

## Effect Different Levels of Powder and Aqueous Extract of Artichoke Leaves on Gastric Ulcer

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**Abstract:** A total of 54 adult female albino rats weighting 130±10g were used in the present study, 6 rats were excluded to use as negative control group (normal control) and others were fasted for 18 hours and given aspirin solution in a dose 200 mg/kg, body weight (oral administration 2 ml three times each 8 hours) to induced gastric ulceration. After 6 hours, 6 rats were sacrificed then stomach was left and opened to insure from gastric ulcer. The remainder 42 induced rats and control group were divided into 8 groups (6 rats in each group) as follows: First group rats fed basal diet as (negative control) (G1), second group induced rats fed basal diet as (positive control) (G2) and from third to fifth group were fed on basal diet with substituted artichoke leaves powder at three levels (5, 10 and 20%). Groups 6, 7 and 8 induced rats fed on basal diet and orally administrated by aqueous leaves extract at three levels (5, 10 and 20%) 2 ml three times/day. Rats were sacrificed at two phases the first phase after a week (half the rats) and the second after two weeks. Chemical composition, antioxidant activity and total phenolic compounds were determined in dried Artichoke leaves, pH value, gastric volume, total acidity of gestic juice, gastric severity, gastritis and odema were determined. Also, histopathological examination was conducted. Results showed that (G2) had the lowest food intake value than other groups however (G1) was the highest value after one and two weeks, the highest weight gain and feed efficiency ratio were observed in (G3) after one week and in (G7) after two weeks. The pH value of (G2) was the lowest value of pH compared to groups, while there were no significant differences ( $p > 0.05$ ) between (G1) and other groups after one and two weeks. Volume of gastric juice for (G2) was the highest value significantly than other groups after one and two weeks, while (G4) was the lowest value after one week, (G2) had the highest total acidity value and significantly different ( $p \leq 0.05$ ) with other groups after one and two weeks. Mild gastric ulcer was found after 6 hours in sample and positive control (G2) which continuous after one and two weeks, however gastric ulcer was diminished in all treatments after one and two weeks, except (G5) at level 20% powder after two weeks. Concerning gastritis results showed that no gastritis found in (G5) after one week and (G3 and G4) after two weeks. It can be concluded that the high anti-ulcerogenic potential of artichoke leaves was referred to antioxidant properties of artichoke leaves, in addition, the presence of phenolic acids and flavonoides contribute to the anti- ulcerogenic activity described here.

**Key words:** Artichoke • Gastric ulcer • Ulcerogenic potential • Polyphenol compounds • Antioxidants

### INTRODUCTION

Ulceration refers to any break in the skin or mucus membrane and is classified according to the part of the digestive system in which it occurs [1]. Gastric ulcer is one of the major gastrointestinal disorders, which occurs due to an imbalance between the offensive (gastric acid secretion) and defensive (gastric mucosal integrity) factors. The incidence of peptic ulcer is increased due to stress, smoking, alcohol, Helicobacter pylori and

ingestion of non-steroidal anti-inflammatory drugs (NSAID). It has been suggested that reactive oxygen species (ROS), primarily super-oxide anions, hydroxyl radicals and lipid peroxides, are the harmful species known to cause the gastric ulcer development [2]. In the last few decades, there has been increasing interest in the potential health benefits of several plant extracts and many of the health-related effects are linked to the presence of the secondary metabolites, such as the polyphenols. These compounds may reduce the risk of

the development of several diseases due to a complex effect but many authors claim that some of their properties may be related both to their antioxidant capacity and other biological activities [3]. It has been well documented that the antioxidant properties of some plants are directly related to both gastroprotective and cytoprotective activities. It was suggested that flavonoids may be the main compounds responsible for the antiulcerogenic activity of plants [4]. *Cynara scolymus* L. (Asteraceae), popularly known as artichoke, is widely cultivated in Mediterranean, American and African Countries. Its sprout is commonly eaten as a vegetable; while its leaves are frequently used in folk medicine in the treatment of hepatitis, hyperlipidaemia, obesity and dyspeptic disorders. Clinical and pre-clinical trials have confirmed the therapeutic potential of this plant, particularly in the treatment of hepatobiliary dysfunction and digestive complaints. And also its effectiveness in patients with irritable bowel syndrome and hyperlipoproteinaemia, as well as its choleric and antioxidant effects. The literature reports several phenolic compounds as the main chemical constituents of artichoke leaves, such as cynarin, caffeic and chlorogenic acids, luteolin, cynaroside and scolymoside and sesquiterpenes, such as cynaropicrin and lupeol, which are indicated as the active principles of this plant [5]. Analytically, main polyphenolic compounds found in artichoke plant are caffeic acid, caffeoylquinic acids, chlorogenic acid, cyanidol glucosides, cynaragenin, cynaropicrin, cynaratriol, cynarin, cynarolide, decanal, eugenol, ferulic acid, flavonoids, folacin, glyceric acid, glycolic acid, heteroside-B, inulin, isoamrerboin, lauric acid, linoleic acid, linolenic acid, luteolin glucosides, myristic acid, neochlorogenic acid, oleic acid, palmitic acid, phenylacetaldehyde, pseudotaraxasterol, scolymoside, silymarin, sitosterol and stearic acid [6]. Artichoke (*Cynara scolymus*, Family *Asteraceae*) is an important component of the Mediterranean diet and it is rich in bioactive polyphenol compounds (mainly cynarin, luteolin and chlorogenic acid), dietary fibers, vitamins and minerals. Traditionally, artichoke leaves were used for the treatment and prevention of many diseases. Artichoke has been used to treat dyspepsia mainly because of its choleric effect that is associated with increased bile formation. Artichoke extracts have been found to exhibit hepatoprotective activity, lipid lowering property, antioxidant effect and reduce postprandial blood glucose in man and experimental animals. Artichoke extracts also produced protective effects against hepatocellular carcinoma both *in vitro* and *in vivo*. Artichoke plant is traditionally treating liver diseases, gallbladder disorders and dyspepsia as well as some conditions such as

hyperlipidemia, overweight and obesity [7]. So our study aimed to investigate the effect of dried and aqueous leaves extract of artichoke at different levels on peptic ulcer in experimental animals.

## MATERIALS AND METHODS

Artichoke was obtained from the local market in Qalubia Governorate, Egypt. A total of 54 adult female albino rats weighting  $130 \pm 10$ g were obtained from Research Institute of Ophthalmology, aspirin (aspogic) ampoules were purchased from Amriya for Pharmaceutical Industries.

**Methods:** Artichoke leaves were washed in clean water and dried by solar energy in Central Research, Dokki, Egypt, Center Laboratory and crushed into fine powder.

**Preparation of Water Soaking of Artichoke Leaves Powder:** 25 g (aqueous extract 1) 5%, 50 g (aqueous extract 2) 10% and 100 g (aqueous extract 3) 20% of artichoke leaves powder were soaked each in 500 ml of distilled water at  $80^\circ\text{C}$  respectively, stirred carefully for about 8 minutes, corked and then left to stand for 14 hours. The solution was filtered using filter paper (Whatman No1) and the filtrate (aqueous extract) stored in a refrigerator at  $4^\circ\text{C}$  till used according to Barine *et al.* [8].

**Analytical Methods:** Chemical composition (moisture, fibers, ash and crude fat) were determined in Artichoke leaves powder according to the method of A.O.A.C [9] while total protein was measured by the modified of Lowary *et al.* [10] using Pye Unicam SP 6-550 Uv/Vis spectrophotometer at 750 nm. Carbohydrate content was determined as total soluble sugar which was determined as glucose (unless otherwise specified) by phenol – sulfuric acid method [11]. The total phenol contents and antioxidant activity in artichoke leaves powder were determined according to the methods of Yen and Duh and Zhang [12, 13]. Phenolic compounds were identified and quantified in dried artichoke leaves by HPLC according to the method of Goupy *et al.* [14].

**Experimental Design:** A total of 54 adult female albino rats weighting  $130 \pm 10$ g were used in the present study, rats were reared in the animal house of Research Institute of Ophthalmology and housed in single cages under normal healthy condition and feed basal diet according to AIN [15] for one week. After adaptation period 6 rats were excluded to use as a negative control group (normal

control) and others were fasted for 18 hours and given aspirin solution in a dose 200 mg/kg, (volume of 1 ml of solution 20 mg/ml, oral administration 2 ml three times each 8 hours) to induced gastric ulceration according to Agrawal *et al.* [16]. After 6 hours, 6 rats were sacrificed then stomach was left and opened to insure from gastric ulcer. The remainder 42 induced rats and control group were divided into 8 groups (6 rats in each group) as follows:

- First group rats fed basal diet as (negative control) (G1).
- Second group induced rats fed basal diet as (positive control) (G2).
- Third to Fifth groups were fed on basal diet with substituted artichoke leaves powder at three levels (5, 10 and 20%) (G3-G5).
- Groups 6, 7 and 8 induced rats fed on basal diet and orally administrated by aqueous leaves extract at three levels (5, 10 and 20%) 2 ml three times/day (G6, G7 and G8).

**Biological Evaluation:** The duration of the study was two weeks, half of rats were sacrificed after the first week (3 rats of each group) and the rest rats were sacrificed after the second week. Rats were weighed every week and food intake also recorded till the end of the experiment. Body weight gain and feed efficiency ratio were calculated according to Chapman *et al.* [17].

**Gastric Secretion:** Gastric juice volume was measured at the end of experimental period. Rats were fasted for 18- 20 hours and allowed to drink water only in the morning of the next day. Rats were sacrificed and their stomachs were ligated around both openings (cardiac and pyloric openings) and injected by 5 ml distilled water, the gastric juice was then collected in sterilized tube and centrifuged at 4000 pm for 5 minutes, the volume of gastric juice was measured by graduated cylinder according to Debnath *et al.* [18].

**Determination of Total Acidity and pH Value of Gastric Juice:** Total acidity and ph value of gastric juice were determined according to the method described by Debnath *et al.* [18].

**Histopathological Examination of the Stomach:** Histopathological examination of the stomach was determined according to the method described by Banchroft *et al.* [19].

**Statistical Analysis:** Data were presented as means  $\pm$  SD. The statistical analysis was carried out using one way analysis of variance (ANOVA) followed by Duncan's multiple range tests. The analysis was done with SPSS [20] computer program, differences between the experimental groups were considered a significant at  $P \leq 0.05$  level [21].

## RESULTS AND DISCUSSION

**Chemical Composition of Dried Artichoke Leaves:** Data presented in Table 1 showed the approximate chemical analysis of dried artichoke leaves. As shown dried artichoke leaves contained 5.96, 7.7, 0.94, 77.75, 6.5 and 1.15 g/100g for ash, fiber, total lipids, total carbohydrate, total protein and moisture, respectively.

**Total Phenolics and Some Phenolic Compounds in Dried Artichoke Leaves:** Data presented in Table 2 showed that the total phenolics and some phenolic acids compounds in dried artichoke leaves. Results indicated that dried artichoke contained total phenolic compounds about 54.98 mg/g, ferulic acid 18.77 mg/g, p. hydroxy benzoic 35.99 mg/g, coumaric acid 7.89 mg/g and Vanillic acid 50.17 mg/g. Nergo *et al.* [22] found that artichoke leaves had highest content of total phenols. The main polyphenolic compounds in artichoke plant are caffeic acid, caffeoylquinic acids, chlorogenic acid, cyanidol glucosides, cynaragenin, cynarapicrin, cynaratriol, cynarin, cynarolide, decanal, eugenol, ferulic acid, flavonoids, folacin, glyceric acid, glycolic acid, heteroside-B, inulin, isoamerboin, lauric acid, linoleic acid, linolenic acid, luteolin glucosides, myristic acid, neochlorogenic acid, oleic acid, palmitic acid, phenylacetaldehyde, pseudotaraxasterol, scolymoside, silymarin, sitosterol and stearic acid as reported by EMA [6] and Al-Ahbab [7].

**Effect of Dried and Aqueous Leaves Extract of Artichoke at Different Levels on Food Intake, Body Weight Gain and Feed Efficiency Ratio after one Week:** Data in Table 3 showed that food intake of positive control group was the lowest value than other all groups (26.3 $\pm$ 0.8). However negative control group was the highest value (44.34 $\pm$ 1.82) followed by (G5) (43.0 $\pm$ 0.7), (G7), (G4) and (G8) (42.93 $\pm$ 0.76, 42.86 $\pm$ 0.64 and 42.37 $\pm$ 1.2) and finally (G6) and (G3) (41.76 $\pm$ 1.2 and 41.43 $\pm$ 1.16). As for body weight gain data showed decrease of rats' body weight in some groups, the higher weight loss was found in positive control group (G2) followed by (G8), (G6) and finally (G5)

Table 1: Chemical composition of dried artichoke leaves (g/100g)

Ash	Fiber	Lipids	Carbohydrate	Protein	Moisture
5.96	7.7	0.94	77.75	6.5	1.15

Table 2: Total phenolics and some phenolic acids in dried artichoke leaves

Compounds	mg/g
Total phenolics	54.98
Ferulic acid	18.77
p.hydroxy benzoic	35.99
Coumaric acid	7.89
Vanillic acid	50.17

Table 3: Effect of dried and aqueous leaves extract of artichoke at different levels on food intake, body weight gain and feed efficiency ratio after one week

Groups	Food intake (g/week)	Body weight gain (g/week)	Feed efficiency ratio
Negative control (G1)	44.34±1.82	8.33±2.88	0.19±0.06
Positive control (G2)	26.3±0.8	- 16.66±5.77	- 0.63±0.22
Powder 5% (G3)	41.43±1.16	10.0±5.0	0.24±0.12
Powder 10% (G4)	42.86±0.64	1.67±2.88	0.04±0.07
Powder 20% (G5)	43.0±0.7	-5.0±8.66	- 0.12±0.2
Aqueous extract 5% (G6)	41.76±1.2	- 5.0±8.66	- 0.12±0.21
Aqueous extract 10% (G7)	42.93±0.76	5.0±5.0	0.12±0.11
Aqueous extract 20% (G8)	42.37±1.2	- 11.67±7.64	- 0.28±0.19

Table 4: Effect of dried and aqueous leaves extract of artichoke at different levels on food intake, body weight gain and feed efficiency ratio after two weeks

Groups	Food intake (g/week)	Body weight gain (g/week)	Feed efficiency ratio
Negative control (G1)	45.03±1.45	5.0±0.0	0.11±0.004
Positive control (G2)	27.3±1.2	- 5.0±10.0	- 0.19±0.38
Powder 5% (G3)	41.6±1.32	1.66±5.0	- 0.001±0.12
Powder 10% (G4)	43.2±0.1	1.67±7.6	0.04±0.17
Powder 20% (G5)	43.2±0.3	- 5.0±5.0	- 0.12±0.12
Aqueous extract 5% (G6)	42.93±0.49	5.0±0.0	0.12±0.001
Aqueous extract 10% (G7)	42.53±1.09	8.3±7.64	0.19±0.18
Aqueous extract 20% (G8)	42.63±1.0	5.0±5.0	0.12±0.12

(- 16.66±5.77, - 11.67±7.64, - 5.0±8.66 and - 5.0±8.66), respectively. On the other hand, the highest weight gain was found in (G3) followed by (G7) and finally (G4) (10.0±5.0, 5.0±5.0 and 1.67±2.88) respectively. With respect to feed efficiency ratio table showed that the highest value of feed efficiency ratio was found in (G3) followed by negative control (G1) and (G7) (0.24 ± 0.12, 0.19 ± 0.06 and 0.12±0.11), respectively, while the lowest value was observed in positive control (G2) (- 0.63±0.22) followed by (G8), (G6) and (G5) (- 0.28±0.19, - 0.12±0.21 and - 0.12±0.2), respectively. Artichoke plant is traditionally treating liver diseases, gallbladder disorders and dyspepsia as well as some conditions such as hyperlipidemia, overweight and obesity [7].

**Effect of Dried and Aqueous Leaves Extract of Artichoke at Different Levels on Food Intake, Body Weight Gain and Feed Efficiency Ratio after Two Weeks:**

Result in Table 4 indicated that the food intake for positive control group (G2) was the lowest value than other all groups (27.3±1.2), while the highest value was

observed in negative control group (G1) (45.03 ± 1.45). Body weight gain showed reduction in positive control and (G5) (- 5.0±10.0 and 5.0±5.0). While the highest increase in body weight gain was observed in (G7) followed by negative control (G1), (G6) and (G8) (8.3±7.64, 5.0±0.0, 5.0±0.0 and 5.0±5.0), respectively. Also, El- Sawy [20] found decrease in body weight gain for positive control group than negative control and groups under study when feed ulcer peptic rats on dried banana pulp. With respect to feed efficiency ratio data showed that the highest increase was found in (G7) (0.19±0.18) followed by negative control group (G1) (0.11±0.004) and finally (G8 and G6) (0.12±0.12 and 0.12±0.001) respectively. However, the highest decreased was found in positive control group (G2) (- 0.19±0.38) followed by (G5 and G3) (- 0.12±0.12 and - 0.001±0.12), respectively. The reduction in body weight gain for positive control group was attributed to gastric ulcer in this group; while the reduction in body weight gain in other groups may be refer to the fiber content in artichoke powder.

Table 5: Effect of dried and aqueous leaves extract of artichoke at different levels on pH value, volume (ml) and total acidity of gastric juice after one week

Groups	pH values	Volume (ml)	Total acidity
Negative control (G1)	4.73±0.56 <sup>a</sup>	0.32±0.01 <sup>b,c</sup>	17.19±0.15 <sup>d</sup>
Positive control (G2)	3.52±0.52 <sup>b</sup>	0.63±0.03 <sup>a</sup>	75.17±2.64 <sup>a</sup>
Powder 5% (G3)	5.08±0.29 <sup>a</sup>	0.27±0.02 <sup>c,d</sup>	21.23±0.3 <sup>c</sup>
Powder 10% (G4)	4.83±0.15 <sup>a</sup>	0.27 ±0.01 <sup>c</sup>	22.9 ± 1.22 <sup>bc</sup>
Powder 20% (G5)	4.98±0.13 <sup>a</sup>	0.29±0.01 <sup>c,d</sup>	21.4±0.1 <sup>c</sup>
Aqueous extract 5% (G6)	4.88±0.23 <sup>a</sup>	0.31±0.01 <sup>c</sup>	21.66±0.46 <sup>c</sup>
Aqueous extract 10% (G7)	4.95±0.13 <sup>a</sup>	0.3±0.02 <sup>c,d</sup>	21.9±1.45 <sup>bc</sup>
Aqueous extract 20% (G8)	5.22±0.34 <sup>a</sup>	0.35±0.02 <sup>b</sup>	24.03 ± 0.38 <sup>b</sup>

Different superscript letters in row denote significant differences ( $p \leq 0.05$ ), while similar superscripts denote non significance

**Effect of Dried and Aqueous Leaves Extract of Artichoke at Different Levels on pH Value, Volume (ml) and Total Acidity of Gastric Juice after One Week:** Results in Table 5 illustrated that the pH value of positive control group (G2) was the lowest value (3.52±0.52) than other all groups under study. On the other hand, there were no significant differences ( $p > 0.05$ ) between all treatments under study and negative control group. As for volume of gastric juice (ml) positive control group was the highest value significantly, while (G4) was the lowest value (0.63±0.03 vs. 0.27 ±0.01). On the other hand, there were no significant differences ( $p > 0.05$ ) between (G1) (0.32±0.01) and (G8, G6 and G7) (0.35±0.02, 0.3±0.02 and 0.3±0.02), respectively. With respect to total acidity results showed that there were significant differences ( $p \leq 0.05$ ) between positive control group (G2) and other all groups, while there no significant differences ( $p > 0.05$ ) between (G4 and G7) (22.9±1.22 and 21.9±1.45) and (G3, G5 and G6) (21.23±0.3, 21.4±0.1 and 21.9±1.45), respectively.

**Effect of Dried and Aqueous Leaves Extract of Artichoke at Different Levels on pH Value, Volume (ml) and Total Acidity of Gastric Juice after Two Weeks:** Results in Table 6 showed that pH value of positive control group (G2) was the lowest value of pH (4.42±0.01) than other all group, while there were no significant differences ( $p > 0.05$ ) between negative control group (G1) and other all groups. However, the volume of gastric juice of positive control was the highest value (0.75±0.01) than other all groups; also there were significant differences ( $p \leq 0.05$ ) between negative control group (0.32±0.01) and all groups. On the other hand, there were no significant differences ( $p > 0.05$ ) between (G3, G4, G6 and G8) (0.28±0.02, 0.28±0.01, 0.28±0.01 and 0.27±0.01), respectively. While there were significant differences ( $p \leq 0.05$ ) between (G5) and all treated groups. With respect to total acidity for negative control (G1) was the lowest significantly value (17.19±0.13) with other all groups, on the other hand positive control (G2) was the highest value (75.01±1.35)

and significantly different ( $p \leq 0.05$ ) with other all groups. The results showed no significant differences ( $p > 0.05$ ) between (G3 and G4) and (G6, G7 and G8) (22.8±0.23 and 21.7±0.4) and (24.93±0.64, 24.53±0.8 and 25.17±1.07), respectively. These results are in agreement with those obtained with El-Sawy [24] who found significant increase in the pH value, volume (ml) and total acidity between positive control and groups under study when fed rats suffer from peptic ulcer on dried banana pulp at different doses for two weeks.

**The Severity of Histopathological Alteration in Stomach of Rats Received Dried Leaves of Artichoke at Ratio (5%, 10% and 20%) after One and Two Weeks:** Results in Table 7 showed that there was mild gastric ulcer after 6 hours in sample and positive control which continuous after one and two weeks. However there was no gastric ulcer at all treatments after one and two weeks except (G5) at level 20% powder which suffer from mild gastric ulcer after two weeks. These results may be referring to high fiber content in the diet which leads to friction in the wall of the stomach and prevents healing ulcers. As for gastritis results showed that no gastritis found in (G5) after one week and (G3 and G4) after two weeks, while mild gastritis was found in (G3, G4) after one week. Moderate gastritis was found in rats after 6 hours, positive control (G2) and (G5) after two weeks. Sever gastritis was found in positive control (G2), after two weeks. Congestion and oedema in submucosa was not found in 6 hours' samples, (G4) after one week and (G3, G4 and G5) after two weeks. On the other hand, it was mild in (G3) after one week and moderate in positive control after one week. Finally, it was sever in (G5) after one week. Serosal odema was found in (G3 and G5) after one and two weeks while after one week only in (G4), however it was moderate after 6 hours' sample and positive control after one week and two weeks. Mild serosal oedma was found in (G4) after two weeks.

Table 6: Effect of dried and aqueous leaves extract of artichoke at different levels on Ph value, volume (ml) and total acidity of gastric juice after two weeks

Groups	pH values	Volume (ml)	Total acidity
Negative control (G1)	5.13±0.95 <sup>ab</sup>	0.32± 0.01 <sup>c</sup>	17.19± 0.13 <sup>f</sup>
Positive control (G2)	4.42±0.01 <sup>b</sup>	0.75±0.01 <sup>a</sup>	75.01±1.35 <sup>a</sup>
Powder 5% (G3)	4.95±0.15 <sup>ab</sup>	0.28±0.02 <sup>e</sup>	22.8±0.23 <sup>ed</sup>
Powder 10% (G4)	4.95±0.15 <sup>ab</sup>	0.28±0.01 <sup>e</sup>	21.7±0.4 <sup>e</sup>
Powder 20% (G5)	5.19±0.26 <sup>a</sup>	0.39±0.01 <sup>b</sup>	29.77±0.15 <sup>b</sup>
Aqueous extract 5% (G6)	5.05±0.31 <sup>ab</sup>	0.28± 0.01 <sup>ed</sup>	24.93± 0.64 <sup>c</sup>
Aqueous extract 10% (G7)	5.03 ± 0.19 <sup>ab</sup>	0.29±0.01 <sup>d</sup>	24.53±0.8 <sup>ed</sup>
Aqueous extract 20% (G8)	5.33±0.25 <sup>a</sup>	0.27±0.01 <sup>e</sup>	25.17±1.07 <sup>c</sup>

Different superscript litters in row denote significant differences (p≤0.05), while similar superscripts denote non significance

Table 7: The severity of histopathological alteration in stomach of rats received dried leaves of artichoke at ratio (5%, 10% and 20%) after one and two weeks

Parameters	(G1) (-) control	After 6 hours	After one week				After two weeks			
			G2(+) control	(G3) 5%	(G4) 10%	(G5) 20%	(G2) (+) control	(G3) 5%	(G4) 10%	(G5) 20%
Gastric ulcer	-	+	+	-	-	-	+	-	-	+
Gastritis	-	++	++	+	+	-	+++	-	-	++
Congestion and oedema in s. m.	-	-	++	+	-	+++	++	-	-	-
Serosal oedma	-	++	++	-	-	-	++	-	+	+

+++ sever, ++ Moderate, + mild, - nil

Table 8: The severity of histopathological alteration in stomach of rats received aqueous extract of dried leaves of artichoke at ratio (5%, 10% and 20%) after one and two weeks

Parameters	(G1) (-) control	After 6 hours	After one week				After two weeks			
			G2(+) control	(G6) 5%	(G7) 10%	(G8) 20%	(G2) (+) control	(G6) 5%	(G7) 10%	(G8) 20%
Gastric ulcer	-	+	+	-	-	-	+	-	-	-
Gastritis	-	++	++	+	+	+	+++	+	+	+
Congestion and oedema in s. m.	-	-	++	+	-	+	++	++	-	+
Serosal oedma	-	++	++	-	-	-	++	-	-	-

+++ sever, ++ Moderate, + mild, - nil

**The Severity of Histopathological Alteration in Stomach of Rats Received Aqueous Extract of Dried Leaves of Artichoke at Ratio (5%, 10% and 20%) after One and Two Weeks:** Results in Table 8 showed that there was gastric ulcer after 6 hours sample, while after one and two weeks it was diminished in all terminated groups except positive control group. Gastritis was mild in (G6, G7 and G8) after one and two weeks, however it was moderate in after 6 hour sample and positive control group. Finally it was sever in positive control group after two weeks. As for Congestion and oedema in sub mucosa, results showed that there were no Congestion and oedema in sub mucosa in after 6 hour sample and (G7) after one and two weeks, while it was mild in (G6) and (G8) after one week and in (G8) after two weeks. Moderate Congestion and oedema in sub mucosa found in positive control after one and two weeks and in (G6) after two weeks. Results concerning that there were no serosal oedema found in all treatments after one and two weeks, however moderate serosal oedema was found after

6 hour sample and in positive control group after one and two weeks. Artichoke caused healing in the ulcer, our results indicated that both dried and aqueous leaves extract of artichoke caused treat in gastric ulcer, except leaves powder at level 20% which may be refer to high fiber content. Our results are in agreement with those obtained by El-Sawy [24], who found that mild inflammation in rats suffer from peptic ulcer after feed on dried banana pulp for two weeks and Nassar *et al.* [5] found that ethanol extract of artichoke caused healing in gastric ulcer by 55%.

**DPPH-Free Radical-Scavenging Activity:** The antioxidant activity was increased when the concentration of the sample increased. Antioxidant activity ranging from 81.27 to 85.91% DPPH for concentrate sample ranging from 4 to 64mg (Photo 1). Artichoke leaf extract is very effective as an antioxidant and its beneficial effects are attributed to antioxidant action reported by Speroni *et al.* [23].

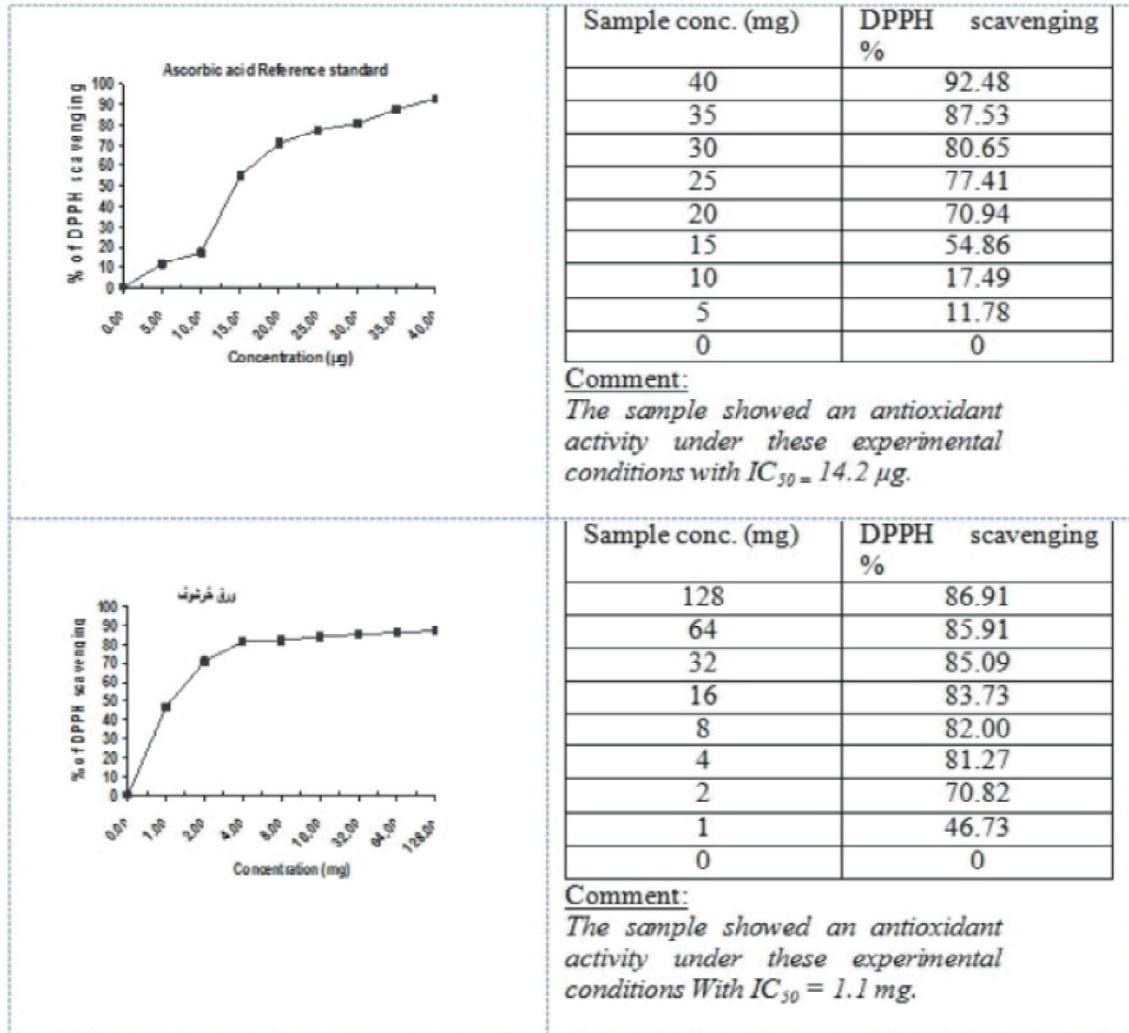
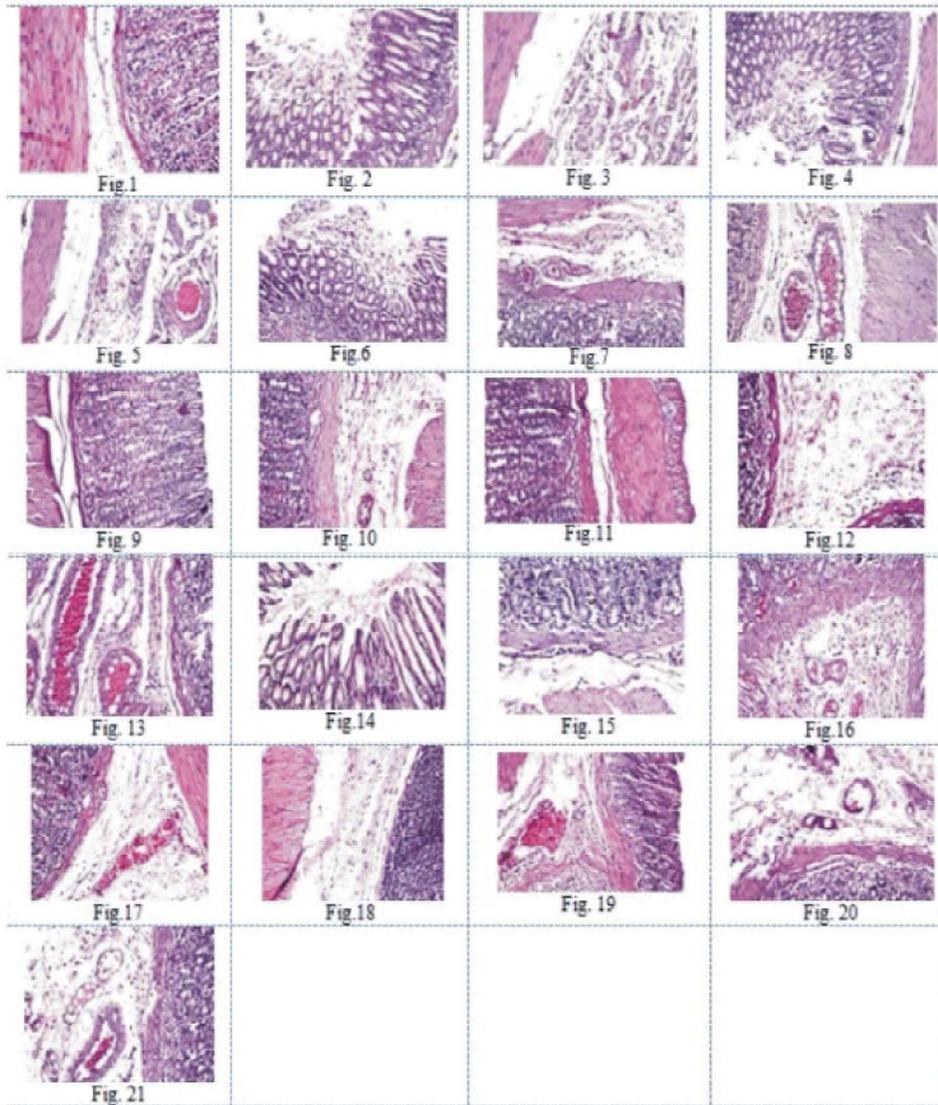


Photo 1: Evaluation of Antioxidant Activity using DPPH scavenging

**Histopathological Examination:** The histopathological findings are presented in Fig. 1-21. Group of rats kept as negative control (G1): There was no histopathological alteration and the normal histological structure of the mucosal, sub-mucosal; muscularis and serosa were recorded in (Fig. 1). Group of experimentally induced rats: After six hours (sample): Focal necrosis and ulceration were detected in the tips of the mucosal surface (Fig. 2), associated with oedema, inflammatory cells infiltration and congestion in the blood vessels of the sub-mucosa (Fig. 3). After one week (G2): The tips of the mucosal surface showed focal ulceration (Fig. 4), while the sub-mucosa had oedema, congestion in the blood vessels and inflammatory cells infiltration (Fig. 5). After two weeks (G2): There were focal necrosis and ulceration in the mucosal lining epithelium (Fig. 6), while the underlying

sub-mucosa showed oedema, inflammatory cells infiltration and congestion in the blood vessels (Fig. 7, 8). Group of experimentally induced rats and treated by 5% dried leaves of artichoke (G3): After one week there was no histopathological alteration as recorded in (Fig. 9). After two weeks the mucosal layer was histologically intact while the underlying submucosa showed oedema and few inflammatory cells infiltration (Fig. 10). Group of experimentally induced rats and treated by 10% dried leaves artichoke (G4): After one week there was no histopathological alteration in the mucosa, sub-mucosa and muscularis (Fig. 11). After two weeks the mucosal layer was histologically intact while the underlying sub-mucosa had oedema with few inflammatory cells infiltration (Fig. 12). Group of experimentally induced rats and treated by 20% dried leaves artichoke (G5):



Histopathological Figures 1-21.

After one week, sever congestion in the blood vessels with oedema were detected in the sub-mucosal layer (Fig. 13). After two weeks, focal necrosis was detected in the tips of the mucosal surface (Fig. 14), associated with oedema and few inflammatory cells infiltration in the sub-mucosal layer (Fig. 15). Group of Experimentally Induced Rats and Treated by Aqueous Extract 5% (G6): After one week the mucosal layer was histologically intact, while the underlying sub-mucosa showed oedema, few inflammatory cells infiltration and congestion in the blood vessels (Fig. 16). After two weeks there was no histopathological alteration in the mucosal layer. The sub-mucosa showed oedema with few inflammatory cells infiltration and congestion in the blood vessels (Fig. 17). Group of

experimentally induced rats and treated by aqueous extract 10 % (G7): After one week the sub-mucosa showed oedema with few inflammatory cells infiltration (Fig. 18). After two weeks sub-mucosa showed oedema with few inflammatory cells infiltration (Fig. 19). Group of experimentally induced rats and treated by aqueous extract 20% (G8): After one week the mucosal layer was histological intact while the sub-mucosa showed oedema with few inflammatory cells infiltration and congestion in the blood vessels (Fig. 20). After two weeks the sub-mucosa showed focal inflammatory cells infiltration with oedema and congestion in the blood vessels (Fig. 21). Ishida *et al.* [25] demonstrated that artichoke leaf extract prevents acute gastric mucosal injuries in rats.

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