

Research Progress on Bioactive Components of *Pinellia Ternata* and Their Mechanisms Against Colorectal Cancer

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Abstract:

Pinellia ternata, the dried tuber of *Pinellia* species (Araceae), is a widely used traditional Chinese medicine with properties of drying dampness to resolve phlegm, directing counterflow *qi* downward to arrest vomiting, and eliminating masses to disperse nodules. In recent years, its antitumor potential has attracted considerable attention. Modern studies have identified that the main anti-colorectal cancer (CRC) constituents in *Pinellia ternata* include alkaloids, polysaccharides, volatile oils, sterols, and lectins. These components exert antitumor effects through multiple mechanisms, including induction of apoptosis and autophagy, cell-cycle arrest, immune modulation, and antioxidant activity, while also synergizing with chemotherapeutic agents and alleviating adverse reactions. Compound formulae containing *Pinellia ternata*, particularly Banxia Xiexin Decoction, have shown promise in adjuvant CRC therapy by improving clinical symptoms, quality of life, and survival. This review systematically summarizes the anti-CRC mechanisms of the active components and the clinical applications of related compound formulae, aiming to provide a theoretical reference for further development and clinical translation.

Keywords:

Pinellia Ternata, Colorectal Cancer, Active Ingredients

1. Introduction

Colorectal cancer (CRC) remains one of the most serious threats to human health. In the late 1990s, it ranked fourth among cancer-related deaths in both men and women under 50 years of age; currently, it has risen to first place in men and second in women[1]. Epidemiological data further reveal a persistent upward trend in both the incidence and mortality of CRC in China[2]. Although chemotherapy, targeted therapy, and immunotherapy have achieved certain progress in CRC treatment, their high costs, significant adverse effects, and the challenge of drug resistance severely limit therapeutic efficacy and are major causes of tumour recurrence, metastasis, and patient mortality. Therefore, exploring novel traditional Chinese medicines and their extracts that are cost-effective and have fewer side effects is of great clinical and public health significance[3].

Pinellia ternata, the dried tuber of *Pinellia* species, was first recorded in *Shennong's Classic of Materia Medica*. It is warm in nature, pungent in taste, and

slightly toxic. Traditionally, it is indicated for patterns of damp-phlegm and cold-phlegm, cough with profuse sputum, phlegm-retention dizziness and palpitations, wind-phlegm vertigo, phlegm-induced headache, vomiting and regurgitation, chest and epigastric stuffiness, and globus hystericus; externally, it is applied to carbuncles and scrofulous nodules. The raw product is toxic and is therefore widely used after standardized processing. Owing to its complex chemical composition, modern pharmacology has identified multiple bioactive constituents with remarkable anticancer potential. In clinical practice, *Pinellia ternata* is often prescribed in compound formulae to exert synergistic effects through compatibility with other herbs. The most representative classical formula is Banxia Xiexin Decoction (BXD), originating from Zhang Zhongjing's *Treatise on Cold Pathogenic Diseases* (Eastern Han Dynasty), composed of *Pinellia ternata*, *Scutellaria baicalensis*, *Coptis chinensis*, dried ginger, ginseng, licorice, and jujube. BXD has the functions of harmonizing the liver and spleen, balancing cold and heat, and eliminating masses. Its compatibility principle lies in the combination of pungent-opening (*Pinellia ternata* and dried ginger) and bitter-descending (*Scutellaria* and *Coptis*) herbs: the former promotes qi movement and resolves dampness, while the latter clears heat, down-regulates rebellious qi, and detoxifies. Moreover, other formulae containing *P. ternata*, such as Xiaoxianxiong Decoction (*Pinellia ternata*, *Trichosanthes kirilowii*, *Coptis chinensis*), have also shown application prospects in the treatment of digestive tract tumours. Collectively, *Pinellia ternata*—whether used alone or as part of a compound—demonstrates broad antitumor potential, meriting further investigation and clinical promotion.

2. Major Bioactive Components of *Pinellia Ternata*

Modern phytochemical studies have revealed that the antitumor active constituents in *Pinellia ternata* include alkaloids, polysaccharides, volatile oils, sterols, organic acids, amino acids, flavonoids, starch, aromatic compounds, proteins (including lectins), and various trace elements. To date, 212 compounds have been isolated and identified from this species[4]. The components with documented antitumor activity are primarily categorized as follows.

2.1. Alkaloids

Alkaloids are regarded as the core antitumor substances in *Pinellia ternata*[5]. The identified alkaloids include ephedrine, trigonelline, choline, guanosine, adenosine, among others, with ephedrine accounting for the highest proportion. Numerous in vitro and in vivo pharmacological experiments have confirmed that total alkaloids from *Pinellia ternata* exert significant anticancer effects through multiple routes: inhibiting proliferation, arresting cell-cycle progression, inducing apoptosis, suppressing angiogenesis, reducing adhesion and invasion, and reversing drug resistance to enhance chemosensitivity[6,7,8]. Notably, among different processed products, the raw herb contains the highest alkaloid content[9].

2.2. Polysaccharides

The polysaccharides of *Pinellia ternata* (*Pinellia ternata* polysaccharide, PTP) constitute another major active fraction. The backbone of PTP is mainly composed of galactose (Gal) and glucose (Glc), with complex branching structures. The specific glycosidic linkage 1,3- α -Glc is considered crucial for its immunomodulatory activity[10]. Studies have shown that PTP, in combination with capecitabine (Xeloda),

enhances the presentation of MHC-II molecules on mouse colon cancer cells. Tumor cells with high MHC-II expression can act as surrogate antigen-presenting cells to deliver tumor antigens to CD4⁺T cells, thereby activating antitumor immunity[11]. Additionally, PTP inhibits cancer cell growth by modulating macrophage function, promoting the generation of anticancer antibodies, and interfering with free radicals[12].

2.3. Lectins

Pinellia ternata agglutinin (PTA) is an active protein isolated from the tuber, belonging to the monocot mannose-binding lectin family[13]. Its molecular structure is a homodimer composed of two identical N-terminal domains and two identical C-terminal domains[14]. PTA exhibits haemagglutinating activity against rabbit and mouse erythrocytes but not human erythrocytes. Several studies using the colon cancer cell line SW-620 have confirmed the antitumor activity of PTA. The C-terminal domain (P-D2) of *Pinellia ternata* lectin, expressed in a soluble form in *E. coli* using a pET-32-SUMO vector, showed good inhibitory activity against SW-620 cells in vitro. The effect was concentration-dependent, and the inhibitory effect on hepatoma Bel-7404 was significantly stronger than on SW-620 ($p < 0.05$)[13]. The N-terminal domain (P-D1) and native PTA also exhibited good antiproliferative activity against SW-620 cells[13]. However, most evidence currently comes from in vitro cellular experiments, and systematic in vivo animal studies and clinical data are lacking. How to attenuate toxicity while maintaining antitumor activity remains a key challenge for clinical translation.

2.4. Volatile Oils

The volatile oils from *Pinellia ternata* exhibit strong bioactivity. Major constituents include anethole, methyl 2-chloroacrylate (4.95%), hexadecenedioic acid (6.92%), butyl vinyl ether (11.8%), and 3-acetyl-amino-5-methylisoxazole (44.40%)[15]. Peng *et al.* employed distillation-extraction to analyze the volatile oil from Ying *Pinellia ternata* and identified siloxanes, phenols, esters, alkanes, and ketones[16]. Of particular clinical relevance, the volatile oil has been applied to manage leukopenia induced by chemotherapy or radiotherapy[17].

2.5. Sterols

Phytosterols are also important bioactive components, including daucosterol, β -sitosterol, campesterol, stigmasta-5,22-dien-3-ol, stigmasta-5,24-dien-3-ol, and cycloartenol[18]. Cycloartenol is not only a key precursor in sterol biosynthesis but also possesses direct antitumor properties[19].

In addition, *Pinellia ternata* contains organic acids (e.g., succinic acid, palmitic acid, malic acid, citric acid, linoleic acid), amino acids (including aspartic acid, glutamic acid, arginine, etc.), flavonoids (e.g., daidzein, methylphosphogonanone B, apigenin, quercetin, kaempferol), starch, aromatic compounds, tannins, and various trace elements, all of which participate in or synergize the antitumor pharmacological activities of the plant.

3. Mechanisms of Action Against Colorectal Cancer

Accumulating evidence indicates that the active constituents of *Pinellia ternata* can inhibit the proliferation of human cancer cells, compress surrounding tissues, and

accelerate cell death[20]. Many of these components exert potent antiproliferative effects, and when used in combination with other traditional Chinese medicines, they modulate multiple cell- signaling pathways to enhance therapeutic outcomes[21].

Trigonelline exerts anticancer activity by suppressing Nrf2 hyperactivation[22]. Trigonelline-loaded micelles, functioning as potent Nrf2 inhibitors, have been proposed as promising tools to overcome oxaliplatin resistance in colon cancer[23]. Moreover, *Pinellia ternata* extracts induce autophagy via inhibition of nuclear Nrf2 and the mitogen-activated protein kinase (MAPK) pathway[21], and promote apoptosis by modulating the expression of Bax/Bcl-2 and caspase-3[24]. Zhang *et al.* further demonstrated that *Pinellia ternata* alkaloids alleviate chemotherapy-induced nausea and vomiting by blocking 5-HT₃ and NK₁ receptors in the guinea pig ileum[25].

Focusing on polysaccharides, PTP triggers apoptosis through the endogenous mitochondrial-mediated pathway and induces S-phase arrest [12,26]. Cao *et al.* found that PTP enhances the antitumor efficacy of capecitabine by upregulating MHC-II expression on tumor cells, which facilitates the presentation of tumor antigens to CD4⁺T cells and strengthens cellular immunity in tumor-bearing mice[27]. Additional experiments suggest that PTP may also act via scavenging free radicals in vivo[28].

At the monomer level, the compound 5,8-epidioxyergosta-6,22-dien-3-ol isolated from *P. ternata* displayed inhibitory activity against the human colon cancer cell line HCT-8 in MTT assays[29]. Yang *et al.* reported that cycloartenol and isopinellioside (at 10 μmol/L) suppressed LPS-induced TNF-α production in mouse peritoneal macrophages by 54.7% and 47.5%, respectively, indicating a potential anti-inflammatory contribution to their antitumor effects[30]. Furthermore, *Pinellia ternata* lectin has been shown to enhance neutrophil chemotaxis and increase TNF-α production via macrophage stimulation[31].

4. Anti-CRC Research on *Pinellia Ternata*-Containing Compound Formulae

In clinical practice, *Pinellia ternata* is frequently administered as part of compound formulae, among which Banxia Xiexin Decoction (BXD) is the most representative. Originating from Zhang Zhongjing's *Treatise on Cold Pathogenic Diseases*, BXD comprises seven herbs: *Pinellia ternata*, *Scutellaria baicalensis*, *Coptis chinensis*, dried ginger, ginseng, licorice, and jujube. Recent studies have confirmed its efficacy against CRC[32].

A randomized controlled trial involving 100 patients with advanced colon cancer demonstrated that the “pungent-opening and bitter-descending” strategy of BXD combined with mFOLFOX6 chemotherapy resulted in significantly lower TCM syndrome scores (P=0.022), a higher overall response rate (P=0.013), improved KPS and QLQ-C30 scores (P=0.003 and P=0.012), and reduced incidence of certain adverse events (SGOT/SGPT and WBC, P=0.001 and P=0.004)[33]. In terms of quality of life, a clinical observation including 152 patients indicated that modified BXD effectively enhanced the quality of life in patients with advanced CRC[34].

Another randomized study of 105 patients with postoperative gastrointestinal dysfunction (liver-spleen disharmony pattern) after radical CRC resection reported that the modified BXD group achieved a total effective rate of 98.11%, significantly

higher than the control group's 86.54%, and effectively reduced serum levels of CA199, CA724, and CEA while promoting gastrointestinal recovery[35].

Retention enema with BXD also showed promising results in metastatic colon cancer complicated by incomplete intestinal obstruction. A randomized trial of 97 stage IV colon cancer inpatients assessed the clinical efficacy of BXD retention enema and the incidence of severe intestinal complications following conversion surgery[36].

Integrating network pharmacology with clinical validation, BXD was found to significantly improve lipid metabolism and immune function in postoperative patients with stage IIB- IIIC colon cancer, extending disease-free survival (DFS)[37]. Additionally, BXD has been applied to precancerous lesions to impede colitis-associated carcinogenesis[38].

Using Cytoscape to construct a "component-target-pathway" network, among 121 active compounds in BXD, 99 were linked to core targets, and 6 targets were associated with major pathways. The top-ranked active components were quercetin, kaempferol, naringenin, and licochalcone A; the core targets were PTGS2, PPARG, AKT1, and BAX; and the principal pathways involved P53, neurotrophin, and AMPK signaling. These findings underscore the multi-component, multi-target, and multi-pathway mode of action of BXD against CRC[39].

Furthermore, network pharmacology research on Xiaoxianxiong Decoction (composed of *Pinellia ternata*, *Trichosanthes kirilowii*, and *Coptis chinensis*) for CRC screened 32 active ingredients, 181 corresponding protein targets, and 9,329 disease targets. Through target fishing, 360 core targets were identified. GO enrichment indicated biological processes related to NAD-dependent histone deacetylase activity, negative regulation of racemase, and cholecystokinin response; molecular functions involved protein serine/threonine kinase activity, ATP binding, and cysteine-type endopeptidase activity regulation during apoptosis; cellular components were associated with spindle microtubules, histone deacetylase complexes, and nucleosomes. KEGG enrichment annotated four pathways: gastrin, cell cycle, hepatitis B infection, and DNA damage response. Molecular docking confirmed strong binding affinities between the selected compounds and their targets[40].

At the clinical application level, numerous studies have demonstrated the obvious antitumor efficacy of Xiaoxianxiong Decoction and its active components. Many practitioners have used it and its modified formulations in clinical cancer treatment, with a broad practical basis, and pharmacological studies have also verified its effectiveness[41]. For colorectal cancer, clinical practice has employed modified Xiaoxianxiong Decoction (e.g., based on the original formula with additions such as *Carapax Amydae*, *Curcuma zedoaria*, *Ranunculus ternatus*, *Rabdosia rubescens*, *Coix lacryma-jobi*, and *Lilium brownii*) for post-operative treatment of rectal cancer. Lao *et al.* also conducted textual research and clinical application analysis of Xiaoxianxiong Decoction[42]. Furthermore, research on modified Xiaoxianxiong Decoction has shown progress: both in vitro and in vivo experiments confirmed its significant antitumor effect, with mechanisms related to induction of pro-apoptotic gene Fas expression and inhibition of anti-apoptotic gene Bcl-2 overexpression[43].

5. Concluding Remarks and Future Perspectives

As a traditional Chinese medicine, *Pinellia ternata* contains diverse bioactive constituents—alkaloids, polysaccharides, volatile oils, sterols, and lectins—that exhibit remarkable multi-target and multi-pathway regulatory potential against colorectal cancer. Beyond direct inhibition of proliferation, induction of apoptosis and autophagy, these components also modulate immune responses, alleviate inflammation, and counteract chemoresistance, thereby offering integrated therapeutic benefits. Compound preparations, especially Banxia Xiexin Decoction, have shown encouraging prospects in clinical studies, including synergistic effects with chemotherapy, toxicity reduction, improvement of quality of life, and extension of survival. Network pharmacology analyses further support the “multi-component, multi-target, multi-pathway” systemic mode of action, which aligns well with the complex pathophysiology of CRC.

Nevertheless, several critical challenges remain. First, the pharmacokinetic profiles and metabolic fates of the active components are poorly understood, hindering optimization of bioavailability. Second, most mechanistic studies are confined to cellular and animal models, with a notable scarcity of large-scale, multicenter randomized controlled trials. Third, the safety evaluation of trace toxic constituents (e.g., calcium oxalate raphides) and the standardization of processing techniques require urgent attention. Fourth, the synergistic rules and optimal proportions among multiple components in compound formulae have yet to be systematically investigated.

Looking forward, it is imperative to integrate multi-omics approaches (e.g., metabolomics, proteomics) and systems biology to deeply decipher the network-regulatory mechanisms of *Pinellia ternata* and its formulae. Concurrently, nanotechnology-based formulations or structural modifications should be pursued to improve targeting and bioavailability. Rigorously designed clinical trials with high-level evidence are urgently needed to facilitate the standardized application of *P. ternata* and its related formulae in comprehensive CRC management. In summary, the medicinal value of *Pinellia ternata* continues to emerge through “traditional-modern” cross-disciplinary research; however, its clinical translation demands concerted multidisciplinary efforts to ultimately bridge the gap from empirical use to evidence-based precision therapy.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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References

- [1] Siegel, R.L.; Giaquinto, A.N.; Jemal, A. Cancer statistics, 2024. *CA: A Cancer Journal for Clinicians*, 2024, 74(1), 12-49.
- [2] Chen, W.; Zheng, R.; Baade, P.D., et al. Cancer statistics in China, 2015. *CA: A Cancer Journal for Clinicians*, 2016, 66(2), 115-132.

- [3] Shen, J.L.; Zhao, X.Y.; Xiao, H.J. Research progress on anti-colorectal cancer mechanism of Sijunzi Decoction and its main active components. *Chinese Journal of Experimental Traditional Medical Formulae*, 2024, 30(16), 240-252.
- [4] Yu, W.L.; Zhang, H. Research progress on traditional application, pharmacology, toxicity and quality control of *Pinellia ternata*. *Chinese Journal of Medicinal Guide*, 2026, 28(3), 262-270.
- [5] Hu, Y.D.; Yu, L. Study on alkaloid chemical constituents of *Pinellia ternata*. *China Prescription Drug*, 2022, 20(1), 32-34.
- [6] Yu, Y.Y.; Shen, Z.; Zhang, X.F, et al. Mechanism of *Pinellia ternata* in treatment of rectal cancer based on network pharmacology. *Journal of Zhejiang Chinese Medical University*, 2020, 44(8), 783-789.
- [7] Chen, C.; Sun, Y.; Wang, Z, et al. *Pinellia* genus: A systematic review of active ingredients, pharmacological effects and action mechanism, toxicological evaluation, and multi-omics application. *Gene*, 2023, 870, 147426.
- [8] Wang, H.; Yu, M.; Li, W.N, et al. Research progress on chemical constituents and anti-tumor mechanisms of *Pinellia ternata*. *Guiding Journal of Traditional Chinese Medicine and Pharmacy*, 2021, 27(8), 49-52.
- [9] Yang, B.Y.; Li, M.; Jing, Y, et al. Differences in chemical constituents and efficacies between *Pinellia ternata* and its processed products. *Chinese Traditional and Herbal Drugs*, 2018, 49(18), 4349-4355.
- [10] Huang, J.S.; Hu, Y.L.; Li, J.M, et al. Research progress on isolation, extraction and pharmacological activities of *Pinellia ternata* polysaccharides. *Shaanxi Journal of Traditional Chinese Medicine*, 2024, 45(9), 1283-1285.
- [11] Cao, S.L.; Meng, X.Z.; Wei, P.K. Synergistic effect of *Pinellia ternata* polysaccharide on MHC-II molecule expression in mouse adenocarcinoma cells under Xeloda intervention. *Progress in Modern Biomedicine*, 2010, 10(11), 2034-2036.
- [12] Tian, W.T. Structural characterization and antitumor activity of *Pinellia ternata* polysaccharide. Master's Thesis, Tianjin University of Science and Technology, Tianjin. 2020.
- [13] Xu, S.W. Expression of soluble *Pinellia ternata* lectin in engineered bacteria and its activity study. Master's Thesis, Zhejiang Sci-Tech University, Zhejiang. 2014.
- [14] Xu, S.W.; Liu, B.Y.; Zhou, W, et al. Soluble expression and activity study of the C-terminal domain of *Pinellia ternata* lectin. *Journal of Zhejiang Sci-Tech University*, 2014, 31(7), 439-444.
- [15] Zhou, Y.L.; Yang, P.; Li, X.X, et al. Research progress on chemical constituents and pharmacological effects of *Pinellia ternata* and prediction of its quality markers (Q-Marker). *Chinese Traditional and Herbal Drugs*, 2024, 55(14), 4939-4952.
- [16] Peng, J.B.; Yan, A.D.; Chen, K.P, et al. GC-MS analysis of volatile oil components from Ying *Pinellia ternata* extracted by different methods. *China Pharmaceuticals*, 2019, 28(9), 25-27.
- [17] Zhang, G.Y.; Xiong, J.D.; Wei, J.Y, et al. Research progress on chemical constituents and pharmacological effects of *Pinellia ternata* and prediction of its

- quality markers. *West China Journal of Pharmaceutical Sciences*, 2024, 39(1), 110-115.
- [18] Zheng, X.B.; Chen, K.L.; Yin, W.Z, et al. GC-MS analysis of liposoluble components from high-yield *Pinellia ternata* in western Hubei. *Journal of Chinese Medicinal Materials*, 2007, 6, 665-667.
- [19] Liang, Y.T.; Jiang, Y.N.; Sun, Y.N. Protective effect and mechanism of cycloartenol from *Pinellia ternata* on myocardial ischemia-reperfusion injury in mice. *Journal of Nanjing University of Traditional Chinese Medicine*, 2024, 40(1), 68-77.
- [20] Yen, M.H.; Lee, J.J.; Yeh, C.F, et al. Yakammaoto inhibited human coxsackievirus B4 (CVB4)-induced airway and renal tubular injuries by preventing viral attachment, internalization, and replication. *Journal of Ethnopharmacology*, 2014, 151(3), 1056-1063.
- [21] Chen, C.; Sun, Y.; Wang, Z, et al. *Pinellia* genus: A systematic review of active ingredients, pharmacological effects and action mechanism, toxicological evaluation, and multi-omics application. *Gene*, 2023, 870: 147426.
- [22] Nguyen, V.; Taine, E.G.; Meng, D, et al. Pharmacological activities, therapeutic effects, and mechanistic actions of trigonelline. *International Journal of Molecular Sciences*, 2024, 25(6), 3385.
- [23] Pirpour, T.A.; Salehi, R.; Velaei, K et al. The potential impact of trigonelline loaded micelles on Nrf2 suppression to overcome oxaliplatin resistance in colon cancer cells. *Molecular Biology Reports*, 2020, 47(8), 5817-5829.
- [24] Li, Z.; Feng, J.; Zhao, X, et al. The extract of *Pinellia ternata*-induced apoptosis of leukemia cells by regulating the expression of Bax, Bcl-2 and caspase-3 protein expression in mice. *Transplantation Proceedings*, 2023, 55(9), 2232-2240.
- [25] Zhang, Q.L.; Gong, L.L.; Li, G.S. et al. Effect of *Pinellia ternata* alkaloids on 5-HT₃ and NK₁ receptors in isolated guinea pig ileum. *Journal of Shandong University of Traditional Chinese Medicine*, 2017, 41(5), 466-468.
- [26] Tian, W.; Zhang, X.; Liu, H, et al. Structural characterization of an acid polysaccharide from *Pinellia ternata* and its induction effect on apoptosis of Hep G2 cells. *International Journal of Biological Macromolecules*, 2020, 153, 451-460.
- [27] Cao, S.L.; Meng, X.Z.; Wei, P.K. Synergistic effect of *Pinellia ternata* polysaccharide on MHC-II molecule expression in mouse adenocarcinoma cells under Xeloda intervention. *Progress in Modern Biomedicine*, 2010, 10(11), 2034-2036.
- [28] Zhang, C.Q.; Ji, J.J.; Wang, C.J. In vivo antitumor effect and mechanism of *Pinellia ternata* polysaccharide. *Strait Pharmaceutical Journal*, 2016, 28(7), 22-24.
- [29] He, P.; Li, S.; Wang, S.J, et al. Chemical constituents of *Pinellia ternata*. *China Journal of Chinese Materia Medica*, 2005, 9, 671-674.
- [30] Yang, X.W.; Han, M.H.; Zhong, G.Y, et al. A new cerebroside from *Pinellia ternata* inhibiting tumour necrosis factor- α production. *Chinese Traditional and Herbal Drugs*, 2008(4), 485-490.

- [31] Yu, H.; Zhao, T.; Wu, H, et al. Pinellia ternata lectin exerts a pro-inflammatory effect on macrophages by inducing the release of pro-inflammatory cytokines, the activation of the nuclear factor- κ B signaling pathway and the overproduction of reactive oxygen species. *International Journal of Molecular Medicine*, 2015, 36(4), 1127-1135.
- [32] Wu, G.C. Study on the effect and mechanism of Banxia Xiexin Decoction in the treatment of colorectal cancer. Master's Thesis, Shanxi Medical University, Taiyuan. 2024.
- [33] Wang, J.T.; Yin, Y.; Li, X.T, et al. Pungent-opening and bitter-descending method of Banxia Xiexin Decoction combined with mFOLFOX6 regimen in the treatment of advanced colon cancer. *Information on Traditional Chinese Medicine*, 2019, 36(1), 34-37.
- [34] Li, Y.D.; Liu, C. Clinical observation on improving quality of life in patients with advanced colorectal cancer using Banxia Xiexin Decoction. *Chinese Medicine Modern Distance Education of China*, 2022, 20(11), 76-77.
- [35] Zhao, L.; Xu, T.S.; Zheng, K. Efficacy of modified Banxia Xiexin Decoction on postoperative gastrointestinal dysfunction in colorectal cancer and its effect on serum tumour markers. *New Chinese Medicine*, 2023, 55(8), 24-27.
- [36] Zhang, C.; Liao, L.G.; Hu, Q.X. Clinical observation of retention enema with Banxia Xiexin Decoction in the treatment of metastatic colon cancer complicated with incomplete intestinal obstruction. *Lishizhen Medicine and Materia Medica Research*, 2023, 34(7), 1673-1675.
- [37] Zhang, X.L.; Jiang, H.L.; Shen, R, et al. Mechanism of Banxia Xiexin Decoction in regulating immune function in postoperative colon cancer patients based on network pharmacology and clinical validation. *Journal of Xinjiang Medical University*, 2026, 49(4), 549-556.
- [38] Sun, X.H.; Shen, C.L.; Wei, D.D, et al. Research progress on clinical application and mechanism of Banxia Xiexin Decoction-like formulae in treating "inflammation-cancer transformation" of digestive system based on "treating different diseases with same method". *Chinese Journal of Experimental Traditional Medical Formulae*, 2024, 1-24 .
- [39] Le, Y.Z.; Xie, J.; Wang, X.P, et al. Exploring the mechanism of Banxia Xiexin Decoction in treating colorectal cancer based on network pharmacology. Proceedings of the 9th China Conference on Traditional Chinese Medicine Information, Xiamen, Fujian, China, 2023.
- [40] Gao, S.Y.; Li, W.Q.; Wang, S, et al. Mechanism study of Xiaoxianxiong Decoction in treating colorectal cancer based on network pharmacology. *Chinese Traditional and Herbal Drugs*, 2022, 53(3), 773-782.
- [41] Ding, R.; Wang, X.; Zhou, P, et al. Research progress on active components with antitumor effects in Xiaoxianxiong Decoction and their mechanisms. *Chinese Journal of Experimental Traditional Medical Formulae*, 2020, 26(22), 186-192.
- [42] Lao, Y.Y.; Hu, F.L.; Tian, J.X, et al. Textual research and clinical application analysis of Xiaoxianxiong Decoction. *Guiding Journal of Traditional Chinese Medicine and Pharmacy*, 2024, 30(12), 129-135.

- [43]Huang, J.L. Study on the antitumor effect and mechanism of modified Xiaoxianxiong Decoction.Ph.D. Thesis, Nanjing University of Chinese Medicine, Nanjing. 2005.



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