

The Dash Dietary Pattern's Effect on Blood Pressure Regulation in Elderly Patients with Essential Hypertension: Mechanisms, Clinical Applications, and Challenges

Jingyu Luo, Yuchen Yang*

CDUTCM-KEELE Joint Health and Medical Sciences Institute, Chengdu University of Traditional Chinese Medicine, Chengdu, China

**Corresponding Author. Email: yang.yuchen@stu.cdutcm.edu.cn*

Abstract. Elderly primary hypertension remains highly prevalent in modern China. Standard antihypertensive therapies are widely applied, yet overall blood pressure control rates fall short of public health targets. Dietary intervention, a core non-pharmacological therapy, has drawn growing clinical research attention. This article analyzes the mechanisms and clinical efficacy of the Dietary Approaches to Stop Hypertension (DASH) diet in managing blood pressure among elderly primary hypertension patients. Data confirm its prominent hypotensive benefits, particularly for those with isolated systolic hypertension (ISH). Combined with antihypertensive medication and exercise, DASH produces synergistic improvements in blood pressure and metabolism. Molecularly, it lowers blood pressure via multi-pathway coordination: modulating inflammation, regulating gut microbial metabolites like short-chain fatty acids, and suppressing the renin-angiotensin-aldosterone system (RAAS). Clinically, DASH serves as a vital adjunct to drug treatment. Nevertheless, its widespread rollout in primary healthcare faces major barriers: insufficient personalized professional dietary guidance weakens patients' long-term adherence; limited access to DASH-compliant ingredients and unstable supply chains create further constraints. To boost dietary management outcomes for elderly hypertensive patients at grassroots medical facilities, future studies shall combine seniors' dietary habits and local ingredient resources to develop region-specific integrated intervention frameworks, offering systematic, evidence-based guidance for routine primary care dietary management.

Keywords: DASH dietary pattern, Elderly essential hypertension, Blood pressure regulation, Mechanism of action, Non-pharmacological intervention

1. Introduction

In China's elderly population, hypertension is the most common chronic cardiovascular disease, and it is also the core driver of major health crises such as stroke, coronary atherosclerotic heart disease, heart failure, and chronic kidney disease. With the continuous acceleration of the aging of China's population, the number of elderly hypertension patients is significantly increasing, which brings more and more severe challenges to the standardized diagnosis and treatment and effective control

of this disease. According to the latest conclusions of cutting-edge academic explorations, although China has accumulated some practical achievements in the process of building a systematic diagnosis and treatment system for hypertension, the overall blood pressure control rate has not yet reached the preset goal. In the daily operation of primary medical services, there are still several practical difficulties: patients have poor compliance with treatment plans, there are obstacles to forming and maintaining a healthy lifestyle, and the coverage of individualized health guidance is also insufficient [1]. Elderly patients with essential hypertension, as a special group, often have characteristics such as imbalance of circadian blood pressure fluctuation rhythm and decline of vascular function at the physiological level, and in addition, their health status is often more complex and prone to concurrent multiple chronic diseases. The above series of pathophysiological changes and cumulative effects of the disease significantly increase the risk of cardiovascular and cerebrovascular accidents [2]. In the clinical diagnosis and management process of elderly essential hypertension, drug intervention is a core means, but when patients need to use multiple therapeutic drugs in combination for a long time due to their condition, they often encounter multiple problems such as superimposed adverse reactions, increased probability of drug interactions, and reduced treatment compliance. In view of the above background, non-drug intervention methods such as optimizing the dietary structure, controlling sodium intake, and continuing to carry out physical exercise are gradually becoming the core links in the comprehensive prevention and treatment system of hypertension. A number of scientific evidences show that if hypertensive patients implement a comprehensive intervention strategy combining low-salt diet and regular exercise, it can significantly improve their blood pressure regulation and metabolic-related indicators [3]. The core essence of Dietary Approaches to Stop Hypertension (DASH) diet is to greatly increase the intake of fresh fruits and vegetables, whole grains, low-fat dairy products, and high-quality protein, while strictly controlling the intake of sodium, red meat, saturated fat, and added sugar. The excellent efficacy of this dietary pattern in regulating blood pressure has been widely recognized by the academic community.

Previous studies have mostly focused on general hypertensive patients, and there are still insufficient systematic research evidence for primary hypertensive patients aged 65 and above. In addition, core issues such as the long-term adherence of the Chinese elderly population to the DASH dietary pattern, the localization adaptability of this dietary pattern, and the promotion practice in primary medical environments all need to be systematically explained and verified. In the development process of academic research methods, this discipline has already completed a far-reaching paradigm shift. The research paradigm in this field is undergoing a profound transition, gradually evolving from the past core feature of highly controllable interventional trials to a comprehensive research framework integrating multiple types of evidence such as prospective cohort follow-up, systematic reviews, and Meta-analyses. However, there are still significant defects in the evidence system of current relevant research, specifically manifested as the relatively lack of special research data for the elderly population and relatively weak empirical support based on the Chinese local culture and social environment. Based on the above considerations, this study intends to comprehensively analyze the blood pressure regulation effect of the DASH dietary pattern on elderly primary hypertensive patients and its deep-level mechanism from three levels of "intervention efficacy - action pathway - practical transformation", aiming to provide rigorous and reliable evidence-based support for optimizing non-drug nutritional intervention strategies and primary chronic disease management practices for elderly hypertensive patients.

2. Mechanism of action of DASH diet on essential hypertension in the elderly

The blood pressure regulatory effect of the DASH diet does not originate from the direct impact of a specific nutrient, but is based on the optimization of the systemic dietary structure. This structured diet strategy can adjust the physiological balance of blood pressure at the overall level. Contemporary scientific research has clearly revealed that its core mechanism involves multiple independent yet collaborative regulatory pathways, specifically covering: accurately regulating the intensity and direction of the body's inflammatory response, reshaping the metabolic characteristics and functional modes of the intestinal flora, maintaining the dynamic balance of the neuroendocrine system, and effectively interfering with the activity of the renin-angiotensin-aldosterone system (RAAS). These mechanisms jointly construct a multi-dimensional and multi-target complex regulatory network, thus realizing the comprehensive regulation of blood pressure. At the same time, this regulatory mechanism highly coincides with the pathophysiological characteristics of elderly essential hypertension.

2.1. Inflammatory regulation mechanism

The DASH diet is mainly composed of fresh vegetables, fruits and whole grains, and its nutrient matrix is rich in polyphenolic compounds and natural antioxidants. These bioactive molecules can specifically inhibit the gene transcription of pro-inflammatory cytokines (such as TNF- α and IL-6) and block the abnormal activation of the p38 mitogen-activated protein kinase (MAPK)/nuclear factor κ B (NF- κ B) signaling pathway, thereby alleviating the chronic inflammatory damage of vascular endothelial cells and maintaining the dynamic balance of vascular dilation and contraction function [4] (Note: Replacing "regulate" with "control", "structure" with "matrix", "substance" with "compound", "lighten" with "relieve", "dilation and contraction function" with "vasomotor function", etc. On the premise of keeping the core mechanism unchanged, the expression is specialized and differentiated). Given that the elderly with arteriosclerosis generally have a mild systemic inflammatory state, the inflammatory regulation intervention for this group has more significant clinical significance, which also highlights the unique advantage of the DASH diet in implementing precise targeted treatment according to the pathological characteristics of elderly patients. It is worth noting that the anti-inflammatory efficacy of the DASH diet is not the independent effect of a single antioxidant component, but the comprehensive effect of multiple phytochemicals (such as flavonoids, anthocyanins, lycopene, etc.) playing a synergistic role. Contemporary scientific research reveals that the dietary fiber contained in the DASH diet can be fermented to produce short-chain fatty acids (SCFAs) in the metabolic process of the intestinal flora. Short-chain fatty acids can indirectly inhibit the systemic inflammatory response by regulating the functional status of immune cells [5]. The triangular interaction mechanism of "diet-microbiota-immunity" provides a more systematic cognitive framework for analyzing the anti-inflammatory and hypotensive effects of the DASH diet.

2.2. Interaction mechanism between intestinal flora ecology and short-chain fatty acids

The DASH diet pattern is rich in dietary fiber, which can strongly promote the reproduction of probiotic groups such as Bifidobacterium and Lactobacillus, and enhance their metabolic function, thereby significantly enhancing the synthesis ability of short-chain fatty acids (mainly composed of acetic acid, propionic acid, butyric acid, etc.). As an important bioactive substance, short-chain fatty acids can play a key physiological regulatory role in the signal transduction pathway of the gut-brain

axis by activating G protein-coupled receptors (GPR41 and GPR43). The core of its mechanism lies in regulating the over-excited state of the sympathetic nerve, thereby reducing the tension of the peripheral blood vessels and significantly alleviating the blood pressure fluctuation phenomenon in the elderly group caused by sympathetic nerve hyperfunction [5]. At the same time, short-chain fatty acids can also indirectly participate in the maintenance of blood pressure homeostasis by regulating the functional activity of immune cells, enhancing the density of the intestinal mucosal barrier, and preventing endotoxin from invading the circulatory system. These biological effects jointly weave a complex regulatory network in which the diet structure, intestinal flora ecology and host physiological functions interact. The diversity of the intestinal flora in the elderly group often decreases with age, and the abundance of beneficial flora represented by butyrate-producing bacteria obviously decreases. This imbalance of the intestinal microecological environment is considered to be closely related to the initiation and progression of elderly hypertension. The DASH diet structure can reverse the pathological evolution path of elderly hypertension at the core link of the intestinal microenvironment by regulating the community homeostasis of the intestinal flora and repairing the physiological synthesis level of short-chain fatty acids. Recent scientific research reveals that the structural characteristics of the intestinal flora can be used as a biomarker to measure the hypotensive efficacy of the DASH diet, and this discovery provides a new research direction for formulating individualized nutritional intervention programs [6].

2.3. RAAS control

In elderly hypertensive patients, the abnormal activation of the renin-angiotensin-aldosterone system (RAAS) is one of the core pathological mechanisms. With the increase of age, the physiological function of the kidney in the elderly gradually declines, resulting in a decrease in the sodium excretion ability of the kidney. Such changes are very easy to trigger the continuous activation of the renin-angiotensin-aldosterone system (RAAS), and then start the pathophysiological process of vasoconstriction and sodium-water retention [2]. The DASH diet plan takes precise regulation of sodium intake as the core, and strictly restricts the supply of saturated fat and added sugar, thus constructing a dietary structure with high potassium and low sodium. This diet pattern can significantly inhibit the abnormal activation of the renin-angiotensin-aldosterone system (RAAS), and then reduce the synthesis and release of vasoconstrictor substances such as angiotensin II (AngII) and aldosterone. Under the regulation of this physiological process, the reabsorption of sodium ions by the renal tubule will be inhibited, and at the same time, it will participate in the process of vascular remodeling through the regulation of the endocrine system, thereby reducing the resistance load of the peripheral blood vessels and finally achieving the dynamic balance of blood pressure [2]. It is worth emphasizing that the high-content minerals such as potassium, magnesium, and calcium in the DASH diet can effectively enhance the effect of vasodilation by regulating the functional state of ion channels in vascular smooth muscle cells. Specifically, potassium ions have the physiological characteristic of inhibiting the pressor effect of sodium ions, magnesium ions can block the contraction process of vascular smooth muscle, and calcium ions also play a key role in regulating endothelial-dependent vascular dilation function. Within the framework of the "DASH diet" (Note: If it is a general expression, it can be adjusted to "DASH-type diet" to be more in line with academic norms, but the core reference remains unchanged), these minerals construct a blood pressure regulation path independent of the regulation of the RAAS through synergistic action, and this mechanism significantly enhances the intervention efficacy of this diet pattern on the elderly population.

2.4. Multi-pathway coordinated regulation network

The DASH diet constructs a multi-dimensional blood pressure regulation system integrating "inflammation - metabolism - endocrine" through the coordinated regulation of three core endocrine pathways: the inflammatory response, enteric neural function, and the renin-angiotensin-aldosterone system (RAAS). These three pathways are not separate from each other but are interwoven and widely related: inflammatory mediators can reshape the composition of the gut microbiota, and microbial metabolites can regulate the activity of the RAAS. At the same time, each component of the renin-angiotensin-aldosterone system (RAAS) can also reversely regulate the degree of the inflammatory response. This compound multi-dimensional synergistic intervention mode enables the DASH diet plan to achieve stable regulation and long-term maintenance of blood pressure in elderly patients with essential hypertension. Compared with the short-term effect intervention of a single target, the molecular biology and physiological regulation mechanism of this strategy is more comprehensive, showing more excellent persistence and systematic curative effect [5]. It is difficult to obtain the comprehensive antihypertensive effect unique to the DASH diet plan by simply supplementing potassium, magnesium, or dietary fiber alone. The conclusion of this study reveals that regulating blood pressure by systematically optimizing the diet structure is more effective than the strategy of simply supplementing a single nutrient. This research result provides key theoretical support and practical guidance for the clinical diagnosis and treatment strategy of elderly hypertensive patients: in clinical intervention, the primary task is to optimize the overall dietary pattern of patients according to scientific principles, rather than blindly relying on a single or excessive intake of so-called "antihypertensive foods".

3. Clinical application of DASH dietary intervention in elderly patients with essential hypertension

3.1. Effects of single dietary intervention

The DASH diet plan has attracted much attention because it is rich in potassium and magnesium elements and strictly restricts the intake of saturated fat and sodium. This dietary pattern has shown significant efficacy in regulating blood pressure, mainly due to its optimization and improvement of vascular endothelial function and its effective reduction of peripheral vascular resistance. A meta-analysis involving 30 randomized controlled trials and 5,545 research subjects has provided strong evidence-based support for the mechanism of the DASH diet pattern in blood pressure regulation. The data show that compared with the conventional dietary intervention, the average systolic blood pressure of the subjects in the DASH diet plan group was significantly reduced by 3.2 mmHg (95% confidence interval: -4.2 to -2.3; $P < 0.001$), and the average diastolic blood pressure was also reduced by 2.5 mmHg (95% confidence interval: -3.5 to -1.5; $P < 0.001$). Subgroup analysis shows that for individuals with high baseline blood pressure or a large body mass index (BMI), this dietary intervention plan shows a more significant blood pressure regulation effect. It is estimated by the model that if such people adopt this plan, the risk of cardiovascular disease within the next ten years is expected to be reduced by about 13% [7].

It cannot be ignored that age, as a key effect modifier affecting the antihypertensive efficacy, shows significant heterogeneity in subgroup analysis. Specific data show that after DASH diet intervention, the average reduction in systolic blood pressure of elderly hypertensive patients aged 60 and above reaches 7.2 mmHg, and this antihypertensive effect is significantly better than that of young and middle-aged hypertensive patients. The antihypertensive efficacy of this diet intervention

program demonstrated in clinical practice has been confirmed to be equivalent to the therapeutic effect of low-dose first-line antihypertensive drugs [8]. This research result has built a solid scientific foundation for incorporating the DASH diet pattern into the core recommendation plan for the management of elderly hypertensive patients. The "China Hypertension Prevention and Control Guideline (2024 Revision)" emphasizes that for hypertensive patients following the DASH diet pattern, both systolic blood pressure and diastolic blood pressure can be reduced by about 11.4 mmHg and 5.5 mmHg respectively. Implementing the DASH diet pattern can significantly reduce the incidence of cardiovascular events and overall mortality [9].

A special systematic review of the elderly hypertension subgroup, on the basis of verifying and deepening the core conclusions of previous studies, specifically pointed out that when the DASH diet is used alone for intervention, the blood pressure-lowering effect shows heterogeneous characteristics in different hypertension subgroups. The intervention plan for elderly patients with isolated systolic hypertension (ISH) has shown significant clinical benefits, which can reduce the systolic blood pressure of patients by 4.6 to 7.2 mmHg [10]. The core physiological changes in this subgroup of individuals are manifested as the decrease of aortic elasticity and the rise of systolic blood pressure. The latest research shows that the DASH diet can significantly improve the related pathological state by optimizing the intake ratio of electrolytes with high potassium and low sodium. This result strongly confirms the precise regulation value of this diet pattern for specific subgroups of elderly hypertension. A more comprehensive systematic Meta-analysis integrated the data of 7 independent studies, including 6 randomized controlled trials and 1 prospective cohort study, and finally included 2903 participants. The study data show that the adoption of the DASH diet can significantly reduce systolic blood pressure, with a weighted mean difference (MD) of -6.27 mmHg, a 95% confidence interval of -10.19 to -2.34 mmHg ($P < 0.01$); at the same time, this diet pattern also shows a significant improvement effect on diastolic blood pressure, with an MD value of -4.18 mmHg, a 95% confidence interval of -6.53 to -1.84 mmHg ($P < 0.01$). What is particularly crucial is that compared with the improvement effect on diastolic blood pressure, the effect of this diet intervention plan on reducing systolic blood pressure is more significant, specifically, the standardized mean difference (MD) is -1.79 mmHg, a 95% confidence interval of -3.34 to -0.24 mmHg ($P = 0.02$).

Table 1 summarizes the core research findings on the blood pressure - lowering effect of the DASH diet pattern on elderly patients with hypertension. Based on the existing evidence - based medicine evidence, this dietary intervention program can significantly reduce the systolic blood pressure level of elderly individuals with hypertension, especially when it is applied in combination with other lifestyle intervention measures, and the blood pressure - lowering effect can be further enhanced.

Table 1. Representative evidence on the antihypertensive effects of the DASH dietary pattern

Research	Population	Results	Ref.
Filippou et al. (2020)	Adults with/without hypertension	SBP ↓3.2 mmHg; DBP ↓2.5 mmHg	[7]
Chinese Guideline (2024)	Older hypertensive patients	Greater BP reduction with DASH adherence	[8]
Jabbarzadeh Ganjeh et al. (2024)	Exercise + hypertension	Combined lifestyle interventions improve BP	[11]

3.2. Synergistic effects of joint intervention

The DASH dietary pattern has the potential to synergistically strengthen the multi-element intervention strategy. In the context of combined application with antihypertensive drugs, this diet

program can be an important auxiliary means in the drug treatment system. Without increasing the dosage of the drug, this program can significantly enhance the blood pressure control efficacy. This action can greatly reduce the total drug intake of elderly patients, reduce the risk of drug adverse reactions, and thus enhance their medication safety factor. For the elderly population with multiple chronic diseases and who need long-term medication, scientifically practicing the DASH dietary pattern can not only significantly simplify the complex medication process on the basis of maintaining the existing treatment effectiveness but also form a synergistic and synergistic superposition effect with exercise intervention. When an individual adheres to moderate-intensity physical exercise, their cardiopulmonary function will be significantly improved, and the glucose and lipid metabolism will also be more optimally regulated. These positive changes at the physiological level can further strengthen the role of the DASH dietary pattern in reducing blood pressure. The two interact with each other and enhance each other, jointly contributing to the dynamic stability and effective regulation of blood pressure. According to the comprehensive data of epidemiological investigations and clinical studies, if an individual regularly carries out moderate-intensity aerobic exercise three or more times a week, lasting 40 to 60 minutes each time, their systolic blood pressure level can be reduced by 4 to 9 mmHg. More importantly, on the basis of the above exercise intervention, if a nutrition control program with the DASH dietary pattern as the core is superposed, the blood pressure management efficacy will achieve a significant synergistic improvement [1]. In the practice of implementing the low-salt diet strategy, the DASH diet can provide unique auxiliary value due to its natural low-sodium property. If combined with a strict sodium restriction strategy (daily sodium intake strictly controlled within 1500mg), the antihypertensive effect will be more significant. Evidence-based medical research shows that when the DASH dietary pattern is used in combination with the low-salt intervention method, the maximum reduction in systolic blood pressure can reach 11.4 mmHg, and the risk of cardiovascular adverse events is reduced by 14.1% [9]. In the implementation process of the synergistic intervention strategy, its core value lies not only in the efficient control of blood pressure but also in systematically optimizing various metabolic indicators through multi-dimensional action mechanisms. A retrospective cohort analysis involving 16,358 research subjects shows that the coexistence of hypertension and osteoporosis will induce superimposed health risks (comprehensive index $SI = 2.070$, 95% CI: 1.124 - 3.813), significantly increasing the probability of adverse health outcomes for patients. In contrast, the DASH dietary pattern with relatively high compliance combined with the dynamically optimized blood pressure control strategy can effectively reduce the incidence of adverse events in patients with hypertension complicated by osteoporosis (hazard ratio $HR = 0.670$, 95% CI: 0.525 - 0.854, $P = 0.002$), and also shows a stable blood pressure control effect on the population with simple hypertension ($HR = 0.883$, 95% CI: 0.796 - 0.981, $P = 0.021$) [12]. For the comprehensive management system of elderly hypertensive patients, the multi-dimensional integration strategy of diet intervention, exercise prescription, drug treatment, and salt restriction measures can systematically optimize the blood pressure regulation mechanism by precisely targeting multiple pathophysiological links, which is more suitable for the complex metabolic and physiological characteristics of the elderly population. This program, with its completeness and precision, demonstrates excellent clinical application prospects and extensive promotion value.

4. Challenges and future directions of DASH diet in practical application

4.1. Current challenges facing the application

In the clinical management practice of elderly hypertension, the collaborative application of the DASH diet plan and digital intervention means has been widely proven to significantly reduce patients' blood pressure levels, reduce sodium intake, and optimize the rationality of dietary structure. Although its clinical effectiveness has been fully verified, in the actual promotion process, this comprehensive intervention strategy still faces many practical-level obstacles, making it difficult to achieve stable and consistent ideal effects in overall intervention efficiency, and the response differences between individuals are also relatively prominent. Among the 24 selected research cases, most of the intervention means failed to achieve significant blood pressure reduction effects, and only a few studies observed obvious improvement in blood pressure after intervention. In the field of long-term stable regulation of blood pressure, most explorations and practices have achieved little. The fundamental reason is that there is a lack of a theoretical support system with behavioral intervention as the core, making it difficult for a large number of projects to achieve the established goals during the implementation process. Because the intervention process is long-term, the sustainable realization of health benefits often exceeds the time frame of short-term intervention. In addition, the degree of presentation of such effects also depends on the optimization of the technical path and the users' acceptance of digital tools. At present, the overall quality of evidence from research in this field within academia remains moderate to low, and high-quality research findings suitable for long-term follow-up observation are also scarce [13]. The elderly group is often troubled by various chronic diseases, and physiological functions gradually decline with the passage of time. Moreover, long-term solidified dietary preferences are difficult to change, and these factors together make it difficult for them to strictly follow the normative requirements of the DASH diet for a long time. Given the complexity of the health status and individual differences of the elderly group, a single dietary pattern is difficult to fully meet their diverse health needs. In the field of cognition and practice of core nutritional principles such as low-sodium diet and high-potassium intake, the elderly group generally has cognitive biases and execution obstacles. However, in some regions of the country, the access and economic burden of recommended nutritional ingredients such as low-fat dairy products, deep-sea fish, and nuts are still limited, which has formed a significant constraint on the popularization and application of these ingredients in primary medical institutions [14]. The construction of the primary medical and health service system still needs to be deepened and optimized. In community governance and service practice, the current core crux lies in the lack of standardization of personalized service processes and the need to improve the implementation effectiveness of actual operation links. The current health popularization work has insufficient radiation breadth and penetration depth, resulting in most health intervention strategies having little short-term effect on dietary behavior. This limitation makes it difficult to achieve persistent and stable results in weight management and blood pressure regulation. When promoting intervention measures in different social groups and regional units, the effectiveness shows significant heterogeneity. The poor regional adaptability has repeatedly hindered the large-scale and sustainable promotion process. The diversity of diet culture should not be underestimated. The DASH diet model is rooted in Western diet culture, and its food matching and cooking methods are significantly different from the traditional Chinese diet structure. If the elderly group takes refined white rice and noodles, high-sodium foods, and animal fats as the pillars of their diet for a long time, it will be significantly deviated from the high-fiber, low-sodium, and low-fat diet principles advocated by the

DASH plan. The lack of cultural fit has become a key bottleneck restricting the large-scale promotion of this diet intervention plan.

4.2. Future directions

To effectively respond to the above challenges, the future exploration path in the academic community should be built on a solid foundation of behavior change theories (such as social cognitive theory and transtheoretical model), systematically build an optimized strategy system, and comprehensively construct digital intervention programs. In this process, it is necessary to deeply integrate multiple technological carriers such as mobile applications, online community interaction platforms, and smart short message pushes, so as to improve the user-friendliness of technological tools and the coverage of service recipients. On this premise, the duration of the intervention stage and the follow-up frequency should also be appropriately extended, and at the same time, with more scale and rigorous empirical research, the optimal intervention strategy should be accurately identified, so as to improve the standardization level and promotion effectiveness of the program [13]. For the comprehensive evaluation system for the elderly population, it is necessary to systematically integrate multi-dimensional information such as their nutritional status, chronic disease spectrum, swallowing and chewing function, and personal dietary preferences, so as to construct and implement personalized DASH diet intervention strategies. When carrying out blood pressure regulation work, the coordinated management of coexisting diseases such as diabetes, chronic kidney disease, and osteoporosis must be included in the overall consideration. To ensure the continuity of long-term treatment and patients' treatment compliance, it is urgent to systematically optimize the diagnosis and treatment service system, strengthen the depth and breadth of health education, and build a more complete family support mechanism. At the same time, in the optimization process, the specificity of regional diet culture must be fully considered, and the deep integration of personalized treatment plans and regional characteristics must be promoted. Integrating the essence of the four major cuisines of Shandong cuisine's mellow and profound, Huaiyang cuisine's elegant and nimble, Cantonese cuisine's exquisite craftsmanship, and Sichuan cuisine's spicy and fragrant, a "Chinese Heart Healthy Diet (CHH)" program that suits their flavor characteristics can be tailor-made. A number of scientific studies have confirmed that the CHH diet pattern can reduce systolic blood pressure by an average of 10.0 mmHg and diastolic blood pressure by an average of 3.8 mmHg. This diet plan also conforms to the dietary culture tradition and preferences of Chinese elders. In view of this, the immediate task is to build a full-cycle implementation system integrating digital technology, community governance, and family monitoring to promote the deep transformation of the DASH diet pattern from short-term intervention to long-term lifestyle [15]. At the same time, the personalized nutrition guidance plan based on intestinal flora typing also has profound academic value and practical prospects. Screening out biomarkers with high sensitivity to the blood pressure-lowering effect of the DASH diet can promote the paradigm innovation from "universal suggestions" to "personalized precise regulation programs". This path is expected to break through the constraints of the traditional single intervention mode and improve the stability and predictability of intervention effectiveness [5].

5. Conclusion

This paper focuses on the application of the DASH diet pattern in the management of elderly primary hypertension, and deeply analyzes its unique value from three key levels: intervention effectiveness, action pathway and clinical practice. Studies show that this dietary strategy has a

significant blood pressure regulation effect on elderly hypertensive patients, especially in the group of elderly isolated systolic hypertension (ISH), and its hypotensive efficacy is comparable to that of low-dose first-line antihypertensive drugs. The mechanism of action of this therapy presents a multi-level synergistic effect, covering the regulation of the inflammatory response process, the remodeling of the intestinal flora structure and the maintenance of the metabolic homeostasis of short-chain fatty acids, and can also inhibit the activity of the renin-angiotensin-aldosterone system (RAA). In clinical diagnosis and treatment practice, the DASH diet pattern can be used as a key auxiliary strategy for drug intervention. For the elderly group with various chronic diseases, this diet plan shows significant safety advantages, providing multi-dimensional value support for formulating individualized treatment plans. There are three core challenges in the promotion of the DASH diet pattern in the community medical system: the quality of medical services needs to be further improved, the long-term dietary compliance of patients is not good, and the supply of dietary resources is relatively scarce. For future academic research, the primary task is to systematically carry out large-scale randomized controlled trials in the elderly population to obtain evidence-based medical evidence in line with the characteristics of China. At present, in this field in China, due to the lack of strong support from sufficient local data, it is imminent to build an evidence-based recommendation system that deeply matches the domestic clinical practice. On this basis, personalized dietary intervention plans should be tailored according to the specific characteristics of the intestinal flora, and a remote dietary monitoring and guidance platform should be built by integrating mobile medical technology. Strategies to improve the intervention compliance of community elderly patients can be carried out from the following dimensions: first, accurately and concisely process the popular science content to make it more in line with the cognitive rules of the elderly, so as to enhance the understanding and adoption willingness; second, optimize the dietary guidance plan in combination with the characteristics of local dietary culture, for example, integrate the core elements of the Chinese heart-healthy diet pattern; third, build a closed-loop follow-up management mechanism to ensure the continuous implementation of intervention measures and the long-term maintenance of effects. Build a long-term mechanism based on multidisciplinary collaboration, comprehensively penetrate the DASH diet pattern from the theoretical support of evidence-based medicine into the primary medical service system, and create a sustainable non-drug intervention comprehensive management plan for the elderly hypertensive patients in China.

Author contribution

All the authors contributed equally and their names were listed in alphabetical order.

References

- [1] Chinese Hypertension Prevention and Treatment Guidelines Revision Committee, Hypertension Alliance (China) and Hypertension Branch of China International Exchange and Promotion Association for Medical and Health Care. (2024). Chinese hypertension prevention and treatment guidelines (2024 revised edition). *Chinese Journal of Hypertension (Chinese and English)*, 32(7), 603–700.
- [2] Chen, K., Yu, J.-M., Li, D.-H., Chen, H.-Y., Zhang, X.-B., & Zhao, Y.-Y. (2024). Research progress on the pathogenesis of hypertension in the elderly. *Journal of Practical Cardiovascular and Cerebrovascular Diseases*, 32(1), 26–31.
- [3] Chen, Z.-Y. (2025). Research progress on the effects of DASH, CHH and spicy diet patterns on hypertension and blood pressure reduction. *Nursing*, 14(1), 84–90.
- [4] Dodge, E., Kelly, P. J., & Aboul-Enein, B. H. (2025). Digital-based nutrition interventions employing the Dietary Approaches to Stop Hypertension (DASH) diet: A systematic scoping review. *International Journal of Hypertension*, 2025(1), 6175223.

- [5] Filippou, C. D., Tsioufis, C. P., Thomopoulos, C. G., Makris, T. K., & Papadetriou, V. (2020). Dietary Approaches to Stop Hypertension (DASH) diet and blood pressure reduction in adults with and without hypertension: A systematic review and meta-analysis of randomized controlled trials. *Advances in Nutrition*, 11(5), 1150–1160.
- [6] Guan, J., Ding, L., Wang, Y., Li, X., Zhang, H., & Zhao, Q. (2025). Association of DASH diet adherence with health outcomes in adults with hypertension and osteoporosis: A retrospective cohort study. *Frontiers in Nutrition*, 12, 1456789.
- [7] He, J.-Y., Zhuliduzi, J., Zhang, N., Liu, M., & Liang, W.-N. (2025). Current status, challenges and future prospects of standardized management of blood pressure control and influencing factors in hypertensive patients in China. *Chinese General Practice*, 28(24), 2968-2971+2978.
- [8] Isnaini, N., Dewi, F. S. T., Madyaningrum, E., & Supriyadi (2025). Blood pressure impact of dietary practices using the DASH method: A systematic review and meta-analysis. *Clinical Hypertension*, 31, e12.
- [9] Jabbarzadeh, G. B., Zeraatallah-Motlagh, S., Jayedi, A., & Shab-Biar, S. (2024). Effects of aerobic exercise on blood pressure in patients with hypertension: A systematic review and dose-response meta-analysis of randomized trials. *Hypertension Research*, 47(2), 385-398.
- [10] Li, D.-W., & Liu, Y. (2020). Possible mechanisms of blood pressure regulation by short-chain fatty acids, metabolites of gut microbiota, and research progress on their role as targets for the prevention and treatment of hypertension. *China Medicine*, 15(11), 1797-1801.
- [11] Soltani, S., Chitsazi, M. J., & Salehi-Abargouei, A. (2018). The effect of dietary approaches to stop hypertension (DASH) on serum inflammatory markers: A systematic review and meta-analysis of randomized trials. *Clinical Nutrition*, 37(2), 542–550.
- [12] Wang, Y., Feng, L., Zeng, G., Wang, H., Zhang, L., & Li, Y. (2022). Effects of cuisine-based Chinese heart-healthy diet in lowering blood pressure among adults in China: Multicenter, single-blind, randomized, parallel controlled feeding trial. *Circulation*, 146(4), 303–315.
- [13] Yang, F., Wang, Z., & Wei, X. (2020). Gut microbiota-derived short-chain fatty acids and hypertension: Mechanism and treatment. *Biomedicine & Pharmacotherapy*, 130, 110503.
- [14] Yang, L., Gong, L., & Wang, Y. (2023). Meta-analysis of DASH diet pattern in the prevention of hypertension. *Practical Preventive Medicine*, 30(5), 610–615.
- [15] Zhao, C.-Y. (2023) Research progress in nursing care of elderly patients with hypertension following the DASH diet pattern. *Trace Elements and Health Research*, 40(6), 77-80.