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Potential protective effects of Artichoke plant on peptic ulcer in rats

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Abstract: Artichoke has been reported to be used internally for the treatment of inflammation of the intestinal mucosa. It has been claimed to act as an antioxidant. The objective of this study was added artichoke powder in baked products and its assessed the protective activity of artichoke against peptic ulcer which induced by ethyl alcohol in adult male rats. Artichoke was used to replace part of the whole wheat flour (2.5%, 5% and 10%) in standard cake. Appearance, taste, flavor, texture, color and overall acceptability were evaluated in cake .The results showed that groups which treatment with artichoke were significantly decreased in ulcer score, ulcer index and increase in preventive index compared with the positive control group. Supplemented rats diet with 10% of artichoke powder were more effective to protect the stomach of ulcer. Moreover sensory evaluation showed that all replacement of artichoke in cake were showed acceptable by the panelists. It concluded that artichoke had a protective activity against peptic ulcer in adult rats which induced by ethyl alcohol. Also, Thirty rats were randomly divided into five groups (n=6 for each), the first and second groups fed standard diet, from the third to the fifth groups fed standard diet containing 2.5, 5, 10% artichoke powder(AP). The rats of second to fifth groups were received a single orally dose of ethyl alcohol 90% at 10 ml/kg body weight. After two hour later and under anesthesia by diethyl ether, abdominal wall was opened, the pylorus identified, stomachs ligated from esophageal opening, removed, opened at greater curvature, gastric juice collected and centrifuged for studying of gastric secretion parameters.

Introduction: Gastric ulcers are common pathologies that affect a significant number of people around the world. Many authors have referred to gastric ulcers as the new‘‘plague of the 21st century’’ **(O'Malley, 2003).** The development of gastric ulcers is a complex and multifactorial process, occurring from an imbalance between aggressive and protective factors present in the gastric mucosa **(Choiet *et.al,*2009).** Some etiologies of gastric ulcers include increased acid secretion and pepsin activity, reduced mucus and bicarbonate secretion, imbalanced bile salt secretion, the presence of *Helicobacter pylori*, increased gastric contractions and decreased blood flow **(Galuska *et al,* 2002; Hoogerwerf and Pasricha, 2001a)**. Furthermore, the increased incidence of gastric ulcers is associated with aggressive factors against the gastric mucosa such as ethanol exposure,stress, smoking, nutritional deficiencies and frequent ingestion of non-steroidal anti-inflammatory drugs (NSAIDs) **(Belaiche *et al,* 2002 and Correa and Houghton, 2007).** The key defense factors of the gastricmucosa include the secretion of bicarbonate and prostaglandin, increased levels of antioxidants and maintaining adequate levels of Nitric Oxide (NO) dilates blood vessels, increases blood flow and stimulates gastric angiogenesis in the healing process of ulcers **(Yang *et al,*2000 and Hoogerwerf and Pasricha, 2001b).** NO also stimulates cell proliferation of the gastric mucosa and granulation tissue formation at the base of an ulcer **(Yang *et.al,*2000).**There are many different experimental models of gastric ulcer induction, including ethanol and acetic acid**.** Using such animal models, researchers simulate conditions to which humans may be exposed and, as a result, develop gastric ulcers **(Wallace *et al*., 1982)**.

Artichoke (*Cynara scolymus* **L**) is an edible vegetable from the Mediterranean area. It is a good source of natural antioxidants such as vitaminC, carotenoids, polyphenols, hdroxycinnamic acids and flavones. Artichoke was used as food and medicine by ancient Egyptians, Greeks, and Romans **(Temple, 2000; Jimenez *et.al,* 2003) .** Artichoke leaves have been used traditionally in Europe to improve digestive and urinary tract health and currently used in Germany and Switzreland **(Orlovskaya *et.al,* 2007).** The chemical composition of artichoke seeds was the : crude protein 21.6%, crude fiber 17.1%, crude oil 24.05% and ash 3.8%. The artichoke flower heads have a high content of vitamin C

(10 mg / 100g FW) and minerals (K 360 mg / 100 g FW; Ca 50 mg / 100 g FW) **(Ceccarelli *et al*., 2010) . Wegener and Fintelman, (1999)** showed that efficacy and the safety of artichoke extracts in the treatment of hepato-biliary dysunction and digestive complaints such as sensation of fullness, loss of appetite, nausea and abdominal pain they concluded that flavonoids and caffeoylquinic acids are mainly responsible for the observed actions so this study was conducted to investigate the effect of artichoke on peptic ulcer.

Materials and Methods

Materials:

The fresh artichoke was purchased from local market of Shiben El-Kom, Governorate Minufia, Egypt. Ethyl alcohol (90%), Folin–Ciocalteu phenol reagent, gallic acid were purchased from Sigma–Aldrich Inc. (St. Louis, MO). All other chemicals were obtained from El-Gomhoreya Company for tradiwy Drugs chenal and medial iustrumasl, Cairo, Egypt.

Preparation of artichoke

Artichoke vegetables were hand washed, divided into small pieces, then dried at 45◦ C drying oven (Plue Pard ng oven, Taiwan) for 20 hours crushed to a fine powder and kept in dark glass bottle in deep freezer (at -16 C) for further analysis **(Megan, 2009).**

Determination of chemical analysis of artichoke powder

Sample of the prepared artichoke as taken for estimating its chemical composition (Moisture, protein, fat, ash, fiber and Carbohydrates, using the methods of **A,O,A,C (2005).** The method used for the determination of total phenols using Folin-Ciocalteau reagent was adapted from **Mc Donald *et.al,* (2001)**. The aluminum chloride colorimetric method was used for the determination of the total flavonoids content of the sample allording to the method described by **Miliauskas *et.al,* (2004)**.

Identification and quantification of phenolics compounds by HPLC

HPLC analysis of extracts was performed using an Agilent 1200 chromatograph equipped with a PDA model G1315B, a Bin pump model G1312A, an auto-sampler model G1313A and a RR Zorbax Eclipse Plus C18 column (1.8 µm, 150 mm ×4.6 mm). The mobile phase Awas 0.2 % formic acid in water and the mobile phase B was acetonitrile. Elution was performed at 0.95 ml min-1 with the following

gradient program of solvent B: 0–20 min, 5–16 %;20–28 min, 16–40 %; 28–32 min, 40–70 %; 32–36 min, 70–99 %; 36– 45 min, 99 % and 45–46, min. 99–5 %.30 The injection volume was 10 µL. Wave lengths of 280 nm (for flavan-3-ols and benzoic acid derivatives) and 360 nm (for flavonols and cinnamic acid derivatives) were selected for detection. Quantification of the compounds was realized using calibration curves obtained by HPLC of pure standards: gallic acid, caffeic acid, caffeic acid cynarin, and apigenin. Chlorogenic acid was used as an internal standard. Some compounds were quantified as equivalents of the most similar chemical structures: gallic acid for gallic acid glucoside, gentisic acid glucoside, protocatechuic acid, p-hydroxybenzoic acid and methyl gallate; caftaric acid as caffeic acid; 5-o - Caffeoylquinic acid (Chlorogenic) , 1,3 – di –o -Caffeoylquinic acid (Cynarin), 1,5 –di -o-affeoylquinic acid ; ellagic acid for ellagic acid pentoside The HPLC method was used according to **Radovanović *et al*., (2010)** with some modification (elution gradient and flow rate).

Biology experiments:

The work was carried out at the Faculty of Home Economic, Menoufia University, Egypt. Thirty male albino rats, Sprague Dawley Strain, weighting (150 ±5 g) were fed a standard diet for 7 days as an adaptation period. The animals were obtained from research Institute of opthalmology, Medical Analysis, Department Giza. Egypt. Rats were kept in cylindrical wire cages with wire bottoms. The diet was introduced in special food cups to avoid scattering of food. Also, water was provided to the rats by glass tube projection through the wire cage. Food and water provided ad-labium and checked daily.

Experimental design

All rats were fed on basal diet for one week for adaptation , then the rats were divided into two main group:

*The first main group (n=6): rats, were fed on the basal diet only as control negative (Normal animals). *The second main group (n=24): rats, were divided randomly into four subgroups(n=6) according to the following scheme : Sub group 1: Rats fed basal diet as the positive control. Sub group 2: Rats fed basal diet supplemented with 2.5 % dried whole artichoke. Sub group 3: Rats fed basal diet supplemented with 5 % dried whole artichoke. Sub group 4: Rats fed basal diet supplemented with 10 % dried whole artichoke.

Collection of gastric secretion and determine ulcer index

After administration of ethyl alcohol to animals two hour later and under anesthesia by diethyl ether. Abdominal wall was opened, the pylorus identified, stomachs ligated from esophageal opening and removed, opened at greater curvature, gastric juice collected and centrifuged for studying of gastric secretion parameters including volume in (ml), titratable acidity, Meq/L, titratable acid output meq/l, Titratable acid output meq/l. Stomach examined for ulceration. Evaluation of degree of ulceration was expressed in terms of ulcer score which is calculated by dividing the total number of ulcers in each group by number of rats in that group **(Robert *et al.*, 1968).**

Ulcer index (U,I) was calculated by multiplying ulcer score x 100 **(Radwan *et.al*, 2003)**. the ulceration (%) was calculated by dividing the number of animals with ulcer by the total number of animals and multiplying by hundred **(Ohara *et.al*, 1992)** and the preventive index was calculated according to the method of **Hano *et al*,.** (**1976).**

Determination of titratable acidity and pH value of gastric secretion

Centrifuged 0.2 ml of gastric juice was titrated using phenol red as an indicator with end point at 7.0 pH against 0.01 NaOH. Titratable acidity was calculated in meq/L. Total titratable acid output Meq/L amount of NaOH that neutralize 100mg of gastric juice **(Deverport, 1972),** pH value were determine according to **(Debnath *et al*., 1974).**

Preparation of cake and sensory evaluation

Cakes were prepared according to the following formula **(Bennion and Bamford, (1983) and Berger, (1986).** The butter and the sieved sugar were placed in the mixer (HMS-Fresh-Egypt) till creamed together (5 min) until light colour. Eggs were added and blended for (5 min) then vanillin, wheat flour, skimmed milk baking powder and water were added to the mixture and blended for min). Butter was put into pans with internal dimension 18.5 x 9.5 x5 and baked for (45 min) at 220 ◦C in electric oven (8605 Universal-Egypt). Cake was cooled at room temperature (220 ◦C) overnight, wrapped with aluminium foil till panel test. Wheat flour was replaced with whole artichoke flour at the level of 0 (control), 2.5, 5 and 10% for giving the replacement cake.

Statistical Analysis

The results recorded as the mean ± SD. The experimental data were subjected to an analysis of variance (ANOVA) for a completely

randomized design using a statistical analysis system **(Artimage and Berry, 1987)**. Duncan's multiple range tests were used to determine the differences among means at the level of 5%.

Results and Discussion: Data in Table (1**)** showed proximate the chemical composition antioxidant activity of AP (On dry weight basis). The artichoke 15.02% protein, 6.6% ash and 8.3% fiber. In similar stamg **Ceccarelli *et al.*, (2010)** recorded that artichoke comprised of crude protein 21.6%, crude fiber 17.1% and ash 3.8%. In the same table, artichoke contain 6.42 % moisture, 1.24% fat and 61.56% carbohydrates. Also total phenol compounds, flavonoids and DPPH% of artichoke were 34.38, 17.2 and 75.5. These results were agreeing with the given result by (**Lattanzio *et al*. 2009).**

Data in table (2**)** showed the phenolics compounds of in AP. The HPLC identification of whole artichoke compounds extracts as compared to authentic standards of phenolic acid allowed identifying eleven phenolic compounds. Chlorogenic acid had recorded higher significantly ($p \leq 0.05$) than other component found in whole artichoke followed by cynarin, luteolin, narirutin, ferulic acid, salicylic acid, caffeic acid, , apigenin, coumarin and gallic acid with values of 0.07, 0.17, 0.16, 0.15, 0.15, 0.14, 0.13, 0.13 and 0.13 respectively. Similar results in phenolic compounds of artichoke were reported by **Wang *et al* ., (2003) and Pandino *et al*., (2011).**

Table (3) showed the effect of whole artichoke on ulcer score, ulcer index, ulceration% and preventive index of normal rats and rats with peptic ulcer. No ulcer score, ulcer index and ulceration% in rats which received saline solution (normal group). On the contrary, positive control group which received ethyl alcohol alone produced bleeding indicating severe gastric damage and an increase in ulcer score, ulcer index and ulceration% than other treated group. On the same context **Ko and Cho, (2000)** reported that alcohol had been shown to affect the mucosal barrier and histology. These ulcerogenic effects play a crucial role in altering gastric mucosal defense mechanisms. The gastric lesion produced by ethanol induced gastric ulcers is due to stasis in gastric blood flow that leads to the development of the hemorrhage and necrosis. All these events lead to cell death and exfoliation in the surface epithelium **(Brzozowski *et al*., 1998).** Rats which feeding artichoke powder were effective to

reducing the ulcer score, ulcer index, ulceration% and the 10% artichoke powder was more effective. In the same table positive control group which received ethyl alcohol alone produced reduction in preventive index, while an increase in preventive index was observed in groups which treated with WP, and the rats which administration 10% WP produced a higher increase in preventive index which was 83.3%. In the same table positive control group produced reduction in preventive index. However an increase in preventive index was observed in groups treated with artichoke, and the rats supplemented with 10% artichoke produced a higher increase in preventive index which was 83.3%. In similar study **Wegener and Fintelman, (1999)** showed that efficacy and the safety of artichoke extracts in the treatment of hepato-biliary dysfunction and digestive complaints such as sensation of fullness, loss of appetite, nausea and abdominal pain they concluded that flavonoids and caffeoylquinic acids are mainly responsible for the observed actions.

Table (4) showed the effect of artichoke powder on antioxidant stats of normal rats and rats with peptic ulcer. In parameters Catalase acidity (CAT) Negative control group had higher significantly which was 397.83 than peptic ulcer groups. Positive control group had lower significantly ($p > 0.05$) which was 334 than all other peptic ulcer groups. Artichoke powder 10% had higher significantly which was 388.33 than all other peptic ulcer groups that feed on artichoke powder with different level followed by whole artichoke 5% which was 381.5 and whole artichoke 2.5% which was 372.8. such results are agreeing with the given result by **(Küçükgergin *et al*, 2010).** In parameters (SOD) Negative control group and artichoke powder 10% had non-significantly with values of 4.65 and 4.64 respectively, followed by whole artichoke 5% and whole artichoke 2.5% with values of 4.5 and 4.19 respectively. Positive control group had lower significantly ($p > 0.05$) which was 3.8 than negative control group and peptic ulcer groups that feed on whole artichoke with different level. These results were similar to the results obtained by **Magielse *et al*., (2014) and Küçükgergin *et al*., (2010).** Regard malonal dihyde acidity Negative control group had lower significantly ($p \leq 0.05$) which was 3.45 than peptic ulcer groups. Positive control group had higher significantly ($p \leq 0.05$) which was 5.58 than negative and other peptic ulcer groups followed by whole

artichoke 2.5%, whole artichoke 5% and whole artichoke 10% with values of 4.14, 3.86 and 3.73 respectively. These results were similar to the results maintained by another studies (**Mehmetçik *et al.*, 2008 and Küçükgergin *et al*., (2010)**

Table (5) showed the effect of artichoke powder on volume, pH, tetrable acidity and total tetrable acid output of gastric juice of normal rats and rats with peptic ulcer. Negative control group had lower significantly ($P \leq 0.05$) in volume of gastric juice which was 1.55 than peptic ulcer groups. Positive control group had higher significantly ($p \leq 0.05$) which was 4.23 followed by artichoke powder 10% which was 2.13. Between artichoke powder 2.5% and artichoke powder 5% had non-significantly with values of 1.98 and 1.67 respectively. Negative control group had higher significantly ($P \leq 0.05$) in pH which was 8.83 than peptic ulcer groups followed by artichoke powder 5% which was 3.14. artichoke powder 10% and artichoke powder 2.5% had non-significantly with values of 3.43 and 3.29 respectively. Positive control group had lower significantly ($P \leq 0.05$) in PH which was 1.70 than negative control group and peptic ulcer groups that feed on different levels of artichoke powder. High gastric acidity is known to be a factor in the etiology of peptic ulcer **(ENO *et.al*, 2004).** Negative control group and artichoke powder 2.5% had non-significantly ($P \leq 0.05$) in Titratable acidity of gastric juice which was 1.93 and 2.06 . Positive control group had higher significantly ($p \leq 0.05$) which was 8.1 followed by artichoke powder 10% and artichoke powder 5% with values of 4.08 and 3.23 respectively. Negative control group and artichoke powder 2.5% had non-significantly in Total titratable acidity of gastric juice which was 113.84 and 109.53 respectively. Positive control group had higher significantly ($p \leq 0.05$) which was 421.3 followed by artichoke powder 10% which was 200.69 and followed by artichoke powder 5% which was 165.54 .These results are in agreement with that obtaned **ENO *et al.*, (2004), Ceccarelli *et al.*, (2010) and Magielse *et al.*, (2014)**

Table (6) showed the Sensory evaluation of cake prepared with different levels of dried artichoke. In Parameters Appearance, control cake had higher significantly ($p \leq 0.05$) which was 8.47 than other cakes prepared with different levels of dried artichoke. Between cakes prepared with 2.5% artichoke powder and 5% artichoke powder had non-significant differences were observed in appearance with values of

6.73 and 6.2 respectively. Cake prepared with 10% of artichoke powder which was 4.2 had lower significantly ($P \leq 0.05$) than control cake and other cakes prepared with different levels of dried artichoke. In Textures, control cake had higher significantly ($p \leq 0.05$) which was 8.6 than other cakes prepared with different levels of dried artichoke. Between cake prepared with 2.5% artichoke powder and 5 % artichoke powder had non-significant differences were observed in textures with values of 7.13 and 7.13 respectively. Cake prepared with 10% of artichoke powder which was 4.87 had lower significantly ($P \leq 0.05$) than control cake and other cakes prepared with different levels of dried artichoke. In color control cake had higher significantly ($p \leq 0.05$) which was 8.07 than other cakes prepared with different levels of dried artichoke, followed by cake prepared with 2.5% artichoke powder, 5% artichoke powder and 10% artichoke powder with values of 6.73, 4.2 and 2.6 respectively. In Parameters Taste, No significant differences were observed in control cake and cakes prepared with 2.5% artichoke powder and 5% artichoke powder which have the highest indicators compared to the other types of cakes prepared with different levels of dried artichoke, with values 8.73, 8.33 and 8.07 respectively, followed by cake prepared with 10% artichoke powder which was 6.33. In Odour, No significant differences were observed in control cake and cakes prepared with 2.5% artichoke powder and 5% artichoke powder had the highest indicators compared to the other types of cakes prepared with different levels of dried artichoke, with values 8.6, 8.87 and 8.47 respectively, followed by cake prepared with 10% of artichoke powder. In General admission, No significant differences were observed in control cake and cake prepared with 2.5% artichoke powder had the highest indicators compared to the other types of cakes prepared with different levels of dried artichoke, with values 8.87 and 8.07 respectively. Followed by cake prepared with 5% artichoke powder which was 6.87 and cake prepared with 10% artichoke powder which was 6.33 , between them had non-significantly differences were observed in General admission . These results are similar to the results maintained by another studies **(Bennion and Bamford, 1983)** and **(Berger, 1986).**

Table (7) showed the effect of adding dried artichoke powder portions on batter and cake properties. In Parameters Viscosity, Cake

prepared with 5% of whole artichoke powder had higher significantly ($p \leq 0.05$) which was 222355.7 than control cake and other cakes prepared with different levels of dried whole artichoke. Followed by cakes prepared with 10 % of whole artichoke powder and 2.5 % of whole artichoke powder with values of 194226 and 106381.7 respectively. Control cake was recarded lower significantly ($P\leq 0.05$) which was 175511.3 than other cakes prepared with different levels of dried whole artichoke. In Parameters Specific Gravity, No significant differences were observed in cakes prepared with 10% of whole artichoke powder and 5% of whole artichoke powder which have the highest indicators compared to control cake and the other types of cakes prepared with different levels of dried whole artichoke, with values 0.824 and 0.827 respectively, followed by cake prepared with 2.5 % of artichoke powder which was 0.787. Control cake which was .759 had lower significantly ($P\leq 0.05$) than other cakes prepared with different levels of dried artichoke. In High, No significant differences were observed in control cake and cakes prepared with 2.5% of artichoke powder, 5% of artichoke powder and 10% of artichoke powder with values of 5.17, 4.83, 4.67 and 4.6 respectively. In Volume, No significant differences were observed in control cake and cakes prepared with 2.5% of artichoke powder, 5% of artichoke powder and 10% of artichoke powder with values of 134, 132, 132.3 and 133.7 respectively. In Cake Weigh, control cake had higher significantly ($p \leq 0.05$) which was 116.57 than other cakes prepared with different levels of dried artichoke. Between cakes prepared with 2.5% artichoke powder and 10% artichoke powder had non-significant differences were observed in cake weigh with values of 113.95 and 115.35 respectively, cake prepared with 5% of artichoke powder which was 112.64 had lower significantly ($P\leq 0.05$) than control cake and other cakes prepared with different levels of dried artichoke. In specific volume, cake prepared with 5% of artichoke powder had higher significantly ($p \leq 0.05$) which was 1.174 than control cake and other cakes prepared with different levels of dried artichoke. followed by cake prepared with 10% of artichoke powder which was 1.157 . Between control cake and Cake prepared with 2.5% of artichoke powder had non-significantly which was 1.149 and 1.156 respectively. Those results are similar to the results maintained by **Bennion and Bamford, (1983)** and **Berger, (1986).**

Table (1): Gross chemical constituents bioactive compound contened and antioxidant activity of artichoke.

Parameters	Artichoke
Moisture(g/100 ml)	6.42 ± .30
Protein(g/100 ml)	15.02 ± .52
Fat(g/100 ml)	1.24 ±.49
Ash(g/100 ml)	6.6 ± .56
Fiber(g/100 ml)	8.3 ± .58
Carbohydrates(g/100 ml)	61.56 ± 1.01
Total phenol(mg /g)	34.38± 0.13
Total Flavonoids(mg ./g)	17.20 ± 0.02

Table (2): The compounds of Phenolic compounds contented in whole artichoke

Parameters	Negative	Peptic Ulcer groups			
		Positive	Whole2.5%	Whole 5%	Whole10%
Volume	1.55 ^{c} ±.31	4.23 ^{a} ± .48	1.98 ^{bc} ± .31	1.67 ^{bc} ± .28	2.13 ^{b} ± .52
PH	8.83^{a} ± 1.86	1.701 ^{c} ± .51	3.29^{b} ± 1.45	3.14 ^{bc} ± .71	3.43^{b} ± 1.19
Titratable acidity	1.93 ^{d} ± .47	8.1^{a} ± .77	2.06 ^{d} ± .20	3.23 ^{c} ± .12	4.08^{b} ± .27
Total Titratable acidity	113.8^{d} ±17. 94	421.3^{a} ± 43.2	109.53^{d} ±13.09	165.54^{c} ± .95	200.69^{b} ±1.05

Table (3) Effect of whole artichoke on ulcer score, ulcer index, ulceration% and preventive index of normal rats and rats with stomach ulcer

phenolic compounds	Concentration mg/100g
Gallic acid	0.13 ± 1.01
Caffeic acid	0.14 ± 1.40
Cynarin	0.70 ± 1.30
Ferulic acid	0.15 ±0.11
Coumarin	0.13 ±0.02
Apigenin	0.13 ±0.03
Luteolin	0.17 ±0.10
Salicylic acid	0.15 ± 1.25m
Chlorogenic acid	5.14 ±0.13
Narirutin	0.16 ±0.01

Table (4) Effect of AP on antioxidant stats of normal rats and rats with peptic ulcer.

Parameters	Negative	Peptic Ulcer groups			
		Positive	AP 2.5%	AP 5%	AP 10%
Ulcer score	--	9.833	5.833	2.5	0.833
Ulcer index	--	983.3	583.3	250	83.33
Ulceration%	--	83.3	50	33.33	16.67
Preventive index	--	16.7	50	66.67	83.33

Means in the saul colur with differant super script letter are significantly deffrant at ($p \leq 0.05$)

Table (5) Effect of AP on volume, pH, tetrable acidity and total tetrable acid output of gastric juice of normal rats and rats with peptic ulcer

Parameters	Negative	Peptic Ulcer groups			
		Positive	Whole2.5%	Whole 5%	Whole10%
CAT	$397.83^{a}\pm 2.32$	$334^{e} \pm 3.58$	$372.8^{d}\pm 3.7$	$381.5^{c}\pm 1.87$	$388.33^{b}\pm 3.62$
SOD	$4.65^{a}\pm .09$	$3.8^{d} \pm .09$	$4.19^{c} \pm .05$	$4.5^{b}\pm .03$	$4.64^{a} \pm .16$
MDA	$3.45^{e} \pm .03$	$5.58^{a} \pm .03$	$4.14^{b} \pm .01$	$3.86^{c} \pm .02$	$3.73^{d} \pm .03$

Means in the saul colur with differant super script letter are significantly deffrant at ($p \leq 0.05$)

Table (6) Sensory evaluation of cake prepared with different levels of dried whole artichoke

Parameters	Appearance	Textures	Color	Taste	Odour	General admission
Control	8.47^{a} ± .92	8.6^{a} ± .83	8.07^{a} ± 1.03	8.73^{a} ± .70	8.6^{a} ± 1.12	8.87^{a} ± .52
AP 2.5%	6.73^{b} ± 1.49	7.13^{b} ±1.19	6.73^{b} ± 1.49	8.33^{a} ± 1.23	8.87^{a} ± .52	8.07^{a} ±1.28
AP 5%	6.2^{b} ± 1.82	7.13^{b} ±1.92	4.2^{c} ± 1.72	8.07^{a} ± 1.49	8.47^{a} ± .92	6.87^{b} ± 1.19
AP 10%	4.2^{c} ± 1.82	4.87^{c} ±1.19	2.6^{d} ± 1.549	6.33^{b} ± .97	7.4^{b} ± 1.12	6.33^{b} ±1.63

Means in the saul colur with differant super script letter are significantly deffrant at ($p \leq 0.05$)

Table (7) Effect of adding dried whole artichoke on batter and cake properties

Parameters	Batter		Cake			
	Viscosity	Specific Gravity	High	Volume	Cake Weigh	Specific Volume
Control	175511.3^{d} ± 3941.1	$.759^{b}$ ± .007	5.17^{a} ± .76	134^{a} ± 2.65	116.57^{a} ± 2.44	1.149^{b} ± .006
AP 2.5%	106381.7^{c} ± 3296.1	$.787^{ab}$ ± .01	4.83^{a} ± .15	132^{a} ± 2.00	113.95^{ab} ± 2.4	1.156^{b} ± .01
AP 5%	222355.7^{a} ± 332.2	$.827^{a}$ ± .04	4.67^{a} ± .61	132.3^{a} ± 1.15	112.64^{b} ± 1.04	1.174^{a} ± .009
AP 10%	194226^{b} ± 4863.7	$.824^{a}$ ± .0	4.6^{a} ± .53	133.7^{a} ± 1.53	115.35^{ab} ± .94	1.157^{ab} ± .01

Means in the saul colur with differant super script letter are significantly deffrant at ($p \leq 0.05$)

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التأثيرات الوقائية المحتملة لنبات الخرشوف علي قرحة المعدة لدي الفئران

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الملخص العربي :

ذكرت التقارير أن الخرشوف يستخدم داخليا لعلاج التهاب الغشاء المخاطي في الأمعاء. وقد ادعى ليكون بمثابة مضاد للأكسدة. و الهدف من هذه الدراسة هي اضافه مسحوق الخرشوف في المنتجات المخبوزة وتقييم النشاط الوقائي للخرشوف ضد القرحة المعوية التي يسببها الكحول الإيثيلي في الفئران الذكور البالغين. تم استخدام الخرشوف ليحل محل جزء من دقيق القمح الكامل (2.5٪ ، 5٪ و 10٪) في الكيك القياسي. تم تقييم المظهر والذوق والنكهة والملمس واللون والمقبولية الشاملة في الكعكة ، ولخصت الدراسة إلى أن الخرشوف له نشاط وقائي ضد القرحة المعوية في الفئران البالغة التي يسببها الكحول الإيثيلي و أيضا ، حيث انه تم تقسيم ثلاثين من الفئران عشوائيا إلى خمس مجموعات (ن = 6 لكل منهما) ، المجموعة الأولى والثانية تغذت علي الوجبة القياسية ، من المجموعة الثالثة إلى الخامسة التي تغذت على حمية قياسية تحتوي على 2.5 ، 5 ، 10٪ مسحوق خرشوف. تم اعطاء الفئران من المجموعة الثانية إلى الخامسة جرعة واحدة من الكحول الإيثيلي بنسبة 90٪ عند 10 مل / كجم من وزن الجسم عن طريق الفم. بعد مرور ساعتين وتحت التخدير بواسطة الداي أيثيل أيثر ، تم فتح جدار البطن ، وتعرف البواب ، والمعدة المربوطة من فتحة المريء ، أزيلت ، وفتحت عند تقوس أكبر ، وعصارة معدة تم جمعها وطردها لدراسة معلمات إفراز المعدة ,وأظهرت النتائج أن المجموعات التي المعاملة مع الخرشوف انخفضت بشكل ملحوظ في درجة القرحة ، مؤشر القرحة وزيادة في المؤشرالوقائي مقارنة مع مجموعة الكنترول الموجبة. كانت الفئران التي تغذت علي 10 ٪ من مسحوق الخرشوف أكثر فعالية لحماية المعدة من القرحة. علاوة على ذلك ، أظهر التقييم الحسي أن جميع استبدال الخرشوف في الكيك قد تم قبوله من قبل أعضاء اللجنة.