

# STUDIUL PLANTELOR MEDICINALE

CZU: 615.322:582.886+615.243

GASTROPROTECTIVE ACTIVITY OF EPILOBIUM ANGUSTIFOLIUM HERB | ACTIVITATEA GASTROPROTECTIVĂ A PĂRȚILOR AERIENE DE EPILOBIUM ANGUSTIFOLIUM

Sviatlana Sheuchuk<sup>1</sup>, Natalia Gurina<sup>2</sup>

<sup>1</sup> PhD student, Department of organization of pharmacy, Belarusian State Medical University, Minsk, Republic of Belarus

<sup>2</sup> Doctor of Biological Science, Dean of pharmaceutical faculty, Belarusian State Medical University, Minsk, Republic of Belarus

**Rezumat.** Studiul proprietăților gastroprotectoare ale părților aeriene de *Epilobium angustifolium* a fost efectuat pe un model al leziunilor mucoasei gastrice a șobolanilor printr-o singură administrare intragastrică de etanol (1 ml de etanol 96%). Administrarea profilactică intragastrică a extractului din părți aeriene de *Epilobium angustifolium* în doza de 500 mg/kg a contribuit la o creștere semnificativă a rezistenței mucoasei gastrice a șobolanilor la efectul nociv al etanolului. Activitatea antiulceroasă a produsului vegetal investigat a fost de 3,18, ce a depășit rezultatele grupului de comparație.

**Cuvinte cheie:** fitoterapie, afecțiuni ale aparatului digestiv, plante medicinale, ulcer peptic, *Epilobium angustifolium* L., produse vegetale.

**Abstract.** The study of the gastroprotective properties of the herb *Epilobium angustifolium* was carried out on an ethanol model of lesions of the gastric mucosa of rats by a single intragastric introduction of ethanol (1 ml of 96% ethanol). Preventive intragastric administration of decoction at dose 500 mg / kg led to a significant increase in resistance of the gastric mucosa of rats to the damaging effect of ethanol. The anti-ulcer activity of the studied medicinal plant raw materials was 3.18, which exceeds the results of the standard group (2.06).

**Keywords:** phytotherapy, diseases of digestive system, medicinal plants, peptic ulcer, *Epilobium angustifolium* L., herbal materials.

## INTRODUCTION

Diseases of the gastrointestinal tract are among the most common diseases in the world. It is known, that 30% of total number of gastrointestinal diseases is peptic ulcer disease. Peptic ulcer disease affects people of the most active, working age, causing temporary and sometimes permanent disability [1]. There are several types of peptic ulcer disease:

- 1) Peptic ulcers caused by *Helicobacter pylori* infection;
- 2) Symptomatic (acute) - medicinal, stressful, etc.;
- 3) Ulcers resulting as a complication from diseases of the internal organs (Cushing ulcers, etc.).

The signs of acute damage of the stomach wall are necrosis, inflammatory exudate, and immature granular tissue. Their characteristic feature is rapid occurrence with frequent development of complications, and almost as rapid healing after elimination of etiological factors. If earlier acute ulcer was described as a rather rare pathology, then in recent years many authors report hundreds of observations [2]. Some of the main causes of gastric ulcers include continual use of alcoholic beverages and anti-inflammatory drugs, long time stress.

The large number of synthetic drugs have been used in conservative treatment of peptic ulcer disease, which can have a toxic effect on the human body. And also, due

to the impossibility, in some cases, to eliminate the etiological factors and the high frequency of relapses and complications, it is recommended to use preventive measures and improve the methods of complex therapy.

It is important to use herbal medicines as a means of prevention, which is associated with low toxicity during long-term use and the availability of medicinal plant raw materials [3].

A promising object of research is *Epilobium angustifolium* L., which is used in traditional medicine and has large raw materials reserves on the territory of the Republic of Belarus. Herb contains an extensive complex of biologically active compounds (tannins (up to 10%), polysaccharides (up to 15%), flavonoids (up to 10%), vitamin C (320 mg%), etc.) [4].

Thus, the purpose of our trial was to study the gastroprotective properties of decoction of *Epilobium angustifolium* L..

## MATERIALS AND METHODS

**Plant material.** *E. angustifolium* herb was collected in the Minsk region of the Republic of Belarus in 2019. The plant material was identified and a herbarium was submitted to Department of Organization of pharmacy, BSMU, Minsk (Belarus). The drying of raw materials was carried

out in a natural air-shadow way. The plant material was dried in shade and powdered. A decoction was prepared according to the article "Infusions and decoctions" of the State Pharmacopoeia of the Republic of Belarus [5].

**Ethanol induced ulcer.** The study of the gastroprotective properties of *E. angustifolium* herb was carried out in accordance with the existing requirements of Good Laboratory Practice (GLP) and generally accepted recommendations for this type of research [6, 7]. 24 female white rats (260–320g) were selected, housed and divided into three groups. Each group contained of eight animals under standard laboratory conditions of temperature (25±2 °C). The animals had free access to food and water. Before experiment, a daily examination of the external condition was carried out for minimum 10 days. The Belarusian State Medical University, Animals Ethics Committee approved all experimental protocol. The control group was given only water purified, test group were given decoction (500 mg/kg, p.o.). Standard group was given "Plantagluclid" in dose 500 mg/kg, p.o.. Active ingredients of "Plantagluclid" is common plantain dry leaf extract.

Rats were fasted for 24hrs prior receiving first doses. The solutions was administered intragastrically with a special metal probe in a 7-day course before modeling an "acute" ulcer. The ulcer was induced using 1 ml of 96% ethyl alcohol by administered orally to each animal. After 24 hours, the rats were removed from experiment by cervical dislocation. The macroscopic observation of stomach was recorded for ulcer scoring after removal of stomach. All stomachs were gently rinsed with water to remove the gastric contents and blood clots and examined for lesions: the number of small (point) (less than 2 mm), large (more than 2 mm), band-shaped ulcers was counted and the severity of hyperemia was recorded. Then the

percentage of animals with ulcers in each group was calculated [8]. The study of the effect of decoction on the motor-evacuation function of the gastrointestinal tract was carried out using the method of "tags". As a "tag" was used activated carbon [9]. The integral index of the number of destructions was determined:

$$IP = (N \times K) / 100,$$

where N - is the average number of destructions per 1 animal,

K - is the percentage of animal lesions in the group.

The anti-ulcer activity was determined as the ratio of the values of the integral index in the control group to the value in the experimental group and expressed in relative units. The test agent was considered active if the anti-ulcer activity was 2 or more units [9, 10].

## RESULTS AND DISCUSSIONS

The preventive intragastric administration of decoction of herb *Epilobium angustifolium* L. at dose 500 mg/kg led to a significant increase of resistance of the gastric mucosa of rats to the damaging effect of ethanol.

The introduction of decoction and "Plantagluclid" led to a significant improvement in the condition of the animals. Macroscopic examination of the stomachs of rats of these groups showed the absence of bloating, folding and color of the gastric mucosa almost did not differ from the same characteristics in the group of intact animals.

There was a statistically significant decrease in the average number of ulcers in test group (by 1.8 times) due to a 2.8-fold decrease of number of point destructions and the absence of band-shaped ulcers relative to similar values in group of untreated animals (Table 1). The absence of hyperemia also indicates the presence of a gastroprotective effect.

**Table 1. Effect of decoction of herb *E. angustifolium* on the formation of lesions in ethanol induced model in rats, (M±m)**

Group	Small ulcers	Large ulcers	Band-shaped ulcers	Hyperemia
Control group (purified water)	Number of ulcerations per animal 10.25±1.72			Expressed
	3.75±1.40	2.13±0.83	4.13±1.92	
Standard group ("Plantagluclid", 500 mg/kg)	Number of ulcerations per animal 6.43±0.98*			Absenced
	3.29±0.70	3.14±0.83	0	
Test group ( <i>E. angustifolium</i> , 500 mg/kg)	Number of ulcerations per animal 5.67±2.06*			Absenced
	1.33±0.48	4.83±2.04	0	

\* Calculations were performed for those animals, that were found to have ulcerative lesions

The preventively introduction of decoction at dose 500 mg/kg led to decrease in number of small ulcers (less than 2 mm) by 2.5 times compared to the drug "Plantagluclid", however, in the standard group, there was a smaller number of large ulcers by 1.53 times compared to the experimental group.

The ability of the studied plant to enhance the motor-evacuation activity of the gastrointestinal tract is an important aspect of anti-ulcer activity. In the control and test group was an acceleration of the motility of the gastrointestinal tract by 49% and 61%, respectively (Table 2). Violation of this function leads to an increase in the time

of exposure to ulcerogen and gastric juice on the gastric mucosa, the throwing of the contents of the duodenum into the stomach, which can reduce the resistance of the

mucous membrane to the effects of irritating factors and contribute to damage to the gastric mucosa [11].

**Table 2. Effect of decoction of herb *E. angustifolium* on motor-evacuation function of the gastrointestinal tract**

Group	Filling the intestines with carbon, %	Acceleration of motorfunction, %
Control group (purified water)	35.3±1.76	-
Standard group ("Plantagluclid", 500 mg/kg)	52.5±2.03	49
Test group ( <i>E. angustifolium</i> , 500 mg/kg)	56.7±1.89	61

The gastroprotective effect of the studied plant was confirmed by a statistically significant decrease in the number of animals with ulcers in test group. So, in the control group, pre-treated with a 7-day course water purified,

founded damage of the mucous membrane of all rats, in the standard group 87.5% of animals were affected, in the experimental group - 75% (table 3).

**Table 3. -Anti-ulcer activity of preventively introduction of *E. angustifolium* herb (500 mg/kg)**

Group	Animals with ulcers (%)	Integral index	Anti-ulcer activity
Control group (purified water)	100%	10,13	-
Standard group ("Plantagluclid", 500 mg/kg)	87,5%	4,92	2,06
Test group ( <i>E. angustifolium</i> , 500 mg/kg)	75%	3,19	3,18

The results obtained showed that the course application has a positive result. The anti-ulcer activity of the studied extract of *E. angustifolium* was 3.18, which exceeds the results of the standard group, where the animals received "Plantagluclid". The analysis of the composition of biologically active compounds of *E. angustifolium* herb supposes that substances of polyphenolic nature (tannins, flavonoids, phenolic acids) cause gastroprotective activity. This group of compounds stabilizes mast cells, helping to maintain an optimal level of microcirculation in damaged tissues, reduces the production of histamine and weakens the damaging effect of ulcerogen [12]. In previous studies, we established a pronounced anti-inflammatory effect of the herb *E. angustifolium* in an *in vivo* experiment on a model of carrageenan inflammation [13]. In case of peptic ulcer the activity of the enzyme and non-enzyme antioxidant systems decreases, resulting in a weakening of the antioxidant defense and an increase in the processes of lipid peroxidation. Biological oxidati-

on reactions lead to the formation of free radicals, which have a high chemical activity. They react with unsaturated fatty acids of the membranes, disrupting their structure [14]. In previous studies, we found that studied plant has a pronounced antioxidant activity and the content of phenolic compounds is directly proportional to the degree of inhibition of free radicals [15].

### CONCLUSIONS

The medicinal plant raw materials with anti-inflammatory and antioxidant activity can be used in case of gastric ulcer disease. Experimental data characterize the decoction of herb *E. angustifolium* at dose of 500 mg/kg as an effective gastroprotective agent. Biologically active compounds of studied plant are mainly substances of a polyphenolic nature, which have an anti-inflammatory and wound-healing effect due to the inhibitory effect on prostaglandin synthetase and lipoxygenase.

## REFERENCES

1. Fadeev P. A. Ulcer disease. Moscow: Onyx LLC, Mir iobrazovanie, 2009, p. 128.
2. Ivashkin V. T., Sheptulin A. A., Baranskaya E. K., Trukhmanov A. S., Lapina T. L. Ulcer disease. Recommendations of the Russian Gastroenterological Association for diagnosis and treatment. Moscow: OOO Tipografiya „Pi kvadrat”, 2013, p. 20.
3. Sambukova Tatyana, Ovchinnikov Boris, Ganapol'sky-Vyacheslav, Yatmanov Alexei, Shabanov Petr. (2017). Prospects for phytopreparations (botanicals) use in modern pharmacology. Reviews on Clinical Pharmacology and Drug Therapy. 15. 56-63. 10.17816/RCF15256-63.
4. Karomatov, I. D. Kipreyuzkolisty, Ivan-chai / I. D. Karomatov, N. I. Turaeva // Biology and integrative medicine. - 2016. - No. 6. - pp. 160-169.
5. State Pharmacopoeia of the Republic of Belarus: 2 t / Min. of Health of. Rep. of Belarus, UE "Center for Expertise and Testing in Health Care" / under total. ed. S. I. Marchenko. - 2nd ed. - Molodechno, 2016. - T. 2. - P. 1368.
6. TCP 125-2008 (02040) Good Laboratory Practice (GLP) Guidelines for Conducting Preclinical Drug Trials. Part 1 / A. N. Mironov [et al.]- M.: Grif and K, 2012 - - 944 p.
7. Moghadamtousi SZ, Rouhollahi E, Karimian H, Fadaeinasab M, Abdulla MA, Kadir HA. Gastroprotective activity of *Annona muricata* leaves against ethanol-induced gastric injury in rats via Hsp70/Bax involvement. Drug Des DevelTher. 2014 Oct 28; 8:2099-110. doi: 10.2147/DDDT.S70096. PMID: 25378912; PMCID: PMC4218895.
8. Mamonova N. V., Zotova A.V., Yegorkina A. A. Anti-ulcer activity of complex collection of medicinal plants. Medical ecology. The science. 2009. No. 4-5. - p. 119-124.
9. Klimentova D. A. Anti-ulcer properties of the infusion of the aboveground part of *Fragaria vesca* (Rosaceae) / D. A. Klimentova, S. G. Aksinenko, A.V. Gorbacheva et al. // Rast. resources. - 2005. - T. 41, issue 2. - pp. 129-134.
10. Lorenz Samira Elshadovna, Zharikov Alexander Yuryevich, Bobrov Igor Petrovich, Mazko Olesya Nikolaevna, Makarova Olesya Gennadyevna, and Kiselev Valery Ivanovich. „Gastroprotective effect of a peptide complex from pig kidney tissues in experimental „indomethacin” ulcer in rats „ Siberian Scientific Medical Journal, vol. 37, No. 6, 2017, pp. 5-9.
11. Churin B. V. Digestive motility of the stomach and small intestine in patients with ulcerative disease / B. V. Churin // Klin. med. - 1996. - Vol. 74, No. 6. - p. 23-27.
12. Zueva E. P., Reichart D. V., Krylova S. G., etc. Medicinal plants in the treatment of gastric ulcer and duodenal ulcer. Tomsk: TSU Publishing House, 2003. 212 p.
13. Sheuchuk S.V. Anti-inflammatory activity of the herb *kipreyauzkolistnogo*/ S. V. Sheuchuk, N. S. Gurina / / BSMU in avangard of medical science and practice. -2020. - No. 10. - pp. 460-463.
14. Zvershkhankovskiy F. A., Vainshtein S. G. Free radical lipid oxidation and antioxidant systems in the pathogenesis of gastroduodenal ulceration. case. 1987. 9: 42-45.
15. Sheuchuk S. V. Antioxidant activity of the grass of narrow-leaved cypress (*ivan-tea*) / S. V. Sheuchuk, N. S. Gurina // Medical Journal-2021. - No.1. - pp. 116-120.