

How Your Kidneys Influence Blood Pressure

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✓ Fact Checked

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STORY AT-A-GLANCE

- › Nearly 46% of American adults suffer from high blood pressure affected by your circulating blood volume and blood vessel constriction, both of which are regulated by your kidneys
- › Research data demonstrates high levels of uric acid, cleared through your kidneys, may increase your risk of gout and kidney stones, and raise your blood pressure
- › Vitamin D helps protect against early kidney disease and therefore helps prevent high blood pressure commonly associated with kidney disease
- › Getting an accurate blood pressure measurement is critical to making decisions about treatment; you may be able to control your blood pressure by getting exercise, staying hydrated and restricting protein

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Nearly 46% of American adults suffer from high blood pressure, which ranks as the second greatest public health threat in the U.S.¹ Your blood pressure is the force needed to push blood through your arteries, delivering oxygen rich blood and nutrients around your body. When measured, you get a high-value (systolic) and a low-value (diastolic).

The high number measures the highest pressure occurring in the blood vessels while your heart is contracting and the low value measures the pressure in your arteries between heartbeats.

A reading of 120/80 mmHg is considered normal. Your systolic pressure, the top number, offers the most information about the stiffness of your arteries and the work your heart is doing to push blood. Your systolic pressure is a major risk factor for cardiovascular disease.

Initial recommendations for individuals whose blood pressure is only slightly elevated includes increasing physical activity, stopping smoking and improving your diet. According to statistics from the American Heart Association, only 1 in 5 Americans gets enough exercise, and poor eating habits may have contributed to 45% of U.S. deaths from heart disease, stroke and Type 2 diabetes in 2012.²

Blood Pressure Guidelines Mean Earlier Intervention

Studies have demonstrated an increased risk from heart disease and stroke with every 20 mmHg rise in your systolic blood pressure or 10 mmHg elevation in your diastolic pressure in people ages 40 to 89.³

Although past guidelines recommended treatment in individuals whose blood pressure was higher than 140/90 mmHg, American College of Cardiology and American Heart Association guidelines recommend treatment for individuals whose blood pressure is 130/80 mmHg.⁴

These guidelines are the first comprehensive changes made in over a decade and lower the definition of high blood pressure in order to address complications that often occur at higher numbers and allow for earlier intervention. With this definition, the number of U.S. adults with high blood pressure rose from 29% to 50%, with the greatest impact expected among those younger than 40.

The guidelines eliminate the category of prehypertension and now categorize individuals as having either stage 1 or stage 2 hypertension. The guidelines are:⁵

- **Normal** less than 120/80 mmHg
- **Elevated** systolic 122-129 mmHg **and** diastolic less than 80 mmHg

- **Stage 1** hypertension systolic 130-139 mmHg or diastolic 80-89 mmHg
- **Stage 2** hypertension systolic at least 140 mmHg or diastolic at least 90 mmHg
- **Hypertensive crisis** systolic over 180 mmHg and/or diastolic over 120 mmHg

Links Between Your Blood Pressure and Kidney Disease

Your kidneys are two bean shaped organs located just below your rib cage on both sides of your spine. They filter up to 150 quarts of blood and flush out waste products through your urine every day.

One of the reasons it's necessary to drink enough water is to ensure healthy kidney function, essential for maintaining homeostasis in your body, including with the composition of your blood. Your kidneys produce hormones regulating the production of red blood cells and those helping to regulate your blood pressure.⁶

Your blood pressure is also affected by vessel constriction and your circulating blood volume; the higher the volume the more the heart muscle gets stretched by the incoming blood.⁷ However, as with all things, balance is necessary. Lower levels of blood (hypovolemia) are as dangerous to your heart and blood pressure as higher levels of blood volume (hypervolemia).

Your kidneys produce hormones regulating arterial and venous constriction, which affects your blood pressure. They also regulate your circulating blood volume. These two functions work together to maintain your blood pressure within normal limits. Within your kidneys are special cells responsible for sensing the amount of sodium in the filtrate, and others to sense your blood pressure.⁸

As blood pressure drops, the amount of filtered sodium also drops and cells release an enzyme called renin. This in turn is converted into angiotensin I, and then to angiotensin II, a peptide hormone causing vasoconstriction and an increase in blood pressure. At the same time, angiotensin II stimulates the adrenal gland to secrete a hormone, aldosterone.⁹

This stimulates the body to reabsorb more sodium, which pulls more water with it. The increase in sodium and water reabsorption reduces your urine output and increases your circulating blood volume. Both of these functions affect your blood pressure measurements.

How Vitamin D Is Connected to Kidney Health

Additionally, your body uses calcium and vitamin D in a continued effort to maintain blood pressure homeostasis. Although your body stores calcium in your bones, it also maintains a consistent level within your blood.

If your calcium level falls, your parathyroid gland releases parathyroid hormone which increases calcium reabsorption from the kidneys and intestines,¹⁰ and stimulates calcium release from your bones. However, the parathyroid hormone also requires vitamin D to stimulate calcium absorption from the kidney and the intestine.

Unfortunately, vitamin D deficiency is common in U.S. populations,¹¹ and those with the lowest levels have a higher risk of cardiovascular disease.¹² The kidneys have an important role in making vitamin D useful within the body as they convert it from supplements or from the sun into an active form.¹³ However, those suffering with chronic kidney disease also experience low vitamin D levels, not from lack of absorption or sun exposure, but from lack of activation within the kidneys.

In a study¹⁴ published in the American Journal of Kidney Diseases, researchers found low vitamin D levels may be able to predict early kidney disease. Those who were deficient were twice as likely to develop albuminuria, type of protein in the urine, over a period of five years. This condition is an early indication of kidney damage.

Of the more than 5,800 men and women without albuminuria in the study, nearly 4% developed it during a five-year follow up. Those who were deficient in vitamin D were found to be 84% more likely to have protein in their urine. For this study, deficiency was defined as having less than 15 nanograms of vitamin D per milliliter of blood (ng/mL). The study's lead author commented:¹⁵

"There is mounting evidence of the benefits of correcting vitamin D levels to prevent or delay the development of albuminuria in the general population. It is also likely patients with chronic conditions such as CKD [chronic kidney disease] may need higher vitamin D levels than the general healthy population."

CKD is one of the most powerful predictors of premature cardiovascular disease, and emerging evidence suggests progression may be linked to low levels of vitamin D.¹⁶ Those with CKD have been found with an exceptionally high rate of severe vitamin D deficiency exacerbated by a reduced ability to convert vitamin D into the active form.

Abnormalities in vitamin D metabolism¹⁷ may also play a role in the development of secondary hyperparathyroidism in CKD. The gradual and progressive decline of the active form of vitamin D in the course of the disease may limit the ability of the kidneys to maintain adequate levels despite increasing levels of parathyroid hormone.

Uric Acid Is Connected to More Than Gout

Uric acid is a normal waste product found in blood and associated with the development of gout when present in large amounts. Gout is a painful arthritic and inflammatory condition often targeting the base of the big toe. Individuals with high blood pressure and kidney disease, and who are overweight, often have high uric acid levels as well.

Your body requires a balance of uric acid as it performs as an antioxidant and a pro-oxidant inside your cells. When levels are too high it tends to increase harmful levels inside the cells where it acts as a pro-oxidant.

While an overabundance of uric acid is associated with the development of gout, a reduction in uric acid has demonstrated the ability to lower blood pressure to normal levels in a teen population.¹⁸ Researchers from Baylor College of Medicine found half the teenagers enrolled in their study with newly diagnosed high blood pressure and higher than normal levels of uric acid responded well when levels of uric acid were reduced using treatment with allopurinol.¹⁹

The treatment reduced uric acid levels and blood pressure to normal in 20 of the 30 teens treated. Dr. Daniel Feig, pediatric nephrologist at Baylor College of Medicine, commented on the results of the study:²⁰

"This is far from being a reasonable therapeutic intervention for high blood pressure, but these findings indicate a first step in understanding the pathway of the disease. You cannot prevent a disease until you know the cause. This study is a way of finding that out."

Previous studies using rats found high levels of uric acid were associated with the development of high blood pressure, and this study demonstrated the same appears to be true in humans. Feig reports current antihyperuricemic pharmaceuticals may not be safe to be used as a first line of therapy for most individuals with high blood pressure.²¹

Higher levels of uric acid are also associated with the development of kidney stones.²² Kidney stones are hard masses forming within the kidney and can affect both children and adults. When concentrations of uric acid in the urine exceed a certain point they no longer remain dissolved and may precipitate into an insoluble substance, which then forms into stones.

The presence of high amounts of uric acid in combination with dehydration increases your risk of uric acid precipitation.

How to Get an Accurate Blood Pressure Reading

Several factors can play into the accuracy of your blood pressure reading.²³ To ensure your reading is as accurate as possible, keep the following factors in mind:

Cuff size — The size of the cuff may change the blood pressure reading significantly. The blood pressure cuff will have an arm circumference range printed on the cuff. Using a cuff that is too small may artificially increase the systolic measurement between 10 mmHg and 40 mmHg.

Cuff placement – The cuff must be placed on a bare arm, not over clothing, with the edges of the cuff aligned and positioned at heart level, approximately 1 inch above the bend in your elbow. The sleeve of your shirt should be off and not rolled up.

Body position – Your body position has a great deal to do with how accurate a peripheral blood pressure measurement will be. The proper position is to have your feet flat on the floor, back supported in a chair, legs uncrossed for at least five minutes and your arm supported while sitting.

Activity – Talking to the person taking your blood pressure during the reading may increase your systolic pressure by 10 mmHg, and a full bladder may increase your systolic reading by 10 mmHg. Prior to taking your blood pressure, it is important that you sit quietly for three to five minutes and do not exercise for at least 30 minutes prior to the reading.

Nicotine, caffeine or alcohol – All should be eliminated in the 30 minutes prior to having your pressure measured.

Stress – If your blood pressure consistently measures greater than 140/90 mmHg or above at the doctor's office, while being consistently lower when measured at home, you may have white coat hypertension. For some people, seeing the doctor is an inherently stressful experience that may temporarily raise your blood pressure. An estimated 15% to 30% of people with documented high blood pressure have white coat hypertension.²⁴

To decrease your risk of being falsely diagnosed with hypertension in this situation, take a moment to calm down (be sure to arrive for your appointment ahead of time so you can unwind), then breathe deeply and relax when you're getting your blood pressure taken.

Machine calibration – Home machines and automated machines must be accurately calibrated to ensure a proper reading. One study²⁵ demonstrated some home pressure

machines were off in up to 15% of patients. Readings from these machines may impact treatment recommendations.

Hearing ability when using a stethoscope – Many of the machines used today in hospitals and some clinics to take blood pressure are automated and don't require someone to manually listen for Korotkoff sounds in your brachial artery. However, there remain a large number of blood pressure measurements taken by an individual listening for the change in sounds in the brachial artery.

Individuals who have some hearing loss may record an abnormal reading when they don't hear the change in sounds correctly.

How to Protect Your Kidneys

Your kidneys play a vital role in your overall health. Eating the right foods helps to improve your kidney function as certain foods help you manage blood pressure, prevent kidney stones and reduce uric acid output better than others. Here are three dietary keys to help protect your kidney function.²⁶

- **Restrict protein** – Uric acid is the metabolic waste product of the breakdown of purine, found in abundance in all meats, poultry and fish. Organ meat and certain oily fish, such as herring and mackerel, tend to have higher levels of purine. It is not necessary to eliminate meat, but care should be taken to balance your protein intake.

An ideal protein intake is likely around one-half gram of protein per pound of lean body mass. The American Kidney Fund²⁷ recommends restricting protein to a maximum of 50 grams if you currently have kidney disease.

- **Drink pure, clean water** – One of the most effective ways to prevent uric acid precipitation is to remain fully hydrated. Ensure your fluid intake is higher during summer months or with strenuous activities, or if you're suffering gastroenteritis with vomiting or diarrhea.

When fully hydrated your urine should be the color of straw and you should ideally be visiting the bathroom around seven to eight times per day. Simply swapping out sweetened beverages, such as sodas and fruit juices, for pure water can go a long way toward improving your kidney function and your overall health.

- **Limit high-purine vegetables** – Asparagus, beans, peas and spinach are plant-based foods with higher levels of purine. Moderate intake does not usually pose a problem, but meals containing large quantities should be avoided.
- **Avoid substances causing water loss** – Certain medications, diuretics, alcohol and caffeine may increase your urine output and without proper rehydration fluid loss may result in dehydration.

Sources and References

- ^{1, 2} [American Heart Association News, January 31, 2018](#)
- ³ [American Heart Association, Understanding Blood Pressure Readings](#)
- ^{4, 5} [American College of Cardiology, New ACC/AHA High Blood Pressure Guidelines Lower Definition of Hypertension](#)
- ⁶ [National Institute of Diabetes and Digestive and Kidney Diseases, Anemia in Chronic Kidney Disease](#)
- ^{7, 8, 9, 10} [How Stuff Works, How Your Kidneys Work](#)
- ¹¹ [Nutrition Research, 2011;31\(1\):48](#)
- ¹² [American Journal of Medical Science, 2009;338\(1\):40](#)
- ¹³ [National Kidney Foundation, Vitamin D: The Kidney Vitamin?](#)
- ^{14, 15} [Nephrology July 1, 2013](#)
- ¹⁶ [Ethnicity and Disease, 2009;19\(4 Suppl 5\) S5](#)
- ¹⁷ [Clinical Journal of the American Society of Nephrology, 2008;3\(5\):1555](#)
- ¹⁸ [The Journal of the American Medical Association, 2008;300\(8\):924](#)
- ^{19, 20, 21} [Science Daily August 27, 2008](#)
- ^{22, 26} [Health Hype, Uric Acid Kidney Stones: Causes, Symptoms, Treatments, Prevention](#)
- ²³ [Healthy Directions](#)
- ²⁴ [Berkley Wellness, January 24, 2017](#)
- ²⁵ [Time Magazine, October 28, 2014](#)
- ²⁷ [American Kidney Fund, Living Well With Kidney Disease](#)