EFFECT OF HEAD SPACE OF GLASS BOTTLES ON THE QUALITY OF SOME EDIBLE OILS STORED IN DAY LIGHT.

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(Manuscript received 28 September 1993)

Abstract

Commercial oil, soybean oil, sunflowe oil , corn oil and olive oil were packed in treasparent small and large glass bottles and stored on shelf at room temperature (25± 2ºC) in day light for 3 months to study the effect of head space and storage on their quality.

The results indicated that the formation of peroxides in oils stored in large glass bottles with head space was higher than in oils stored in small glass bottles. The induction periods of samples stored in small glass bottles were longer than those kept in large glass bottles. The acidity increased gradually at lower rates during storage. The saturated fatty acids increased whereas the unsaturated unsaturated fatty acids decreased in oils kept in large glass bottles with head space.

INTRODUCTION

Edible oils are sensitive to oxidative processes resulting in rancidity, production of undesirable flavors and quality losses during storage (Gunstone and Norris, 1982). The primary products of lipid oxidation are hydroperoxides which generally are referred to as peroxides.

Therefore, it seems reasonable to determine the concentration of peroxides as peroxides as a measure of the extent of oxidation (Gray, 1978). Cucurachi (1975) noticed that light causes significant deterioration of olive oil quality in the presence of air and the peroxide fromation is generally insufficient to lead to the development of rancid odor decause of the limited amount of oxygen in the head space. Werman and Neeman (1986) reported that exposure to diffused day light or artificial light is well known to cause a marked acceleration in the deterioration of unsaturated oils. On the other hand Carlsson, *et al.* (1976) reported that photo-oxidation of unsaturated oil is not prevented by known free radical scavengers, but is retarded by chelates which quench the onset of oxygen.

During photo-oxidation, the natural antioxidant, a-tocopherol exposed to light undergoes rapid pero-xidation and thus has no effect on inhibiting oil oxidation.

The aim of this work is to study the effect of head space and storage on shelf in day light on the quality of certain edible oils.

MATERIALS AND METHODS

Materials

Commercial oil, soybean oil, sunflower oil, corn oil and oiver oil were obtained form local market.

Sample preparations

The oils were dried with sodium sulphate anhydrous, and filtered. The samples were packed in transparent glass bottles (small and large glass bottles) having a volume of 20 ml without head space and 250 ml with head space (as common in local market). The bottles were closed with corks and stored on shelf at room temperature (25± 2°C) in day light for 3 months. The small glass bottles (12) were filled to the top and were used as no head space containers for comparison.

Mathods

Peroxide value (milliequivalents/kg oil) and acid value were determined as described in A.O.A.C. (1980). The fatty acid composition of the oil was detrmined by gas liguid chromatography.

Preparation of fatty acid methyl esters

The methyl esters were prepared using benzene: methanol : concentrated sulfuric acid (10:86:4) Methylation was carried out for one hour at 80-90°C according to stahl (1967).

Gas liquid chromatography apparatus (pye-unicam model 104) was used for the identification of the fatty acid methyl esters. The conditions used were identical to those reported by El-Sharkawy *et al.* (1984).

The relative percentages of the fatty acids were determined by measuring the area under each peak according to the method of Fryer *et al.* (1960) and Nelson *et al.* (1970).

RESULTS AND DISCUSSION

Edible oils samples were stored on shelf in small and large glass bottles in day light at room temperature up to three months. As shown in Table 1, the formation of peroxides in large glass bottles with head space was higher than in oils stored in small glass bottles. Similar results for light catalyzed oxidation have been reported by Carlesson *et al.* (1976).

The induction periods are usually considered as an indicator for oils keeping quality.

The induction periods of samples stored stored in small glass bottles were higher than those of large botttles. These results show the effect of light in developing peroxides during storage. Such results are in agreement with those of Gutierrez *et al.* (1973), kiritsaks and Dugan (1984), werman and Neeman (1986) and khalil and El-Agaimy (1991).

The peroxide value generally increased at the end storage as compared with imitialstorage. The acceleration of peroxide formation in case of large glass bottles with head space may be due to oxygen penetration and initiation of oxidation mechanism, in addition to the possibilities of more light facilitating oxidation (kiritsakis *et al.*, 1983). These results show that olive oil is sensitive to oxidation in the presence of light and that it is desirable to avoid exposure to light during starage (Carlesson

et al. 1976).

From the results obtained in table 2 it could be observed that the acidity increased gradually at lower rates during storage. After three months of storage, the acidity ranged between 0.38 to 0.71, 0.38 to 0.71, 1.35 to 1.98, 1.90 to 2.54 and 0.33 to 1.95 in oils kept in small glass bottles. The acidity in oils of large glass bottles with head space was higher than in oils stored in small glass bottles without head space.

Fatty acids are the integral constituents of every fat or oil . The degree of ocmplexity of the glycerides basically depends on the number of fatty acids and their amounts as well. Besides, the chemical behaviour of lipids largely depend upon their fatty acid constitution, Litchfield (1972). Separation and determination of fatty acid methyl esters were carried out by gas liquid chromatography to identify their types and amounts. This had been carried out for oils stored in small and large glass bottles. As shown in Table 3, the saturated fatty acids in oils kept in large glass bottles with head space were higher than in fresh oil or in oils kept in small glass bottles. The unsaturated fatty acids (oleic and linoleice) however were the highest in fresh oil. This may be due to the fact that the oxidation rate for oils in kept large glass bottles was faster, and there was a sufficient amount of oxygen to initiate oxidation. Gutierrez *et al.* (1973) demonstrated that oxygen and light should be excluded during olive oil storage.

Inconclusion, edible oils should be stored in small glass bottles. Large bottles however, are permeable to oxygen which stimulates and enhances oxidative deterioration.

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Table 1. Effect of head space and storage on th eperoxide value of some edible oils.

			Commercia oil		Sobean oil			Sunflower oil		Corn oil		Olive oil
Zero time		1cm*	0.00		4.09		1.49		0.00		10.79	
			(1)	(2)	(1)	(2)		(1)	(2)		(1)	
First month	after 7 days	3	0.0	1.69	6.28	12.02	2.1	10.88	0.48	5.96	12.5	26.05
	14 days	5	0.00	4.17	8.98	27.69	3.94	16.23	1.87	23.15	19.27	38.8
	21days	7	4.88	7.97	12.00	37.35	9.56	25.34	5.96	39.44	29.06	49.19
	30 days	9	8.82	11.39	28.62	43.02	10.22	28.15	12.68	48.64	31.63	60.00
Second month	37 days	10	10.45	16.87	33.26	45.71	12.22	32.77	17.6	53.94	33.3	74.41
	44 days	11	15.14	25.1	40.9	51.58	13.7	38.65	18.1	67.5	45.2	77.53
	51 days	12	20.00	43.00	51.7	66.7	14.3	43.02	20.9	69.59	58.1	80.8
	58 days	14	29.88	46.31	57.08	69.7	16.88	47.15	24.3	73.20	65.92	85.3
Third month	65 days	15	33.8	56.35	58.75	78.40	28.03	59.5	26.98	82.58	66.33	97.84
	72 days	16	38.81	65.56	59.7	83.17	29.28	60.75	38.5	86.19	73.87	107.98
	79 days	17	38.25	78.57	62.75	91.35	32.18	62.46	47.52	94.17	75.35	127.56
	86 days	19	48.14	86.97	68.47	99.27	37.02	79.38	52.98	103.42	83.57	138.94

(1) Small glass bottles (without head space).
(2) Large glass bottles (with head space).
* Head space formed.

Table 2. Effect of head space and storage on th acidity of some edible oils.

		Commercia oil		Sobean oil		Sunflower oil		Corn oil		Olive oil	
Zero time	1cm*	0.00		4.09		1.49		0.00		10.79	
		(1)	(2)	(1)	(2)	(1)	(2)			(1)	
First month	after 7 days	0.38	0.42	0.38	0.40	1.40	1.29	1.98	2.02	0.47	3.65
	14 days	0.42	0.52	0.44	0.48	1.58	1.89	1.98	2.21	0.98	3.82
	21days	0.48	0.58	0.44	0.62	1.62	2.20	2.00	2.30	1.48	2.24
	30 days	0.54	0.66	0.58	0.72	1.7	2.20	2.08	2.42	1.5	5.12
Second month		0.69	0.84	0.64	0.78	1.85	2.38	2.15	2.88	1.91	6.6
Third month		0.71	0.91	0.71	0.98	1.98	3.16	2.54	3.76	1.95	12.19

(1) Small glass bottles (without head space).
(2) Large glass bottles (with head space).

Table 3 . Effect of head space and storage on th fatty acids composition of some edible oils .

	Commercia oil			Sobean oil			Sunflower oil			Corn oil			Olive oil		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
8 : 0	-	-	1.18	-	-	-	-	-	-	-	-	-	-	-	-
10 : 0	-	-	0.46	-	-	-	-	-	-	-	-	-	-	-	-
12 : 0	-	-	0.82	-	-	-	-	-	-	-	-	-	-	-	-
13 : 0	-	-	0.26	-	-	-	-	-	-	-	-	-	-	-	-
14 : 0	-	0.62	1.06	-	-	-	-	-	-	-	-	-	-	-	-
15 : 0	-	-	2.72	-	-	-	-	-	-	-	-	-	-	-	-
16 : 0	20.16	20.49	25.09	13.48	15.20	18.61	12.05	12.03	14.03	14.26	14.88	16.99	26.45	29.75	35.72
18 : 0	-	-	-	3.2	4.46	9.76	3.00	3.92	4.84	2.55	3.94	4.64	-	-	-
18 : 1	30.00	29.36	25.28	24.33	23.28	20.24	14.16	13.00	11.2	29.14	28.90	26.7	56.22	54.70	51.17
18 : 2	49.84	49.53	43.10	58.99	57.06	51.39	70.79	70.1	69.93	54.05	52.28	51.67	17.33	15.55	13.11

(1) Fresh oil.
(2) Small glass bottles (without head space).
(3) Large glass bottles (with head space).

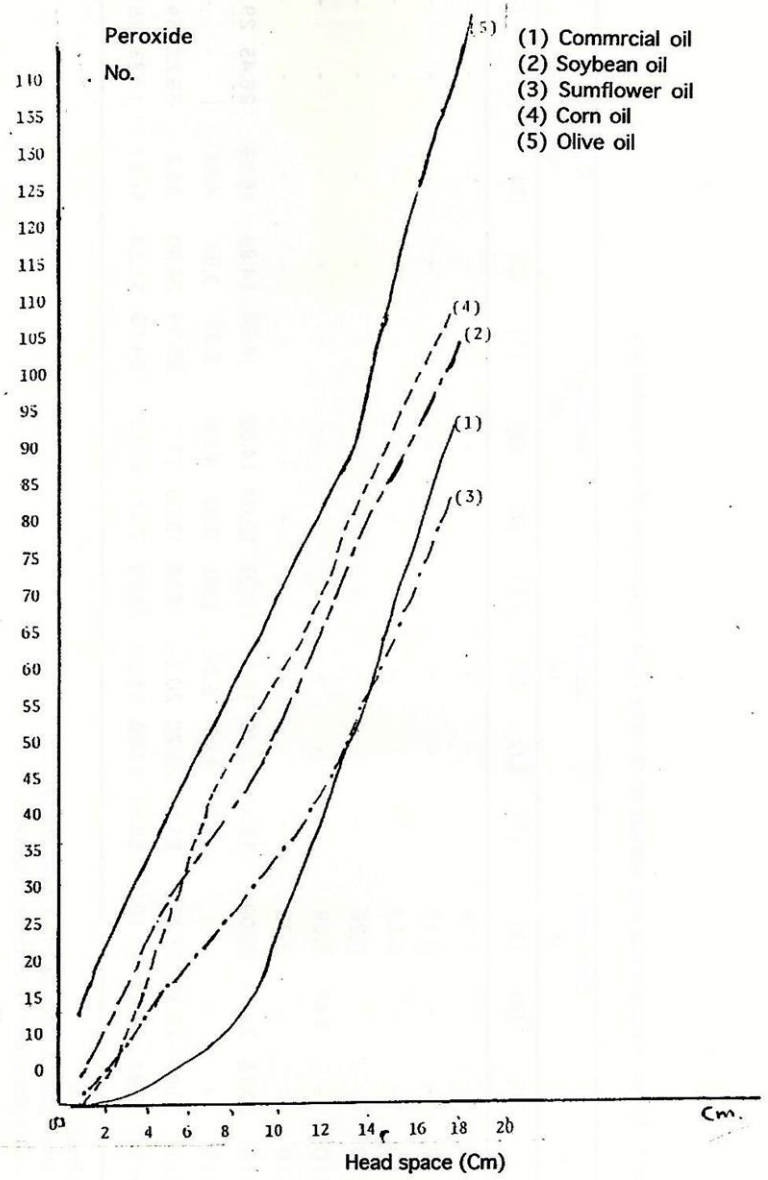

Fig. 1. Effect of head space on the peroxide value of some edible oils.

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تأثير الفراغ القمى والتخزين في الضوء العادى علي درجة جودة بعض الزيوت الغذائية

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١ – قسم علوم الأغذية كلية الزراعة جامعة الزقازيق .
٢ – قسم بحوث تصنيع الفاكهة ـ معهد بحوث البساتين ـ مركز البحوث الزراعية ـ الجيزة.

تم وضع بعض الزيوت الغذائية مثل الزيت التجاري ، زيت فول الصويا ، زيت عباد الشمس ، زيت الذرة ، زيت الزيتون في عبوات زجاجية شفافة (زجاجات صغيرة في حدود ٢٠جم بدون ترك فراغ وزجاجات اخري كبيرة في حدود ٢٥٠جم مع ترك فراغ مماثل كما هو في السوق المحلي) وخزنت الزجاجات علي الرف في درجة حرارة الغرفة (٢٥ ± ٢م°) في الضوء العادي ولمدة ٣ شهور وكان القصد من ذلك معرفة القمي والتخزين في الضوء العادي علي جودة الزيوت الغذائية السابقة .

وتتلخص النتائج فى الاتى :-

زاد رقم البيروكسيد بنسبة عالية في الزجاجات الكبيرة ذات الفراغ القمي اكثر من الزجاجات الصغيرة التي ليس بها فراغ قمي . زادت الحموضة قليلة خلال التخزين كما زادت الاحماض الدهنية المشبعة وقلت نسبة الاحماض الدهنية الغير مشبعة في حالة الزجاجات الكبيرة التي بها فراغ قمي نتيجة عملية أكدة الروابط الزوجية .

لذلك ينصح في حالة تخزين الزيوت تعبئتها في زجاجات صغيرة الحجم حتي يمكن تلافي حدوث الاكسدة عند التخزين ومن ثم إطالة فترة صلاحيتها.