# Extraction, Identification and Evaluation of Antioxidant Activity in Some Herbs and Spices

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## ABSTRACT

Addition of synthetic antioxidants can control lipid oxidation in foods, but their use has become restricted because of their health risks and toxicity. The increasing consciousness of consumers, with regard to food additive safety, created a need for identifying alternative natural and safer sources of food antioxidants. Green tea, sage, caraway, rosemary, ginger, anise, coriander, fenugreek, cumin and black cumin were subjected to screening for its phenolic compounds using TLC. Then, they were extracted with methanol. The phenolic compounds were identified in the methanolic extracts using HPLC, and then evaluated for their antioxidant activity. The obtained results revealed that green tea contained the highest amount of total phenolic content 155.72 g/kg followed by sage (82.8 g/kg), and ginger contained the lowest amount (25.7 g/kg). Eight phenolic compounds were separated and identified from green tea, nine from sage and four from caraway. Moreover, it was found from this study, that green tea extract showed antioxidant activity similar to TBHQ at the same concentration. Green tea showed antioxidant activity two folds of sage and four folds of caraway extract.

***Key words: oxidation, natural antioxidant, synthetic antioxidant, phenolic compounds, herbs, spices.***

## INTRODUCTION

Auto-oxidation of fats and oils not only lowers the nutritional value of food, but also is associated with aging membrane damage, heart disease stroke emphysema, and cancer in living organisms (Addis & Warner, 1991, Jang *et al.*, 1997, Arai *et al.*, 2000). Lipid peroxidation that involves a series of free radical mediated chain reaction process is also associated with several types of biological damage. Therefore, much attention has been focused on the use of antioxidants, especially natural antioxidants, to inhibit lipid peroxidation (Namiki, 1990, Sherwin, 1990, Wanasundara & Shahidi, 1998).

Antioxidants play an important role in preventing undesirable changes in flavour and nutritional quality of foods. Antioxidants protect the cells against tissue damage associated with various human diseases (Shahidi *et al.*, 1992).

Reports revealing that BHA and BHT could be toxic, together with the increasing consciousness of consumers with regard to food additive safety, created a need for identifying alternative natural and probably safer sources of food antioxidants such as tocopherols in spite of the higher manufacturing costs and lower efficiency (Shahidi *et al.*, 1992, Buxiang & Fukuhara, 1997, Hirose *et al.* 1998, Wanasundara & Shahidi, 1998). The replacement of synthetic antioxidant by natural one may have benefits due to health implications and functionality such as solubility in both oil and water (Namiki, 1990, Al Saikhan *et al.*, 1995, Hagerman *et al.*, 1998, Reglero *et al.*, 1999). Vegetable materials contain many compounds with antioxidant activity. Some plants have been studied as sources of potentially safe natural antioxidants for the food industry, various compounds have been isolated, many of them being polyphenols (Hagerman *et al.*, 1998). Some components of extracts isolated from natural sources such as oilseeds, spices, fruits, and vegetables have been proven in model systems to be as effective antioxidants, as synthetic antioxidant (Al-Saikhan *et al.*, 1995, Benzie & Szeto, 1999, Baublis *et al.*, 2000, Moure *et al.*, 2001, Wenli *et al.*, 2001, Melo *et al.*, 2005).

Natural antioxidants are in great demand today due to both consumer preference and health concerns associated with the use of synthetic antioxidants. Literature data about chemical composition and the antioxidant occurrence and activity of plant material in Egypt are very limited. Therefore, the objectives of this study were to extract, identify, and evaluate the antioxidant compounds in some herbs and spices.

## MATERALS AND METHODS

### Materials

**Herbs and spices:** All herbs and spices used in this work were obtained from a local herb grocery at Alexandria. The group of herbs and spices used were: Ginger (*Zingiber officinale*), rosemary (*Rosemarinus officinalis*), green tea (*Camellia sinensis*), sage or salvia (*Salvia officinalis*), black cumin (*Nigella sativa*), fenugreek (*Trigonella foenumgraecum*), coriander or cariander fruit (*Coriandrum sativum* L.), caraway (*Carum carvi* L.), cumin (*Cuminum cyminum*), anise or aniseed (*Pimpinella anisum* L.). The samples were cleaned, ground and sieved through 60-mesh sieve, and stored in refrigerator at 4ºC for further treatments and/or analysis.

**Sunflower oil:** The refined, bleached, and deodorized (RBD) sunflower oil without any additives used in the present study was kindly supplied by Sila Company, at Fayoum, Egypt, sunflower oil was chosen for testing the antioxidant activity of the dried powder, and the extracts of each plant materials (Crapiste *et al.*, 1999).

### Methods:

**Extraction of antioxidant:** The antioxidant compounds were extracted according to the method described by Adegoke & Gopala Krishna (1998) with some modification as follows: Firstly, sage was chosen to select the optimum solvent for extraction .The solvents used were methanol, ethanol, diethyl ether, acetone, chloroform, and hexane. According to this primary study, methanol gave the highest amount of extracted yield. Therfore, methanol was chosen as a solvent.

The powder of each dried samples (100g each) was extracted using methanol (500ml), with constant stirring for 24 hours at room temperature (25 ±2ºC). The extracts were filtered with Whatmann No. 1 filter paper. The filtered material was re-extracted to maximize the antioxidant extract. The filtrates were evaporated under vacuum in a rotary evaporator at 45ºC and weighed to determine the extracted yield of each plant material. The colours of the methanolic extracts were described visually.

**Isolation and identification of antioxidant compounds:** The antioxidant compounds were isolated and identified using thin-layer chromatography (TLC). (Pratt & Miller, 1984, Xing & White, 1997).

**Determination of total phenolic contents:** Total phenols (TP) content of the extract were assayed colorimetrically using the Folin-ciocalteu method (Gamez-Meza *et al.*, 1999). The absorbance was measured at 750 nm using a Shimadzu 160 1 PC UV - visible Spectrophotometer.

**Identification of phenolic composition with HPLC:** To identify the phenolic composition of the methanolic plant extracts used in this study, HPLC system was carried out according to (Lin *et al.*, 1998) using a Waters 600 E system controller. The Waters 484 tunable absorbance detector was used to detect phenolic compounds constituents at 280 nm, and all peaks were plotted and integrated by a Waters 745 data module. The HPLC method used a Cosmosil (C18-MS packed column (5 µm, 46 mmi. d. × 250 mm) (Nacalai Tesque, Inc., Kyoto, Japan). The plant materials extracts were filtered through a 0.45 µm filter disk, and then 20 µl was injected into the column. Each authentic standard compound was injected. The mobile phase was methanol doubly distilled water / formic acid (19.5: 80.2: 0.3, v/v/v) and run by an isocratic elution at a flow rate of 1 ml/min. For the gradient elution, the solvent systems that were used: mobile phase A, methanol / formic acid / water (20: 0.3: 79.7, v/v/v, mobile phase B, methanol / formic acid (99.7: 0.3, v/v). The gradient HPLC was performed as follows: 100% A for 10 min, to 90% A and 10% B for 15 min, and to 70% A and 30% B for 35 min in a linear gradient mode, elution was continued for 15 min. In all cases, the flow rate was 1.0ml/min and continuous bubbling with helium gas degassed both mobile phase flasks.

Identification of the phenolic compounds was based on the comparison of the retention times of unknown peaks to those reference authentic standards. The amount of each constituent in the plant material extracts was estimated by the integrated datum provided by the Waters data module.

**Determination of antioxidant activity of dried powder and methanolic extract of the chosen herbs and spices:** The antioxidant activity of green tea leave, sage and caraway, were tested in both dried powder and methanolic extract forms. Different amounts (100, 200, 400, 600 and 800 ppm) of each powder or extract were added separately to 50 g of sunflower oil to study the effectiveness of these materials as antioxidants. At the same time, TBHQ (Tertiary-butyl hydroquinone) as a synthetic antioxidant (200 ppm food grade)

was added to sunflower oil, as a control sample. The oxidation effect of sunflower oil containing no additives was measured for reference purposes. The oil and additives were placed in 100 ml beakers and thoroughly mixed by ultrasonic waves using a (Soniprep 150). The beakers were transferred to a drying oven set at 60±2ºC for up to 18 days. Peroxide value (PV), conjugated dienes hydroperoxide, thiobarbituric acid number (TBA), and anisidine value (AV) were determined at zero time, 6, 9, 12, 15 and 18 days. The produced data for (PV) and (AV) were used to calculate the total oxidation: the totox value (TV) according to AOCS official method (1989).

## RESULTS AND DISCUSSION

### Screening of some herbs and spices for phenolic compound:

Extracts of plant materials collected as natural sources for antioxidant were screened by TLC separations for identifying the phenolic compounds. This was used as a qualitative test. The TLC plates showed that spices, contained antioxidant components as they produced clear colour bands on the TLC plates (Figure 1). It is clear from the TLC plates that there are great variations among these materials for their antioxidant components.

**Extracted yield and total phenolic content in different herbs and spices:** Table (1) shows the extracted yield and total phenolic content obtained from the different plant materials used. The green tea contained the highest amount of methanolic extracted yield (18.15%) followed by sage and caraway, which produced almost the same percentage of extracted yield (8.84 – 9.03%). Cumin, ginger, and rosemary exhibited the lowest amount (2.9 – 4.02%). The total phenolic content appeared to be proportional to the extracted yield (%). These variations in total phenolic content could be attributed to the specific nature of the plant type. Kim *et al.*, (1994) reported that the antioxidant activity of extracts produced from herbs was dependent on the type of herb rather than the solvent used.

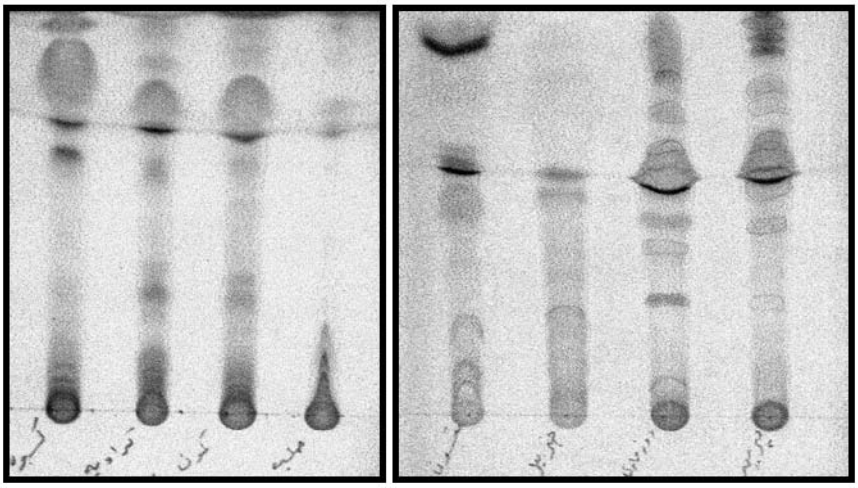

**Fig. 1: TLC separations of phenolic compounds of spices**

**Table 1: Extracted yield and total phenolic contents of different herbs and spices**

| Plant material | Methanolic extracted yield (%) | Total phenolic (%) | Total phenolic content (g/kg) |
|---|---|---|---|
| Green tea | 18.151 | 15.572 | 155.721 |
| Sage | 9.038 | 8.280 | 82.808 |
| Caraway | 8.817 | 5.212 | 52.120 |
| Cumin | 4.020 | 3.005 | 30.050 |
| Ginger | 3.315 | 2.570 | 25.700 |
| Rosemary | 2.900 | 2.680 | 26.800 |

**Identification of phenolic composition with HPLC:** The mehanolic extracts of the plant material tested as natural sources of antioxidant (green tea, sage, caraway, cumin, ginger and rosemary, were subjected to HPLC for analysis. The HPLC system used authentic standards for identification of each phenolic compound. Table (2) shows composition of the phenolic compounds of each extract of plant material as determined by HPLC. These results revealed that polyphenols are the most abundant group among the constituents of the tea leaves. The major active constituent of tea has been identified as catechins, which represents an important contribution especially to the taste of green tea. The action mechanisms of catechin as an anti carcinogenic agent could be attributed to its antioxidant property as a scavenger of the reactive oxygen species (Katiyar *et al.*, 1993).

The present data of catechins and the polyphenols content in green tea, as determined by HPLC, are in good agreement with the data obtained by Lin *et al.* (1998). The main antioxidant activity of sage was attributed to carnosic acid, carnosol and rosmarinic acid as reported by Cuvelier *et al.*, (1996). Furthermore, Wang *et al.*, (1998) studied the phenolic compounds in sage. They separated and identified ten phenolic compounds by spectroscopic methods (NMR, MS, IR). Therefore, the present data of phenolic compounds for sage are nearly the same data obtained by Wang *et al.* (1998).

Phenolic compounds are widely distributed in nature. It is suggested that their antioxidant activity is related to their conjugated rings and hydroxyl groups (Decker, 1995). It is not, therefore, surprising that most of phenolic compounds from sage showed some antioxidant activity. Among these compounds is rosmarinic acid, whose antioxidant activity has been studied extensively (Chen & Ho, 1997). The results of caraway are similar to those found by Zhang *et al.*, (1992) who reported that caraway extracts contained carvone, *trans* carveol, limonene, anethofuran and *Beta*-myrcene, which exhibited antioxidant activities.

Ginger spices are considered as new sources of natural antioxidants, because most ginger rhizomes are used for spices in tropical areas. The rhizome of a popular ginger species, *Zingiber officinale*, is well known to have potent antioxidant activity (Lee & Ahn, 1985). The potent antioxidant activity of curcumin and its analogs were much stronger than that of α-tocopherol (Larson, 1988). Meanwhile, Jitoe *et al.*, (1992) reported that the antioxidants present in the extracts were curcuminoids. The data presented in Table (2) show the existence of curcuminoid, however in lower amounts (0.31mg/g) as compared to other components that ranged from 2.65 to 14.76 mg/g in ginger.

## Assessment of antioxidant activity of dried powder and methanolic extracts of some herbs and spices

**Peroxide value:** Peroxide value (meq/kg) was determined during accelerated storage of sunflower oil at 60±2ºC as primary products of auto-oxidation to evaluate the antioxidant activity of green tea, sage and caraway, for both the dry powder and methanolic extract. These spices were chosen for their antioxidant activities evaluation because of its higher phenolic contents, as well as sage and caraway, which are used as hot beverages.

Figure (2) illustrates the peroxide value of sunflower oil with added dry powder of green tea. Sunflower oil with green tea additives (100, 200, 400, 600, and 800 ppm) showed much lower PV than that of the control sample with no additives. However, the highest antioxidant effect was noted when TBHQ (200 ppm) was compared to all concentrations of green tea powder added to the sunflower oil.

This means that the antioxidant activity of both green tea extract and TBHQ are comparable. Increasing the concentration of green tea extract in sunflower oil had markedly increased the antioxidant activity. The dried green tea powder was less effective in inhibiting the formation of hydroperoxides as compared to the methanolic extract of green tea. This can be attributed to the fact that the phenolic content is more concentrated in extract than in powder. This is in agreement with Balentine (1992), who concluded that green tea extract had antioxidant activity in vegetable oil and animal fat. Green tea catechins have attracted much attention because of their physiological effects, particularly their effectiveness in inhibiting the oxidation of lipids (Hara, 1994).

Figure (4) shows that antioxidant activity of sage powder has the lowered peroxide value of sunflower oil as compared to control sample. The addition of 400 ppm of sage extract inhibits the hydroperoxide formation in sunflower oil in a similar way as that produced by adding 200 ppm of TBHQ. On the other hand, using sage has all

**Table 2: Composition and content of phenolic compounds in methanolic extracts of various herbs and spices as determined by HPLC**

| Plant material Mg/g | Compound | Compound content |
|---|---|---|
| 1. Green tea | Epigallocatechin 3-gallate | 90.14 |
| | Epigallocatechin | 1.01 |
| | Epicatechin gallate | 18.2 |
| | Epicatechin | 4.8 |
| | Catechin | 0.2 |
| | Gallocatechin 3 gallate | 1.5 |
| | Gallic acid | 2.12 |
| | Caffeine | 48.95 |
| 2. Sage | Rosmarinic acid | 26.73 |
| | Picein | 2.46 |
| | Carnosic acid | 8.44 |
| | Terpinene | 24.92 |
| | Sabinene | 11.57 |
| | *p*- Cymene | 5.43 |
| | Limonene | 3.47 |
| | Myrcene | 3.6 |
| | Linalol | 2.49 |
| 3. Cumin | Cuminaldehyde | 19.72 |
| | Terpene | 7.65 |
| 4. Ginger | Cineole | 10.43 |
| | Linalool | 14.76 |
| | Zingliberol | 2.65 |
| | Terpenes | 3.29 |
| | Curcuminoid | 0.31 |
| | Vanillic acid | 1.87 |
| | Caffeic acid | 1.02 |
| | Hydroxytyrosel | 3.29 |
| 5. Caraway | Carvone | 40.08 |
| | Trans-carveol | 1.23 |
| | Limonene | 10.38 |
| | *Beta* myrcene | 1.72 |
| 6. Rosemary | Cineole | 1.92 |
| | Rosemaric acid | 2.51 |
| | Rosemanole | 18.87 |
| | Epirosemanole | 3.21 |
| | Carnosal | 1.24 |

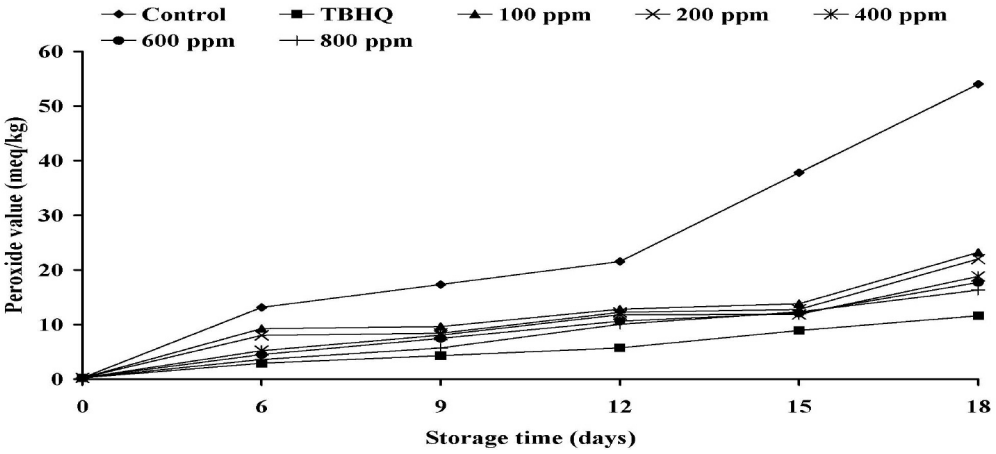


**Fig. 2: Peroxide value of sunflower oil with added powder of green tea during different storage time at 60±2ºC**

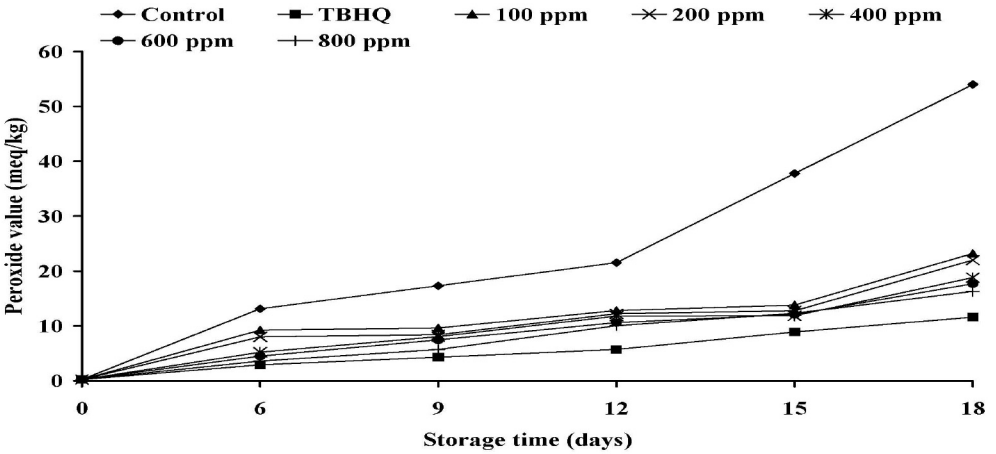


**Fig. 3: Peroxide value of sunflower oil with added methanol extracts of green tea during different storage time at 60±2ºC**

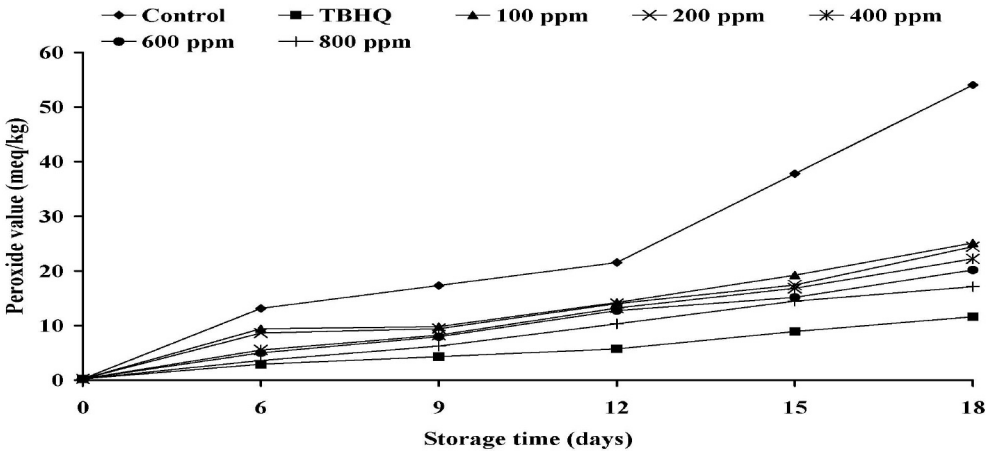


**Fig. 4: Peroxide value of sunflower oil with added powder of sage during different storage time at 60±2ºC**

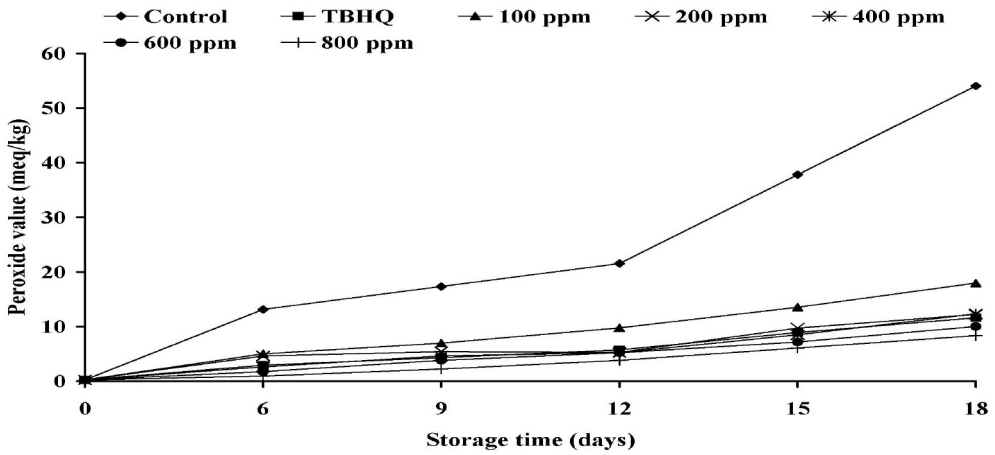


**Fig. 5: Peroxide value of sunflower oil with added methanol extracts of sage during different storage time at 60±2ºC**

the advantages of using natural additives that was described before. The higher activity of green tea and sage extracts than their dry powder may be attributed to the presence of other substances in the dry powder or to possible antagonistic effects of other components.

However Figures (6), and (7) show that in case of caraway only, 800 ppm of caraway methanolic extract had the same antioxidative effect of 200 ppm of TBHQ. It could be concluded that the antioxidant activity of 200 ppm green tea extract had the same antioxidant activity as 200 ppm TBHQ. Therefore, the green tea extract exhibited antioxidant activity as two folds of sage extract and four folds of caraway extract as indicated by PV values during the storage period of sunflower oil.

The antioxidant activity can be arranged in the following order: green tea > sage > caraway. Kim *et al.*, (1994) reported that the antioxidant activity of extract produced from herbs was dependant on the herb type. Moreover, the extract form proved to contain much more phenolic compounds as compared to those present in the powder form of the plant material. The highest antioxidant activity of methanolic extracts can be partially attributed to the activity of the present phenolic compounds (Shahidi et al, 1992). Many researches found that methanolic extracts contained the most effective antioxidants when produced from different plant sources (Tsuda *et al.*, 1993, Yen & Duh, 1993, Mehta *et al.*, 1994, Onyeneho & Hettiarachy, 1988). Methanol appeared to be the best solvent for extracting compounds such as phenolics, flavonoids, and other polar materials (Toda *et al.*, 1985, Kim *et al.*, 1994). These results were further confirmed by the data reported by Economou *et al.*, (1991) and Duh *et al.*, (1992). These results are in full agreement with our results.

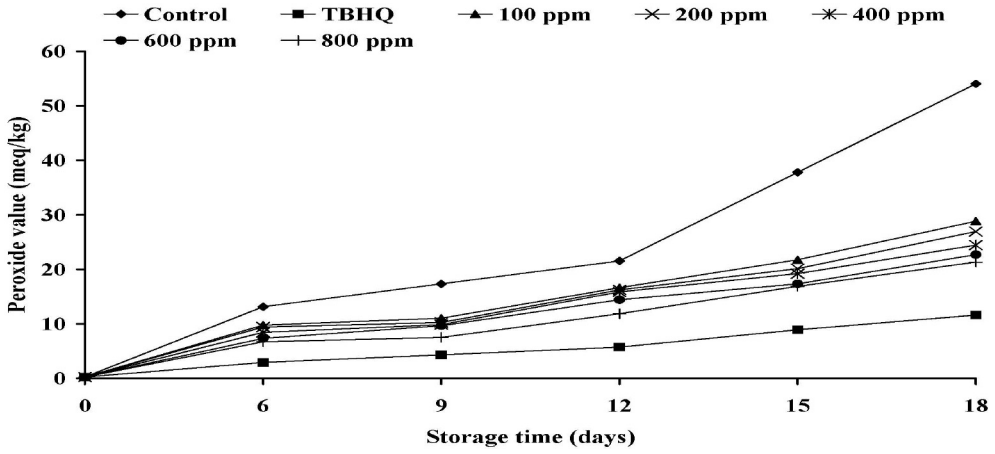


**Fig. 6: Peroxide value of sunflower oil with added powder of caraway during different storage time at 60±2ºC**

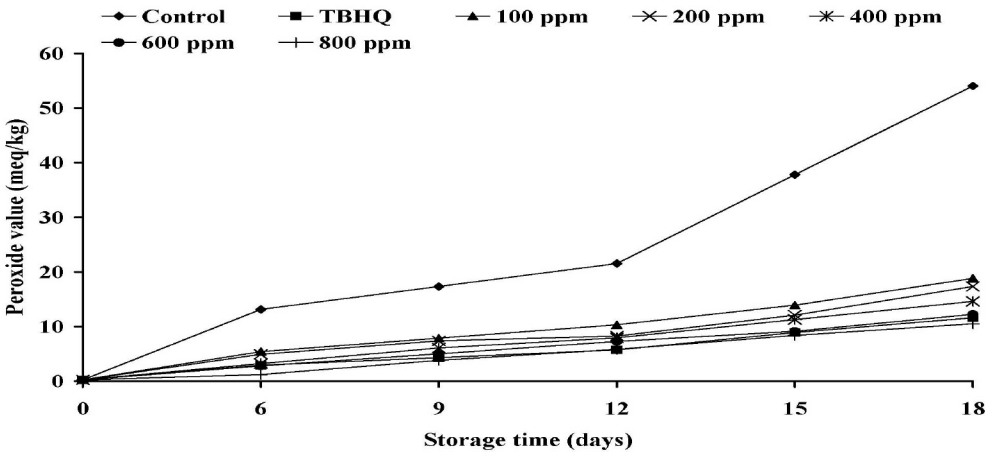


**Fig. 7: Peroxide value of sunflower oil with added methanol extracts of caraway during different storage time at 60±2ºC**

The results obtained for conjugated diene hydroperoxide, thiobarbituric acid, anisidine value and totox value are completely corresponding to the data obtained for peroxide value. Measurement of antioxidant activity of sunflower with these different methods with different concentration of each added powder or extract from green tea, sage and caraway showed similar trends to those produced by the peroxide value (Tables 3, 4, 5, 6, 7, 8, 9 and 10).

**Table 3: Anisidine value of sunflower oil with added herbs and spices powder during storage time at 60±2°C**

| Storage time (days) | Control* | TBHQ (200ppm) | Ansidine value (200 ppm of herbs and spices powder) | | |
|---|---|---|---|---|---|
| | | | Green tea | Sage | Caraway |
| 0 | 0.6 | 0.6 | 0.6 | 0.60 | 0.60 |
| 6 | 2.55 | 1.91 | 1.98 | 2.04 | 2.91 |
| 9 | 5.97 | 4.03 | 4.94 | 4.84 | 5.83 |
| 12 | 9.56 | 5.17 | 5.36 | 5.73 | 6.36 |
| 15 | 11.89 | 7.81 | 8.02 | 8.68 | 9.07 |
| 18 | 14.22 | 10.40 | 10.76 | 11.21 | 11.87 |

* Control: Sunflower oil without any addition

**Table 4: Anisidine value of sunflower oil with added herbs and spices methanol extracts during storage time at 60±2°C**

| Storage time (days) | Control* | TBHQ (200ppm) | Ansidine value (200 ppm of herbs and spices powder) | | |
|---|---|---|---|---|---|
| | | | Green tea | Sage | Caraway |
| 0 | 0.6 | 0.6 | 0.6 | 0.60 | 0.60 |
| 6 | 2.55 | 1.91 | 1.94 | 1.98 | 2.19 |
| 9 | 5.97 | 4.03 | 4.12 | 4.47 | 5.12 |
| 12 | 9.56 | 5.17 | 5.12 | 5.64 | 5.96 |
| 15 | 11.89 | 7.81 | 7.90 | 8.52 | 9.34 |
| 18 | 14.22 | 10.40 | 10.50 | 11.03 | 11.37 |

* Control: Sunflower oil without any addition

**Table 5: TBA value of sunflower oil with added herbs and spices powder during storage time at 60±2°C**

| Storage time (days) | Control* | TBHQ (200ppm) | Ansidine value (200 ppm of herbs and spices powder) | | |
|---|---|---|---|---|---|
| | | | Green tea | Sage | Caraway |
| 0 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 6 | 6.34 | 3.03 | 4.42 | 4.74 | 5.18 |
| 9 | 12.29 | 5.02 | 5.79 | 6.12 | 6.25 |
| 12 | 15.13 | 7.77 | 7.30 | 7.95 | 8.43 |
| 15 | 18.30 | 8.77 | 7.77 | 8.33 | 9.22 |
| 18 | 21.48 | 9.78 | 9.78 | 9.80 | 9.92 |

* Control: Sunflower oil without any addition

**Table 6: TBA value of sunflower oil with added herbs and spices powder during storage time at 60±2°C**

| Storage time (days) | Control* | TBHQ (200ppm) | Ansidine value (200 ppm of herbs and spices powder) | | |
|---|---|---|---|---|---|
| | | | Green tea | Sage | Caraway |
| 0 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 6 | 6.34 | 3.03 | 3.10 | 3.67 | 4.61 |
| 9 | 12.29 | 5.02 | 5.14 | 5.45 | 6.22 |
| 12 | 15.13 | 7.77 | 7.80 | 7.85 | 8.30 |
| 15 | 18.30 | 8.77 | 8.30 | 8.15 | 8.82 |
| 18 | 21.48 | 9.78 | 9.23 | 9.43 | 9.82 |

* Control: Sunflower oil without any addition

**Table 7: Totox value of sunflower oil with added herbs and spices powder during storage time at 60 ± 2°C**

| Storage time (days) | Control* | TBHQ (200ppm) | Ansidine value (200 ppm of herbs and spices powder) | | |
|---|---|---|---|---|---|
| | | | Green tea | Sage | Caraway |
| 0 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 |
| 6 | 28.81 | 7.75 | 17.98 | 19.28 | 21.71 |
| 9 | 40.61 | 12.63 | 13.74 | 23.66 | 26.29 |
| 12 | 52.6 | 16.59 | 29.82 | 33.73 | 38.8 |
| 15 | 87.43 | 25.59 | 33.54 | 43.48 | 49.29 |
| 18 | 122.22 | 33.6 | 54.76 | 60.05 | 65.71 |

* Control: Sunflower oil without any addition

**Table 8: Totox value of sunflower oil with added herbs and spices methanol extracts during storage time at 60±2°C**

| Storage time (days) | Control* | TBHQ (200ppm) | Ansidine value (200 ppm of herbs and spices powder) | | |
|---|---|---|---|---|---|
| | | | Green tea | Sage | Caraway |
| 0 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 |
| 6 | 28.81 | 7.75 | 8.74 | 11.18 | 12.03 |
| 9 | 40.61 | 12.63 | 12.52 | 15.54 | 19.86 |
| 12 | 52.60 | 16.59 | 15.12 | 16.14 | 22.46 |
| 15 | 87.43 | 25.59 | 22.90 | 27.96 | 33.48 |
| 18 | 122.22 | 33.60 | 20.52 | 35.43 | 40.34 |

* Control: Sunflower oil without any addition

**Table 9: Effects of herbs and spices powders on the formation of conjugated diene hydroperoxides in sunflower oil during storage time at 60±2°C**

| Storage time (days) | Control* | TBHQ (200ppm) | Ansidine value (200 ppm of herbs and spices powder) | | |
|---|---|---|---|---|---|
| | | | Green tea | Sage | Caraway |
| 0 | 0.014 | 0.010 | 0.014 | 0.015 | 0.015 |
| 6 | 0.025 | 0.014 | 0.018 | 0.019 | 0.047 |
| 9 | 0.070 | 0.040 | 0.053 | 0.055 | 0.095 |
| 12 | 0.109 | 0.068 | 0.084 | 0.092 | 0.119 |
| 15 | 0.191 | 0.092 | 0.109 | 0.120 | 0.140 |
| 18 | 0.287 | 0.167 | 0.177 | 0.186 | 0.197 |

* Control: Sunflower oil without any addition

**Table 10: Effects of herbs and spices methanolic extracts on the formation of conjugated diene hydroperoxides in sunflower oil during storage time at 60±2°C**

| Storage time (days) | Control* | TBHQ (200ppm) | Ansidine value (200 ppm of herbs and spices powder) | | |
|---|---|---|---|---|---|
| | | | Green tea | Sage | Caraway |
| 0 | 0.014 | 0.010 | 0.010 | 0.012 | 0.013 |
| 6 | 0.025 | 0.014 | 0.014 | 0.017 | 0.017 |
| 9 | 0.070 | 0.040 | 0.042 | 0.050 | 0.057 |
| 12 | 0.109 | 0.068 | 0.072 | 0.089 | 0.085 |
| 15 | 0.191 | 0.092 | 0.099 | 0.118 | 0.117 |
| 18 | 0.287 | 0.167 | 0.172 | 0.183 | 0.195 |

* Control: Sunflower oil without any addition

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# التعرف على مضادات الأكسدة الطبيعية لبعض الأعشاب والتوابل واستخلاصها وتقدير فاعليتها

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يعتبر التزنخ التأكسدي للزيوت والدهون هو المسئول عن التغيرات التي قد تحدث في رائحة ونكهة المواد الغذائية، وهو الذي يسبب أيضا الانخفاض في الجودة أو القيمة التغذوية، كما يؤثر على سلوك وأمان المنتجات الغذائية. ويرجع ذلك إلى تكوين النواتج الثانوية والتي قد تؤدي بدورها إلى تكوين مركبات سامة. لذلك فإن إضافة مثبطات الأكسدة يكون ضروريا لمنع التغيرات التي تحدث في اللون والنكهة، وكذلك لحماية الفيتامينات من الهدم.

وقد تسبب مضادات الأكسدة الصناعية تأثيرات سامة، لذلك فإن استبدالها بمضادات الأكسدة الطبيعية يمكن أن يؤدي إلى فوائد عديدة من منظور الصحة العامة. ولقد تم التوجه مؤخرا إلى استخدام العديد من مثبطات الأكسدة النباتية كمصادر طبيعية وآمنة حتى يمكن استخدامها في التصنيع الغذائي، أمكن كذلك عزل العديد من المركبات التي يعتبر معظمها أو غالبيتها مركبات فينولية، إلا أن المعلومات عن التركيب الكيميائي ونشاط مضادات الأكسدة من المصادر النباتية محدودة جدا، ومن ثم فلقد أجريت هذه الدراسة حتى يمكن التعرف على المركبات الفينولية. وطرق استخلاصها من بعض المصادر النباتية، وكذلك اختبار نشاطها كمواد مضادة للأكسدة. وفي الدراسة الحالية تم اختيار ثلاثة أنواع من المستخلصات النباتية لدراسة تأثيرها المضاد للأكسدة وتشير أهم النتائج إلى ما يلي:

- أظهر الفصل على الطبقة الرقيقة للفصل الكروماتوجرافي تبايناً شديداً في كمية الفينولات للمصادر المختلفة.
- الميثانول هو المذيب الأكفأ الذي يعطي أعلى كمية عائد من مضادات الأكسدة.
- كان النشاط المضاد للأكسدة في المضادات المستخلصة من النباتات الطبيعية على النحو التالي: الشاي الأخضر > الميرامية > الكراوية.