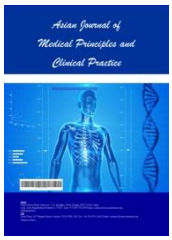

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Study the Protective Effects of *Portulaca oleracea* on Peptic Ulcer in Male Rats

Alaa Qadhi[1] and Nehal A. A. Elfky[1*]

[1]Department of Clinical Nutrition, Faculty of Applied Medical Sciences, Umm Al Qura University, Makkah, Saudi Arabia.

Authors' contributions

This work was carried out in collaboration between both authors. Author AQ contributed to obtain the subject conception. Author NAAE conducted the research work and wrote the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Peptic ulcer disease is thought to result from a disturbed balance between the protective factors represented by the mucosa–bicarbonate barrier and the aggressive forces represented by acid and pepsin. This study aimed to investigate the effect of *Portulaca oleracea* juice on a peptic ulcer in rats. Twenty-eight male rats were divided into four groups of equal weight and number (5 rats each). Group I served as the positive control group (untreated group) and Group II served as a standard group (treated with the antiulcer agent), groups III and IV serviced as tested groups with *Portulaca oleracea* for two weeks at a dose of 0.50 and 1.00 ml/100 g of body weight, respectively. At the last day of the experimental period (14 days), all rats were starved of food but not of water for 18 hours. After fasting period, Groups I was given orally distilled water; standard group II was given (I/P) intra-perioteneally Zantac (ranitidine) at a dose 6 mg/100 g body weight, 60 min prior administered ethanol. Groups (I and II) were given orally saline and the other two groups were given *Portulaca oleracea* juice, 120 min prior administered ethanol. Then ethanol was administered orally to all `groups at 0.5 ml/100 g. After four hours of Ethyl alcohol administration, all animals were sacrificed and their stomachs were taken out and washed by normal saline. The gastric juice

**Corresponding author: E-mail: nehal_elfaky@yahoo.com;*

for each animal was collected to measure the volume of the gastric contents and pH value was measured. The present results showed that *Portulaca oleracea* extract had a significantly positive anti-ulcer effect which was more detectable with increasing doses of the extract. The present results concluded that regular intake of *Portulaca oleracea* had an anti-ulcer effect.

Keywords: Peptic ulcer; Portulaca oleracea; rats.

1. INTRODUCTION

The gastrointestinal tract is one of the largest organs in the body extends from the mouth to the anus and includes the pharyngeal structures, oesophagus, stomach, liver and gallbladder, pancreas, and small and large intestine. It is extremely active in carrying out the physiologic and metabolic function of secretion, digestion, absorption and cellular replication [1,2]. Peptic ulcer (PU) is a lesion in the mucosa of the stomach or duodenum in which acid and pepsin play a major role in it. This term is often used to encompass any gastric or duodenal ulceration [3,2].

The pathogenesis of peptic ulcer disease is multifactorial, including chronically using non-steroid anti-inflammatory drugs, cigarette smoking, alcohol, and reactive oxygen species (ROS) [4]. *H. pylori* can damage the mucosal defence system by reducing the thickness of the mucus gel layer, diminishing mucosal blood flow, and interacting with the gastric epithelium throughout all stages of the infection. *H. pylori* infection can also increase gastric acid secretion; by producing various antigens, virulence factors, and soluble mediators, *H. pylori* induces inflammation, which increases parietal-cell mass and, therefore, the capacity to secrete acid [5]. Recently many herbs are using to treat the peptic ulcer that is including, plants and its content of photochemical and antioxidants like *Portulaca oleracea*. *Portulaca oleracea* is a warm-climate annual herb, known as khurfa in Arabic and common purslane in English. *Portulaca oleracea* is an annual herb which could be perennial in tropical lands with fleshy purplish-green stem and alternate fleshy leaves with obtuse emarginate apex. Flowers grow at the end of the stem in groups and are yellow. Seeds are small nearly one millimetre or less which have the granulate or flat stellate surface, reddish-brown when immature form and becomes black when matured [6]. It is eaten raw as a salad and also is eaten cooked as a sauce in soups or as greens. *Portulaca oleracea or Purslane* provides a rich plant source of nutritional benefits [7,8]. *Purslane* has been used as an antiseptic, anti-diuretic, vermifuge in oral ulcer and urinary disorders analgesic and anti-inflammatory effects [9]. The leaves are poulticed and applied to burns. A tea made from the leaves is used in the treatment of stomach aches and headaches [10]. The qualitative phytochemical studies of this plant extract showed the presence of alkaloids, coumarins, flavonoids, saponins, tannins etc [11].

2. MATERIALS AND METHODS

2.1 *Portulaca oleracea*

Fresh *Portulaca oleracea* used in this study was free from any physical defect and purchased from the local market from Makah, KSA.

2.2 Rats and Diet

Twenty-eight male rats of Sprague-Dawley strain weighing 200 ± 5 g were obtained from the Laboratory Animal Colony, Medicine College, Umm Al Qura University, KSA. Basal diet constituents were purchased from Baghafar Company for Pharmaceutical and Chemical, Jeddah, KSA.

2.3 Drugs and Chemicals

Ethyl alcohol was obtained from Nile Co., for Pharmaceutical Industries (Cairo, Egypt). Anti-ulcer agent (Zantac ™ (Ranitidine) was obtained in the form of ampoules from GlaxoSmithKline S.A.E., El-Salam City, Egypt.

2.4 Preparation of *Portulaca oleracea*

Portulaca oleracea were cleaned and washed with running tap water to remove dust, then cleaned *Portulaca oleracea* were Squeezed using a blender by using distilled water to prepare the juice of *Portulaca oleracea*. Fig. 1 and 2 showed *Portulaca oleracea* before and after preparation of plant juice.

Fig. 1. Fresh *Portulaca oleracea*

Fig. 2. Juice of *Portulaca oleracea*

2.5 Preparation of Basal Diets

The basal diet (AIN-93M) was prepared according to [12] as shown in Table 1. Diet was formulated to meet recommended nutrients levels for rats.

Table 1. Constituents of the basal diet (AIN 93M)

Ingredient	Content (g/kg)
Casein	200.000
Corn starch	546.200
Sucrose	100.00
Soybean oil	50.000
Fibres	50.000
Mineral mix.	40.000
Vitamin mix.	10.000
L-Cystine	1·800
Choline chloride	2.000
Tert-Butylhydroquinone	0.008

2.6 Experimental Design and Grouping of Rats

All Animals were fed on the basal diet and water *ad libitum* and they were maintained under healthy conditions of humidity, temperature (20-25°C) and light (12-h light: 12-h dark cycle) for one week before starting the experimental to acclimatization. All animals were treated following the guidelines for the care and use of the laboratory animals, Physiology Department, Medicine College, Umm Al Qura University, KSA. After the acclimatization period, rats were divided into four groups of equal weight and number (5 rats each). Group I served as a positive control group (untreated group) and Group II served as a standard group (treated with the antiulcer agent), Groups III, and IV serviced as tested groups. Groups I and II fed on the basal diet and given orally saline solution at a volume of 1.0 ml / 100 g of body weight. Groups III, and IV, fed on the basal diet and given orally *Portulaca oleracea* juice by tube feeding for two weeks at a dose of 0.5 ml and 1.0 ml /100 g of body weight, respectively.

2.7 Induction of Gastric Ulcer by Ethyl Alcohol

At the last day of the experimental period (14 days), all rats were starved of food but not of water for 18 hours. After fasting period, Groups I was given orally distilled water; standard group II was given (I/P) intraperitoneally Zantac (ranitidine) at a dose 6 mg/100 g body weight, 60 min prior administered ethanol. Groups (I and II) were given orally saline and the other two groups were given *Portulaca oleracea* juice, 120 min before administered ethanol [13]. Then ethanol was administered orally to all `groups at 0.5 ml/100 g [14].

2.8 Determination Gastric Juice Volume and Gastric Juice PH

After four hours of ethyl alcohol administration, all animals were sacrificed using an overdose of diethyl ether and their stomachs were taken out and washed by normal saline. The gastric juice for each animal was collected in clear tubes and centrifuged at 3000 rpm for 10 min. The supernatant gastric juice was put in a measuring cylinder to measure the volume of the gastric contents. The measuring cylinder was minimum graduation of 0.1 ml. To determination of gastric juice pH. The supernatant of stomach content was decanted off in a clean container. The pH was measured by using digital pH meter (pH scan-2, Eutech Cybernetics Pvt. Ltd., Singapore). The pH meter measured the pH up to one decimal digit with ± 0.1 pH variation.

2.9 Gastric Ulcer Index

The method described by Agarwal et al. [15] was employed in the present study. In briefly, after 4hours of administrated ethanol, all rats were sacrificed after using an overdose of diethyl ether and their stomachs removed and washed by saline. The gastric juice was collected in the test tube. Then stomachs opened along the greater curvature, washed with saline and examined under a dissecting microscope for gastric ulcers. The sum of length for all lesions area for each animal was measured and served as the ulcer index. The curative ratio was calculated for each group using the following equation:

Curative ratio (CR) = (LC-LT / LC) x100

LC: The length of gastric ulcer in the positive group.
LT: The length of gastric ulcer in the treated group.

2.10 Statistical Analysis

The obtained results were expressed as Mean ±SE. Data were evaluated statistically using one -way analysis of variance (ANOVA). The significant difference between means was estimated at $p < 0.05$.

3. RESULTS

3.1 pH of Gastric Juice

pH values of gastric juice in treated rats with antiulcer drug and orally administration of *Portulaca oleracea* juice at different doses are recorded in Table 2. Results demonstrated that standard group was given I/P antiulcer drug and groups were given orally different doses of *Portulaca oleracea* juice (0.5 ml and 1.0 ml /100 g b. wt) had a significant increase in pH values of gastric juice at $p<0.05$ as compared to positive group (untreated group). Rats given orally *Portulaca oleracea* juice at different doses had higher pH values of gastric juice (6.46 ± 0.23 and 6.96 ± 0.0 5, respectively) which were significantly increased as compared to the standard group. The increase in pH values of gastric juice was more detectable with increasing the dose of plant juice as shown in Fig. 1.

3.2 The Volume of Gastric Juice

The volume of gastric juice (cm^3) in treated rats with antiulcer drug and different doses of *Portulaca oleracea* juice shown in Table 2. Data obvious that volume of gastric juice (cm^3) of group given I/P antiulcer drug (standard group) and rats given orally different doses of *Portulaca oleracea juice* had significant decrease in gastric juice volume (2.14 ± 0.09, 2.22 ± 0.18 and 1.36 ± 0.17, respectively) at $p<0.05$ as compared to positive group. However, rats given orally *Portulaca oleracea* juice at a dose of 1.0 ml/100 g b.wt had a significant decrease in volume of gastric juice as compared to standard rats. In contrast, rats given orally plant juice at a dose of 0 .5 ml/100 g b.wt, had no significant differences in the volume of gastric juice as compared to the standard group.

3.3 Length of Gastric Ulcer

The length of gastric ulcer (mm) in untreated and treated rats with *Portulaca oleracea* juice at different doses is recorded in Table 3. Tabulated results revealed that the length of gastric ulcer (mm) as mean ± SE of the treated group with the antiulcer drug (standard group) was significant decrease (3.56 ± 0.27 mm) at $p < 0.05$ as compared to positive group (7.82 ± 0.81 mm). Groups are given orally

Table 2. Effect of antiulcer drug and oral administration of *Portulaca* juice on volume and pH value of gastric juice in rats

Groups	Parameter as Mean ± SE	
	The volume of gastric juice (ml)	The pH of gastric juice
Positive group	3.34 ± 0.11 a	4.50 ± 0.21d
Standard group (treated with drugs)	2.14 ± 0.09b	5.68 ± 0.22c
The treated group with plant juice at a dose of 0.5 ml/100 g b.wt	2.22 ± 0.18b	6.46 ± 0.23b
The treated group with plant juice at a dose of 1.0 ml/100 g b.wt	1.36 ± 0.17c	6.96 ± 0.0 5a

Different superscript letters in the same column denote significant differences at p<0.05

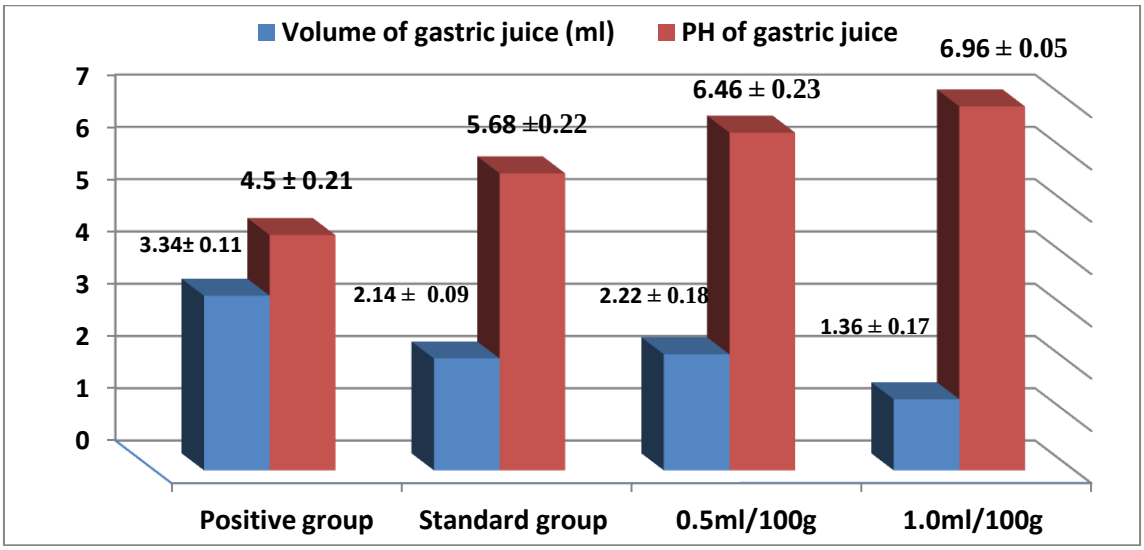

Fig. 3. Effect of antiulcer drug and oral administration of *Portulaca* juice on volume and pH value of gastric juice in rats

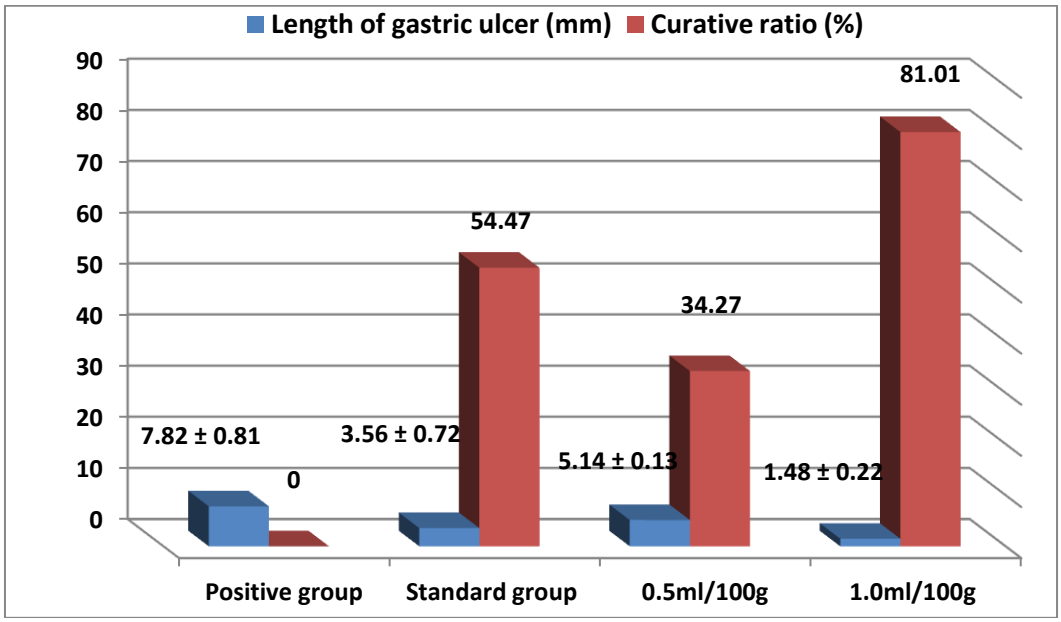

Fig. 4. Effect of antiulcer drug and oral administration of *Portulaca juice* on the length of gastric ulcer (mm) and curative ratio in rats

Table 3. Effect of antiulcer drug and oral administration of *Portulaca oleracea* juice on the length of gastric ulcer (mm) and curative ratio in rats

Groups	Parameter as Mean ± SE	
	Length of gastric ulcer (mm)	Curative ratio (%)
Positive group	7.82 ± 0.81a	0
Standard group (treated with drugs)	3.56 ± 0.27c	54.47
Treated groups with plant juice at a dose of 0.5 ml/100 g .wt	5.14 ± 0.13b	34.27
Treated groups with plant juice at a dose of 1.0 ml/100 g .wt	1.48 ± 0.22d	81.01

Different superscript letters in the same column denote significant differences at p<0.05

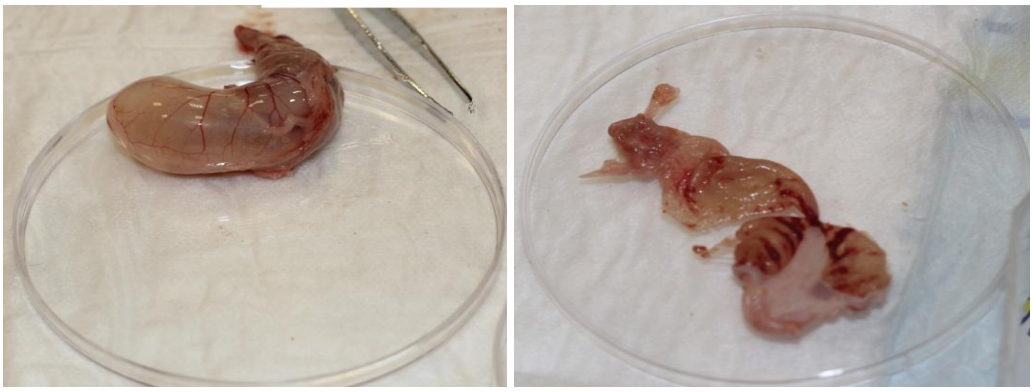

Fig. 5. Illustrate the stomach of positive rats

Portulaca oleracea juice at doses of (0.50 and 1.00 ml/100 g b.wt) had a significant decrease in the length of gastric ulcer at p <0.05 as compared to positive groups. Rats given orally the plant juice at a dose of (1.0 ml/100 g b.wt) had a significant decrease in the length of gastric ulcer (1.48 ± 022 mm) at p <0.05 as compared to the standard group.

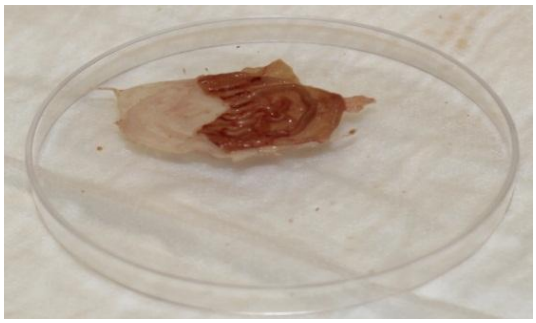

Fig. 6. Illustrate the stomach of the standard group (Treated with antiulcer drug)

3.4 Curative Ratio

Effect of antiulcer drug and oral administration of *Portulaca oleracea* juice at different doses on the curative ratio of peptic ulcer in rats is recorded in Table (3) above. Mean values of the curative ratio of groups given orally plant juice at a dose of (1.0 ml/100 g.wt) were higher compared with treated rats with the antiulcer drug. The decreasing in gastric length and the curative ratio of treated rats with plant juice was more detectable with increasing the doses of plant juice as shown in Fig. 4.

4. DISCUSSION

A peptic ulcer is a sore on the inner lining of the stomach or duodenum—the first part of the small intestine. Gastric hyperacidity and ulcer are very common causing human suffering today. Therefore, the present study was done to investigate the antiulcer effect of oral administration of *Portulaca* juice and compare it with the antiulcer drug as a reference of antiulcer.

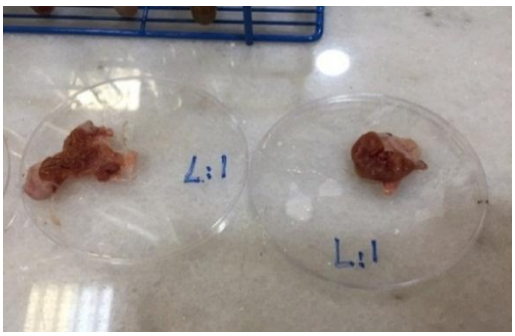

Fig. 7. Illustrate the stomach of treated 0.5 ml of plant extract

Fig. 8. Illustrate the stomach of treated 1.0 ml of plant extract

The present results showed that pH values of gastric juices in treated rats with antiulcer drug and oral administration of *Portulaca oleracea* juice at different doses had significant increases

in pH values and decreases in the volume of gastric juice as well as decreases in the length of gastric ulcers compared to the untreated group. The positive effect of *Portulaca oleracea* juice on pH values and volume of gastric juice, lower gastric ulcer length and curative ratio were more detectable with increasing the dose of plant juice.

Our results were agreed with [16] studied the aqueous and ethanolic of whole plant extracts in mice for their ability to inhibit gastric lesions induced by HCl, absolute ethanol and pylorus-ligation, and compare it with sucralfate. They demonstrated that both extracts showed a dose-dependent reduction in the severity of ulcers. The highest dose of extracts exerted similar activity to sucralfate. The oral administration of extracts reduced the gastric acidity in pylorus-ligated mice.

Recently, [17,8] studded gastroprotective effect of 50% ethanolic extract of *P. oleracea* in different gastric ulcer models (i.e. gastric ulcers induced by ethanol, aspirin, cold restraint stress and pyloric ligation) in rats. They showed dose-dependent inhibition of ulcer index with maximum index reduction in ethanol and minimum in aspirin-induced ulcer [18] founded that extract of *P. oleracea* induced noticeable protection of the gastric mucosa against the acid attack, protect the gastric mucosa significantly and cure the ulcerations.

Gastroprotective activity of *P. oleracea* might be due to gastric defence factors. The extract also prevents the oxidative damage of gastric mucosa by blocking lipid peroxidation and by the significant decrease in superoxide dismutase, and an increase in catalase activity [17]. The antioxidant property of *Portulaca oleracea* is attributed to its constituents, such as gallotannins, omega-3 fatty acids, ascorbic acid, α-tocopherols, kaempferol, quercetin, and apigenin [19].

5. CONCLUSION

The present study concluded that *Portulaca oleracea* had a protective effect against peptic ulcer by increasing PH and decreasing volume of gastric juice. Also, it lowers gastric ulcer length and improves the curative ratio of ulcers. The present results showed that pH values of gastric juices in treated rats with antiulcer drug and oral administration of *Portulaca oleracea* juice at different doses had significant increases in pH values and decreases in the volume of gastric juice as well as decreases in the length of gastric ulcers compared to the untreated group. The positive effect of *Portulaca oleracea* juice on pH values and volume of gastric juice, lower gastric ulcer length and curative ratio were more detectable with increasing the dose of plant juice.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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