Egypt. J. Agric. Res. , 72 (2), 1994.

EFFECT OF THE PERIOD BETWEEN OLIVE HARVESTING AND OIL PRODUCTION ON THE QUALITY OF OLIVE OIL

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(Manuscript received 20 March 1991)

Abstract

Olive oil extracted from picual variety was physically and chemically evaluated. Fatty acid composition, hydrocarbons and sterols content, and stability were studied. The effect of time elapsed after fruit horvesting till pressing on the above mentioned properties of olive oil was also investigated. Results indicated that the values of refractive index, iodine value total unsaturated fatty acids and the ratio of total unsaturated total saturated fatty acids were decreased in the oil samples extracted after storge compared to the fresh sample. More over peroxide value, total saturated fatty acids were increased in the oil extracted from the stored sample.

The period elapsed from fruit collecting till pressing affect the acidity where it increased sharply from 0.66 to 10.35. Also squalene relative percentage was increased from 66.227 to 78.35. And B sitosterol was the major sterol.

INTRODUCTION

Olive oil is becoming one of the most important oils in Egypt. It is used almost in edible purposes as a cooking and salad oil. It is also used in soap manufacture and for production of textile oil and sulfonated oils (Swern, 1979).

As it is known, the quality of olive oil greatly depends on its degree of acidity which should be below 3.3% to be used in food. Moreover, within the limits of 3.3% olive oil is graded to commercial categories. Several factors are responsible for the remarkable development of acidity especially under the production conditions pre-

vailing in Egypt. Hence, resolution of this problem requires systematic approach.

Several inestigators reported the properties of olive oil such as Ratini (1961), Gracian (1967), Rovesti, 1968; Gega (1971) , Gattuso *et al* . (1972), El - Qadi (1976) , Lamparelli and Interesse, (1977), Ismael (1982) and El - Sharkawy *et al.* (1984). It was found that olive oil had the following properties. refractive index at (25^{o}C), 1.4660-1.4697, acid value 0.3-4.0, iodine value 78.0-88.7. The fatty acid composition of some olive varieties was studied by Ratini (1961), Colakoglu (1972), El Qadi (1976) , Ismael (1982) and El - Sharkawy *et al* . (1984). In addition the unsaponifiable matter compounds which play an important role in olive oil quality were studied by Ciusa, *et al.* 1968 and 1970, Itoh *et al.* 1973, El - Qadi (1976) . Ismael (1982) , Khalil (1982) and El - Sharkawy *et al.* (1984).

Recently the stability of fats and oils discussed by Bailly (1951) , Thompson (1960) , Valintinis and Romani (1960), El - Qadi (1976), Montefredine and Testa (1964) and Ismael (1982).

Therefore, this work aims to investigate the effect of time elapsed from fruit horvesting till pressing on the quality of olive oil by studing the physico-chemical properties, fatty acid composition , hydrocarbons and sterols and stability of olive oil through following the peroxide and acidity in oven test.

MATERIALS AND METHODS

Materials :

Ripe olive fruit (picual variety) was purchased from a private farm at El - Fayoum Governorate at November 1989. The samples was divided into two groups as follows : The first is the fresh as a control, while the second were stored for 21 days in plastic cage at room temperature.

Methods:

Whole fruits were ground in cracker , packed in a cheese cloth and pressed in a hydraulic laboratory carver press. The pressure was gradually increased to 300

kg/cm^2. The obtained juice was collected and left to separate the oily layer which was washed several times with cold water , dried, filtrated and kept in brown glass bottles at-10°C till analysis.

Analytical methods :

Refractive index at 25°C, free fatty acids (as oleic acid percent) , peroxide value (as milliequivalent / kg oil), and iodine value were determined according to methods described by the A. O. C. S. (1964).

Preparation of the fatty acid methyl esters :

The methyl esters of olive oil was prepared using benzene: methanol : concentrated sulfuric acid (10:86:4) and methylation was carried out for one hour at 80-90°C according to Stahl (1967).

Identification of the fatty acids methyl esters :

Gas - liquid chromatography apparatus (A Pye- unicam model 4550) was used. The conditions used were identical to those reported by Ismael (1989). Peak areas were measured using spectrophysic integrator.

Separation and Identification of unsaponifiable matter by G.L.C.:

The unsaponifiable matter were extracted after saponification of oil at room temperature according to the method described by Mordert (1968).

Measurement of stability .

Oven test:

The oven test method suggested by Thompson (1960), was adopted for checking the stability of olive oil samples.

As oil sample (50 gm) was placed in a 250 ml beaker covered with a watch glass and incubated at 63±1 untill rancidity took place. Rancidity was periodically assessed every 48 hours by determining the peroxide value and the % acidity.

RESULTS AND DISCUSSION

The results in Table 1 reveal that the refractive index and iodine value were decreased in the oil of the fruits which were stored for a period . The peroxid number of the oil produced from fresh fruit was 6.4 meg. /kg. oil while that of the oil produced from fruit which were stored for a period has peroxide number of 6.9 meg/kg. oil . This means that the oil produced in the two cases has nearly the same peroxide number.

Concerning the acidity , the results in the same table show an increase in the acidity from 0.66% to 10.35% (as oleic acid); it should be stated here that the acid value should be considered as one of the constants characterising edible oils specially the olive oil since it is generally affected by various factors related to both hydrolysis and oxidation of the oil.

These result revealed that olive oil produced from the fruits which were stored for a period has acidity more than (3.3%) while it must be lower to be used in human foods. The oils having higher percent could be used in industry. Therefore the production of this oil should be operated under specific conditions by which the oil is not subjected to enzymatice hydrolysis.

Arranging olive fruits to form a relatively high number of layers in the plastic cage result in bad storage conditions in cencern to temperature, poor air circulation, and growth of molds. Such conditions activate the lipase (in the fruit) and from molds . As a result, the acidity increased from 0.66% (oil extracted directly from fresh fruit) to 10.35% forthe oil extracted from the stored fruit.

The results in Table 1 also show that the olive oil extracted from fresh fruit contains low amount of saturated fatty acids, while the unsaturated fatty acids represented 81.51% of total fatty acids, The major saturated fatty acid was palmatic acid, while oleic acid was the predominant unsaturated acid followed by linoleic lowest unsaturated fatty acid was the linolenic acid. These results agree with the findings of Wolff (1968) and Swern (1979).

Results also show that the ratio of the total unsaturated fatty acids/total saturated fatty acids (Tus/Ts) were decreased in the oil sample extracted from fruit which left for a period of time prior to pressing. These changes can be due to the effect of improper temperature and growth of molds which might activate the hydro-

Table 1. Effect of the period between harvest and oil production on the physical , chemical properties and fatty acids composition of olive oil.

Characteristics	Picula variety	
	oil from fresh fruits	Oil from Storted fruits
A - Properties:		
Refractive index at 25°C	1.4692	1.4685
Iodine value	83.24	81.93
Acidity (% oleic)	0.66	10.35
Peroxide value meg./kg.	6.4	6.9
B - Fatty acid composition (%)		
$C_{12:0}$	0.061	0.122
$C_{14:0}$	0.079	0.622
$C_{16:0}$	16.417	18.768
$C_{18:0}$	1.927	2.191
Total saturated (Ts)	18.484	21.70
$C_{16:1}$	1.953	1.918
$C_{18:1}$	71.681	69.514
$C_{18:2}$	7.386	6.250
$C_{18:3}$	0.495	0.615
Total unsat. (Tus)	81.515	78.297
Tus / Ts ratio	4.41	3.608

lytic enzymes in the fruit , and this could be supported by the decrease in iodine value as mentioned above. Such findings agree with the results of El Sharkawy *et al* . (1986) and El Agamy (in press).

The effect of the period elapsed from fruit collecting till pressing on hydrocarbons and sterols compounds fraction of olive oil of picual variety is shown in Table 2. From these results it can be noticed that the squalene represents the major hydrocarbon compound in the olive oil samples obtained either from fresh or stored fruits. On the otherhand the results show that the squalene content was increased from 66.227% in fresh fruit oil to 78.35a% in the olive oil from stored fruit. This increase may be due to the decrease in the other components such as C_{22}, C_{28} , C_{30} during storage of fruits.

As for sterol fraction data in Table 2 indicated that B sitosterol which was the major sterol compound in olive oil samples decreeased from 10.825% to 9.72% due to fruits storage.

Table 2. Effect of the period between olive harvesting and oil production on hydrocarbons and sterols content of oil (%)

Compound	Retention time	Oil from fresh fruit	Oil from stored fruit
C_{20}	0.321	1.335	2.143
C_{22}	0.363	5.549	0.699
C_{24}	0.410	0.926	3.666
C_{28}	0.562	6.775	0.671
Squalene	0.686	66.227	78.354
C_{30}	0.720	3.341	2.839
Campsterol	0.876	2.249	1.906
Stigmasterol	0.912	2.773	-
B sitosterol	1	10.825	9.772

Stability of the oil by oven test:

The changes occurred in the peroxide values and acidity of oil during its storage in an oven was a measure of its stability , concerned values appear in Table 3 and are graphically illustrated in Fig. 1. it is evident that olive oil extracted from fresh fruit had an induction period of 11 days while the olive oil extracted from stored fruit had an induction period of 10 days. This decrease in stability may be due to storage of fruits. Concerning the acidity , it is clear that the oil extracted from stored fruits showed more remarkable increase in acidity it increased from 10.35 to 15.69 but the oil extracted from fresh fruit increased from 0.66 to 1.53 this remarkable increase in the first sample may be attributed to the ezymatic hydrolysis of the oil by molds.

It is recommended that olive oil must be directly extracted after harvesting from the tree since the quality of olive oil (acidity) is affected by the period between harvesting and oil production.

Table 3. Effect of the period between harvesting and oil extraction on the stability of olive oil.

Time	Oil from fresh fruit	Oil from stored fruit
1 - Peroxide values (meq./kg)		
0	6.4	6.9
1	7.1	7.3
3	9.08	9.78
5	12.84	15.20
7	14.82	17.11
9	17.20	25.41
11	20.41	38.21
13	50.22	60.12
15	73.4	84.31
17	94.22	98.15
19	126.22	116.21
21	134.21	132.61
23	170.33	160.21
25	163.20	153.11
27	150.21	148.21
2 - Acidity (% oleic):		
0	0.66	10.35
1	0.68	10.92
3	0.70	10.98
5	0.72	11.21
7	0.75	12.38
9	0.79	12.40
11	0.85	12.62
13	1.04	13.02
15	1.07	13.40
17	1.35	13.80
14	1.39	13.98
21	1.45	14.20
23	1.49	14.26
25	1.51	14.70
27	1.53	15.69

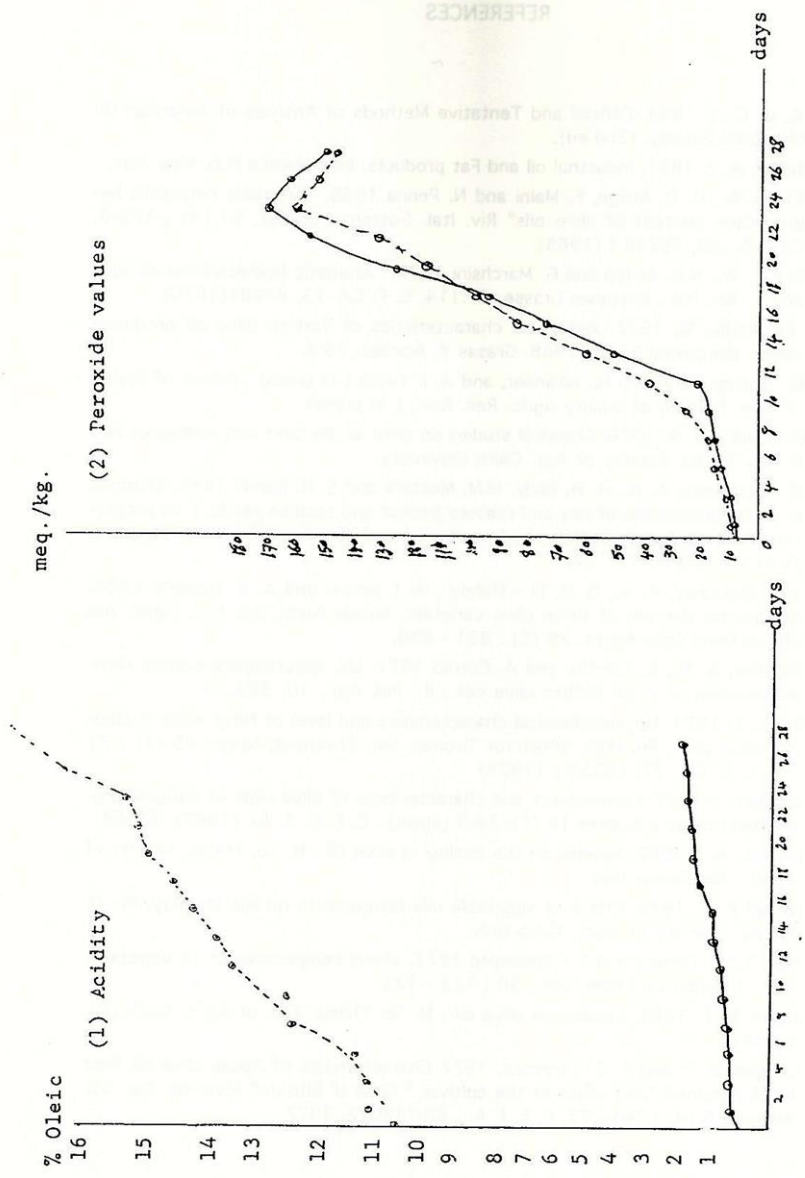

Fig. 1. Effect of the period between harvest and oil extraction on the stability of olive oil.

—— oil from fresh fruit
--- oil from stored fruit

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تأثير الفترة مابين جمع ثمار الزيتون واستخلاصها علي خواص جوده الزيت

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تم تقدير الخواص الطبيعية والكيماويه لزيت الزيتون المستخلص من صنف البيكوال تم ايضا دراسة تركيب الأحماض الدهنيه والهيدروكربونات والاستيرولات ودراسه الثبات علي الزيت بتتبع رقم البيروكسيد والحموضة في الفرن علي درجه ٦٣مْ +١ ، وتضمن البحث ايضا دراسة تأثير الفتره ما بين جمع الثمار واستخلاص الزيت علي خواص الزيت السالفه الذكر.

،وأظهرت النتائج حدوث انخفاض في قيمة كل من معامل الأنكسار والرقم اليودي والأحماض الدهنيه الكليه الغير مشبعة وأيضا النسبه ما بين الأحماض الدهنية الغير مشبعة والأحماض المشبعة في عينات الزيت من ثمار الزيتون المخزنة مقارنه بالثمار الطازجة.

وأظهرت النتائج تأثير واضح علي الحموضه حيث لوحظ زيادتها من ٠,٦٦ في العينة المستخلصه من الثمار الطازجة الي ١٠,٣٥ ٪ في العينه المستخلصه من الثمار المخزونه.

لوحظ أيضا زياده في كيمه الأسكوالين كما حدث نقص في ك٢٢ ، ك٢٨ ، ك٣٠ وكان البيتاسيتوستيرول هو الاستيرول الرئيسي.

كما اظهرت النتائج أنه لم يحدث تغير كبير في درجة ثبات الزيت نتيجة للمعامله بالنسبه لتتبع رقم البيروكسيد أما بالنسبه للحموضه فحدث زياده سريعه جداً في العينات المتروكه فتره قبل الأستخلاص.