



The Effect of Phenolic Components of Artichoke Jerusalem *Helianthus Tuberosus* in the Obstruction of Oxidation of some Local Oils

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Abstract

Phenolic compounds were extracted from the artichoke Jerusalem (*Helianthus tuberosus*), in two types of ethanol extraction using 98% ethanol for 24 hours at laboratory temperature and water extraction using distilled of Boiled water for 24 hours. 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 /g(Gallic acid) while the amount of flavonoids in the alcoholic extract was 26.63 mg / g(Gallic acid). The water extract was 11.23 mg / g(Gallic acid). The oil extract was superior to 88.3% antioxidant, but the water extract was 77.43%. The inhibitory effect of the added Artichoke Jerusalem extract concentrations (0.1, 0.15, 0.2%), oil to inhibit the oxidation of Palm Oil and Sunflower oil as it exceeded the reduction of peroxide values during the reservoir periods (15, 30, 45, 60 days)

Keywords: Antioxidant Activity, Artichoke Jerusalem, Palm Oil , Phenolic, Sunflower Oil

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Citation: Adnan Wahhab Habeeb Al-Mudhafir (2019), The Effect of Phenolic Components of Artichoke Jerusalem (*Helianthus Tuberosus*) in the Obstruction of Oxidation of some Local Oils. Int J Nutr Sci & Food Tech. 5:7, 55-59

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Received: July 22, 2019

Accepted: August 01, 2019

Published: August 26, 2019

Introduction

The Artichoke Jerusalem (earth apple) is one of the spring vegetable crops belonging to the Astraceae family (*Helianthus Tuberosus L.*). The composition of the vehicle follows the family of perennial vegetable crops, but is regenerated annually with the total vegetable deaths annually during the winter to give new growth during the spring[1]. The part that is dealt with is tubers that are made up at the end of the legs. The roots of the body are irregular and have protrusions which are eyes that contain buds and are eaten. It is cooked or used in pickling and is rich in insulin, which is used in the industry to obtain fructose (fructose) which also contains antioxidant phenolics [2,3]. The Artichoke Jerusalem 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 antioxidants and fat-loving substances such as

carotenoids, love and water substances such as phenolic compounds [3,4,5]. Artichoke Jerusalem was first used for medical purposes and was gradually used as food [6]. Fruits and vegetables are an important part of our lives as food, not only because they provide the main dietary fiber of nutrients, but are a group of micronutrients, including minerals, vitamins and antioxidants such as carotenoids and multiple phenols [7]. Explain [8,9] that Artichoke Jerusalem is rich in antioxidants, whether it is carotenoids or water-loving substances (phenols). Although the content of carotenoids varies considerably between the structures of (*Helianthus Tuberosus*) [10]. Phenolic compounds act as antioxidants in oxidation processes by breaking the chain of active reactions, "primary oxidation" or by removing free radicals "secondary oxidation", according to [7,11]. Food oils are subject to oxidative oxidation during production, storage, purchase and even consumption stages, such as palm oil from the *Elaeis guineensis*, which contain small amounts of phenolic substances, terpenes and sterols. The cultivation of the sun flower (*Helianthus Annuus L.*) has increased significantly in recent years, mainly due to the quality of its oil, which is useful for human consumption [12]. Oil palm tree (*Elaeis guineensis*) is the principal source of palm oil and Palm based phytochemicals mainly include phenolic compounds [13], terpenes, and sterols 16. Cultivation of sunflower (*Helianthus annuus L.*) has significantly increased in recent years, mainly due to quality of its oil, which is useful for the human consumption [14]. The seed oil contains unsaturated fatty acids (linoleic 56%, oleic 30% linolenic 0.7%) and saturated fatty acids (14%). And It content a protein 37% clopulin, 51% clotillin, and also connate 7% insoluble oils. Palm Oil also carries a wide range of amino acids rich in vitamin E (tocopherol) beta-sitostiron and phytine. [15], Because palm oil is rich in unsaturated fatty acids, including linoleic, it works to reduce Ldl cholesterol, which reduces cholesterol in the blood and prevents atherosclerosis and blood vessels. It also leads to low blood pressure. Earlier, diseases caused by phytosterol [16]. Oils and fats are naturally composed of esters of triglycerides, called triglycerides. Peroxidase is an indicator of the oxidizing oxidation of oils and thus reflects the

quality of the products containing these oils [17, 18]. The aim of the study is to increase the useful life of some oils used for human consumption.

Materials :

Buying Earth apple from the local Iraqi market and buying the type of pure palm oil production and sunflower oil produced by Company of Aldar made in Iraq and It produced in 2019.

Methods :

Preparation of plant extracts

1-Alcohol Extracts

I attended alcoholic extracts by method, [19]. 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°C, and then the extract was filtered using the Whatman No.1 filter paper. And then filtered using Vacuum Evaporator rotary evaporator at a temperature of 40°C 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.

2-Water Extracts

Prepare the extracts with water [20]., weigh 100 g of each sample with 500 ml of distilled boiling water and leave for 24 hours then put in a magnetic mixer for 30 minutes. Then, filter the Buchner funnel through the Whatman No.1 filter paper with discharge and concentrate in the rotary vacuum evaporator at 40°C, placed in dark containers and kept in the refrigerator until use.

3- Determination of total phenols

The value of phenols in the water and alcohol extracts of plants was determined using Folin-Ciocalteu [21]., method by dissolving 1 g of plant extracts in 46 mL of distilled water and 1 ml of Folin-Ciocalteu reagent. Mix well. 3 ml sodium carbonate (2%) Na₂CO₃ and leave the mixture for 2 hours with intermittent vibration, then measure the absorbance with a wavelength of 760 nm. The amount of phenols in the extracts was calculated on the basis of the relationship between acid concentration and absorption at the 760 nm wavelength and using a standard gallic acid solution at a concentration of 0-100 mg / ml.

4-Determination of total flavonoids

The method described above [22]., 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 AlCl₃.6H₂O 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.

5-Measure antioxidant activity

Antioxidant efficacy in alcoholic and aquatic extracts was estimated according to the method described in using the proposed linoleic acid system [23]. 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 mM 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 molar 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:

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

6- Antioxidants in the Oil :

And then dissolving 0.02% of the industrial antioxidant BHT and phenolic extracts 0.1, 0.15, 0.2% 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 [24]., 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 [25].

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 0.05 [26].

Results and discussion

1-Total phenol content

Figure 1 shows the differences between water and alcohol extracts in the phenolic compounds of Artichoke Jerusalem with 58.27 mg / g for extract and 42.62 mg / g for water extract. The difference in the amount of phenolic compounds between the extracts of water and alcohol is due to the nature of the separate compounds and the solubility of the high solvents used in the extraction. [27]. Water extracts containing small amounts of phenolic compounds compared with high levels of alcohol extracts because of the efficiency of ethanol in the extraction of polyphenols and tannins from the plant [28].

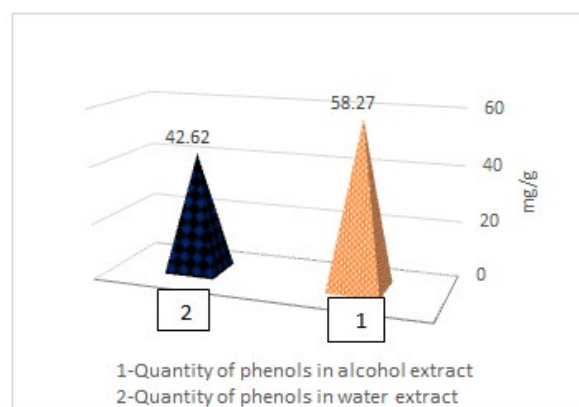


Figure 1: Total content of phenolic compounds in Artichoke Jerusalem extract

Total flavonoids content

Figure (2) shows the amount of flavonoids in water and alcohol extract from Earth Apple extract. The highest concentration of flavonoids in the Earth Apple extract was 26.61 mg /Rutin/g, followed by Earth Ap-

ple (11.25 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^[29].

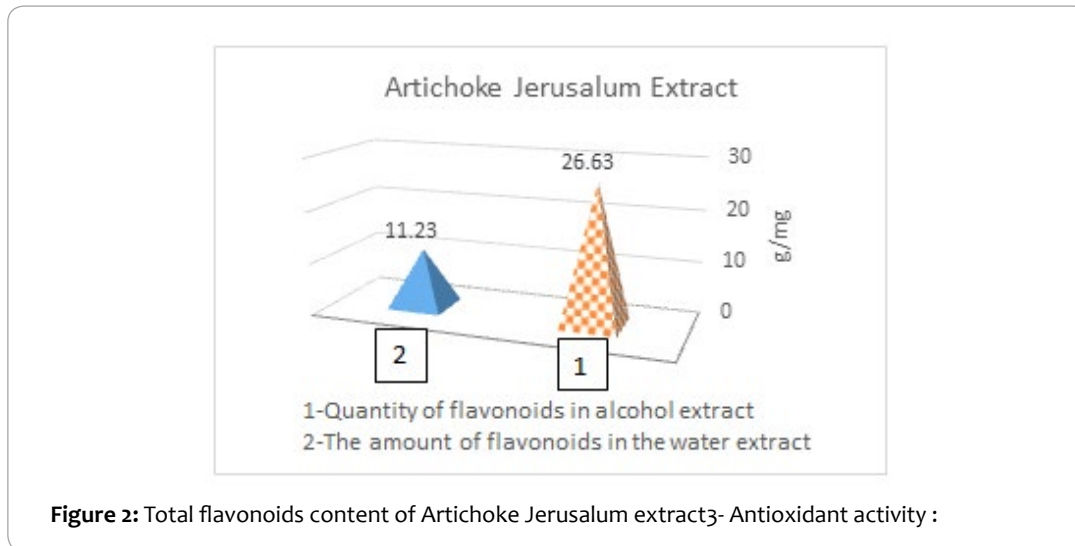


Figure 2: Total flavonoids content of Artichoke Jerusalem extract³- Antioxidant activity :

Figure (3) shows the effectiveness of antioxidants between prepared extracts, industrial antioxidants, and alcohol and water extracts. Oil extract from the Earth Apple gave the highest antioxidant effect of 88.32% and was lower than BHT 96.21%. The water extract of the Arti-

choke Jerusalem gave an antioxidant effect of 77.41%. 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^[11, 30].

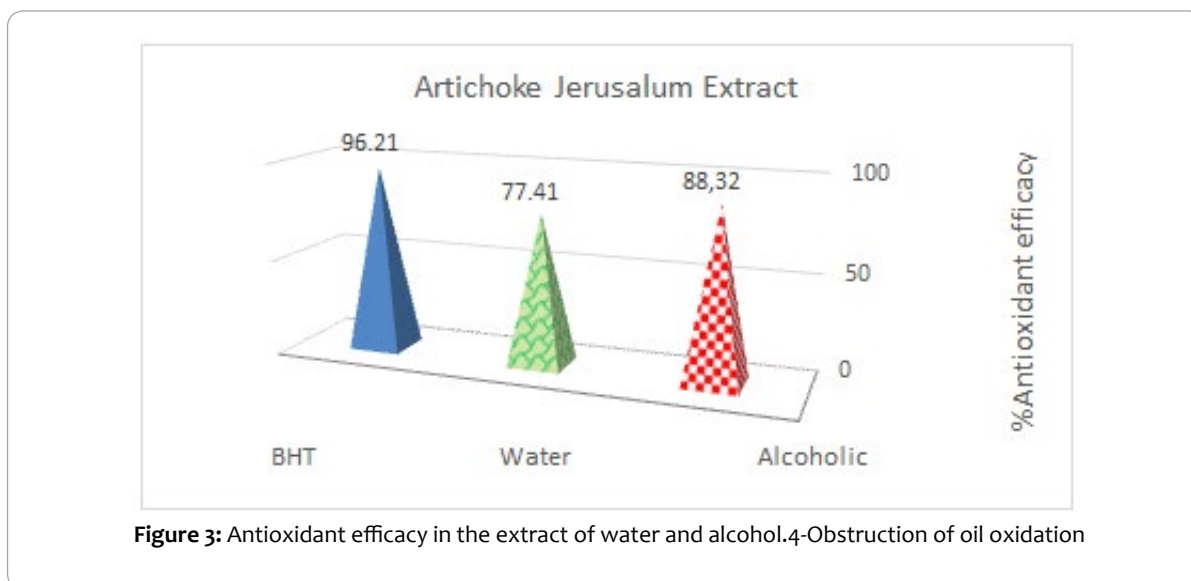


Figure 3: Antioxidant efficacy in the extract of water and alcohol.4-Obstruction of oil oxidation

Palm Oil :

Table 1 shows the effect of alkaline extract of phenolic substances (T1, T2, T3) in concentrations (0.1, 0.15, 0.2) as well as the T4 water extract at a concentration of 0.2% and compared with the control sample T5 (without addition) and another sample T6 added (BHT) to the values of peroxide of Palm oil stored for periods (15, 30, 45, 60) day and temperature of 45°C the results showed that the T3 concentration was higher than 0.2% for the 60 day storage period of 2.81 Meq / kg oil compared to the T6 treatment using industrial antioxidants (BHT) of 3.02 Meq / kg oil if there were no significant differences at 0.1, Compared

to the control sample of 11.0 Meq / kg of Palm 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. 34Research showed that the value of peroxide in Palm oil and canola oil was about 10.62.5.73 Meq / kg oil respectively^[32].

Storage Duration (Day)	Treatment						Oil*Fruit
	T1	T2	T3	T4	T5	T6	
15	5.42	5.11	4.83	4.42	8.04	3.02	5.14
30	4.11	3.41	2.83	3.03	8.04	3.02	4.07
45	3.42	3.41	3.04	4.02	8.42	3.02	4.22
60	4.42	3.02	2.81	3.01	11.00	3.02	4.54
Alcoholic % 0.2 (T3)		Alcoholic% 0.15 (T2)			Alcoholic 0.1%(T1)		
BHT %0.2 (T6)		Control (T5)			water% 0.2 (T4)		

Table 1: Effect of the Artichoke Jerusalem extract Peroxide values (Meq / kg) for Palm Oil for different storage periods and storage grade 45° C.

Sunflower Oil

Table (2) shows the effect of Artichoke Jerusalem extract on the peroxide values of sunflower Oil for different storage periods and at 45°C all treatments showed an effective anti-oxidant effect of Sun flower oil and $p \leq 0.05$ 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 $p \leq 0.05$ 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 18.0Meq/kg and treatments (T1, T2, T3, T4) showed a higher effect of industrial antioxidants during the 60 day storage period (3.43, 3.22, 3.22, 4.03) Meq / kg, while T6 (4.80 Meq / kg) in this regard, 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 ^[33].

Storage Duration (Day)	Treatment						Oil*Fruit
	T1	T2	T3	T4	T5	T6	
15	5.41	4.62	4.21	5.00	11.03	3.00	5.54
30	6.02	4.43	3.60	3.02	16.04	3.00	6.01
45	5.02	4.62	4.40	3.02	16.05	3.00	601
60	3.43	3.22	3.22	4.03	18.00	4.80	6.11
Alcoholic % 0.2 (T3)		Alcoholic% 0.15 (T2)			Alcoholic 0.1%(T1)		
BHT %0.2 (T6)		Control (T5)			water% 0.15 (T4)		

Table 2: Effect of Artichoke Jerusalem extract on peroxide values (Meq / kg) for Sun flower Oil for different storage periods and storage grade 45°C

Conclusions

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

Acknowledgments

The author thanks the Department of Food Science at the Faculty of Agriculture, University of Kufa for their assistance in the use of laboratories

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