



REVIEW ARTICLE

Beyond Pills: Exploring Effective Ways to Tackle Hypertension through Non-Pharmacological Means

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Abstract

Hypertension (HTN) is a systemic disease characterized by the force of pressure within the arterial vessels. HTN is a modifiable risk factor for multiple health outcomes, including cardiovascular disease and stroke, which have substantial impact on an individual's quality of life and the healthcare system as a whole. Accumulating evidence suggests lifestyle interventions can play an important role in the reduction of blood pressure and in some cases may obviate the need for pharmacotherapy. Interventions which show the most promise include dietary modification, weight loss, exercise, alcohol avoidance, adequate sleep hygiene, and integrative medicine. Data based screening and interviewing may aid clinician implementation.

Keywords

HTN: Hypertension, DASH: Dietary approach to stop hypertension, BP: Blood pressure, Lifestyle intervention, Diet, Exercise, Weight loss, Sleep, Integrative approaches, Behavioral change, Motivational interview

Introduction

Hypertension is a multifactorial disease process impacting multiple organ systems through various physiological mechanisms including sympathetic and parasympathetic activation, arterial elasticity, and renal and adrenal endocrine signaling. It stands to reason that the complex etiology of hypertension will result in many approaches to the condition's mitigation. The clinical diagnosis of hypertension is based on standardized external cuff readings of the medium sized brachial vessel. Recent guidelines support the diagnosis when blood pressure is recorded at 130/80 mmHg or higher on two separate occasions. If ambulatory

home blood pressure monitoring is indicated, then an average blood pressure reading greater than 125/75 mmHg is diagnostic for hypertension [1]. The effects of regularly elevated pressure enacted against arterial walls and vascularly perfused tissues are detrimental. Despite the known adverse health outcomes, HTN still remains a significant public health concern with almost half the adult population in the United States having hypertension and 75% of those patients having uncontrolled hypertension [2]. It remains one of the most preventable and modifiable risk factors for major adverse cardiovascular events such as myocardial infarctions, strokes, heart failure, and sudden cardiac death. Despite the availability of various pharmacotherapies with unique mechanisms to lower blood pressure, there remain challenges such as cost, patient adherence, medication side effects, increased clinical visitations, and lab tests.

It is important for clinicians and patients to be knowledgeable of the non-pharmacologic options for improving blood pressure. Lifestyle modifications can be used in patients with elevated blood pressure or stage 1 hypertension in lieu of medications and should always be encouraged in patients already on pharmacotherapy. Such lifestyle modifications include dietary changes, weight loss, exercise, reduction of alcohol intake, sleep, medication management, and integrative approaches. Evidence-based lifestyle interventions should be encouraged to give patients the highest likelihood of success at improving their Blood Pressure [3].

Discussion

Dash diet

The Dietary Approach to Stop Hypertension (DASH) diet is one evidence proven method of effectively reducing blood pressure. The initial DASH trial was one of the first clinical trials of its kind to provide a comparison of an entirely controlled dietary pattern [4]. Individuals adhering to the DASH diet are likely to be meeting ideal requirements of blood pressure affecting minerals, with emphasis on foods rich in magnesium, potassium, and fiber, such as fruits, vegetables, beans, nuts and other whole grains and limitations on food high in saturated fat and sugar [5]. The original DASH trial has since been replicated dozens of times since its initial publication. Meta-analysis has supported the conclusion that recommended dietary adjustment results in systolic and diastolic BP reduction independent of initial BP level [6]. The effects were found to go even beyond blood pressure reduction with one meta-analysis by Soltani S, et al. which concluded that adherence to the DASH diet is associated with a significant inverse dose response to all-cause cancer mortality, stroke, and cardiovascular disease [7]. While the DASH diet itself is not explicitly a sodium restricted diet, strict adherence will have the effect of lower sodium intake, and those following the diet will likely fall below the recommended total of 2300 mg per day. This is a substantial reduction considering the average American consumes 3400 mg of sodium daily [8]. For even better control, a sodium intake of 1500 mg daily is recommended by the American Heart Association.

MIND diet: Combination of mediterranean and dash

Another diet which has been shown to effectively reduce systolic blood pressure and arterial stiffness is the Mediterranean diet [9]. There is much overlap in the Dash and Mediterranean diet; both diets focus on increasing consumption of fruits, vegetables, whole grains and legumes while reducing intake of added sugar and saturated fats. The Mediterranean diet allows for consumption of more heart healthy fats and encourages eating fish at least twice weekly. The MIND diet, which is a combination of the DASH diet and Mediterranean diet, is becoming increasingly popular. It has been linked to improved cardiovascular health as well as decreasing cognitive decline as you age [10].

Fiber

Fiber is an important part of a healthy diet; foods high in fiber can aid in weight loss, lower blood cholesterol and glucose levels, as well as help move material through the digestive system. Fiber comes in two forms: soluble and insoluble. Soluble fiber dissolves in water and helps feed healthy gut bacteria. Insoluble fiber does not dissolve and helps stick to other material

in the digestive tract to form regular stools and improve bowel function. Most people consume less than half of their daily recommended allowance of fiber [11]. A recommended 25-30 grams of fiber should be consumed daily with the average American consuming only 15 grams per day [12]. A meta-analysis of RCTs published between 1990 and 2013 noted a systolic and diastolic reduction in BP of 2.9 and 1.5 mmHg respectively in patients who received a median difference of 4 grams more of soluble fiber [13]. A more recent meta-analysis of 3 large prospective trials also noted a 4.3 and 3.1 mmHg reduction in systolic and diastolic pressures in those with increased dietary fiber intake [14]. Increased fiber leads not only to improved blood pressure but improves other aspects of overall health, including weight, cholesterol, cardiovascular risk, and diabetes [15].

Potassium

Diets high in potassium have been shown to reduce blood pressure as much as 4.3 mmHg systolic [16]. An intake of 2600 mg of potassium for women and 3400 mg for men is recommended daily; however, the majority of people fall short [17]. Unlike sodium, potassium is believed to be vasoactive and can directly lead to vasodilation by stimulating vascular smooth muscle cells [18]. Foods rich in potassium include fruits and vegetables, nuts, beans, and dairy. However, increased potassium intake should be cautioned in patients with kidney disease.

Omega 3

Studies have demonstrated that eating a diet rich in omega 3 fatty acids can have a modest but clinically significant reduction in blood pressure [19]. The effect is more pronounced in hypertensive individuals and patients with high normal blood pressure. The amount of omega 3 needed to consume daily is believed to be around 3-4 grams [20]. The effects can likely be compounded when combined with other appropriate dietary changes such as moderation of salt intake. Common foods with Omega-3 include tuna, trout, mackerel, salmon, herring, and flaxseeds, chia seeds, walnuts, and soybean.

Weight loss and exercise

Weight loss is an integral part of blood pressure management. It is expected that there will be a reduction of 1 mmHg per 1 kg of weight loss in obese or overweight patients [21]. There are many weight loss strategies, however the underlying principle of caloric restriction remains the same. A calorie deficit is the primary driver of weight loss and requires adherents to consume less calories than they burn. This could be done by either increasing daily caloric expenditure, decreasing daily calorie intake, or both. It is also important to understand the caloric density of various

foods. For example, 1 gram of butter has significantly more calories than 1 gram of pasta.

Increasing your activity level is another highly effective method of expending calories and reducing blood pressure. Just 20-30 minutes daily of activity that increases breathing and heart rate such as brisk walking can decrease BP by up to 8 mmHg [16]. If daily exercise is not an option, similar blood pressure reduction can be achieved by 25 to 50 minutes of more intense aerobic activity such as jogging or brisk walking on an incline every other day [22]. Additionally, adequate hydration is imperative before and after workouts. One 12-week weight loss study showed people who drank half a liter of water 30 minutes before meals lost 44% more weight than those who did not [23].

Alcohol intake

Daily alcohol consumption can cause elevated blood pressure, even in moderate quantities. Heavy alcohol use is considered 3 or more drinks per day for women, and 4 or more drinks per day for men. Decreasing from heavy to moderate alcohol was shown to decrease Systolic BP by 5.5 mmHg, and Diastolic BP by 4.0 mmHg [24]. Ideally, alcohol consumption should be limited to no more than two drinks per day for men and no more than one drink per day for women. A drink is one 12 oz. beer, 4 oz. of wine, 1.5 oz. of 80-proof spirits or 1 oz. of 100-proof spirits [25].

Sleep

Reduced sleep duration and quality have been found to be related to elevated blood pressure [26]. Sleep deprivation may lead to increased sympathetic activity and increased blood pressure variability [27]. Adults should get 7-9 hours of sleep each night. Binge sleeping, which is sleeping less during the week and trying to catch up on weekends should be avoided as studies have shown that it does not counteract the harmful effects of inadequate sleep during the week [28]. It is also imperative to assess for conditions such as sleep apnea which is associated with loud snoring, cessation of breathing during sleep, day time fatigue, and a neck circumference of > 15.75 inches. Patients at risk for sleep apnea should be evaluated with a sleep study and receive appropriate treatment to prevent or control hypertension and other adverse health outcomes. Patients should be counseled on the importance of maintaining proper sleep hygiene. The National Sleep Foundation recommends stopping the use of cell phones and other devices 30 minutes before bedtime [29]. The blue light emitted by cell phones and electronic devices affect melatonin production, the hormone responsible for regulating your sleep-wake cycle [30].

Integrative approaches

Stress management: Stress has long been related to elevated Blood Pressure and individuals with

a higher stress level being more likely to develop HTN. Acute and chronic stress is thought to increase sympathetic innervation leading to increased heart rate and contractility, vasoconstriction, and release of catecholamines which consequently lead to increases in blood pressure and other adverse health outcomes [31]. Hypertensive patients struggling with managing their stress levels should be counseled on various techniques such as meditation and yoga to provide healthy outlets for stress relief.

Meditation: Meditation, particularly transcendental meditation, a form of silent mantra meditation focusing on promoting a state of relaxed awareness and stress relief, has important health benefits. A systematic review and meta-analyses of available literature suggests that this form of meditation can lead to an average systolic reduction in blood pressure of 4.3 mmHg. Subgroup analysis showed elderly patients and those with higher initial BP readings had a greater reduction [32]. Meditation is also beneficial when managing stress and can help with anxiety and depression.

Tai chi: Tai chi is a practice originating in China and involves slow, purposeful movements and posturing aimed at supporting a meditative state of mind and controlled breathing. It has become increasingly popular at promoting healthful habits, rehabilitation, and pain management. A systematic review involving 26 studies found that 85% of those studies had significant reduction in blood pressure readings ranging from 3-32 mmHg systolic to 2-18 mmHg diastolic [33]. Tai chi may be an underemphasized adjunct non-pharmacologic approach to managing hypertension in patients.

Yoga: Yoga, like tai chi, is another practice which combines posturing, breathing and meditation in order to promote strength, calmness, flexibility and overall wellbeing. One systematic review of yoga and HTN showed yoga had a modest but clinically significant reduction in blood pressure averaging an 8.17 mmHg reduction in systolic and 6.14 mmHg reduction in diastolic readings [34].

Medications: It is important for patients to understand that certain medications can lead to secondary hypertension. Popular medications such as NSAIDs, aspirin, and acetaminophen are associated with elevated blood pressure [35]. NSAIDs affect the blood pressure through influence on prostaglandin production, as well as increase in the production of endothelin, leading to vasoconstriction [36]. Sympathomimetics, such as common decongestants phenylephrine or pseudoephedrine, can also cause elevated blood pressure [35]. It is imperative that patients are questioned about OTC medications and current medication lists are thoroughly reviewed.

Meaningful behavioral change

Provider knowledge and patient education are necessary to implement lifestyle interventions. Two challenges often encountered are patient screening and initiation of lifestyle changes. Identifying patients' interests and current lifestyle deficiencies can be done with trial validated questionnaires so targeted BP reduction interventions can be pursued. An example is the 8-question screening tool, Starting the Conversation, which identifies high yield dietary strengths and weaknesses [37]. Similar, poignant questions in regards to other behavioral habits, including sleep quality, exercise, and stress levels, could identify further behavioral deficiencies that can be improved.

Patient willingness to make change is also essential for achieving behavioral modification. An assessment can be performed in an objective manner, such as scaling interest numerically 0-10 or with specific verbal descriptors ranging from no interest to very interested. Areas of high interest may be actively pursued and low interest areas may be tabled and re-evaluated at future visitations [38].

Sustaining lifestyle changes will likely be the greatest challenge for any provider or patient. A plethora of data exists regarding behavioral change modifications; however, inconsistency of target goals, methodology, and outcomes cause difficulty for providers to choose strategies which might achieve desired outcomes in a time efficient manner. The UPSTF identifies the 5 A's as the most rigorously studied clinically validated tool for behavioral change [39]. The A's stand for Assess, Advise, Agree, Assist, and Arrange. A second clinically validated strategy commonly used is Motivational Interviewing [40]. Both behavioral change strategies are designed to prompt goals and identify methods to achieve them, while maintaining personal autonomy in an empathetic environment. Individuals' behavior are guided by unique personal and environmental motivators that require extended time and regular counseling to achieve and maintain.

Conclusion

Non-pharmacologic approach to hypertension is indicated in all patients with or without pharmacotherapy. Clinicians should be well versed on various non-pharmacologic interventions so appropriate and meaningful discussions can be had with patients. There is the opportunity to prevent, reduce, or eliminate the need for pharmacotherapy through lifestyle and behavioral modifications.

Clinical Significance

- Hypertension is a prevalent disease with significant negative health consequences.
- Non-pharmacological approaches to hypertension are not well known and poorly implemented by clinicians.

- Lifestyle interventions for HTN are effective for reducing blood pressure; clinical evidence shows significant reductions of blood pressure with implementation of non-pharmacological modifications.
- Data driven behavioral modification techniques exists which can aid clinicians in implementing lifestyle modifications.

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Conflict of Interest

None.

Authors Contribution

All authors participated in collection, organization, and writing of the following manuscript.

References

1. Unger T, Borghi C, Charchar F, Khan NA, Poulter NR, et al. (2020) International society of hypertension global hypertension practice guidelines. *Hypertension* 75: 1334-1357.
2. Facts about hypertension (2023) Centers for disease control and prevention.
3. Whelton P, Carey R, Aronow W, Casey DE Jr, Collins KJ, et al. (2017) ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: Executive summary. *J Am Coll Cardiol* 71: 2199-2269.
4. Sacks FM, Obarzanek E, Windhauser MM, Svetkey LP, Vollmer WM, et al. (1995) Rationale and design of the dietary approaches to stop hypertension trial (DASH). A multicenter controlled-feeding study of dietary patterns to lower blood pressure. *Ann Epidemiol* 5: 108-118.
5. Steinberg D, Bennett GG, Svetkey L (2017) The dash diet, 20 years later. *JAMA* 317: 15299.
6. Filippou CD, Tsioufis CP, Thomopoulos CG, Mihas CC, Dimitriadis KS, et al. (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. *Adv Nutr* 11: 1150-1160.
7. Soltani S, Arablou T, Jayedi A, Salehi-Abargouei A (2020) Adherence to the dietary approaches to stop hypertension (DASH) diet in relation to all-cause and cause-specific mortality: A systematic review and dose-response meta-analysis of prospective cohort studies. *Nutr J* 19: 37.
8. Shelley McGuire, Institute of medicine (2013) Sodium intake in populations: Assessment of evidence 5: 19-20.
9. Jennings A, Berendsen AM, de Groot LCPGM, Feskens EJM, Brzozowska A, et al. (2019) Mediterranean-style diet improves systolic blood pressure and arterial stiffness in older adults. *Hypertension* 73: 578-586.
10. Morris MC, Tangney CC, Wang Y, Sacks FM, Bennett DA, et al. (2015) Mind diet associated with reduced incidence of alzheimer's disease. *Alzheimer's & Dementia* 11: 1007-1014.

11. Slavin JL (2008) Position of the american dietetic association: Health implications of dietary fiber. *J Am Diet Assoc* 108: 1716-1731.
12. Soliman GA (2019) Dietary fiber, atherosclerosis, and cardiovascular disease. *Nutrients* 11: 1155.
13. Evans CE, Greenwood DC, Threapleton DE, Cleghorn CL, Nykjaer C, et al. (2015) Effects of dietary fibre type on blood pressure: Asystematic review and meta-analysis of randomized controlled trials of healthy individuals. *J Hypertens* 33: 897-911.
14. Reynolds AN, Akerman A, Kumar S, Diep Pham HT, Coffey S, et al. (2022) Dietary fibre in hypertension and cardiovascular disease management: Systematic review and meta-analyses. *BMC Med* 20: 139.
15. Evans CEL (2020) Dietary fibre and cardiovascular health: A review of current evidence and policy. *Proc Nutr Soc* 79: 61-67.
16. Whelton PK, He J, Cutler JA, Brancati FL, Appel LJ, et al. (1997) Effects of oral potassium on blood pressure: Meta-analysis of randomized controlled clinical trials. *JAMA* 277: 1624-1632.
17. (2022) A primer on potassium.
18. Haddy FJ, Vanhoutt PM, Feletou M (2006) Role of potassium in regulating blood flow and blood pressure. *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology* 290.
19. (2023) Consuming about 3 grams of omega-3 fatty acids a day may lower blood pressure.
20. Mori TA (2010) Omega-3 fatty acids and blood pressure. *Cellular and Molecular Biology* 56: 83-92.
21. Lim SL, Johal J, Ong KW, Han CY, Chan YH, et al. (2020) Lifestyle intervention enabled by mobile technology on weight loss in patients with nonalcoholic fatty liver disease: Randomized controlled trial. *JMIR mHealth and uHealth* 8: e14802.
22. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, et al. (2003) Seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. *Hypertension* 42: 1206-1252.
23. Dennis EA, Dengo AL, Comber DL, Flack KD, Savla J, et al. (2010) Water consumption increases weight loss during a hypocaloric diet intervention in middle-aged and older adults. *Obesity* 18: 300-307.
24. Alcohol: Does it affect blood pressure? (2022) Mayo Clinic.
25. (2022) Limiting alcohol to manage high blood pressure.
26. Knutson KL, Van Cauter E, Rathouz PJ, Yan LL, Hulley SB, et al. (2009) Association between sleep and blood pressure in midlife. *Arch Intern Med* 169: 1055.
27. Spiegel K, Leproult R, Van Cauter E (1999) Impact of sleep debt on metabolic and endocrine function. *The Lancet* 354: 1435-1439.
28. Depner CM, Melanson EL, Eckel RH, Snell-Bergeon JK, Perreault L, et al. (2019) Ad libitum weekend recovery sleep fails to prevent metabolic dysregulation during a repeating pattern of insufficient sleep and weekend recovery sleep. *Curr Biol* 29: 957-967.
29. Suni E (2022) Healthy sleep tips. *Sleep foundation*.
30. Pateras E (2020) Blue light blocking ophthalmic lenses and their benefits-a review. *Journal of Materials Science Research and Reviews* 5: 13-20.
31. Ayada C, Toru U, Korkut Y (2015) The relationship of stress and blood pressure effectors. *Hippokratia* 19: 99-108.
32. Bai Z, Chang J, Chen C, Li P, Yang K, et al. (2015) Investigating the effect of transcendental meditation on blood pressure: A systematic review and meta-analysis. *J Hum Hypertens* 29: 653-662.
33. Yeh GY, Wang C, Wayne PM, Phillips RS (2008) The effect of tai chi exercise on blood pressure: A systematic review. *Prev Cardiol* 11: 82-89.
34. Hagins M, Selfe T, Innes K (2013) Effectiveness of yoga for hypertension: Systematic review and meta-analysis. *Evid Based Complement Alternat Med* 2013: 649836.
35. Chiong JR, Aronow WS, Khan IA, Nair CK, Vijayaraghavan K, et al. (2008) Secondary hypertension: current diagnosis and treatment. *Int J Cardiol* 124: 6-21.
36. Aronow WS, Fleg JL, Pepine CJ, Artinian NT, Bakris G, et al. (2011) ACCF/AHA 2011 expert consensus document on hypertension in the elderly: A report of the American College of cardiology foundation task force on clinical expert consensus documents. *Circulation* 124: 259-352.
37. Paxton AE, Strycker LA, Toobert DJ, Ammerman AS, Glasgow RE (2010) Starting the conversation performance of a brief dietary assessment and intervention tool for health professionals. *Am J Prev Med* 40: 67-71.
38. Hauser ME, McMacken M, Lim A, Shetty P (2022) Nutrition-an evidence-based, practical approach to chronic disease prevention and treatment. *J Fam Pract* 71: S5-S16.
39. Whitlock EP, Orleans CT, Pender N, Allan J (2002) Evaluating primary care behavioral counseling interventions: An evidence-based approach. *Am J Prev Med* 22: 267-284.
40. Bischof G, Bischof A, Rumpf HJ (2021) Motivational interviewing: An evidence-based approach for use in medical practice. *Dtsch Arztebl Int* 118: 109-115.