Application of some vegetables extracts on storage period of corn and linseed oils

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ABSTRACT

This study aimed to determine the phenolic and flavonoids content of carrot, cabbage and green pepper extracts and their effects on some chemical properties of corn and linseed oils during storage period. Phenolic and flavonoids content were determined by high performance liquid chromatographic method using ultraviolet (UV) detector set at 280nm and 330nm, respectively. Corn and linseed oils storied (Six months) at room temperature (25±5°c) after additional 500 ppm, 1000 ppm and 1500 ppm from carrot, cabbage and green pepper extracts and compared with additional 200 ppm synthetic antioxidants (BHT & BHA). The oils samples analyzed every month for acid, peroxide and iodine values during storage period. The results showed that in the end of storage period acid and peroxide values of corn and flaxseed oils which treated with 1500 ppm carrot cabbage and green pepper extracts were lower than other treatments , while iodine value were higher. It can be concluded that the additional of carrot, cabbage and green pepper extracts enhanced the acid, peroxide and iodine values of corn and linseed oils in the end of storage period.

***Keywords**: Antioxidants- carrot, cabbage and green pepper extract -Corn and linseed oils –Chemical properties.*

INTRODUCTION

Vegetables are good sources of natural antioxidant such as vitamins, minerals and phenolic compounds **(Zhang and Hamauzu 2004).** Fruits and vegetables are rich sources of various phytonutrients, many of which have antioxidant properties. In addition to the well-known antioxidants, vitamins C and E, and ß carotene, fruits and vegetables contain other phytonutrients which significantly contribute to antioxidant activity and other health benefits **(Alasalvar et al., 2005).**

Carrot *(Daucus carota)* is one of the important root vegetable crops and is highly nutritious as it contains appreciable amount of vitamins B1, B2, B6 and B12. It also contains many important minerals **(Ong and Chytil 1983).** in addition **(Torronen et al., 1996) and (Sharma et al., 2012).** Carrot is one of the important root vegetables rich in bioactive compounds like carotenoids and dietary fibers with appreciable levels of several other functional components having significant health-promoting properties and source of natural antioxidants having anticancer activity.

Cabbage is an excellent source of Vitamin C It also contains significant amounts of glutamine, an amino acid which has anti-inflammatory properties. Cabbage can also be included in dieting programs, as it is a low calorie food. It is a source of indole-3-carbinol, a compound used as an adjuvant therapy for recurrent respiratory papillomatosis, a disease of the head and neck caused by human papillomavirus that causes growths in the airway that can lead to death **(Butnariu, 2008).**

Green pepper is one of the most widely used spices and is available in black, green, and white **Govindarajon (1997).** Peppers are cultivated in most temperate and tropical areas in the world. They are considered to be good sources of various

nutritional compounds, such as carotenoids, flavonoids and mineral elements. There is a growing interest in peppers as a food containing beneficial compounds, especially because diet supplements do not provide the same nutritional and medicinal benefits as fresh fruits and vegetables (Bosland and Votava, 1999).

Vegetable oils have natural protection substances against deterioration caused by different factors, light, heat, basis, salts, enzymes and package material, these changes may by develop before or after modern processing storage, hydrolysis, auto-oxidation, polymerization, pyrolysis and uptake of flavor of foreign origin (Miller 1998**)**.

Flaxseed *(limum usitatissimum)* is of the family linaceae, also known as linseeds (Sello, 2006). The funded Flaxseed or linseed *(Linum usitatissimum L.*) comes from the flax plant, an annual herb. The main importance of flaxseed is in the human nutrition sector because it is emerging as an important functional food ingredient thanks to the content of active compounds, pointed to provide health benefits. There are several ways to eat flaxseed: milled, in the form of oil or added to bakery product (Bernacchia et al., 2014**).** Linseed has been used for a very long time in human and animal nutrition. Currently, there is an increasing interest in linseed oil because of its particularly high content in α-linolenic acid (ALA), an omega-3 fatty acid (FA) **(**Michotte et al., 2011).

Corn oil (maize oil) is obtained from seeds (kernels) that contain only 3–5% oil. Almost all commercial corn oil is obtained by pressing (Moreau 2005). Its main use is in cooking, where its high smoke point makes refined corn oil valuable frying oil, it is also a key ingredient in some margarine. Corn oil is generally less expensive than most other types of vegetable oils (Dupont et al., 1990). Corn oil contains

omega-3 and omega-6 by 4: 1 and the optimal ratio is believed to be 4: 1 or less (Daley et al., 2004). Corn oil has long been a popular cooking oil, because of its mild flavor, its stability (due to low levels of linolenate), and its reputation as a healthy edible oil (due its high levels of polyunsaturated fatty acids). Because of its higher levels of polyunsaturated than most other commodity vegetable oils (especially soy), corn oil was considered a superior oil and was sold at a premium (Frank 2011). In recent years the antioxidant properties of tocopherols (such as those found in corn oil) may be involved in combating atherosclerosis by preventing the oxidation of low-density lipoproteins **(**Saldeen et al., 1999).

Natural antioxidants from plant sources, the antioxidant and radical scavenging activities of some medicinal plants and fruits have been extensively studied in the last few decades (Singh et al., 2002). Antioxidants are widely used in food processing to prevent undesirable decomposition process and protect the quality of oil by retarding oxidant. Antioxidants compounds are an effective means for solving problem of rancidity and storage caused by the oxidation of lipids their effectiveness is generally attributed to their ability of reaction with free radicals and termination of chain reaction between unsaturated fatty acids and oxygen (EL-Jamal, 2001).

Chemical properties play an important role on oil quality, which can be evaluated by different constants such as acid value (AV), thiobarbituric acid (TBA) test, peroxide value (PV), iodine value (IV), Kreis Value (KV), and total carbonyl compounds (TC). These constituents are used to express the degree of oil deterioration **(**Wanasundara et al., 1994).

Consequently, this investigation aims to evaluate the chemical composition of carrot, cabbage and pepper, and

effect of phenolic and flavonoids content of carrot, cabbage and pepper extracts on some chemical properties of corn and linseed oils during storage period.

MATERIALS and METHODS

1. **Materials**

   Carrots, cabbage, green pepper, corn and flaxseed oil were obtained from local market in Egypt Chemical were Burch aced from El-gomhoria Company, Cairo, Egypt.

2. **Methods**

Preparation of Carrots, cabbage and green pepper:

Carrot, cabbage and green pepper cleaned from extraneous matter and properly washed with tab water then dried in air-oven for 24 h at 40 ºC and then crushed into fine powder.

Preparation of Carrots, cabbage and green pepper extracts:

The dried Carrots, cabbage and green pepper ground in a blender to form powder, thereafter, 10g of the powder macerated in 100 ml absolute ethanol and the extraction repeated three times. The extracts filtered through Whatman filter paper (No. 40) and concentrate in a rotary evaporator under reduced pressure.

Corn and linseed oils storied (Six months) at room temperature (25±5°c) after additional 500 ppm, 1000 ppm and 1500 ppm from synthetic antioxidants (200 ppm of BHT & BHA), carrot, cabbage and green pepper extracts. Control corn and linseed oils and treated samples with extracts analyzed every month for acid, peroxide and iodine values during storage period.

Chemical analysis of vegetables:

Determination of moisture, crude protein, crude lipids ash and fibers

Moisture, Crude protein, Crude lipids and Ash content of the carrots, cabbage and green pepper was determined according to the method described by **AOAC (2000)**.

Determination of carbohydrates:

Carbohydrates content was calculated by difference from the following equation: according to **AOAC (2000).**

Carbohydrates content % = 100 – (Protein + Moisture + Ash + Lipids + Fiber)

Chemical properties of oils:

Determination of acid, peroxide and iodine value:

Acid, peroxide and iodine value was determined according to **AOAC (2000).**

Determination of Flavonoids Compounds:

Flavonoids compounds were determined by HPLC according to the method of **Mattila *et al.* (2000)** as follow: 5g of sample were mixed with methanol and centrifuged at 10000 rpm for 10 min. and the supernatant was filtered through a o.2 µm Millipore membrane filter then 1-3 ml was collected in a vial for injection into HPLC Hewllet Packared (series 1050) equipped with auto sampling injector, solvent degasser, ultraviolet (UV) detector set at 330nm and quarter HP pump (series 1050). The column temperature was maintained at 35◦ C. Gradient separation was carried out with methanol and acetonitrile as mobile phase at flow rate of 1 ml/min. Flavonoid acid standard from sigma Co. were dissolved in a mobile phase and injected into HPLC. Retention time and peak area were used to calculation of phenolic compounds concentration by the data analysis of HEWLLET Packared software.

Determination of phenolic Compounds:

Phenolic compounds were determined by HPLC according to **Goupy *et al.* (1999)** as follow: 5g of sample were mixed with methanol and centrifuged at 10000 rpm for 10 min. and the supernatant was filtered through a o.2 µm Millipore membrane filter then 1-3 ml was collected in a vial for injection into HPLC Agilaut (series 1200) equipped with auto

samplling injector, solvent degasser, ultraviolet (UV) detector set at 280 nm and quarternary HP pump (series 1100). The column temperature was maintained at 85◦ C. Gradient separation was carried out with methanol and acetonitrile as mobile phase at flow rate of 1 ml/min. phenolic acid standard from sigma Co. were dissolved in a mobile phase and injected into HPLC. Retention time and peak area were used to calculation of phenolic compounds concentration by the data analysis of HEWLLET Packared software. Aminex-carbohydrate HPX- 87C 300mm × 7.8mm.

Instruments of High-Performance Liquid Chromatography (HPLC)

HPLC Agilent 1200 series equipped with Quaternary pump, Auto sampler, and column compartment set at 35◦C, Maltiwave length detector set at (230nm – 280nm) for detection phenolic / Flavonoid compounds and degasser. Coulmr. Used for fractionation Zorbas ODS 4.6 × 250 nm and the flow rate of mobile phase run was 1 ml/min.

Statistical analysis:

The statistical evaluation of the mean ± stander deviation data was analyzed according to **(Zar, 1984).**

RESULTS and DISCUSSION

- ***Chemical composition of carrot, cabbage and green pepper.***

From data in table (1) It can be noticed that moisture, crude protein, total lipids, ash, fiber and carbohydrate content of carrot were (10.65, 5.08, 3, 7, 1.30 and 83.62), respectively, while these values were (4.23, 10.41, 2.42, 9.00, 2.50 and 75.67) for green pepper and the chemical composition of cabbage were (9.63, 10.33, 2.45, 9.00, 1.30 and 76.92), respectively. Such results are in agreement with those obtained by **Elbasuony, (2014).**

- ***Flavonoids content of cabbage, pepper and carrot extracts.***

Flavonoids are phenolic compound with high antioxidant activity**.** Moreover, they have antitumoral and antimicrobial activities and participate in the prevention of cardiovascular diseases **(Nijveldt *et al.,* 2001) and (Cushine and Lamb 2005**). From table (2) it can by noticed that cabbage extract contain flavonoids (ppm) as luteolin (152.74), narengin (139.77), rutin (315.70), hisperidin (112.85), rosmarinic (92.94), quercetrin (168.09), quercetin (44.40), hispertin (115.04), kampferol (21.68), apegnin (21.11) this results are agreement with (**Kusznierewicza et al., 2008).** Who estimated that the content of bioactive compounds in cabbages derived from different regions and reported that the values of total polyphenols; flavonoids and flavanols were 3.69 ±0.37, 4.91±0.52, 3.7±0.37, 2.74±0.27 mg gallic acid equivalent "GAE"/g;1.82 ±0.21 , 2.42±0.24, 1.82±0.19 and 1.41±0.15mg catechin equivalent " CE"/g and 3.05 ±0.04, 4.0670.05, 3.0170.03 and 2.370.02 µg catechin equivalent "CE" /g) for cabbages derived from England, Belgium, Germany and Poland regions, respectively. Moreover pepper extract contain luteolin (313.07), narengin (54.90), rutin (303.96), hisperidin (1068.34), rosmarinic (29.90), quercetrin (186.26), quercetin (28.53), hispertin (13.82), kampferol (24.37), apegnin (1.27) ppm, this results are agreement with **(Bosland and Votava 1999).** Who reported that the peppers are cultivated in most temperate and tropical areas in the world. They are considered to be good sources of various nutritional compounds, such as carotenoids, flavonoids and mineral elements, there is a growing interest in peppers as a food containing beneficial compounds, especially because diet supplements do not provide the same nutritional and medicinal benefits as fresh fruits and vegetables. Additional carrot extract contain luteolin (320.75), narengin (84.12), rutin (190.05), hisperidin (951.95), rosmarinic (84.08), quercetrin (354.45),

quercetin (163.17), hispertin (231.56), kampferol (46.70), apegnin (12.58) ppm, this results are agreement **(Yena et al., 2008).** Studied the antioxidant composition (mg/g DM) in carrot with various treatment (means standard error, n=3) and reported that total Phenolics and Total flavondoids of carrot were 3.72 and 3.02 (mg/g DM).

- ***Phenolic compounds content of cabbage, pepper and carrot extracts***

From table (3) it can by noticed that cabbage extract contain gallic (318.86), pyrogallol (2395.99), 4-amino-benzoic (238.19), 3-oH-tyrosol (1221.05), protocatchuic (751.98), chlorogenic (341.03), catechein (845.63), catechol (554.26), caffeine (346.23), p-oH-benzoic (460.57), caffeic (373.01), vanillic (84.85), p-coumaric (104.33), ferulic (93.51), iso-ferulic (67.89), reversetrol (142.10), ellagic (260.22), alpha-coumaric (93.29), 3,4,5-methoxy-cinnamic (157.46), coumarin (64.64), salycillic (790.52), cinnamic (20.78) ppm, this results are agreement **(Watanabe et al., 2011)**. Mentioned that the total phenols of methanolic extracts from orange-colored and normal Chinese cabbage, the total phenols of methanolic extracts from orange-colored Chinese cabbage (387 ±11 mg/ 100 g DW) was higher than the methanolic extracts from normal Chinese cabbage (263 ± 2 mg/100 g DW) ($P < 0.001$). Moreover pepper extract contain Gallic (1764.71), pyrogallol (7194.00), 4-amino-benzoic (1226.44), 3-oH-tyrosol (3405.92), protocatchuic (4714.14), chlorogenic (4504.89), catechein (2694.35), catechol (706.49), caffeine (1272.03), P-oH-benzoic (1072.62), caffeic (357.11), vanillic (497.27), p-coumaric (416.88), ferulic (176.53), iso-ferulic (46.67), reversetrol (94.40), ellagic (1548.81), e-vanillic (4777.33), alpha-coumaric (450.30) 3,4,5-methoxy-cinnamic (77.02), coumarin (24.55), salycillic (612.12), cinnamic (27.00) ppm, this results are agreement **(Reis**

***et al.,* 2013).** Who studded that phenolic compounds on a dry basis of pepper in natural and dried at temperatures of 45, 55 and 65C◦ and the values were 9748.22, 1480.25, 1450.70 and 1415.44 mg GAE kg^{-1}, respectively.

Additional carrot extract contain Gallic (1337.81), pyrogallol (3741.56), 4-amino-benzoic (497.37), 3-oH-tyrosol (2465.47), protocatchuic (3144.85), chlorogenic (4427.13), catechein (2361.11), catechol (527.13), caffeine (319.19), P-oH-benzoic (1387.60), caffeic (1102.80), vanillic (594.78), p-coumaric (320.00), ferulic (207.92), iso-ferulic (119.13), reversetrol (41.01), ellagic (243.62), alpha-coumaric (442.33) 3,4,5-methoxy-cinnamic (276.65), coumarin (27.62), salycillic (1912.19), cinnamic (30.39) ppm, this results are agreement **(Alasalvar *et al.,* 2001).** Mentioned that the total amount of phenolic in purple carrots was 74.6 mg/100 g. Whereas the corresponding values in yellow, orange and white varieties ranged from 7.72 to 16.2 mg/100 g.

- ***Acid values (mg KOH /gm oil) of corn and flaxseed oils as affected by BHT, BHA, carrot, green pepper, and cabbage extracts during storage period (Six months).***

The development of free fatty acid content in oil is usually considered to be one of the main parameters used in evaluating the quality of firing oil **(Sello, 2006)**. Table (4) showed the acid value of corn oil as affected by (BHT) and (BHA) during storage period (six month). From table (4) it can by noticed that acid value of corn oil increased from (0.150) at zero time to (0.542) after six month for control sample, while the acid values of oils treated with (BHT) and (BHA) were (0.143, 0.156) and (0.443, 0.436), respectively. Moreover it can by observed that the addition of (BHT) and (BHA) reduced the values of acid value of corn oil in the end of storage period, this reduction in acid values due to synthetic antioxidants (BHT

& BHA) retard undesirable changes due to oxidation **(Lagouri et al., 1992)**. In additional the same trend of results was confirmed by **El-Agaimy et al., (1989)** Who reported that the values of free acidity of corn oil were (0.09 - 0.16). Moreover, from table (5) it can by noticed that acid value of corn and linseed oils which treated with (500, 1000, 1500 ppm) carrot cabbage and green pepper extracts were lower than other treatments in the end of storage period (six months).

- ***Peroxide values (Meq/kg oil) of corn and linseed oil as affected by BHT, BHA, carrot, green pepper, and cabbage extracts during storage period (Six months).***

In spite of the fact the peroxide value (P.V) is an important for the quality assessment of fats and crude oils, peroxide value was determined to follow up the antoxidation of fats and crude oils. Table (6) show the peroxide value of corn oil as affected by (BHT) and (BHA) during storage period (six month). From table (6) it can by noticed that the changes in the peroxide values of corn oil increased from (2.300) at zero time to (8.700) after six month for control sample, while the peroxide value of oil treated with (BHT) and (BHA) were (2.267, 2.333) and (7.333, 7.367), respectively. The same trend of results was confirmed by **(El-Agaimy et al., 1989)**. Who stated that peroxide values were 1.02-9.6. From the same table (12) it can by observed that the addition of (BHT) and (BHA) reduced the values of the peroxide value of corn oil in the end of storage period. From table (7) it can by noticed that that peroxide values of corn and flaxseed oils which treated with 500,1000 and 1500 ppm carrot cabbage and green pepper extracts were lower than other treatments in the end of storage period (six months).

- ***Iodine values of corn and flaxseed oil as affected by BHT, BHA, carrot, green pepper, and cabbage extracts during storage period (Six months).***

Table (8) show the iodine value of corn oil as affected by (BHT) and (BHA) during storage period (six month). From table (8) it can by noticed that the iodine values of corn oil decreased from (132.82) at zero time to (105.75) after six month for control sample, while the iodine value of oil treated with (BHT) and (BHA) were (132.61, 132.40) and (116.11,118.44) respectively. The same trend of results was confirmed by **(El-Agaimy *et al*., 1989)** who reported that iodine values were 110.15-122.25. Also, it can by observed that the addition of (BHT) and (BHA) reduced the values of iodine value of corn oil in the end of storage period compared with control sample. From table (9) it can by concluded that the iodine value of corn oil and flaxseed oils which treated with 500, 1000 and 1500 ppm carrot cabbage and green pepper extracts were higher than control sample and oils treated with synthetic antioxidants (BHA &BHT) in the end of storage period (six months).

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Table (1): Chemical composition of carrot, green pepper and cabbage

Compounds (%)	Carrot	Pepper	Cabbage
Moisture content	10.65±0.1	4.23 ± 0.10	9.63 ± 0.60
Crude protein*	5.08±0.20	10.41±0.10	10.33±0.74
Total lipids*	3.00± 0.30	2.42 ± 0.71	2.45 ± 0.70
Ash content*	7.00 ± 1.41	9.00 ± 1.41	9.00 ± 1.42
Fiber*	1.30 ± 1.24	2.50 ± 1.10	1.30 ± 0.12
Carbohydrates*	83.62	75.67	76.92

Values are means of four replicates ± stander deviation

***** On dray weight basis

Table (2) Flavonoids content of cabbage, pepper and carrot extracts (ppm).

Flavonoids (PPM)	Extracts		
	Cabbage extract	Pepper extract	Carrot extract
Luteolin	152.74	313.07	320.75
Narengin	139.77	54.90	84.12
Rutin	315.70	303.96	190.05
Hisperidin	112.85	1068.34	951.95
Rosmarinic	92.94	29.90	84.08
Quercetrin	168.09	186.26	354.45
Quercetin	44.40	28.53	163.17
Hispertin	115.04	13.82	231.56
Kampferol	21.68	24.37	46.70
Apegnin	21.11	1.27	12.58

Table (3) Phenolic compounds content of cabbage, pepper and carrot extracts (ppm)

Phenolic compounds (ppm)	Extracts		
	Carrot extract	Pepper extract	Cabbage extract
Gallic	1337.81	1764.71	318.86
Pyrogallol	3741.56	7194.00	2395.99
Amino-benzoic-4	497.37	1226.44	238.19
OH-Tyrosol-3	2465.47	3405.92	1221.05
Protocatchuic	3144.85	4714.14	751.98
Chlorogenic	4427.13	4504.89	341.03
Catechein	2361.11	2694.35	845.63
Catechol	527.13	706.49	554.26
Caffeine	319.19	1272.03	346.23
P-OH-benzoic	1387.60	1072.62	460.57
Caffeic	1102.80	357.11	373.01
Vanillic	594.78	497.27	84.85
p-coumaric	320.00	416.88	104.33
Ferulic	207.92	176.53	93.51
Iso-ferulic	119.13	46.67	67.89
Reversetrol	41.01	94.40	142.10
Ellagic	253.62	1548.81	260.22
e-vanillic	…	4777.33	…
Alpha-coumaric	442.33	450.30	93.29
methoxy-cinnamic-3,4,5	276.65	77.02	157.46
Coumarin	27.62	24.55	64.64
Salycillic	1912.19	612.12	790.52
Cinnamic	30.39	27.00	20.78

Table (4): Acid value of corn oil as affected by BHT, BHA, carrot, cabbage, green pepper and storage period (mg KOH /g oil)

Storage period (Months)	Control	Synthetic antioxidant		Natural antioxidant								
				Carrot			Cabbage			Green pepper		
		BHT	BHA	500 ppm	1000 ppm	1500 ppm	500 ppm	1000 ppm	1500 ppm	500 ppm	1000 ppm	1500 ppm
Zero time	1.253± 0.03	1.247± 0.03	1.234± 0.01	1.328± 0.15	1.228± 0.02	1.222± 0.03	1.197± 0.02	1.141± 0.07	1.221± 0.04	1.216± 0.00	1.153± 0.03	1.134± 0.06
1	1.421± 0.02	1.228± 0.02	1.253± 0.02	1.328± 0.02	1.290± 0.02	1.227± 0.01	1.284± 0.03	1.252± 0.02	1.272± 0.01	1.253± 0.02	1.216± 0.04	1.150± 0.02
2	1.621± 0.03	1.415± 0.03	1.440± 0.03	1.546± 0.01	1.515± 0.02	1.415± 0.02	1.496± 0.00	1.468± 0.01	1.371± 0.03	1.477± 0.03	1.403± 0.06	1.340± 0.03
3	1.795± 0.03	1.590± 0.02	1.577± 0.01	1.689± 0.01	1.636± 0.03	1.583± 0.01	1.646± 0.02	1.580± 0.01	1.533± 0.02	1.614± 0.01	1.561± 0.01	1.508± 0.01
4	2.188± 0.02	1.814± 0.02	1.820± 0.03	2.076± 0.02	1.879± 1.07	1.733± 0.04	2.026± 0.02	1.833± 1.04	1.689± 0.04	2.007± 0.02	1.805± 1.02	1.652± 0.03
5	2.581± 0.02	2.138± 0.04	2.163± 0.04	2.450± 0.02	2.253± 1.29	2.082± 0.02	2.412± 0.02	2.197± 1.25	2.032± 0.03	2.375± 0.03	2.188± 1.25	2.013± 0.01
6	2.899±0 .02	2.531± 0.01	2.512± 0.01	2.836± 0.04	2.683± 1.54	2.481± 0.02	2.768± 0.03	2.627± 1.51	2.431± 0.02	2.761± 0.04	2.618± 1.50	2.3100 ± 0.03

Table (6): Peroxide value of corn oil as affected by BHT, BHA, carrot, cabbage, green pepper and storage period (mg KOH /g oil)

Storage period (Months)	Control	Synthetic antioxidant		Natural antioxidant								
		BHT	BHA	Carrot			Cabbage			Green pepper		
				500 ppm	1000 ppm	1500 ppm	500 ppm	1000 ppm	1500 ppm	500 ppm	1000 ppm	1500 ppm
Zero time	2.300± 0.02	2.267± 0.01	2.333± 0.01	2.367± 0.01	2.333± 0.01	2.333± 0.02	2.200± 0.03	2.333± 0.01	2.267± 0.01	2.233± 0.02	2.333± 0.01	2.333± 0.01
1	3.200± 0.02	2.800± 0.02	2.800± 0.02	3.167± 0.01	3.100± 0.33	3.067± 0.02	3.067± 0.02	2.967± 0.30	2.933± 0.02	2.933± 0.04	2.900± 0.31	2.867± 0.04
2	4.367± 0.01	2.833± 0.30	4.233± 0.11	4.333± 0.02	4.100± 0.43	4.067± 0.02	4.233± 0.04	3.967± 0.42	3.967± 0.01	4.067± 0.02	3.900± 0.40	3.867± 0.02
3	5.433± 0.04	5.100± 0.02	5.000± 0.02	5.200± 0.04	5.000± 0.53	4.933± 0.02	5.133± 0.02	4.833± 0.52	4.667± 0.05	5.033± 0.01	4.800± 0.49	4.733± 0.04
4	6.533± 0.04	5.400± 0.03	5.400± 0.04	6.267± 0.02	6.067± 0.64	5.767± 0.03	6.167± 0.03	5.933± 0.62	5.633± 0.03	6.100± 0.02	5.867± 0.60	5.567± 0.03
5	7.633± 0.05	6.500± 0.02	6.367± 0.03	7.433± 0.03	7.133± 0.75	6.633± 0.02	7.333± 0.04	7.000± 0.76	6.467± 0.02	7.233± 0.01	6.933± 0.73	6.367± 0.03
6	8.700± 0.04	7.333± 0.02	7.367± 0.03	8.533± 0.03	8.367± 0.88	7.767± 0.02	8.433± 0.01	8.233± 0.88	7.633± 0.03	8.367± 0.04	8.200± 0.86	7.567± 0.02

Table (7): Peroxide value of linseed oil as affected by BHT, BHA, carrot, cabbage, green pepper and storage period (mg KOH /g oil)

Storage period (Months)	Control	Synthetic antioxidant		Natural antioxidant								
		BHT	BHA	Carrot			Cabbage			Green pepper		
				500 ppm	1000 ppm	1500 ppm	500 ppm	1000 ppm	1500 ppm	500 ppm	1000 ppm	1500 ppm
Zero time	4.867± 0.01	4.833± 0.01	4.800± 0.02	4.800± 0.02	4.800± 0.00	4.700± 0.02	4.700± 0.03	4.867± 0.01	4.700± 0.04	4.833± 0.01	4.733± 0.03	4.800± 0.02
1	5.600± 0.02	5.200± 0.02	5.167± 0.01	5.200± 0.02	5.467± 0.02	5.400± 0.00	4.900± 0.02	5.433± 0.01	5.367± 0.01	4.733± 0.01	5.367± 0.01	5.333± 0.01
2	7.633± 0.03	5.667± 0.04	5.700± 0.04	7.233± 0.01	6.500± 0.037	5.933± 0.01	6.867± 0.01	6.400± 0.02	5.833± 0.02	6.667± 0.01	6.300± 0.00	5.733± 0.03
3	8.567± 0.03	6.700± 0.03	6.600± 0.02	8.200± 0.02	7.300± 0.05	6.900± 0.02	7.867± 0.01	7.100± 0.02	6.867± 0.01	7.733± 0.01	7.067± 0.02	6.800± 0.00
4	9.500± 0.02	7.200± 0.02	7.167± 0.01	9.133± 0.03	8.200± 0.04	7.433± 0.01	8.800± 0.02	8.000± 0.02	7.367± 0.01	8.600± 0.02	7.900± 0.02	7.300± 0.02
5	10.433± 0.04	8.200± 0.02	8.100± 0.02	9.900± 0.02	9.033± 0.01	8.433± 0.01	9.700± 0.02	8.833± 0.03	8.367± 0.01	9.433± 0.01	8.700± 0.02	8.300± 0.02
6	11.300± 0.05	9.100± 0.02	9.067± 0.03	10.50± 0.02	10.067± 0.02	9.700± 0.03	10.167± 0.01	10.00± 0.0	9.467± 0.01	9.967± 0.01	9.700± 0.03	9.333± 0.03

Table (8): Iodine value of corn oil as affected by BHT, BHA, carrot, cabbage, green pepper and storage period (mg KOH /g oil)

Storage period (Months)	Control	Synthetic antioxidant		Natural antioxidant								
		BHT	BHA	Carrot			Cabbage			Green pepper		
				500 ppm	1000 ppm	1500 ppm	500 ppm	1000 ppm	1500 ppm	500 ppm	1000 ppm	1500 ppm
Zero time	132.82± 0.73	132.61± 1.01	132.40± 1.47	132.82± 0.73	131.98± 1.27	133.03± 0.37	132.61± 0.63	133.03± 0.366	132.82± 0.37	132.82± 1.32	133.25± 0.63	133.25± 0
1	131.13± 3.66	131.34± 3.30	132.40± 1.47	130.70± 1.27	131.13± 1.94	132.40± 1.47	130.92± 0.97	131.34± 1.68	132.40± 1.47	131.34± 2.20	132.82± 0.37	133.03± 0.37
2	129.02± 3.66	129.23± 3.49	131.55± 2.93	129.44± 1.68	130.07± 2.77	131.55± 2.93	129.86± 1.60	130.50± 2.56	131.55± 2.93	130.28± 1.83	131.98± 1.10	132.82± 0.37
3	122.67± 3.66	123.09± 3.36	129.44± 3.36	127.53± 2.91	128.59± 4.46	129.44± 3.36	127.53± 4.16	128.17± 5.08	129.44± 3.36	128.80± 1.10	130.50± 2.56	131.55± 2.93
4	116.33± 3.66	120.77± 6.03	122.88± 3.49	120.13± 1.32	121.61± 3.19	122.88± 3.49	120.34± 2.04	121.19± 0.63	122.88± 3.49	122.04± 6.39	123.52± 8.80	124.10± 7.15
5	113.79± 0.73	118.02± 7.72	121.19± 6.05	118.65± 3.30	119.50± 4.03	121.19± 6.05	118.02± 3.17	119.29± 3.86	121.19± 6.05	120.13± 4.68	121.61± 6.66	123.30± 9.29
6	105.75± 3.66	116.11± 7.95	118.44± 7.33	108.29± 0.73	110.40± 3.36	112.10± 3.66	109.98± 1.83	111.04± 1.74	114.21± 0.0	112.10± 3.66	114.42± 6.66	116.33± 9.69

Table (9): Iodine value of linseed oil as affected by BHT, BHA, carrot, cabbage, green pepper and storage period (mg KOH /g oil)

Storage period (Months)	Control	Synthetic antioxidant		Natural antioxidant								
				Carrot			Cabbage			Green pepper		
		BHT	BHA	500 ppm	500 ppm	500 ppm	500 ppm	500 ppm	500 ppm	500 ppm	500 ppm	1500
Zero time	190.773± 0.73	190.562± 1.32	190.985± 1.27	190.562± 1.83	190.350± 0.00	190.773± 1.32	190.350± 0.63	190.985± 2.20	190.139± 0.37	190.773± 0.73	190.985± 0.63	190.350± 0.00
1	182.948± 0.37	188.870± 0.73	188.658± 0.37	183.371± 0.63	184.640± 0.63	185.909± 0.63	183.794± 0.37	185.063± 0.37	186.332± 0.37	184.428± 0.73	185.486± 0.37	186.755± 0.37
2	182.313± 0.37	187.389± 0.37	187.601± 0.37	182.736± 0.63	184.005± 0.63	184.851± 0.37	183.159± 0.37	184.428± 0.37	185.274± 0.63	183.582± 0.37	184.640± 0.00	185.909± 0.63
3	180.621± 0.37	186.543± 0.63	186.332± 0.37	181.044± 0.37	181.679± 1.47	181.890± 1.83	180.833± 0.00	181.044± 0.37	182.948± 1.83	181.256± 0.73	181.467± 1.10	184.217± 0.37
4	177.660± 0.00	185.697± 0.37	185.486± 0.37	178.083± 0.73	178.929± 0.00	179.987± 0.97	178.506± 0.37	179.352± 0.73	181.044± 0.97	178.718± 0.37	179.775± 0.73	183.371± 1.10
5	174.911± .73	184.851± 0.37	184.640± 0.00	175.545± 0.97	177.872± 0.37	178.929± 0.63	176.180± 0.73	178.295± 0.635	179.987± 0.37	176.814± 0.97	178.718± 0.37	182.102± 0.63
6	172.796± 0.97	183.371± 1.10	183.159± 0.97	174.276± 0.37	177.449± 0.37	177.872± 0.73	175.968± 0.37	177.237± 0.37	178.929± 0.63	176.603± 0.97	177.660± 0.64	181.044± 0.73

تطبيقات مستخلصات بعض الخضروات علي مدة تخزين زيت الذرة والكتان

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تهدف هذه الدراسة إلى تقدير محتوى مستخلصات الكرنب والجزر والفلفل الأخضر من الفينولات والفلافونولات وأثر هذه المركبات على بعض الخواص الكيميائية لزيت الذرة وزيت بذرة الكتان خلال فترة التخزين) ستة أشهر .(تم تقدير محتوى الفينولات والفلافونولات بواسطة جهاز التحليل الكروماتوجرافى السائل عالي الكفاءة باستخدام (UV detector)كاشف الأشعة الفوق بنفسجية على طول موجي 380 نانوميتر و 330 نانوميتر على التوالي. تم تخزين زيت الذرة وزيت بذرة الكتان) ستة أشهر (على درجة حرارة الغرفة 5±25درجة مئوية بعد إضافة 1500 ,1000 , 500 جزء في المليون من مستخلصات الكرنب والجزر والفلفل الأخضر ومقارنتها بإضافة 200 جزء فى المليون من مضادة الأكسدة الصناعية (بيوتيلاتد هيدروكسى تولوين) و (بيوتيلاتد هيدروكسى انيزول) ، وقد تم تحليل عينات الزيوت لقيم (رقم الحموضة- رقم البيروكسيد- الرقم اليودي) كل شهر خلال فترة التخزين , وأوضحت النتائج إلى أنه في نهاية فترة التخزين كان رقم الحموضة ورقم البيروكسيد لعينات زيت الذرة وزيت بذرة الكتان المعاملة بـ 1500جزء في المليون من مستخلصات الكرنب والجزر والفلفل الأخضر اقل من باقي المعاملات ، بينما كانت قيمة الرقم اليودي لهذه العينات أعلى من باقي المعاملات. وفى النهاية يمكن استنتاج أن إضافة مستخلصات الكرنب والجزر والفلفل الأخضر أدى الى تحسين رقم الحموضة والبيروكسيد والرقم اليودي في نهاية فترة التخزين.

الكلمات المفتاحية: مضادات الاكسدة- مستخلص الجزر والكرنب والفلفل الاخضر- زيت الذرة والكتان- الخصائص الكيميائية