nicole flynn
NUTRITION + WELLNESS

Blood Pressure Dysregulation

Hypertension, or high blood pressure, is one of the most common chronic health conditions worldwide and a leading contributor to cardiovascular disease, kidney failure, and stroke. As blood pressure in the heart increases, the heart must work harder to move blood adequately throughout the body and if uncorrected, eventually results in heart failure.

The incidence of hypertension has been steadily increasing over the past several decades due to aging populations, sedentary lifestyles, rising obesity rates, and poor dietary patterns. Emerging data shows hypertension is now affecting younger populations, including adults in their 20s and 30s, likely due to stress, poor metabolic health, and high sodium intake.

Hypertension is influenced by genetic, environmental and diet and lifestyle factors. Most hypertension cases can be controlled through diet and lifestyle modifications, which will be discussed below. Nonmodifiable risk factors include age, genetics and ethnicity, with African American adults tending to develop hypertension earlier. Older age and obesity are the two strongest risk factors.

(Bikman, 2021; Raymond & Morrow, 2023)

Consequences of high blood pressure.

In the United States, one in three adults has high blood pressure - often called a “silent killer” - because most people are asymptomatic. While hypertension is regarded as the number one risk factor for stroke, the cardiac, cerebrovascular and renal systems are also affected by chronically high blood pressure. It often occurs with other risk factors for cardiovascular disease, including obesity, insulin resistance/diabetes, high triglyceride and low HDL levels. Dr. Benjamin Bickman, one of the country’s leading experts on insulin resistance, teaches that insulin resistance and cardiovascular disorders are inseparable. And in fact, recent findings suggest that insulin resistance and high insulin levels directly cause high blood pressure. For those diagnosed

with hypertension, this means that treating and reversing insulin resistance is key to reducing blood pressure.

Chronic high blood pressure damages the delicate lining of blood vessels, promoting endothelial dysfunction and accelerating atherosclerosis. This not only raises the risk of heart disease and stroke but can also impair kidney function, reducing the ability to filter waste products and regulate fluid balance. Hypertension may increase calcium loss, contributing to bone density decline, and is associated with a greater risk of vascular dementia due to restricted blood flow to the brain.

(Bikman, 2021; Feuz, 2025)

What is high blood pressure and how is it measured?

Blood pressure is a function of cardiac output - how hard the heart is working to pump blood through the body. Thus, the diameter of the blood vessel affects blood flow. When the diameter of the blood vessels is decreased, resistance and blood pressure increase. Conversely, when the diameter of blood vessels is expanded, blood pressure decreases. The key to reversing high blood pressure is creating conditions that allow blood to flow through the vessels without overworking the heart.

Systolic blood pressure (the upper reading on a blood pressure measurement) is the force exerted on the walls of the blood vessels as the heart contracts. Diastolic blood pressure (the lower reading) measures the force as the heart relaxes between contractions.

Functional medicine recognizes the following blood pressure markers[1]:

Category	Systolic mm Hg	Diastolic mm Hg
Normal	120-129	80-85
Borderline high blood pressure (prehypertension)	130-139	85-89
Mild high blood pressure (stage 1)	140-159	90-99

[1] In 2017, the American Heart Association and the American College of Cardiology redefined hypertension - lowering the diagnostic threshold and increasing the number of Americans eligible for pharmaceutical interventions.

Moderate high blood pressure (stage 2)	160-179	100-109
Severe high blood pressure	180 or over	110 or over

(Murray and Pizzorno, 2012)

Causes of high blood pressure

High blood pressure is most often the result of factors that affect blood vessel constriction and fluid volume. Dietary and lifestyle factors are typically recognized as the underlying cause. In his book, *Why we get sick: The hidden epidemic at the root of most chronic disease -- and how to fight it*, Dr. Benjamin Bickman attributes high blood pressure directly to insulin resistance and describes how insulin resistance works to increase blood pressure. Insulin resistance is a reduced response to the hormone insulin.

Before diving into the causes of high blood pressure, it's important to understand the hormone system that regulates blood pressure, fluid and electrolyte balance - the Renin Angiotensin System (RAS). The RAS system is activated when blood pressure drops, blood volume is low, or sodium levels are too low. Here's how it works:

1. If your body detects low blood pressure or low sodium, the kidneys release the enzyme Renin.
2. Renin acts on a protein called angiotensinogen, which is produced by the liver. It breaks apart angiotensinogen to make Angiotensin I, which is still inactive.
3. Angiotensin I circulates through the lungs until it encounters the enzyme ACE (Angiotensin-Converting Enzyme), which converts it to Angiotensin II, an active hormone.
4. Angiotensin II narrows the blood vessels and stimulates the release of aldosterone from the adrenal glands.
5. Aldosterone causes the kidneys to reabsorb sodium (and water follows sodium) and excrete potassium. The result is increased blood pressure, water retention and swelling.

This system is tightly connected with electrolyte balance.

(Feuz, 2025)

Simple Dehydration

When the body is dehydrated, water is lost from the blood, which reduces plasma volume. When the brain detects dehydration, the hypothalamus signals the pituitary gland to release vasopressin,

an antidiuretic hormone. Vasopressin tells the kidneys to reabsorb more water, reducing urine output, and causes the blood vessels to constrict, which increases blood pressure. Dehydration also triggers the kidneys to release renin, which starts the cascade addressed above.

(Feuz, 2025)

Salt and Water Retention

According to Bikman, insulin increases blood pressure through its action on aldosterone. Aldosterone signals the kidneys to hold onto sodium and reabsorb it into the blood so that it is not expelled through the urine. So if the adrenal glands release more aldosterone into the blood, the body will retain more sodium (and water). Insulin naturally increases aldosterone levels in the body. So if you have more insulin, as during insulin resistance, you naturally have more aldosterone, and higher blood pressure.

Thicker Blood Vessels

Insulin also contributes to high blood pressure by thickening blood vessel walls. Insulin is an anabolic hormone, so it signals cells, including endothelial cells in blood vessel walls, to grow bigger. As blood vessel walls grow due to increased insulin, blood vessels begin to narrow.

(Bikman, 2021)

Blood Vessels Can't Dilate

Nitric oxide (NO) is a powerful vasodilator, which means that it increases the diameter of blood vessels. Endothelial cells produce NO, which increases the size of blood vessels. When the diameter of the blood vessel increases, blood pressure decreases. In a metabolically healthy body, insulin activates the production of NO in endothelial cells - this helps increase blood flow to muscles. However, when aldosterone and endothelial growth are overactive with insulin resistance, insulin is less able to stimulate NO production in endothelial cells because the endothelial cells have become less responsive to the insulin.

Overstimulation of the Sympathetic Nervous System

The sympathetic nervous system is the body's fight or flight regulation system. When the SNS is overactivated (for example by adrenal disorders or sleep apnea), either frequently or chronically, it drives up blood pressure by vasoconstriction, increasing cardiac output, and activating the RAS system. Bikman says that insulin subtly activates the SNS and when insulin is chronically elevated, so is the SNS.

(Bikman, 2021; Raymond and Morrow, 2023)

High Uric Acid

High levels of uric acid contribute to high blood pressure. Uric acid is a nitrogen-containing compound produced as a byproduct of purine metabolism in the body. There are three sources of uric acid: fructose, alcohol and purines. High levels of uric acid are strongly related to obesity and hypertension. Elevated uric acid causes high blood pressure in two ways. First, high uric acid causes oxidative stress, which constricts blood vessels, forcing the heart to pump harder. Second, when there is a consistent surplus of uric acid, lasting injury and inflammation in the kidneys can occur, which makes them less able to do their job excreting salt. The salt retention contributes to rising blood pressure.

Uric acid also undermines nitric oxide activity by compromising its production and damaging its functionality.

(Perlmutter 2022)

Function:

While uric acid is primarily a waste product, it has some antioxidant properties. It helps protect cells from damage caused by free radicals.

Levels:

Normal uric acid levels in the blood range from 3.4 to 7.2 mg/dL for men and 2.4 to 6.1 mg/dL for women. Elevated levels (hyperuricemia) can lead to conditions like gout and kidney stones.

Heavy Metals and Environmental Chemicals

Environmental toxins such as BPAs and PCBs, and heavy metals such as lead, mercury, cadmium and arsenic, may also contribute to hypertension. In one study, systolic blood pressure increased by almost 5 after consuming two canned beverages, as opposed to two glass bottled beverages, due to exposure to BPAs. In another study, serum concentration of PCBs (farmed fish) were strongly associated with blood pressure. The kidneys play a primary role in the elimination of toxins and their presence disrupts the kidneys' ability to regulate the body's fluid volume, resulting in sodium (and water) retention.

(Feuz, 2025; Murray and Pizzorno, 2012)

Gut Dysbiosis. Recent research identifies gut dysbiosis and intestinal barrier dysfunction as key contributors to rising blood pressure. In a notable 2023 review, hypertension is linked to shifts in gut microbiota, characterized by increases in harmful bacteria and toxins, alongside declines in

beneficial microbes and protective short-chain fatty acids.. These changes weaken gut barrier integrity, triggering systemic inflammation and impaired endothelial function, both of which elevate vascular resistance and drive hypertension.
(Yang et al., 2023)

Lifestyle Factors
Diet and lifestyle factors have proven superior to drugs in most cases of borderline to mild high blood pressure. In addition to diet and dehydration, important lifestyle factors include smoking, stress, and lack of exercise. The most important dietary factors include excessive calorie intake, high sodium to potassium ratio, low fiber, high sugar consumption, low consumption of essential fatty acids and a diet low in calcium, magnesium and vitamin C.

(Murray, et al. 2005; Murray and Pizzorno, 2012)

Functional and nutritional therapy approaches to hypertension

Functional and nutritional therapy approaches to hypertension include reducing systemic inflammation, improving insulin sensitivity, addressing key nutrients and identifying underlying drivers. The most important dietary goals for most people with any form of high blood pressure is achieving normal body weight and increasing the amount of plant foods in the diet.

(Murray and Pizzorno, 2012)

Diet. Although there are several diets that have been used to lower blood pressure, foods that should typically be included in a diet to reduce blood pressure include garlic, onions, celery, high quality fatty acids, foods high in antioxidants, foods high in potassium (except in the case of those with kidney disease) and foods high in nitric oxide. For a complete dietary protocol see Hypertension Protocol.

(Feuz, 2025; Murray et al., 2005)

The Dietary Approaches to Stop Hypertension (DASH) diet has been used to successfully reduce blood pressure. The DASH diet limits sodium to about 1500 mg/day and is rich in fruits, vegetables and low fat dairy foods. It is also low in cholesterol but high in fiber, potassium, calcium and magnesium.

A diet high in potassium and low in sodium may also be therapeutic. Research suggests that a potassium-to-sodium ratio of 5:1 is ideal to maintain health.

Reducing Inflammation. Whether triggered by poor diet, chronic stress, infections, or other factors, systemic inflammation prompts the body to release higher levels of inflammatory cytokines. These cytokines can impair the function of the endothelial lining, reducing its ability to relax properly. They also stimulate the liver to produce C-reactive protein (CRP), a key marker of inflammation. Elevated CRP contributes to plaque buildup in the arteries, narrowing their diameter and hardening their walls. As the arteries become less flexible and more constricted, the heart must work harder to pump blood, leading to increased blood pressure. Therefore, following an anti-inflammatory diet and taking steps to address inflammation may work to improve blood pressure.

(Feuz, 2025)

Improving Insulin Sensitivity. Improving insulin sensitivity may be one of the most powerful interventions for reducing high blood pressure because insulin resistance is a root driver of multiple mechanisms that elevate blood pressure. When cells become resistant to insulin, the body compensates by producing more, leading to hyperinsulinemia. Excess insulin stimulates the kidneys to retain sodium and water, increasing blood volume and activates the sympathetic nervous system, which raises heart rate and constricts blood vessels. It also promotes endothelial dysfunction and vascular stiffness, both of which increase vascular resistance. By improving insulin sensitivity - through targeted nutrition, regular physical activity, stress management, and adequate sleep, these underlying drivers can be reversed, often leading to significant, sustained reductions in blood pressure without relying solely on medications.

(Bikman, 2021)

Breathing exercises have been reported to have positive physiological effects on the body. Studies have shown that the regular practice of yoga and breathing exercise about three times per week may dramatically decrease blood pressure. Similarly, breathing exercises alone have been shown to both decrease blood pressure and increase heart rate variability. Slow and deep breathing exercise decreases respiration rate, which causes increased inhalation and exhalation volume, which leads to an increased amount of oxygen entering the blood stream, helping to inhibit sympathetic nervous system activity.

(Garg et al., 2022)

Nutraceuticals for lowering blood pressure

Beyond diet and lifestyle, research shows that targeted nutraceuticals can play a supportive role in lowering blood pressure. These natural compounds work through mechanisms such as balancing electrolytes, improving blood vessel function, and reducing inflammation.

Ensuring adequate intake of key electrolytes may help lower blood pressure. For example, supplementation with 2.5-5 g of potassium per day has been shown to reduce both systolic and diastolic blood pressure, more so in those with high sodium diets. Potassium supplementation may be especially useful in people older than 65 who often don't respond well to blood pressure lowering medications but should be avoided in those with kidney disease. Likewise, magnesium supplementation may also be beneficial (6-10 mg//kg day). Magnesium helps blood vessels relax, help improve insulin sensitivity and also helps to maintain the cellular balance between sodium and potassium. Like potassium, it should also be used with care in people with kidney disease.

(Murray and Pizzorno, 2012)

The benefits of nitric oxide were discussed above. Arginine, an amino acid, is important for the formation of nitric oxide. Arginine plays a central role in relaxing blood vessels, thereby improving blood flow and kidney function. Supplementation has been shown to significantly improve blood pressure, although primarily in younger subjects.

In addition to nutrients, several naturally occurring peptides have been shown to be beneficial in improving blood pressure. These peptides inhibit angiotensin converting enzyme (ACE), which plays a role in constricting large blood vessels and causing the kidney to retain sodium. There are two studied peptides: bonito, which comes from a bonito fish and a peptide from sardines. While consuming these fish may be beneficial, one must typically supplement with concentrated peptides in order to achieve therapeutic dosages.

Coenzyme Q10 is an essential component of mitochondria. Studies have shown an association between hypertension and CoQ10 deficiency. Supplementation with CoQ10 (225 mg/day) has been shown to reduce blood pressure, although the effect is usually not seen for 4-12 weeks.

(Murray and Pizzorno, 2012)

Herbs have historically been used to lower blood pressure, and more recently, their effects have been studied. Both Hawthorne extract and leaves from the olive tree (*Olea europaea*) (1000 mg/day) have been used to regulate blood pressure. Hibiscus tea and extracts have also demonstrated antihypertensive properties.

(Murray and Pizzorno, 2012)

Conclusion

Hypertension is a complex condition influenced by genetics, environment, diet, and lifestyle, but it is also one of the most modifiable risk factors for chronic disease. Left unchecked, high blood pressure damages the heart, blood vessels, kidneys, and brain. Yet, with the right interventions, it can often be effectively managed or even reversed. Addressing insulin resistance, reducing systemic inflammation, supporting gut health, and balancing electrolytes provide powerful leverage points for lowering blood pressure naturally. Diet and lifestyle remain the foundation of care, while targeted nutraceuticals and botanicals can further enhance vascular health and resilience. By focusing on root causes rather than symptom suppression, individuals have the opportunity to not only reduce their blood pressure but also improve overall metabolic health, reduce cardiovascular risk, and restore vitality for the long term.

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