DOI: 10.66069/ojspub.20542236

Mingmen Fire Exhaustion and the Tumor Microenvironment: A Hypothesis Connecting Traditional Tonic Therapy to Modern Oncology

Xuan Liu[1], Jiajing Wang[1], Chengguang Yang[2,*]

[1]Shaanxi University of Chinese Medicine, Xianyang 712046, Shaanxi, China
[2]Shaanxi Provincial Hospital of Chinese Medicine, Xi'an 710003, Shaanxi, China
Correspondence Author

Abstract: ***Objective:*** ***To construct a systematic explanatory hypothesis model based on the theory of Mingmen Fire Exhaustion and advances in tumor microenvironment (TME) research.*** ***Methods:*** ***By integrating the TCM Mingmen theory with modern TME research, this study analyzes the issue at the metabolic, immunological, and microcirculatory levels.*** ***Results:*** ***Mingmen Fire Exhaustion may participate in TME formation through systemic energy metabolism disorders, neuro-endocrine-immune (NEI) network dysfunction, and microcirculatory perfusion insufficiency; the TME may in turn exacerbate systemic functional imbalance through feedback mechanisms.*** ***Conclusion:*** ***The proposed "Mingmen Fire Exhaustion–TME" hierarchical hypothesis provides a theoretical framework for the Mingmen-warming tonic approach, yet requires further experimental and clinical validation.***

Keywords: Mingmen Fire Exhaustion, Tumor microenvironment, Metabolic reprogramming, Immunosuppression, Mingmen-warming tonic therapy.

1. Introduction

The tumor microenvironment (TME) is a complex ecosystem composed of tumor cells, immune cells, stromal cells, and vascular structures, playing a critical role in tumor initiation, progression, and therapeutic resistance [1-3]. The TME is not a static structure but is in a state of continuous dynamic evolution, with core features including metabolic reprogramming, immunosuppression, and tissue hypoxia [1-3].

At the metabolic level, tumor cells meet their proliferative demands by enhancing glycolysis and suppressing oxidative phosphorylation, resulting in lactate accumulation and extracellular acidification [2]. At the immune level, the TME induces effector T cell dysfunction through multiple mechanisms, including nutrient competition, immune checkpoint activation, and release of inhibitory cytokines [3]. At the physical level, aberrant angiogenesis leads to local hypoxia and insufficient perfusion, further exacerbating the metabolic-immune imbalance [4-5]. Although immune checkpoint inhibitors have achieved remarkable efficacy in some tumors, the overall response rate remains suboptimal due to the complex immunosuppressive network of the TME. Among these, T cell metabolic exhaustion is considered one of the core bottlenecks limiting therapeutic efficacy [3].

In traditional Chinese medicine (TCM), the pathogenesis of tumors has long been understood from the perspectives of "healthy qi deficiency" (zheng xu) and "yang qi dysregulation" (yang qi shi tiao). "Mingmen Fire Exhaustion" (mingmen huo shuai), as an important theoretical concept describing the overall functional decline of the body, has been elaborated by physicians throughout history from the angles of warming, propelling, and consolidating functions [9-14]. In recent years, research on the relationship between the Mingmen theory and tumors has mainly focused on three aspects: (1) exploring the TCM pathogenesis of tumors from the perspectives of "yang deficiency" and "yang-supplementing method"; (2) experimental studies on yang-warming formulas regulating tumor immune function and microenvironment; (3) application of Mingmen-related theories (such as Sanjiao-Mingmen and Mingyuan theory) in tumor clinical practice [7,12,18]. Meanwhile, modern TME research has shifted from a single tumor cell perspective to a holistic systems analysis, emphasizing the interactive regulatory mechanisms among metabolism, immunity, and the microenvironment [1-3].

However, studies that structurally compare and hierarchically model the relationship between "Mingmen Fire Exhaustion" as a holistic functional state concept and the TME as a local microenvironmental system remain lacking. Cross-system theoretical mapping in this area is still in its exploratory stage.

This paper attempts to propose an explanatory hypothesis from the perspectives of systems medicine and comparative medicine: Mingmen Fire Exhaustion may be functionally correlated with the formation and maintenance of the TME. Based on the analytical pathway of "holistic functional state → local microenvironmental changes," the two may exhibit the following hierarchical associations: decline in holistic bodily function → local metabolic and perfusion abnormalities → immune suppression → persistent microenvironmental imbalance. This study aims to provide a structured analytical framework for the modern expression of fundamental TCM theories, while introducing a holistic functional state perspective into TME research, thereby providing a theoretical foundation for subsequent multidisciplinary investigations.

2. Modern Interpretation of Mingmen Fire Exhaustion

2.1 Theoretical Foundation and Functional Positioning of the Mingmen Theory

The Mingmen theory originated from the Nan Jing (Classic of Difficult Issues) statement that "the right kidney is the Mingmen," and was gradually developed by physicians throughout history from an anatomical localization into a functional conceptual system. Chapter 36 of the Nan Jing states: "The Mingmen is where the spirit and essence reside, and where the original qi is attached," establishing the Mingmen as the fundamental driving force of life activities. During the Ming and Qing dynasties, Zhang Jingyue proposed that "the Mingmen is the abode of water and fire" and "the source of transformation of the five viscera," further emphasizing the core role of the Mingmen in the regulation of yin and yang, thereby expanding it from a local visceral concept into a symbolic expression of the holistic regulatory system.

Modern research tends to view the Mingmen as a "functional integration concept"—a comprehensive theoretical model reflecting the body's physiological homeostatic regulatory capacity, rather than a single anatomical structure [9]. Lin Mingxin pointed out that the Mingmen, corresponding to humans, is "the place where the human body generates, transmits, and regulates vital substances, energy, and information" [9]. From a theoretical perspective, the Mingmen is a TCM expression of systemic functional status, and its core functions can be summarized as energy warming, functional propulsion, and homeostatic maintenance.

2.2 Functional State Interpretation of Mingmen Fire Exhaustion

Mingmen Fire Exhaustion is clinically characterized by aversion to cold, cold extremities, mental fatigue, lassitude, and soreness and weakness of the lower back and knees. Its essence is a state of "decline in warming and propelling functions." From a modern medical perspective, it can be interpreted from the following three aspects.

1) Energy metabolic disorders. Mingmen Fire Exhaustion may correspond to a decline in basal metabolic rate and reduced energy supply efficiency. At the cellular level, this may manifest as attenuated oxidative metabolism, decreased ATP production, and impaired energy utilization [21]. This correspondence is a functional analogy, not a structural equivalence.

2) NEI network dysfunction. The maintenance of bodily homeostasis depends on the coordinated regulation of the neuro-endocrine-immune (NEI) network. Mingmen Fire Exhaustion can be regarded as a TCM description of "decline in holistic regulatory capacity," which may be functionally correlated with NEI network dysfunction [3]. Wang Xiaomin pointed out that under physiological conditions, the Mingmen contains yin and yang within, which are distributed throughout the body via the Sanjiao [14], highly consistent with the holistic coordinating function of the NEI network. However, direct equivalence between the two lacks experimental evidence.

3) Microcirculatory perfusion insufficiency. Tissue perfusion depends on the matching of vascular tone regulation and metabolic demand. In states of functional hyporesponsiveness, peripheral circulation is weakened and local perfusion is insufficient. Shi Zhiyao et al. [12] pointed out that renal cancer originates from Mingmen deficiency and insufficient kidney qi, leading to Sanjiao qi mechanism dysfunction, thereby affecting the normal circulation of qi and blood throughout the body. The widespread existence of hypoperfusion and hypoxia in the TME is phenotypically comparable to the TCM description of "warming failure and sluggish qi-blood circulation," but this remains a cross-system descriptive correspondence.

2.3 Theoretical Integration of Mingmen Fire Exhaustion and the Tumor Pathogenesis Model

In the TCM tumor pathogenesis model of "deficiency–cold–stasis–toxin" (xu–han–yu–du), Mingmen Fire Exhaustion occupies the core position of "deficiency" as the initiating link in holistic functional decline: deficiency refers to the decline of holistic regulatory capacity (Mingmen Fire Exhaustion); cold refers to reduced metabolism and circulation due to functional insufficiency; stasis refers to accumulation of metabolic products and microcirculatory disturbance; toxin refers to pathological products formed by the long-term evolution of the abnormal microenvironment. This model is a logical deduction within the TCM theoretical system, and its correspondence with the modern TME evolutionary process is merely a "structural analogy," not a causal mapping.

In summary, Mingmen Fire Exhaustion is a TCM expression reflecting the decline of the body's holistic functional regulatory capacity, and may have functional correlations or structural analogies with states such as energy metabolism disorders, NEI dysfunction, and microcirculatory disturbances [9,12,14]. However, it must be clarified that: Mingmen Fire Exhaustion is not equivalent to any modern medical disease; the current correspondences are based on systematic analogical analysis; and its mechanistic interpretation requires subsequent experimental validation.

3. Core Features of the Tumor Microenvironment

3.1 Structural Composition and Systemic Properties of the TME

The TME is composed of tumor cells together with various non-tumor cells, including immune cells, vascular endothelial cells, cancer-associated fibroblasts (CAFs), and the extracellular matrix (ECM) [4-5]. The TME is a dynamically evolving ecosystem in which components form complex regulatory networks through cytokines, metabolite exchange, and direct cell-cell contact [4-5]. Tumor cells actively shape the microenvironment through metabolic reprogramming and signaling regulation, forming structures that favor their own survival and immune evasion [2-3].

3.2 Three Core Pathological Features of the TME

The abnormal state of the TME is centrally manifested in three mutually coupled pathological features: metabolic reprogramming, immunosuppression, and microenvironmental disturbance [1-5].

1) Metabolic reprogramming and acidification. Tumor cells

preferentially rely on glycolysis for energy production even under aerobic conditions (the Warburg effect) [2], resulting in extensive lactate production and extracellular acidification, while forming nutrient competition with immune cells. When substrates such as glucose and amino acids are limited, effector T cell function becomes restricted and gradually enters a state of energy exhaustion [3].

2) Hypoxia and HIF signaling activation. Hypoxia is prevalent within solid tumors, originating from aberrant vascular structure and insufficient perfusion; tumor tissue oxygen partial pressure is significantly lower than that of normal tissue [4]. Hypoxia activates a series of adaptive responses through stabilization of hypoxia-inducible factor-1α HIF−1α, including promotion of glycolytic gene expression, suppression of mitochondrial oxidative metabolism, and alteration of cell survival and migration capacity [1], further reinforcing tumor cell hypoxia adaptation and exacerbating metabolic disturbance [1,4].

3) Immunosuppressive microenvironment formation. Regulatory T cells (Tregs), myeloid-derived suppressor cells (MDSCs), and tumor-associated macrophages (TAMs) collectively participate in the establishment of the immunosuppressive state [5]. Through mechanisms including suppression of effector T cell proliferation and activity, secretion of inhibitory cytokines such as IL-10 and TGF-β, consumption of key nutrients, and upregulation of immune checkpoint molecules, these cells lead to decreased immune surveillance and tumor immune evasion [3,5].

3.3 Metabolic-Immune Coupling and Systemic Imbalance

The three major features of the TME reinforce each other through metabolic-immune coupling mechanisms: lactate accumulation suppresses T cell function; hypoxia promotes expansion of immunosuppressive cell populations; and restricted immune cell metabolism in turn attenuates antitumor responses [1-3]. The TME thus evolves from a "local abnormality" into a self-sustaining pathological ecosystem [4-5]. The TME is a dynamically imbalanced system with self-organizing characteristics—at the metabolic level, energy redistribution and substrate competition are enhanced; at the immune level, the inhibitory network predominates; and at the physical level, hypoxia, hypoperfusion, and an acidic environment persist [4-5].

4. Hypothesis Construction: A Hierarchical Correlation Model of Mingmen Fire Exhaustion and the Tumor Microenvironment

4.1 Model Construction Principles and Theoretical Boundaries

This model is based on systems medicine and comparative medicine approaches, aiming to describe possible correspondences between "holistic functional state" and "local microenvironmental changes." It must be clarified that: this model is not a causal mechanism model; it does not constitute a direct equivalence between TCM and modern medical concepts; it is primarily used for explanatory analysis and research hypothesis generation. Methodologically, this model employs a three-layer analytical framework of "structural correspondence + functional mapping + dynamic feedback" [9,12,14].

4.2 Level One: Decline in Holistic Regulatory Capacity

Mingmen Fire Exhaustion indicates a decline in the body's holistic warming and propelling functions [9]. From a systems biology perspective, this represents a weakening of the body's holistic homeostatic regulatory capacity, involving decreased energy supply efficiency, reduced stress response capacity, and diminished multisystem coordinated function [12,14]. The key feature of this stage is the decline of holistic systemic responsiveness, which may reduce immune surveillance against aberrant cell proliferation and provide a background condition for subsequent local microenvironmental abnormalities [11].

4.3 Level Two: Local Metabolic and Perfusion Abnormalities

Against the background of declining holistic regulatory capacity, local tissues are more prone to metabolic-perfusion mismatch. In tumor tissues, due to aberrant vascular structure and rapid proliferation demands, hypoxic and hypoperfused regions form [1,4], and tumor cells further adapt to the microenvironment through metabolic reprogramming [2]. Manifestations include insufficient oxygen supply and metabolic dependency switching, lactate accumulation and acidification, and uneven nutrient distribution with enhanced local competition [1-3].

4.4 Level Three: Immune Function Restriction and Cell Population Remodeling

Alterations in the local metabolic environment further affect immune cell function. In hypoxic, low-glucose, and high-lactate environments, effector T cell function is suppressed, while immunosuppressive populations including Tregs, MDSCs, and TAMs relatively predominate [3,5]. Manifestations include decreased effector cell function, increased proportion of suppressive cells, and enhanced immune checkpoint signaling—that is, local immune regulatory network remodeling, with decreased immune surveillance and enhanced immunosuppression coexisting [3,5].

4.5 Level Four: Dynamic Feedback and System Stabilization

Once formed, the TME can enter a self-sustaining state through multiple feedback mechanisms: metabolic products (lactate, adenosine) persistently suppress immune function; inflammatory and immunosuppressive signals cyclically reinforce each other; tumor cells affect distal regulatory systems through exosomes; and the local microenvironment further reinforces metabolic adaptability [1-3,16]. At this stage, the TME exhibits certain self-organizing and self-stabilizing characteristics [4-5].

In summary, this model can be summarized as: decline in holistic regulatory capacity → local metabolic and perfusion

abnormalities → immune function restriction → dynamic feedback maintaining the abnormal microenvironment. This process emphasizes hierarchical associations and dynamic interactions among systems, rather than a single causal chain.

5. Potential Mechanisms of Mingmen - Warming Tonic Therapy in Remodeling the Tumor Microenvironment

5.1 Representative Agents and Evidence Level

Commonly used agents in the Mingmen-warming tonic approach include Aconitum carmichaelii (Fuzi), Cinnamomum cassia (Rougui), Zingiber officinale (Ganjiang), Epimedium brevicornu (Yinyanghuo), and Psoralea corylifolia (Buguzhi), with representative formulas including Sini Decoction (Si Ni Tang), Yougui Yin, and Yanghe Decoction (Yang He Tang) [19-23]. Existing evidence is divided into three levels: in vitro experiments (effects on tumor cell proliferation, migration, and apoptosis) [21]; animal experiments (regulation of tumor growth and immune parameters in tumor-bearing models) [20,25-26]; and clinical observations (symptom improvement and immune parameter changes) [19,23]. Overall, the evidence is predominantly preclinical, with limited high-quality randomized controlled studies [19,23].

5.2 Possible Metabolic Regulatory Effects

Mingmen-warming formulas may participate in tumor-related metabolic regulation through multi-target pathways. (1) Energy metabolism: Some studies suggest that yang-warming agents may promote oxidative phosphorylation and improve mitochondrial function [20-21], but most are limited to animal or cellular models, and human effects require further validation [21]. (2) Metabolic stress pathways: They may be related to AMPK/mTOR and other energy-sensing pathways, affecting energy distribution and metabolic adaptability [16]. (3) Hypoxia signaling: They may affect HIF-1α expression, indirectly regulating hypoxic adaptation responses [1,20].

5.3 Immunomodulatory Effects on the Microenvironment

The effects of Mingmen-warming formulas on the immune microenvironment are primarily manifested as "immune balance modulation" rather than unidirectional enhancement of immune responses [19,23-24]. (1) Effector immune function: Animal experiments show they may increase $CD4^+$ T cell proportions, IL-2 levels, and NK cell activity [21,23]. (2) Immunosuppressive microenvironment: They may affect TAM polarization, promoting transition from M2-like to M1-like phenotype [23-24], but this is mainly derived from experimental models with insufficient clinical evidence [23]. (3) Immune cell population balance: They may affect Treg/MDSC proportions [19,23], though the specific pathways remain unclear [25-26].

5.4 Potential Synergy with Immune Checkpoint Inhibitors

The combination of metabolic regulation and immunotherapy is an important direction for improving tumor treatment outcomes [16]. Mingmen-warming tonic therapy may have the following synergistic values: improving immune cell metabolic status to enhance the basis for immunotherapy response; regulating the immunosuppressive microenvironment to potentially increase immune checkpoint inhibitor sensitivity; and improving holistic functional status to optimize treatment tolerability [16,19]. However, this synergy primarily remains at the level of theoretical speculation and preliminary experimental observation, lacking large-scale clinical evidence [19].

Mingmen-warming tonic therapy may participate in TME regulation through three levels: the metabolic level—affecting energy metabolism and cellular stress adaptation [20-21]; the immune level—regulating effector- suppressive immune balance [19,23-24]; and the systemic level—potentially improving holistic functional status and affecting microenvironmental stability [16,19].

6. Discussion

6.1 Theoretical Significance and Innovations

This study constructs a hierarchical correlation explanatory model of "Mingmen Fire Exhaustion–TME" from the perspectives of systems medicine and comparative medicine, providing a structured expression of the Mingmen theory in a modern context [9]. The theoretical significance is embodied in three aspects. (1) Providing a cross-system explanatory analytical framework: Previous studies have mostly focused on empirical clinical applications or single-disease analyses [11-14]; this study attempts to structurally contrast "holistic functional state" with "local pathological ecosystem" from a systems level [9,12]. (2) Strengthening the systems medicine explanatory dimension of the TME: Starting from the "holistic–local" hierarchical relationship, it provides a complementary explanatory perspective for TME formation and maintenance [1-5]. (3) Providing an integrative hypothesis for the mechanistic study of yang-warming methods: It incorporates dispersed mechanistic explanations into a unified "metabolism–immunity–microenvironment" framework [16,19].

6.2 Relationship with Existing Research

This study complements existing research in the following aspects: in TME research—emphasizing the potential influence of holistic functional status on the local microenvironment [1-5]; in TCM research—extending Mingmen Fire Exhaustion from empirical description to a systematic functional model [9,12,14]; in tumor immunology research—introducing the TCM "holistic regulation" perspective as a complementary explanatory framework [18-19]. Existing studies have explored related issues from the perspectives of "yang-supplementing method," "Sanjiao-Mingmen," and "yang deficiency and tumors" [7,12,18], but have not yet formed a unified hierarchical structural model, which this study attempts to integrate.

6.3 Key Limitations

This study is a theoretical hypothesis construction with the following unavoidable limitations. (1) Lack of direct experimental evidence: There are no universally recognized objective quantitative indicators for "Mingmen Fire

Exhaustion," and animal models have not been standardized [20]; the model is primarily based on literature integration and theoretical deduction. (2) Explanatory boundaries of cross-system mapping: "Mingmen Fire Exhaustion" is a functional state concept, while the TME is a pathological microenvironment concept; the correspondence between them is essentially a cross-system analogical analysis and should be understood as structural mapping rather than causal relationships [9]. (3) Limited evidence quality: Studies supporting the effects of Mingmen-warming formulas on tumors are predominantly in vitro experiments, animal models, and small-sample clinical observations, with insufficient high-quality randomized controlled trials [19,21,23]. (4) Unclear applicability boundaries: Yang-warming strategies are not applicable to all tumor types, especially in cases with significant inflammation or "excessive heat toxin," where their effects may be complex or uncertain [18].

6.4 Future Research Directions

(1) Animal model construction: Introduce energy metabolism inhibition or endocrine regulatory factors on the basis of existing tumor models to construct composite models closer to a "functional hyporesponsive state" [20]. (2) Multi-omics TME analysis: Systematically analyze the effects of Mingmen-warming interventions on TME immune cell composition, metabolic profiles, and spatial structure through single-cell sequencing, spatial transcriptomics, and metabolomics [1-3,16]. (3) Clinical stratification studies: Conduct prospective clinical studies observing the adjunctive effects of Mingmen-warming interventions on the basis of standard treatment, with focus on immune parameters, TME biomarkers, and the association between TCM syndrome differentiation and efficacy [19,23].

7. Conclusion

Based on the Mingmen theory and modern TME research, this paper proposes the "Mingmen Fire Exhaustion–TME hierarchical correlation model" as an explanatory hypothesis. Mingmen Fire Exhaustion, as an important TCM theoretical concept describing holistic functional decline, may have functional correlations or structural correspondences with the core TME features of metabolic abnormalities, immunosuppression, and hypoxic microenvironment in tumor development. The formation and maintenance of the TME are the cumulative result of multi-level systemic imbalance, rather than a linear process driven by a single factor. Mingmen-warming tonic therapy may have potential roles in TME regulation by affecting metabolic status, immune function, and microenvironmental balance, but the mechanisms require experimental and clinical validation. This study is a theoretical hypothesis construction; its core value lies in providing an interdisciplinary explanatory analytical framework rather than establishing deterministic causal mechanism conclusions. The relevant hypotheses await further validation and refinement through subsequent multidisciplinary research.

References

[1] Peng Y M, Luo X M, Chen J Y. Research progress and new immunotherapy strategies of tumor microenvironment metabolism[J]. Journal of Sichuan University (Medical Sciences), 2023, 54(3): 505-509.

[2] Yang Y, Fan D, Zheng B H, et al. Research progress on the function of immunometabolism in tumor immunity [J]. Journal of Sichuan University (Medical Sciences), 2023, 54(3): 510-516.

[3] Progress in regulating T cell metabolism in tumor immunotherapy[J]. Central South Pharmacy, 2023, 21(6): 1520-1526.

[4] Zhao C H, Xiao N, Xu J M. Research progress of immunotherapy strategies for solid tumors based on tumor immune microenvironment typing[J]. Chinese Journal of Cancer Biotherapy, 2023, 30(5): 424-431.

[5] Guo R, Tan Q, Ma J. Remodeling tumor microenvironment to improve immunotherapy efficacy [J]. Chinese Journal of the Frontiers of Medical Science (Electronic Version), 2023, 15(10): 1-8.

[6] Liu G Y, Zhou H Y, Ding J L, et al. Targeting immunometabolism to improve tumor microenvironment[J]. Journal of Esophageal Diseases, 2023, 5(4): 279-284.

[7] Xiong H T, Cai L, Zheng H G. Exploration of the tumor microenvironment based on the theory of "pi jian zhi chu, bi you fu yang"[J]. Shandong Journal of Traditional Chinese Medicine, 2024, 43(10): 1025-1030.

[8] Shi M R, Zhang N Z, Chu W F, et al. Exploring the pathogenesis and treatment of lung cancer based on "mild fire generating qi and sthenic fire consuming qi"[J]. Shaanxi Journal of Traditional Chinese Medicine, 2024, 45(8): 1096-1100.

[9] Lin M X. Review of the theory of Mingmen in traditional Chinese medicine[J]. China Journal of Traditional Chinese Medicine and Pharmacy, 2025, 40(1): 13-18.

[10] Zheng Z Q, Lin K M, Chen W J. Analysis of the relationship between "zheng" and "xie" and cancer based on "Cunkou pulse normal yet death"[J]. Nei Mongol Journal of Traditional Chinese Medicine, 2025, 44(12): 1-3.

[11] Zhang X, Zhang W Y, Shi Z R. Discussion on the treatment of tumor based on "Mingmen is the origin of nature"[J]. China Journal of Traditional Chinese Medicine and Pharmacy, 2024, 39(1): 481-484.

[12] Shi Z Y, Sun Q M, Gao Y, et al. Pathogenesis and clinical treatment of renal cancer and metastasis based on theory of "Sanjiao and Mingmen"[J]. Acta Chinese Medicine, 2024, 39(1): 34-38.

[13] Analysis of the formation mechanism of malignant tumors based on the theory of heart spirit, monarch fire, and minister fire[J]. Jilin Journal of Traditional Chinese Medicine, 2025, 45(2): 156-160.

[14] Yang Z Z, Yang C G, Cheng P Y, et al. Wang Xiaomin's approach to malignant pleural effusion based on Mingyuan-Sanjiao-membrane source theory[J]. Jilin Journal of Traditional Chinese Medicine, 2024, 44(3): 283-287.

[15] Chen Y, Zhou T, Liu C B, et al. Clinical application of Zhang Jingyue's Mingmen theory in elderly lung cancer[J]. Hebei Journal of Traditional Chinese Medicine, 2023, 45(7): 1188-1192.

[16] Lim S A, et al. Metabolic reprogramming of the tumor microenvironment to enhance immunotherapy[J]. BMB Reports, 2024, 57(9): 388-399.
[17] Exploration of the intervention mechanism of traditional Chinese medicine on tumor microenvironment based on the theory of “healthy qi deficiency and toxin spreading”[J]. Global Traditional Chinese Medicine, 2025, 18(3): 456-462.
[18] Xu X X, Yu Z H, Chai K Q. Application of Yang-supporting theory in malignant tumors[J]. China Modern Doctor, 2024, 62(10): 91-95.
[19] Research progress of Yang-warming and stasis - dissipating treatment for malignant tumors[J]. Chinese Medicine Modern Distance Education of China, 2024, 22(9): 203-206.
[20] Research overview of Yiyi Fuzi Baijiang San in intervening colitis-cancer transformation[J]. Journal of Shanghai University of Traditional Chinese Medicine, 2024, 38(2): 89-95.
[21] Effects and mechanism of Aconiti lateralis praeparata radix-containing serum on invasion and migration of human hepatocellular carcinoma cells[J]. Journal of Guizhou Medical University, 2024, 49(5): 712-719.
[22] Research progress on the effects of icariin on digestive system tumors and its mechanism[J]. Chinese Archives of Traditional Chinese Medicine, 2024, 42(2): 156-161.
[23] Efficacy of Yanghe Decoction combined with GT regimen chemotherapy on stage IV triple-negative breast cancer and its effect on Th17/Treg cell levels[J]. Jiangxi Journal of Traditional Chinese Medicine, 2023, 54(5): 45-49.
[24] Application of Yanghe Decoction in the treatment of malignant tumors based on Yang-warming method[J]. Modern Chinese Clinical Medicine, 2023, 30(2): 66-70.
[25] Effects of Yiqi Wenyang Granules combined with bevacizumab on tumor tissue microenvironment in lung cancer mice[J]. Modern Journal of Integrated Traditional Chinese and Western Medicine, 2022, 31(5): 632-638.
[26] Experimental study of Yiqi Wenyang Granules combined with bevacizumab regulating tumor angiogenesis in Lewis tumor-bearing mice[J]. Global Traditional Chinese Medicine, 2022, 15(7): 1186-1192.
[27] Application of Yang-supporting method in tumor clinical practice based on “yang transforming qi, yin forming shape”[J]. Shandong Journal of Traditional Chinese Medicine, 2024, 43(1): 28-33.