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# التغيرات فى الخواص الحسية وجودة زيت الزيتون أثناء تخزين الثمار على درجة الحرارة المنخفضة

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**المخلص العربى :**

**تم تخزين ثمار الزيتون صنف بيكوال وأرب كوين تحت درجة حرارة منخفضة (٥°م) لمدة ٥، ١٠ أيام لدراسة التغيرات فى جودة الزيت وتركيب الأحماض الدهنية والبولى فينولات والتوكوفيرولات الكلية والثبات والخواص الحسية للزيت المنتج منهم وأيضاً تم تخزينها (الثمار) لمدة ٥، ١٠ أيام على درجة حرارة الجو (٢٧-٣٠°م) لفحص التلف على درجة الحرارة المحيطة ومقارنتهم بالزيت المنتج من الزيتون الطازج وقت الحصاد.**

**لذلك قيمت جودة زيت الزيتون على أساس الحموضة ورقم البيروكسيد والقياس فى منطقة الـ U.V على طول موجى ٢٣٢ و ٢٧٠ نانوميتر والخواص الحسية وكانت النتائج كالآتى:**

- **الزيت المنتج من الزيتون الطازج ( صنف بيكوال ) والمخزن على درجة ٥°م لمدة خمسة أيام ضمن حدود زيت الزيتون البكر الممتاز. بينما الزيوت المتحصل عليها من الزيتون المخزن على درجة حرارة منخفضة ٥°م لمدة عشر أيام والزيوت المتحصل عليها أيضاً من الزيتون المخزنة لمدة خمسة أيام على درجة حرارة الجو (٢٧-٣٠°م) وصفت كزيت زيتون بكر ولكن جودة الزيوت المستخلصة من الزيتون المخزن على درجة حرارة منخفضة (٥°م) لمدة عشرة أيام كانت عموماً أعلى من المستخلصة من الزيتون المخزن لمدة خمسة أيام على درجة الحرارة المحيطة (٢٧-٣٠°م).**
- **كما وجد أن الزيوت المستخلصة من الزيتون المخزن على درجة الحرارة المحيطة (الجو) لمدة عشرة أيام ضمن نطاق زيت الزيتون اللمبنتى.**

- **على الجانب الآخر الفينولات والتوكوفيرولات الكلية والثبات فى الزيوت المستخلصة من الثمار المخزنة على درجة الحرارة المنخفضة (٥°م) نقصت بزيادة وقت التخزين ولكنهم سجلوا نقص كبير جداً فى الزيوت المستخلصة من الثمار المخزنة على درجة الحرارة المحيطة بزيادة وقت التخزين مقارنة بالزيوت المستخلص من الثمار الطازجة وقت الحصاد.**
- **كما زاد حمض الأوليك فى الزيوت المنتجة من الثمار المخزنة على درجة الحرارة منخفضة (٥°م) والمخزنة أيضاً على درجة حرارة الجو ولكن نقص حمض اللينوليك فى الزيوت المتحصل عليها أى أن كان نوع التخزين بينما لا يكون هناك تأثير واضح لتخزين الثمار عموماً على حمض اللينولينك فى زيوتها.**
- **يفضل إجراء دراسات مستقبلية تتعلق بدارسة خلط زيت الزيتون صنف أرب كوين مع زيت الزيتون صنف بيكوال أو غيره لإنتاج ناتج زيت زيتون يتفق مع المواصفات العالمية من ناحية مستوى حامض الأوليك(٥٥%) وغيره من الأحماض مثل البالمتيك واللينوليك ذلك لتعميق الاستفادة من الكمية المنتجة لزيت الزيتون صنف أرب كوين.**

# CHANGES IN THE ORGANOLEPTIC CHARACTERISTICS AND QUALITY OF OLIVE OIL DURING FRUITS STORAGE AT LOW TEMPERATURE

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**ABSTRACT :** ***Picual and Arbqueen varieties of olive fruits were stored at cold. temperature (5°C) for 5 and 10 days to study the changes in oil quality, fatty acid composition, total polyphenols and tocopherols, stability and organoleptic test of oils produced from them. Also these varieties were stored for 5 and 10 days at atmospheric temperature (27– 30° C) to verify the deterioration at an ambient temperature and it is compared with oil from fresh olives at the harvesting time.***

***Therefore, olive oil quality was evaluated based on acidity, peroxide value, k232 and K270, and organoleptic characteristics.***

***The results are as follows:***

***Oils produced from fresh olives (picual var.) and stored at 5°C for 5 days were within the limit of extra-virgin olive oil, while oils obtained from olives stored at low-temperature (5°C) for 10 days and those obtained from olives stored at ambient temperature for 5 days were qualified as virgin olive oil, but quality of oil from olives stored at low-temperature (5°C) for 10 days were generally higher than oils from olives stored at ambient temperature for 5 days. Oils extracted from olives stored at ambient temperature for 10 days were within the range required for lampante olive oil. On the other hand, total polyphenols and tocopherols and stability in oils extracted from fruits stored at low-temperature (5°C) decreased by increasing the storage time, but it recorded a higher decrease in oils extracted from fruits stored at ambient temperature by increasing the storage time compared with oils from fresh fruits at harvesting time. Oliec acid increased in either oils produced from olives stored at 5°C and also at controlled temperature, but lenoleic acid decreased in either oils obtained from olives at whatever storage period, while no clear effect of stored fruits was detected on the lenolenic acid their oils generally.***

***Keywords:*** ***Olive fruits, storage, low-temperature, physical and chemical properties of oil and organoleptic tests of olive oil.***

## INTRODUCTION

**Extra - virgin olive oil is considered to be the best olive oil for its organoleptic characteristics, for its stability and chemical composition. It is the juice of olives harvested at optimum maturity and correctly processed. It is practically the only vegetable oil that can be consumed directly in its raw state and which contains important nutritional elements (fatty acids, vitamins, etc.). It should have an organoleptic score of ≥ 6.5 and a maximum acidity of 1 (Mendez and Falque, 2007).**

**In many olive producing countries, processing of olives is not well synchronized with harvest due to the limited oil extraction capacities of the industrial facilities. Therefore, after harvesting olives might be piled in heaps and stored at ambient temperature for up to several weeks before processing for oil extraction. The greatest amount of oil deterioration occurs during the harvesting and processing procedures. Pressure within the olive pile may damage the fruits and the fluid secretion from the crushed olives which may provide an optimum media for growth of fungi and bacteria. Also heat produced by the olives respiratory activity may accelerate deterioration. Oil extracted from these damaged olives lead to an increase in acidity, decrease in stability, and an increase in volatile acids such as acetic or butyric which cause a musty smell (Tayfun Agar *et al.,* 1999).**

**Cornicabra cultivar VOO obtained from drupes stored for 5 or 8 days at 20 or 10°C, respectively retained the "extra-virgin" category, according to chemical quality indices, since only small increases in free acidity and peroxide values were observed, and the bitter index of this monovarietal oil was reduced by 30-40%. Storage under monolayer conditions at 10°C for up to two weeks is also feasible because "off-odor" development was delayed, and a 50% reduction in bitterness was obtained, and the overall good quality of the final product was preserved. (Antonio *et al.,* 2010).**

**Changes in volatile and phenolic compounds, quality indices and sensory attributes indicated that virgin olive oil quality was lost within the first week of fruit cold storage and regained at the second week. Also olive fruit cold storage may be beneficial, with a possibility of increasing oil yield and moderating the sensory quality of virgin olive oils (Kalua *et al.,* 2008).**

**In a few days from the fruit storage under controlled temperature, the physical and chemical structure of the olives is altered and oil extracted from them has a very poor quality. Thus types of oils must be refined before consumption (Gutierrez, *et al.,* 1992).**

**Olive oils obtained from olive fruits stored at 5°C preserved the best characteristics compared to those obtained from olives kept at ambient temperature (Clodoveo *et al.,* 2007).**

**The effect of time elapsed after fruit harvesting till pressing on the physical and chemical properties of olive oil were investigated. RI, IV and total unsaturated fatty acid decreased, moreover peroxide value, acidity and total saturated fatty acids increased in oil extracted from the stored samples compared to the fresh samples (Awatif, 1994).**

**According to the International Olive Council IOC (2006) standard grades of olive oils are virgin olive oils obtained from the fruits of the olive tree by mechanical or other physical means under specific conditions particularly thermal condition which do not lead to the alteration of the characteristics of the oil. When virgin olive oil is intended for consumption in its natural states, it is called by one of the following designations:**

**a) Extra virgin olive oil which has a maximum acidity of 0.8% (as oleic acid) and the median of the defects is equal to zero while the median of the fruity attributes is more than zero.**
**b) Virgin olive oil has maximum acidity of 2% (as oleic acid) and the median of the defects is more than zero and less than or equal 2.5 while the median of the fruity attribute is more than zero.**
**c) Ordinary virgin olive oil has a maximum acidity of 3.3% (as oleic acid) and the median of the defects is above 2.5 and less than or equal to 6.0.**
**d) Lampante olive oil has an acidity more than 3.3% (as oleic acid) and the median of the defects is more than 6.0.**

**The defects mean the negative attributes such as fusty, musty, rancid and metallic flavor as mentioned by IOC (2007).**

**This study demonstrates the changes in quality, fatty acid composition, some natural antioxidant and organoleptic test of oils during fruits storage at low-temperature and at room temperature.**

## MATERIALS AND METHODS

### a- Materials:

**Olive fruits of picual and Arbqueen vars. were harvested in olive groves in the same area [Kom-Oshim, El-Fayom Governorate] during the crop season 2010. Harvesting was done by hand using rakes. Olives were stored to obtain fruits of uniform size and colour and then distributed randomly in 3kg. lots that were placed into 10 plastic cages.**

### Methods:

### 1. Storage treatments :

**A group of four cages of olives (Picaul and Arbqueen vars.) were kept at 5°C in a frigorific. Another group of four cages of olives were kept under atmospheric conditions (normal ambient temperature) at room temperature (27 - 30°C) to verify the deterioration rate at an ambient temperature. Two samples of picual and Arbqueen vars. were taken at harvesting time being as (fresh fruits). Quality evaluations were made initially on day 1 for (fresh olives) and after 5 and 10 days for stored olives respectively.**

## 2. Sample preparation :

**Oil extraction: the fruits of picual and Arbqueen cultivars were crushed and packed in cheese cloth then pressed by using hydraulic press. The extracted oil was dried over anhydrous sodium sulphate, filtered through a whatman filter paper No.1 and kept in brown glass bottles at 5°C till analysis.**

## 3- physical and chemical properties of samples of olive oils:

- **Refractive index at 25°C of the oils: was determined according to the A.O.A.C (2000) by using refractometer (NYRL-3 poland)**
- **Iodine value: was calculated from fatty acids content.**
- **Acidity and peroxide value: were determined according to the method of the A.O.A.C (1995).**
- **Absorbency in ultraviolet at 232 and 270 nm. (Diene and Triene) and at 266, 270 and 274nm (ΔK): Ultraviolet and visible spectra were conducted using a pyeunicum double beam spectrophotometer model sp 1600, as described by Kates (1972). The samples were dissolved in freshly distilled cyclohexane and the absorption were taken at 232, 266, 270 and 274nm.**

**$\Delta K = A270 - {}^{1}/_{2}$ (A266 + A274) according to the method in the IOOC (2001).**

## 4- Fatty acid composition:

**The fatty acids methyl esters were prepared using trans-esterification with cold methanolic solution of potassium hydroxide. The fatty acid methyl esters were identified by GC-capillary column according to the methods of IOOC (2001).**

## 5- Determination of total tocopherols:

**The total tocopherols content was determined in virgin olive oils according to the method of Wong *et al.* (1988).**

## 6- Determination of total polyphenols:

**The polyhenols were extracted from the oil by aqueous methanol (60%v/v) then the total polyphenols in the methanolic extract was estimated with folin-ciolcateau reagent according to the method described by Gutfinger (1981).**

## 7- The stability of oils:

**The oxidative stability of oils was estimated using Rancimat a 679. (Metrohn Herisou, Co., Switzerland at 100°C with an air flow rate of 20 1/hr according to the method described by Mendez *et al.* (1997).**

## 8-Organoleptic Evaluation :

**The oil samples (15 ml each) were presented in covered blue glasses (diameter 70mm, capacity 130ml) at 28 ± 2°C. The glass was warmed and after removing the cover the sample was smelled and then tasted by the panelists to judge its flavor. The different attributes of the oils were assessed by panelists to judge its flavour which is evaluated, as a median value of the panelists score. The organoleptic assessment of virgin olive oil were conducted according to the method (profile sheet) described by IOC (2007).**

## 9- Statistical analysis :

**Data of the sensory evaluation were analyzed by the analysis of variances using the general linear model (GLM) procedure within a package program of the statistical analysis system (copyright 1987, SNS institute Znc.carry, NC, 2755128, USA, SAS proprietary software, release 6.03]. Specific differences between treatments were determined by LSD test for each attribute. Results were tested for degree of significant level at $P<0.05$.**

## RESULTS AND DISCUSSION

## Changes in physical and chemical properties of olive oil during fruit storage:

**Data in Tables (1 and 2) show the changes in physical and chemical properties of oils obtained from olives (picual and Arbqueen vars.) stored at cold temperature (5°C) and ambient temperature (as controlled temperature) for 5 and 10 days. Results indicated that, values of referactive index of oil increased during storage of olives at 5°C, while they decreased in oils produced from olives stored at ambient temperature compared to oils from fresh olives (at harvesting time). Iodine value (IV) decreased in oils extracted from olives stored at either low-temperature (5°C) or the ambient temperature. The decrease in iodine value is clearly observed with increasing storage time. Generally the decrease in IV of oils from fruits stored at ambient temperature was higher than in oils from fruits stored at 5°C. This decrease may be due to the decrease in total unsaturated and the increase in the total saturated fatty acids in oils from fruits stored at ambient temperature. From the results in the same tables, the oils obtained from fresh olives (Picual and Arbqueen vars.) had an average FFA (acidity) of 0.55 and**

**0.52% respectively. With regarding the FFA values of oils extracted from olives stored at 5°C they were 0.69 and 0.77% in picual and Arbqueen vars., respectively. But the oils extracted from the olives stored at 5°C for 10 days and that stored at ambient temperature for 5 days had FFA values >1 % and <2%. On the other hand, the oils obtained from the olives stored at ambient temperature for 10 days had an acidity of 3.87 and 5.87% in picual and Arbqueen vars., respectively. In general the FFA of oils increased with increasing storage time at low temperature and ambient temperature. The higher increase in acidity in oils extracted from olives stored at ambient temperature may be due to the microorganisms in an oil-rich tissue in olives stored at ambient temperature that induce hydrolytic activity by lipases, which leads to the release of fatty acids from triacylglycerol molecules of the oils. (Clodoveo *et al.,* 2007).**

**Table (1): Physical and chemical characteristics of picual olive oil during fruits storage:-**

| Physical and chemical properties | fresh sample | Storage of olive fruits (Day) at | | | |
|---|---|---|---|---|---|
| | | Low- temperature 5°C | | Ambient temperature (27-30°C) | |
| | | 5 | 10 | 5 | 10 |
| Refractive index at 25°C | 1.4676 | 1.4678 | 1.4679 | 1.4675 | 1.4672 |
| Iodin value $I_2$/100g oil | 82.29 | 80.75 | 79.68 | 79.76 | 78.82 |
| Conjugated diene UV. [abs.at232nm]. | 1.14 | 1.630 | 1.862 | 2.046 | 2.686 |
| Conjugated triene UV [abs.at 270nm.] | 0.140 | 0.150 | 0.159 | 0.200 | 0.413 |
| ΔK | 0.001 | 0.004 | 0.008 | 0.009 | 0.017 |
| Free fatty acid (%) | 0.52 | 0.77 | 1.23 | 1.45 | 3.87 |
| Peroxide value (meq/kg oil) | 1.53 | 5.46 | 8.43 | 7.81 | 15.62 |

**Table (2): Physical and chemical characteristics of Arbqueen olive oil during fruits storage:-**

| Physical and chemical properties | fresh sample | Storage of olive fruits (Day) at | | | |
|---|---|---|---|---|---|
| | | Low- temperature 5°C | | Ambient temperature (27-30°C) | |
| | | 5 | 10 | 5 | 10 |
| Refractive index at 25°C | 1.4684 | 1.4687 | 1.4688 | 1.4683 | 1.4682 |
| Iodin value ($I_2$/100g oil) | 87.80 | 86.26 | 85.48 | 84.44 | 83.09 |

| | | | | | |
|---|---|---|---|---|---|
| **Conjugated dien UV. [abs.at232nm.]** | **1.507** | **1.832** | **2.108** | **2.158** | **2.434** |
| **Conjugated triene UV [abs.at 270nm.]** | **0.106** | **0.141** | **0.177** | **0.217** | **0.307** |
| **ΔK** | **0.001** | **0.005** | **0.007** | **0.008** | **0.011** |
| **Free fatty acid (%)** | **0.55** | **0.69** | **1.2** | **1.52** | **5.87** |
| **Peroxide value (meq/kg oil)** | **0.77** | **3.20** | **6.63** | **6.13** | **10.43** |

**With regarding to the results in the same tables, the peroxide value of the oils extracted from fresh olives (Picual and Arbqueen vars.) were 1.53 and 0.77 meq/ Kg oil respectively, These values of peroxide increased to 7.81 and 15.62 meq/ Kg oil in picual var. and 6.13 and 10.43 meq/Kg oil in Arbqueen var. when olives stored at controlled temperature for 5 and 10 days respectively, but cold temperature storage at 5°C for 5 and 10 days delayed the rise in the peroxide value of the oils, which were 5.46 and 8.43 meq/Kg oil in picual vars. and 3.2 and 6.63 meq/ Kg oil in Arbqueen var. This may be due to the higher total polyphenol and tocopherols contents of olives stored at 5°C than those stored at ambient temperature under study. Also from the results, values of k232 and 270 in all oils from olives stored at low-temperature for 5 and 10 days recorded a slight increase compared to oils from fresh olives. These values are within the limit for extra virgin olive oil, whereas the maximum permitted values of K232 and K270 for extra-virgin olive oils are 2.5 and 0.20, respectively (Clodoveo *et al.* 2007). While the oils from olives stored at ambient temperature for 5 and 10 days had a higher values of K232 or that K270, which exceeded the limit for extra-virgin olive oil. ΔK recorded slight increase in all oils from olive stored either at 5°C for 5 and 10 days and stored at ambient temperature for 5 days compared with oils from fresh olive, but it recorded a higher increase in oils from olives stored at ambient temperature for 10 days. These results are similar to those of previous reports (Clodoveo *et al.,* 2007).**

## Change in fatty acid composition of olive oil during fruit storage:

**The data in Tables (3 and 4) reveal the changes in fatty acid composition of picual and arbqueen olives oil during fruit storage at cold temperature (5°C) and ambient temperature. The saturated fatty acids found in picual and Arbqueen olive oil are palmitic acid followed by stearic and arachidic acids. Palmitic acid percentage was 16.79 and 22.65 (in picual and Arbqeen vars. respectively) at harvest (fresh olive) and decreased to 16.45 and 16.38% in picual var. and 21.93 and 21.53% in Arbqueen var. during fruits storage at 5°C for 5 and 10 days. But it increased in all samples during storage at the ambient temperature. While stearic acid recorded slight increase in all oils produced from fruit stored at 5°C and ambient temperature compared to oils**

**from fresh olives. Oleic acid is the main monounsaturated fatty acid in picual and Arbqueen olive oils 60.28 and 45.17% respectively. These values of oleic acid increased to 62.57 and 63.43% in picual var. and 47.25 and 48.68% in Arbqueen var. as a result of fruits storage at 5°C. Also it increased in oils extracted from fruits stored at ambient temperature. Polyunsaturated fatty acids are very important for human nutrition as they are considered to be essential acids. Linoleic acid was the dominant polyunsaturated fatty acid in picual and arbqueen olive oils (13.97 and 24.64% respectively. These values of lenoleic acid decreased during fruit storage at 5°C and controlled temperature for 5 and 10 days, while no clear effect of storage at 5°C and ambient temperature was detected on the lenolenic, palmitoleic, arachidic and other fatty acids in all samples compared with oils from fresh olives.**

**Table (3): Changes in fatty acid composition of picual olive oil during fruit storage:**

| Fatty acid composition (%) | Fresh samples | Storage of olive fruits (Day)at | | | |
|---|---|---|---|---|---|
| | | Low- temperature at 5°C | | Ambient temperature (27-30°C) | |
| | | 5 | 10 | 5 | 10 |
| C16: 0 | 16.79 | 16.45 | 16.38 | 17.03 | 17.05 |
| C16:1 | 2.48 | 2.43 | 2.5 | 2.84 | 2.77 |
| C17:0 | 0.06 | 0.04 | 0.04 | 0.08 | 0.09 |
| C17:1 | 0.09 | 0.08 | 0.07 | 0.12 | 0.14 |
| C18:0 | 4.4 | 4.51 | 4.69 | 4.53 | 4.61 |
| C18: 1 | 60.28 | 62.57 | 63.43 | 61.72 | 62.34 |
| C18: 2 | 13.97 | 11.97 | 11.08 | 11.87 | 11.03 |
| C18: 3 | 1.07 | 1.07 | 0.98 | 1.05 | 1.06 |
| C20:0 | 0.46 | 0.48 | 0.47 | 0.43 | 0.48 |
| C20:1 | 0.27 | 0.25 | 0.27 | 0.24 | 0.26 |
| C22:0 | 0.09 | 0.09 | 0.07 | 0.08 | 0.09 |
| C24:0 | 0.04 | 0.06 | - | - | 0.05 |
| TS | 21.84 | 21.63 | 21.65 | 22.15 | 22.54 |
| Tus | 78.10 | 78.37 | 78.35 | 77.85 | 77.46 |

**Table (4): Changes in fatty acid composition of Arbqueen olive oil during fruit storage.**

| Fatty acid composition (%) | Fresh samples | Storage of olive fruits (Day)at | | | |
|---|---|---|---|---|---|
| | | Low- temperature at 5°C | | Ambient temperature (27-30°) | |
| | | 5 | 10 | 5 | 10 |
| C16: 0 | 22.65 | 21.93 | 21.53 | 23.22 | 23.98 |
| C16:1 | 3.82 | 3.79 | 3.68 | 3.97 | 3.59 |
| C17:0 | 0.22 | 0.16 | 0.15 | 0.17 | 0.16 |
| C17:1 | 0.31 | 0.27 | 0.25 | 0.28 | 0.25 |

| | | | | | |
|---|---|---|---|---|---|
| **C18:0** | **1.75** | **2.02** | **2.33** | **1.99** | **2.13** |
| **C18: 1** | **45.17** | **47.25** | **48.68** | **46.43** | **46.86** |
| **C18: 2** | **24.64** | **22.78** | **21.62** | **22.18** | **21.19** |
| **C18: 3** | **1.04** | **1.01** | **1.02** | **1.01** | **1.03** |
| **C20:0** | **0.39** | **0.4** | **0.39** | **0.39** | **0.42** |
| **C20:1** | **0.27** | **0.26** | **0.24** | **0.24** | **0.26** |
| **C22:0** | **0.08** | **0.09** | **0.07** | **0.08** | **0.09** |
| **C24:0** | **0.05** | **0.04** | **0.04** | **0.04** | **0.04** |
| **TS** | **24.75** | **24.64** | **24.51** | **25.89** | **26.82** |
| **TUS** | **75.25** | **75.36** | **75.49** | **74.11** | **73.18** |

**Generally, there was no clear change in total saturated and unsaturated fatty acids of all oils from fruit stored at 5°C. On the other hand, total saturated fatty acids recorded slight increase in oil from fruits stored at ambient temperature, but total unsaturated fatty acids decreased in these oils. These changes may be due to the effect of improper temperature and growth of molds which might activate the hydrolytic enzymes in the fruit. These results are similar to those obtained by (Tayfun *et al.* 1999).**

## Changes in total polyphenols and tocopherols and oxidative stability of olive oil during fruit storage:

**Virgin olive oil contains phenolic compounds which are responsible for its fragrance and peculiar flavour. These substances also contribute to the oxidative stability of the oil, and protect consumers against cancer and a therosclerosis (Clodoveo *et al.,* 2007). Tables (5 and 6) reveal the changes in the total polyphenol, tocopherol content and oxidative stability of the oils produced from olives (picual and Arbqueen varieties) during fruits storage at 5°C and at room temperature. The total phenols and tocopherols and oxidative stability decreased in oils from olives kept at low temperature, but they recorded a higher decrease in oils obtained from olives stored at ambient temperature compared with that of oils from fresh olives. This decrease in polyphenol during storage at ambient temperature may provide an optimum medium for growth of fungi and bacteria which are able to metabolize a wide variety of aromatic compounds, such as phenols and its derivatives (Servili *et al.,* 2004). Also the decrease in polyphenols of oils from olive at low-temperature (5°C) may have abacteriostasis action that controls microbial development. Moreover, breakdown of the cells may favour contact of the phenolic substances with the oxidative enzymes. Also olives contain oxidoreductases, such as polyphenoloxidase and peroxidase, that may oxidize polyphenols and impair the health – related qualities and sensory characteristics of olive. The activity of these enzymes decreased at low-temperature. Therefore the decrease in polyphenol content in oils from olives at atmospheric temperature was higher than that at low-temperature (Servili *et al.,* 2003).**

**Table (5): Changes in stability and some natural antioxidant of picual olive oil during fruit storage.**

| Natural antioxidant | Fresh samples | Storage of olive fruits (Day) at | | | |
|---|---|---|---|---|---|
| | | Low- temperature at 5°C | | Ambient temperature (27-30°C) | |
| | | 5 | 10 | 5 | 10 |
| Stability (hr.) | 31.0 | 21.16 | 11.31 | 7.5 | 4.62 |
| Total polyphenol (ppm) | 162.39 | 135.60 | 119.69 | 99.96 | 75.83 |
| Total tocopherol (ppm) | 126.7 | 94.95 | 68.70 | 68.00 | 46.70 |

**Table (6): Changes in stability and some natural antioxidant of Arbqueen olive oil during fruit storage.**

| Natural antioxidant | Fresh samples | Storage of olive fruits (Day) | | | |
|---|---|---|---|---|---|
| | | Low- temperature at 5°C | | Ambient temperature (27-30°C) | |
| | | 5 | 10 | 5 | 10 |
| Stability (hr.) | 29.94 | 21.0 | 12.06 | 7.5 | 5.38 |
| Total polyphenols (ppm) | 145.90 | 130.02 | 113.22 | 89.96 | 68.76 |
| Total tocopherol (ppm) | 140.0 | 109.71 | 91.5 | 86.0 | 62.7 |

## Changes in organoleptic characteristics of olive oil during fruit storage:

**Olive oil quality during storage is favored by factors such as: oxygen, temperature, light, metals and other. In order to obtain the best possible quality of olive oil (Low acidity, negligible oxidation and best sensory characteristics the following points are suggested:**

**Protect the fruit while it is on the tree collect it with a minimum of damage and store it for the shortest possible time under favorable conditions (Cool places) before processing (Kiritsakis 1990).**

**Data in Table (7) show changes in organoleptic test of oils produced from olives (picual and arbqueen vars.) as a result of fruits storage at cold and atmospheric temperatures. From the results in this table, the median of the positive properties (fruity attribute) recorded higher values in oils from fresh olives (picual and arbqueen vars.), to be 7.8 and 7.3 respectively, while defect properties (Musty and Fusty) were equal to zero, but these values of median of the fruity recorded slight decrease (7.1 and 6.15 respectively) and defect**

**properties were equal to zero in oils from olives stored at low-temperature for 5 days compared to oils from fresh olive. While the values of the median of the fruity of the oils extracted from olive stored at 5°C for 10 days decreased to 5.02 and 4.3 but values of the defect properties more than zero, 0.62 and 0.83 (Musty) and 0.8 and 0.92 (Fusty) in picual and arbqueen vars. respectively. On the other hand, values of the median of the fruity attributes of oils from olives (Picual and Arbqueen vars.) stored at ambient temperature for 5 days decreased to 2.3 and 1.5 but the median of the defects increased to 1.91 and 2.04 (Musty) and to 2.2 and 2.5 (Fusty), respectively. While the positive properties (Fruity) decreased to zero, but the defects properties**

**Table 7**

**increased to 3.9 and 4.2 (Musty) and to 6.02 and 6.5 (Fusty) in oils obtained from olives (picual and Arbqueen vars. respectively) stored at ambient temperature for 10 days. Therefore, according to IOC (2006), the olive oils under study can be divided into: oils from fresh and stored (at 5°C for 5 day) olives being within the limit of extra- virgin olive oil while oils extracted from olives stored at 5°C for 10 days and at atmospheric temperature were classified as virgin olive oil. But oils obtained from olives stored at ambient temperature for 10 days were described as Lampante olive oil. These results are in agreement with those obtained by Antonio *et al*. (2010) who mentioned that the Cornicabta cultivar VOO obtained from olives stored for 5 and 8 days at 20 or 10°C, respectively retained the "extra-virgin" category.**

## CONCLUSION

**Olive oils produced from olive fruits stored at low-temperature (5°C) preserved the best and organoleptic characteristics compared to those obtained from olives stored at ambient temperature (atmospheric temperature) (27-30°C). While the olive oil extracted from the Arbqueen variety is somewhat and/or slightly out of the limits considered by the standard described by the IOC (2006) as a result of the slight decrease of the percentage of the oleic acid which should be 55% or more as well as the increased percentage of palmitic and linoleic acid being 20 and 21% respectively, when compared to the chemical composition of picual olive oil. In order to make use of the arbaqueen olive oil characterized by having high oil yield and good stability it would be profitable to make blends between the oils of Arbqueen and picual and /or other varieties to overcome this problem and to obtain olive oil characterized by equilibrium chemical composition. This would be accomplished by further investigations.**

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# التغيرات فى الخواص الحسية وجودة زيت الزيتون أثناء تخزين الثمار على درجة الحرارة المنخفضة

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**المخلص العربى :**

تم تخزين ثمار الزيتون صنف بيكوال وأرب كوين تحت درجة حرارة منخفضة (٥°م) لمدة ٥، ١٠ أيام لدراسة التغيرات فى جودة الزيت وتركيب الأحماض الدهنية والبولى فينولات والتوكوفيرولات الكلية والثبات والخواص الحسية للزيت المنتج منهم وأيضاً تم تخزينها (الثمار) لمدة ٥، ١٠ أيام على درجة حرارة الجو (٢٧-٣٠°م) لفحص التلف على درجة الحرارة المحيطة ومقارنتهم بالزيت المنتج من الزيتون الطازج وقت الحصاد.

لذلك قيمت جودة زيت الزيتون على أساس الحموضة ورقم البيروكسيد والقياس فى منطقة الـ U.V على طول موجى ٢٣٢ و ٢٧٠ نانوميتر والخواص الحسية وكانت النتائج كالآتى:

- الزيت المنتج من الزيتون الطازج ( صنف بيكوال ) والمخزن على درجة ٥°م لمدة خمسة أيام ضمن حدود زيت الزيتون البكر الممتاز. بينما الزيوت المتحصل عليها من الزيتون المخزن على درجة حرارة منخفضة ٥°م لمدة عشر أيام والزيوت المتحصل عليها أيضاً من الزيتون المخزنة لمدة خمسة أيام على درجة حرارة الجو (٢٧-٣٠°م) وصفت كزيت زيتون بكر ولكن جودة الزيوت المستخلصة من الزيتون المخزن على درجة حرارة منخفضة (٥°م) لمدة عشرة أيام كانت عموماً أعلى من المستخلصة من الزيتون المخزن لمدة خمسة أيام على درجة الحرارة المحيطة (٢٧-٣٠°م).
- كما وجد أن الزيوت المستخلصة من الزيتون المخزن على درجة الحرارة المحيطة (الجو) لمدة عشرة أيام ضمن نطاق زيت الزيتون اللمبنتى.

- **على الجانب الآخر الفينولات والتوكوفيرولات الكلية والثبات فى الزيوت المستخلصة من الثمار المخزنة على درجة الحرارة المنخفضة (٥°م) نقصت بزيادة وقت التخزين ولكنهم سجلوا نقص كبير جداً فى الزيوت المستخلصة من الثمار المخزنة على درجة الحرارة المحيطة بزيادة وقت التخزين مقارنة بالزيوت المستخلص من الثمار الطازجة وقت الحصاد.**
- **كما زاد حمض الأوليك فى الزيوت المنتجة من الثمار المخزنة على درجة الحرارة منخفضة (٥°م) والمخزنة أيضاً على درجة حرارة الجو ولكن نقص حمض اللينوليك فى الزيوت المتحصل عليها أى أن كان نوع التخزين بينما لا يكون هناك تأثير واضح لتخزين الثمار عموماً على حمض اللينولينك فى زيوتها.**
- **يفضل إجراء دراسات مستقبلية تتعلق بدارسة خلط زيت الزيتون صنف أرب كوين مع زيت الزيتون صنف بيكوال أو غيره لإنتاج ناتج زيت زيتون يتفق مع المواصفات العالمية من ناحية مستوى حامض الأوليك(٥٥%) وغيره من الأحماض مثل البالمتيك واللينوليك ذلك لتعميق الاستفادة من الكمية المنتجة لزيت الزيتون صنف أرب كوين.**

**Table (7): Changes in sensory characteristics of olive oil during fruit storage .**

| Variety | Picual | | | | | Arbqueen | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Organoleptic test / Storage of olive fruits (day) | Perception of positive attributes | | | Perception of effect | | Perception of positive attributes | | | Perception of effect | |
| | Fruity | Bitter | Pungent | Musty | Fusty | Fruity | Bitter | Pungent | Musty | Fusty |
| Fresh sample | 7.8[a] | 1.86[a] | 6.2[a] | - | - | 7.3[a] | 1.70[a] | 6.03[a] | - | - |
| Low-temperature at 5°C | | | | | | | | | | |
| 5 | 7.1[ab] | 1.83[a] | 5.8[a] | - | - | 6.15[b] | 1.62[a] | 5.42[ab] | - | - |
| 10 | 5.02[c] | 1.43[b] | 4.83[b] | 0.62[g] | 0.80[f] | 4.3[d] | 1.40[b] | 4.26[c] | 0.83[f] | 0.92[f] |
| Ambient temperature (27-30°C) | | | | | | | | | | |
| 5 | 2.3[f] | 0.45[d] | 4.05[c] | 1.91[c] | 2.2[e] | 1.5[g] | 0.41[d] | 3.81[cd] | 2.04[e] | 2.5[d] |
| 10 | - | 0.5[d] | 3.12[d] | 3.9[cd] | 6.02[a] | - | 0.44[d] | 2.76[e] | 4.2[c] | 6.5[a] |
| L.S.D | 0.5724 | 0.3827 | 0.7391 | 0.8084 | 0.7240 | 0.5660 | 0.5673 | 0.4215 | 0.8043 | 0.7475 |