



NephU[™]

Improving Awareness & Patient Outcomes

Plant-Based Diets for the Management of Hypertension in Chronic Kidney Disease



NephU[™]

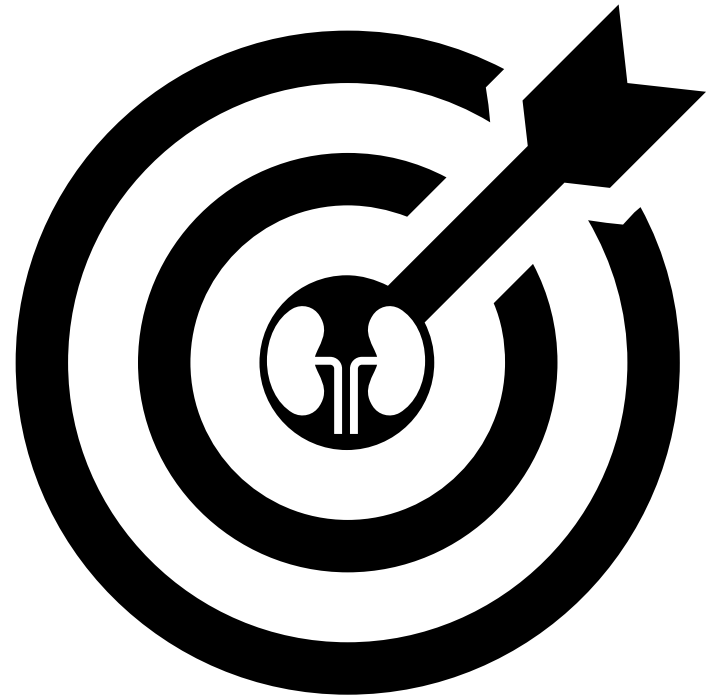
Improving Awareness & Patient Outcomes

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Objectives

- To define Chronic Kidney Disease (CKD).
- To discuss the interrelationship between hypertension and CKD.
- To describe the role of plant-based diets in the management of hypertension in CKD.



CKD: Chronic Kidney Disease

Stages of CKD

% of normal kidney function²

Stage 1

90% or more

Stage 2

60-89%

Stage 3

30-59%

Stage 4

15-29%

Stage 5

<15%

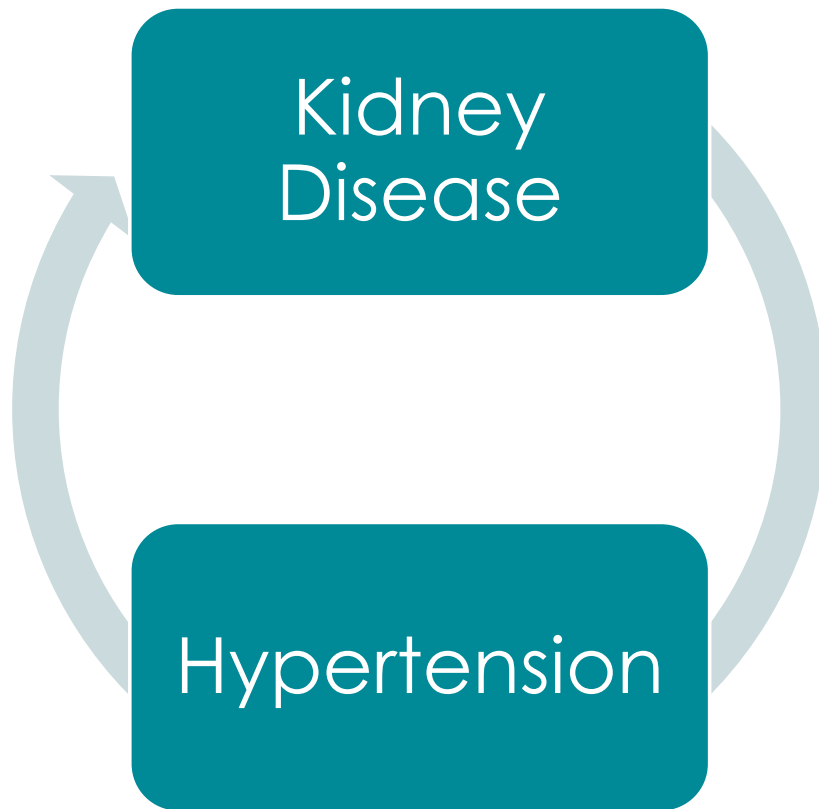
- Chronic kidney disease (CKD) is defined as the presence of kidney damage that persists for more than 3 months.¹
- CKD is subdivided into five stages according to glomerular filtration rate (GFR) category.^{1,2}

Stage 1	Kidney damage with normal kidney function GFR ≥ 90 mL/min per 1.73 m ²
Stage 2	Kidney damage with mild loss of kidney function GFR 60 - 89 mL/min per 1.73 m ²
Stage 3	Mild to severe loss of kidney function GFR 30- 59 mL/min per 1.73 m ²
Stage 4	Severe loss of kidney function GFR 15 -29 mL/min per 1.73 m ²
Stage 5	Kidney Failure-ESRD (end-stage renal disease) GFR <15 mL/min per 1.73 m ²

Table and figure adapted from National Kidney Foundation Website ²

1. Thomas R et al. *Prim Care*. 2008; 35(2): 329–vii. 2.. National Kidney Foundation. The Facts about Chronic Kidney Diseases. 2019 <https://www.kidney.org/atoz/content/about-chronic-kidney-disease>. Accessed 7/22/2020.

Interrelationships Between CKD and Hypertension

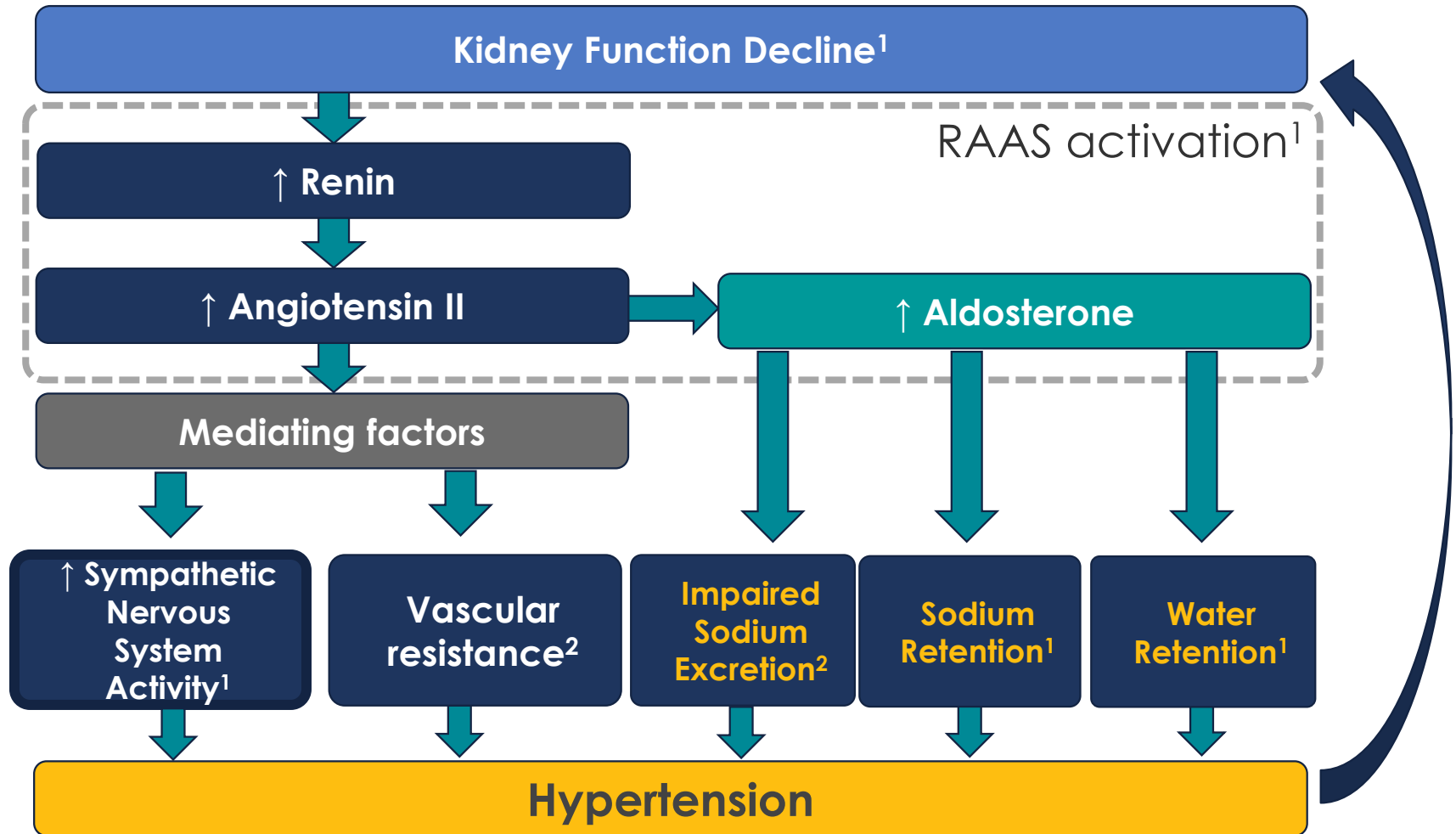


- **High blood pressure**, also known as **hypertension**, is defined as an increase in the amount of force, or pressure, that the blood places on the blood vessels as it moves through the body.¹
- **Hypertension** is a *cause* and a *complication* of CKD.²
- **Hypertension** is the *second most common cause* of **kidney disease** and **kidney failure**.¹

CKD: Chronic Kidney Disease

1. <https://www.niddk.nih.gov/health-information/kidney-disease/high-blood-pressure>. Last accessed February 2021. 2. Pugh D, et al. Management of hypertension. *Drugs* 2019; 79: 365–379.

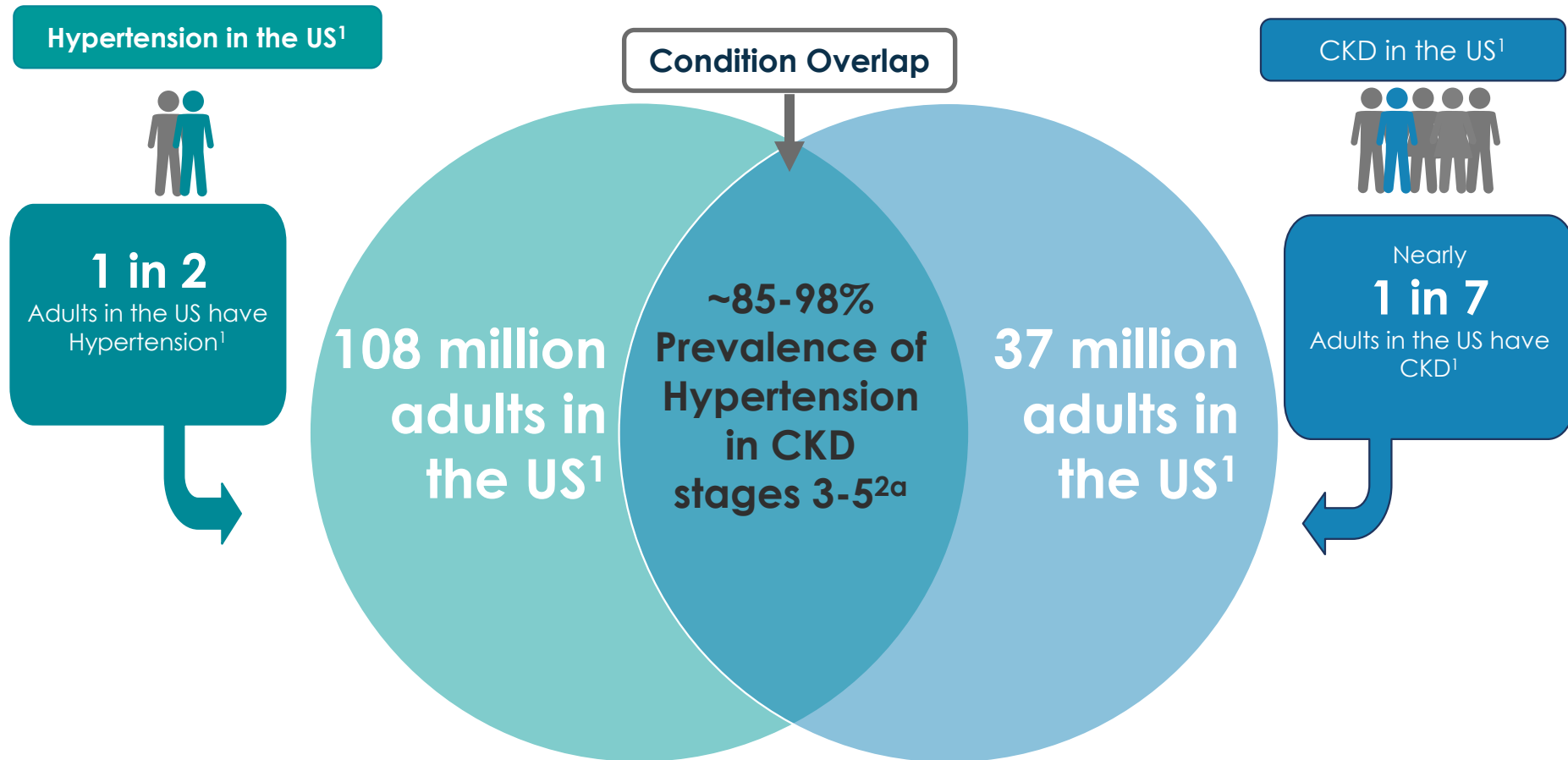
Mechanism of Hypertension in CKD



CKD: Chronic Kidney Disease, RAAS: Renin-Angiotensin-Aldosterone System

1. Pugh D, et al. Management of hypertension in chronic kidney disease. *Drugs* 2019; 79: 365–379.
2. Hall, JE. Kidney dysfunction mediates salt-induced increases in blood pressure. *Circulation* 2016;133(9): 894–906.

Hypertension & CKD: Prevalence Overlap



^aData from National Health and Nutrition Examination Survey (NHANES), 1999-2004; CKD: Chronic Kidney Disease

1. <https://www.niddk.nih.gov/health-information/kidney-disease/high-blood-pressure>. Last accessed February 2021
2. Rao, et al. Hypertension and CKD: Kidney Early Evaluation Program (KEEP) and National Health and Nutrition Examination Survey (NHANES), 1999-2004. *Am J Kidney Dis.* 2008; 51(S2):S30-S37.

Nutrition & Lifestyle Factors

- Nutrition and lifestyle factors are important modulators of both high blood pressure¹ and incident CKD.²
- Early management of pre-hypertension or hypertension include:¹
 - Increasing physical activity
 - Decreasing body weight
 - Decreasing alcohol consumption
 - Reducing sodium intake
 - Smoking cessation

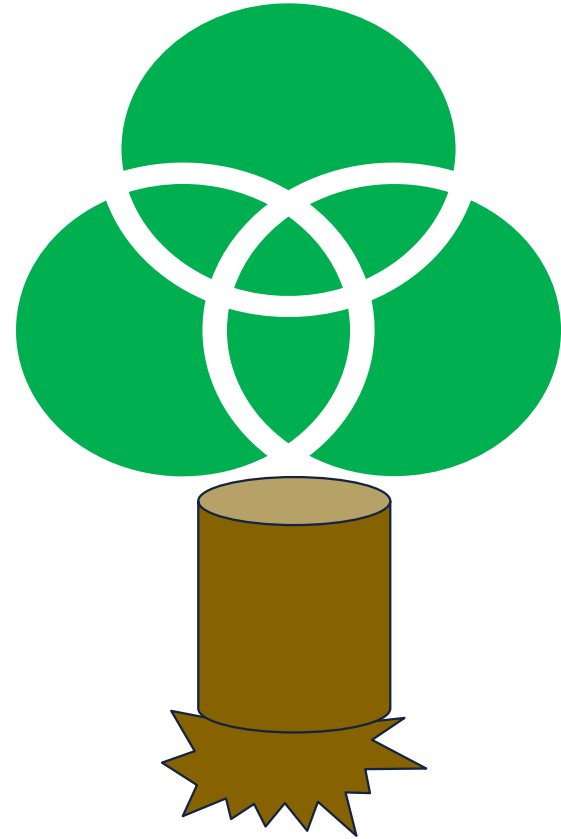
CKD: Chronic Kidney Disease

1. Su X, et al. Kidney is essential for blood pressure modulation by dietary potassium. *Curr Cardiol Rep.* 2020; 22: 124: 1-8.

2. Kelly JT, et al. Modifiable lifestyle factors for primary prevention of CKD: A systematic review and meta-analysis *JASN* 2021; 32: 239–253.

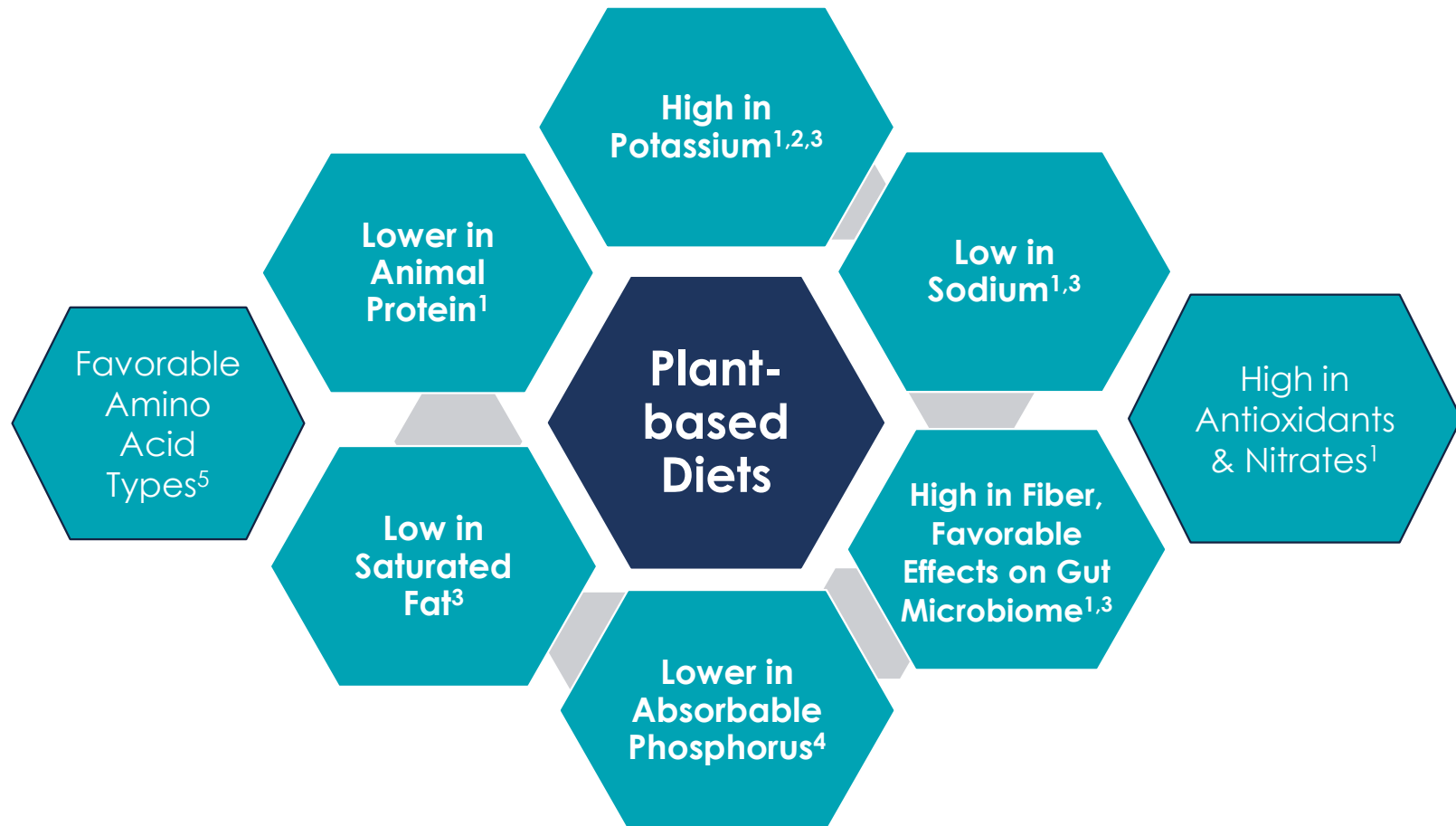
Plant-Based Diets & Hypertension

- A predominantly or completely plant-based diet may be useful as first-line therapy to manage hypertension.



Joshi S, et al. Plant-based diets and hypertension. *Am J Lifestyle Med.* 2019; 14(4): 397-405.

Some Potential Benefits of Plant-Based Diets



1. Joshi S, et al. Plant-based diets and hypertension. *Am J Lifestyle Med.* 2019, 14(4): 397-405.
2. Kalantar-Zadeh K, Fouque D. Nutritional management of chronic kidney disease. *N Engl J Med.* 2017; 377;18: 1765-1776 .
3. Cases A, et al. Vegetable-based diets for chronic kidney disease? It is time to reconsider. *Nutrients* 2019; 11: 1263; doi:10.3390/nu110612633.
4. Joshi S, Shah S, Kalantar-Zadeh K. Adequacy of plant-based proteins in chronic kidney disease. *J Renal Nutr.* 2019; 29 (2):112-117.
5. Tuttle KR, et al. Dietary amino acids and blood pressure: A cohort study of patients with cardiovascular disease. *Am J Kidney Dis.* 2012; 59(6):803-809.

What was Then vs. What is Now

Paleolithic Diet

- Our ancestors in the Paleolithic era consumed a high-potassium and low-sodium diet
 - About 11,000-15,000 mg/day potassium and 700 mg/day sodium, with a ratio of 16:1.^{1,2}
- The human body developed renal mechanisms to excrete significant loads of potassium rapidly and to preserve sodium.²

Western Diet

- The Western diet is typically high in sodium (particularly from processed foods), and low in potassium.¹
- On average, Americans consume 3400 mg/day sodium³, and less potassium than is recommended by the IOM's Food & Nutrition Board: 4700 mg/day.¹

1. Palmer BF, Clegg DJ. Achieving the benefits of a high-potassium, paleolithic diet, without the toxicity. *Mayo Clin Proc.* 2016 ;91(4):496-508. 2. Su X, et al. Kidney is essential for blood pressure modulation by dietary potassium. *Curr Cardiol Rep.* 2020; 22: 124: 1-8.. 3. Sodium in Your Diet fact sheet. <https://www.fda.gov/food/nutrition-education-resources-materials/sodium-your-diet>. Last accessed February 2021.

Translating Sodium into Practical Terms

Food & Nutrition Board: AI Level for Males and Females ¹	Sodium (mg/day) or [g/day]	Teaspoons (tsp) of Salt/day
Adults (19-50 years)	1500 [1.5]	2/3 tsp
Adults (50-70 years)	1300 [1.3]	1/2 tsp

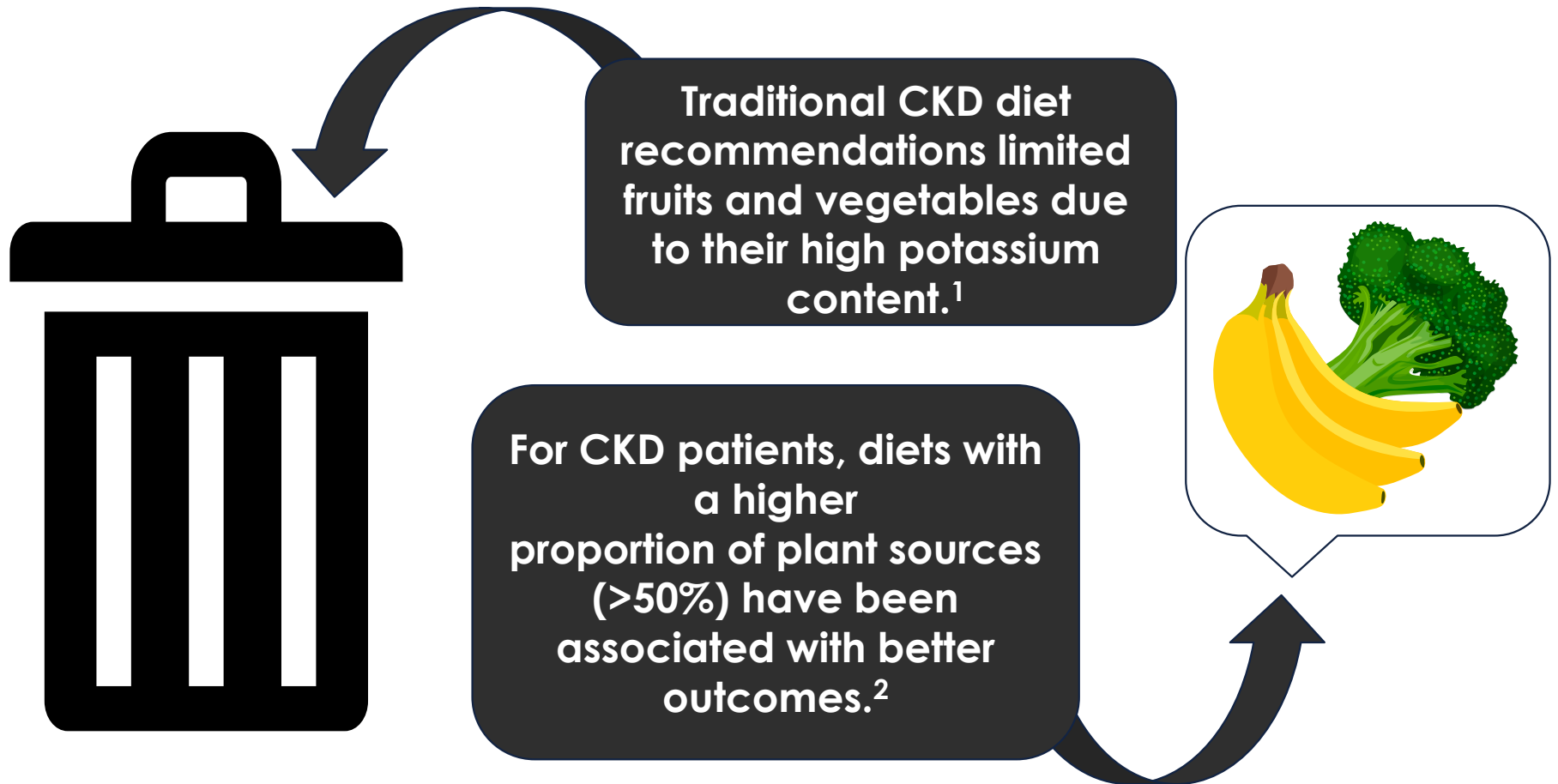
A single teaspoon of table salt (a combination of sodium and chloride) contains ~2300 mg [2.3 g] of *sodium*, equivalent to ~100 mmol or 100 mEq.²



AI: Adequate Intake


1. Sodium & Chloride Intake Recommendations - NUTRI-FACTS. https://www.nutri-facts.org/en_US/nutrients/minerals/sodium-and-chloride/intake-recommendations.html. Last accessed February 2021. 2. Sodium in Your Diet fact sheet. <https://www.fda.gov/food/nutrition-education-resources-materials/sodium-your-diet>. Last accessed February 2021.

Out with the Old, In with the New



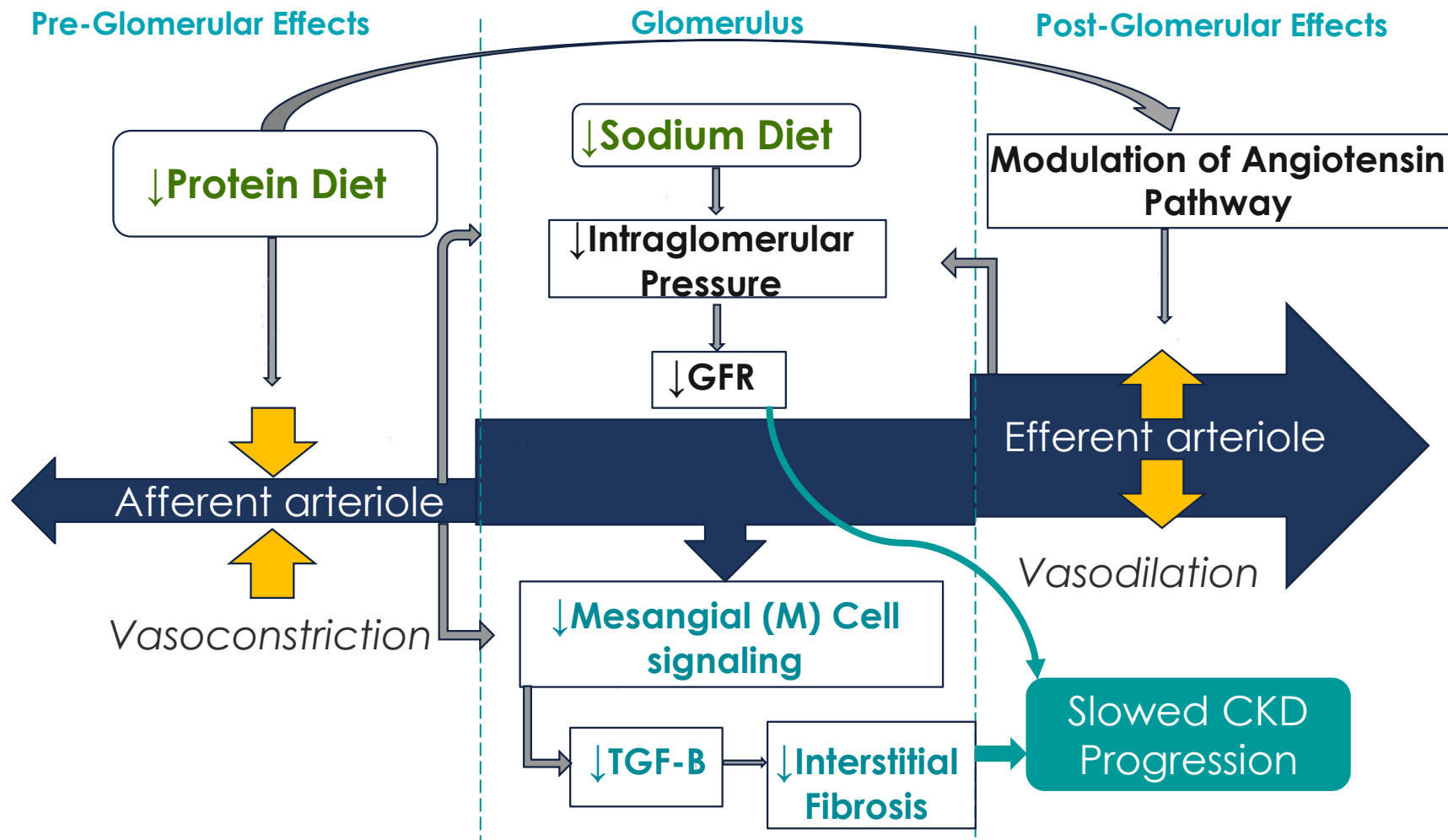
CKD: Chronic Kidney Disease

1. Cases A, et al. Vegetable-based diets for chronic kidney disease? It is time to reconsider. *Nutrients* 2019; 11: 1263; doi:10.3390/nu11061263
2. Chen X, et al. The associations of plant protein intake with all cause mortality in CKD. *Am J Kidney Dis.* 2016; 67: 423-30.



THE IMPORTANCE OF LOW SODIUM & PROTEIN DIETS FOR KIDNEY HEALTH & BLOOD PRESSURE CONTROL

Kidney Effects of Low Protein/Sodium Diets



CKD: Chronic Kidney Disease; GFR: Glomerular Filtration Rate, TGF: transforming growth factor β
 Kalantar-Zadeh K, Fouque D. Nutritional management of chronic kidney disease. *N Engl J Med* .2017; 377;18: 1765-1776.

Low vs. High Protein Intake Impacts Kidney Over Time

Low Protein Intake

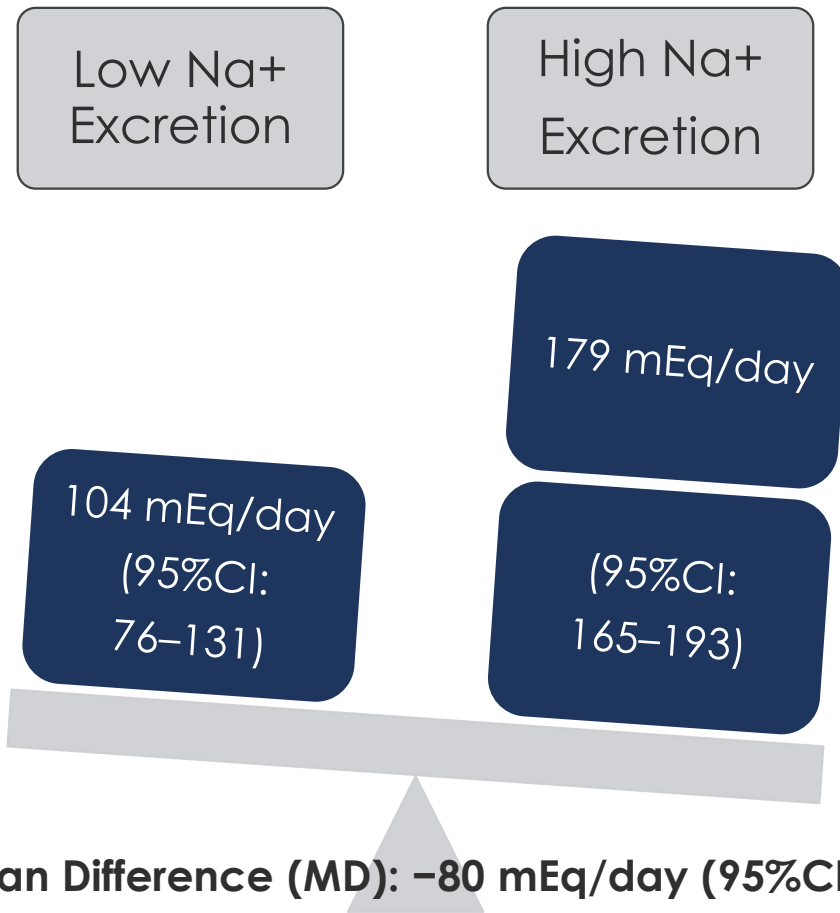
- Pre-glomerular effects may lead to post-glomerular advantages to slow CKD progression
- Mitigates proteinuria
- Decreases urea
- Ameliorates azotemia & uremic toxins

High Protein Intake

- **Short term effects:**
 - Dilates the afferent arterioles
 - Increases glomerular filtration
- **Long term effects:**
 - Glomerular hyperfiltration over time may lead to damage of remaining glomeruli through M-cell signaling, increased TGF- β , and progressive fibrosis kidney damage.

CKD: Chronic Kidney Disease, GFR: Glomerular Filtration Rate, M-cell: Mesangial (M) Cell, TGF: transforming growth factor β
Kalantar-Zadeh K, Fouque D. Nutritional management of chronic kidney disease. *N Engl J Med.* 2017; 377:18: 1765-1776.

Sodium Intake in Chronic Kidney Disease



- A meta-analysis of RCTs evaluating the effects of low versus high salt intake in adult patients with non-dialysis CKD on change in BP, proteinuria, and albuminuria was conducted.
- 11 RCTs were included, with n=738 CKD patients, stages 1-4.

CKD: Chronic Kidney Disease, RCTs: Randomized Clinical Trials, Na+: Sodium, CI: Confidence Intervals

Garofalo C, et al. Dietary salt restriction in chronic kidney disease: A meta-analysis of randomized clinical trials. *Nutrients* 2018; 10, 732; doi:10.3390/nu10060732

Sodium Intake in Chronic Kidney Disease

Blood Pressure	Clinic	Ambulatory
Systolic BP	-4.9 mmHg (95%CI: -6.8 to -3.1; p <0.001)	-5.9 mmHg (95%CI: -9.5 to -2.3; p <0.001)
Diastolic BP	-2.3 mmHg (95%CI: -3.5 to -1.2; p <0.001)	-3.0 mmHg (95%CI: -4.3 to -1.7; p <0.001)

- **Proteinuria (MD): -0.39 g/day (95%CI: -0.55 to -0.22, p <0.001).**
- **Albuminuria (MD): -0.05 g/day (95%CI: -0.09 to -0.01, p = 0.013).**
- ***Moderate salt restriction significantly reduced systolic and diastolic BP and proteinuria/albuminuria in patients with CKD (stages 1–4).***

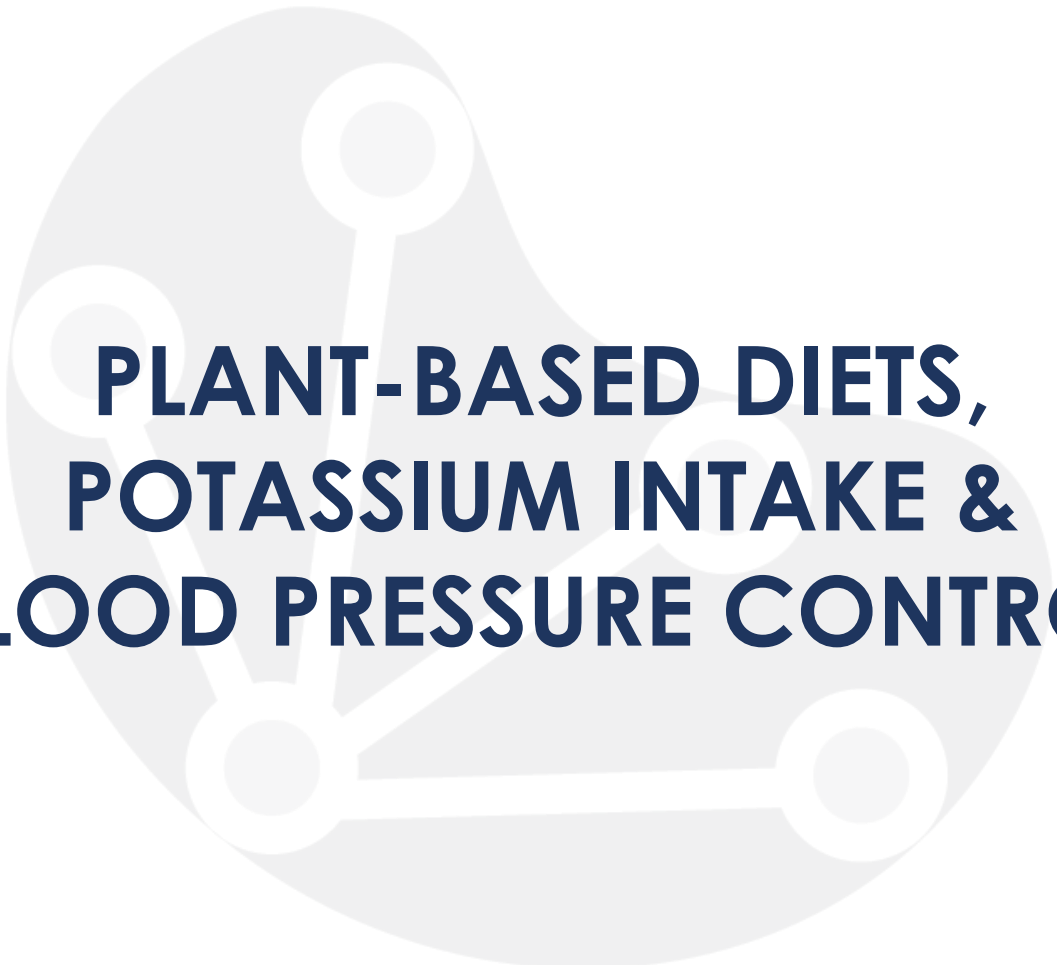
BP: Blood Pressure, MD: Mean Difference

Garofalo C, et al. Dietary salt restriction in chronic kidney disease: A meta-analysis of randomized clinical trials. *Nutrients* 2018; 10, 732; doi:10.3390/nu10060732

Further Review of the Evidence

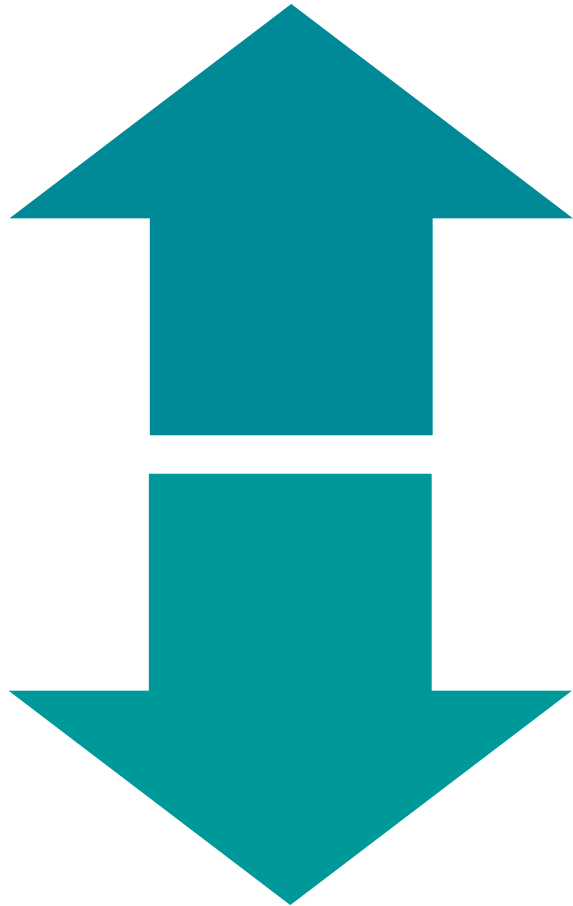
- A Low Sodium Diet (LSD) is beneficial for hypertension control, irrespective of BP levels:
 - Lowers proteinuria; enhances the antiproteinuric effect of RAAS inhibition in non-dialysis CKD patients
- Sodium restriction assumes a greater importance in ESKD because of the mismatch between intake and removal
 - Leading to hypertension, LVH, and higher CV risk
- ***Reducing salt intake is crucial for hypertensive CKD patients at all stages.***
- Ways to improve long-term adherence to LSD are needed.

LSD: Low Sodium Diet, BP: Blood Pressure, RAAS: Renin-Angiotensin-Aldosterone System, CKD: Chronic Kidney Disease, ESKD: End-Stage Kidney Disease, LVH: Left Ventricular Hypertrophy, CV: Cardiovascular
Borrelli S, et al. Sodium Intake and chronic kidney disease. *Int J Mol Sci.* 2020; 21: 4744; doi:10.3390/ijms21134744



PLANT-BASED DIETS, POTASSIUM INTAKE & BLOOD PRESSURE CONTROL

Potassium and Blood Pressure



Higher
Potassium (K+)
Consumption
is associated with
Lower
BP and
Cardiovascular Risk

K+: Potassium, BP: Blood Pressure

Murillo-de-Ozoresa AR, et al. Molecular mechanisms for the regulation of blood pressure by potassium. *Curr Top Membr.* 2019;83:285-313.

Sodium-Potassium Relationships

- Recent evidence has shown that renal handling of sodium and blood pressure is directly affected by potassium intake.¹
- Low Na⁺:K⁺ ratio has been shown to have a stronger correlation with blood pressure than potassium or sodium intakes alone.¹
- The most consistent and impressive pressure-lowering effects of potassium are observed when dietary salt consumption is also high.²

Na⁺/K⁺: Sodium/Potassium

1. Murillo-de-Ozoresa AR, et al. Molecular mechanisms for the regulation of blood pressure by potassium. *Curr Top Membr.* 2019; 83: 285-313.
2. Su X, et al. Kidney Is essential for blood pressure modulation by dietary potassium. *Curr Cardiol Rep.* 2020; 22: 124: 1-8.

Kidney & Potassium Homeostasis

- The kidney is one of the major organs responsible for both electrolyte and blood pressure homeostasis.
- 90% of ingested K⁺ is excreted in the urine, while 10% is excreted through the stool.

BP: Blood Pressure, K⁺: Potassium

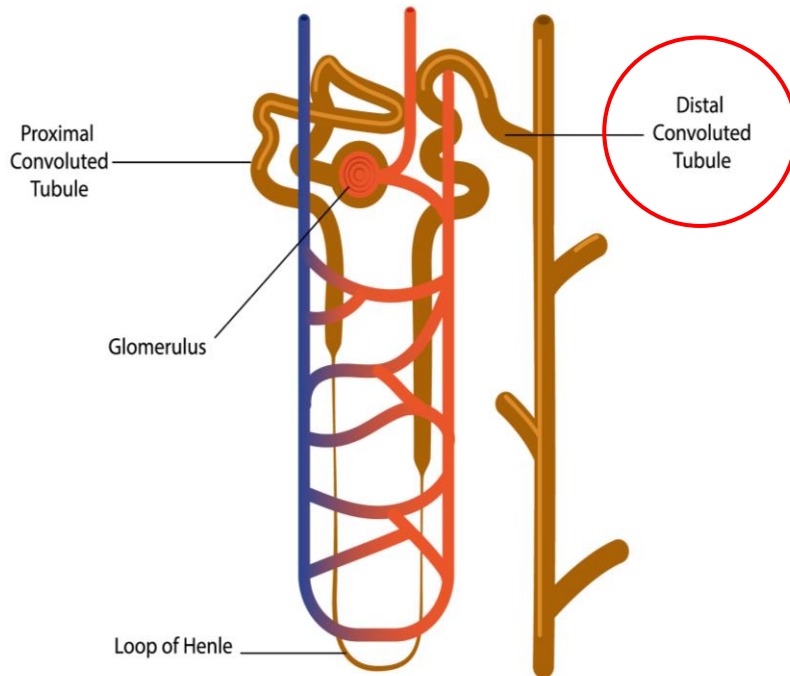
Murillo-de-Ozoresa AR, et al. Molecular mechanisms for the regulation of blood pressure by potassium. *Curr Top Membr.* 2019;83:285-313.

Kidney & Potassium Homeostasis

The DCT is a critical site for Potassium Homeostasis

The DCT is responsible for:

- Na^+/Cl^- reabsorption
- K^+ secretion
- Calcium and magnesium handling

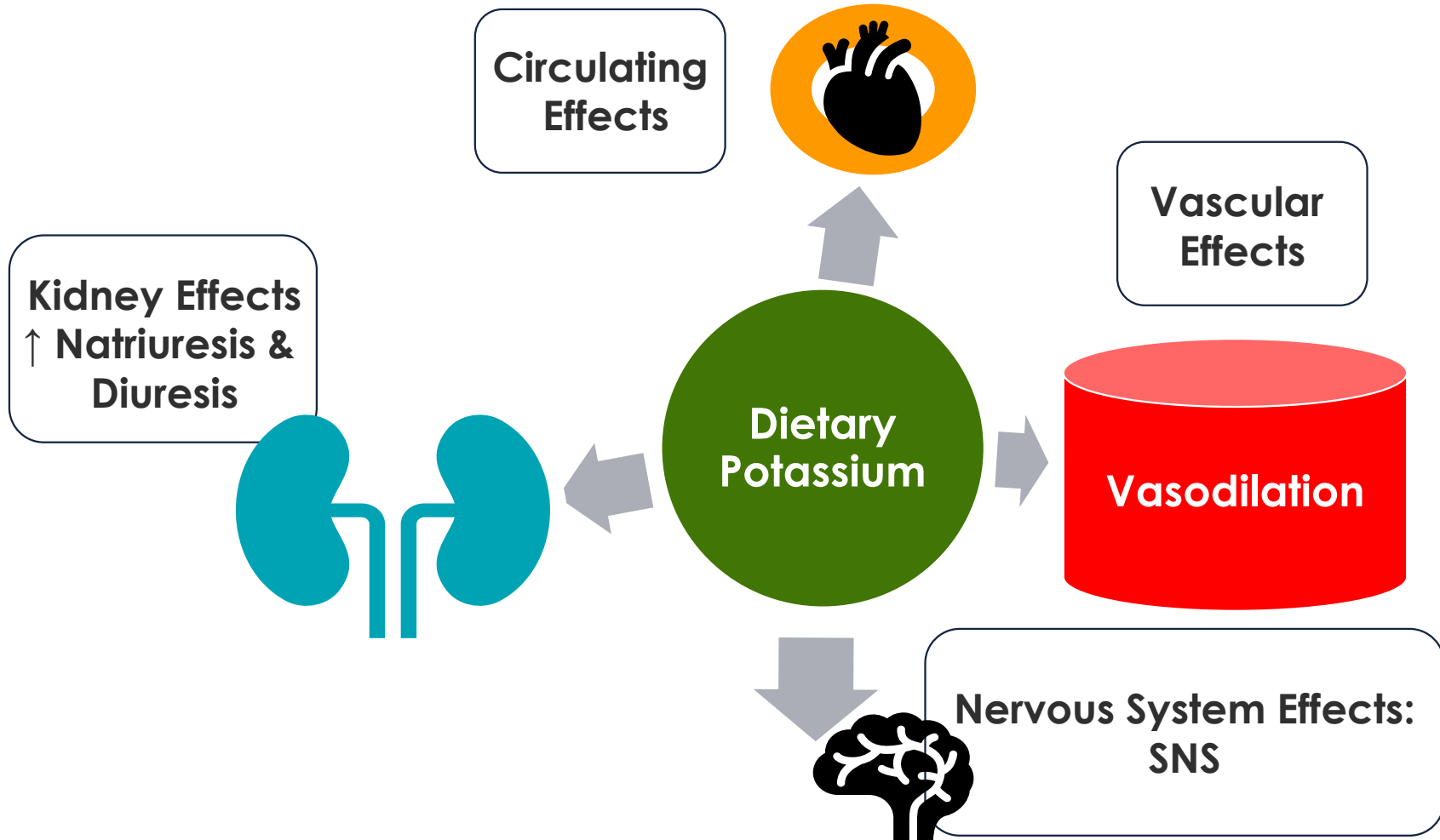


The Na^+/Cl^- cotransporter (NCC; SLC12A3) plays an important role in the regulation of:

- Electrolyte homeostasis
- Extracellular Fluid volume
 - Blood Pressure

DCT: Distal Convoluted Tubule , Na^+/Cl^- : Sodium/Chloride, K^+ : Potassium, NCC; SLC12A3:: Na^+/Cl^- Cotransporter
Su X, et al. Kidney is essential for blood pressure modulation by dietary potassium. *Curr Cardiol Rep.* 2020; 22: 124: 1-8.

Beneficial Effects of Dietary Potassium Intake



SNS: Sympathetic Nervous System

Su X, et al. Kidney is essential for blood pressure modulation by dietary potassium. *Curr Cardiol Rep.* 2020; 22: 124: 1-8.

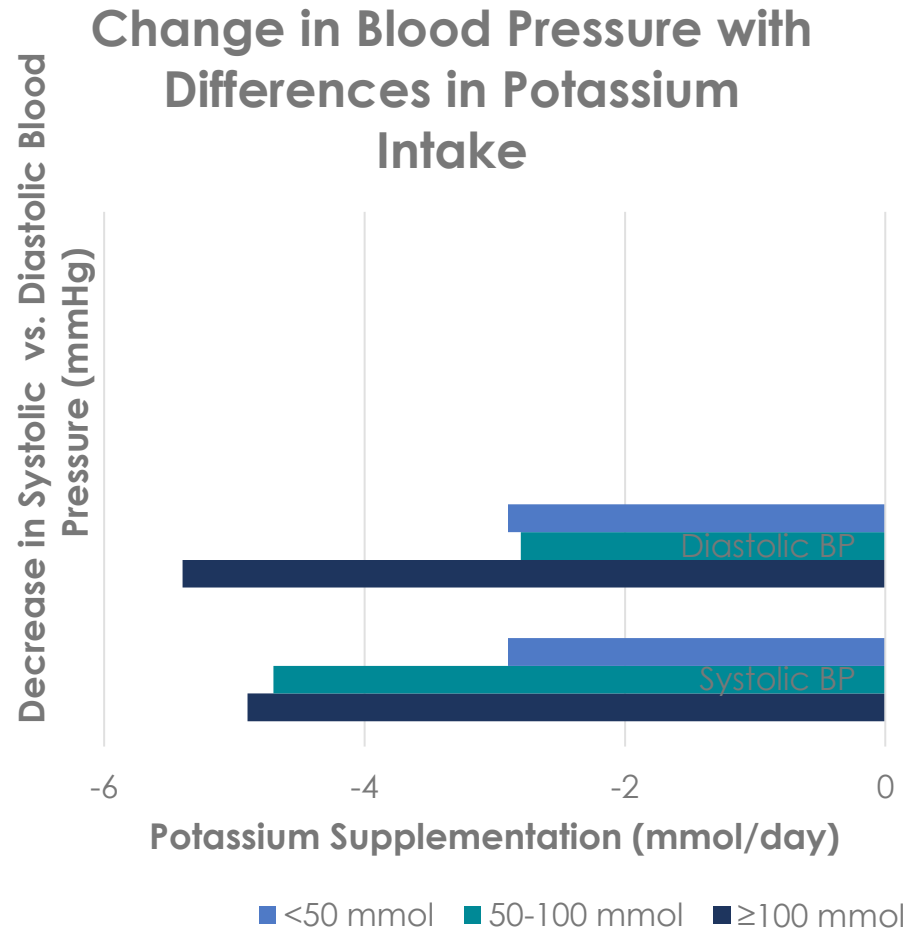
Potassium and Blood Pressure

- Results from a meta-analysis showed that higher K⁺ intake decreased the mean difference (MD) of **SBP** and **DBP** in a *random-effects model*^a
 - Compared to placebo, K⁺ supplementation resulted in significant reductions in:
 - **SBP** (MD -4.25 mmHg; 95% CI: -5.96 to -2.53)
 - **DBP** (MD -2.53 mmHg; 95% CI: -4.05 to -1.02)
- The change-score analysis showed significant changes in BP compared to baseline between the intervention vs control groups^b
 - **SBP** (MD -8.89 mmHg; 95% CI: -13.67.96 to -4.11)
 - **DBP** (MD -6.42 mmHg; 95% CI: -10.99 to -1.84)

a: from a total of 9059 articles and included 23 trials with 1213 participants ; b: based on 8 out of 23 trials

K⁺: Potassium; SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure, MD: Mean Difference, CI: Confidence Interval
Poorolajal J, et al. Oral potassium supplementation for management of essential hypertension: A meta-analysis of randomized controlled trials. *PLOS ONE* 2017; 1-16.

Potassium Intake and Blood Pressure



A sub-group analysis of low, medium and high K⁺ dosages were categorized, and a meta-analysis was performed for each category.

A dose-response relationship between K⁺ intake and reductions in both SBP and DBP was observed.

K⁺: Potassium; SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure

Poorolajal J, et al. Oral potassium supplementation for management of essential hypertension: A meta-analysis of randomized controlled trials. *PLOS ONE* 2017; 1-16.

Plant-Paleo Diet

- High potassium diets have salutary and protective effects on hypertension and a wide array of cardiovascular conditions.¹
- Potassium's beneficial effects have primarily been linked to eating high-potassium diets, rather than taking potassium supplements.¹
- Patients will benefit from switching away from processed food and embracing a diet rich in fruits and vegetables.²

1. Su X, et al. Kidney is essential for blood pressure modulation by dietary potassium. *Curr Cardiol Rep.* 2020; 22: 124: 1-8.

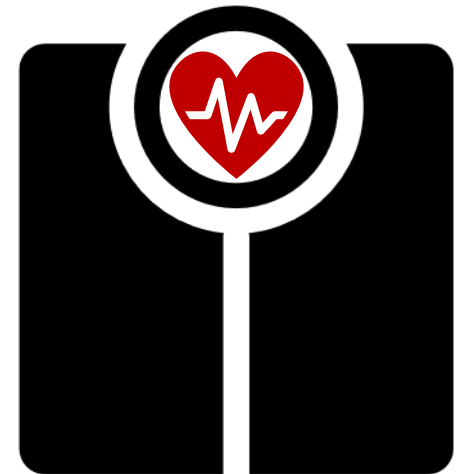
2. Palmer BF, Clegg DJ. Achieving the benefits of a high-potassium, paleolithic diet, without the toxicity. *Mayo Clin Proc.* 2016; 91 (4):496-508.



OTHER BENEFITS OF A PLANT-BASED DIET

Plant-Based Diets and Weight Control

- Obesity can facilitate a rise in BP through many mechanisms:
 - Increased tubular sodium reabsorption
 - Impaired pressure natriuresis
 - Activation of RAAS
 - Increased SNS activity
- Plant-based diets are high in fiber, low in saturated fat, and lower in energy density.
 - Facilitates weight control and hypertension management



BP: Blood Pressure, RAAS: Renin-Angiotensin-Aldosterone System, SNS: Sympathetic Nervous System
Joshi S, et al. Plant-based diets and hypertension. *Am J Lifestyle Med.* 2019, 14(4): 397-405.

Does Amino Acid Type Matter?

In a cohort study, Amino Acids (AA) from a Low-Fat versus Mediterranean-style Diet in patients with prevalent cardiovascular disease were assessed at baseline, 3 and 6 months, and then every 6 months for 2 years.

Associated with higher BP

Higher intakes of methionine and alanine, amino acids found in greater amounts in animal-based foods.

Higher intakes of histidine and threonine, amino acids found in greater amounts in plant-based foods.

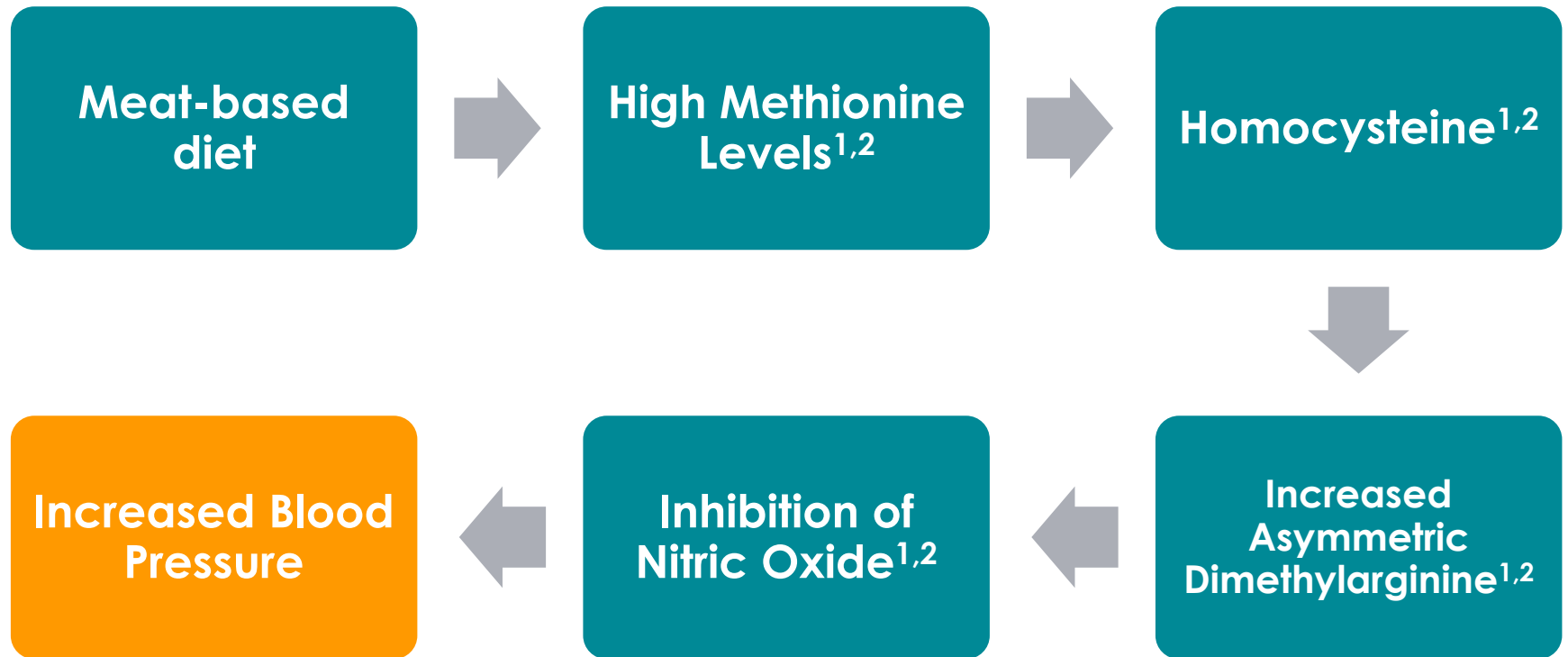
Associated with lower BP

The AA ratio found in plants resulted in better BP outcomes

AA: Amino Acid, BP: Blood Pressure

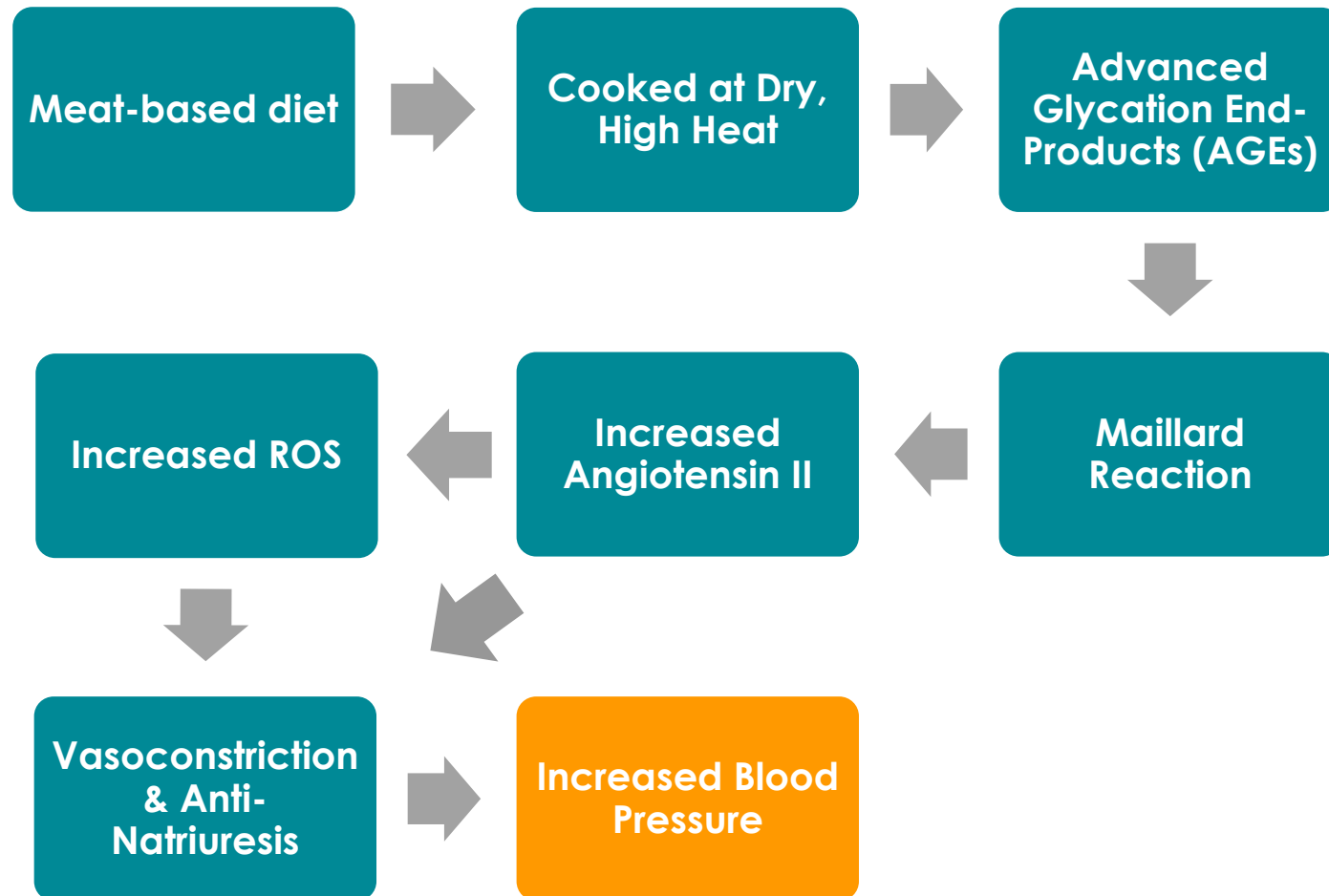
Tuttle KR, et al. Dietary amino acids and blood pressure: A cohort study of patients with cardiovascular disease. *Am J Kidney Dis.* 2012; 59(6): 803-809.

Hypertensive Mechanisms of Meat-Based Diets



1. Tuttle KR, et al. Dietary amino acids and blood pressure: A cohort study of patients with cardiovascular disease. *Am J Kidney Dis.* 2012; 59(6): 803-809.
2. Joshi S, et al. Plant-based diets and hypertension. *Am J Lifestyle Med.* 2019, 14(4): 397-405.

Hypertensive Mechanisms of Meat-Based Diets

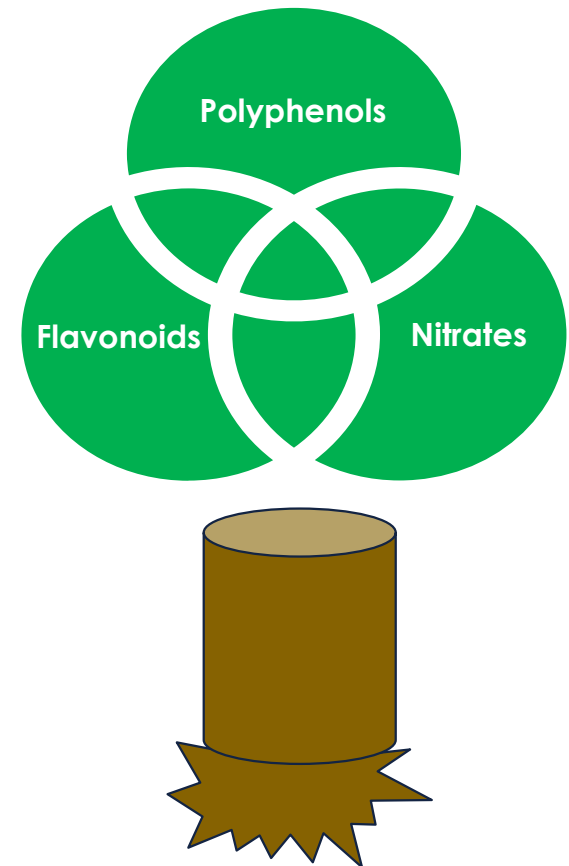


AGEs: Advanced Glycation End-Products, ROS: Reactive Oxygen Species

1. Tuttle KR, et al. Dietary amino acids and blood pressure: A cohort study of patients with cardiovascular disease. *Am J Kidney Dis.* 2012; 59(6): 803-809. 2. Joshi S, et al. Plant-based diets and hypertension. *Am J Lifestyle Med.* 2019, 14(4): 397-405.

Plant-Based Diets, Antioxidants, & Nitric Oxide

- Plants are rich in antioxidants and nitrates¹ which may increase the bioavailability of NO through several pathways, including Re-dox signaling.²
- Because NO leads to vasodilation and lowering of BP, these mechanisms add to the antihypertensive effect of plant-based diets.²



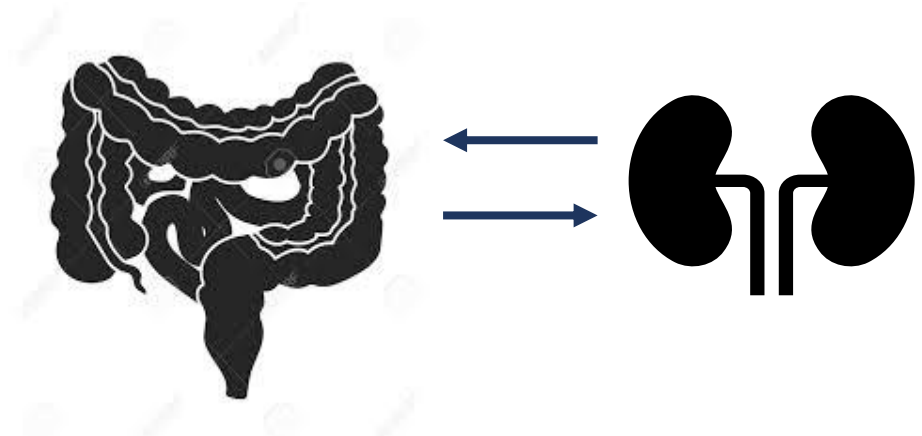
RE-DOX: Reduction/Oxidation, NO: Nitric Oxide, BP: Blood Pressure

1. Cases A, et al. Vegetable-based diets for chronic kidney disease? It is time to reconsider. *Nutrients* 2019; 11: 1263; doi:10.3390/nu11061263

2. Joshi S, et al. Plant-based diets and hypertension. *Am J Lifestyle Med.* 2019, 14(4): 397-405.

Gut-Kidney Connection

- There is a bidirectional relationship between CKD and the gut microbiome.¹
- Microbiota-derived metabolites contribute to the progression of CKD
and
- CKD and concomitant inflammation contributes to changes in the diversity and richness of the microbiota.²



Dysbiosis in the microbiome is linked to the development of several non-communicable diseases including kidney disease, CVD, and others.¹

CKD: Chronic Kidney Disease, CVD: Cardiovascular Disease

1. Al-Khordor, Shatat IE. Gut microbiome and kidney disease: a bidirectional relationship. *Pediatr Nephrol.* 2017; 32:921–9312. 2. Al-Khordor, et al. The microbiome and blood pressure: Can microbes regulate our blood pressure? *Frontiers in Pediatrics* 2017; 5(138): 1-12.

Fiber for Hypertension Management

- Several fiber-related mechanisms have been suggested, including the relationships between short-chain fatty acids and their vasodilatory effects.¹
- Further understanding of microbial aberrations may enable us to better understand the pathophysiology of, and interrelationships with, high blood pressure and kidney disease.²

CKD: Chronic Kidney Disease

1. Joshi S, et al. Plant-based diets and hypertension. *Am J Lifestyle Med.* 2019, 14(4): 397-405. 2. Al-Khordor, et al. The microbiome and blood pressure: Can microbes regulate our blood pressure? *Frontiers in Pediatrics* 2017; 5(138): 1-12.

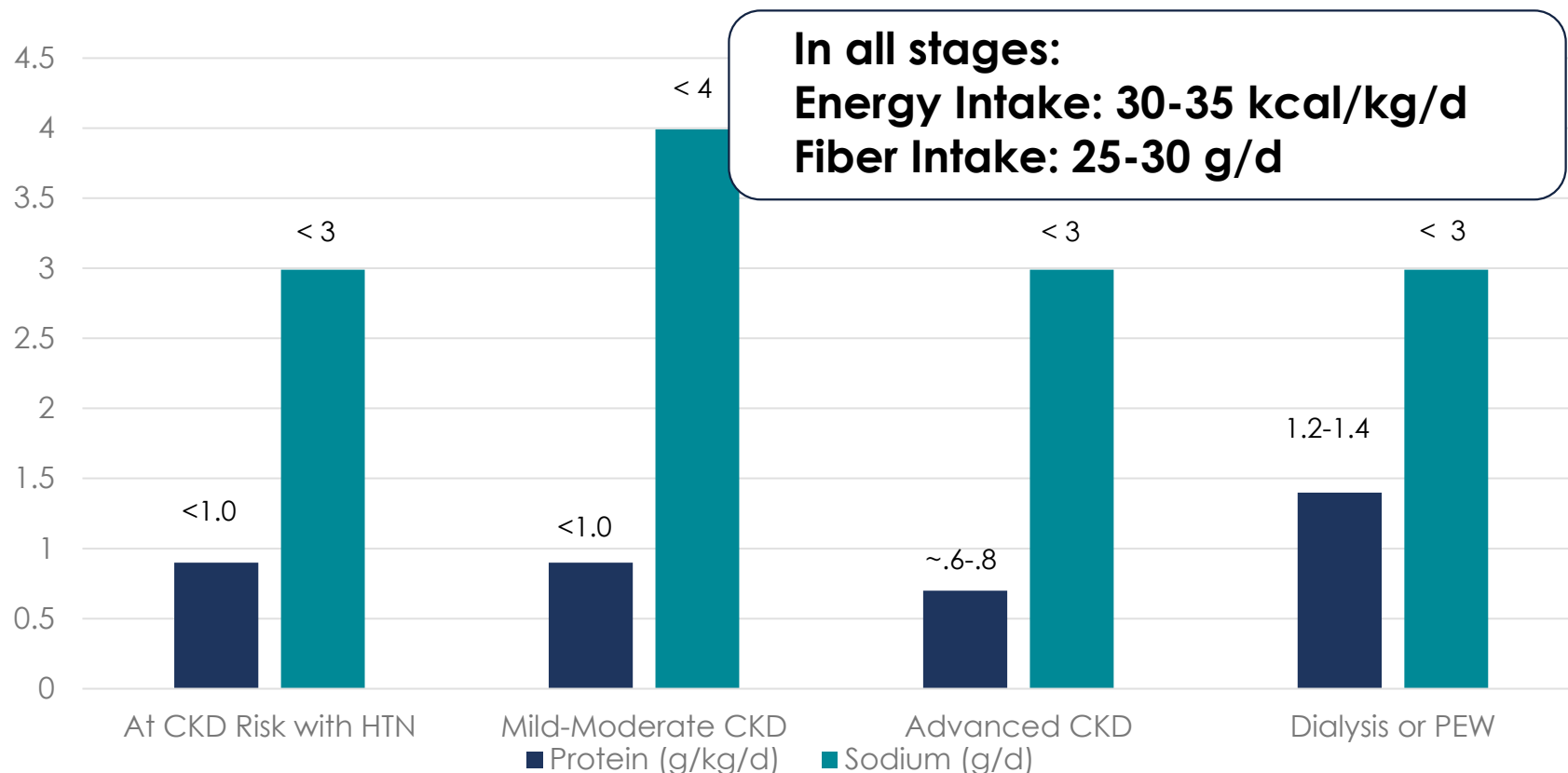


DIETARY MANAGEMENT OF HYPERTENSION

WHAT DOES THE EVIDENCE SAY?

Recommended Nutrient Intakes for Adults

Nutrient Recommendations per CKD stage



CKD: Chronic Kidney Disease, HTN: Hypertension, PEW: Protein-Energy Wasting

Kalantar-Zadeh K, Fouque D. Nutritional management of chronic kidney disease. *N Engl J Med.* 2017; 377;18: 1765-1776.

The National Kidney Foundation's Kidney Disease Outcomes Quality Initiative (KDOQI) Clinical Practice Guideline for Nutrition in CKD

Developed as a joint effort with
the Academy of Nutrition and Dietetics

Protein Type

- In adults with CKD stages 1-5, on dialysis (1B^a) or posttransplantation (OPINION^b), there is insufficient evidence to recommend a particular protein type (plant vs animal) in terms of the effects on nutritional status, calcium/phosphorus levels, or the blood lipid profile.

Fruits & Vegetables

- In adults with CKD stages 1-4, it is suggested that prescribing increased intakes of fruits and vegetables may decrease body weight, blood pressure, and net acid production (2C^c).

a: 1B: Level 1 and Grade B evidence, b: 2C: Level 2 and Grade C evidence, c: Opinion: Expert Opinion only, CKD: Chronic Kidney Disease

1. Ikizler TA, Burrowes JD, Byham-Gray LD, et al; KDOQI Nutrition in CKD Guideline Work Group. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *Am J Kidney Dis.* 2020; 76(3)(suppl 1): S1-S107.

The National Kidney Foundation's Kidney Disease Outcomes Quality Initiative (KDOQI) Clinical Practice Guideline for Nutrition in CKD

Developed as a joint effort with
the Academy of Nutrition and Dietetics

Sodium

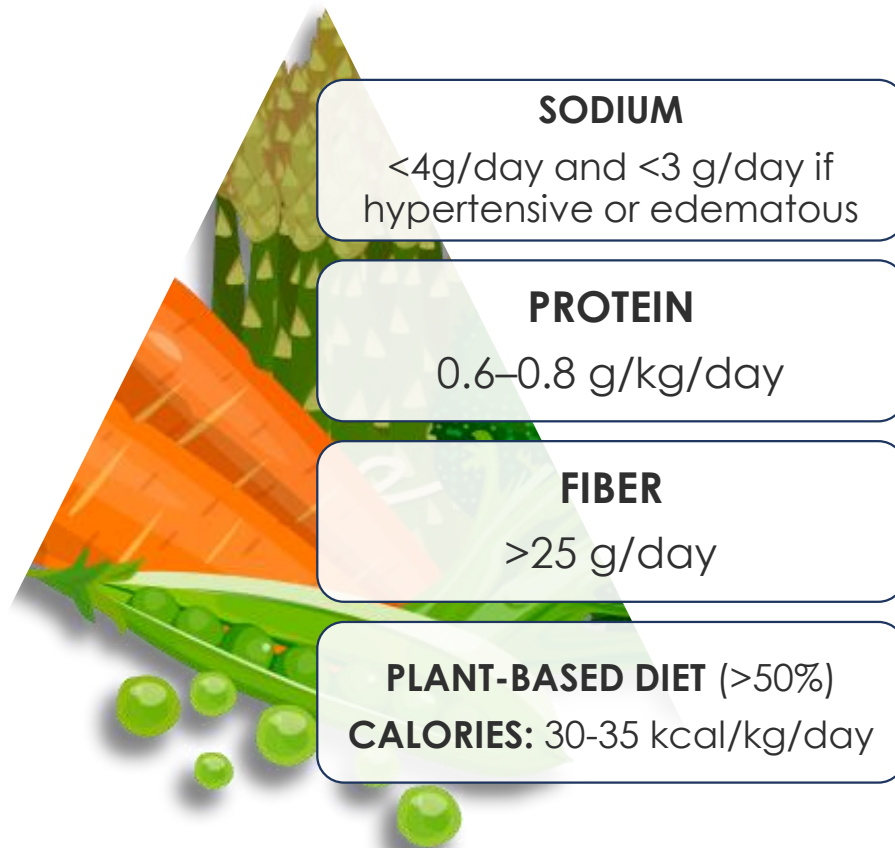
- In adults with CKD stages 3-5 (1B^a), or CKD stage 5 on dialysis (1C^b), or posttransplantation (1C^b), it is recommended to limit sodium intake to less than 100 mmol/d (or <2.3 g/d) to reduce blood pressure and improve volume control.

Potassium

- In adults with CKD stages CKD 3-5 (on dialysis or posttransplantation), it is reasonable to adjust dietary potassium intake to maintain serum potassium within the normal range (OPINION).

a: 1B: Level 1 and Grade B evidence, b: 1C: Level 1 and Grade C evidence, c: Opinion: Expert Opinion only, CKD: Chronic Kidney Disease
1. Ikizler TA, Burrowes JD, Byham-Gray LD, et al; KDOQI Nutrition in CKD Guideline Work Group. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *Am J Kidney Dis.* 2020; 76(3)(suppl 1): S1-S107.

Plant-Dominant Low-Protein Diet

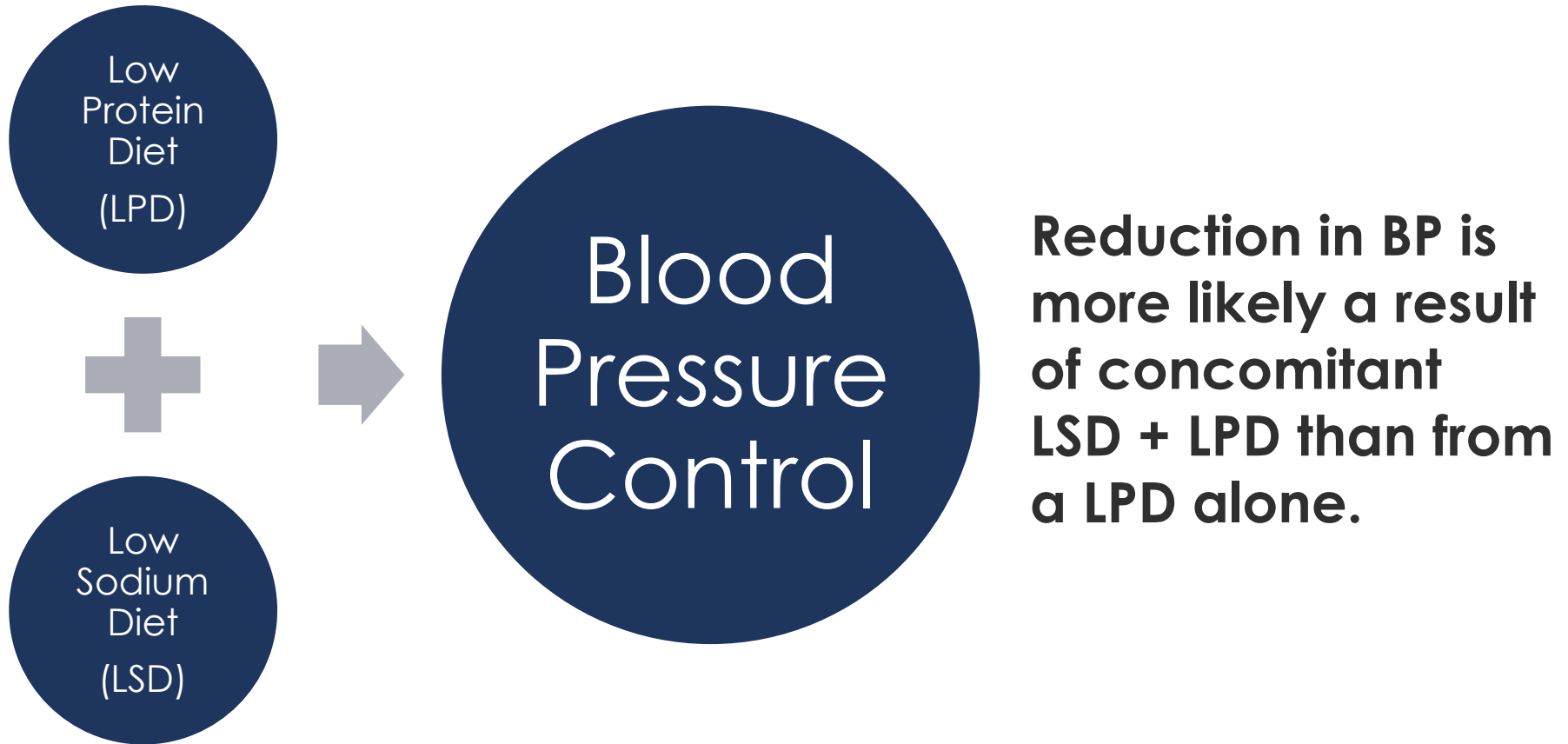


A patient-centered PLADO diet, administered by dietitians trained in non-dialysis CKD care, is promising and consistent with the precision nutrition.

PLADO: Plant-Dominant Low-Protein Diet, CKD: Chronic Kidney Disease

Kalantar-Zadeh K, Joshi S, et al. Plant-dominant low-protein diet for conservative management of chronic kidney disease. *Nutrients* 2020, 12, 1931; doi:10.3390/nu12071931

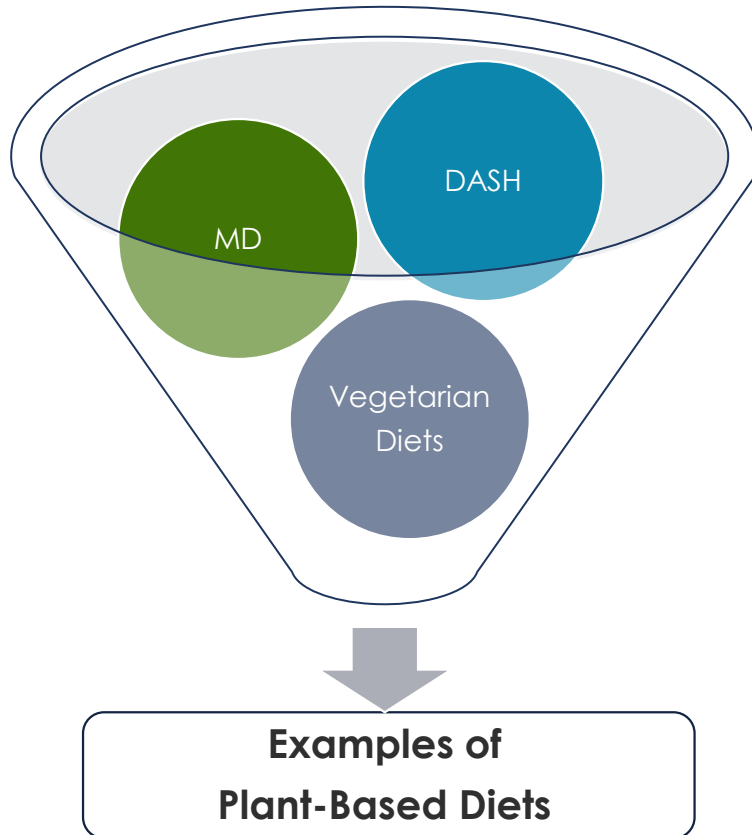
Nutrition & Blood Pressure Control



LPD: Low Protein Diet, LSD: Low Sodium Diet, BP: Blood Pressure

Kalantar-Zadeh K, Fouque D. Nutritional management of chronic kidney disease. *N Engl J Med.* 2017; 377;18: 1765-1776.

Examples of Plant-Based Diets

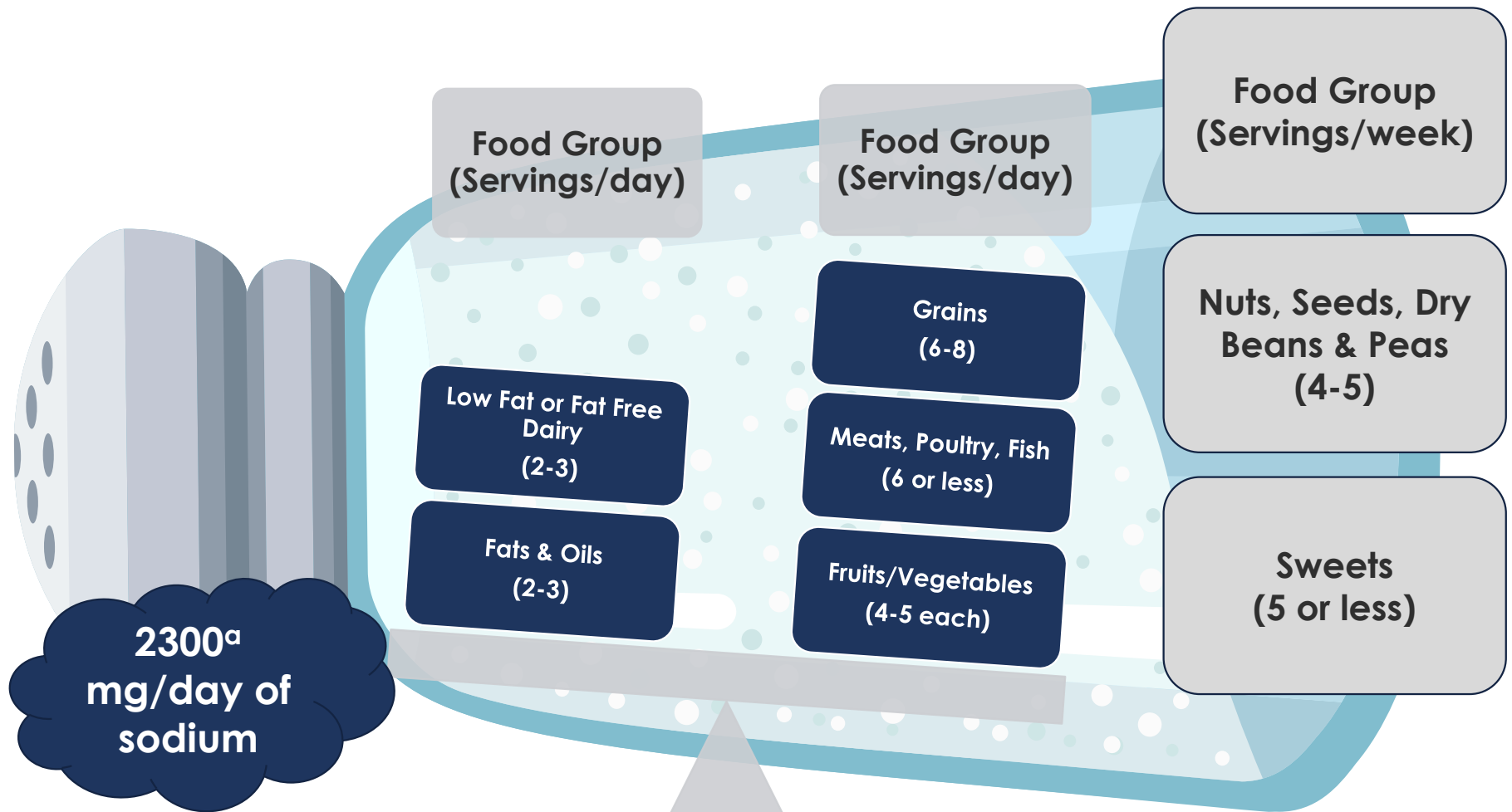


Plant-Based Diet Types: Vegetarian, Mediterranean, & DASH

- LOW in processed meats, sodium, and saturated fat
- HIGH in fiber, potassium, and other nutrients
 - Associated with a lower risk of mortality from CVD
 - Slow the progression of kidney disease

DASH: Dietary Approaches to Stop Hypertension, MD: Mediterranean Diet, CVD: Cardiovascular Disease
Cases A, et al. Vegetable-based diets for chronic kidney disease? It is time to reconsider. *Nutrients* 2019; 11: 1263; doi:10.3390/nu11061263

Daily and Weekly DASH Eating Plan Goals for a 2,000-Calorie-a-Day Diet



a: 1,500 milligrams (mg) sodium lowers blood pressure even further than 2,300 mg sodium daily.

<https://www.nhlbi.nih.gov/health-topics/dash-eating-plan>. Last accessed February 2021.

Risk of Hyperkalemia?

- Despite the relatively higher potassium content of plant-based diets, there is no evidence to suggest a risk for hyperkalemia in these patients, even with advanced CKD stages.¹
- This is probably due to the high fiber content that facilitates gastrointestinal transit time allowing less potassium to be absorbed compared to diets high in animal-based proteins that often worsen constipation and increase the risk of hyperkalemia.¹
- No studies have shown differences in serum potassium levels in patients consuming plant-derived versus omnivore-derived potassium sources.²
- Also, the use of different cooking techniques can minimize the amount of potassium absorbed.²

CKD: Chronic Kidney Disease

1. Joshi S, Shah S, Kalantar-Zadeh K. Adequacy of plant-based proteins in chronic kidney disease. *J Renal Nutr.* 2019; 29 (2):112-117. 2. Cases A, et al. Vegetable-based diets for chronic kidney disease? It is time to reconsider. *Nutrients* 2019; 11: 1263; doi:10.3390/nu11061263

In Summary and Call-to-Action

- An important modifiable risk factor for CKD is hypertension, which is improved with a plant-based diet.¹
- Plant-based diets have the potential as first-line therapy for the management of hypertension.²
- The time is now to individualize/liberalize the diet for CKD patients by counseling them on a diet richer in plants.³
- Additional large, long-term, high-quality studies are needed to determine the cause(s)-and-effect(s) of plant-based diets on both CKD³ and hypertension outcomes.²

CKD: Chronic Kidney Disease

1. Joshi S, Shah S, Kalantar-Zadeh K. Adequacy of plant-based proteins in chronic kidney disease. *J Renal Nutr.* 2019; 29 (2):112-117. 2. Joshi S, et al. Plant-based diets and hypertension. *Am J Lifestyle Med.* 2019, 14(4): 397-405. 3. Cases A, et al. Vegetable-based diets for chronic kidney disease? It is time to reconsider. *Nutrients* 2019; 11: 1263; doi:10.3390/nu11061263



NephUTM

Improving Awareness & Patient Outcomes

Plant-Based Diets for the Management of Hypertension in Chronic Kidney Disease