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Investigating the Impact of a polyherbal Syrup Containing Licorice, Peppermint, and Chamomile Extracts on Inflammation and Peptic Ulcers in Male Rats

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A B S T R A C T

Objective: Peptic ulcers result from erosion of the stomach's protective lining and excessive secretion of gastric acid, causing pain, inflammation and, in severe cases, bleeding. Conventional treatments, including antibiotics and surgery, are often associated with side effects and significant economic burden. In traditional medicine, medicinal plants are valued for their anti-inflammatory and protective properties. This study aims to evaluate the combined effect of hydroalcoholic extracts of three plants on peptic ulcer healing compared to the effects of each extract administered individually.

Method: In this study, licorice, peppermint, and chamomile medicinal plants were obtained from the Zagros Mountains of Ilam Province. After authentication, their extracts were obtained using Soxhlet extraction method. A total of 49 male rats were then divided into seven groups with gastric ulcers induced by administration of aspirin and Helicobacter. The animals were anesthetized with ketamine and xylazine and then euthanized according to ethical guidelines. The stomachs were then excised, ulcers quantified, and tissue samples prepared and fixed for macroscopic and histologic analysis.

Results: According to the results, the chamomile and peppermint group showed slow healing of the stomach ulcers by day 21. The deeper parts of the ulcers remained unhealed, and the gastric tissue continued to show signs of inflammation and bleeding. In the licorice treated group, a more pronounced recovery was observed on day 21 compared to the chamomile and peppermint groups. While some wounds had healed, the deeper parts remained unhealed. Epitheliogenesis and tissue repair were more advanced than in other groups. In the polyherbal treated group, a relative and acceptable improvement of the gastric wall tissue was observed by day 21 with the herbal combination. Healing and epitheliogenesis were well advanced, with recovery approaching that of Recolic treated group. However, some areas still contained inflammatory cells and blood vessels.

Conclusion: Overall, it can be concluded that polyherbal compounds have the potential to aid in the healing of peptic ulcers. Ongoing research and further investigation into the improvement and efficacy of these treatments may contribute to the development of more effective therapeutic strategies for peptic ulcers.

Keywords: Digestive system, Stomach, Gastric ulcer, Medicinal plants, Treatment.

➢ **How to cite this paper**

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Introduction

Peptic ulcers result from the breakdown of the stomach's protective lining due to excessive secretion of gastric acid. This acid causes an ulcer to form in the stomach, which in acute cases is accompanied by pain, severe inflammation and bleeding [1]. Symptoms of peptic ulcers include stomach pain and burning, bloating, indigestion, weight loss, acid reflux, dark stools, and nausea [1]. Peptic ulcers can result from an imbalance of digestive fluids in the stomach and duodenum [2]. Other causes include Helicobacter pylori infection [3], Zollinger-Ellison syndrome, and physiologic stress [1-3]. The use of non-steroidal anti-inflammatory drugs (NSAIDs) such as aspirin, naproxen and ibuprofen also contribute to the development of peptic ulcers [4]. Epidemiologically, approximately half of the population has experienced and suffers from peptic ulcers [5]. However, there is no definitive cure, and treatments such as antibiotics, endoscopy and surgery pose significant challenges for patients due to drug side effects and high economic costs [6].

In traditional medicine, medicinal plants have been recommended as an effective and less complex solution for the treatment of peptic ulcers [7]. These plants, due to their anti-inflammatory, antioxidant, and gastric mucosal protective properties, can help alleviate symptoms and promote healing of peptic ulcers [8]. Recent research has demonstrated the protective effects of certain plants in reducing pain and healing peptic ulcers due to their multiple properties [9]. In traditional Iranian medicine, licorice, peppermint, and chamomile are commonly used to treat digestive and stomach problems, especially peptic ulcers.

The licorice plant, scientifically known as *Glycyrrhiza glabra*, is a perennial that typically grows half a meter to one meter tall, but can reach up to two meters under optimal conditions [10]. Historically, the rhizome of this plant has been used to treat various digestive disorders, including stomach ulcers [11]. Contemporary research continues to support the therapeutic benefits of the licorice rhizome and its constituents in the prevention and treatment of digestive ailments such as stomach ulcers, flatulence, constipation, tonsillitis, and hepatitis. As a result, this plant has recently gained popularity in Europe and America for its use in treating stomach ulcers and stomach cancer [12].

Peppermint, scientifically known as *Mentha piperita* L., is a perennial herbaceous plant of the mint family. It has a long history of use as a medicinal plant throughout the world [13]. In ancient Egypt, peppermint was cultivated for its digestive benefits, while in Greece and Rome it was used to soothe the stomach. Since the 18th century, it has also been popular in Europe for treating stomach ailments [14]. The primary chemical constituent of peppermint is its essential oil, which is extracted from the leaves by water or steam distillation [15]. Historically, peppermint has been used to treat various digestive disorders in different age groups [16].

The chamomile plant, scientifically known as *Matricaria chamomilla* L., is one of the oldest known medicinal plants. It is used to treat a variety of ailments, including digestive disorders such as stomach and intestinal ulcers, flatulence and indigestion, and nervous disorders [17]. In addition, the flavones in chamomile have a positive effect on blood pressure and serve as a dietary supplement. Taking chamomile with licorice is recommended for increased benefits [18].

Despite the individual beneficial effects of licorice, peppermint, and chamomile in the treatment of peptic ulcers and other digestive problems, and considering the side effects and high costs associated with conventional chemical drugs for these conditions, the combined effect of hydroalcoholic extracts of these three plants on peptic ulcer healing has not been investigated. Therefore, the aim of this research is to elucidate the effects of simultaneous consumption of hydroalcoholic extracts of licorice, peppermint, and chamomile on peptic ulcers and to compare these effects with those of each plant extract when used separately.

Materials & Methods

Preparation of Medicinal Plants

In this study, the required medicinal plants, namely licorice (*Glycyrrhiza glabra* L.), peppermint (*Mentha piperita* L.), and chamomile (*Matricaria chamomilla* L.), were collected from the Zagros Mountains of Ilam Province. To ensure the authenticity and quality of the plants, the samples were identified and verified by botanists at Ilam University. Immediately after collection, the plants were transported to the laboratory for drying and preparation of extracts.

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Preparation of Extracts

After collection, the plants were dried in the shade at room temperature to preserve their active compounds. The plant extracts were then obtained using a Soxhlet apparatus.

Animal Study

Forty-nine male rats, each weighing approximately 200 to 250 grams, were allocated into seven experimental groups as follows:

Group 1: Healthy control group

Group 2: Aspirin + Helicobacter group (ulcer induction) (ulcer control group)

Group 3: Aspirin + Helicobacter + licorice extract (200 mg/kg)

Group 4: Aspirin + Helicobacter + peppermint extract (100 mg/kg)

Group 5: Aspirin + Helicobacter + chamomile extract (200 mg/kg)

Group 6: Aspirin + Helicobacter + combination of extracts

Group 7: Aspirin + Helicobacter + Recolic herbal syrup (product of Daroupakhsh Company)

Peptic Ulcer Induction

To induce gastric ulcers, the rats in the respective groups were fasted for 48 hours. Then, aspirin tablets at a dose of 200 mg/kg (Porsina Company, Iran) dissolved in 1% carboxymethylcellulose (CMC) solution were administered to the rats orally by gavage using a feeding needle in a volume of 0.5 ml. Approximately 12 hours later, gastric ulcers were observed in the rats.

Macroscopic and Histological Examinations

In accordance with ethical protocols for laboratory animal research, mice were humanely euthanized to minimize pain and distress in accordance with international standards. In this study, a combination of ketamine and xylazine was administered to achieve complete anesthesia and ensure that the animals did not experience pain. After deep anesthesia and confirmation of the absence of vital signs, the animals were euthanized using appropriate methods. This approach ensures that animals are not subjected to unnecessary pain or suffering and that all procedures comply with regulatory guidelines and ethical principles of animal care.

The stomachs were then excised and sections taken from the greater curvature for wound assessment. The stomachs were emptied, gently rinsed with water, and the wounds were counted under a light microscope. Wounds smaller than 1 mm were counted as one, those between 1 and 2 mm as two, and those larger than 3 mm as three.

After thorough wound counting and macroscopic examination, the stomach samples were fixed in 10% formalin-saline solution and sent to the histological laboratory for tissue sectioning and histological analysis.

Results

Based on the results, the chamomile and peppermint group showed slow healing of the ulcers by day 21. The deeper regions of the ulcers remained unhealed and the gastric tissue was still inflamed and hemorrhagic. A more pronounced recovery was observed in the licorice treated group on day 21 (Figure 12) compared to the chamomile and peppermint groups. While some wounds had healed, the deeper parts of the wounds were still unhealed. Epitheliogenesis and tissue repair were more advanced than in the other groups.

In the polyherbal treated group, a relative and acceptable improvement in the gastric wall tissue was noted on day 21 with the herbal combination. Healing and epitheliogenesis were well advanced, with recovery approaching that of Recolic treated group. However, some areas of inflammatory cells and blood vessels were still present (Figures 1-13).

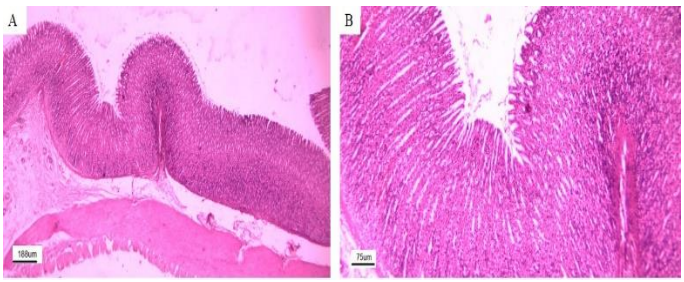

Figure 1. The photomicrograph illustrates the histologic architecture of the stomach in the healthy control group, with images taken at 4X (A) and 10X (B) magnification using H&E staining. The stomach structure in this group naturally includes the gastric glands, which include the isthmus, neck, and base

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regions. These regions are composed of the mucosa, lamina propria, muscularis mucosae, submucosa, and muscular layer. The mucosa has a simple columnar surface epithelium, elongated columnar isthmus cells, and short columnar cervical mucosa cells. The cervical and basal regions are lined predominantly by parietal cells, which are pyramidal and multilayered. Chief or peptic cells are located primarily in the basal region of the gland and appear normal without pathologic lesions.

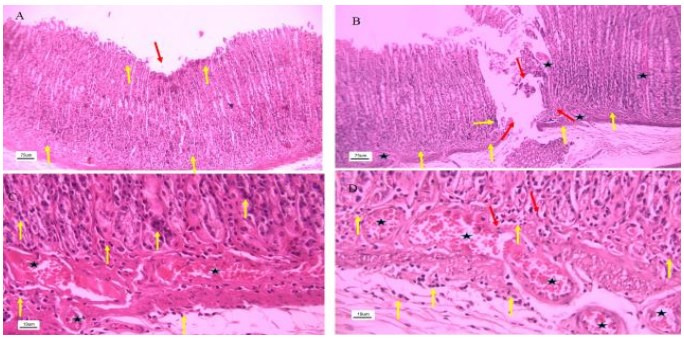

Figure 2. The photomicrograph shows the histologic structure of the stomach in the gastric ulcer control group on day 7, with images taken at 10x (A, B) and 40x (C, D) magnification using H&E staining. In this group, co-administration of aspirin and Helicobacter pylori resulted in severe mucosal damage as evidenced by multiple ulcers in the gastric wall. The normal architecture of the gastric wall is disrupted, with surface epithelial cells appearing scaly and absent in some areas. The epithelial cells show pyknosis with hyperchromatic nuclei, and the parietal cells are vacuolated with pyknotic nuclei. The chief cells have also lost their organization and appear wrinkled with darkly stained nuclei. The blood vessels have destroyed the muscularis mucosae and infiltrated the lamina propria, the epithelium, and the lining of the gastric glands, showing significant congestion. (The yellow arrow indicates inflammatory cells, the red arrow indicates gastric ulcers, and the black star indicates hyperemia).

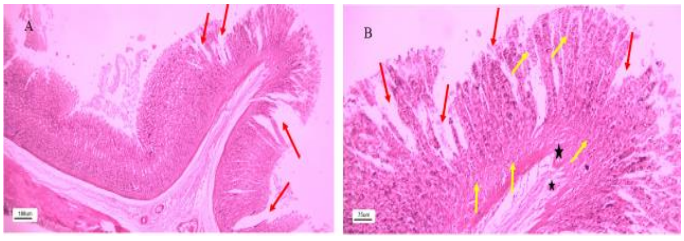

Figure 3. The photomicrograph labeled Figure 3 shows the histologic structure of the stomach in the chamomile treated group on day 7, with images taken at 4X (A) and 10X (B) magnification using H&E staining. In this group, similar to the ulcer control group, severe mucosal damage is evident in the stomach wall. Gastric ulcers are prominent and gastric glands have lost their organization, with some areas showing complete disappearance of gastric cells, similar to the ulcer control group. The cells show pyknosis and hyperchromatinization, and inflammatory and mononuclear cells have infiltrated the lamina propria and epithelial tissue. The gastric tissue remains hemorrhagic and inflamed, indicating that chamomile has not facilitated repair of the damage within 7 days. (The yellow arrow indicates inflammatory cells, the red arrow indicates gastric ulcers, and the black star indicates hyperemia).

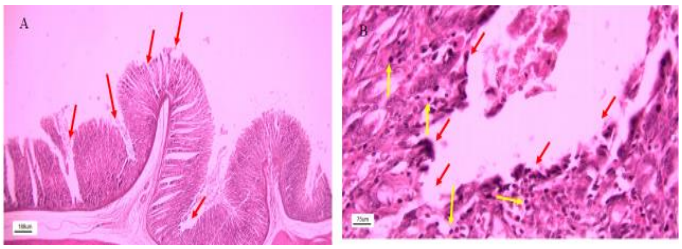

Figure 4. The photomicrograph shows the histologic structure of the stomach in the peppermint treated group on day 7. The stomach tissues in the peppermint group showed severe mucosal damage similar to the ulcer control group as observed under H&E staining at 4x (A) and 40x (B) magnification. The presence of gastric ulcers was evident, with disorganized and partially absent gastric glands. Some gastric cells were also absent, similar to the ulcer control group, and showed pyknosis and hyperchromatinization. Inflammatory and mononuclear cells were present, and the tissue remained hyperemic and inflamed. Peppermint treatment did not facilitate repair within the 7-day period, as indicated by the yellow arrows pointing to inflammatory cells and the red arrows marking the sites of gastric ulcers.

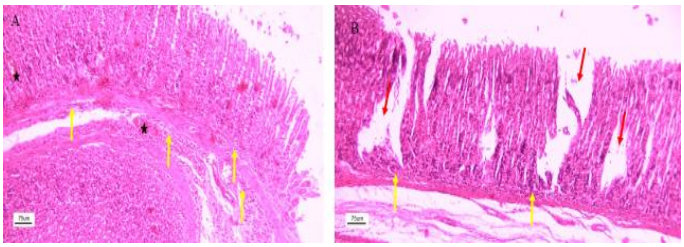

Figure 5. The photomicrograph illustrates the histologic structure of the stomach in the Recolic treated group on day 7. The stomach of Recolic treated group was examined by H&E staining at 10x magnification (A and B). This group showed severe mucosal damage similar to the ulcer control group. Gastric ulcers were prominently visible with disrupted and partially absent gastric glands. Similar to the ulcer control group, some gastric cells were missing. The cells exhibited

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pyknosis and hyperchromatinization, and inflammatory and mononuclear cells were present. The inflammation observed was comparable to that in the gastric ulcer control group, as indicated by the yellow arrow (inflammatory cells), red arrow (gastric ulcer), and black star (hyperemia).

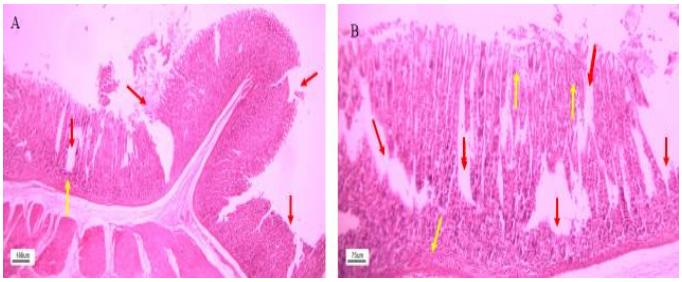

Figure 6. The photomicrograph displays the histologic structure of the stomach in the licorice treated group on day 7. The stomach tissue in the licorice treated group showed severe mucosal damage similar to that in the ulcer control group, as observed by H&E staining at ×4 (A) and ×10 (B) magnification. The gastric wall showed clear signs of gastric ulceration with disorganized and partially absent gastric glands. In addition, some gastric cells were missing, similar to the ulcer control group. The cells showed pyknosis and hyperchromatinization, with visible inflammatory and mononuclear cells. The tissue remained hyperemic and inflamed, indicating that licorice treatment did not ameliorate the damage within the 7-day period (yellow arrow indicates inflammatory cells, red arrow indicates the site of the gastric ulcer).

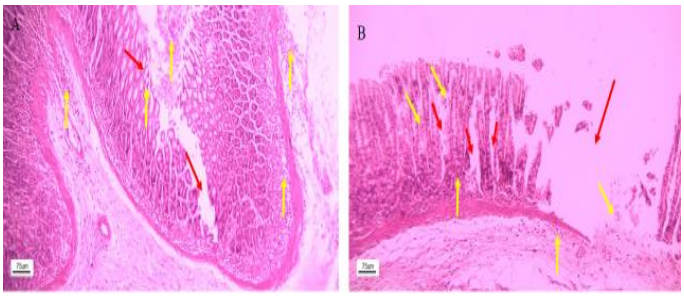

Figure 7. The photomicrograph displays the histologic structure of the stomach in the polyherbal treated group on day 7. Stomach tissue in the polyherbal treated group showed severe mucosal damage similar to that in the ulcer control group, as observed by H&E staining at 10x magnification (A and B). The gastric wall showed clear signs of gastric ulceration with disorganized and partially absent gastric glands. In addition, some gastric cells were missing, similar to the ulcer control group. The cells showed pyknosis and hyperchromatinization, with visible inflammatory and mononuclear cells. The tissue remained hyperemic and inflamed, indicating that the combination of herbs did not ameliorate the damage within the 7-day period (yellow arrow indicates inflammatory cells, red arrow indicates the site of the gastric ulcer).

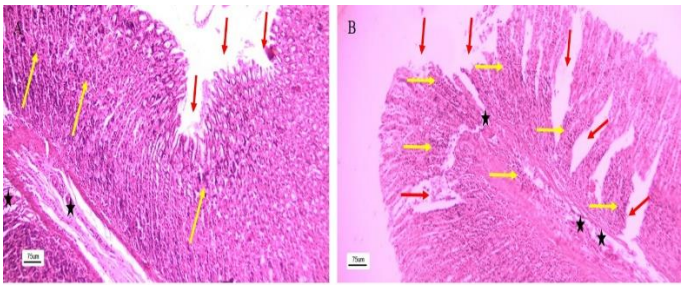

Figure 8. The photomicrograph shows the histologic structure of the stomach in the gastric ulcer control group on day 21 (A. H&E staining, 10x; B. H&E staining, 10x). In this group, the gastric ulcers remain unhealed after 21 days. The glands and cells in certain regions of the gastric wall have disappeared. Many cells show pyknosis and hyperchromatic nuclei. The gastric wall tissue is inflamed with congested blood vessels. Inflammatory cells have infiltrated the mucosal area, and some regions of the tissue have undergone severe damage and destruction (yellow arrow indicates inflammatory cells, red arrow indicates gastric ulcer, and black star indicates hyperemia).

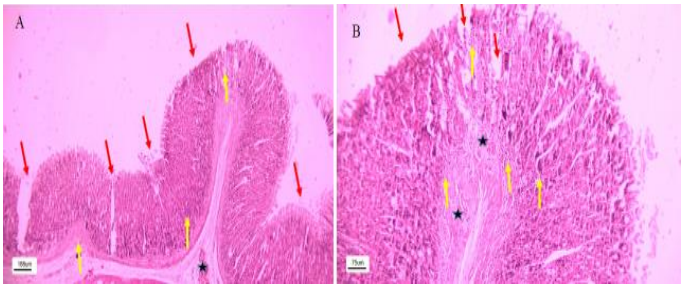

Figure 9. The photomicrograph displays the histologic structure of the stomach in the chamomile treated group on day 21. The gastric tissue in the chamomile treated group was examined by H&E staining at 4x (A) and 10x (B) magnification. Slow healing of the ulcers was observed in this group, with the deeper regions of the ulcers remaining unhealed. There was a slight recovery of apical epithelial cells; however, many areas showed loss of cells and glands. Numerous cells showed pyknosis and hyperchromatic nuclei. The gastric wall tissue was inflamed and congested with blood vessels, indicating hyperemia. The presence of inflammatory and mononuclear cells in the mucosa was evident, as highlighted in the images (yellow arrow indicating inflammatory cells, red arrow indicating gastric ulcer, and black star indicating hyperemia).

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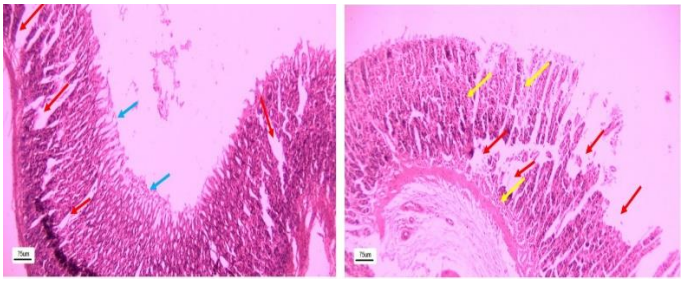

Figure 10. The photomicrograph illustrates the histologic structure of the stomach in the peppermint treated group on day 21. The gastric tissue in the peppermint treated group was examined by H&E staining at 10× magnification (A and B). Similar to the chamomile treated group, the healing of the gastric ulcers in the peppermint treated group progressed slowly, with the deeper parts of the wounds remaining unhealed. Slight recovery of apical epithelial cells was observed; however, many areas showed cell and glandular loss. Numerous cells showed pyknosis and hyperchromatic nuclei. The gastric wall tissue was inflamed and vascularized. The presence of inflammatory and mononuclear cells in the mucosa was evident in the images, as indicated by yellow arrows for inflammatory cells, red arrows for gastric ulcers, and blue arrows for epitheliogenesis.

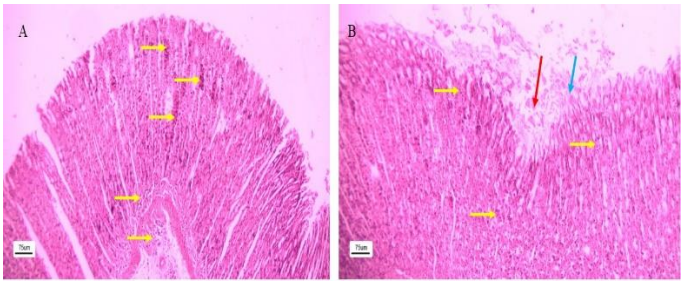

Figure 11. The photomicrograph shows the histologic structure of the stomach in the Recolic treated group on day 21. Stomach tissue in the Recolic treated group was examined by H&E staining at 10× magnification (A and B). After the administration of Recolic, partial recovery of the gastric wall tissue was observed. Healing and contraction of the wound opening were evident with significant epitheliogenesis. There was significant recovery of glands and cells. The density of inflammatory and mononuclear cells had decreased, although some inflammatory cells and blood vessels were still present in certain areas. The images highlight these observations with yellow arrows indicating inflammatory cells, red arrows indicating gastric ulcers, and blue arrows indicating epitheliogenesis.

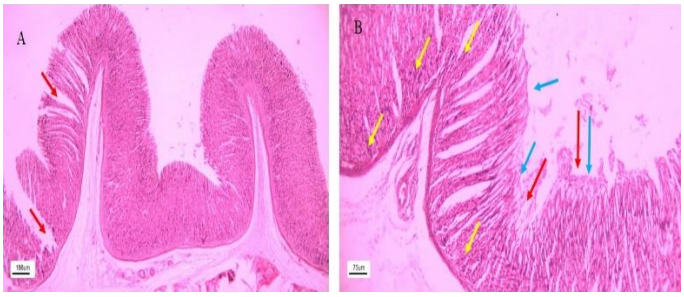

Figure 12. The photomicrograph shows the histologic structure of the stomach in the licorice treated group on day 21. The stomach tissue in the licorice treated group was examined using H&E staining at 4× and 10× magnifications (A and B). Following 21 days of licorice administration, there was a slight improvement in the stomach wall tissue, which was more pronounced than in the chamomile and peppermint groups. However, the deeper parts of the wounds remained unhealed. Figure 12 shows evidence of epitheliogenesis and healing of gastric cells and glands, with yellow arrows indicating inflammatory cells, red arrows marking gastric ulcers, and blue arrows highlighting epitheliogenesis.

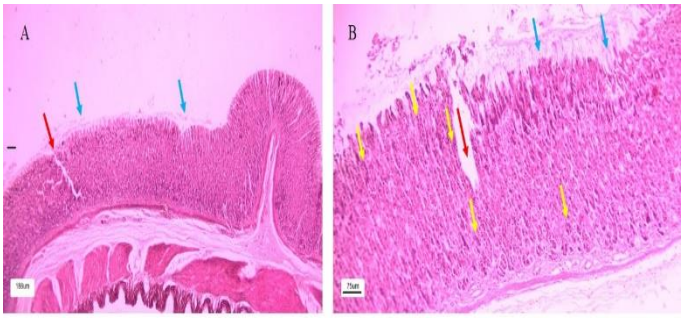

Figure 13. The photomicrograph shows the histological structure of the stomach in the polyherbal-treated group on day 21. Gastric tissue in the polyherbal-treated group was examined by H&E staining at 4× and 10× magnification (A and B). After 21 days of combined administration of chamomile, peppermint, and licorice, there was a relative and acceptable improvement in stomach wall tissue that exceeded the improvements observed in the individual chamomile, peppermint, and licorice groups. Some of this improvement was comparable to that seen in the Recolic-treated drug group at day 21. In both the polyherbal and Recolic-treated groups, healing and contraction of the wound opening were evident, with some degree of epitheliogenesis and acceptable glandular and cellular recovery. However, inflammatory cells and blood vessels were still present in certain areas, as indicated by yellow arrows for inflammatory cells, red arrows for gastric ulcers, and blue arrows for epitheliogenesis.

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Discussion

Gastrointestinal ulcers are deep lesions that can lead to more serious gastrointestinal disorders. Larypoor *et al.* (2020) investigated the combined effects of hydroalcoholic extracts of *Glycyrrhiza glabra* and *Astraglus gossypinus* on gastric ulcers in rats. Their study concluded that co-administration of these herbal extracts significantly improved peptic ulcers in the rat model [19]. Previous research has shown that licorice has antispasmodic properties in the digestive tract and relieves visceral pain by inhibiting phosphodiesterase 3. The aqueous-alcoholic extract of licorice enhances anti-ulcer activity in the stomach by enhancing the gastric mucosal defense mechanisms. As a result, licorice extract is beneficial in the treatment of peptic ulcers and the relief of gastrointestinal spasms. In addition, licorice extract or dried root has been shown to increase serotonin and prostaglandin secretion in the stomach, thereby exerting an anti-inflammatory effect [20-23]. In a separate study comparing the inhibitory effects of mint, thyme, licorice, chamomile, and pennyroyal extracts on Helicobacter pylori in a culture medium, the results showed that mint and licorice extracts exhibited stronger antibacterial activity against this bacterium compared to the other plant extracts [24]. The study by Dashtpima et al. (2014) aimed to evaluate the effect of chamomile decoction on leishmaniasis wounds. The results showed that the efficacy of chamomile decoction in healing leishmaniasis wounds was comparable to that of glucanthim, a chemical drug used to treat this condition [25]. The results of a study indicate that the chamomile contains primary compounds such as alpha-bisabolol and flavonoids (xanthum) [26]. Chamomile facilitates the healing of peptic ulcers through mechanisms including anti-inflammatory and antispasmodic effects, stimulation of gastric mucus production, and mitigation of free radical-induced damage [27].

The licorice contains compounds such as glycyrrhizin, flavonoids, and saponins [28]. Due to its anti-inflammatory and antimicrobial properties, licorice enhances the production of gastric mucus, decreases gastric acid secretion, and protects the gastric mucosa, thereby promoting the healing of gastric ulcers [29]. Peppermint is rich in menthol and flavonoids [30]. Through its anti-inflammatory and antispasmodic mechanisms, peppermint relieves stomach pain, stimulates bile production and secretion, and improves digestive function in peptic ulcer disease [31]. In modern medicine, traditional medicine and medicinal plants are becoming increasingly important, especially in the development of new drugs and the improvement of treatment methods. Numerous scientific and experimental studies have demonstrated that medicinal plants can aid in the treatment of diseases through complex and diverse mechanisms. In particular, plants such as chamomile, licorice, and peppermint, recognized as effective treatments in traditional medicine, play an important role in the treatment of peptic ulcers and related conditions. These traditional effects were validated in this experimental study.

Conclusion

The results of this study indicate that a polyherbal syrup containing licorice, peppermint, and chamomile extracts has significant beneficial effects on reducing inflammation and healing peptic ulcers in male rats. Compared to the individual use of each extract, the combined formulation (polyherbal) demonstrated superior efficacy in promoting gastric tissue repair and wound healing. Specifically, the medicinal plants used in this study contribute to the improvement of peptic ulcers through their anti-inflammatory properties, enhancement of gastric mucus production, and mitigation of free radical-induced damage.

Statements and Declarations

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki.

Consent to participate

Informed consent was obtained from all individual participants included in the study.

Author contributions

SM; KV; HA: Conceptualization, the original draft writing, investigation, writing including reviewing and editing and investigation and formal analysis; SM; PN; GHM: Conceptualization, supervision, and project administration; ZR;

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SM and HA: Conceptualization, the original draft writing, investigation, writing including reviewing and editing

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References

1. Bereda G. Peptic Ulcer disease: definition, pathophysiology, and treatment. J Biomed Biol Sci. 2022;1(2):1-10. DOI:10.12345/jbbs.2022.002
2. Beiranvand M. A review of the most common in vivo models of stomach ulcers and natural and synthetic anti-ulcer compounds: a comparative systematic study. Phytomedicine Plus. 2022;2(2):100264. DOI:10.1016/j.phyplu.2022.100264
3. Sohail R, Mathew M, Patel KK, Reddy SA, Haider Z, Naria M, et al. Effects of non-steroidal anti-inflammatory drugs (NSAIDs) and gastroprotective NSAIDs on the gastrointestinal tract: a narrative review. Cureus. 2023;15(4). DOI:10.7759/cureus.2023.015
4. Dadfar A, Edna TH. Epidemiology of perforating peptic ulcer: A population-based retrospective study over 40 years. World J Gastroenterol. 2020;26(35):5302-5310. DOI:10.3748/wjg.v26.i35.5302
5. Brătucu MN, Prunoiu VM, Strâmbu V, Brătucu E, Răvaș MM, Simion L, et al. Unusual complicated gastric ulcers. Medicina. 2021;57(12):1345. DOI:10.3390/medicina57121345
6. Khoshnam SE, Farzaneh M, Bahaoddini AA, Sarvary F, Shabani S. Evaluation of the Interactive Effects of Glycyrrhiza Glabra Hydroalcoholic Extract and L-NAME Drug on Blood Pressure and Heart Rate of Male Rats. J Babol Univ Med Sci. 2016;18(6):59-65.
7. Ardalani H, Hadipanah A, Sahebkar A. Medicinal plants in the treatment of peptic ulcer disease: A review. Mini Rev Med Chem. 2020;20(8):662-702. DOI:10.2174/1389557520666200414123334
8. Boakye-Yiadom M, Kumadoh D, Adase E, Woode E. Medicinal plants with prospective benefits in the management of peptic ulcer diseases in Ghana. Biomed Res Int. 2021;2021:5574041. DOI:10.1155/2021/5574041
9. Mubashir A, Ghani A, Mubashar A. Common medicinal plants effective in peptic ulcer treatment: a nutritional review. DOI:10.1016/j.jfda.2023.123456
10. Jalilzadeh-Amin G, Najarnezhad V, Anassori E, Mostafavi M, Keshipour H. Antiulcer properties of Glycyrrhiza glabra L. extract on experimental models of gastric ulcer in mice. Iran J Pharm Res. 2015;14(4):1163-1170.
11. Khayyal MT, El-Ghazaly MA, Kenawy SA, Seif-El-Nasr M, Mahran LG, Kafafi Y, et al. Antiulcerogenic effect of some gastrointestinally acting plant extracts and their combination. Arzneimittelforschung. 2000;51(7):545-553. DOI:10.1055/s-0031-1300358
12. Khoshnam SE, Farzaneh M, Bahaoddini AA, Sarvary F, Shabani S. Evaluation of the Interactive Effects of Glycyrrhiza Glabra Hydroalcoholic Extract and L-NAME Drug on Blood Pressure and Heart Rate of Male Rats. J Babol Univ Med Sci. 2016;18(6):59-65.
13. Keifer MDD, Uibrecht C, Rae Abrams PT, Basch PD, Giese MDN, Giles MSM, et al. Peppermint (Mentha piperita): An evidence-based systematic review by the Natural Standard Research Collaboration. J Herb Pharmacother. 2007;7:91-143. DOI:10.1300/j123v07n02_05
14. Shkarupii VA, Odiintsova OA, Kazarinava NA, Thrachenko KG. Use of essential oil of peppermint (Mentha piperita) in the complex treatment of patients with infiltrative pulmonary tuberculosis. Probl Tuberk Bolezn Legk. 2006;(9):43-45.
15. Mehrofarin A, Naghdi Badi H, Poorhadi M, Hdavi E, Qavami N, Kadkhoda Z. Phytochemical and Agronomical Response of Peppermint (Mentha piperita L.) To Bio-fertilizers and Urea Fertilizer Application. JMP. 2011;4(40):107-118.
16. Shah PP, D'Mello PM. A review of medicinal uses and pharmacological effects of Mentha piperita. Nat Prod Rad. 2004;3(4):214-221.
17. Tyler VE, Brady LR, Robbers JE. Pharmacognosy. Lea Febiger, Philadelphia, USA. 1988; pp:27-32.
18. Akah PA, Orisakwe OE, Gamaniel KS, Shittu A. Evaluation of Nigerian traditional medicine: Effect of some Nigerian folk remedies on peptic ulcer. J Ethnopharmacol. 1998;62(2):123-127. DOI:10.1016/S0378-8741(98)00055-3
19. Khoshnam SE, Farzaneh M, Valipour M, Bahaoddini A, Valipour A. Review of the phytochemical, pharmacological and physiological properties of Licorice (Glycyrrhiza glabra). J Clin Excel. 2015;4(1):56-71.
20. Blumenthal M, Goldberg A, Brinckmann J. Herbal Medicine, Expanded Commission E Monographs. 1st ed. Integrative Medicine Communications, USA. 2000; pp:233-235.
21. Colalto C. Herbal interaction on absorption of drugs: Mechanisms of action and clinical risk assessment. Pharmacol Res. 2010;62:207-227. DOI:10.1016/j.phrs.2010.01.003
22. Jalilzadeh-Amin G, Najarnezhad V, Anassori E, Mostafavi M, Keshipour H. Antiulcer properties of Glycyrrhiza glabra L. extract on experimental models of gastric ulcer in mice. Iran J Pharm Res. 2015;14(4):1163-1170.
23. Kang JS, Yoon YD, Cho LJ, Han MH, Lee CW, Park SK, et al. Glabridin, an isoflavan from licorice root, inhibits inducible nitric oxide synthase expression and improves survival of mice in experimental model of septic shock. J

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Pharmacol Exp Ther. 2005;312(3):1187-1194. DOI:10.1124/jpet.104.074484
24. Nourizadeh E, Mirzapur T, Ghasemi KE, Razavi SM, Latifi SN. Investigating the antibacterial effects of mint, licorice, oregano, chamomile and thyme extracts on Helicobacter pylori. Daneshvar Med Res. 1382;11(52):67-71.
25. Dashtpima A, Mushfa A, Means L, Aref Khah N, Shahriari S, Mohseni M, et al. The effect of chamomile on the healing of cutaneous leishmaniasis caused by Leishmania major in Balb C mice. Armaghane Danesh. 2013;20(2):127-136.
26. Dai YL, Li Y, Wang Q, Niu FJ, Li KW, Wang YY, et al. Chamomile: A review of its traditional uses, chemical constituents, pharmacological activities and quality control studies. Molecules. 2022;28(1):133. DOI:10.3390/molecules28010133
27. Omar A, Mohamed FE. Potential effects of Curcumin, Thyme, and Chamomile Oils against Indomethacin-induced Gastric ulcer in male Wister Albino rats. 2024;10(2):315-32. DOI:10.1016/j.jfda.2024.10.007
28. Cheng M, Zhang J, Yang L, Shen S, Li P, Yao S, et al. Recent advances in chemical analysis of licorice (Gan-Cao). Fitoterapia. 2021;149:104803. DOI:10.1016/j.fitote.2021.104803
29. Wu Y, Guo Y, Huang T, Huang D, Liu L, Shen C, et al. Licorice flavonoid alleviates gastric ulcers by producing changes in gut microbiota and promoting mucus cell regeneration. Biomed Pharmacother. 2023;169:115868. DOI:10.1016/j.biopha.2023.115868
30. Radivojac A, Bera O, Zekas G, Stanisavljevic R. Natural and synthetic substances in anti-ulcer treatment: pathophysiology and mechanisms of action. Phytomedicine. 2022;20(2):123-138. DOI:10.1016/j.phyplu.2022.100230
31. Malekmohammad K, Rafieian-Kopaei M, Sardari S, Sewell RD. Toxicological effects of Mentha x piperita (peppermint): a review. Toxin Reviews. 2021 Oct 2;40(4):445-59.

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