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ON INJURED GASTRIC ULCER RATS**

By

Abd El-Ghany, M. A

*Department of Home Economics,
Faculty of Specific Education,
Mansoura University, Egypt*

Rasha M. Nagib

*Department of Home Economics,
Faculty of Specific Education,
Mansoura University, Egypt*

Afaf-Haniem M. Ramadan

*Department of Home Economics, Faculty of
Specific Education, Mansoura
University, Egypt*

Fayza M. EL-Ezaly

*Department of Home Economics, Faculty of
Specific Education, Mansoura
University, Egypt*

Research Journal Specific Education

Faculty of Specific Education

Mansoura University

ISSUE NO. 83 MAY , 2024

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*Abd El-Ghany M. A**

*Afaf-Haniem M. Ramadan**

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Abstract:

The present study was designed to investigate the curative effect of date palm and date biscuits on gastric ulcer. The effect of date and date biscuits on the nutritional and gastric ulcer healthy status. Thirty adult albino male rats Sprague –Dawley strain weighting 180 ± 10 g were classified into five groups, (6 rats each), (-ve) group and four rat groups which administered orally of Piroxicam drug (30 mg/kg) After 24 h fasting as induced-gastric ulcer and reclassified into (+ve) group, treated with 20 mg/kg b.w of Omeprazole drug, treated with 200 gm date powder, treated with 200 gm of date powder biscuit groups. The study was assigned for 60 days. The results revealed that, the control (+ve) group showed a significant decrease in final weight, weight gain, feed efficiency ratio (FER), catalase (CAT), superoxide dismutase (SOD), glutathione peroxides (GSH),(GSH-R),(GSH-PX),(GSH-ST) compared with control (-ve) group. but showed significant increase in malondialdehyde (MDA), hydrogen peroxide (H₂O₂), C-Reactive Protein (CRP), interleukin-6 (ILK) and prostaglandin (PEG2) compared with (-ve) group. The date powder, and date powder biscuit groups showed a significant increase in final weight, weight gain, food intake, (FER), organ stomach, (CAT), (SOD), (GSH),(GSH-R),(GSH-PX),(GSH-ST), but showed significant decrease in (MDA), (H₂O₂), (CRP), (ILK), (PEG2) at $p < 0.001$ compared with (+ve) group. The histopathological results showed that treated groups it became nearly normal tissues compared to (+ve) group. It can be recommending that the consumption of date powder and date powder biscuit can lower gastric ulcer with increase of antioxidant enzymes

Key words: gastritis, dates, bakery products, experimental animals and Piroxicam drug

* Department of Home Economics, Faculty of Specific Education, Mansoura University, Egypt.

INTRODUCTION

Date palm is the most popular fruit in the Middle East and North Africa. It is widely consumed and has been used for traditional medical purposes for a long time. Fruits are rich in nutrients and contain dietary fiber, sugar, protein, vitamins, minerals, flavonoids and phenolic compounds. Therefore, based on the existing evidence, palm fruit has been found to be a good source of natural antioxidants that can be used to treat infectious diseases related to oxidative stress ([Al-Shwveh, 2019](#)). Date palm (*Phoenix dactylifera L.*) is one of the most important cultivates grown in the world. On the other hand, Egypt produces 1.5 million tons of dates annually being average 18 percent of the global production of 7.5 million tons according to [Amin et al., \(2019\)](#). Date fruit can be considered as a factor for increasing vaginal delivery and also reducing the frequency of caesarean section in order to prevent its great complications ([Karimi et al., 2020](#)). Date fruit (*Phoenix dactylifera L*) is a fruit with many healthy pharmacological activities; it helps to prevent cardiac diseases, cancers and other chronic disorders due to presence of some beneficial components. Date fruit is the best natural source to prevent heart diseases and other diseases ([Khalid et al., 2017](#)).

Although date fruits are admired for this food and pharmacological characteristics of indigenous peoples in the Middle East and North Africa, which is not yet recognized in the West due to the lack of adequate scientific registration ([Vayalil, 2002](#)). It has a high nutritive value and it is excellent source of minerals, dietary fiber and other beneficial healthy metabolites. Date are not only considered as a nutritious fruit but also improve sensory characteristics of any product in which these are added ([AL-Hooti et al., 1997](#); [Baliga et al., 2011](#) and [Abd El-Ghany et al.,2021](#)). The date palm fruit is rich in sugar, protein, dietary fiber, minerals, and some vitamins. The high percentage of sugar in dates is a good source of quick energy ([Al-Shahib and Marshall ,2003](#)). Date has been considered as a source of antioxidants. Antioxidants inhibit oxidative mechanisms that lead to do generative diseases such as heart disease, brain dysfunction and arthritis. Date palms are said to have antitumor activity, ant mutagenic properties, can

reduce the level of cancer, especially pancreatic cancer, activate the immune system, and regulate the action of antibiotics (**Ishurd & Kennedy, 2005; and Mansouri et al., 2005**). Recent studies have shown that dates contain large amounts of flavonoid glycosides, including quercetin, apigenin, p-coumaric acid, ferulic acid, and synaptic acid (**Abdelhak et al., 2005; Biglari et al., 2008**). In traditional medicine, the use of date fruit is recommended for treatment of liver diseases and to be consumed by pregnant women before and after delivery (**Al-Mamary et al., 2010**). Date palm fruits are an energy-consuming food source and nutritious because of low fat content (0.2% - 0.5%); good source of protein (2.3 - 5.6%), vitamins and dietary fiber (6.4 - 11.5%). The palm is a good source of minerals such as selenium, copper, potassium, magnesium, high consist of antioxidants and phenolic compounds (**Iftikhar et al., 2014**).

Due to the widespread consumption of dates in our region, the fact that dates are known to be beneficial against peptic ulcers, and the fact that Muslims usually consume more dates during the month of Ramadan, perhaps to protect the gastric mucosa from the harmful effect of stomach acid, and due to the scarcity of information about the pharmacological properties of the fruits Dates, we thought of conducting this study to evaluate the effect of date palm and date-fortified biscuits on nutritional status ,the incidence and severity of piroxicam-induced gastric ulceration in rats .

MATERIALS AND METHODS

Materials

- 1-Brexin drug (Piroxicam) was obtained from Pharmacia Company, Abor City. Each tablet contains 20 mg of piroxicam. The animal dose (30 mg/kg). Adjustable to anterior of paper as that listed by **Barbastefano et al., (2007)**.
- 2- Omez drug (Omeprazole) was obtained from Egyphar Company, Abor City. Each tablet contains 20 mg of Omeprazole. The animal dose (20 mg/kg) adjustable to anterior of paper as that listed by **Raeesi et al., (2019)**.

3-Date palm fruits (*Phoenix dactylifera* L.) of Tamr El wadi were obtained from New Valley Governorate, Egypt.

4-Experimental animals: Thirty adult albino male rats Sprague –Dawley strain were purchased from the Agricultural Research Center, Giza, Egypt. The average weight was 180 ± 10 g. The animals were kept under observation for five days before experiment and fed on basal diet according to **NRC, (1995)** and water ad libitum. The standard diet comprised of casein (200g/kg), corn starch (497g/kg), sucrose (100g/kg), cellulose (30 g/kg), corn oil (50g/kg), mineral mixture (100g/kg), vitamins mixture (20g/kg) and DL-methionine (3g/kg)

Methods:

1-Preparation of date powder

Date fruits were cleaned, de-stoned, dried in an oven under vacuum at 60°C for 8 hrs. Cooled and ground to small particles ([Sablani et al., 2008](#)). The experimental work was carried out at the Department of Home Economics, Faculty of Specific Education Mansoura University.

2- Date biscuits preparing:

Hard sweet biscuits were prepared by partially replacement of the sucrose with 30% of date powders. The recipe of the prepared biscuit was carried out according to the method of **El-Sharnouby et al., (2012)**. According to sensorial evaluation, the 30% of date powders high score results was considered as best formula and added to rat basal diet

3- Grouping of rats and experimental design:

The rats were randomly classified into five groups (6 rats each) and fed on the basal diet. The rats classified into control negative (-ve) group and four rat groups which administered orally of Piroxicam drug (30 mg/kg) After 24 h fasting as induced-gastric ulcer according to **Barbastefano et al., (2007)**. and reclassified into control positive (+ve) and three treated groups which were Omeprazole (20mg/kg b.w), date powdered (200g/kg/diet) and date powder biscuit(200g/kg/diet) All treatments were given in a 1ml volume from stock solution by stomach tube all over the period of the experiment. The study was assigned for 60 days . The food

intake was calculated daily and the body weight gain was recorded weekly. Feed efficiency ratio was determined according to the method of **Chapman et al., (1959)**

4-Collection and preparation of blood samples for analysis:

At the end of the experiment, the rats were sacrificed to obtain blood samples. Part of blood was heparinized while the rest part of blood was left to coagulate then centrifuged at 3000 rpm for 15 minutes to obtain serum for each individual sample and then stored at -20 °C for some laboratory analyses. Blood samples were testing for determination of Anti-inflammation (CRP, IL-6 and PEG2) C- reactive protein level (CRP) was measured depending on the method of **Vaishnavi (1993)**. While IL-6 interleukin-6 was assessed and quantified according to the method of **Calabrese and Rose-John., (2014)**, PEG2 prostaglandins was measured depending on the method of (**Robert., 1979**), Antioxidant enzymes Confirmation of glutathione peroxides (GSH ; GSH-R ; GSH-Px;GSH-S-T) activity in plasma according to **Paglia and Valentine (1967)**.while Confirmation of superoxide dismutase SOD activity in plasma according to **Nishikimi et al., (1972)** and Enzymatic CAT activity was measured by according [Aebi., \(1984\)](#) respectively . Free radical in blood: Malondialdehyde (MDA) measured calorimetrically according to the method of **Uchiyama and Mihara (1978)** while H₂O₂ hydrogen peroxide was measured depending on the method of (**Brand, 2016**)

5-Histopathological examination of the stomach:

The stomach was fixed in 10% neutral buffered formaldehyde solution at pH 7.5 and cleared in xylol and embedded in paraffin. 4 µm thick sections were prepared and stained with Hematoxylin and Eosin (H&E) for subsequent histopathological examination according to **Bancroft et al, (2012)**.

6-Statistical data analysis:

All tests were accomplish using computer package of the statistical analysis program (SPSS, version 24, 2016), the collected data were presented as means ± standard deviations (means ± S.D), statistically

analyzed using one way analysis of Variance (ANOVA), and the means between groups were compared by least significant difference (LSD) statistic test, according to (Artmitage and Berry 1987).

RESULTS AND DISSCUSION

1- Nutritional results

Data in Table (1) showed that final weight, body weight, body weight gain and feed efficiency ratio (FER) were significantly lower in gastric ulcer rat than in the negative group and showed non-deference in food intake. date powder treated group showed significant raise in final weight, body weight gain and FER, while showed non-significant difference in body weight gain percent and food intake comparing with untreated control (+ve) group, while found non-significant difference in final weight, weight gain and food intake but showed significant decrease in weight gain % and FER comparing with omeprazole group. date powder biscuit treated group found significantly raise in final weight, body weight gain, body weight gain percent and FER, while showed non-significant difference in food intake compared with untreated control (+ve) group, however showed non-significant difference in final weight, body weight gain, body weight gain percent and food intake but showed significant reduced in FER in comparing with omeprazole group

Table (1) Body weight gain, food intake and feed efficiency ratio (FER) of the experimental rats groups

Variables Groups	Initial weight (gm)	Final weight (gm)	Weight gain (gm)	Weight gain %	Food intake (gm)	FER
Control (-ve)	a 187.00 ±9.63	a 314.50 ± 11.26	a 127.50 ±11.65	a 68.67 ±10.60	a 17.49 ±0.04	a 0.122 ±0.02
Control (+ve)	a 184.00 ± 9.00	d 253.83 ±10.54	d 69.83 ±10.32	cd 38.06 ±11.04	a 18.48 ±0.07	e 0.063 ±0.02
Omeprazole drug	a 180.00 ±7.18	b 281.67 ±10.84	b 101.67 ±11.75	ab 56.48 ±12.14	a 17.88 ±0.01	b 0.097 ±0.02
Date powder	a 186.17 ±7.03	b 286.67 ± 4.63	c 80.50 ±6.57	c 43.37 ±4.76	a 18.22 ±0.09	d 0.074 ±0.01
30%Date powder biscuit	a 186.33 ±10.52	bc 272.50 ± 10.75	c 86.17 ±10.86	bc 46.77 ±13.59	a 17.47 ±0.07	c 0.082 ±0.02

Mean values in each column having different letter (a, b, c, d...) are significantly at $P < 0.05$.

Data in Table (2) showed anti-inflammatory parameters (CRP, IL-6 and PG2) in gastric ulcer rats in groups treated with omeprazole, date powder and date powder biscuit. The non-treated gastric ulcer rat control (+ve) group showed significant increase CRP, IL-6 and PG2 compared with normal control (-ve) group. The treated gastric ulcer rats with date powder group showed significant decrease in CRP, IL-6 and PG2 compared with non-treated control (+ve) group, while showed non-significant difference in CRP and PG2 but showed significant decrease in IL-6 compared with omeprazole group. The treated gastric ulcer rats with date powder biscuit group showed significant decrease in CRP, IL-6 and PG2 compared with non-treated control (+ve) group, while showed non-significant difference in CRP, IL-6, but found significant decrease in PG2, compared with

omeprazole group. These result in agreement with Rahmani et al., (2014) who stated that dates fruits has medicinal value are summarized in terms of therapeutic implications in the diseases control through anti-oxidant, anti-inflammatory, anti-tumor and anti-diabetic effect. Also, ethnic use of drugs from date palms (*Phoenix dactylifera* L.) fruits as anti-inflammatory agents. Polyphenols are the predominant compounds in date extracts, making them potential candidates in these activities. Further studies are underway to clarify the active ingredient in hopes of better understanding its effects (Abd El-Ghany, 2007 and Bouhlali et al., 2018).

Table (2) Serum anti- inflammation parameters (CRP, IL-6 and PG2) of the experimental rats groups

Variable Groups	CRP (Mg/l) serum	IL-6 (Pg/ml) serum	PG 2 (Mg/l) serum
Control (-ve)	c 0.67 ±0.15	d 16.32 ±3.02	d 14.34 ±1.06
Control(+ve)	a 2.13 ±0.39	a 81.22 ±6.93	a 38.53 ±1.38
Omeprazole drug	b 0.99 ±0.37	b 55.93 ±3.35	b 25.28 ±1.48
Date powder	b 0.96 ±0.29	c 48.58 ±2.24	b 24.80 ±2.28
Date powder biscuit30%	b 1.09 ±0.41	b 52.76 ±5.33	bc 22.22 ±0.75

CRP: C-reactive protein, IL-6: interleulin-6, PG2: prostaglandin

Mean values in each column having different letter (a, b, c, d...) are significantly at $P < 0.05$

Data in Table (3) showed antioxidant enzymes (CAT, SOD, GSH, GSR, GPx and GST) in tissues of the stomach for gastric ulcer rats groups treated with omeprazole, date powder and date powder biscuit. The non-treated gastric ulcer control (+ve) rat group showed significant decrease in CAT, SOD, GSH, GSR, GPx and GST compared with normal control group. The treated gastric ulcer rat with date powder group showed significantly rise in CAT, SOD, GSH, GSR, GPx and GST comparing with untreated control (+ve) group, However found significantly increase in SOD and non-significant difference in CAT and GSH but significant decrease in GSR, GPx and GST compared to omeprazole group. The treated gastric ulcer and ulcerative colitis rats with date powder biscuit group found significantly raise CAT, SOD, GSH, GSR, GPx and GST comparing with untreated control (+ve) group, while found non-significant difference in CAT, SOD and, GPx but found significant decrease in GSH and GSR and significant increase in GST compared with omeprazole group. These result in agreement with **Vayalil (2002)** who stated that the antioxidant and the antimutagenic activity in dates implicated the presence of compounds with potent free radical scavenging activity. **Guo et al., (2003)** reported that dates had the second-highest antioxidant value of 28 fruits commonly consumed in China. **El-Far et al., (2016)** reported that oxidative stress is an imbalance between oxidant production and antioxidants. Enzymatic and non-enzymatic antioxidants reduce the reactive oxygen species (ROS) induced by oxidation. Superoxide dismutase (SOD), catalase (CAT), reduced glutathione (GSH), oxidized glutathione (GSSG) and glutathione S-transferase (GST) are the enzymatic antioxidants of concern. Date Palm (*Phoenix dactylifera*) has anti-oxidant potential via its phenolic, flavonoids and small molecules such as vitamin C, vitamin E and GSH. These antioxidant constituents of *P. dactylifera* may directly react with ROS to destroy them by accepting or donating electrons to eliminate the unpaired condition of ROS, or may indirectly decrease the cellular free radicals by enhancing the activities and expressions of antioxidant enzymes that lead to prevention of lipid peroxidation, DNA damage and protein modification.

Table (3): Some antioxidant enzymes (CAT, SOD, GSH, GSR, GPx, and GST) in tissues of the stomach in experimental rats groups.

variable Groups	CAT (u/g) tissue	SOD (u/g) tissue	GSH (mmol/g) tissue	GSR (u/g) tissue	GPx (u/g) tissue	GST (u/g) Tissue
Control (-ve)	a 6.58 ±0.81	a 632.28 ±4.20	a 341.67 ±14.59	a 24.33 ±2.60	a 66.95 ±7.24	a 312.67 ±7.55
Control (+ve)	d 1.34 ±.16	e 227.83 ±7.70	e 156.00 ±12.24	e 6.26 ±1.50	d 29.56 ±2.68	e 73.15 ±2.56
Omeprazole drug	c 4.51 ±0.55	c 403.00 ±83.01	b 262.50 ±22.34	b 15.96 ±1.90	b 52.60 ±7.83	cd 242.83 ±14.80
Date powder	bc 5.35 ±0.39	b 482.50 ±39.10	bc 258.00 ±16.80	c 13.35 ±1.01	c 37.08 ±3.77	c 227.83 ±36.22
30%Date powder biscuit	c 4.25 ±0.67	cd 396.00 ±21.06	cd 250.17 ±3.25	cd 12.96 ±1.92	b 54.43 ±13.81	ab 269.33 ±56.80

CAT: Catalase, SOD: Superoxide dismutase, GSH: Glutathione GSR: glutathione reductase, GPx: glutathione peroxidase, GST: glutathione-S-transferase. Mean values in each column having different letter (a, b, c, d...) are significantly at P<0.05

Data in Table (ξ) showed free radical (MDA and H₂O₂) in gastric ulcer groups treated with omeprazole, date powder and date powder biscuit. The non- treated gastric ulcer rat control (+ve) group showed significant increase malondialdehyde (MDA) and hydrogen peroxide (H₂O₂) compared with normal control (-ve) group. The treated gastric ulcer rat with date powder and date powder biscuit groups showed significant decrease in MDA and H₂O₂ level compared with non-treated control (+ve) group, however showed non-significant difference in MDA and H₂O₂ level compared with omeprazole group. The data were in the line with those of (El Abed *et al.*, 2018) the antioxidant potential observed in date palms (Phoenix

dactylifera L.) extract can be also contributed for reducing inflammation. Thus, the potent anti-inflammatory activity of *P. dactylifera* parthenocarpic dates extract may be related to cumulative effects of different active compounds to reduce the synthesis, release, and action of prostaglandins or free radicals. The modified active ingredients in date palm include flavonoids, steroids, phenols, and saponins, are believed to be antidiabetic, primarily by scavenging free radicals through antioxidant activity by inhibiting alpha-amylase and alpha-glycosidase enzymes. (El Abed *et al.*, 2017 and Eddine *et al.*, 2014).

Table (4): some free radical of stomach tissues (MDA and H₂O₂) in experimental rats groups.

Groups Variables	Control (-v)	Control (+v)	Omeprazole drug	Date Powder	30%Date powder biscuit
MDA (nmol/g)tissue	d 1.29 ±0.13	a 15.27 ±0.80	bc 6.31 ±1.10	b 8..01 ±1.40	bc 6.65 ±1.10
H ₂ O ₂ (mM/g)tissue	d 0.06 ±0.01	a 2.85 ±0.51	b 1.25 ±0.45	b 1.88 ±0.14	bc 1.05 ±0.12

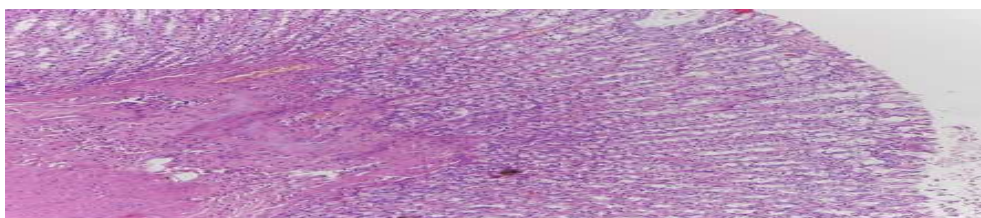
MDA: Malondialdehyde, H₂O₂: hydrogen peroxide

Mean values in each column having different letter (a, b, c, d...) are significantly at P<0.05.

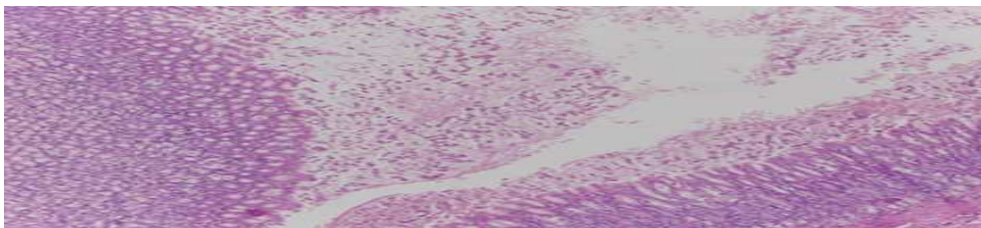
Histopathological results:

The obtained results are confirmed by the histopathological changes. Macroscopically examination of the stomach of rat from the control (- ve) group revealed normal stomach epithelium with no ulceration and inflammation (Pict.1). Meanwhile, the stomach of rat from the control (+ve) group revealed superficial ulceration with infiltration of inflammatory cells, with loss of gastric mucosal histology (Pict.2). stomach of rat from Omeprazole drug group showed regeneration of the surface epithelium with

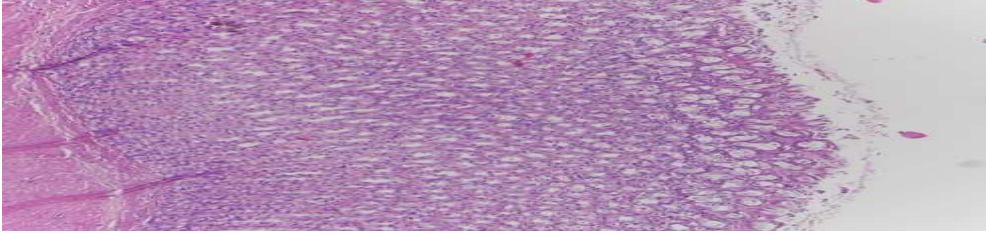
mild inflammatory infiltration (Pict.3).The stomach of rats from Date powder group showed near normal stomach with very mild surface ulceration and very trivial inflammation (Pict. 4).The stomach of rats from Date powder biscuit group showed a moderate superficial ulceration appears with infiltration of inflammatory cells, with some restored .These results were in agreement with (Yunus *et al.*, 2005) Date extract was able to change in goblet cell number may affect the susceptibility of the parasite-infected host to limit the capacity of pathogen from increasing penetration of the epithelium. Date Palm Tree (*Phoenix dactylifera L*) extract was shown at 250 mg / kg to reduce gastric mucosa epithelial damage and distortion from the sub mucosal layer and preserving endothelial cells Safety, this may be due to the fact that (*Phoenix. Dactylifera L*) extract contains phenolic compounds and antioxidants (Al-Alawi *et al.*, 2017 and Abd El-Ghany *et al.*, 2017).



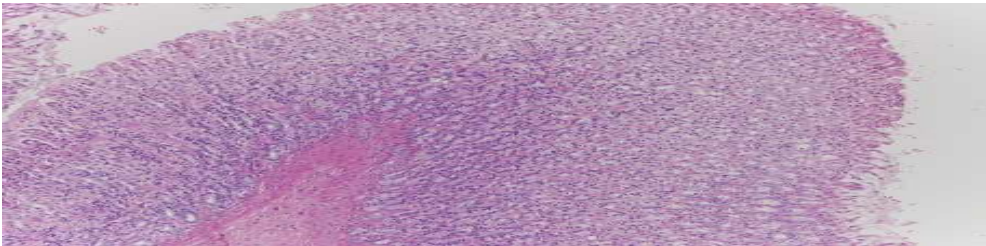
Pic (1) control (-ve) showed normal stomach epithelium with no ulceration and inflammation (H and E stain, × 100).



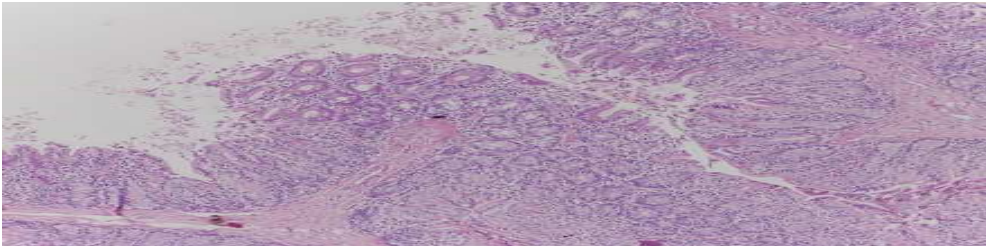
Pic (2) control (+ve) showed superficial ulceration with infiltration of inflammatory cells, with loss of gastric mucosal histology. (H and E stain, × 100).



Pic (3) Treated by Omeprazole drug group showed regeneration of the surface epithelium with mild inflammatory infiltration (H and E stain, $\times 100$).



Pic (4) Treated by Date powder group showed near normal stomach with very mild surface ulceration and very trivial inflammation (H and E stain, $\times 100$).



Pic (5) Treated by Date powder biscuit group showed a moderate superficial ulceration appears with infiltration of inflammatory cells, with some restored cells. (H and E stain, $\times 100$).

Declarations

All the biological experimental procedures were applied according to Internationally Ethical Guidelines for the care and use of laboratory animals. And permission for the experiment was obtained from the Research Ethics Committee at the Faculty of Specific Education, Mansoura University.

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التأثيرات البيولوجية لمسحوق التمر و بسكويت التمر على الفئران المصابة بقرحة المعدة

عبدالغني محمود عبدالغني* عفاف هانم محمود رمضان*

رشا محمد نجيب* فايزة محمد محمود الازلي*

الملخص العربي:

تهدف هذه الدراسة إلى التعرف على تأثير التمر وبسكويت التمر على القرحة المعدية، لقد حظي استخدام المنتجات الطبيعية باهتمام العديد من الباحثين، حيث اثبت أن التمر له فوائد صحية تماثل تأثير الدواء على قرحة المعدة. ولذلك فقد صممت الدراسة الحالية للتحقق من تأثير كل من دواء قرحة المعدة ومسحوق التمر وبسكويت مسحوق التمر على القرحة المعدية في ذكور الفئران. وقد أجريت الدراسة على 30 من ذكور الفئران البيضاء البالغين التي تزن 180 ± 10 وتم تقسيمهم الي خمس مجموعات كل مجموعته تحتوي علي ستة فئران.المجموعه الاولى (السليمة) تغذت فقط علي الغذاء القياسي خلال فترة التجربه،و25 من الفئران تم أصابتها بقرحة المعدة عن طريق اعطاء 30 ملجم/كجم من البيروكسيكام بالفم بعد صيام 24ساعه ثم تم اعاده تقسيمهم الي المجموعه الضابطة الموجبة والمجموعه المعالجه بدواء الامبيرازول(20ملجم / كجم من وزن الجسم يومياً) ،والمجموعه المعالجه بمسحوق التمر (200 جم / كجم من الوجبة) والمجموعه المعالجه بمسحوق بسكويت التمر (200 جم / كجم من الوجبة) واستمرت الدراسة لمدة 60 يوماً

وأسفرت نتائج الدراسة عن انخفاض معنوي في الوزن النهائي للفئران والوزن المكتسب ومعدل كفاءه الطعام ومستوي الكتاليز وسوبر اكسيد ديسموتاز ومستويات الجلوتاثيون اكسيد بينما لوحظه زياده معنويه في مستوي المالونداالدهيد والبيروكسيد هيدروجين في المجموعه الضابطة الموجبة "المريضه" وذلك بالمقارنة بالمجموعه الضابطة السالبة "السليمة". واثبتت نتائج المجموعات المعالجه بدواء الامبيرازول ومسحوق التمر وبسكويت التمر اظهرت زياده معنويه في الوزن النهائي والوزن المكتسب ومعدل كفاءه الطعام ومستويات كل من الكتاليز والسوبر اكسيد ديسموتاز والجلوتاثيون بروكسيدز بينما اظهرت انخفاض معنوي في مستوي المالونداالدهيد والبيروكسيد الهيدروجين والانتروكوكين والبروستاجلاندين وذلك بالمقارنه بالمجموعه الضابطة الموجبة كما أظهرت النتائج الهستوباثولوجية لانسجة المعدة أن مجموعات الفئران المعالجه بدواء الأومبيرازول ومسحوق التمر ومسحوق بسكويت التمر اظهرت تغيرات أقل في الأنسجة للمعدة، بالمقارنة بالمجموعه الضابطة الموجبة حيث أصبحت أنسجة قريبة من الموجبة الضابطة السالبة "السليمة".

و توصي الدراية بضرورة تناول مسحوق التمر وبسكويت مسحوق التمر لانه يقلل من الآثار الجانبية لعقار البيروكسيكام على المعدة واعطاء تأثير مثل عقار الأومبيرازول ويحسن الحالة الصحية لقرحة المعدة مع زيادة الإنزيمات المضادة للأكسدة. لذا يمكن اعتبار مسحوق التمر ومسحوق البسكويت من احدي علاجات القرحة الهضمية.

الكلمات المفتاحية: التهابات المعدة، - التمر - منتجات المخابز،- حيوانات التجارب-

البيروكسيكام

* قسم الاقتصاد المنزلي، كلية التربية النوعية، جامعة المنصورة، مصر