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INFLUENCE OF DRY EXTRACT OF BRASSICA OLEARACEA ON THE MORPHOLOGICAL STRUCTURE OF THE GASTRIC MUCOSA OF RATS DURING AN EXPERIMENTAL ULCER CAUSED BY ALCOHOL-PREDNISOLONE MIXTURE

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Мета – дослідження впливу сухого екстракту капусти городньої на морфологічний стан слизової оболонки шлунка щурів на тлі експериментального спирто-преднізолонного виразкового ураження.

Матеріали і методи. Виразкове ураження слизової оболонки шлунка білих нелінійних щурів відтворювали за допомогою внутрішньошлункового введення суміші 80% етилового спирту і преднізолону 20 мг/кг з розрахунку 0,6 мл на 100 г маси тіла. Сухий екстракт капусти городньої в дозах 30, 40, 50 і 60 мг/кг та препарат порівняння альтан у дозі 1 мг/кг вводили внутрішньошлунково у лікувально-профілактичному режимі: щодня одноразово протягом 3 днів до моделювання патології, у день введення спирто-преднізолонної суміші та наступного дня наприкінці експерименту. Гістологічно досліджували слизову оболонку фундального та пілоричного відділів шлунка. Проводили напівкількісну оцінку стану слизової оболонки за наявністю деструктивних змін у межах всього мікропрепарату, гемокапілярних розладів, набряку стромы слизової оболонки та потужністю мукоїдної секреції слизоутворюючими клітинами покривно-ямкового епітелію поза зон деструкцій за виразністю ШИК-реакції.

Результати. Введення спирто-преднізолонної суміші щурам призводило до виникнення виразного гострого виразково-ерозивного процесу у різних ділянках слизової оболонки шлунка, який супроводжувався значними гемокапілярними розладами та набряком стромы. У більшості випадків виразки розповсюджувалися на всю глибину або більшу частину залозистих трубок. На ділянках поза зон деструкцій, спостерігали зниження мукоїдної секреції клітинами покривно-ямкового епітелію, додатковими клітинами власних залоз, залозистими клітинами пілоричних залоз, стимуляцію продукції пепсину, посилення кислотоутворення. Сухий екстракт капусти городньої зменшував виразність гострого виразково-ерозивного процесу та гемокапілярних розладів і набряку, відбувалося обмеження зон деструкцій, стабілізувалися процеси мукоїдного синтезу, децю зменшувалася виразність пепсино- і кислотоутворення. Дані експерименту свідчать про виражені гастропротекторні властивості сухого екстракту капусти городньої, найбільш виразний позитивний ефект встановлено у дозі 50 мг/кг

Висновки. За виразністю гастропротекторної дії сухий екстракт капусти городньої переважав вітчизняний рослинний препарат порівняння альтан у дозі 1 мг/кг. Отримані результати свідчать про перспективність подальшого експериментального дослідження фармакологічних властивостей сухого екстракту капусти городньої з метою створення ефективного противиразкового фітосабору

Ключові слова: виразкова хвороба шлунка та дванадцятипалої кишки, спирто-преднізолонна виразка, сухий екстракт капусти городньої, слизова оболонка шлунку, гістологічне дослідження

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1. Introduction

Nowadays, throughout the world, including in Ukraine, ulcerative pathologies of the gastrointestinal tract remain one of the urgent problems of health protection. According to statistics, gastric ulcer and duodenal ulcer is from 10 to 20% of the adult population [1]. In Ukraine, gastric ulcer takes the second place (after chronic gastritis and duodenitis) among all diseases of the digestive organs and predominantly affects people of young and middle, most working age, which indicates the high social importance of treating this disease [2].

2. Statement of the problem in general, the relevance of the topic and its connection with important scientific and practical issues

Peptic ulcer is a chronic recurrent disease, characterized by complex multi-factor etiology and patho-

genesis, a long and severe course, frequent complications and involvement of other digestive organs in the pathological process [1]. Currently, the formation of a gastroduodenal ulcer is considered as the result of a massive impact of a complex of various factors of general and local order, which are ultimately implemented due to an imbalance between the aggression factors (hydrochloric acid, pepsin, bile acids, H. pylori infection) and the state of mucosal protective elements membranes (mucous-bicarbonate barrier, epithelial hydrophobicity, proper blood supply, epithelial cell regeneration, production of secretory immunoglobulin A and prostaglandins and other mediators) [3].

The complexity of etiology and pathogenesis, a variety of clinical manifestations of peptic ulcer disease necessitate a complex therapy, which allows you to act simultaneously on different mechanisms of the onset and development of peptic ulcer [4].

3. Analysis of recent research and publications in which the solution of this problem is initiated and on which the author relies

Modern therapy of peptic ulcer is complex and includes eradication anti-helicobacter therapy, long-term antisecretory therapy, the use of antacid and gastroprotective drugs, agents that improve reparative processes, normalizes the motor function of the stomach and antispasmodics [4, 5]. Along with standard drugs in the complex treatment regimen of ulcers, medicinal plants are prescribed, which, due to their anti-inflammatory, anesthetic, antisecretory, antispasmodic, reparative, enveloping, astringent, antioxidant properties, have a pronounced anti-ulcer effect [6, 7].

4. Isolation of previously unsolved parts of the general problem to which the article is devoted

The cabbage (*Brassica oleracea* L.), which has many years of experience in traditional medicine, is one of the promising plants for the creation of a prophylactic preparation. The raw material base of this plant in Ukraine is a large, rich complex of biologically active substances that make up its composition indicate the relevance of the search and development of a new herbal medicine for the treatment of gastric ulcers based on garden cabbage.

Our previous studies have established that the dry extract of cabbage garden, developed at the National University of Pharmacy, has a pronounced anti-ulcer effect on the model of acute alcohol-prednisolone gastric ulcer in rats, enhances the motor-evacuation function of the intestine and does not change the indices of gastric secretory activity [8–10].

The foregoing has served as a rationale for studying the protective properties of the dry extract of cabbage garden on the gastric mucosa with alcohol-prednisolone ulcer.

5. The formulation of the goals and objectives of the study

The aim of this work was to study the effect of dry cabbage extract on the morphological state of the gastric mucosa of rats on the background of an experimental alcohol-prednisolone ulcer.

6. Presentation of the main material (methods and objects) with the rationale for the results

Ulcerative lesions of the gastric mucosa were reproduced using a mixture of ethyl alcohol and prednisolone [11]. This model relates to acute experimental ulcerative pathology, which develops rapidly, is distinguished by high reproducibility, short duration and compliance with some elements of the pathogenesis of gastric ulcer in humans.

Studies were conducted on non-linear white rats of both sexes weighing 180–220 g, which were kept in standard vivarium conditions of the Central Research Laboratory of the National University of Pharmacy at a temperature of 22±1 °C, humidity of 50–60 %, in a room with a change in light mode “day-night”.

For 24 hours, animals were kept on hunger with free access to water. Then the rats were administered intragastrically through a metal probe a mixture of pred-

nisolone at a dose of 20 mg/kg and 80 % ethanol at the rate of 0.6 ml per 100 g of rat body weight.

Experimental animals were divided into groups: the first - intact control; the second is control pathology; 3–7th groups – animals with stomach ulcers, which were intragastrically injected with dry cabbage extract in doses of 30, 40, 50 and 60 mg/kg and the reference drug Altan (Altan, table. film-coated sheath, 10 mg, PJSC SIC “Borshchahivskiy CPP”) at a dose of 1 mg/kg in the treatment and prophylactic regimen: daily for 3 days before the pathology simulation, on the day of the introduction of the alcohol-prednisolone mixture and the next day at the end of the experiment. Distilled water was used as a solvent for the studied substances.

24 hours after the modeling of the ulcerative lesion, animals of all groups were removed from the experiment, the stomachs were removed, they were washed with physiological saline and their microscopic examination was performed.

The mucosa of the fundal and pyloric parts of the gastric mucosa was examined.

Samples of the gastric mucosa, which were taken from experimental and control rats from the same areas of topography of the stomach, were fixed in 10% formalin solution, dehydrated in alcohols of increasing strength, embedded in paraffin. For review microscopy, sections were stained with hematoxylin and eosin. In addition, a Schick reaction was performed according to MacManus (detection of neutral mucopolysaccharides to determine the synthesis of mucoid secretion by mucus-forming elements of the stomach [12, 13]. Microscopic examination of microscopic preparations was carried out on a Granum microscope, and a Granum DSM 310 digital video camera was used. The photos were processed on a computer Pentium 2.4GHz using Toup View.

For ease of comparison of the results obtained, a semi-quantitative assessment of the state of the mucous membrane was carried out according to the following indicators:

1. The presence of destructive changes within the whole microdrug:

- 0 points – no damage;
- 0.5 points - surface erosion with damage only to the epithelium;
- 1 point – superficial erosion with damage to the pathogenic epithelium;
- 2 points - single ulcers, with a depth of lesion of the glandular tubes not more than $\frac{1}{3}$ of their length;
- 3 points – ulcers with a depth of lesion of the glandular tubes to their length;
- 4 points - ulcers with a total lesion of the glandular tubes.

2. Hemocapillary disorders:

- 0 points – no disorders;
- 1 point – moderate focal fullness of capillaries of the superficial zones of the mucous membrane;
- 2 points – expressive focal fullness of capillaries of the superficial zones of the mucous membrane;
- 3 points – diffuse plethora of capillaries of the superficial zones of the mucous membrane, erythrocyte stasis;

4 points – expressive expansion and fullness of blood vessels of different caliber, hemorrhage.

3. *Swelling of the stroma of the mucous membrane:*

- 0 points – no sign;
- 1 point – weak focal character;
- 2 points – moderate focal character;
- 3 points – expressive focal or diffuse character;

4. *The power of mucoïd secretion of mucus-forming cells of the pathogenic epithelium outside the zones of destruction by the expressiveness of the CHIC reaction:*

- 0 points – no staining;
- 1 point – weak staining;
- 2 points – moderate color;
- 3 points – expressive coloring;

To obtain statistical conclusions, analysis of variance was used (Kruskal-Wallis criterion); when comparing samples, the Man-Whitney criterion was used with a probability level of $p \leq 0.05$ [14–16]. For statistical processing we used the program Statistica 6.0. The results in the tables are given in E (LQ; UQ).

According to the results of microscopic examination in intact rats, the surface of the mucous membrane of the fundus of the stomach is covered with a single-layer cubic or cylindrical epithelium, which allocates a lot of mucous secretion. The gastric pits (microscopic surface grooves) are shallow. Own (fundal) glands of the stomach tightly arranged, long. Three types of cells are differentiated in the glandular tubes: mucous membranes (additional), parietal and main cells. Mucous cells are mainly found in the initial part of the glands, near the neck, they secrete mucus, similar to the cells of the epithelium. Parietal cells prevail in number over other glandular cells, spread over 2/3 of the gland bodies, their cytoplasm is clearly oxyphilic. They are involved in the production of hydrochloric acid. In the end sections of the glandular tubes, the main cells predominate. The secretory zone is well expressed in them, the cytoplasm has a basophilic staining. The main role of these cells is the synthesis of pepsinogen granules, the proenzyme of the main enzyme of the gastric juice, pepsin. In all animals, the territorial location of the glandular cells is not disturbed, the lumen of the glandular tubes is normal, visually the secretory activity of all these cells is within the normal range. The stroma of the mucous membrane contains a moderate number of lymphocytes and eosinophilic cells. When staging a PAS-reaction in the apical portions of the surface epithelium cells, cytoplasm of the fossa epithelium cells and mucous cells of the glandular tubes, a significant amount of neutral mucopolysaccharides was found (Fig. 1).

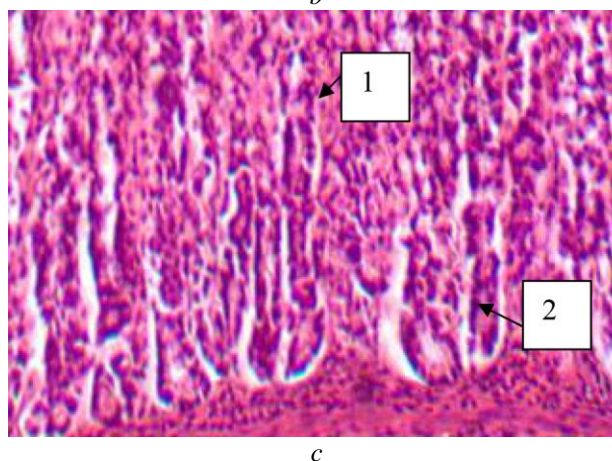
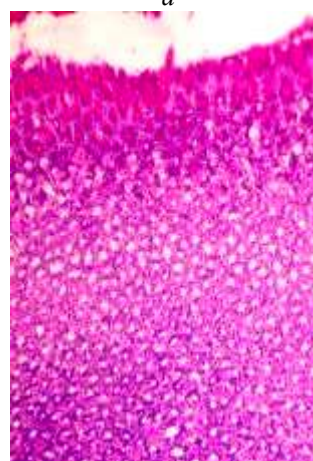
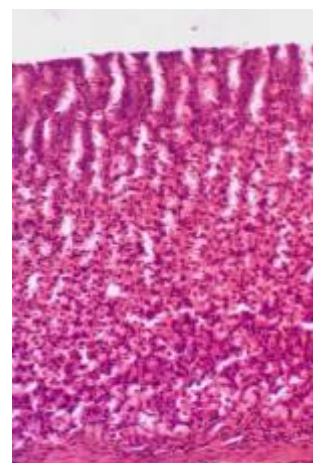


Fig. 1. Fundamental portion of the stomach of intact rats: *a* – normal state of the covering-patchy epithelium, glandular cells of the mucous membrane glands (hematoxylin-eosin, $\times 100$); *b* – significant content of PAS-positive material in mucus-forming cells (PAS-reaction, $\times 400$); *c* – normal functional state parietal (1) and major (2) cells of their own glands. Haematoxylin-eosin. $\times 400$

Between the zone of the bottom and the pyloric area, the prepyloric zone is isolated, in which the so-called intermediary glands are located. In their structure, they resemble both their own and pyloric glands.

The cellular elements in the intermediary glands are in a different quantitative relationship than their own: additional cells are contained not only in the surface section of the glandular tube, but descend to the basal

section, their cytoplasm is rich in PAS -positive material (draw. 2). The main cells are significantly reduced, the parietal cells are basically the same location as in their own glands (Fig. 2).

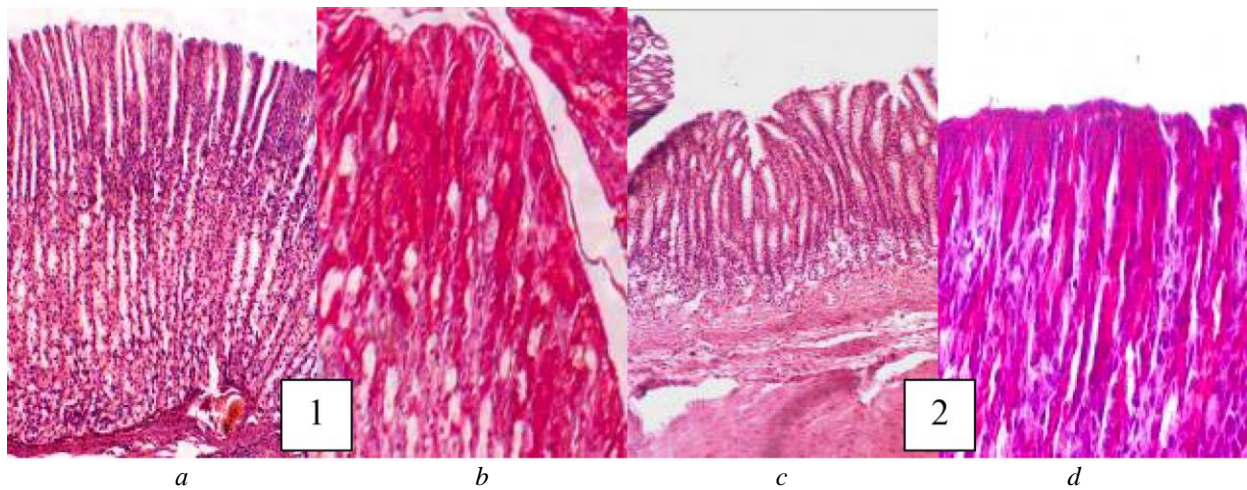


Fig. 2. The prepyloric part of the stomach of intact rats 1: *a* – the state of the cellular elements in the intermediary glands corresponds to the normal (haematoxylin-eosin, $\times 200$), *b* – sufficient PAS-positive reaction in secretory cells. The pyloric portion of the stomach of intact rats 2: *c* – integumentary-epithelium, cells of the pyloric glands of the mucous membrane unchanged; *d* – expressive PAS-positive reaction in secretory cells (PAS-reaction, $\times 250$, $\times 400$)

In the pyloric stomach surface epithelium is higher, the gastric pits are deeper and broader. Pyloric glands are located quite loose, connective tissue layer between them more expressive. The glandular tube is lined by a single layer of cells, the cytoplasm which clearly PAS - positive, indicating a significant content of mucoid secretions (Fig. 2).

The state of the microcirculatory bed in all studied sections of the stomach were without features. The muscular plate of the mucous membrane is not changed. Submucosal shell relatively wide, consisted of loose connective tissue containing blood vessels normal.

After the introduction of alcohol-prednisolone mixture on the microscope slide in all rats was discovered to have acute erosive-ulcerous lesions of the mucous membrane in all studied areas of the stomach. Ulcerative defects of different rats varied in size. The defect is usually extended to the entire depth of the mucous membrane, crater defect filled with necrotic mass, and cell detritus. Sometimes, apparently due to broken blood vessels and capillaries among necrotic masses seen basophilic homogeneous accumulation - deposition of hydrochloric acid haematin (Fig. 3).

Single defects reached $\frac{1}{2}$ - $\frac{2}{3}$ the length of the glands. Under such defects, basal sections of ferriferous tubes are seen, in which the linearity of the location is often disturbed, and cell dissociation and necrobiosis are noted (Fig. 4). In addition to acute ulcers in most rats, so-called surface erosion has been traced, most of which have al-

ready been formed: they are characterized by desquamation and necrobiosis of epithelial integumentary cells and cells of the gastric fossae, stroma exposure (Fig. 4, *d*).

In areas of the mucous membrane of the fundal and prepyloric (especially) sections outside the ulcers, the cytoplasm of a part of the parietal cells is vacuolized, enlightened (Fig. 5, *a*).

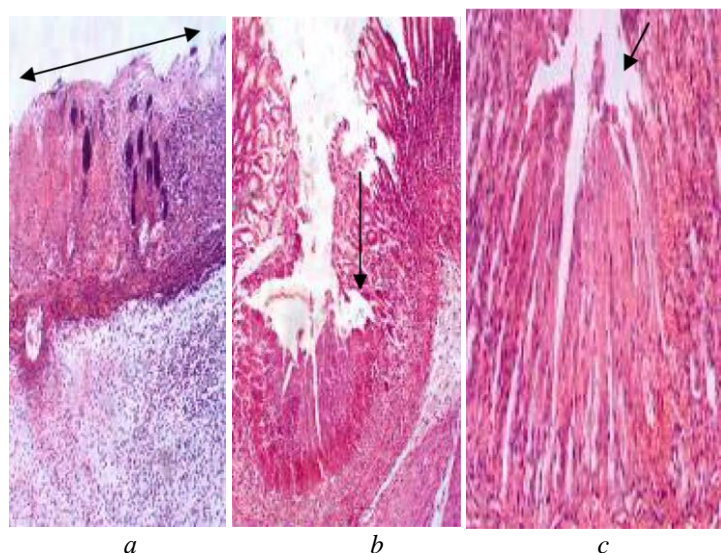


Fig. 3. The stomach of rats, which were introduced alcohol-prednisolone mixture. The ulcer defect in the: *a* – fundal; *b* – pyloric; *c* – prepyloric parts is spread over the entire depth of the mucous membrane. Haematoxylin-eosin. $\times 100$

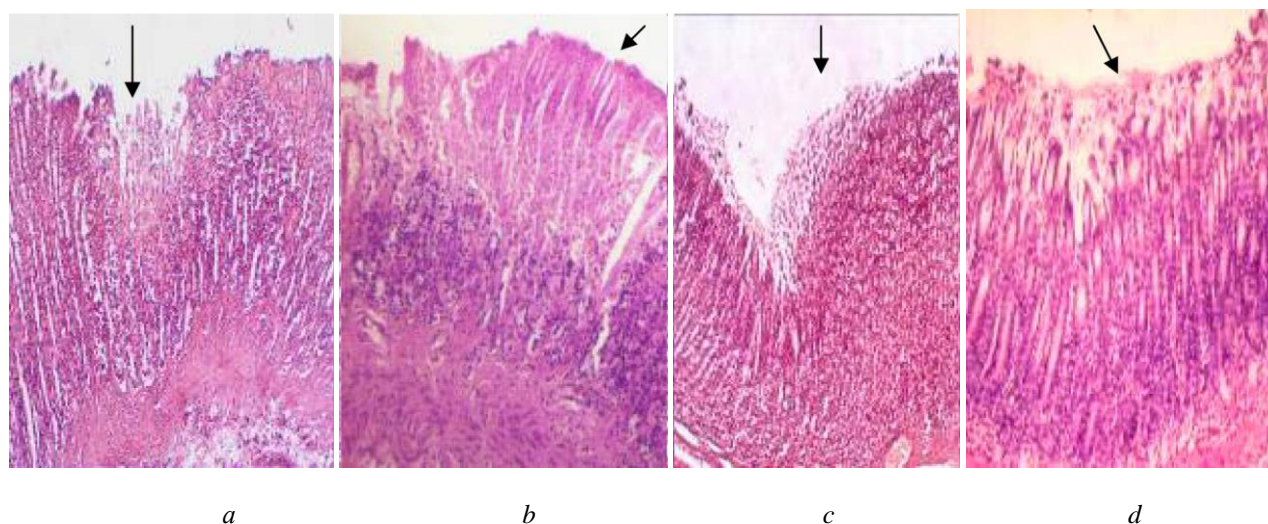


Fig. 4. The stomach of rats, which were introduced alcohol-prednisolone mixture. Ulcerative defect in: *a* – fundal; *b* – pyloric parts, surface erosion with necrobiosis of integumentary and dimpled cells in the: *c* – prepyloric; *d* – pyloric parts spread $\frac{1}{2}$ the length of the glandular tubes. Haematoxylin-eosin. $\times 100$, $\times 200$

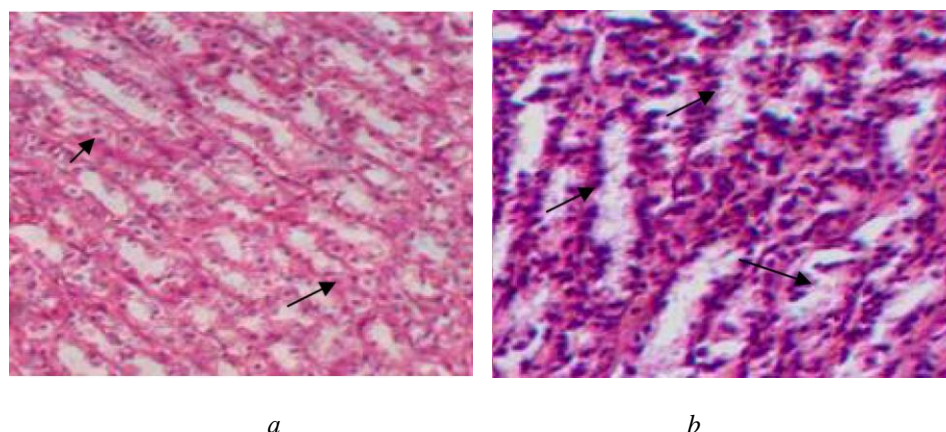


Fig. 5. The stomach of the rat, which was injected alcohol-prednisolone mixture: *a* – vacuolization of the cytoplasm of the parietal cells of the prepyloric part; *b* – expansion of the lumen of the basal divisions of its own glands, reduction of the secretory zone and basophilia of the cytoplasm of the main cells, residues of secretion in the lumen. Haematoxylin-eosin. $\times 250$, $\times 400$

In the main cells, the cytoplasm is significantly less basophilic, the lumen of the glandular tube is enlarged, the remnants of the secret are seen in the lumen, and the secretory zone of the cells is narrowed – a rapid leaching of the secret from the cytoplasm (Fig. 5, *b*).

A similar state of the main and parietal cells morphologically reflects a certain increase in the functional activity of the parietal and main cells, that is, acid production and ulcer activity [17].

Mucosa-forming cells of the mucous membrane (epithelium and patchy epithelium, additional cells of the intrinsic and intermediary glands, cells of the pyloric glands) are visually reduced in size (sometimes flattening),

the secretory zone of the cytoplasm is also reduced, depleted of PAS-positive secret (Fig. 6).

That is, the digestive capacity of the gastric juice increased while reducing the process of mucoid synthesis, and, as a result, the protective effect of mucus.

Subepithelially in the stroma of various parts of the mucous membrane are often seen varying severity of swelling, sharply stretched blood capillaries filled with red blood cells in a state of stasis, often diapedesis hemorrhages (Fig. 7). The vessels of the submucosal layer were often in a state of paralytic damage and significant blood supply, the submucosal layer itself was clearly swollen in the zone of direct lesion of the mucous membrane.

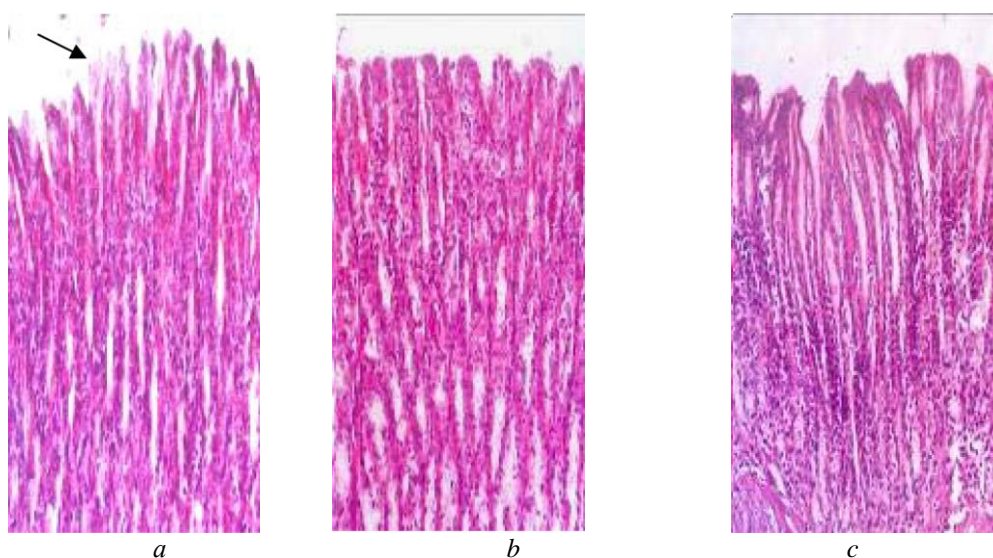


Fig. 6. The stomach of rats, which were introduced alcohol-prednisolone mixture. The distinct depletion of the cytoplasm of mucous-forming cells of the mucous membrane of the: *a* – fundal; *b* – the prepyloric; *c* – the pyloric parts of the PAS-positive material. PAS-reaction. $\times 200$

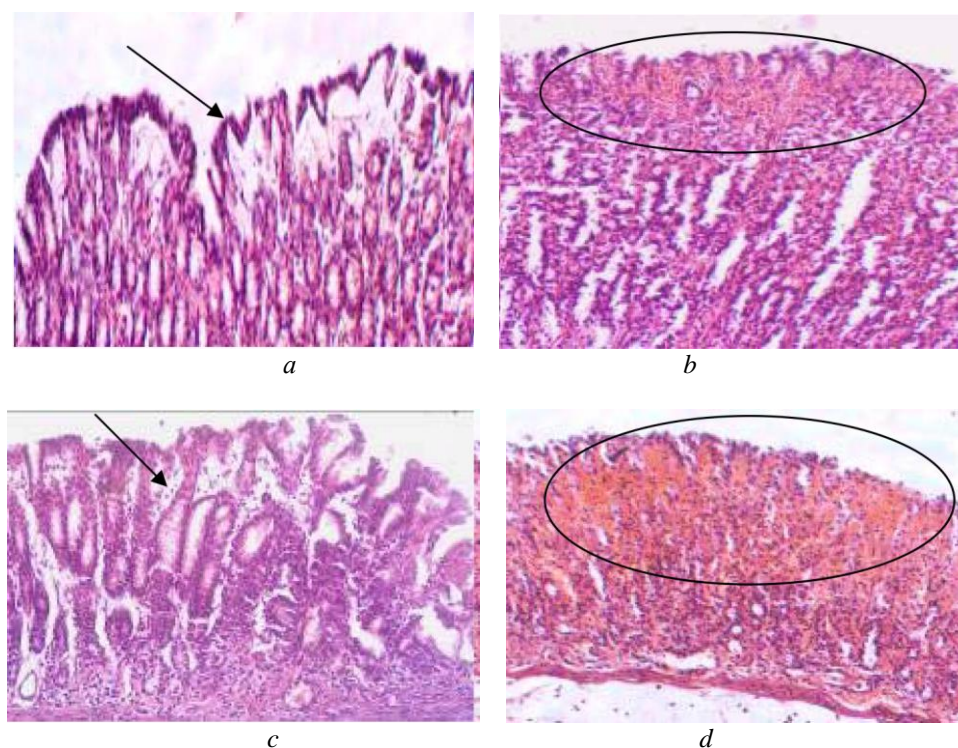


Fig. 7. The stomach of the rats, which were injected alcohol-prednisolone mixture. Stromal edema and pronounced full-blooded of the capillary network stasis of erythrocytes, bleeding in: *a, b* – fundal; *c, d* – pyloric parts. Hematoxylin-eosin. $\times 100$

Prophylactic and therapeutic administration of dry cabbage extract on the background of an alcohol-prednisolone mixture positively affected the histological condition of the gastric mucosa of rats. At the same time, the severity of the effect depended on the dose of dry cabbage extract. Thus, according to the administered doses, the pathological process on microscopic preparations was followed up: 30 mg/kg in 60 %, 40 mg/kg in 50 %, 50 mg/kg and 60 mg/kg in 20 % of animals.

With an increase in the dose of the studied dry extract of cabbage, not only the proportion of rats with

pathology, but also the severity of the pathology itself was reduced.

In rats receiving the extract at a dose of 30 mg/kg, in general, a few acute ulcers spread in most cases to the entire depth of the mucous membrane; surface erosion, which is quite widespread in length, also occurred (Fig. 8). After the introduction of dry cabbage extract at a dose of 40 mg/kg, the depth of the ulcers did not exceed $\frac{1}{2}$ - $\frac{1}{3}$ the length of the glandular tubes, the safety of the remaining basal gland fragments was higher than in the control pathology group. The presence and extent of surface erosion was reduced (Fig. 8).

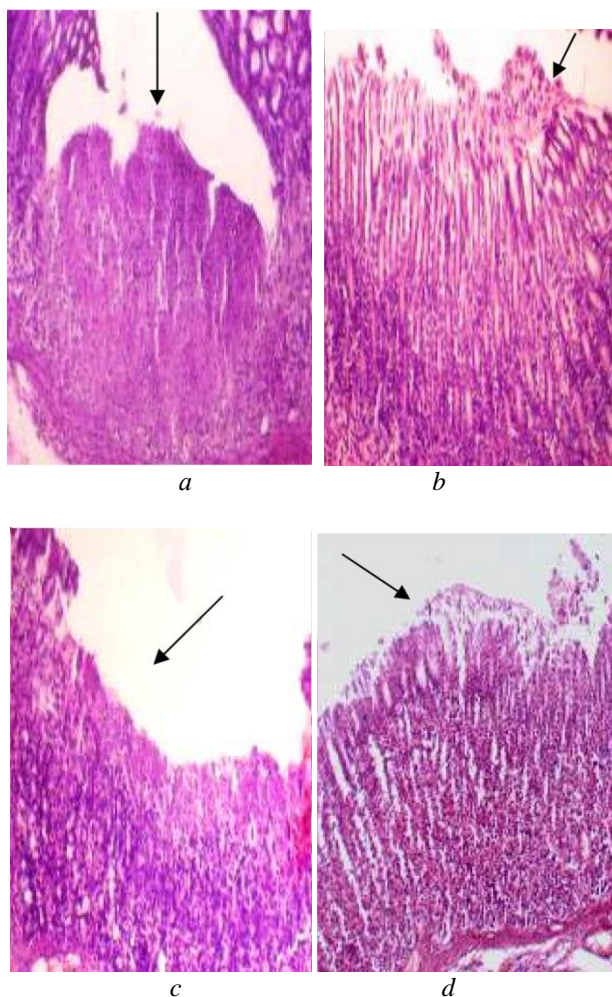


Fig. 8. The stomach of rats injected with dry cabbage extract at a dose of 30 mg/kg (a, b) and 40 mg/kg (c, d) against the background of an alcohol-prednisolone mixture: *a* – the ulcer defect is spread to the entire depth of the mucous membrane of the prepyloric section; *b* – formed surface erosion in the fundal; *c* – the depth of the ulcer does not exceed $\frac{1}{2}$ the length of the glands; *d* – moderate surface erosion in the state of formation in the prepyloric part. Haematoxylin-eosin. $\times 100$

Subject to the introduction of dry cabbage extract in doses of 50 and 60 mg/kg, all the microsamples of the stomach had only a different severity of surface mucosal erosion (Fig. 9). In most cases, destructive changes were observed only in the prepyloric zone of the stomach.

Outside the zones of destruction, the morphological state of the parietal and main cells of the intrinsic and intermediary glands was close to the intact control (Fig. 10).

Hemodynamic disorders and stromal edema of the mucous membrane in all animals are clearly reduced, only in some rats to which dry extract of cabbage was administered at a dose of 30 mg / kg, there were observed small individual areas with expansion of part of the subepithelial capillaries without signs of pronounced congestion (Fig. 10).

In general, with an increase in the dose of the extract against the background of the introduction of an alcohol-prednisolone mixture, a larger volume of the mucous

membrane on microscopic specimens had a histological structure typical of the studied zone (Fig. 11).

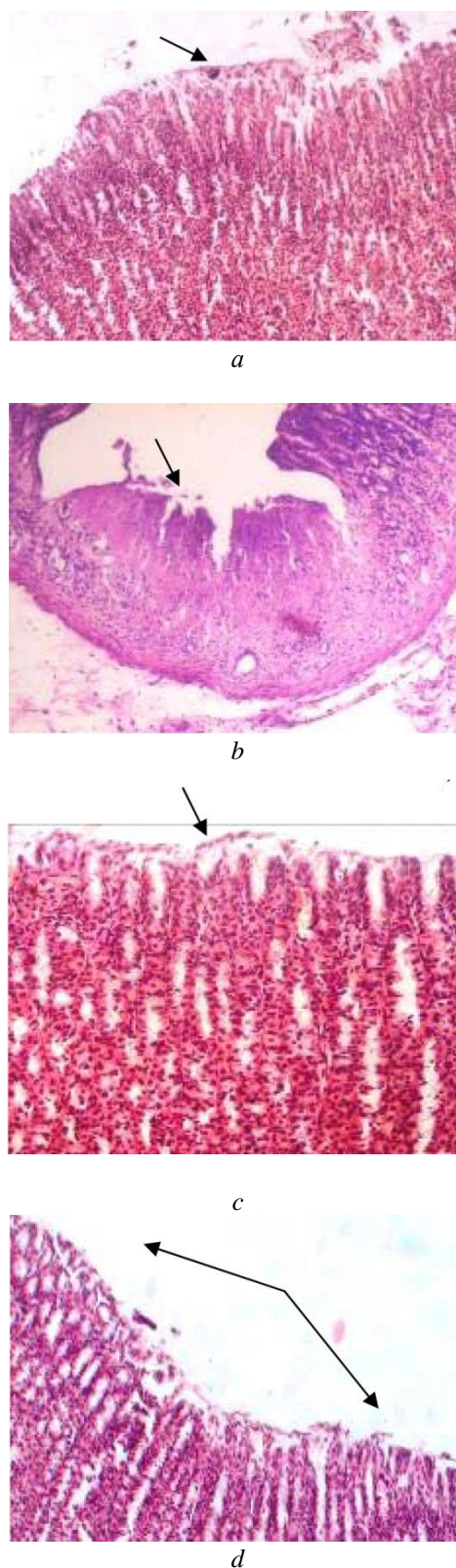


Fig. 9. The stomach of rats injected with dry cabbage extract at a dose of: *a, b* – 50 mg/kg; *c, d* – 60 mg/kg on the background of an alcohol-prednisolone mixture. Surface erosion of various stages of formation (*a, b, d*), ulcerative defect (*c*) of the prepyloric part. Haematoxylin-eosin. $\times 100, \times 200$

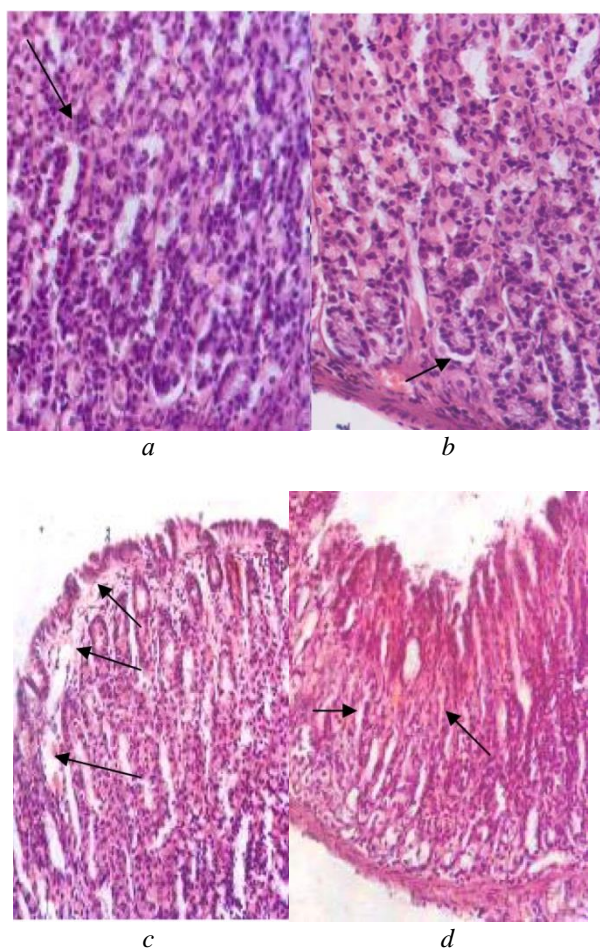


Fig. 10. The stomach of rats injected with dry extract of cabbage at a dose of: *a* – 40 mg/kg; *b* – 50 mg/kg; *c, d* – 30 mg/kg against the background of an alcohol-prednisolone mixture. The state of the main and parietal cells, the lumen of the glandular tubes corresponds to the normal; expansion of subepithelial capillaries without signs of expressive plethora in the prepyloric (*c*) and pyloric (*d*) parts. Haematoxylin-eosin. $\times 200$

Power mucoid synthesis cells cover-pit epithelium, additional cells of their own and intermediary glands, cells of the pyloric glands are distinctly enlarged in comparison with the control conditions and did not differ significantly between the groups (Fig. 12).

Altan also reduced the severity of erosive damage to the mucosa of the stomach. Acute ulcer was detected in 20% of rats in prepyloric area, the defect extended to the entire depth of the mucosa. Yet 40% of the rats observed various intensities of surface erosion in prepyloric and pyloric parts (Fig. 13).

The areas which damage the structure of the mucosa in many areas of conventional (Fig. 14, *a*). However noted focal stromal edema in the majority of rats (Fig. 14, *b*) and hemocapillary disorders in the form of pronounced plethora of capillaries and small hemorrhages with disruption of the structure of the glands (Fig. 14, *c, d*).

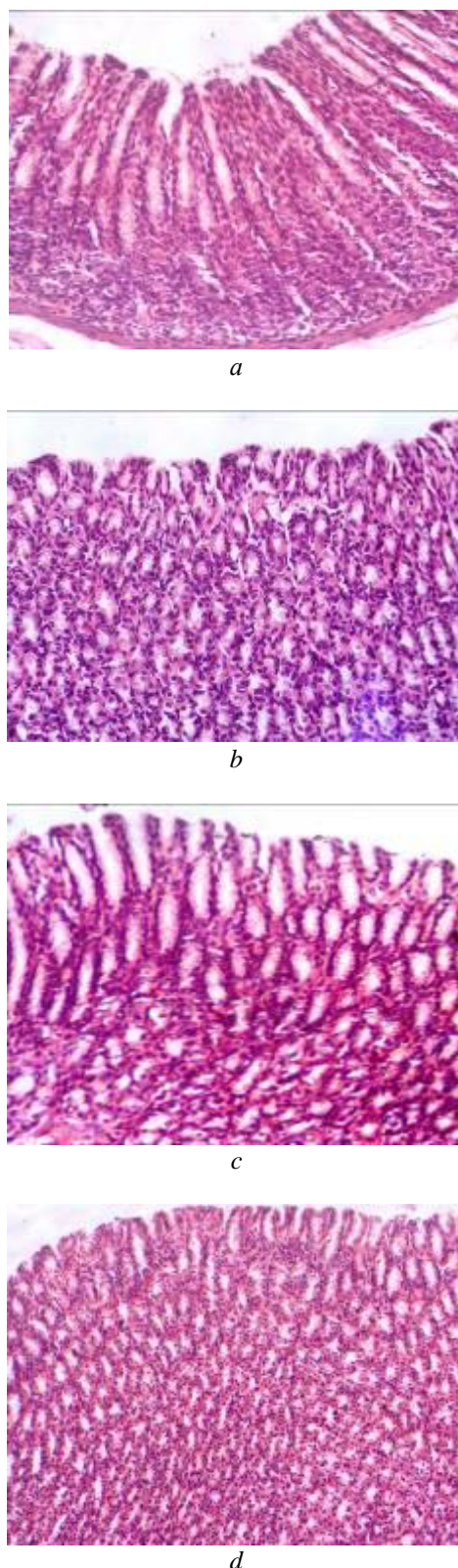


Fig. 11. The stomach of rats injected with dry cabbage extract at a dose of: *a* – 30 mg/kg; *b* – 40 mg/kg; *c* – 50 mg/kg; *d* – 60 mg/kg on the background of an alcohol-prednisolone mixture. The normal state of different parts of the mucous membrane: pyloric (*a*), prepyloric (*b*), fundal (*d*). Haematoxylin-eosin. $\times 200$.

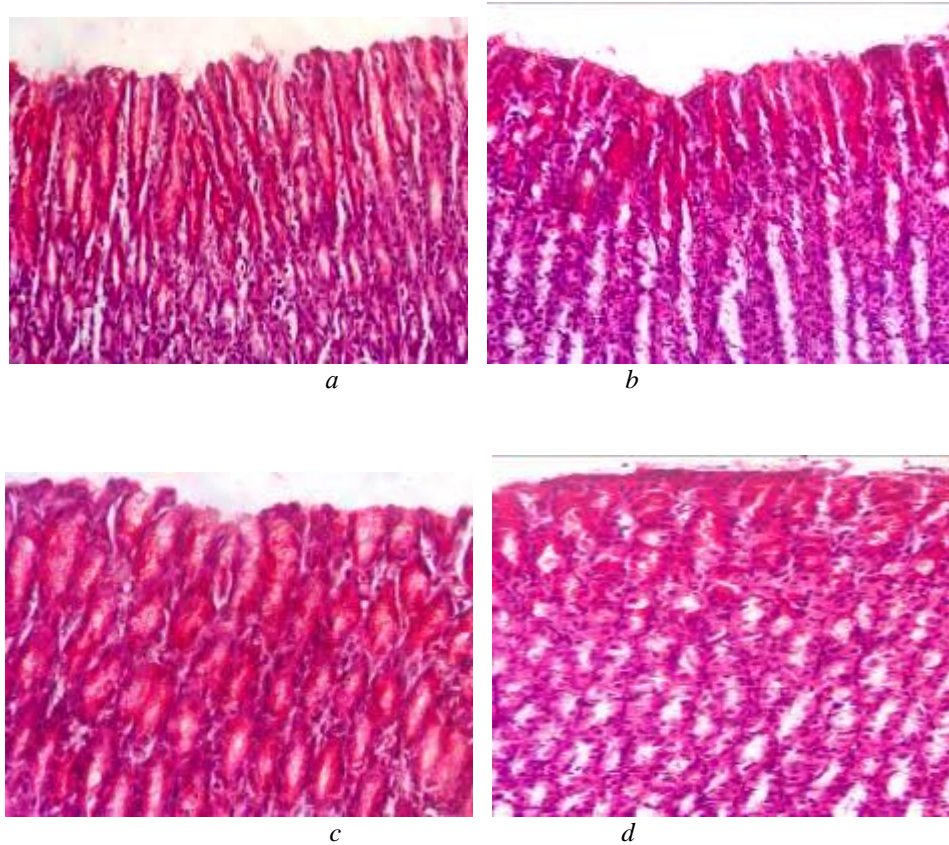


Fig. 12. The stomach of rats injected with dry extract of cabbage at a dose of: *a* – 30 mg/kg; *b* – 40 mg/kg; *c* – 50 mg/kg; *d* – 60 mg/kg on the background of an alcohol-prednisolone mixture. A distinct increase in the intensity of the PAS-reaction in mucus-forming cells of various parts of the mucous membrane. PAS-reaction. $\times 200$

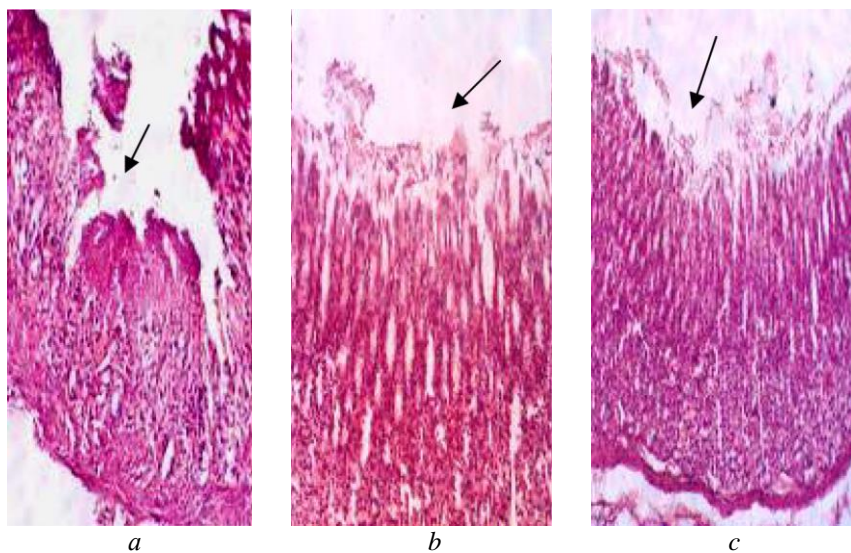


Fig. 13. The stomach of rats with administered Altan at a dose of 1 mg/kg on the background of an alcohol-prednisolone mixture: *a* – acute ulcer in the prepyloric section; extensive surface erosion in various parts of the mucous membrane (*b* – prepyloric, *c* – pyloric). Haematoxylin-eosin. $\times 200$

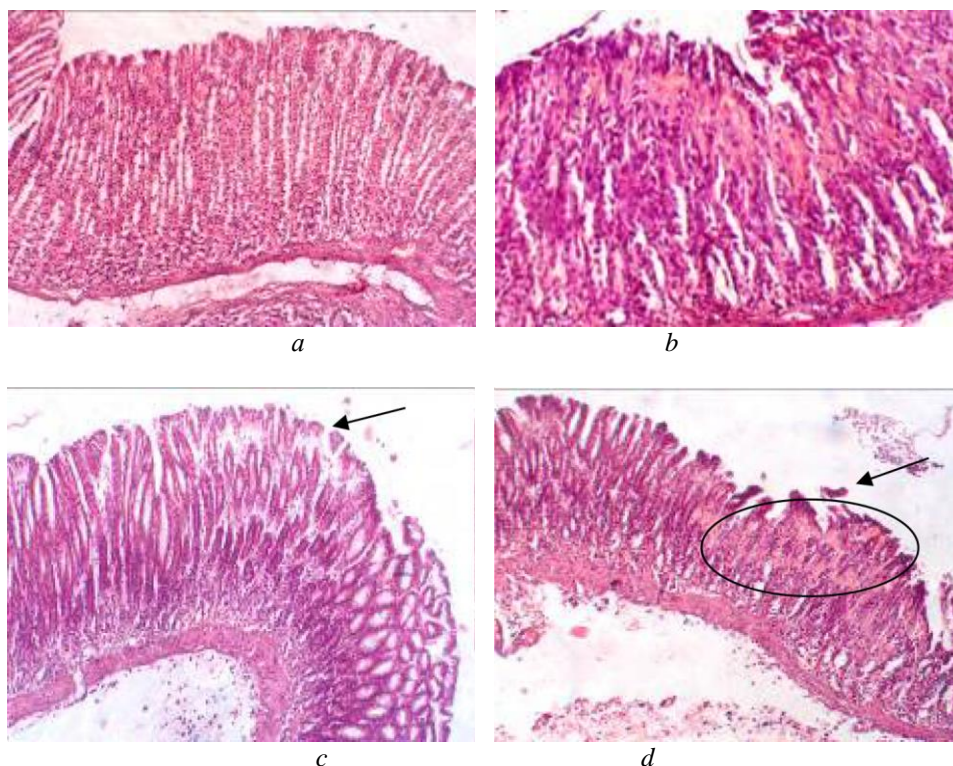


Fig. 14. The stomach of rats with administered Altan at a dose of 1 mg/kg on the background of an alcohol-prednisolone mixture: *a* – normal histostructure in the prepyloric section; *b* – focal stromal edema in the pyloric section; *c* – hemorrhages with a violation of the mucous membrane structure in the prepyloric; *d* – pyloric parts. Hematoxylin-eosin. ×100

The activity of the main cells of their own glands varied in different parts of the bottom and the prepyloric zone. The functional activity of mucous-forming elements of the mucous in different parts of the mucous membrane varied, quite often mosaically reduced, although, in general, it was visually more than in the control pathology (Fig. 15). The results of a comparative semi-quantitative assessment of the effects of various doses of cabbage extract on the severity of morphologi-

cal signs of an acute ulcerative-erosive process in the gastric mucosa are shown in the table.

As can be seen from the table, cabbage extract in all studied doses had a positive effect on the condition of the gastric mucosa of rats under the conditions of the introduction of an alcohol-prednisolone mixture in all studied parameters, with the exception of a dose of 30 mg/kg, which did not have a significant gastroprotective effect.

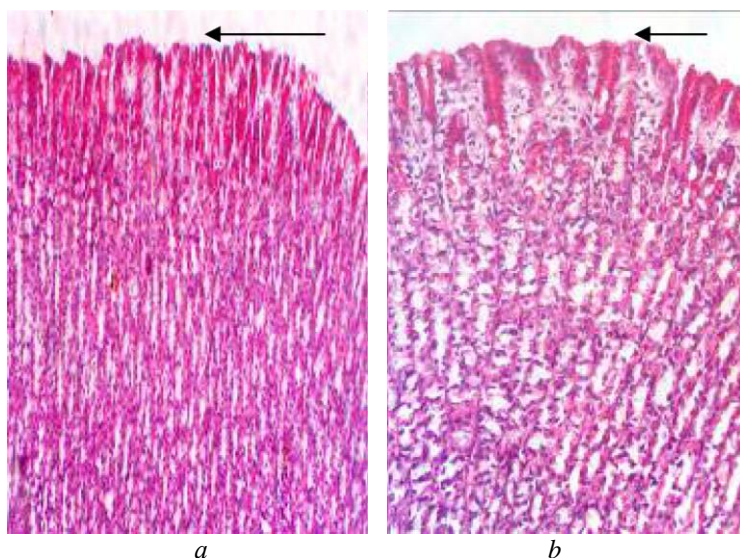


Fig. 15. The stomach of the rats, which were injected Altan at a dose of 1 mg/kg on the background of alcohol-prednisolone mixture: different expression PAS-positive reaction (*a* – normal; *b* – reduced) in prepyloric part of the mucous membrane. PAS-reaction. ×200

With an increase in the dose of the extract to 40 mg/kg and 50 mg/kg, the effectiveness of the effect increased, but with the use of the extract at a dose of 60 mg/kg, there was no significant decrease in the morphological signs of an acute ulcer-erosive process. Thus, the obtained results allowed to state the

most pronounced protective effect among the studied doses of dry cabbage extract at a dose of 50 mg/kg (Table 1).

The comparison drug Altan was inferior to the studied doses of dry cabbage extract in all or most of the selected parameters.

Table 1

The effect of dry cabbage extract on the severity of morphological signs of the pathological process in the stomach of rats induced by an alcohol-prednisolone mixture, points, M (LQ; UQ)

Groups of rats	Signs			
	Presence of de-structions	Stromal edema	Hemocapillary disorders	Force PAS-reaction outside the zones of destruction
Intact control (IC)	0(0;0)	0(0;0)	0(0;0)	3(3;3)
Control pathology (CP)	4(3;4)*	3(3;3)*	3(2;3)*	1(1;1)*
Control pathology + cab-bage extract 30 mg/kg	3(2;4)*	0(0;1)**	1(0;1)**	3(2;3)**
Control pathology + cab-bage extract 40 mg/kg	1(0,5;2)*/**/#	0(0;0)**/ω	0(0;0)**/ω	3(3;3)**/ω
Control pathology + cab-bage extract 50 mg/kg	0,5(0;0,5)**/#/ψ	0(0;0)**/ω	0(0;0)**/ω	3(3;3)**/ω
Control pathology + cab-bage extract 60 mg/kg	0,5(0;0,5)**/#/ψ	1(0;1)**/ω	0(0;0)**/ω	3(2;3)**/ω
Control pathology + Altan 1 mg/kg	1(0;1)**/#	2(2;2)*/**/#/	1(1;2)*/**	2(2;2)*/**
p	0.0010	0.0002	0.0007	0.0037

Note: * – differences are statistically significant with respect to group IC; ** – differences are statistically significant with respect to group CP; # – differences are statistically significant with respect to group cabbage extract 30 mg/kg; ψ – differences are statistically significant with respect to group cabbage extract 40 mg/kg; ω – differences are statistically significant with respect to group Altan 1 mg/kg

Thus, the introduction of an alcohol-prednisolone mixture to rats resulted in a pronounced acute ulcerative-erosive process in various parts of the gastric mucosa, which was accompanied by significant hemocapillary disorders and stromal edema.

In most cases, the ulcers spread to the entire depth or most of the glandular tubes. In areas outside the zones of destruction, a decrease in mucoid secretion by cells of the gastric superficial-foveolar epithelium, additional cells of its own glands, glandular cells of the pyloric glands, stimulation of pepsin production, increased acid formation were observed. That is, the aggressiveness of the gastric juice increased with a decrease in the protective effect of mucus.

The studied dry cabbage extract reduced the severity of the acute ulcerative-erosive process and hemocapillary disorders and edema. Under the influence of dry cabbage extract, the destruction zones were limited, the processes of mucoid synthesis stabilized, the severity of pepsin and acid formation decreased (by the morphological state of the parietal and main cells). All this indicates

that the studied dry cabbage extract exhibits gastroprotective properties. The most distinct positive effect manifests itself in a dose of 50 mg/kg.

The comparison drug Altan at a dose of 1 mg/kg improves the barrier function of the mucous membrane of the stomach, increases the level of neutral mucopolysaccharides compared with the control pathology. However, in terms of gastroprotective effect, Altan is inferior to dry cabbage extract in the most effective dose of 50 mg/kg.

7. Conclusions from the study and prospects for further development in this area

1. According to the severity of the gastroprotective effect, the dry extract of cabbage exceeded the domestic herbal comparator drug Altan at a dose of 1 mg/kg.

2. The results indicate the promise of further experimental studies of the pharmacological properties of dry extract of cabbage in order to create an effective anti-ulcer herbal medicine.

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medychnoi dopomohy «Peptychna vyrazka shlunka ta dvanadtsiatypaloi kysky u doroslykh». Adaptovana klinichna nastanova «Peptychna vyrazka shlunka ta dvanadtsiatypaloi kysky»: Nakaz MOZ Ukrainy No. 613. 03.09.2014. URL: http://old.moz.gov.ua/ua/portal/dn_20140903_0613.html

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