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Evaluation of Changes in Fatty Acid Composition in Three Different Varieties of Olives During the Course of Maturation

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ABSTRACT: Olives belong to the family of olea europaea L. is a popular fruit tree. The fruit and the oil extracted from it is consumed worldwide particularly in the Mediterranean regions. In this study changes in the fatty acid composition of the oil extracted from olive fruit during the course of maturation is investigated. This work is concerned with the best harvesting point when oleic acid the predominant fatty acid reaches its maximum concentration. Three different varieties of olives from Fars province were chosen and subjected to oil extraction. The quantitative and qualitative determinations concerned with the fatty acids were carried out on the oil and concluded that maturation of olives depending on the variety played an important role in the fatty acid composition of the extracted oils.

Keywords: *Fatty Acid Composition, Olive, Olive Oil.*

Introduction

Olives belong to the family of olea europaea L. is a tree fruit product harvested between November and March in the Mediterranean regions. Due to the popularity of this fruit and the oil extracted from it, the areas under cultivation has been increased not only in the Mediterranean regions but in other part of the world, particularly middle east and to some extent, Iran. The moderate to high oil content of the fruit, the fatty acid composition, presence of alpha– tocopherol as a primary antioxidant and a potent vitamin E, presence of phenolic compounds, Such as caffeic acids, homovanillic acid, tyrosol, hydroxyl tyrosol and P-hydroxy phenyl acetic acid make this fruit and its extracted oil quite nutritious, popular and healthy.

The fruit contains 47-57% water, 11-28% oil, 1.2-2% protein, 19-20% carbohydrate, 5-9% cellulose and 1.7-2% ash (Hui, 2005).

The estimated amount of olive oil produced in the world in 2009 was 2881500 ton while Iran contributed a small fraction of the mentioned quantity (3000 ton). The consumption of olive in the world during quoted year was approximately 2839000 ton while the consumption in Iran was 7000 ton meaning 435 gr oil was consumed per person in the world while this figure was reduced to 120 g per person in Iran (IOC standard 2009). Olive fruit and particularly olive oil contain high concentration of oleic acid which constitute a high concentration of triolein in the oil (40-59%). Therefore the oil

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might be regarded and included in high oleic acid oils (Patumi, 1999). The nature of the oil and its chemical and physical characteristics contribute important roles not only in the nutritional and health benefit of the oil but also in its preservation and stability. Therefore the aim of this study is to evaluate the changes in the fatty acid composition of the oil extracted from three different varieties of olives during the course of maturation, since the results might provide useful information's concerned with the best harvesting point where oleic acid has reached its maximum concentration.

Materials and Methods

Three different varieties of olives (Arbeqina, Zard and Koroneiky) were collected from olive garden located in Shiraz, Fars province. The sampling was preformed for four successive months. 2 kg of samples were collected from south, north, east and west of trees and were sent to the laboratory for further analysis within 24 h. Ripening index was determined by colour index coefiecient according to Servili *et al* (2002) according to the following formula;

$$\sum (i \times ni)/ N$$

Where
i = 0 number of fruit with 100% greenness
i =1 number of fruit with 50% colour change
i=2 number of fruit with more than 50% colour change
i=3 number of fruit with more than 100% colour change
i=4 number of fruit with meaty part of fruit which has changed colour

Therefore as the colour changes increase, the colour index become greater, showing the increased ripening.

Cold pressing was applied to extract the oil for further analysis. Fatty acid analysis and determination were carried out by preparation of methyl ester followed by the application of methyl esters to a GC apparatus equipped with CPSill 88 capillary column and Flame Ionization Detector according to IOC standard method number Co1/T.20/Doc.24

SPSS software and Duncan test were used for the statistical analysis of the results.

Results and Discussion

Table 1 shows the oil concentration in the olive fruits under the investigation at different intervals prior to the harvesting and maturation.

The results indicated that at fruits maturation point the oil content reached its maximum concentration. The Arbeqina variety had the highest amount (30%).

Table 1. Oil content (dry weight bases) of three varieties of olives during maturation (%)

Name of variety	Harvesting dates	Oil (%)
Arbeqina	06.05.1388	6.0
	05.06.1388	10.0
	06.07.1388	15.3
	22.08.1388	30.0
Zard	06.05.1388	7.0
	05.06.1388	8.5
	06.07.1388	13.0
	22.08.1388	18.5
Koroneiky	06.05.1388	6.0
	05.06.1388	6.5
	06.07.1388	11.5
	22.08.1388	19.0

Tables 2, 3 and 4 show the fatty acid composition of the three varieties examined. The Arbeqina variety presents a drastic increase in oleic acid content with a significant fall in the concentration of linoleic and linolenic acids, which indicate a significance difference during the course of maturation. Saturated fatty acids had the least variations in their concentrations.

Koroneiky variety (table 3) has similar pattern but higher concentration of oleic acid and lower concentrations of linoleic and linolenic acids are obtained. Vossen (1997) has stated similar pathway indicating that linoleic acid content as well as the viscosity of the oil are reduced during the course of maturation

Zard variety (table 4) shows a different pathway as compared to other two varieties and the concentrations of both oleic and linoleic acids did not alter greatly during the course of maturation and final harvesting.

Table 2. Fatty acid composition of oil extracted from Arbeqina olive variety during maturation (%)

Arbeqina	**Harvesting dates**			
Fatty acids	06.05.1388	05.06.1388	06.07.1388	22.08.1388
C14:0	0.1	trace	trace	trace
C16:0	12.7	12.8	17.2	12.6
C16:0	1.1	0.8	1.5	1.1
C17:0	0.1	0.0	0.1	0.1
C17:0	0.1	0.1	0.2	0.2
C18:0	3.2	3.0	2.7	2.2
C18:0	48.4	58.4	58.6	67.9
C18:0	27.0	21.8	15.9	13.6
C18:0	4.2	1.6	1.5	0.8
C20:0	0.6	0.3	0.6	0.5
C20:0	0.4	0.5	0.4	0.3
C22:0	0.4	0.3	0.4	0.1
Other	1.2	0.0	0.3	0.2

Table 3. Fatty acid composition of oil extracted from Koroneiky olive variety during maturation (%)

Koroneiky	**Harvesting dates**			
Fatty acids	06.05.1388	05.06.1388	06.07.1388	22.08.1388
C14:0	0.1	0.0	0.0	Trace
C16:0	11.0	9.8	20.9	14.6
C16:1	0.5	0.4	1.3	1.0
C17:0	0.8	0.0	0.0	0.0
C17:1	0.0	0.0	0.0	0.0
C18:0	3.9	4.5	4.7	2.7
C18:1	45.0	55.1	63.5	74.3
C18:2	30	24.9	6.1	5.1
C18:3	5.7	2.0	0.7	0.8
C20:0	2.1	0.2	1.1	0.5
C20:1	0.4	0.6	0.4	0.3
C22:0	0.4	0.4	0.3	0.1
Other	0.4	0.4	0.4	0.1

Table 4. Fatty acid composition of oil extracted from Zard olive variety during maturation (%)

Zard	Harvesting dates			
Fatty acids	1388/5/6	1388/6/5	1388/7/6	1388/8/22
C14:0	Trace	Trace	0.02	Trace
C16:0	15.07	19.03	16.7	17.8
C16:1	0.66	1.29	1.47	1.49
C17:0	0.19	0.06	0.07	0.06
C17:1	0.01	0.09	0.08	0.07
C18:0	3.45	2.98	3.12	3.21
C18:1	49.7	52.5	52.7	50.3
C18:2	23.3	19.98	27.7	24.8
C18:3	5.84	3.09	1.43	1.18
C20:0	0.19	0.41	0.69	0.56
C20:1	0.49	0.38	0.36	0.25
C22:0	0.39	0.15	0.2	0.16
Other	0.71	0.04	0	0.12

Hashempour (2010) reported the fatty acid composition of Zard variety which was harvested in Kazeron region and found that oleic (52.9%), linoleic (24.74%), palmitic (17.20%), stearic (1.91%), linolenic (1.45%) and palmitoleic (1.04%) acids in the mentioned respective decreasing order.

Jamalizadeh (2009) investigated the concentrations of stearic, oleic and linoleic acids in Zard variety during maturation and reported a decrease in oleic and increases in the concentrations of both stearic and linoleic acids. It therefore might be concluded that the variety, maturation period, harvesting point, zone and region, methods of cultivation, nursing, the climatical conditions are regarded among the factors which are important in the fatty acid composition and changes. Therefore apart from fatty acid profile, odour, taste, concentration of the phenolic and polyphenolic compounds which might provide unique characteristics to the oil and are important in terms of nutrition and consumers acceptance might be altered in respect of mentioned factors.

Conclusion

Maturation of olives, depending on the variety play an important role in the fatty acid composition of the extracted oil. Oleic acid the predominant fatty acid in olive oil has been increased considerably in two out of three varieties of olives collected and examined in Fars province.

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