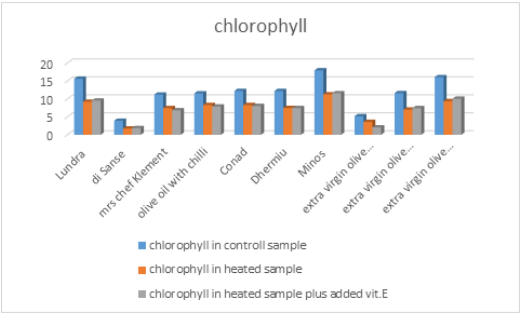
This correlation is maintained throughout the thermal degradation process, proving a major content of phenolic compounds in the extra virgin olive oil.

Antioxidant profile changes in olive oil samples ahead and after heating are shown in graph. 1, 2 and 3. The trend of reducing chlorophyll, carotenoids, and polyphenols contents can be easily seen. The differences between the three groups of samples can also be observed between olive oil samples heated at 180°C.



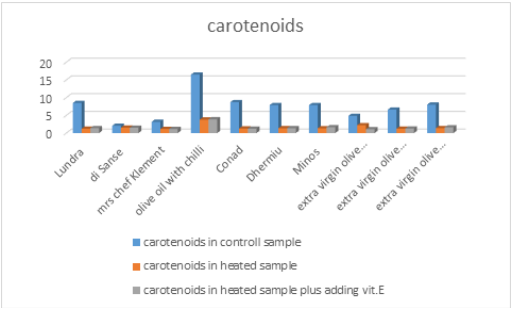
Graf. 1. The concentration of polyphenols in control sample, in heated sample, in heated sample plus vit. E.

Sample no. 4 (olive oil with chilly) has a high level of polyphenols and the value did not change after heating, this mean that oxidative stability is in good conditions to cover the oxidation of polyphenols in the sample. The samples added vit. E have progressive values than the heated samples without vit. E, because of the antioxidant property of vitamin E.



Graf. 2. The concentration of chlorophyll in control sample, in heated sample, in heated sample plus vit. E.

The chlorophylls are responsible for the characteristic green color of the olive fruits and their products. In this case the values of chlorophyll is decreased after heating process in all samples.



Graf. 3. The concentration of carotenoids in control sample, in heated sample, in heated sample plus vit. E.

Olive oils contain a relatively rich variety of carotenoids (β-carotene, lutein, violaxanthin, neoxanthin, and other xanthophylls). By the graph is clear that the values of carotenoids before and after the heat treatment are significant different, so they are damaged by the thermal process. Also in this case the added vitamin E has a positive role to protect the antioxidants by the thermal treatment.

Conclusions

The changes in antioxidant compounds (chlorophyll, carotenoids, and polyphenols) after and ahead the heating treatment show reduction, especially among samples heated at 180°C (in both extra virgin and virgin olive oil samples).

Recommendations

The recommendation is to be more studies about heat treatment of olive oil and to measure the changes in the profile of fatty acids due to repeated heating cycles to see the changes.

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