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Professional Education Series

Support. Inform. Educate. Empower.

Kidneys and Kale: Preventative Kidney Care With Plants

TODAY'S AGENDA:

- Introduction & Housekeeping
- Speaker Introduction
- Presentation
- Q&A
- Closing



WEBINAR HOST:

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Renal Dietitian



Kidneys & Kale:

Preventative Kidney Care with Plants

AnnaMarie Rodriguez, RDN, LD, FAND

Registered/Licensed Dietitian/Nutrition Consultant





Disclosures

- Self-Employed:
 - Nutrition Directions LLC
- Employed by Pentec Health Inc
 - IDPN/IPN infusion therapy
- VN DPG Speakers Bureau
- RPG DPG Speakers Bureau
- Board Member, P-POD

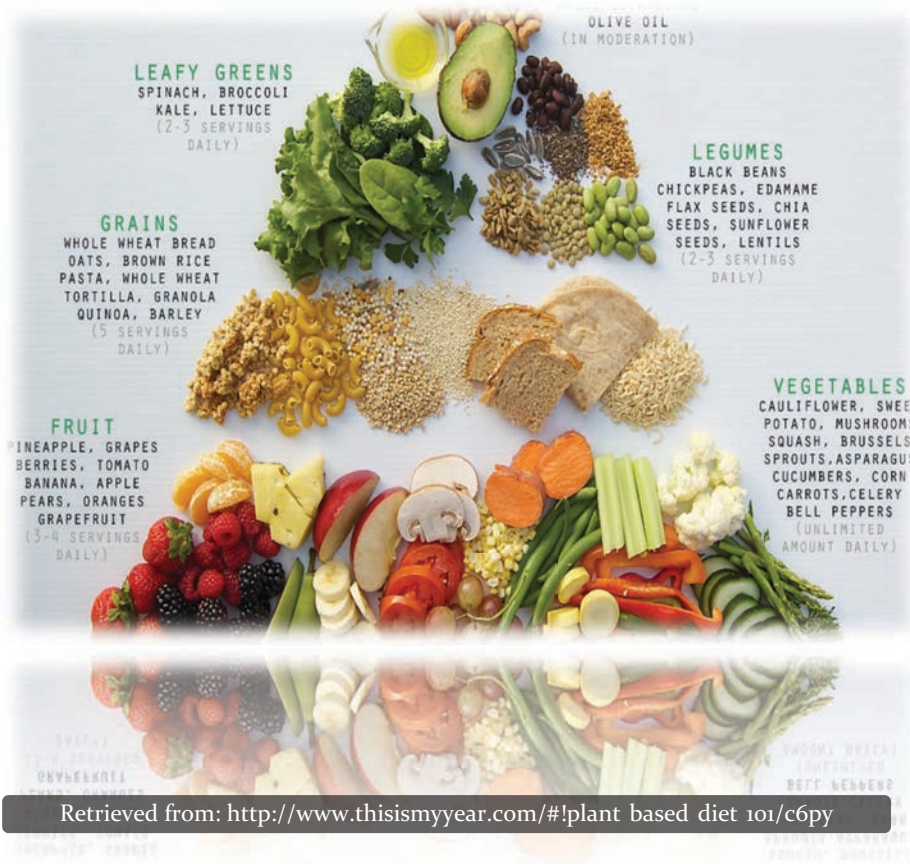


Learning Outcomes

- Evaluate, interpret, and integrate current evidence on inclusion of plant-based foods in Chronic Kidney Disease (CKD) nutrition in preventative care to delay disease progression
- Implement affordable plant-based protein to meet daily needs in populations impacted by health disparities and food insecurity



What is Plant-Based Nutrition?



Retrieved from: <http://www.thisismyyear.com/#!/plant-based-diet-101/c6py>

A plant-based diet consists mostly or entirely of foods derived from plants, including vegetables, grains, nuts, seeds, legumes and fruits, and with few or no animal products. A plant-based diet is not necessarily vegetarian, and is an umbrella term to describe eating patterns that are “plant-dominant”

The phrase “plant-based” and its evolution

- **Vegan** – 100% plant-based
- **Lacto - and/or ovo vegetarian** – may include dairy and/or eggs
- **Pesco-vegetarian** – occasional fish or seafood
- **Flexitarian** – occasional intake of meat/animal product
- **Whole-Food Plant-Based (WFPB)** – whole plant-based foods as opposed to refined or processed plant foods
- Note the **DASH** and **Mediterranean** lifestyle is largely plant-based
- **PLADO** – a plant-dominant low-protein diet for persons with kidney disease



Goals of Nutrition Intervention and CKD:

Decrease risks and progression of the disease to End Stage Kidney Disease (ESKD)

Projected Growth in 2019 of Incidence & Prevalence of ESKD in the US through 2030

■ ESKD Incidence Rate 2015-2030:

➤ Projected to rise between **11-18%**

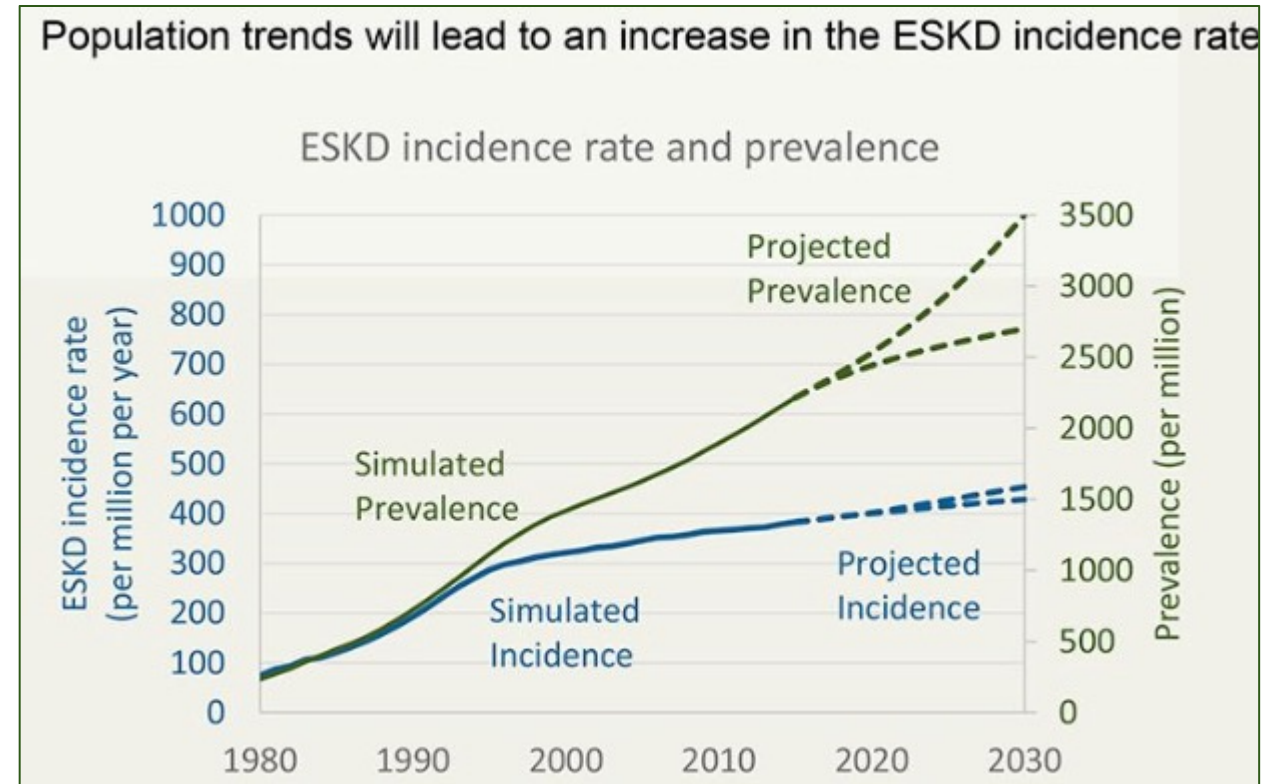
■ ESKD Prevalence Rate 2015-2030:

➤ Projected to rise from 0.69 million to **0.97 - 1.26** million patients

“Future interventions should be directed to preventing the progression of CKD to kidney failure”

The pandemic affect:

Height of the pandemic: 25% drop in documented ESKD incidence, a level not observed since 2011²



McCullough et al. *JASN* 2019

1. McCullough et al. *Am Soc Neph* 2018
2. Wetmore et al. *JASN* 2021

CKD/ESKD Facts (U.S.)

- 1 in 7 (or 35.5 million people) have CKD
- 9 in 10 adults with CKD are unaware they have CKD
- 1 in 3 adults with severe CKD are unaware they have CKD¹



- 808,000 persons living with ESKD
- Compared with White people
 - Black people are nearly 4 times more likely to develop ESKD.
 - Hispanic people and Native American people are more than twice as likely to develop ESKD.
 - Asian people are 1.4 times more likely to develop ESKD.



THE RISK FOR KIDNEY DISEASE CONTINUES TO INCREASE

THE CAMPAIGN BY THE NKF IN COLLABORATION WITH THE US DEPT OF HEALTH AND HUMAN SERVICES AND THE AMERICAN SOCIETY OF NEPHROLOGY

Share the Risk Quiz with your friends and family—it only takes a minute: MinuteForYourKidneys.org

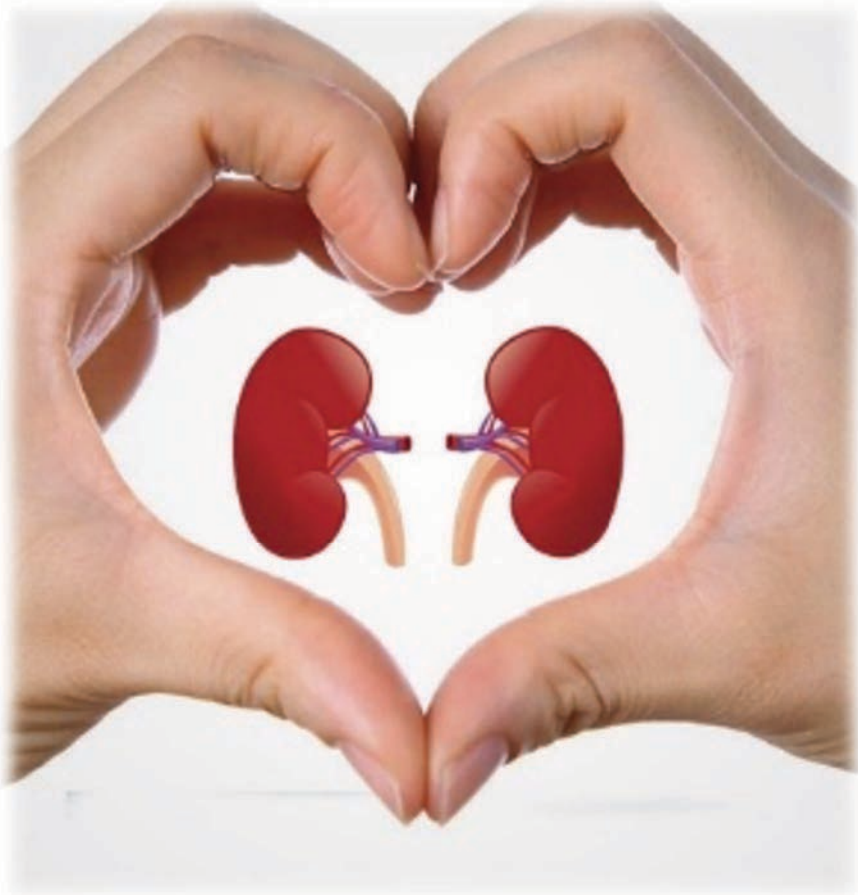


33% of American adults are at risk for kidney disease.

PROUD COLLABORATOR OF
ARE YOU THE 33%?

Take the quiz at MinuteForYourKidneys.org to find out where you stand.

Carolyn Crist writes in 2018: “*Diet guidance could slow kidney disease, cut costs*”

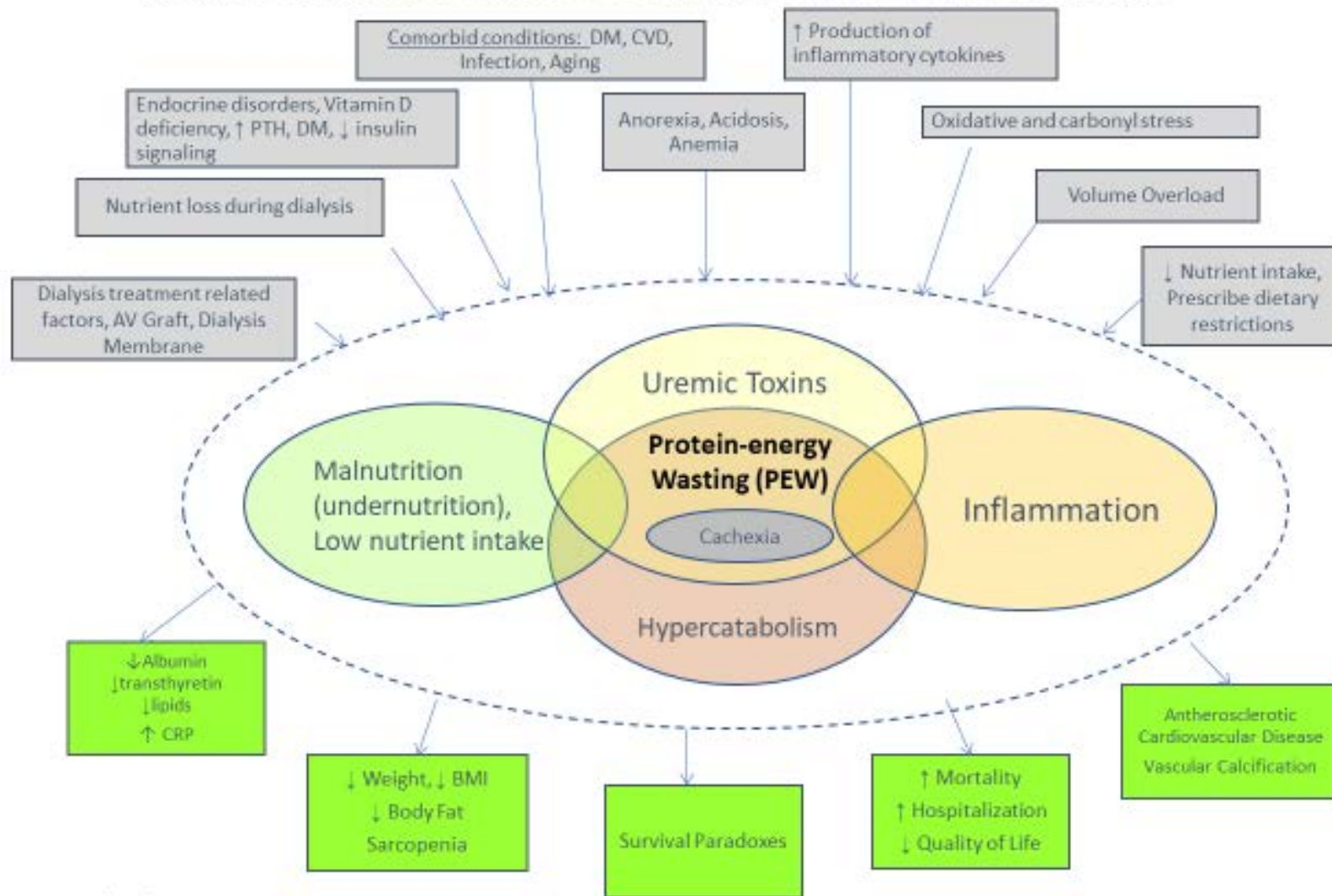


- Crist writes: Patients with chronic kidney disease could slow the progression of their illness and delay dialysis through nutrition therapy
- 10% of persons with non-dialysis CKD meet with an RDN
- CKD affects ~15% of the US population
- Progress is needed; an action plan for change.

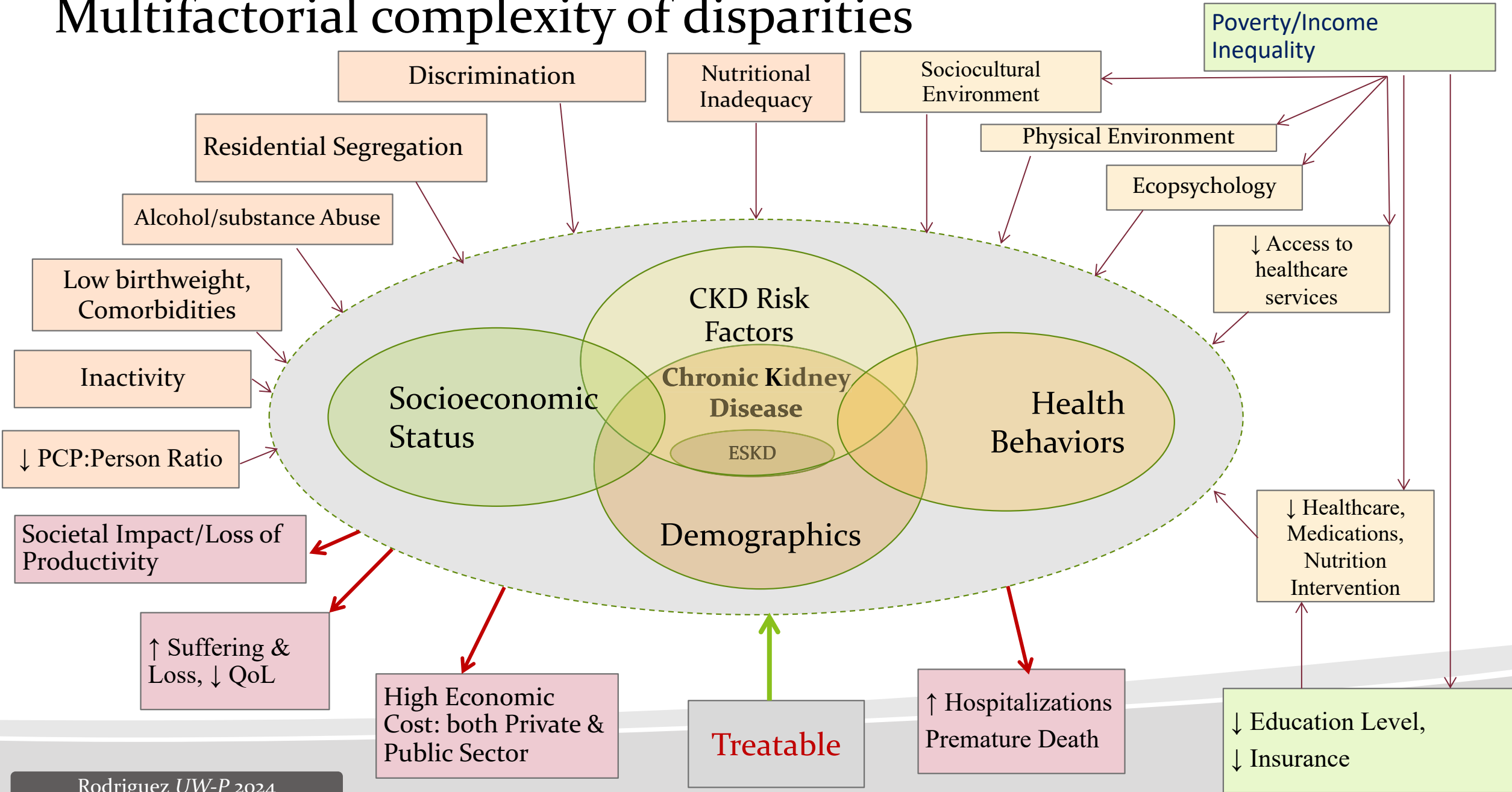


Nutritional guidance
embraces concepts that
serves both the complexity
of the disease status and of the
disparities = Multifactorial Global
Approach

Global Approach to the multifactorial complexity of the disease



Multifactorial complexity of disparities





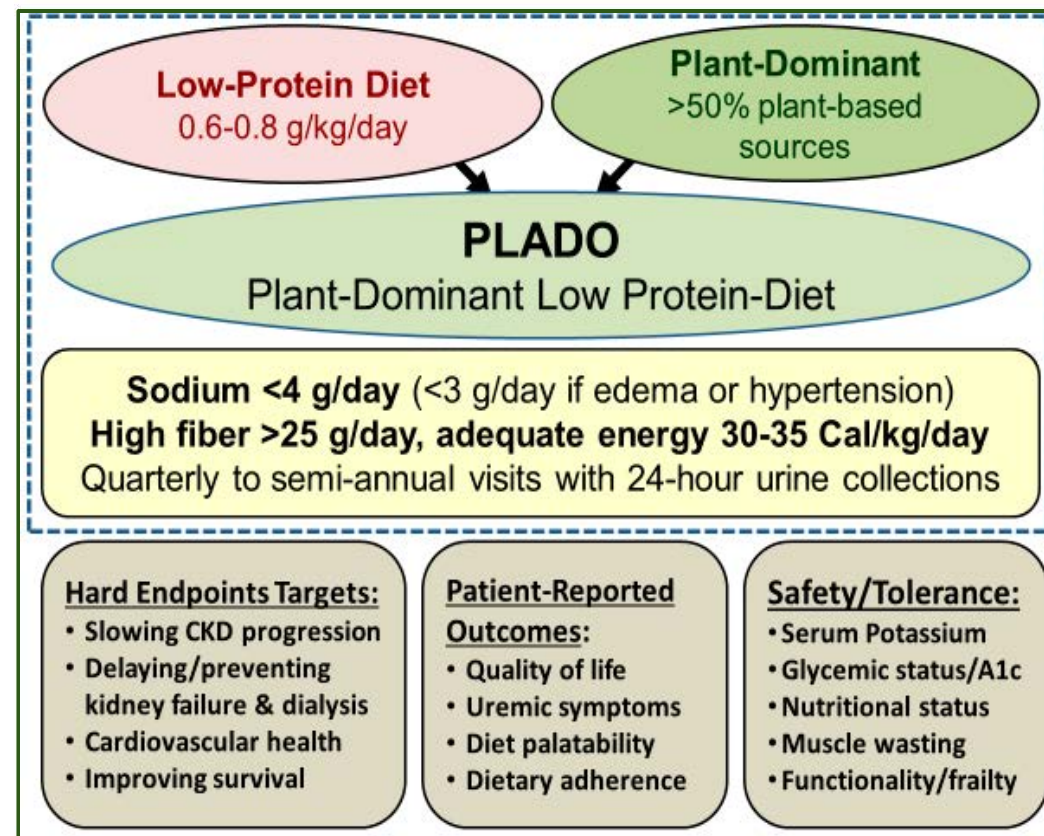
PLADO: Plant-Dominant Low Protein Diet

PLADO Defined:

- LPD with DPI of 0.6–0.8 g/kg/day
- >50% plant-based protein

- Relatively low sodium intake <3 g/day
- Higher dietary fiber of at least 25–30 g/day
- Adequate DEI of 30–35 Cal/kg/day (IBW)

PRO TIP: Alkaline intake is kidney protective and allows greater diet flexibility



Protein: Just how much is needed?

Adults with CKD on MHD and PD, and those who have diabetes: dietary protein of 1.0 -1.2 g/kg body weight/day.

Adults with CKD 3-5 (non-dialyzed) a LPD of 0.55-0.6 g/kg body weight/day or a VLPD providing 0.28-0.43 g/kg with additional keto acid/amino acid analogs to meet 0.55-0.6 g/kg/day is recommended.

Adults with CKD 3-5 patients, not on dialysis who have diabetes: dietary protein of 0.6 –0.8 g/kg ideal body weight per day.





Protein type...
What is the
consensus?
Plant or Animal?

Adults with CKD 1-5D and post-transplant: insufficient evidence to make conclusions about the effects of protein type (plant vs. animal) on nutritional status, calcium or phosphorus levels, or the blood lipid profile

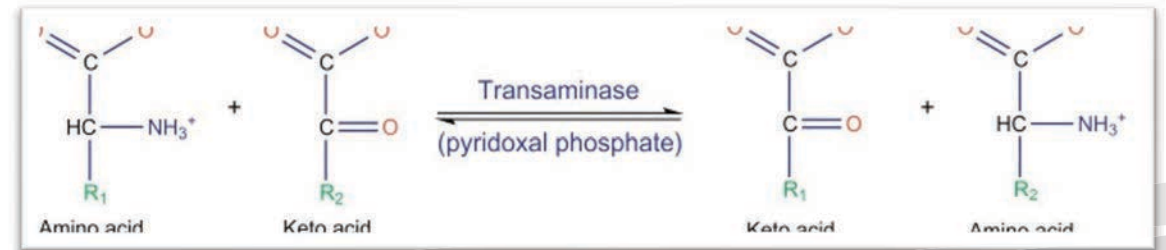
Ketoanalogues (KAs)

Those on a VLPD need to be supplemented to remain in nitrogen balance¹

Recommendations: a very-low protein diet providing 0.28 to 0.43 g dietary protein/kg ideal body weight/day with additional keto acid analogs to meet protein requirements (0.55 to 0.60 g /kg body weight/day)¹

Point of fact, the only protein-modified diets are either a VLPD or a plant-based diet²

- Historically Keto-analogues have been unavailable in the US without an Rx²
- Use of KAs with a VLPD as a progressive approach to delay the progression of CKD is appealing; what are the obstacles?
 - Availability, cost-inhibitive
 - Broad deficiency of knowledge and a hesitancy with use²





Plants, Patients, & CKD: individualized approach

Implementation of plant-based low protein diets is dependent on dietitians who are well trained in non-dialysis CKD¹

Behavior change counseling by dietitians is a key skill set that is critical in successful lifestyle and habit modifications²

Both dietitians and other healthcare providers use telehealth increasingly frequently since the COVID-19 pandemic³

Telehealth alternatives for MNT continue to be needed to overcome challenges in dietetic education; overcome barriers and restrictions, to promote ownership and self-monitoring in kidney health management

Past and recent reports suggest under-utilization of dietetic manpower and expertise for the purpose of non-dialysis CKD care⁴

1. Kramer et al. *JAND* 2018
2. Kalantar-Zadeh et al. *Nutrients* 2020
3. Kalantar-Zadeh et al. *J Ren Nutr* 2020
4. Kalantar-Zadeh et al. *BMC Neph* 2016

Evidence on inclusion of plant-based nutrition & CKD

- Supportive evidence
- Alkalinity vs Acidity
- Inflammation
- Minerals
- Fiber & the gut
- Dysgeusia



Supportive plant-based nutrition data in CKD



✓ TLGS: Tehran Lipid and Glucose Study¹

- Participants in highest quartile of plant protein intake exhibited **30% lower risk of CKD** (OR 0.70; 95% CI)
- Conversely, those with highest quartile of animal protein intake had a **37% higher risk for CKD** (OR 1.37; 95% CI)

✓ MESA: Multi-Ethnic Study of Atherosclerosis²

- High intake of WG, F/V, & low-fat dairy was associated with **20% lower urinary albumin-creatinine ratio** (P = 0.004)
- Nondairy animal intake was associated with an **11% higher urinary albumin-creatinine ratio** (P = 0.03)

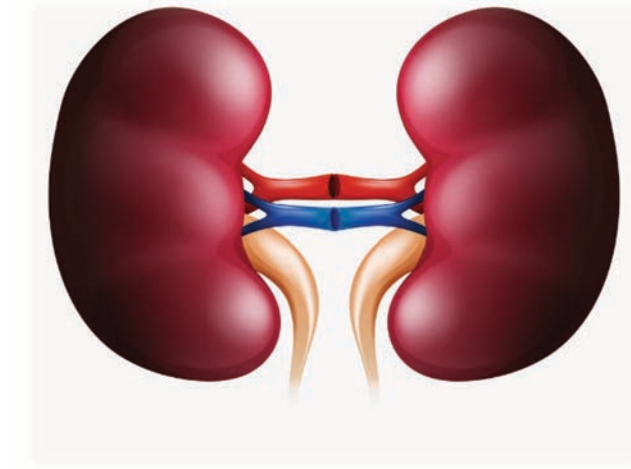
- Singapore Chinese Health Study: >63,000 participants, median of 15.5 yrs - Highest quartile of red meat intake had **40% increased risk of developing CKD** (HR 1.40, 95% CI)³
- Atherosclerosis Risk in Communities Study (ARIC): ~12,000 participants, median of 23 years – highest intake of nuts, legumes, & low-fat dairy had **19% lower risk for CKD** (HR 0.81, 95% CI) and intake of red and processed meats **increased risk of CKD by 23%** (HR 1.23, 95% CI)⁴

1. Yuzbashian et al. *J Neph* 2014
2. Nettleton et al. *Am J Clin Nut* 2008
3. Lew et al. *JASN* 2016
4. Haring et al. *J Ren Nutr* 2017

Acidosis and Progression of CKD

Goraya data:

- CKD stage 2 due to hypertensive nephropathy, 30 days of increased fruit and vegetable consumption produced similar reductions in urinary NAG (a reduction in dietary acid) and albuminuria as did oral sodium bicarbonate¹
- CKD stage 3 due to hypertensive nephropathy, randomized to either NaHCO₃ or F/V for 3 years in which both produced similar outcomes in preserving glomerular filtration rate³
- CKD stage 4 and serum bicarbonate <22 mEq/L who were randomized to 1 year of sodium bicarbonate at 1.0 mEq/kg per day or increased fruits and vegetables to reduce dietary acid by half: GFR did not differ at baseline and at 1 year⁴



3 Acidosis increases endothelin (ET)-mediated tubulo-interstitial injury¹ and evidence suggests dietary acid load (DAL) impacts kidney health²

3 Multiple studies review the use of oral alkali to combat acidosis – **what about diet modification?**

1. Goraya et al. *Kidney Int* 2012

2. Joshi et al. *AJKD* 2021

3. Goraya et al. *Kidney Int* 2014

4. Goraya et al. *Clin J Am Soc Neph* 2013

Alkalinity/Acidity

- Metabolic acidosis: a consequence of and a contributor to progression of kidney disease
 - *Beyond the progression of CKD, it has effects on skeletal metabolism, insulin resistance, and PEW*
- The kidneys regulate H^+ excretion by reabsorbing filtered HCO_3^- and generating new HCO_3^- in response to various stimuli ¹

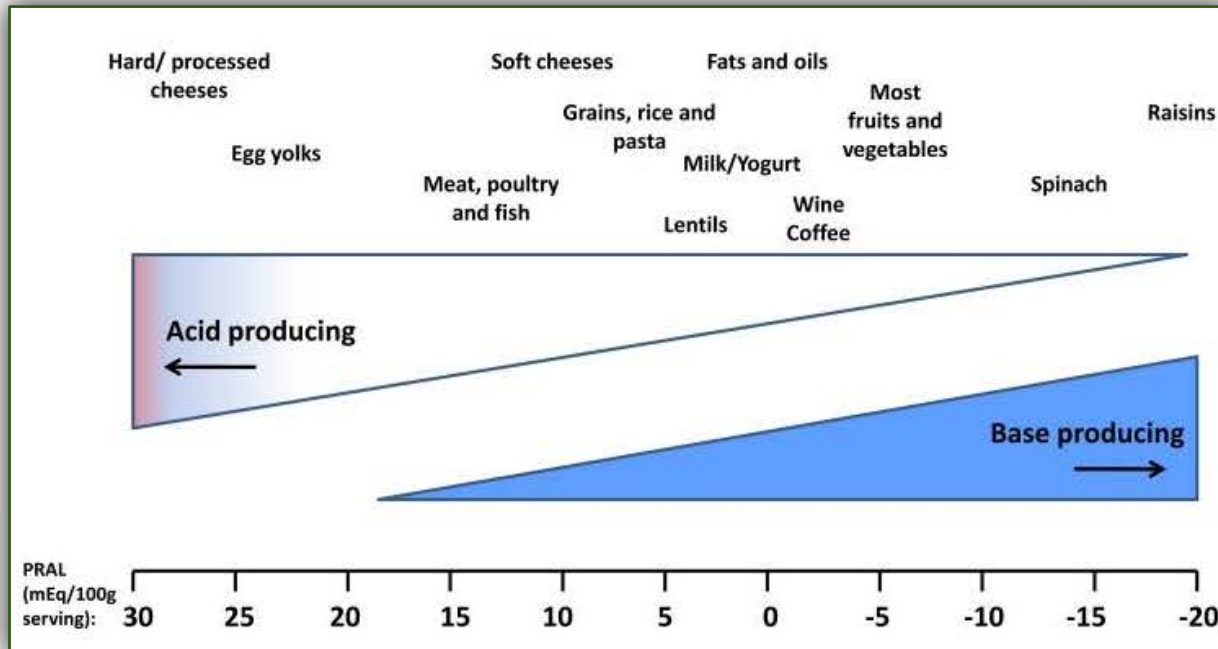


- Nonvolatile acid production in the body comes from diet, especially the Western diet which favors animal-based acid-inducing foods.
 - Acid-forming due to organic sulfur found in amino acids methionine, cysteine, and homocysteine and oxidized to sulfate²
- Plant-based foods have natural alkali (citrate & malate) and is converted to bicarbonate
- *NHANES III (~1,500 adults) showed a significant increased risk for kidney failure for those in the highest tertile of DAL consumption (Relative Hazard 3.04; 95% CI)³*

1. Chen et al. *BMC Nephrol* 2014
2. Scialla et al. *Adv Chronic Kidney Dis* 2013
3. Joshi et al. *AJKD* 2021

Alkalinity/Acidity & PRAL

Potential Renal Acid Load (PRAL) indicates the correlation between diet and acid-base balance; foods “0” or less increases alkalinity¹



Scialla et al. *Adv Chronic Kidney Dis* 2013

Food high in dietary acid load include cheese, meat, eggs

- Diets high in animal protein produce high levels of net endogenous acid production (NEAP)

Fruits and vegetables are rich in alkali precursors

- Vegan and vegetarian diets result in low, or even negative, NEAP

Higher NEAP has been associated with lower serum bicarbonate in persons with kidney disease²

- Prevalence increases with age: middle-aged and older individuals, populations in whom the capacity to excrete an acid load is relatively impaired

PRO TIP: Balance nutritional intake with ample fruits and vegetables with minimal animal protein intake

1. Scialla et al. *Adv Chronic Kidney Dis* 2013

2. Kraut et al. *AJKD* 2015

LPD/PRAL (low-PRAL or ash-alkaline)

Potential Renal Acid Load (PRAL)

- Chronic low-grade acid accumulation: cardiometabolic diseases,¹ renal disorders,^{2,3} and various cancer types⁴⁻⁶
- Alkaline diets may exert beneficial effects toward human health,⁷⁻⁸ some studies also reported that excess diet alkalinity may be detrimental^{9,10}

Until recently, nutritional adequacy of alkalizing diets has rarely been assessed in large populations and it is virtually unknown if alkaline diets align with current dietary guidelines

1. Iwase et al. *J Diabetes Investig* 2015
2. Rebholz et al. *Am J Nephrol* 2015
3. Scialla et al. *KI* 2012
4. Ronco et al. *Oral Sci* 2022
5. Shi et al. *Cancer Epidemiol Biomark Prev* 2021
6. Park et al. *Int J Cancer* 2018
7. Welch et al. *Osteoporos Int* 2013
8. Rodrigues et al. *J Ren Nutr* 2018
9. Xu et al. *J Nutr* 2016
10. Garcia-Gavilan et al. *J Nutr* 2021
11. Storz & Ronco *Healthcare* 2023

Storz & Ronco¹¹

- Analyzed nutrient intakes in 29,683 individuals (7234/LPD, 22,449/HPD)
- Compared both groups with the daily nutritional goals (DLG) in the 2020-2025 Dietary Guidelines for Americans (DGA)
- ✓ LPD consumers met the DGA recommendations for saturated fat and potassium, consumed significantly more fiber than individuals on an HPD and yielded a more favorable potassium-to-sodium intake ratio.
- ✓ Mean PRAL of individuals on an LPD was -12.67 (0.23) mEq/day, indicating an alkalizing potential. The mean PRAL of individuals on an HPD was 23.35 (0.20) mEq/day, indicating acidifying properties.

Both LPD & HPD groups failed to meet goals for calcium & Vitamin D¹

F+V = antioxidants and phytochemicals



- Vicious cycle: inflammation → PEW → catabolic process of both CKD and renal replacement therapy (RRT)
- Patients with CKD tend to be older, (>65 years old) and are exposed to ***“Inflamm-aging”***

“Inflamm-aging”: a consequence of a global reduction in the ability to cope with antigenic, chemical, physical, and nutritional stressors and of a gradual increase in proinflammatory markers¹

Patients on dialysis are often encouraged to consume increased protein, often in the form of animal protein. Animal protein, when exposed to high-temperature cooking, is subject to oxidation → generating reactive oxygen species and chemical toxins²

1. Calder et al. *Age Res Rev* 2017

2. Jiang et al. *Meat Sci Food* 2016

Antioxidants + Phytochemicals = Powerhouse against Inflammation

- F&V have the strongest effects in prevention of CVD, noting a nonlinear threshold effect of 800 g per day (~5/day)¹
- Hundreds of epidemiological analyses have provided consistent longitudinal evidence that F/V exert a protective effect against CVD¹
 - F/V lends to anti-inflammatory and anti-oxidant effects: decreased risk of CKD progression and CVD^{2,3}
 - It is important to note: most patients with CKD do not progress to ESKD; only 3% will experience ESKD⁴

PRO TIP: Minimum of 5/day F+V is both kidney and cardio protective



1. Wallace et al. *Crit Rev Sci Nutr* 2019
2. Rapa et al. *Int J Mole Science* 2019
3. Hirahatake et al. *J Ren Nutr* 2019
4. Hudson Scholle et al. *CMS* 2021

Plants & the gut

Plant-Based foods generate fewer uremic toxins, reduces proteinuria, tempers GFR decline through a variety of mechanisms¹

Plant-based diets favorably shift gut bacteria from a proteolytic profile to a sacchrolytic profile²⁻⁴

- Promotes short-chain fatty acids
- Strengthens intestinal barrier integrity
- Reduce inflammation
- Improve immunity

1. Haring et al. *Am J Ren Nutr* 2017
2. Nallu et al. *Am J Trans Research* 2017
3. Mafra et al. *Nutrients* 2019
4. Camerotto et al. *Nutrients* 2019
5. Goraya et al. *Clin J Am Soc Nephrol* 2013
6. Fogelman. *Circ Research* 2015



The shift reduces production of key uremic toxins known to promote CKD:

- p-cresyl sulfate (p-CS)
- indoxyl sulfate (IS)⁵
- indole-3-acetic acid (IAA)
- trimethylamine-N-oxide (TMAO)²

These uremic toxins are associated with animal protein intake and favor growth of proteolytic bacteria in the gut microbiome²

TMAO: biomarker of both CVD & CKD as well as a renal toxin⁶



Gut Data



Increased fiber in controlled feeding trials in CKD reduces urea & creatinine levels in a systematic review & meta-analysis¹



Normal kidney function: ~60% lower uremic toxins p-CS & IS in persons following a vegetarian vs. omnivorous nutrition lifestyle²



Cross-sectional study: vegetarians/non-vegetarians undergoing RRT, those on a vegetarian diet had 47% and 67% lower IS & p-CS respectively³



The effect is multifactorial: both the fiber and reduction of animal protein/replacement with plant protein is beneficial

1. Chiavaroli et al. *Eur J Clin Nutr* 2014
2. Patel et al. *Clin J Am Soc Neph* 2012
3. Kandouz et al. *Hemo Int* 2016

Minerals: phosphorus

Phytate or phytic acid is the form of phosphorus occurring largely in cereals, seeds, legumes... it is largely indigestible¹



- Needs to be hydrolyzed to release the phosphorus for absorption
- In humans, phytase activity is very low in the gut
 - ③ Phytase is an enzyme that increases availability of phosphorus
 - ③ Phytate is not digestible to humans (or nonruminant animals); we lack the digestive enzyme required to remove phosphate from the inositol in the phytate molecule^{1,2}

1. Kalantar-Zadeh et al. *CJASN* 2010
2. Waheed et al. *Neph Dial Trans* 2013

Minerals: phosphorus and potassium

Processing is known to hydrolyze phytic acid and make it more available for absorption^{1,2}

In a study by Moorthi (CKD 3-4) the effect of a 70% plant protein diet on urine phosphorus excretion appears equivalent to that of phosphorus binders³



Plant matrix hinders potassium absorption from unprocessed vegetables and fruits⁴

It is suggested that potassium in unprocessed plant foods may not be >60% absorbed⁵

PRO TIP: Consider both Actual content of minerals in food **AND** the bioavailability from various food sources

1. Karp et al. *J Ren Nutr* 2012
2. Karp et al. *J Ren Nutr* 2012
3. Moorthi et al. *Am J Neph* 2014
4. Melse-Boonstra. *Front Nutr* 2020
5. Picard. *J Ren Nutr* 2018

Bottom Line: Phosphorus Bioavailability



Organic (natural)



Natural sources in animals and plants

- Dairy products, fresh meat, fish seafood, poultry¹
 - Readily absorbed: ~40 – 60%^{2,3} and can reach up to 80%⁴
- Nuts, seeds, grains, vegetables, legumes, etc¹
 - Low absorption: less than 50% (2,3) and as low as 10% & 30%¹
 - *Plant-based protein is without both phos- and potassium-based preservatives used in meat processing^{5,6}*

Inorganic (unnatural)



Additive or preservative

- Fast foods, Canned/bottled beverages, Ready-to-eat foods, Enhanced meats, etc¹
- The salts are not protein bound and readily dissociate in the gut. Absorbed 90 – 100%^{2,3}

PRO TIP: Eat fresh, avoid processed and ready-to-eat or convenience foods with additives; check the labels! Holds true for sodium as well!

1. Noori et al. *AJKD* 2010
2. Kalantar-Zadeh et al. *Clin J Am Soc Nephrol* 2010
3. Kalantar-Zadeh et al. *Nutrient* 2020
4. González-Parra et al. *Int J Nephrol* 2021
5. Kalantar-Zadeh et al. *JASN* 2010
6. Parpia et al. *J Ren Nutr* 2018



Added Benefit of a PB diet: Low Sodium

- Improved blood pressure (BP)
 - Reduced CKD risk
 - Improved proteinuria
- Decreased risk of CVD, stroke
- ESKD: improved hypervolemia, BP, and decreased CV mortality²

Sodium:

World Health Organization states sodium intake to <2.3 g/day is one of the most cost-effective measures to improve public health¹

Consider this: Organic or Inorganic?

Increased trend in modified plant proteins:

- We must ask ourselves: are they safe?
- Processed foods: additives & preservatives - added minerals such as potassium, phosphorus, and salt!
 - Label Scrutineer
 - Toss the shaker & spice it up!
 - Use the 1 mg sodium/1 calorie rule (Pritikin “1 to 1” rule)

Inorganic: Growing use of Additives

Nutrition Facts:	
Serving Size 8fl.ozs.(240 mL)	
Servings Per Container 2	
Amount Per Serving	
Calories 0	
	% Daily Values*
Total Fat 0g	0%
Sodium 0mg	0%
Total Carbohydrates 0g	0%
Sugars 0g	0%
Protein 0g	0%
*Percent Daily Values are based on a 2,000 calorie diet.	

Ingredients: purified water, organic extracts from cloves, organic cardamom seeds, organic cinnamon bark, and natural flavor

- In 1990, estimated intake of phosphorus from additives was 470 mg/day
- Increased reliance on convenience and processed foods could result in an increase of phosphorus by over 1 gram per day
- Electronic databases have been shown to underestimate the amount of phosphorus in foods by ~250 – 350mg¹

CONTAINS 0% JUICE • LOW SODIUM	
Nutrition Facts	
Serving Size 12 fl oz (355 mL)	
Servings Per Container About 11	
Amount Per Serving	
Calories 70	
	% Daily Value*
Total Fat 0g	0%
Sodium 110mg	5%
Total Carbohydrate 20g	7%
Sugars 19g	
Protein 0g	
Vitamin C	150%
Not a significant source of calories from fat, saturated fat, <i>trans</i> fat, cholesterol, dietary fiber, vitamin A, calcium and iron.	
*Percent Daily Values are based on a 2,000 calorie diet.	

WATER, HIGH FRUCTOSE CORN SYRUP, CITRIC ACID, NATURAL FLAVOR, SODIUM HEXAMETAPHOSPHATE (TO PROTECT FLAVOR), GREEN TEA, ASCORBIC ACID (VITAMIN C), POTASSIUM SORBATE (PRESERVES FRESHNESS), PHOSPHORIC ACID, SUGAR, ACESULFAME POTASSIUM, CALCIUM DISODIUM EDTA (TO PROTECT FLAVOR), HONEY

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Unilever

PRO TIP: Tried & True patient education is to locate the hidden phosphorus (PHOS) on food labels and ingredients lists²

1. Uribarri et al. *Seminars in Dialysis* 2003
2. Sullivan et al. *JAMA* 2009



Phosphorus Data

- Crossover study in CKD 3-4, fed a vegetarian diet exhibited **reduced serum phosphorus, FGF-23, and urinary phosphate excretion** compared with a meat-based diet of an equivalent phos content¹
- Even partial replacement of animal-based protein with plant-based protein resulted in **decreases of serum phos** in patients with CKD²
- CKD 3-4, fed an omnivore diet with 70% plant protein for 4 weeks and urine phos decreased 215 +/- 232mg/d (p<0.001); **28% reduction** (note a 46% reduction with the previous 100% plant diet)³
- Finnish balance study on 3 'healthy' groups: animal: 70% animal/30% plant, & 50/50 animal/plant, and plant: 70% plant/30% animal and **urinary recovery of iPhos was 64%, 62%, and 54% respectively**. Of note: bone turnover markers were increased in the plant group - it was assumed to be associated with reduced intakes of calcium and vitamin D⁴
- It is suggested plant-based nutrition **decreased phos by ~50%** and this may be over-estimated.⁵ Of utmost importance, the consumer and patients need education on plant-based nutrition and to recognize the dangers processed foods present.

1. Moe et al. *Clin J AM Soc Neph* 2010
2. Azadbakht et al. *J Ren Nutr* 2009
3. Moorthi et al. *Am J Neph* 2014
4. Itkonen et al. *JN* 2021
5. Calvo & Uribarri *Adv Nutr* 2021

Potassium: individualize

“Adults with CKD 3-5D and post- transplant: adjust dietary potassium intake to maintain serum potassium within the normal serum range”¹

- Potassium derived from plants promotes intracellular potassium distribution (alkaline and insulin stimulating), and fecal excretion of potassium due to the natural fibers found in plant-based diets²
- Growing evidence: plant-based/DASH/Mediterranean diets in persons with eGFR of 30–59 ml/min per 1.73 m² may delay progression to ESKD and dialysis and may potentially improve survival³

PRO TIP: Fiber increases stool quantity and frequency, which when excreted facilitates potassium excretion



1. Ikizler et al. *AJKD* 2020
2. St-Jules et al. *J Ren Nutr* 2016
2. Clegg et al. *Clin J Am Soc Nephrol* 2019

Uncovering Concerns of Hyperkalemia



Concerns of hyperkalemia are overinflated; though plant-based items are commonly the cause: juices, sauces, dried fruit¹ though it's important to note the variance of fiber which impacts both the content and absorption



As an aside, the top “5” sources of K⁺ in our patient's diets are beef, chicken, Mexican food, hamburgers, and legumes²



Meats are typically absent from high-potassium food lists despite containing more than the ‘cutoff’; e.g. 3.5oz pork chop = 387mg compared to a kiwi = 312 mg³



Consider non-dietary factors such as prolonged fasting, hyperosmolality, metabolic acidosis, tissue breakdown, constipation, and medications⁴

1. te Dorsthorst et al. *Eur J Clin Nutr* 2018
2. Noori et al. *AJKD* 2010
3. St-Jules et al. *J Ren Nutr* 2016
4. Pani et al. *Sem Dial* 2014

Dysgeusia

- Common in CKD, contributor to poor adherence to recommended dietary intake, decreased QoL, often resulting in protein energy wasting (PEW)
 - Changes in taste acuity, impaired detection of salty tastes, or a metallic taste¹
 - Alteration in taste: neglected symptom of CKD²
- Combative approaches: correction of imbalances, toxins, deficiencies, use of a more alkali diet may alleviate symptoms.³
- Avoid trigger foods, mild or plain foods, cold foods, oral hygiene
- May need temporary use of oral nutrition supplements (ONS).



1. Fitzgerald et al. *Chem Sense* 2019
2. Brennan et al. *J Ren Nutr* 2020
3. Stegeman & Boyd 2008

Meal Replacements (“ONS”)

Caution with Protein:

- CKD Stage 3-5 non-dialysis
 - Adeq kcals/low protein
- CKD on dialysis
 - Adeq kcals & protein

Common proteins in plant-based ONS:

pea protein, rice or grain protein, sprouted beans or seed proteins, hemp protein, and more

Pea Protein:

- Contains all essential AA, rich in Fe, GF
- Low in fiber overall (less ‘gas’, bloating), source of soluble fiber (heart benefits)
- Pea protein powder may have higher Na (trade off clean extraction vs chemicals), low in methionine, but rich in arginine, and higher leucine content than soy protein
- Easy to mix & digest

TO-DRINK SHAKES				
Product Name ¹	Organic Nutrition [™] Vegan Nutritional Shake	Organic Nutrition [™] Vegan Nutritional Shake	Kids Plant Protein [™] Organic Nutritional Shake	Kids Plant Protein [™] Organic Nutritional Shake
Flavor	Smooth Chocolate	Vanilla Bean	Chocolate	Vanilla
Serving Size	11 FL OZ (330 mL)	11 FL OZ (330 mL)	8 FL OZ (237 mL)	8 FL OZ (237 mL)
Calories (kcal) ²	240	230	200	200
Protein (g) ³	16	16	8	8
Phosphorus (mg) ⁴	110	100	140	140
Potassium (mg) ⁵	290	120	220	90
Sodium (mg) ⁶	270	260	190	190



BARS					
Product Name ¹	Organic Protein [™] Snack Bar	Organic Protein [™] Snack Bar	Organic Protein [™] Snack Bar	Organic Protein [™] Snack Bar	Organic Protein [™] Snack Bar
Flavor	Peanut Butter Chocolate Chunk	Peanut Butter	Chocolate Chip Cookie Dough	Chocolate Brownie	S'mores
Serving Size	1 Bar (40g)	1 Bar (40g)	1 Bar (40g)	1 Bar (40g)	1 Bar (40g)
Calories (kcal) ²	150	150	150	150	150
Protein (g) ³	10	10	10	10	10
Phosphorus (mg) ⁴	24	44	5	16	6
Potassium (mg) ⁵	60	70	0	100	0

Table 1. Protein Digestibility-Corrected Amino Acid Scores (PDCAAS) for Selected Foods^{25,26}

Food	PDCAAS
Egg	1.00
Cow's milk	1.00
Beef	0.92
Soy protein, concentrate	0.99
Chickpeas (canned)	0.71
Pea flour	0.69
Kidney beans (canned)	0.68
Pinto beans (canned)	0.63
Rollled oats	0.57
Black beans (canned)	0.53
Lentils (canned)	0.52
Peanuts	0.52
Wheat	0.42



Insidious Barriers to plant-based nutrition: Beyond the scope



Put the plants together = Balanced Nutrition

Table 3. A Practical Guide for the Inclusion of Plant-Based Foods in Patients With Kidney Disease

	Rationale
Daily Servings of Food Type	
2-4 servings of fruits	Unprocessed or minimally processed plant foods are the foundation of many healthy eating patterns due to their low caloric density, healthy fat content, fiber content, and high content of vitamins, minerals, and antioxidants. For patients with kidney disease, these foods tend to be low in sodium, have limited phosphate bioavailability, and have plant proteins, which may reduce hyperfiltration and uremic toxin production.
5+ servings of nonstarchy vegetables	
2+ servings of whole grains and starchy vegetables*	
3+ servings of legumes	
2-3 servings of nuts and seeds	
Foods to Exclude	
Fruit juices, vegetable sauces	Increase the rate of potassium ingestion (dried fruit may carry a similar risk); lack fiber; often prepared with added sugars.
Highly processed foods	Often contain added sodium and phosphorus. Calorically dense and nutritionally poor.
Meat	May worsen blood pressure, associated with adverse kidney-related outcomes, higher phosphate bioavailability.
Dairy	Higher phosphate bioavailability, calorically dense.

Data from Hever and Cronise.³⁰

*Starchy vegetables are grouped with whole grains given their similar calorie density.

The “How to” transition to PB:

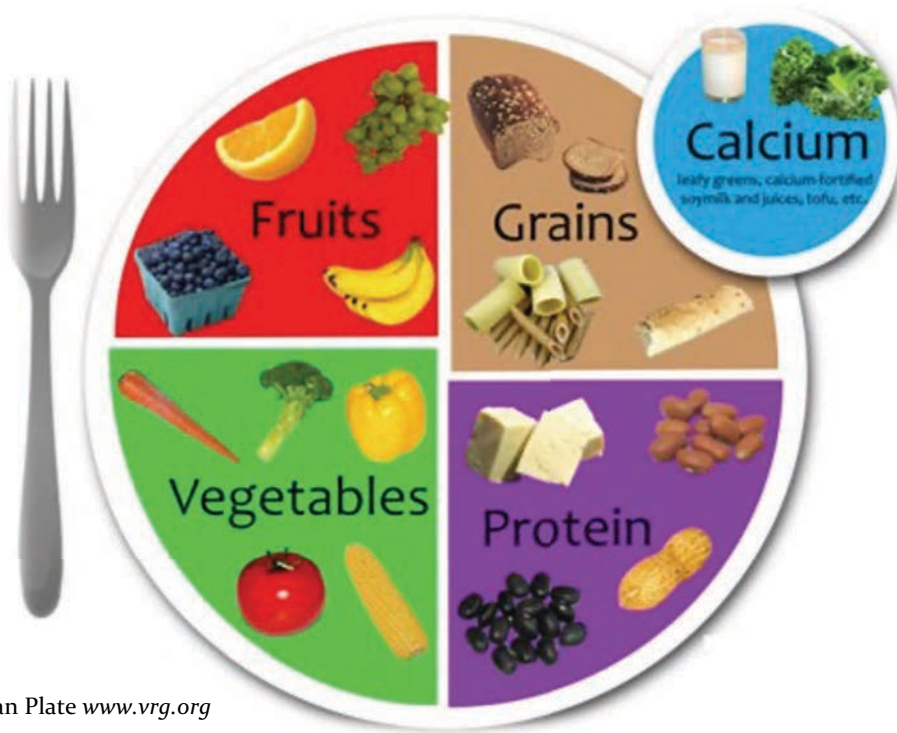
- Start gradually: 1 PB meal per week
- Gradually increase to a PB meal per day
- Monitor biochemical outcomes and adjust: request patients to record intake/serving sizes if discrepancies are noted
- Incremental changes are easier to manage
- Adapt familiar recipes instead of reinventing.

Even small incremental increases in F+V are highly beneficial!

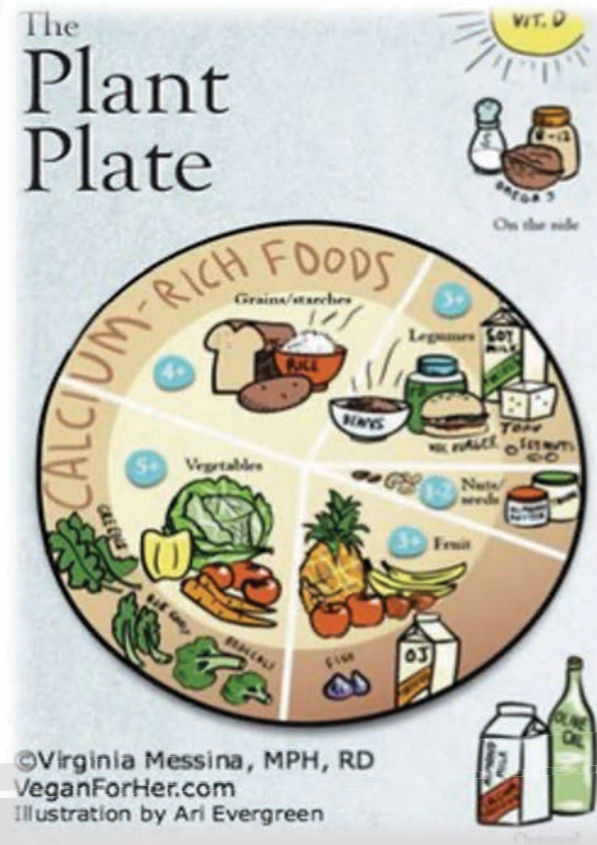
PRO TIP: Education on portion sizes = servings

What exactly can I eat?

Teaching Tools: Food Guides



My Vegan Plate www.vrg.org



The Plant Plant Virginia Messina, MPH, RD



The Vegan Plate RDs Brenda Davis & Vesanto Melina

Tools: the plant-based menu

Food Group, Servings/day	Servings per day: CKD	Sample Foods & Serving Size	Notes
Fruit 4+ servings	2 - 4 servings	1/2 c fruit juice* 1/4 c dried fruit* 1 med piece of fruit (4 oz) 1/2 cup fruit	These are sweet treats and enjoy the full array of colors!
Vegetables 5+ servings	5+ servings nonstarchy; 2+ servings starchy	1/2 c juice* 1/2 c cooked veg 1 c raw leafy veg	Choose a vast color selection: purple, blue, green, yellow, orange, red, and white
Grains 3+ servings	2+ servings	1/2 c cooked rice, pasta, quinoa, cereal, grains 1/2 c raw sprouted quinoa, buckwheat, other grains 1 slice bread 1 oz ready-to-eat cereal	Choose whole grains as often as possible. The servings are flexible to meet energy needs
Beans/Legumes 3+ servings	3+ servings	1/2 c lentils, beans, peas, tofu, tempeh 1 c raw peas or sprouted lentils or peas 1/4 c peanuts 2 T peanut butter 1 oz meat alternative**	Powerhouse of protein and micronutrients, including iron, zinc. Include at most meals
Nuts & Seeds 1+ servings	2-3 servings	1/4 c nuts & seeds 2 T nut or seed butter	Contribute to protein, micronutrients, fats, and can be a good source of omega-3

Calcium-rich foods: figs, bok choy, kale, broccoli, black or white beans, almonds, tahini

* limit servings with CKD

** need to check labels for hidden fat & preservatives

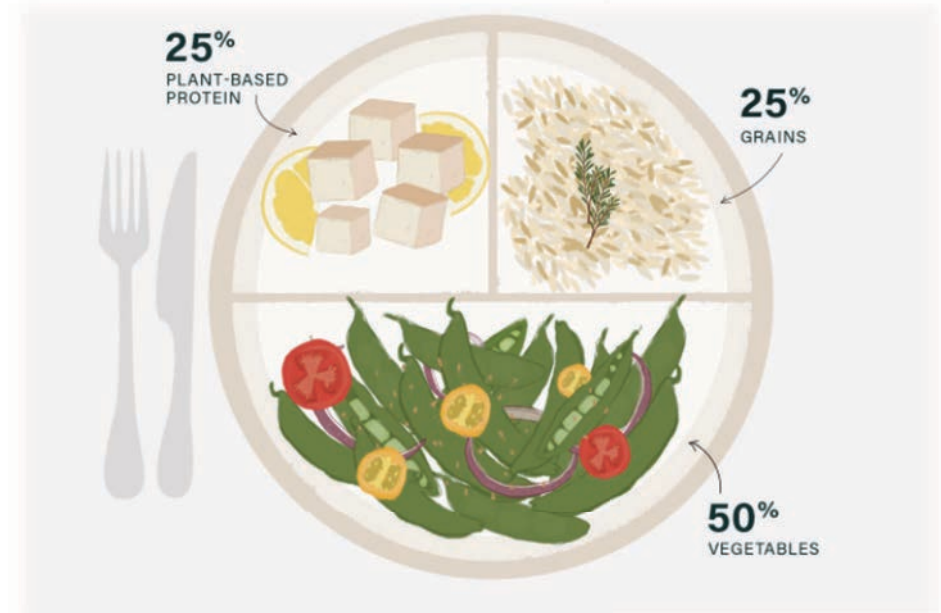
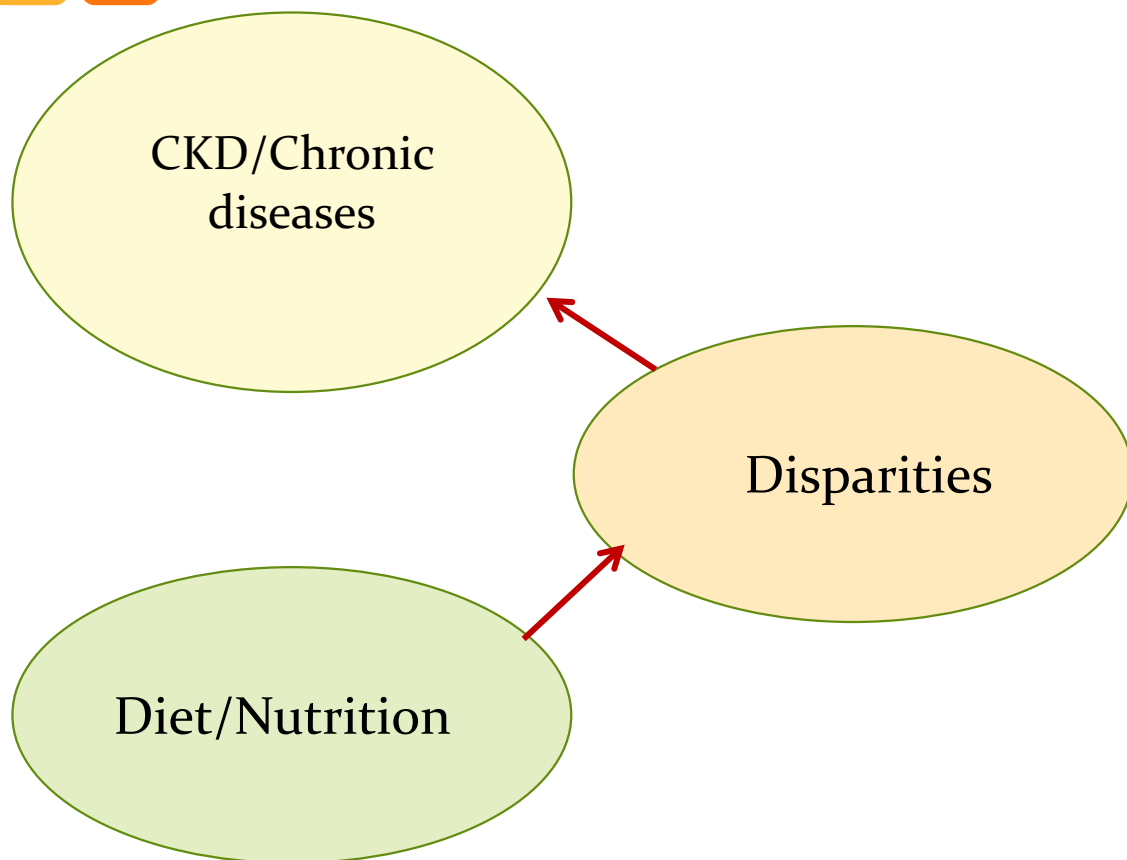


Photo: W+G Creative

Keep it simple:
Use the 50-25-25 Rule for meal plans!



Diet is a key contributor to disparities in many chronic diseases¹

Contributors to diet-related disparities: Social inequality, Demographics, Psychosocial factors, Environmental influences, Cultural preferences

Nutrition education & intervention: Be versatile, innovative; adapt & tailor to the recipient

Partner:

- Local food banks & farmers markets
- Community gardens
- Community-based centers
- Advocate for policies to dismantle health inequities
- Individually: Screen for food insecurity, avoid a standard “healthy plate”, individualize interventions to include healthy traditional cuisines.

Think Inclusive: traditional cuisines

Consider: Cost & availability, Access, Ease of preparation & storage.



Vegetarian Nutrition Dietetic Practice Group has developed Culture Plates and Culture Kitchen education tools!

1. <https://www.vndpg.org/idea/culture-plates>



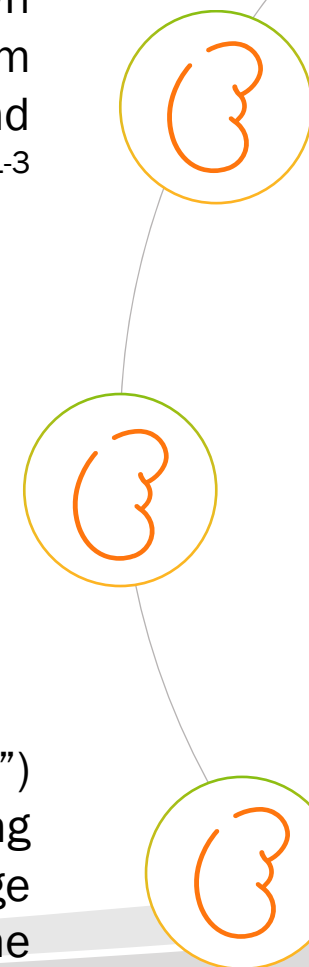
Readiness to change

Plant-based diets are not only adequate, but safe for patients with CKD

Acceptability of plant-based diets is shown in a variety of studies ranging from diabetes to cardiac disease and premenopause¹⁻³

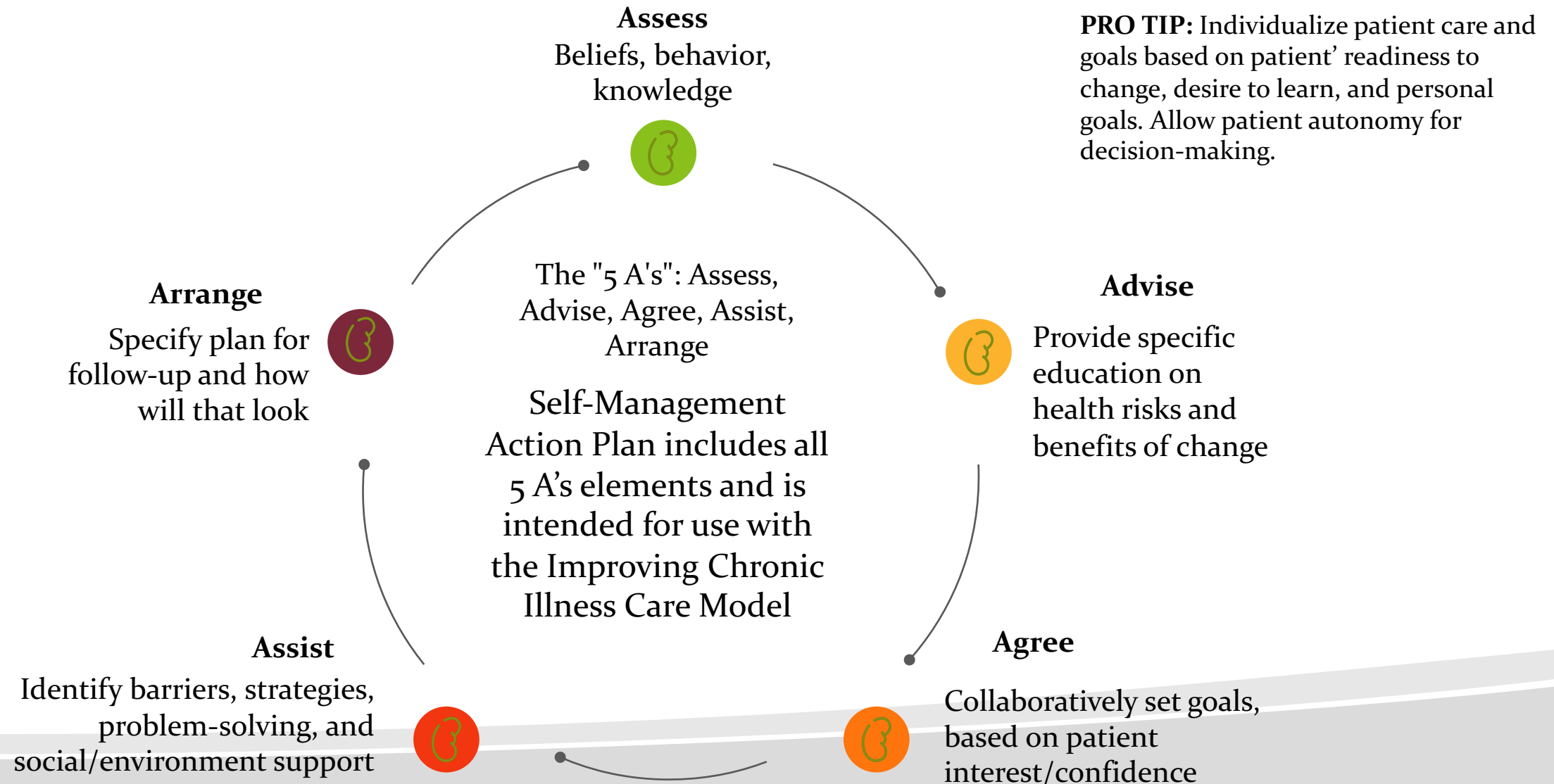
The first step in change is to **desire** the change, **commit** to change and establishing **goals** – even small goals

Five major steps to intervening (the “5 A’s”) are a useful strategy in identifying willingness and appropriate change behaviors to incorporate based on the patient’s willingness or readiness to change



1. Barnard et al. *Am J Clin Nutr* 2009
2. Barnard et al. *J Cardiopulm* 1992
3. Barnard et al. *J Nutr Educ* 2000

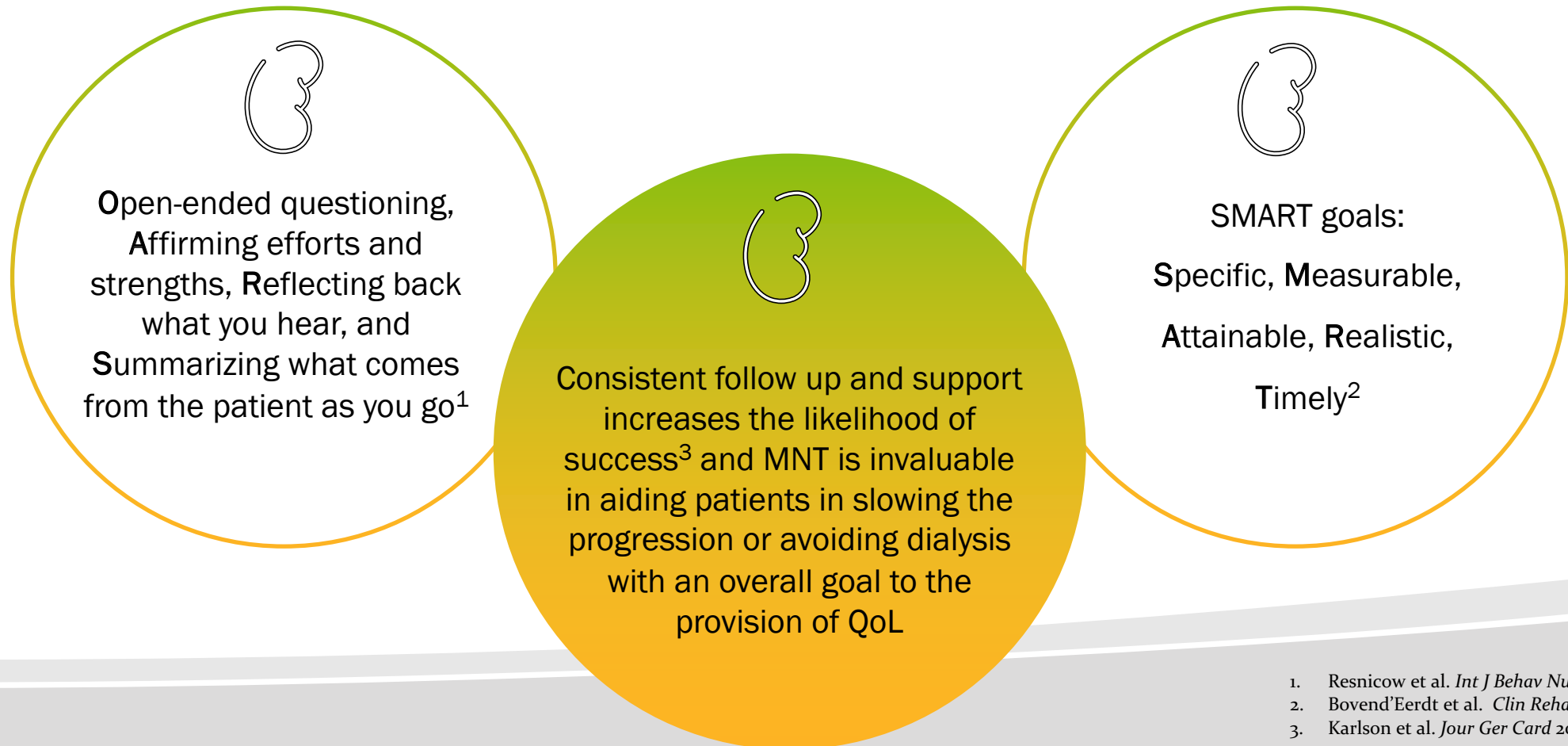
The “5 A’s”: patient-centered care





Tools for intervention

The Motivational Interviewing (MI) approach with OARS



1. Resnicow et al. *Int J Behav Nutr Phys Act* 2012
2. Bovend'Eerd et al. *Clin Rehab* 2009
3. Karlson et al. *Jour Ger Card* 2017



Take Away Messages



- A LPD consisting largely of plant-based protein is kidney protective and readily provides the body with sufficient protein.
- Plant-based nutrition has beneficial effects on the gut microbiome and lends to a reduction of uremic toxins known to promote CKD
- Plant-based nutrition can be incorporated into the new guidelines considering the bioavailability of minerals and this enhances further education opportunities for Dietitians/Nutritionists
- Consider a multifactorial global approach of both the disease status and of disparities when individualizing nutrition care.
- Implementation of a plant-based nutrition care plan is proven to make dietary impact in slowing the progression of CKD though needs to be patient-driven to enhance patient QoL.

Thank you: Questions!

AnnaMarie Rodriguez, RDN, LD, FAND

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