

Pharmacological Mechanisms and Clinical Application Research Progress of Erdong Decoction in Diabetes Mellitus

Chanchun Lin*, Juanjuan Wang, Xiaojun Xiao, Nan Zhang

School of Life Sciences, Neijiang Normal University, Neijiang 641100, Sichuan, China

*Correspondence Author

Abstract: To summarize the material basis, pharmacological mechanisms and clinical application status of Erdong Decoction for diabetes mellitus, so as to provide references for its basic research and clinical syndrome differentiation medication. Relevant domestic and foreign literatures published in recent years were retrieved. The research progress of Erdong Decoction intervening diabetes mellitus was systematically reviewed from the perspectives of formula compatibility, bioactive components, pharmacological effects and clinical applications. Erdong Decoction contains various bioactive components including flavonoids, saponins and alkaloids. It exerts hypoglycemic effects through multiple pathways such as improving insulin resistance, regulating glucose and lipid metabolism, anti-inflammation and anti-oxidation. Clinically, it can be used alone or combined with western medicines to treat diabetes mellitus and its complications including diabetic nephropathy and diabetic retinopathy. Erdong Decoction achieves definite therapeutic efficacy for diabetes mellitus with yin deficiency and dryness-heat syndrome, and integrated traditional Chinese and western medicine treatment presents prominent advantages. Further experimental verification on the holistic action mechanism of the complete formula is required in subsequent studies.

Keywords: Erdong Decoction, Diabetes Mellitus, Pharmacological Effects, Clinical Application, Network Pharmacology.

1. Introduction

Diabetes mellitus is a chronic metabolic disease induced by absolute or relative insulin secretion deficiency and insulin utilization disorder, characterized by persistent hyperglycemia, among which type 2 diabetes mellitus accounts for over 90% of clinical cases [1]. In traditional Chinese medicine (TCM), diabetes mellitus is categorized as “Xiaoke”, and yin fluid depletion and internal dryness-heat are regarded as one of its core pathogenesis. Clinically, the therapeutic principle of nourishing yin and clearing heat is commonly adopted for syndrome differentiation treatment [2]. Erdong Decoction is a classic prescription for treating Xiaoke, with primary effects of promoting fluid production to quench thirst, nourishing yin and clearing heat. In recent years, an increasing number of clinical observation and network pharmacology studies focusing on Erdong Decoction for diabetes mellitus have been carried out, while systematic reviews concerning its active substances, action mechanisms and clinical applications remain scarce. This paper integrates existing relevant literatures to comprehensively sort out research advances of Erdong Decoction in diabetes mellitus treatment, aiming to provide reference for deepening basic research and rational clinical medication.

2. Formula Compatibility

Erdong Decoction originates from Yi Xin Wu (Insights into Medical Practice), composed of eight medicinal herbs: Radix Asparagi, Radix Ophiopogonis, Radix Trichosanthis, Radix Scutellariae, Rhizoma Anemarrhenae, Folium Nelumbinis, Radix Ginseng and Radix Glycyrrhizae. It nourishes yin, clears heat, promotes fluid production and relieves thirst, and is clinically applied for diabetes mellitus, pertussis, hyperthyroidism and other diseases [3].

Radix Asparagi and Radix Ophiopogonis are tuberous roots of

Liliaceae medicinal plants. Combined application of the two herbs nourishes lung and stomach yin fluid, eliminates excess heat in lung and stomach, moistens dryness and lung, and relieves thirst. Matched with Rhizoma Anemarrhenae, they further nourish kidney yin and clear deficient heat. Radix Trichosanthis, derived from the rhizome of Cucurbitaceae plants, clears heat and purges fire, generates fluid and quenches thirst, widely used for lung-heat cough, stomach-heat dysphoria with thirst and various Xiaoke symptoms. Radix Scutellariae clears heat and eliminates dampness, purges fire and detoxifies, with remarkable efficacy for damp-heat and lung-heat disorders. Folium Nelumbinis clears summer-heat, and simultaneously regulates lipid metabolism and reduces weight. Radix Ginseng is a vital tonic herb that greatly tonifies primordial qi, supplements qi of the spleen, lung, heart and kidney, and generates fluid to quench thirst, frequently used for Xiaoke with dual deficiency of qi and yin. Radix Glycyrrhizae tonifies spleen qi, alleviates acute pain, and harmonizes medicinal properties of the whole formula [4].

Ancient medical records in Yi Xin Wu · Three Types of Xiaoke stated that “all three types of Xiaoke are caused by accumulation of dryness-heat”. Huangdi Nei Jing (Huangdi’s Internal Classic) also recorded pathogenesis of polydipsia and polyphagia induced by kidney disorder and stomach heat. Subsequent physicians established yin deficiency and dryness-heat as the core pathogenesis of Xiaoke [2].

From the perspective of compatibility logic, Radix Asparagi and Radix Ophiopogonis act as monarch drugs. Sweet and cold in nature, they enter the lung, stomach and kidney meridians, directly targeting the root of yin deficiency and dryness-heat, and ameliorate core symptoms including dry mouth, polydipsia and lassitude. Rhizoma Anemarrhenae, Radix Scutellariae and Radix Trichosanthis serve as minister drugs, specially clearing accumulated heat in lung and

stomach, assisting monarch drugs to strengthen the effects of clearing heat, moistening dryness and generating fluid to quench thirst. Radix Ginseng, Folium Nelumbinis and Radix Glycyrrhizae are adjuvant and messenger drugs, which not only mitigate the side effect of cold medicinal herbs damaging the spleen and stomach, but also tonify qi and nourish yin. The formula features precise compatibility combining purgation and tonification.

3. Main Bioactive Components

Erdong Decoction possesses complex and diverse chemical compositions, and hundreds of active substances have been separated and identified via modern detection technologies. Researchers detected 185 components including organic acids, amino acids, flavonoids and polysaccharides by ultra-high performance liquid chromatography-tandem mass spectrometry (UPLC-MS/MS); seven characteristic components such as neomangiferin, mangiferin, hyperoside and baicalin can be stably detected by high performance liquid chromatography (HPLC) [5-6]. Other studies marked 9 characteristic peaks via HPLC fingerprint spectrum and clarified seven core substances [7-8]. Subsequent researches adopted UHPLC-HR-MS, UHPLC-QqQ-MS and other technologies to supplement component detection methods of Radix Asparagi, Radix Ophiopogonis, Radix Trichosanthis and Radix Ginseng, and optimize the quality evaluation system of this formula [9-10].

4. Pharmacological Effects

Modern studies demonstrate that Erdong Decoction intervenes type 2 diabetes mellitus and its complications comprehensively through multi-component, multi-target and multi-pathway characteristics, with core effects including alleviating insulin resistance, regulating glucose and lipid metabolism, anti-inflammation, anti-oxidation, and protecting pancreatic islets and hepatocytes.

4.1 Improving Insulin Resistance and Stably Regulating Blood Glucose

Insulin resistance and impaired pancreatic β -cell function are key pathogenic links of type 2 diabetes mellitus. Insulin resistance manifests as decreased insulin sensitivity, blocked glucose uptake and utilization, compensatory massive insulin secretion by pancreas, and ultimately hyperinsulinemia [11-12]. Under physiological conditions, insulin transmits signals via the PI3K/Akt signaling pathway to promote glucose transport and glycogen synthesis, and inhibit hepatic gluconeogenesis. Abnormality in any link of this pathway leads to insulin signal transduction disorder and elevated blood glucose [13].

Multiple bioactive components in Erdong Decoction can target this pathway to ameliorate insulin resistance. Mangiferin and isomangiferin in Rhizoma Anemarrhenae inhibit α -glucosidase activity, reduce blood glucose and improve insulin sensitivity [14]; baicalein upregulates the expression of insulin receptor, insulin receptor substrate 1, PI3K, Akt and glucose transporters [15]; ginsenosides activate pathway-related proteins to facilitate glucose uptake [16]. Results of network pharmacology and molecular docking also verify that baicalein, nuciferine and oroxylin A

have strong binding capacity with core target AKT1, and exert hypoglycemic effects by activating the PI3K/Akt pathway [6,17].

4.2 Regulating Lipid Metabolism and Correcting Glucose-Lipid Metabolic Disorder

Erdong Decoction modulates in-vivo lipid metabolism and ameliorates glucose-lipid metabolic disorder, reducing inducing and aggravating factors of diabetes mellitus fundamentally. Huangdi Nei Jing · Treatise on Strange Diseases records that “greasy food generates internal heat, sweet food causes middle energizer fullness, leading to upward counterflow of qi and Xiaoke”, indicating obesity is a vital inducement of type 2 diabetes mellitus. Excessive accumulation of free fatty acids inhibits PI3K/Akt pathway activity and aggravates metabolic disorder [18-19]. Animal experiments reveal that combined administration of Erdong Decoction and aerobic exercise significantly reduces blood glucose and blood lipid in diabetic model rats, promotes insulin secretion and effectively corrects glucose-lipid disorder [20]. Monotherapy with Erdong Decoction also decreases fasting blood glucose, insulin level and insulin resistance index, improves impaired glucose tolerance; meanwhile, it reduces total cholesterol, triglyceride and low-density lipoprotein cholesterol, elevates high-density lipoprotein cholesterol, and alleviates hepatic fatty infiltration and pathological injury [21].

Adiponectin is a critical insulin-sensitizing factor regulating glucose and lipid metabolism [12]. Ginsenosides and nuciferine in Erdong Decoction increase in-vivo adiponectin levels; quercetin and icariin modulate targets such as MAPK and PPAR α to improve lipid metabolism and insulin resistance from multiple perspectives [22-24].

4.3 Inhibiting Inflammatory Response and Alleviating Metabolic Injury

Erdong Decoction contains various anti-inflammatory active substances that downregulate pro-inflammatory factor expression and block inflammatory pathway activation, mitigating metabolic damage induced by chronic inflammation. Chronic low-grade inflammation is an important factor exacerbating insulin resistance [25-26]. Inflammatory factors including tumor necrosis factor- α (TNF- α) and interleukin-6 (IL-6) activate the STAT3 pathway, degrade insulin receptor substrates and block insulin signal transduction [27]. Experiments prove that Erdong Decoction effectively reduces levels of TNF- α , IL-6 and other pro-inflammatory factors, inhibits excessive activation of inflammatory pathways, and relieves metabolic damage caused by inflammation [21].

Components including wogonoside, hyperoside, kaempferol and acacetin in this formula bind inflammation-related targets such as CXCL8, TNF, EGFR and STAT3 to block inflammatory signal transmission, fundamentally alleviate inflammation-mediated metabolic injury and delay diabetes mellitus progression [6,22].

4.4 Anti-Oxidative Stress and Protecting Pancreatic Islets and Hepatocytes

Erdong Decoction improves systemic anti-oxidative capacity, eliminates redundant reactive oxygen species (ROS), alleviates oxidative damage, and realizes protective effects on pancreatic β -cells and hepatocytes. Oxidative stress leads to massive ROS accumulation, damages pancreatic β -cells and hepatocytes, and disrupts normal insulin secretion function [28]. Baicalin in Erdong Decoction enhances activity of antioxidant enzymes including superoxide dismutase and catalase, reduces lipid peroxide content and alleviates systemic oxidative injury; meanwhile, it inhibits pancreatic β -cell apoptosis and maintains normal insulin secretion, achieving dual effects of lowering blood glucose and protecting visceral organs [15].

At present, most experimental studies on the integral action mechanism of Erdong Decoction are based on network pharmacology prediction. Multiple researches screened core bioactive components, quality markers and key targets of this formula, clarified its synergistic effect via multiple pathways, and laid a foundation for subsequent mechanism verification.

Comprehensive analysis of multiple network pharmacology studies shows that the PI3K/Akt signaling pathway serves as the core pathway for Erdong Decoction intervening type 2 diabetes mellitus, with AKT1 and STAT3 as high-frequency key targets. Different bioactive components synergistically act on multiple pathways to jointly realize hypoglycemic, lipid-regulating, anti-inflammatory and other pharmacological effects. Nevertheless, obvious deficiencies exist in current pharmacological researches on Erdong Decoction: most existing experimental data derive from single-herb component analysis or theoretical prediction via network pharmacology and molecular docking, while systematic in-vivo and in-vitro verification experiments targeting the complete formula are insufficient, and the integral action mechanism after compatibility of the whole formula has not been systematically clarified.

5. Clinical Applications

Based on its effects of nourishing yin, clearing heat, generating fluid and moistening dryness, Erdong Decoction is indicated for Xiaoke with yin deficiency and dryness-heat syndrome. It can be used alone based on syndrome differentiation or combined with western hypoglycemic drugs, with wide applications in prediabetes, confirmed diabetes mellitus and various complications.

5.1 Monotherapy of Traditional Chinese Medicine

5.1.1 Intervention for Prediabetes

Prediabetes is a critical stage to block blood glucose progression and prevent diabetic complications [29]. Hu Chengyu et al. conducted a randomized parallel controlled study to observe the intervention effect of Erdong Decoction on 55 prediabetic patients. The results revealed that the total effective rate of the observation group exceeded 95%, while that of the control group was merely about 60%, confirming that Erdong Decoction significantly improves insulin sensitivity and possesses high clinical promotion value [30]. Tian Jinying et al. carried out a controlled study enrolling 56 prediabetic patients and 35 healthy subjects, with fasting

blood glucose, postprandial blood glucose, postprandial insulin and insulin sensitivity index as evaluation indicators. After treatment, the insulin sensitivity index of patients increased significantly compared with baseline ($P<0.01$), further verifying the applicability of Erdong Decoction for prediabetes intervention [31].

5.1.2 Treatment of Simple Type 2 Diabetes Mellitus and Impaired Glucose Tolerance

Erdong Decoction is commonly applied for syndrome differentiation treatment of type 2 diabetes mellitus with yin deficiency and dryness-heat or dual deficiency of qi and yin. Yang Ge adopted modified Yunu Decoction combined with Erdong Decoction to treat diabetes mellitus with stomach dryness and fluid injury, whose clinical efficacy was superior to simple western medicine treatment [32]. Xie Zhendong observed the effect of modified Erdong Decoction on patients with impaired glucose tolerance (IGT) and yin deficiency constitution. After treatment, fasting blood glucose (FBG), total cholesterol (TC), free fatty acids (FFA), triglyceride (TG) and low-density lipoprotein cholesterol (LDL-C) of patients decreased markedly, while high-density lipoprotein cholesterol (HDL-C) increased significantly, with statistically significant inter-group differences, indicating that this formula effectively ameliorates glucose-lipid metabolic disorder in patients with yin deficiency constitution [33]. Zhang Yanli applied modified Erdong Decoction to treat type 2 diabetes mellitus with dual deficiency of lung and kidney qi-yin. The control group received conventional hypoglycemic regimen of pioglitazone combined with metformin. The total effective rate of the observation group reached 90.00%, far higher than 62.5% of the control group ($P<0.01$) [34].

5.1.3 Treatment of Diabetic Complications and Co-morbidities

Modified Erdong Decoction can be applied for various diabetic complications and co-morbidities after syndrome differentiation. Huang Lu treated stage 2–3 diabetic nephropathy patients with dual deficiency of qi and yin via modified Erdong Decoction. The observation group achieved superior efficacy in improving fasting blood glucose, 2-hour postprandial blood glucose, blood lipid, urea nitrogen, creatinine, 24-hour urinary protein quantification, urinary albumin/creatinine ratio, IL-6 and TCM syndrome integral, without obvious adverse reactions [35].

For patients complicated with other diseases, Xu Wenjun et al. combined Zishui Qinggan Decoction and Erdong Decoction to treat diabetes mellitus complicated with hyperthyroidism. Postprandial blood glucose, free thyroxine (FT4) and total thyroxine (TT4) of patients were effectively controlled after treatment, simultaneously regulating glucose metabolism and thyroid function [36]. Xu Huayu reported that Erdong Decoction combined with modified Buyang Huanwu Decoction and Simiao Yongan Decoction can be differentially prescribed for diabetic foot [37]. In addition, clinical reports concerning Erdong Decoction for diabetes mellitus accompanied by constipation and peripheral neuropathy are available.

5.2 Integrated Traditional Chinese and Western Medicine

Therapy

Combination of Erdong Decoction with western hypoglycemic drugs including metformin, sulfonylureas and insulin has become the mainstream clinical regimen, realizing complementary advantages of TCM and western medicine: western medicines rapidly control blood glucose, while TCM alleviates Xiaoke symptoms, reduces western medicine dosage, and mitigates adverse reactions of western medicines such as gastrointestinal discomfort and hypoglycemia.

Zhang Liao et al. added modified Erdong Decoction on the basis of routine western treatment to intervene diabetic retinopathy, while the control group only received oral calcium dobesilate capsules. Comparative results showed that D-dimer, visual field gray scale, fundus hemorrhage spot area and microaneurysm volume of the observation group were significantly lower than those of the control group ($P < 0.05$), confirming that the integrated TCM and western medicine regimen ameliorates fundus lesions and visual function of patients [38]. Ran Xiaodan et al. combined glimepiride, metformin and modified Erdong Decoction to treat diabetes mellitus complicated with hyperthyroidism, which stably controlled blood glucose and effectively regulated thyroid function [39].

6. Discussion and Prospect

Modern pharmacological researches confirm that multiple medicinal herbs in Erdong Decoction including Radix Asparagi, Radix Ophiopogonis, Rhizoma Anemarrhenae, Radix Scutellariae and Radix Ginseng possess definite hypoglycemic activity. The PI3K/Akt signaling pathway acts as the core pathway mediating insulin-regulated glucose metabolism, and blocked signal transduction of this pathway directly induces insulin resistance, serving as the key pathological basis of type 2 diabetes mellitus. In-vivo glucose-lipid metabolic disorder, massive release of chronic inflammatory factors and accumulated ROS induced by oxidative stress disrupt normal functions of the PI3K/Akt pathway from different links, promoting the occurrence and progression of diabetes mellitus.

Multiple bioactive substances in this formula such as mangiferin, anemarsaponin BII, baicalin, nuciferine and quercetin can target and bind key targets including AKT1, ADIPOQ, TNF and IL2, multi-dimensionally activate the PI3K/Akt signaling pathway, and simultaneously realize multiple pharmacological effects including lowering blood glucose, regulating lipid, anti-inflammation and anti-oxidation, reflecting the unique advantage of synergistic intervention of TCM compound prescriptions with “multi-component, multi-target and multi-pathway”.

Clinically, integrated TCM and western medicine regimens have become the mainstream mode for comprehensive intervention of diabetes mellitus and its complications. Monotherapy with Erdong Decoction based on syndrome differentiation relieves typical Xiaoke symptoms including dry mouth, polydipsia and lassitude in patients with yin deficiency and dryness-heat syndrome. When combined with conventional western hypoglycemic drugs such as metformin, sulfonylureas and insulin, it not only relies on western

medicines to rapidly and stably reduce blood glucose, but also exerts TCM characteristics of nourishing yin, generating fluid and clearing accumulated dryness-heat, alleviates Xiaoke discomfort, reduces western medicine dosage, and lowers incidence of adverse reactions such as hypoglycemia and gastrointestinal irritation. It presents favorable application value in multiple scenarios including prediabetes, diabetic nephropathy, diabetic retinopathy, diabetic foot and concurrent hyperthyroidism.

Existing researches on hypoglycemic mechanisms of Erdong Decoction have obvious limitations: current pharmacological interpretations are mostly based on single-herb component experiments or theoretical prediction via network pharmacology and molecular docking, lacking systematic in-vivo and in-vitro verification targeting the complete compound prescription. Differences in pharmacological efficacy corresponding to different compatibility dosages and syndrome differentiation types remain unclear, restricting standardized clinical promotion of this formula. Based on collation of existing researches, further exploration can be carried out from three aspects:

Conduct in-vitro cell experiments relying on core bioactive components, key targets and signaling pathways screened by network pharmacology to clarify regulatory mechanisms of characteristic components on target proteins of insulin signaling pathway;

Construct diabetic animal models to observe integral intervention effects of complete Erdong Decoction compound on blood glucose, blood lipid, inflammation, oxidative stress indicators and pathway protein expression of model animals, and distinguish efficacy differences between single herbs and compatible whole formula;

Carry out large-sample, multi-center clinical controlled studies, standardize modified schemes, administration dosages and treatment courses of Erdong Decoction, establish standardized diagnosis and treatment regimens for diabetes mellitus with different syndromes of yin deficiency and dryness-heat, dual deficiency of qi and yin, and further excavate application potential of Erdong Decoction in prevention and treatment of diabetes mellitus.

Funding Acknowledgements

This work was supported by Neijiang Normal University Achievement Transformation Project (2021ZH02, 2022ZH02) and University Students' Innovation and Entrepreneurship Training Program (X2025059).

References

- [1] Yang B F, Chen J G. Pharmacology[M]. Beijing: People's Medical Publishing House, 2024: 535.
- [2] Ni Q, Xu Y. TCM Therapeutics of Diabetes Mellitus[M]. Beijing: China Science and Technology Press, 2019: 39.
- [3] Peng Z Z, Zhang L Y, Pan M, et al. Research Overview of Classic Prescripior Erdong Decoction[J]. Chinese Journal of Ethnomedicine and Ethnopharmacy, 2023, 32(14):71-77.

- [4] Zhang T M. Lectures on Clinical Chinese Materia Medica by Zhang Tingmo[M]. Beijing: People's Medical Publishing House, 2024: 530-531.
- [5] Shi J. Component Analysis and Hypoglycemic Activity Mechanism of Classic Prescripitor Erdong Decoction[D]. Harbin: Harbin University of Commerce, 2021.
- [6] Shuai L X, Chen W, Yuan Y, et al. Prediction and Analysis of Quality Markers (Q-Marker) of Classic Prescripitor Erdong Decoction Based on Fingerprint and Network Pharmacology[J]. Chinese Herbal Medicines, 2022, 53(18):5682-5691.
- [7] Peng Z Z, Tang J W, Pan M, et al. Study on HPLC Fingerprint of Reference Sample of Classic Prescripitor Erdong Decoction[J]. Journal of Guizhou University of Traditional Chinese Medicine, 2023, 45(4):18-22.
- [8] Wu J M, Hua J, Ding J W. Establishment of HPLC Fingerprint for Material Reference of Classic Prescripitor Erdong Decoction[J]. China Pharmaceuticals, 2024, 33(5):42-47.
- [9] XUE X X, JIAO Q S, JIN R N, et al. The combination of UHPLC-HRMS and molecular networking improving discovery efficiency of chemical components in Chinese classical formula[J]. Chinese Medicine, 2021, 16(1):50.
- [10] Wang X Y, Li B X, Shi S G, et al. Determination of Potential Active Components and Mechanism Analysis of Erdong Decoction Based on UHPLC-QqQ-MS and Network Pharmacology[J]. Chinese Journal of Experimental Traditional Medical Formulae, 2024, 30(5): 28-34.
- [11] Petersen M C, Shulman G I. Mechanisms of Insulin Action and Insulin Resistance[J]. Physiological Reviews, 2018, 98(4):2133-2223.
- [12] Lv C A, Wang R R, Meng Z X. Molecular Mechanism of Pancreatic β -cell Function Changes During the Progression of Type 2 Diabetes Mellitus[J]. Hereditas, 2022, 44(10):840-852.
- [13] Xiao J. Research on Mechanism of Insulin Resistance Induced by PI3K Pathway[D]. Chongqing: Chongqing Medical University, 2020.
- [14] Wang W J, Yang Z M, Liu A, et al. Research Progress on Chemical Constituents, Pharmacological Effects and Quality Marker Prediction of *Rhizoma Anemarrhenae*[J]. China Journal of Chinese Materia Medica, 2025, 50(4): 934-945.
- [15] Xu F, Chen T, Wang Z H. Research Progress on Anti-Diabetes Effects and Mechanisms of *Radix Scutellariae* in Recent Decade[J]. Global Journal of Traditional Chinese Medicine, 2022, 15(2):342-348.
- [16] Zhang J S, Liu Y, Zhang L H. Research Progress on Mechanism of Ginseng Extract and Ginsenosides Against Type 2 Diabetes Mellitus[J]. Pharmacology and Clinics of Chinese Materia Medica, 2023, 39(7): 114-119.
- [17] Ouyang X J, Chen B, Yu T. Discussion on Typical Pharmacodynamic Components and Mechanism of Erdong Decoction Based on Network Pharmacology and Molecular Docking[J]. Chinese Medical Journal, 2024, 14(11):4-8.
- [18] Lewis G F, Carpentier A, Adeli K, et al. Disordered Fat Storage and Mobilization in the Pathogenesis of Insulin Resistance and Type 2 Diabetes[J]. Endocrine Reviews, 2002, 23(2):201-229.
- [19] Wang B, Li H L, Yang W Y. Role of Insulin-PI3K/Akt Pathway in Pancreatic β -cell Secretory Dysfunction Induced by High Free Fatty Acids[J]. Chinese Journal of Clinical Physicians (Electronic Edition), 2012, 6(14):3968-3971.
- [20] Yuan X G, Xie M Z, Yang Y. Effects of Erdong Decoction and Aerobic Exercise on Glucose and Lipid Metabolism in Type 2 Diabetic Rats[J]. Chongqing Medicine, 2018, 47(28):3610-3613.
- [21] Li H, Jiang L J, Zhang W F. Effects of Erdong Decoction on Glucose and Lipid Metabolism in T2DM Mice Based on IRS-1/PI3K/Akt Signaling Pathway[J]. Chinese Journal of Experimental Traditional Medical Formulae, 2025, 31(23):21-29.
- [22] Chen H, Shi J, Lei S F. Discussion on Mechanism of Classic Prescripitor Erdong Decoction Treating Diabetes Mellitus Based on Network Pharmacology and Molecular Docking[J]. Sichuan Journal of Traditional Chinese Medicine, 2025, 43(8):68-76.
- [23] Li Y R. Mechanism of Ginsenoside Rb1 Upregulating Adiponectin to Improve Hepatic Steatosis[D]. Nanjing: Nanjing University of Chinese Medicine, 2022.
- [24] Yang D H, Lou Z H, Cheng B. Effects of *Folium Nelumbinis* on Inflammatory Factors and AdipoR2 Expression in NAFLD Rats Induced by High-Fat and High-Glucose Diet[J]. China Journal of Chinese Materia Medica, 2016, 41(18):3406-3411.
- [25] Wei Y Z, Chen K M, Whaley-Connell A T, et al. Skeletal muscle insulin resistance: role of inflammatory cytokines and reactive oxygen species[J]. American Journal of Physiology-Regulatory, Integrative and Comparative Physiology, 2008, 294(3): R673-R680.
- [26] Shah A, Mehta N, Reilly M R. Adipose Inflammation, Insulin Resistance, and Cardiovascular Disease[J]. Journal of Parenteral and Enteral Nutrition, 2008, 32(6):638-644.
- [27] Zhang L P, Chen Z H, Wang Y, et al. Stat3 activation induces insulin resistance via a muscle-specific E3 ubiquitin ligase Fbxo40[J]. American Journal of Physiology-Endocrinology and Metabolism, 2020, 318(5): E625-E635.
- [28] Yu M M, Wang Z G, Zhao Y F. Research Progress on TCM Monomers Intervening Oxidative Stress to Prevent and Treat Diabetic Microvascular Complications[J]. Acta Materia Medica Sinica, 2026, 37(7):1395-1400.
- [29] Shi M F. Effect of Erdong Decoction on Pancreatic β -cell Function in Prediabetic Patients[J]. Yunnan Journal of Traditional Chinese Medicine, 2016, 37(5):39-40.
- [30] Hu C Y, Zhang H X. Random Parallel Controlled Study on Effect of Erdong Decoction on Insulin Sensitivity in Prediabetes[J]. Journal of Practical Traditional Chinese Internal Medicine, 2013, 27(17):14-15.
- [31] Tian J Y, Ma Z D, Chen G Z. Effect of Erdong Decoction on Insulin Sensitivity in Prediabetes[J]. Chinese Journal of Traditional Medical Emergency, 2013, 22(3): 386-387.
- [32] Yang G. Clinical Observation on 96 Cases of Diabetes Mellitus Treated by TCM Syndrome Differentiation[J]. Chinese Medical Guide, 2012, 10(10):304-305.
- [33] Xie Z D. Effect of Modified Erdong Decoction on Glucose-Lipid Metabolic Indicators of Patients with Impaired Glucose Tolerance and Yin Deficiency

- Constitution[J]. New Journal of Traditional Chinese Medicine, 2014, 46(1):117-119.
- [34] Zhang Y L, Pei R X. Random Parallel Controlled Study on Modified Erdong Decoction Combined with Western Medicine for Type 2 Diabetes Mellitus with Dual Deficiency of Lung and Kidney Qi-Yin[J]. Journal of Practical Traditional Chinese Internal Medicine, 2012, 26(10):48-49.
- [35] Huang L. Clinical Research on Modified Erdong Decoction for Stage CKD2–3 Diabetic Nephropathy with Dual Deficiency of Qi and Yin[D]. Changsha: Hunan University of Chinese Medicine, 2024.
- [36] Xu W J, Hua W J, Chen H, et al. Effects of Modified Zishui Qinggan Decoction Combined with Modified Erdong Decoction on Endocrine Metabolism of Patients with Diabetes Mellitus Complicated with Hyperthyroidism[J]. Shaanxi Journal of Traditional Chinese Medicine, 2022, 43(6):736-739.
- [37] Xu H Y. Research Progress on Internal TCM Treatment of Diabetic Foot[J]. Guangming Journal of Chinese Medicine, 2014, 29(8):1788-1789.
- [38] Zhang L, Gao J C, Yan L M. Clinical Analysis of Routine Western Therapy Combined with Modified Erdong Decoction for Diabetic Retinopathy[J]. Diabetes New World, 2023, 26(17):159-162.
- [39] Ran X D, Xiao W Z, Chen J H. Modified Erdong Decoction for Diabetes Mellitus Complicated with Hyperthyroidism[J]. Hubei Journal of Traditional Chinese Medicine, 2010, 32(5):57-58.

Author Profile

Chanchun Lin obtained her Bachelor's degree in Chinese Materia Medica and Master's degree in Pharmacognosy from Chengdu University of Traditional Chinese Medicine in 2014 and 2017, respectively. She has been employed at Neijiang Normal University since July 2017.