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STUDY THE EFFECT OF PHENOLIC COMPOUNDS EXTRACTED FROM CARROT PLANT AND ASSESS THEIR EFFECTIVENESS AS ANTIOXIDANT

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Abstract

Phenolic compounds were extracted from the carrot plant (*Daucus carota* L.), in two types of ethanol extraction using 98% ethanol for 24 hours at laboratory temperature and water extraction using distilled water for 30 minutes. Fulin-Ciocatea method was used to estimate the amount of phenols in the extract. The alcohol extract gave a higher phenol content of 58.29 mg / while the amount of flavonoids in the alcoholic extract was 26.63 mg / g. The water extract was 11.23 mg / g. The oil extract was superior to 88.3% antioxidant, but the water extract was 77.43%. The inhibitory effect of the added carrot extract concentrations 0.05, 0.10, 0.15%), oil to inhibit the oxidation of olive oil and corn oil as it exceeded the reduction of peroxide values during the reservoir periods (15, 30, 45, 60 days).

***Keywords*:** Phenolic compounds, carrots, antioxidant activity

Introduction

The carrot are one of the winter vegetable crops belonging to the tent family (*Daucus carota L. var. Sativa*). The orange carrot is rich in its high content of carotene pigments, some of which turn into vitamin A in the human body. Carotenoids work as antioxidants and act as anti-cancer drugs (Young *et a*l., 2004; Linting, 2004). Carrot is one of the most important vegetables in the world. Its biologically active ingredients may be beneficial to a large number of consumers. It is rich in healthy antioxidants and fat-loving substances such as carotenoids, love and water substances such as phenolic compounds (Hager and Howard, 2006; Sharma *et al*. 2012; Leja. 2013). The carrot were first used for medical purposes and were gradually used as food (Da Silva Dias, 2014). Fruits and vegetables are an important part of our lives as a diet not only because they provide the main dietary fiber of food ingredients but are considered a group of micronutrients, including minerals, vitamins and antioxidants such as carotenoids and multiple phenols (Augspole *et al*., 2014). Explain (Tanaka *et al*., 2012; Fiedor and, Burda, 2014) that carrots are antioxidants, especially beta-carotene, and in recent years, the island has increasingly consumed the benefits of food, has beneficial health effects such as anti-cancer and antioxidants, and in enhancing immunity, as well as the activity of some carotenoids. Carrot is rich in antioxidants, whether carotenoids or water-loving substances (phenols). Although the content of carotenoids varies greatly between the structures of the carrot (Baranski *et al*., 2012). Plants extracted from plants play an important role in the industry. Among the known species of these compounds, tainanes, which were used in tanning, ink manufacturing, and phenolic compounds in the manufacture of colored materials and plastic compounds. Phenolic compounds are known as low molecular weight compounds containing an aromatic ring with one or more hydroxyl groups (Halfi, 2009). Phenolic compounds are part of plant compounds with a long history in industries such as tanning skin, wine and inks, as well as their important role in human health (Ramli, 2006). Inedible and edible food crops contain multiple phenols with multiple applications in the food, pharmaceutical and cosmetic industries (Kähkönen, *et al*., 1999). Phenolic compounds act as antioxidants that enter oxidation processes by breaking down the chain of active reactions, "primary oxidation" or by removing the free radicals "secondary oxidation", according to (Augspole *et al*.; Ndhlala*, et al*., 2010). Food oils are subject to fatty oxidation during different stages of production, storage, purchase and even consumption (Bouaziz, *et al*., 2010). Olive oil is a very important agricultural product in the Mediterranean region in particular Spain, Italy, Greece, Turkey, Tunisia, Syria and Morocco. Turkey produces about 4.3% of the world's olive oil and ranks sixth in the world both in production and consumption (I.O.O.C., 2007). The quality and stability of olive oil is affected mainly by oxidation of fat, resulting in the formation of undesirable flavor and low nutritional value, causing health risks, natural and undesirable flavor and leading to toxicity. This process occurs as a result of the presence of free radicals in the light known as photoxidation (Gutiearrez, and Fernandez, 2002). The seed oil contains unsaturated fatty acids (linoleic 56%, oleic 30% linolenic 0.7%) and saturated fatty acids (14%). Proteins contain about 37% clopulin, 51% clotillin, and 7% insoluble oils. Corn also carries a wide range of amino acids rich in vitamin E (tocopherol) beta-sitostiron and phytine (Moreal *et al*., 1990). Because corn oil is rich in unsaturated fatty acids, including linoleic, it works to reduce LDL, which reduces cholesterol in the blood and prevents atherosclerosis and blood vessels. It also leads to lower blood pressure. Earlier, diseases caused by phytosterols (Lowell, 2006). Oils and fats are naturally composed of esters of triglyceride fatty acid, called triglycerides. The peroxidase is an indicator of the oxidative oxidation of oils and thus reflects the quality of the products containing these oils (Nwobi *et al.,* 2006, Orthoefer, *et al*., 1987).

Materials and Methods

Materials : The purchase of the seeds of orange carrots from the Iraqi local markets and buy the type Pure olive oil (Mersal) company production made in Spain , date product 2018, and corn oil production company (Alder) made in Iraq was purchased from local Iraqi markets.

Methods :

Preparation of plant extracts

Alcohol Extracts: I attended alcoholic extracts by method (Elmastas *et al*., 2015), with a weight of 100 g of each

sample and add 500 ml of 98% ethyl alcohol and mix well and leave for 24 hours at laboratory temperature 25-30 m, and then the extract was filtered using the Whatman No.1 filter paper. And then filtered using Vaccum Evaportor rotary evaporator at a temperature of 40 meters and leaving the concentrated filtrate at the laboratory temperature until a concentrated sticky substance was obtained, and the packaging was sealed and sealed in the refrigerator until use.

Water Extracts : Prepare the extracts with water (Moussawi, and Al-Halafi, 2012) weighing 100 g of each sample with 500 ml of distilled boiling water and leave for 24 hours and mixed 30 minutes on a magnetic mixer. Then, sprinkle with the Buechner funnel through the Whatman No.1 filter paper with discharge and concentrate the rotary vacuum evaporator at 40°C, it is installed at laboratory temperature 30-25 °C, placed in dark containers and kept in refrigerator until use.

Determination of Total Phenols: The value of the phenols in the water and alcohol extracts of the plants was determined using the Folin-Ciocalteu method (Slinkard and Singleton, 1997) by dissolving 1 g of plant extracts in 46 ml of distilled water and 1 mL of the Folin-Ciocalteu reagent. The mixture was mixed well. 3 mL sodium carbonate (2%) Na_2CO_3 and leave the mixture for 2 hours with intermittent shaking, then measure absorption at a wavelength of 760 nm. The amount of phenols in the extracts was calculated based on the correlation between acid concentration and absorption at a 760 nm wavelength and using a standard solution of Gallic acid at a concentration of 0-100 mg / ml.

Determination of total flavonoids : The method described above (Huan, 2004) was followed to estimate the total flavonoids content in plant extracts, dissolving 1 g of plant extracts in 1.5 ml ethyl alcohol and adding an equal volume of $AlCl_3.6H_2O$ concentration (2% in 100 ml methanol). The concentration of flavonoids in the extracts was calculated by preparing a standard solution of the Rutin flavonide compound with concentrations of 0-100 mg / ml and the absorption measure at 367 nm wavelength. The amount of flavonoids was calculated by drawing on the graphical relationship Between acid concentration and absorption.

Measure antioxidant activity : Antioxidant efficacy in alcoholic and aquatic extracts was estimated according to the method described in (Hilfi and Musawi, 2011) using the proposed linoleic acid system (Osawa and Namiki,1981). Preparation of a mixture consisting of 4.1 ml linoleic acid (2.5% ethanol), 4 ml of each extract and 8 ml of phosphate-regulated solution 0.05 ml and pH = 7 and 3.9 ml of distilled water, incubate the mixture in dark-brown containers at 40°C 24 hour. The percentage of thiosanate oxidation was estimated to add 0.1 mL of mixture to 9.7 ml of ethanol (75% concentration) and 0.1 mL of ammonium thiocyanate (30% concentration). After three minutes, 0.1 mL chloride chloride (20 ml molariate concentration) in 3.5% hydrochloric acid and then measuring absorbance with a 500 nm wavelength, the control sample was prepared in the same manner above except for mixing 4 ml of ethanol rather than plant extracts. Calculation rate of linoleic acid peroxides was calculated according to the following equation :

$$\text{Antioxidant effectiveness} = 100 - \frac{\text{Read the absorption of the model}}{\text{Read the absorption of the control sample}} \times 100$$

Antioxidants in the Oil : Then dissolving 0.02% of the industrial antioxidant BHT and phenolic extracts 0.05,0.10, 0.15% in the ethyl alcohol and added to the oil samples at 45°C to equal the final concentration of antioxidant in the oil as stated (Scott, 1965), then mix the mixture well and incubated the degree Heat 45°C and put another model of oil free of the antioxidant promised a comparison model. The antioxidant efficiency of the oil was followed for 60 days by estimating the peroxide value according to the method mentioned in (A.O.A.C., 2008).

Statistical analysis

Complete Randomized Design (CRD) was used to analyze all the studied factors as statistically analyzed. These factors were tested using a least significant difference (L.S.D.) at a probability level of P‧ 0.05 (Genstat, 2009).

Results and Discussion

The Total Content of Phenols : Figure (1) shows the differences between water and alcohol extracts in phenolic compounds of the islands with 58.29 mg/g for the extract and 42.63 mg/g for the water extract. The difference in the amount of phenolic compounds between water and alcohol extracts is due to the nature of the separate compounds and solubility of high solvents used for extraction. (Cai *et al*., 2004) The containment of water extracts contains small quantities of phenolic compounds compared with high levels of alcohol extracts due to ethanol efficiency in the extraction of polyphenols and tannins from the plant (Tawaha *et al*., 2007).

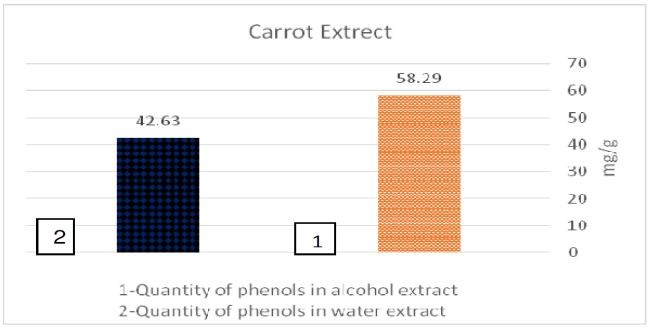

Fig. 1: Total content of phenolic compounds in carrot extract

Total flavonoids content: Figure (2) shows the amount of flavonoids in water and alcohol extract from carrot extract. The highest concentration of flavonoids in the carrot extract was 26.63 mg /Rutin/g, followed by carrots (11.23 mg/g). The high flavonoids in water alcohol extracts are due to the high ethanol tolerance of phenolic compounds for different types of fruits compared to other solvents (Nickavar and Abolhsani, 2009).

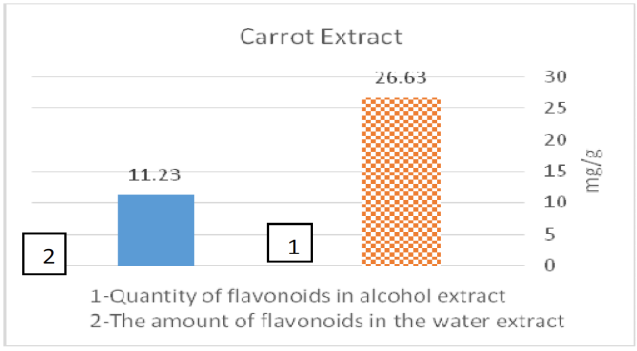

Fig. 2: Total flavonoids content of carrot extract

Antioxidant activity : Figure (3) shows the effectiveness of antioxidants between prepared extracts, industrial antioxidants, and alcohol and water extracts. Oil extract from the islands gave the highest antioxidant effect of 88.3% and was lower than BHT 95.77%. The water extract of the carrot gave an antioxidant effect of 77.43%. The differences between water and alcohol extracts in antioxidant efficacy values may be due to the nature and concentration of phenolic compounds found in plants as well as to the type and nature of the solvent (Meyer *et al*., 1998 ; Kähkönen. 1999).

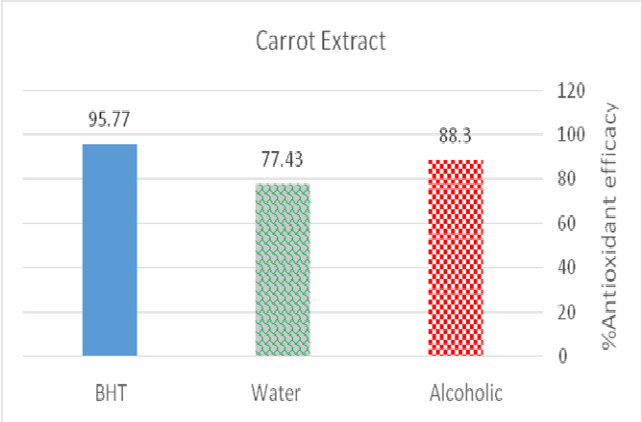

Figure 3: Antioxidant efficacy in the extract of water and alcohol

Obstruction of oil oxidation

Olive Oil : Table 1 shows the effect of alkaline extract of phenolic substances (T1, T2, T3) in concentrations %(0.05, 0.10, 0.15) as well as the T4 water extract at a concentration of 0.15% and compared with the control sample T5 (without addition) and another sample T6 added (BHT) to the values of peroxide of olive oil stored for periods (15, 30, 45, 60) days and temperature of 45°C the results showed that the T3 concentration was higher than 0.15% for the 60 days storage period of 2.8 mEq / kg oil compared to the T6 treatment using industrial antioxidants (BHT) of 3.0 mEq / kg oil if there were no significant differences at 0.05(P‧ 0.05) Compared to the control sample of 11.0 mEq / kg of olive oil for 60 days, with significant differences between the results this means that natural substances can be used instead of industrial materials to preserve oils and get better results without side effects on public health because the antioxidant mechanism inhibits oil oxidation during storage periods due to its interaction with free radicals or decomposition of peroxides or formation of complexes with metal ions. (Yang. 2002). Research showed that the value of peroxide in olive oil and canola oil was about 10.62 , 5.73 mEq / kg oil respectively (Roiaini . 2015).

Corn Oil : Table (2) shows the effect of carrot extract on the peroxide values of corn oil for different storage periods and at 45°C all treatments in zero time equal 8.0 Meq/kg and showed the effect of carrot extract on the peroxide values of corn oil for different storage periods and at 45°C all treatments showed an effective anti-oxidant effect of corn oil and significantly compared to the control sample T5 and the industrial antioxidant T6, results show that all concentrations showed inhibitory efficacy to inhibit oil oxidation but to varying degrees based on concentrations antioxidant activity increased with increased concentration. there was no significant difference between the peroxide values of the highest concentration and its value with the industrial antioxidant, while there was a rapid increase in the peroxide value of the T5 control sample (T1, T2, T3, T4) showed a higher effect of industrial antioxidants during the 60 day storage period (3.4, 3.2, 3.2, 4.0) mEq / kg, while T6 (4.8 mEq / kg) in this regard, While there was a rapid increase in the peroxide value of the T5 control sample at 18.0 mEq / kg plant extracts have shown high antioxidant activity due to their ability to inhibit oxidation of fat and oils for their ability to bind iron, which is among the compounds that are characterized by effective phenolic compounds in these plant extracts (Roiaini *et al*., 2015).

Table 1: Effect of the plant extract Peroxide values (mEq / kg) for olive oil for different storage periods and storage grade 45°C.

Oil*Fruit	Treatment						Storage Duration (Day)
	T6	T5	T4	T3	T2	T1	
	6.0	6.0	6.0	6.0	**6**	6.0	**0**
5.1	3.0	8.0	4.4	4.8	5.0	5.4	15
4.03	3.0	8.0	3.0	2.8	3.4	4.0	30
4.13	3.0	8.0	4.0	3.0	3.4	3.4	45
4.6	3.0	11.0	3.0	2.8	3.0	4.4	4.6
(T1) %0.05 Alcoholic (T2) 0.1 %Alcoholic (T3) 0.15 % Alcoholic (T4) 0.15 % water (T5) Control (T6) 0.2% BHT							

Table 2: Effect of carrot extract on peroxide values (mEq / kg) for edible oil for different storage periods and storage grade 45°C

Oil*Fruit	Treatment						Storage Duration (Day)
	T6	T5	T4	T3	T2	T1	
	8.0	8.0	8.0	8.0	8.0	8.0	0
5.5	3.0	11.0	5.0	4.2	4.6	5.4	15
6.0	3.0	16.0	3.0	3.6	4.4	6.0	30
5.0	3.0	16.0	3.0	4.4	4.6	5.0	45
6.1	4.8	18.0	4.0	3.2	3.2	3.4	60
(1T) %0.05 Alcoholic (T2) 0.1 %Alcoholic (T3) 0.15 % Alcoholic (T4) 0.15 % water (T5) Control (T6) 0.2% BHT							

Conclusions

The results showed that the quantities of phenols extracted alcoholic higher than the extract of water from the carrot, and added to different concentrations helped to an increase (Shelf life) for vegetable oils more than 60 days at a temperature of 45°C.

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