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Other professional sciences
(Pharmacy)

PHYTOCHEMICAL STUDY OF A PHYTOCOMPOSITION FOR THE CORRECTION OF HYPERACID GASTRIC CONDITIONS

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Introduction. Hyperacid gastric conditions and gastroesophageal reflux disease (GERD) remain significant medical and social challenges in modern gastroenterology. Their high prevalence, chronic recurrent course, substantial impact on patients' quality of life, and the risk of complications necessitate the search for new effective and safe approaches to prevention and comprehensive treatment [1].

The pathogenesis of hyperacid disorders is multifactorial and includes excessive acid aggression, impaired motility of the upper gastrointestinal tract, weakening of the protective mucosal barrier, oxidative stress, local inflammation, and reduced reparative potential of the mucosa. Conventional pharmacotherapy, particularly proton pump inhibitors, antacids, and prokinetics, is effective; however, it does not always provide complete symptom control, especially in chronic and recurrent forms of the disease [2].

In this context, the development of multicomponent herbal remedies containing a complex of biologically active substances and capable of exerting gastroprotective, demulcent, anti-inflammatory, antioxidant, reparative, and antispasmodic effects is considered a promising approach. Herbal compositions based on *Althaea officinalis* L., *Hypericum perforatum* L., *Calendula officinalis* L., and *Epilobium angustifolium* L. are of particular interest because each of these medicinal plants contains pharmacologically significant groups of biologically active compounds that may contribute to the correction of hyperacid gastric conditions.

Aim of the Study: To perform a phytochemical investigation of a phytocomposition consisting of marshmallow roots (*Althaea officinalis* L.), St. John's wort herb (*Hypericum perforatum* L.), calendula flowers (*Calendula officinalis* L.), and fireweed herb (*Epilobium angustifolium* L.), and to provide a theoretical justification for its potential use in the correction of hyperacid gastric conditions.

Materials and Methods

The object of the study was a herbal composition containing roots of *Althaea officinalis* L., herb of *Hypericum perforatum* L., flowers of *Calendula officinalis* L., and herb of *Epilobium angustifolium* L. For phytochemical analysis, aqueous and hydroalcoholic extracts were prepared from the medicinal plant materials.

The hydroalcoholic extract was primarily used for the identification of flavonoids, carotenoids, and essential oils, whereas the aqueous extract was used for the detection of polysaccharides and tannins. Flavonoids were identified using the Shinoda test, reactions with potassium hydroxide, ferric chloride, and lead acetate solutions. Tannins were detected by reactions with ferric ammonium sulfate, gelatin, and quinine hydrochloride. Carotenoids were identified using concentrated sulfuric acid and ferrous sulfate reactions. Essential oils were determined using the Sabetay and Ehrlich–Müller reactions. Polysaccharides were detected by precipitation with 95% ethanol followed by Fehling's test after acid hydrolysis. The identification of biologically active

compounds from medicinal plant raw materials was performed according to the requirements of the State Pharmacopoeia of Ukraine (State Pharmacopoeia of Ukraine, 2015) [3].

Results. The phytochemical analysis confirmed the presence of the major groups of biologically active substances in the investigated phytocomposition, namely flavonoids, tannins, polysaccharides, carotenoids, and essential oils.

The presence of flavonoids was confirmed by positive qualitative reactions in the hydroalcoholic extract. The principal sources of flavonoids in the composition are *Hypericum perforatum*, *Calendula officinalis*, and *Epilobium angustifolium*. Flavonoids play an important role in antioxidant and anti-inflammatory activity due to their ability to reduce free radical formation, stabilize cellular membranes, and suppress pro-inflammatory mediators.

Tannins were detected in the aqueous extract of the phytocomposition. Their presence is important because of their potential astringent, anti-inflammatory, and membrane-stabilizing properties. Tannins may contribute to reducing mucosal permeability, forming a protective layer on the mucosal surface, and decreasing the intensity of local inflammatory processes.

Positive reactions for polysaccharides indicated the presence of mucilaginous substances in the phytocomposition, mainly derived from *Althaea officinalis* roots. These polysaccharides provide demulcent and cytoprotective effects, which are particularly important in hyperacid conditions where the gastric and esophageal mucosa are exposed to the damaging effects of acidic gastric contents.

The detection of carotenoids was mainly associated with the presence of *Calendula officinalis*.

Carotenoids are involved in tissue repair, maintenance of epithelial integrity, and antioxidant protection. The presence of essential oils further enhances the pharmacological potential of the composition through their possible anti-inflammatory, antimicrobial, and mild antispasmodic activities.

Discussion. The obtained results indicate that the investigated phytocomposition contains a complex of biologically active substances capable of influencing several key pathogenetic mechanisms involved in hyperacid gastric disorders. Polysaccharides from *Althaea officinalis* provide mucoprotective activity, flavonoids and carotenoids contribute to antioxidant and anti-inflammatory effects, tannins participate in mucosal protection and inflammation control, while essential oils may enhance anti-inflammatory and antispasmodic actions.

Of particular interest is the presence of *Hypericum perforatum* L. in the composition. Traditionally, St. John’s wort is recognized for its antidepressant and neurotropic properties; however, in the context of hyperacid gastric disorders, its inclusion in the herbal formulation has a broader pathogenetic rationale. Current concepts of GERD and functional upper gastrointestinal disorders increasingly emphasize the importance of the gut–brain axis, a bidirectional communication network involving the central nervous system, enteric nervous system, gut microbiota, immune system, and endocrine pathways [4].

Dysfunction of the gut–brain axis may contribute to visceral hypersensitivity, enhanced perception of heartburn and pain, altered gastrointestinal motility, and the development of GERD phenotypes that are refractory to conventional acid-suppressive therapy. Chronic stress and anxiety disorders may intensify symptoms even in the absence of significant morphological changes in the mucosa. Therefore, modulation of neurohumoral regulatory mechanisms is considered a promising complementary therapeutic strategy.

The inclusion of *Hypericum perforatum* in the investigated phytocomposition is justified by the presence of flavonoids, hypericin, hyperforin, and other phenolic compounds capable of influencing neurotransmitter systems associated with stress, anxiety, and visceral sensitivity. Consequently, St. John’s wort may contribute not only to antioxidant and anti-inflammatory effects but also to the correction of gut–brain axis disturbances, which is particularly relevant for patients with functional heartburn, non-erosive reflux disease, and stress-associated manifestations of hyperacid conditions [5].

Furthermore, the flavonoids of *Hypericum perforatum* may enhance the gastroprotective potential of the composition through antioxidant activity, suppression of inflammatory responses, and support of reparative processes within the gastrointestinal mucosa. In combination with the mucilage polysaccharides of *Althaea officinalis*, the reparative carotenoids of *Calendula officinalis*, and the polyphenolic compounds of *Epilobium angustifolium*, this creates a foundation for the multifaceted pharmacological activity of the phytocomposition.

Thus, the results of the phytochemical analysis confirm the rationale for combining these medicinal plants within a single formulation. The potential activity of the phytocomposition may be directed not only toward reducing acid aggression and protecting the mucosa but also toward correcting inflammatory, oxidative, reparative, and neurohumoral disturbances associated with hyperacid gastric conditions.

Conclusions

1. The investigated phytocomposition was shown to contain flavonoids, tannins, polysaccharides, carotenoids, and essential oils.
2. The identified biologically active substances support the potential gastroprotective, demulcent, anti-inflammatory, antioxidant, reparative, and antispasmodic activities of the composition.
3. Polysaccharides from Althaea officinalis represent an important component of the mucoprotective activity of the phytocomposition due to their ability to form a protective layer on the mucosal surface.
4. Flavonoids, tannins, and carotenoids provide antioxidant and anti-inflammatory effects that are pathogenetically justified in hyperacid gastric disorders.
5. The inclusion of Hypericum perforatum in the herbal formulation is justified by its potential influence on the gut–brain axis, visceral hypersensitivity, and stress-associated manifestations of hyperacid conditions.
6. The obtained results indicate the перспективність of further experimental and clinical investigation of the phytocomposition as a potential herbal remedy for the comprehensive correction of hyperacid gastric conditions.

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