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Abstract:

The effect of ethanolic extract of Beta vulgaris L. roots and dietary Lglutamine on the healing of peptic ulcers in experimental rats has been investigated. Forty-two adult male albino rats, weighting (170:180g) of the Sprague Dawley Strain were employed and divided into 7 groups. Each group consisted of 6 rats, one was used as a negative control, and the others were administered aspirin orally (200 mg/kg B.Wt.). One of these groups was used as a positive control. In contrast, group (3,4) received dietary L-glutamine, group (5,6) received Beta vulgaris L. roots extract, and the last group was treated with omeprazole as a standard drug for 7 days. The length of the gastric ulcer, the volume of gastric juice, the pH value, the total acidity, and the histopathological changes of the stomach were investigated. Results confirmed that oral administration with both tested extracts reduced the length of gastric ulcer, the total acidity, the volume of gastric juice, and the histopathological changes. The highest curative ratio for gastric ulcer was obtained by a dose of 600mg/kg of Beta vulgaris L. roots extract compared with the omeprazole group. Our findings concluded that *Beta vulgaris* L. roots and dietary Lglutamine could be used for healing peptic ulcers.

Keywords: *Beta vulgaris* L. roots, dietary L-glutamine, peptic ulcer, aspirin, omeprazole, gastric juice, pH, total acidity, and histopathological changes.

1-Introduction:

Pathophysiology: The peptic ulcer disease (PUD) mechanism is caused by an imbalance between stomach mucosal protective and destructive factors (Malik et al., 2023). Peptic ulcer (PU) is a prevalent condition that affects millions of people each year, with an incidence rate of 0.1% to 1.5%. It substantially influences human health (Ansari et al., 2023). PU is caused by either H. pylori infection or non-steroidal antiinflammatory drugs (NSAIDs), including aspirin. NSAIDs -induced gastroprotective ulcer are primarily caused by inhibiting the cyclooxygenase (COX)-1 (Majumdar & Looi, 2024). In addition, the imbalance between offensive factors (H. pylori, excessive gastric acid, elevated free radicals, and gallbladder fluid) and defensive factors (prostaglandins, blood fluid, antioxidants, and mucosa) leads to PU (Sayehmiri et al., 2018). PUD continues to be a substantial cause of mortality and morbidity worldwide (Kavitt et al., 2019).

Beta vulgaris, or beetroot, belongs to the Chenopodiaceae family. Beetroot is a wonderful source of nutrients, such as proteins, sugars, sucrose, vitamins (vitamin C and complex B), minerals, and fiber (Punia **Bangar** et al., 2023). The carotenoids, vitamins, and polyphenols of antioxidant. anti-inflammatory, beetroots have anti-diabetic. cardiovascular disease-lowering, hepato-protective activities, and wound healing (Chhikara et al., 2019). Red beet is the primary source of betanin and has around 300-600 mg/kg of betanin (Esatbeyoglu et al., **2015**). Nowadays, many consumers prefer "functional foods" to enhance their eating habits and maintain their health. The beetroot has recently gained popularity as a potential "functional food" in this regard (Chen et al., 2021).

Dietary supplements are extensively utilized and have the potential to improve health when properly targeted to those in need (**Rautiainen** *et al.*, **2016**). Glutamine (Gln) is a non-essential amino acid that is abundant in the body. It is predominantly synthesized by skeletal muscle and accounts for \sim 30% of the plasma free amino acids (**Apostolopoulou** *et al.*, **2020**). Gln is a non-essential amino acid, but it functions as an essential amino acid in illness states and plays a major role in the animal's physiology (**Shah** *et al.*, **2020**).

Given the widespread interest in the treatment of ulcers, the present study was designed to investigate the effect of *Beta vulgaris* L. roots extract and dietary L-glutamine (L-Gln) on the healing of acute gastric ulcer induced experimentally by acetylsalicylate in rats.

2- Materials:

Plants: The fresh beetroot (*Beta vulgaris* L.) was obtained from the local market.

Aspirin was obtained from the pharmacy. Acetylsalicylic acid (aspirin) belongs to the family of NSAIDs. Aspirin was prepared by dissolving

it in distilled water. A volume of 1 ml of this solution was given orally (at the level of 200 mg/kg body weight) for 1 day to induce acute gastric ulcer in male albino rats.

- **Omeprazole** was obtained from the pharmacy. A medicine that reduces the amount of gastric acid.
- **Dietary L-Gln supplement:** Optimum Nutrition Gln powder imported by Ramco Pharm Pharmaceutical Trading Company, Ramses Street, Cairo.
- **Chemicals**: Formalin, ethanol (ethyl alcohol), sodium hydroxide (NaOH), and phenolphthalein were obtained from Al-Gomhouria Pharmaceutical Company, Al-Sawah, Al-Amiriya, Cairo, Egypt.
- **Rats**: A total of 42 male albino rats of the Sprague Dawley strain were obtained from the National Research Center Dokki, Cairo, Egypt. The experiment was conducted in the animal house at the Faculty of Home Economics, Menoufia University.
- **Diet**: The rats were fed a starch-free ration composed of soya bean powder 44%, wheat bran, molasses, fish meal, fibers 3.3%, methionine, calcium carbonate, sodium chloride, calcium phosphate, and ash (net protein 22% and fats 4.7%) (**Barnard** *et al.*, 2009). The diet was fed and water was provided ad libitum. It is produced by Cairo, Agricultural Development Company, 6 October city, Giza, Egypt.

3- Methods:

1- Preparation of ethanolic extracts

The beetroot was washed with clean water to remove dirt, an amount of 300 g dried beetroot was crushed then macerated for 5 days in 750 ml of ethyl alcohol 96%. The extract was filtered utilizing filter paper, and a rotary evaporator was used to concentrate the filtrate to dryness in the vacuum at 50°c, then stored in the fridge until used (**Oghogho** *et al.*, 2022; Nugraha *et al.*, 2020).

2- Chemical composition analysis of *Beta vulgaris* L. roots powder

Chemical composition analysis of dried beetroots was conducted in the central laboratory at The Faculty of Agriculture, Menoufia University

3- The high-performance liquid chromatography (HPLC) analysis of *Beta vulgaris* L. roots

HPLC analysis was conducted in the National Research Center Dokki District, Cairo Governorate.

4- Experimental design

The Science Research Ethics Committee of the Faculty of Home Economics accepted the research protocol (MUFHE /S/ NFS / 32/24).

The investigation was performed on 42 mature male albino rats, their weights ranging from 170:180 grams. Before the start of the experiment, all the rats were fed the basic diet for a week to adapt.

Administration of treatments

Each rat was given beetroot extracts and L-Gln in a 1-2ml/kg b.wt volume. Double doses of each extract were given orally using a stomach tube. For beetroots extracts and L-Gln doses of 300 mg/kg and 600 mg/kg of body weight (**Bekheet & Shalan, 2023; Hijazi** *et al.,* **2018**). Oral feeding was performed once daily on an empty stomach for 7 consecutive days using a rat stomach tube.

Rats groups

- 1- The first main group: the negative control group (G1) (healthy 6 rats) fed on ration only + normal saline (2 mL/kg).
- 2- The second main group: infected groups (n = 36) were given orally aspirin at a dose of 200mg/kg B.Wt for induction of acute peptic ulcer according to **Elkerdasy and Mousa** (2021). Rats with aspirin-induced peptic ulcer were divided into 6 subgroups, each group consisted of 6 rats.
- The first subgroup (G2): The positive control group was fed on ration only.
- The second subgroup (G3): Rats with peptic ulcer fed on ration + L-Gln at a dose of 300 mg/kg B.Wt.
- The third subgroup (G4): Rats with peptic ulcer fed on ration + L-Gln at a dose of 600 mg/kg B.Wt.
- The fourth subgroup (G5): Rats with peptic ulcer fed on ration + *Beta vulgaris* L. roots extract at a dose of 300 mg/kg B.Wt.
- The fifth subgroup (G6): Rats with peptic ulcer fed on ration + *Beta vulgaris* L. roots extract at a dose of 600 mg/kg B.Wt.
- The sixth subgroup (G7): Rats with peptic ulcers fed ration and treated with omeprazole (20 mg/kg) as a standard drug (Rahman *et al.*, 2020).

On the last day of the experimental period, all rats were fasted for 12-14 hours and were only allowed to drink water. The next morning, all rats were slaughtered and dissected. Each rat's stomach was removed, washed, and placed in formalin solution.

At the end of the experiment, the following was done 1- Measurement the length of gastric ulcer

At the end of the experimental period, all animals fasted for 12-14 hours. All animals were sacrificed, and their stomachs were tied around both apertures (pyloric and cardiac sphincters) and injected with 3ml of distilled water. The gastric juice was collected into a sterile tube. The stomachs were opened lengthwise, rinsed with saline, and examined using the dissecting microscope for ulcers. The stomach ulcer length was

measured and expressed as mean+SE for each group (Header *et al.*, 2016). According to the procedure presented by Akhtar and Ahmed (1995) using the following formula:

Curative ratio (CR) = $(LC - LT / LC) \times 100$.

LC = length of ulcer in control positive group.

LT = length of ulcer in treated group.

2- Measurement the volume of gastric juice

Gastric juice was collected in tubes and centrifuged at 500 RPM., for 5 minutes, gastric juice volume was measured using a graduated cylinder (Hadda *et al.*, 2014).

3- Estimation of gastric pH

The gastric content that was previously put into a centrifuge tube was employed for the determination of gastric pH. The supernatant was collected and its pH was determined using a digital pH meter (**Tarique** *et al.*, **2016**).

4- Determination of total acidity

A 1 ml sample of gastric juice was diluted with 1 ml of distilled water and was placed into a 50 ml conical flask, where two drops of phenolphthalein indicator were added and titrated with 0.01N NaOH until a persistent pink color was visible, the volume of 0.01N NaOH consumed was recorded (Ahmed *et al.*, 2022).

5- Histopathological examination of gastric tissue

Specimens from stomachs were collected from rats of all experimental groups at the end of the experimental period, fixed in 10% neutral buffered formalin (pH=7. 0), dehydrated in ethyl alcohol, then cleared in xylol and embedded in paraffin; 4-6 micron-thick sections prepared and stained with hematoxylin and eosin for examining both fore and glandular parts of the stomach (**Bancroff** *et al.*, **1990**).

6- Statistical analyses

Statistical analyses were performed with SPSS software SPSS version 24. This includes statistics; means±SE, inferential statistics; 95% confidence intervals of the difference, and ANOVA. Results were analyzed statistically; a conclusion and suitable recommendation were presented.

4- Results and Discussion:

This study investigated the impact of feeding rats on ethanolic extracts of *Beta vulgaris* L. roots and L-Gln on treating acute stomach ulcers caused by aspirin. The length of the gastric ulcer, volume, total acidity, and histological analysis of the stomach's glandular and fore portions were the characteristics that were investigated in this study.

1- Chemical composition, total phenolic, and total flavonoids analysis of *Beta vulgaris* L. roots

The chemical composition analysis of red beetroot powder showed that carbohydrates and protein are the highest values (70% and 12.1%) respectively, fiber, moisture, fat, and ash are followed with values (10.8%, 5.1%, 1.1%, and 0.88%) respectively as shown in Table (1).

HPLC indicated that the content of total phenols in beetroot that was extracted using 96% ethanol is (17.51 mg GAE/g) and total flavonoids with value (14.21 mg CE/g) as shown in Table (1).

Our data showed that beetroot powder is a valuable source of carbohydrates, protein, and fiber. These results are in agreement with those obtained by **Mitrevski** *et al.* (2023), who said that beetroot powder contains fat (0.59±0.12), carbohydrate (77.41±0.60), total dietary fiber (19.90±0.55), protein (11.4±0.20), ash (3.80±0.18), and moisture (6.80±0.18). Also, **Farhan** *et al.* (2024) showed that beetroot powder contains moisture (8.23±0.03), ash (10.06±0.02), protein (12.72±0.04), fats (1.51±0.03), and crude fiber (20.13±0.04).

According to our data, ethanolic extract of red beetroot is a rich source of phenolic compounds and flavonoids. These results are as in the research of **Edziri** *et al.* (2019), who said that the methanolic extract of *Beta vulgaris* L. roots contains phenolic (39.75 mg GAE/g), flavonoid (20.73 mg CE/g), and *Beta vulgaris* L. roots juice contains total flavonoids $(1.423 \pm 0.87CE mg/g)$, total phenols $(0.978 \pm 0.35 \text{ GAE} mg/g)$.

Nutrients	Value
Protein	12.1%
Moisture	5.1%
Ash	0.88%
Fat	1.1%
Fiber	10.8%
Carbohydrates	70%
Total phenols	17.51 (mg GAE/g)
Total flavonoids	14.21 (mg CE/g)

 Table (1): Chemical composition, total phenolic, and total flavonoids analysis of *Beta vulgaris* L. roots

2- Effect of *Beta vulgaris* L. roots, L-glutamine, and omeprazole on the length of gastric ulcer in rats

The collected data demonstrated that rats developed stomach ulcer length after receiving a single oral dose of aspirin (200 mg/kg). Table (2) shows that the mean length of stomach ulcer in the control (+ve) group was 6.90±0.292 (mm), while it was zero in the control (-ve) group's normal.

Oral treatment of *Beta vulgaris* L. roots extract and L-Gln at doses of 300 and 600mg/kg b.wt, as well as omeprazole at 20mg/kg b.wt, for 7 days after injected aspirin (200mg/kg), caused a significant decrease in aspirin-induced stomach ulcers.

These findings show that the ulcer length was much longer in the aspirin-induced rats than in the normal rats. Following oral feeding with various treatments for all treated groups demonstrated a significant decrease in the length of peptic ulcer compared with the aspirin-induced rats group.

Rats were orally given the extract of *Beta vulgaris* L. roots at doses of 300 and 600mg/kg for 7 days after injected aspirin significantly (P<0.001) decreased the length of gastric ulcer compared with the control (+ve) group (2.40 ± 0.187 , 1.10 ± 0.245 and 6.90 ± 0.292 mm) respectively. The same trend was observed for rats groups' oral administration of L-Gln (4.70 ± 0.255 , 3.90 ± 0.640 and 6.90 ± 0.292 mm) respectively. Meanwhile, rats that received omeprazole orally as a standard drug showed significantly (P<0.001) decreased compared with the control (+ve) ($2.70\pm.374$ and 6.90 ± 0.292 mm) respectively as shown in Table (2).

The curative ratios from aspirin-induced gastric ulcer in rats following the administration of *Beta vulgaris* L. roots extract and L-Gln two tested doses were (65.22%, 84.06%, and 31.88%, 43.48%) respectively. The highest curative ratio for gastric ulcer was obtained by a dose of 600mg/kg of *Beta vulgaris* L. roots extract compared with the omeprazole group (84.05% and 60.87%) (Table 2).

Our results revealed that *Beta vulgaris* L. root extract caused a significant decrease in stomach ulcers. The current findings concur with the research conducted by **Jagtap and Deore** (2018), who hypothesized that the methanol extract demonstrated cytoprotection by lowering the release of stomach acid in response to ethanol-induced ulceration, also methanolic extracts of *Beta vulgaris* 200 and 400 mg/kg/p.o could greatly reduce stomach ulcers, as evidenced by the ulcer index reductions of 66.93% and 96.94%, respectively, in ethanol-induced ulceration when compared to control. In addition, **Vidal** *et al.* (2014) explained that natural betalains inhibit the inflammatory response by inactivating the enzymes lipoxygenase and cyclooxygenase.

According to our findings, stomach ulcers were significantly reduced by L-Gln. These results are as in the study of, **Lozada-Urbano** *et al.* (2022), who suggested that Gln and probiotics can potentially serve

as an effective therapy for gastric mucosa, and said that future research could look into the use of Gln alone or in combination as a prophylactic measure for gastric mucosal desquamation.

Groups		Aspirin and	Doses	Gastric ulcer length (mm)		
		treatment	(mg/kg b.wt)	Mean±SE	CR%	
Control-ve	1	-	-	0.00	-	
Control+ve 2		Aspirin(Asp)	200	6.90±0.292	-	
Treated groups	3	(Asp)+L- Glutamine	300	4.70±0.255***	31.88	
	4	(Asp)+ L- Glutamine	600	3.90±0.640***	43.48	
	5	(Asp)+ <i>Beta</i> vulgaris L. roots	300	2.40±0.187***	65.22	
	6	(Asp)+ <i>Beta</i> vulgaris L. roots	600	1.10±0.245***	84.06	
	7	(Asp)+Omeprazole	20	2.70±0.374***	60.87	

Table (2): Effect of *Beta vulgaris* L. roots extract, L-glutamine at two doses, and omeprazole on aspirin-induced gastric ulcer in rats

CR: Curative Ratio. *Differences are significant at 0.05 compared with +ve. ** Differences are significant at 0.01 compared with +ve. *** Differences are significant at 0.001 compared with +ve

3- Effect of *Beta vulgaris* L. roots, L-glutamine, and omeprazole on the volume of gastric juice in rats

The gathered data revealed that after receiving a single oral dose of aspirin (200 mg/kg) rats induced gastric ulcers and increased the volume of gastric juice. Table (3) shows that the mean volume of gastric juice in the control (+ve) group was 0.78 ± 0.037 (ml), while it was 0.52 ± 0.037 (ml), in the control (-ve) normal group.

Oral treatment of *Beta vulgaris* L. roots extract at doses of 300 and 600mg/kg b.wt, L-Gln at a dose of 600mg/kg b.wt, and omeprazole at 20mg/kg b.wt, caused a significant decrease in the volume of gastric juice in rats. However, L-Gln at 300 mg did not differ statistically significantly from the group of aspirin-induced rats (0.72 ± 0.037 , and 0.78 ± 0.037 ml) respectively.

Rats were orally given the extract of *Beta vulgaris* L. roots at a dose of 600 mg/kg for 7 days after injected aspirin significantly (P<0.001) decreased the volume of gastric juice compared with the control (+ve) group (0.54 ± 0.025 , and 0.78 ± 0.037 ml) respectively. *Beta vulgaris* L. roots at a dose of 300mg/kg for 7 days after injected aspirin significantly (P<0.01) decreased the volume of gastric juice compared with the control (+ve) group (0.58 ± 0.037 , and 0.78 ± 0.037 ml) respectively. The same trend was observed for rats groups administration orally omeprazole as a standard drug decreased the volume of gastric juice compared with the control (+ve) group (0.62 ± 0.037 and 0.78 ± 0.037 ml)

respectively. Meanwhile, L-Gln at a dose of 600 mg/kg for 7 days after injected aspirin significantly (P<0.05) decreased the volume of gastric juice compared with the control (+ve) group (0.66 ± 0.040 , and 0.78 ± 0.037 ml) respectively.

The decrease ratios for the volume of gastric juice from aspirininduced gastric ulcer in rats after oral treatment of *Beta vulgaris* L. roots extract and L-Gln at two tested doses were (25.64%, 30.77%, and 7.69% 15.38%) respectively. The highest decrease ratio for the volume of gastric juice was obtained by a dose of 600mg/kg of *Beta vulgaris* L. roots extract compared with the omeprazole group (30.77% and 20.51%) (Table 3).

Our results showed that *Beta vulgaris* L. root extract caused a significant decrease in the volume of gastric juice. The current findings concur with **Thiruvengadam** *et al.* (2024), who said that *Beta vulgaris* L. root has several therapeutic applications, such as antiviral, antioxidant, antibacterial, and analgesic functions. It's a functional food due to useful active components such as amino acids, minerals, phenolic acid, flavonoid, betaxanthin, and betacyanin. Also, **Zhang** *et al.* (2020) confirmed that flavonoids and polyphenols in plants have exhibited gastroprotective properties against peptic ulcers, and natural chemicals are increasingly recognized as attractive possibilities for preventing and treating peptic ulcers.

According to our data, the volume of gastric juice was significantly decreased by L-Gln. These results are due to Gln being the principal fuel for the gastrointestinal epithelium and maintaining the mucosal tissue (Huang *et al.*, 2019). Moreover, Bekheet and Shalan (2023) discovered that Gln and platelet-rich plasma (PRP) exhibit good protective benefits against aspirin-induced acute gastric ulcers in rats but PRP is preferable to Gln.

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Groups		Aspirin and	Doses	Volume of gastric juice (ml)			
		treatment	(mg/kg	Mean±SE	DR%		
			b.wt)				
Control-ve	1	-	-	$0.52 \pm 0.037^{***}$	33.33		
Control+ve	2	Aspirin(Asp)	200	0.78 ± 0.037	-		
Treated 3		(Asp)+L-	300	0.72 ± 0.037	7.60		
groups		Glutamine	300	300 0.72±0.037			
4		(Asp)+L-	600	0.66+0.040*	15 38		
		Glutamine	000	0.00±0.040	15.50		
	5	(Asp)+Beta	300	0 58+0 037**	25.64		
6		vulgaris L. roots	300	0.38±0.037	25.04		
		(Asp)+Beta	600	0.54+0.025***	30.77		
		vulgaris L. roots	000	0.34±0.023			
		(Asp)+Omepraz	20	0 62+0 037**	20.51		
		ole	20	0.02±0.037	20.51		

Table	(3):	Effect	of	Beta	vulgaris	L.	roots	extract,	L-glutamine	at	two
doses,	and	omepra	azol	le on	volume o	f ga	stric j	uice in r	ats		

DR: means Decrease Ratio. *Differences are significant at 0.05 compared with +ve. ** Differences are significant at 0.01 compared with +ve. *** Differences are significant at 0.001 compared with +ve

4- Effect of *Beta vulgaris* L. roots, L-glutamine, and omeprazole on the PH value of gastric juice in rats

The collected data demonstrated that rats developed stomach ulcers and decreased pH value of gastric juice after receiving a single oral dose of aspirin (200 mg/kg). Table (4) shows that the mean pH value of gastric juice in the control (+ve) group was (3.99 ± 0.129), while it was (5.54 ± 0.171) in the control (-ve) group normal.

Oral treatment of *Beta vulgaris* L. roots extract and L-Gln at doses of 300 and 600mg/kg b.wt, as well as omeprazole at 20mg/kg b.wt, for 7 days after injected aspirin (200mg/kg), caused a significantly increased pH value in aspirin-induced stomach ulcers.

These findings show that the pH of gastric juice was less valuable in the aspirin-induced rats than in the normal rats. Following oral feeding with various treatments for all treated groups demonstrated a significant increase in the pH value of gastric juice compared with the aspirininduced rats group.

Rats were orally given the extract of *Beta vulgaris* L. roots at doses of 300 and 600mg/kg for 7 days after injected aspirin significantly (P<0.001) increased the pH value of gastric juice compared with the control (+ve) group (5.37 ± 0.199 , 5.46 ± 0.143 , and 3.99 ± 0.129) respectively. Rats were orally given the extract of L-Gln at doses of 300 and 600mg/kg for 7 days after injected aspirin significantly (P<0.01) increased the pH value of gastric juice compared with the control (+ve) group (4.67 ± 0.158 , 4.76 ± 0.162 , and 3.99 ± 0.129) respectively. Meanwhile, rats that received omeprazole orally as a standard drug showed significantly (P<0.001) increased the pH value of gastric juice compared with the control (+ve) (5.19 ± 0.168 and 3.99 ± 0.129) respectively as shown in Table (4).

The increased ratios for the pH value of gastric juice from aspirininduced gastric ulcer in rats following the administration of *Beta vulgaris* L. roots extract and L-Gln two tested doses were (34.59%, 36.84%, and 17.04%, 19.30%) respectively. The highest increase ratio for the pH value of gastric juice was obtained by a dose of 600mg/kg of *Beta vulgaris* L. roots extract compared with the omeprazole group (36.84% and 30.08%) (Table 4).

In light of our results, *Beta vulgaris* L. roots extract significantly increased the pH value of gastric juice. These results are due to flavonol containing antihistaminic effects, which reduce histamine levels by limiting histamine production from stomach mast cells and inhibiting the gastric H+/K+ proton pump, hence reducing gastric acid secretions (Mota *et al.*, 2009).

The present data showed that L-Gln caused a significant increase in the pH value of gastric juice. These results are in agreement with those obtained by **Amagase** *et al.* (2010), who discovered that through inhibition of cellular accumulation of ammonia, Gln decreased chemokine production and cell death resulting in the prevention of H. pylori-induced gastric diseases in vivo, glutamine-would be useful for prophylactic treatment of H. pylori-induced gastric diseases in patients. Additionally, among the basic nutrients for immune cell activity and fate, Gln is arguably the most generally recognized immunonutrient (Newsholme *et al.*, 2023).

Table	(4):	Effect	of	Beta	vulgaris	L.	roots	extract,	L-glutamine	at	two
doses,	and	omepra	azol	le on	the PH va	alu	e of ga	stric juic	e in rats		

Groups		Aspirin and	Doses	PH of gastric ju	ıice
		treatment	(mg/kg	Mean±SE	IR%
	-		D.WL)		
Control-ve	1	-	-	$5.54 \pm 0.171^{***}$	38.85
Control+ve	2	Aspirin(Asp)	200	3.99±0.129	-
Treated	3	(Asp)+L- Glutamine	300	$4.67 \pm 0.158^{**}$	17.04
groups	4	(Asp)+ L- Glutamine	600	4.76±0.162**	19.30
	5	(Asp)+ <i>Beta</i> vulgaris L. roots	300	5.37±0.199***	34.59
6		(Asp)+ <i>Beta</i> vulgaris L. roots	600	5.46±0.143***	36.84
	7	(Asp)+Omeprazole	20	5.19±0.168***	30.08

IR: means Increase Ratio. *Differences are significant at 0.05 compared with +ve. ** Differences are significant at 0.01 compared with +ve. *** Differences are significant at 0.001 compared with +ve

5- Effect of *Beta vulgaris* L. roots extract, L-glutamine at two doses, and omeprazole on total acidity of gastric juice in rats

The collected data demonstrated that rats developed stomach ulcers and increased the total acidity of gastric juice after receiving a single oral dose of aspirin (200 mg/kg). Table (5) shows that the mean total acidity of gastric juice in the control (+ve) group was (6.96 ± 0.244), while it was (3.47 ± 0.038) in the control (-ve) normal group.

Oral treatment of *Beta vulgaris* L. roots extract at doses of 300 and 600mg/kg b.wt, L-Gln at doses of 300 and 600mg/kg b.wt, and omeprazole at 20mg/kg b.wt, caused a significant decrease in the total acidity of gastric juice in rats.

Rats were orally given the extract of *Beta vulgaris* L. roots at doses of 300 and 600mg/kg for 7 days after injected aspirin significantly (P<0.001) decreased the total acidity of gastric juice compared with the control (+ve) group (4.12 ± 0.252 , 3.74 ± 0.236 , and 6.96 ± 0.244) respectively. The same trend was observed for rats groups' administration orally omeprazole as a standard drug decreased the total acidity of gastric juice compared with the control (+ve) group

 $(4.72\pm0.191, \text{ and } 6.96\pm0.244)$ respectively. Meanwhile, L-Gln at doses of 300 and 600mg/kg for 7 days after injected aspirin significantly (P<0.05) decreased the total acidity of gastric juice compared with the control (+ve) group (6.34\pm0.164, 6.29\pm0.239, and 6.96\pm0.244) respectively.

The decrease ratios for the total acidity of gastric juice from aspirininduced gastric ulcer in rats following the administration of *Beta vulgaris* L. roots extract and L-Gln at two tested doses were (40.80%, 46.26%, and 8.91%, 9.63%) respectively. The highest decrease ratio for the total acidity of gastric juice was obtained by a dose of 600mg/kg of *Beta vulgaris* L. roots extract compared with the omeprazole group (46.26% and 32.18%) (Table 5).

Based on the recorded results, *Beta vulgaris* L. roots extract notably decreased the total acidity of gastric juice. These results are owing to flavonoids being able to protect the stomach and duodenal mucosa through increased antioxidants, mucus, activity of superoxide dismutase and catalase enzymes and glutathione concentrations, immunoregulatory, and reduction in H+ (Serafim et al., 2020).

According to our findings, L-Gln markedly decreases the total acidity of gastric juice, this comes in agreement with **Ommurugan** *et al.* (2018), who discovered that L-Gln and CoQ10 when used alone as well as in combination with sucralfate and pantoprazole showed no ulcers formation, test drugs showed decrease in the rate of gastric acid secretion, higher gastric pH, decreased free and total acidity level.

Table (5): Effect of *Beta vulgaris* L. roots extract, L-glutamine at two doses, and omeprazole on total acidity of gastric juice in rats

Groups		Aspirin and treatment	Doses (mg/kg	Total acidity of gastric juic (mEq/l/100g)		
			b.wt)	Mean±SE	DR%	
Control-ve	1	-	-	3.47±0.038***	50.14	
Control+ve	2	Aspirin(Asp)	200	6.96±0.244	-	
Treated 3 groups 4 5 6		(Asp)+L- Glutamine	300	6.34±0.164*	8.91	
		(Asp)+ L- Glutamine	600	6.29±0.239*	9.63	
		(Asp)+ <i>Beta</i> vulgaris L. roots	300	4.12±0.252***	40.80	
		(Asp)+ <i>Beta</i> vulgaris L. roots	600	3.74±0.236***	46.26	
	7	(Asp)+Omeprazole	20	4.72±0.191****	32.18	

DR: means Decrease Ratio. *Differences are significant at 0.05 compared with +ve. ** Differences are significant at 0.01 compared with +ve. *** Differences are significant at 0.001 compared with +ve

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5- Histopathological examination of the stomach

Light microscopic examination of the stomach of rats from G1 (negative control group) showed normal histoarchitecture of gastric tissue (H & E stain; X 100) (Figure 1). In adverse, the stomach of rats from G2 (positive control group) showed focal coagulative necrosis of gastric mucosa (black arrow) and focal mucosal mononuclear cell infiltrations (blue arrow) (H & E stain; X 100) (Figure 2). Meanwhile, the stomach of the rat from G3 (300 mg/kg B.Wt. L-Gln) showed mild submucosal edema (black arrow) and few submucosal mononuclear cell infiltrations (blue arrow) (H & E stain; X 100) (Figure 3). The stomach of rats from G4 (600 mg/kg B.Wt. L-Gln) showed congested blood vessel (black arrow) and few submucosal mononuclear cell infiltrations (blue arrow) (H & E stain; X 100) (Figure 4). Otherwise, the stomach of rats from G5 (300 mg/kg B.Wt. Beta vulgaris L. roots) showed few mucosal inflammatory cell infiltrations (arrow) (H & E stain; X 100) (Figure 5). The stomach of rats from G6 (600 mg/kg B.Wt. Beta vulgaris L. roots) showed no histopathological damage (H & E stain; X 100) (Figure 6). On the other hand, the stomach of a rat from G7 (20 mg/kg B.Wt. Omeprazole) mild submucosal edema (black arrow) and few submucosal mononuclear cell infiltrations (blue arrow) (H & E stain; X 100) (Figure 7).



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تأثير جذور البنجر والجلوتامين الغذائى على شفاء قرحة المعدة في فئران التجارب

أ.د/ على بدوي رصاص أستاذ التغذية بقسم التغذية وعلوم الأطعمة كلية أستاذ التغذية وعلوم الأطعمة والعميدالأسبق لكلية التربية النوعية جامعة المنوفية أ.د / منى إبراهيم محمد أستاذ التغذية وعلوم الأطعمة كلية التربية النوعية جامعة المنوفية

الملخص العربي:

تم دراسة تأثير المستخلص الإيثانولي لجذور البنجر والجلوتامين الغذائي على شفاء قرحة المعدة في فئران التجارب. استُخدم اثنان وأربعون فأرًا أبيضَ ذكرًا بالغًا بوزن (± 180جم) من سلالة سبراغ داولي، وقُسِّموا إلى 7 مجموعات. تتكون كل مجموعة من 6 فئران، استُخدمت إحداها بوصفها مجموعة ضابطة سالبة، وأُعطى الآخرون الأسبرين عن طربق الفم (200 ملجم/كجم من وزن الجسم لدى الفئران)، واستُخدمت إحدى هذه المجموعات بوصفها مجموعة ضابطة موجبة، في حين تلقت المجموعة الثالثة والرابعة الجلوتامين الغذائي، والمجموعة الخامسة والسادسة مستخلص جذور البنجر، وعولجت المجموعة الأخيرة بالأوميبرازول بوصفه دواءً قياسيًّا لمدة 7 أيام. ثم أجريت الدراسة على: طول قرحة المعدة، وحجم عصير المعدة، وقيمة الرقم الهيدروجيني، والحموضة الكلية، إضافة إلى التغيرات النسيجية المرضية للمعدة. أظهرت النتائج أن تناول المستخلصين المختبرين عن طريق الفم قلل من سعة قرحة المعدة والحموضة الكلية وحجم العصارة المعدية والتغيرات النسيجية المرضية. وكانت أعلى نسبة شفاء لقرحة المعدة حصلنا عليها بجرعة (600 ملجم/كجم من مستخلص جذور البنجر) مقارنة مع مجموعة الأوميبرازول. وأكدت النتائج التي توصلنا إليها أنه يمكن استخدام جذور البنجر والجلوتامين الغذائي لعلاج قرحة المعدة.

الكلمات المفتاحية: جذور البنجر، الجلوتامين الغذائي، القرحة المعدية، الأسبرين، أوميبرازول، عصير المعدة، رقم الحموضة، الحموضة الكلية، التغيرات النسيجية المرضية.