Nutrition Priorities for Stage 2-3 CKD

Clarifying MNT for early kidney disease management

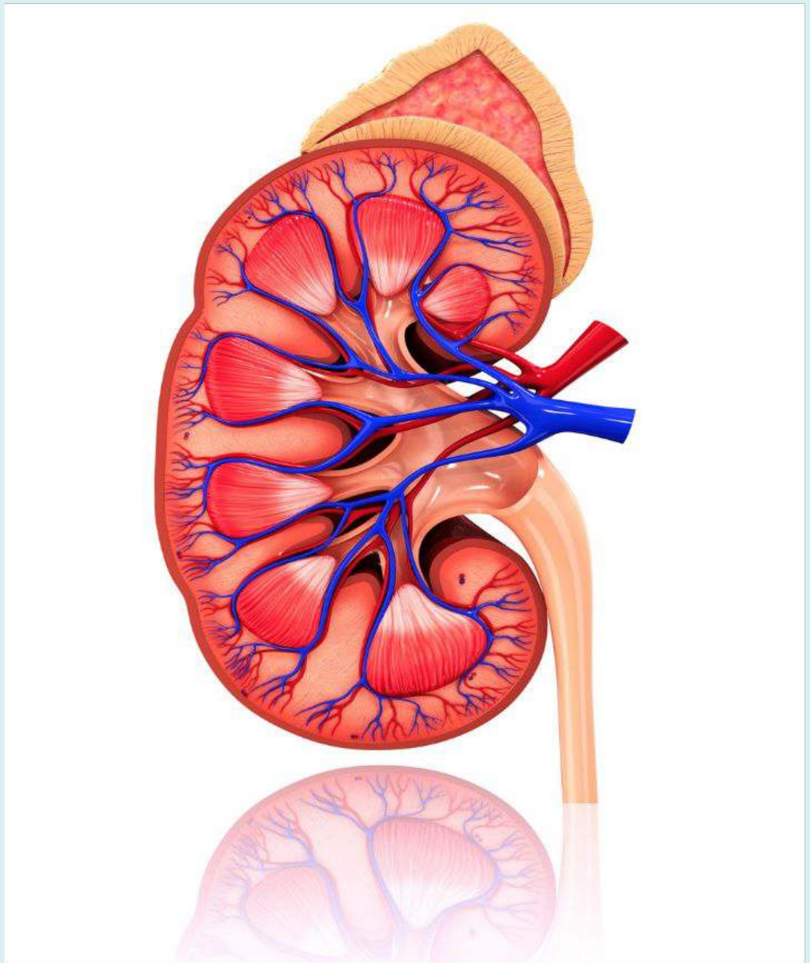
Lindsey Zirker, MS, RD
Kidney Nutrition Institute

Disclosures

Consultant for Kidney Nutrition Institute

Objectives

- Explain the pathophysiologic mechanisms of CKD progression that influence nutrition priorities in stages 2–3.
- Differentiate evidence-based MNT strategies for early-stage CKD from those used in advanced CKD or dialysis.
- Apply appropriate nutrition interventions and referral criteria to support patients with stage 2–3 CKD in clinical practice.



CKD pathophysiology

The spectrum of CKD[1]

Dysfunction

Normal GFR, acute kidney injury

Disease

CKD<60 OR other factors

Failure

GFR<15

Diagnosis of Kidney Disease[1]

Chronic kidney disease is defined as either kidney damage or a GFR of less than 60 for at least 3 months

In stages 1-2, decreased GFR plus one or more of the following factors is used to determine a CKD diagnosis:

- Albuminuria (albumin excretion of >30mg/ 24 hours or albumin creatinine ratio>30mg/mmol)
- Urine sediment abnormalities
- Electrolyte and other abnormalities due to tubular disorders
- Histologic or structural abnormalities (biopsy, ultrasound, CT scan, MRI)
- History of kidney transplantation
- Genetic testing revealing kidney disease (PKD)

Glomerular Filtration Rate[2]

- An ESTIMATE of average filtration rate of individual nephrons x the number of nephrons in the kidneys
- “Normal” GFR varies with age, sex, body size, physical activity, diet and pharmacologic therapy
- Equations use age, sex, body surface area and creatinine or cystatin C.
- Assumes a “normal” amount of muscle mass

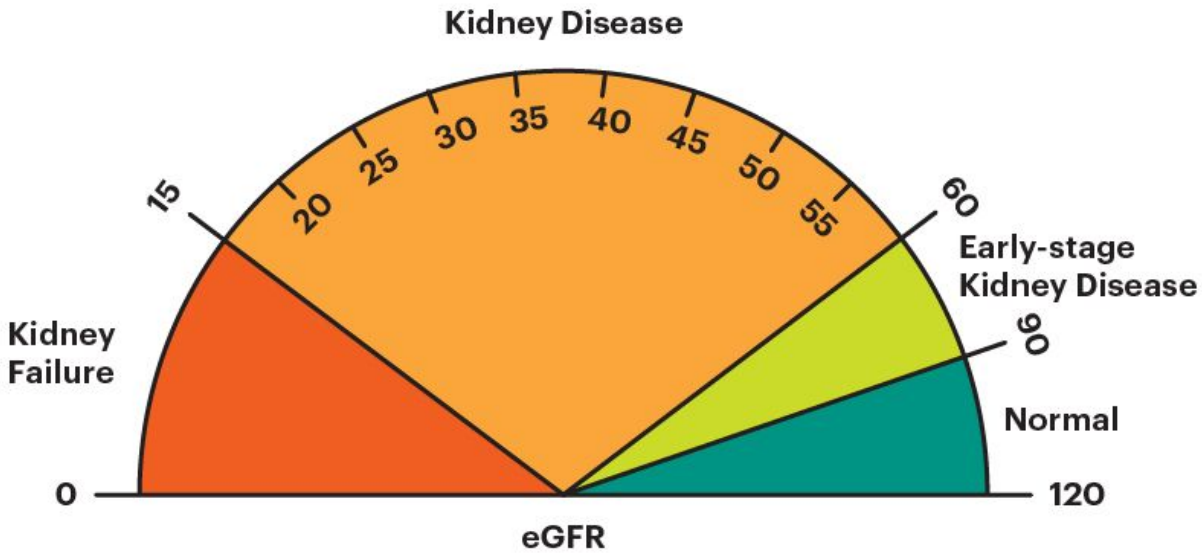


Figure 1. GFR and Kidney Disease[3]

"Normal" GFR based on age[3]

AGE (years)	AVERAGE ESTIMATED GFR
20-29	116
30-39	107
40-49	99
50-59	93
60-69	85
70+	75

Creatinine VS Cystatin C for estimating GFR[2,4]

Creatinine Pros

- Widely available, fast, inexpensive

Creatinine Cons

- Impacted by dehydration, changes in muscle mass, not accurate for those with higher weight or PKD, can be degraded by gut bacteria or impacted by medications. Not accurate for GFR>60

Cystatin C Pros

- May be able to detect glomerular damage sooner that creatinine, not impacted by hydration

Cystatin C Cons

- Impacted by inflammation, weight, diabetes, thyroid disease, more costly, slower results, not accurate for PKD

2024 KDIGO Guidelines for CKD Evaluation and Management: use both with albuminuria!

Proteinuria vs albuminuria[5]

- Proteinuria= elevated presence of protein in the urine (above 150mg/d)
- Albuminuria= abnormal loss of albumin through the urine
  - Earliest indicator of glomerular diseases (such as diabetic glomerulosclerosis)
  - Albuminuria with or without a reduction in eGFR lasting >3 months = kidney damage
- Spot urine albumin-to-creatinine ratio is the preferred method of assessing, however you will get ALL kinds of protein urine assessments :)

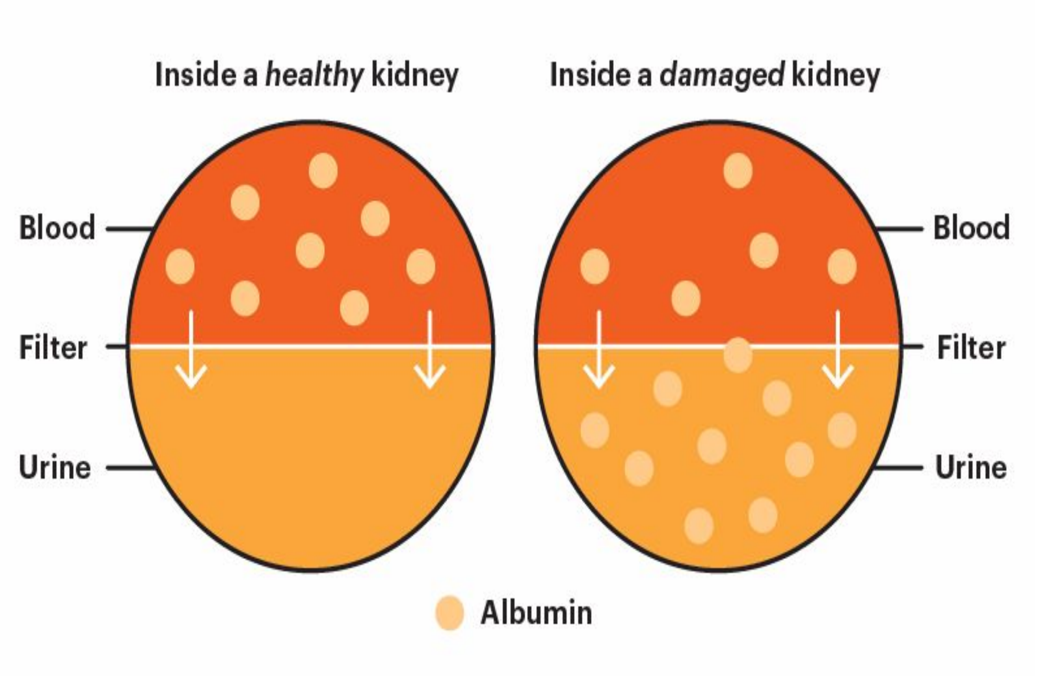
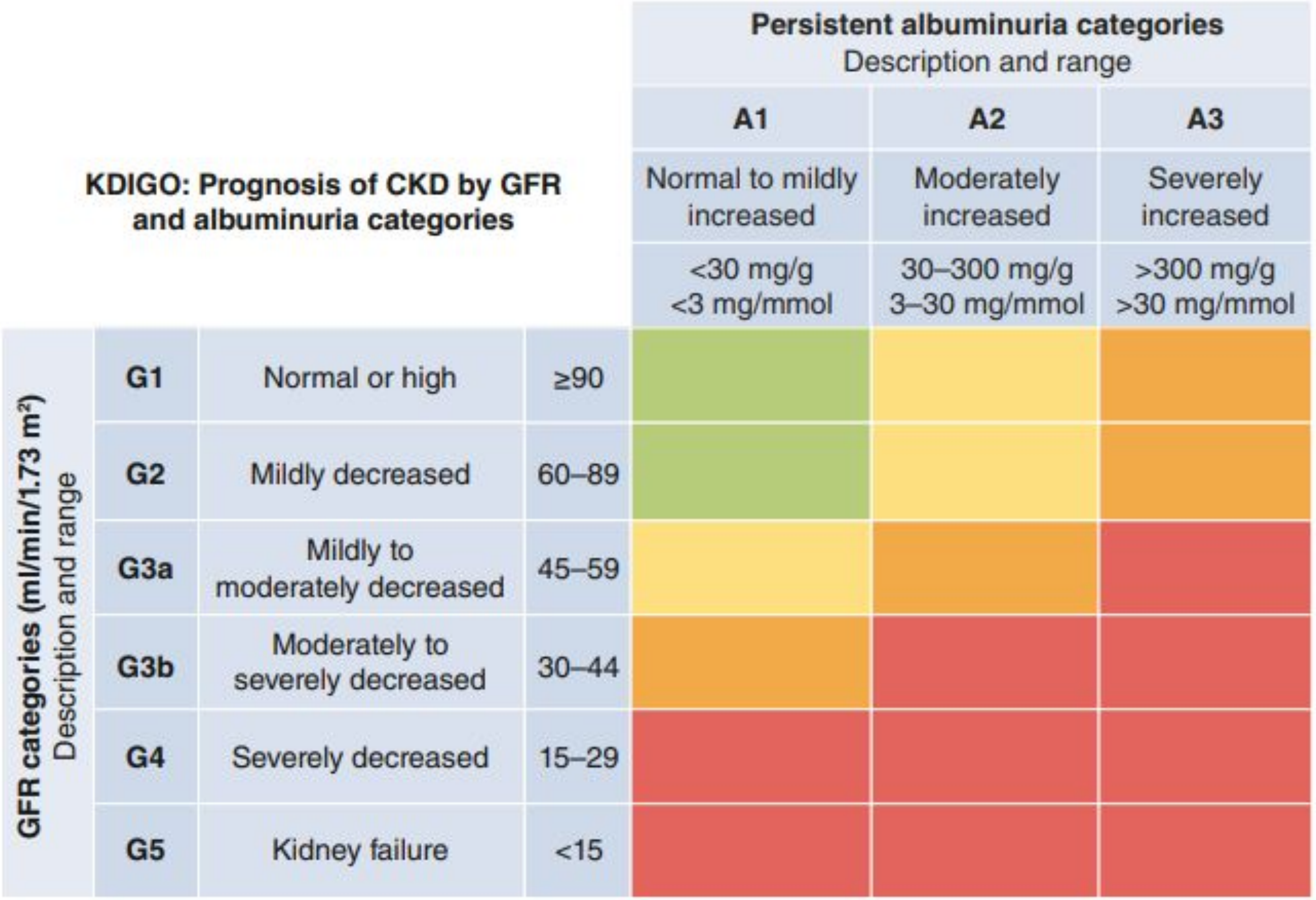


Figure 2. Protein in the urine[3]



KDIGO: Prognosis of CKD by GFR and albuminuria categories				Persistent albuminuria categories Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30–300 mg/g 3–30 mg/mmol	>300 mg/g >30 mg/mmol
GFR categories (ml/min/1.73 m²) Description and range	G1	Normal or high	≥90			
	G2	Mildly decreased	60–89			
	G3a	Mildly to moderately decreased	45–59			
	G3b	Moderately to severely decreased	30–44			
	G4	Severely decreased	15–29			
	G5	Kidney failure	<15			

Green: low risk (if no other markers of kidney disease, no CKD); Yellow: moderately increased risk; Orange: high risk; Red: very high risk. GFR, glomerular filtration rate.

Figure 3. Prognosis of CKD by staging and albuminuria[4]

Takeaways

Keep GFR in context:

- Consider other factors impacting accuracy
    - Would creatinine or cystatin C be more accurate for your patient?
- Consider trends of GFR
- Look at albuminuria

Educate your patients so they can focus on the real priority

Don’t treat all patients with CKD like they have kidney failure or will have kidney failure

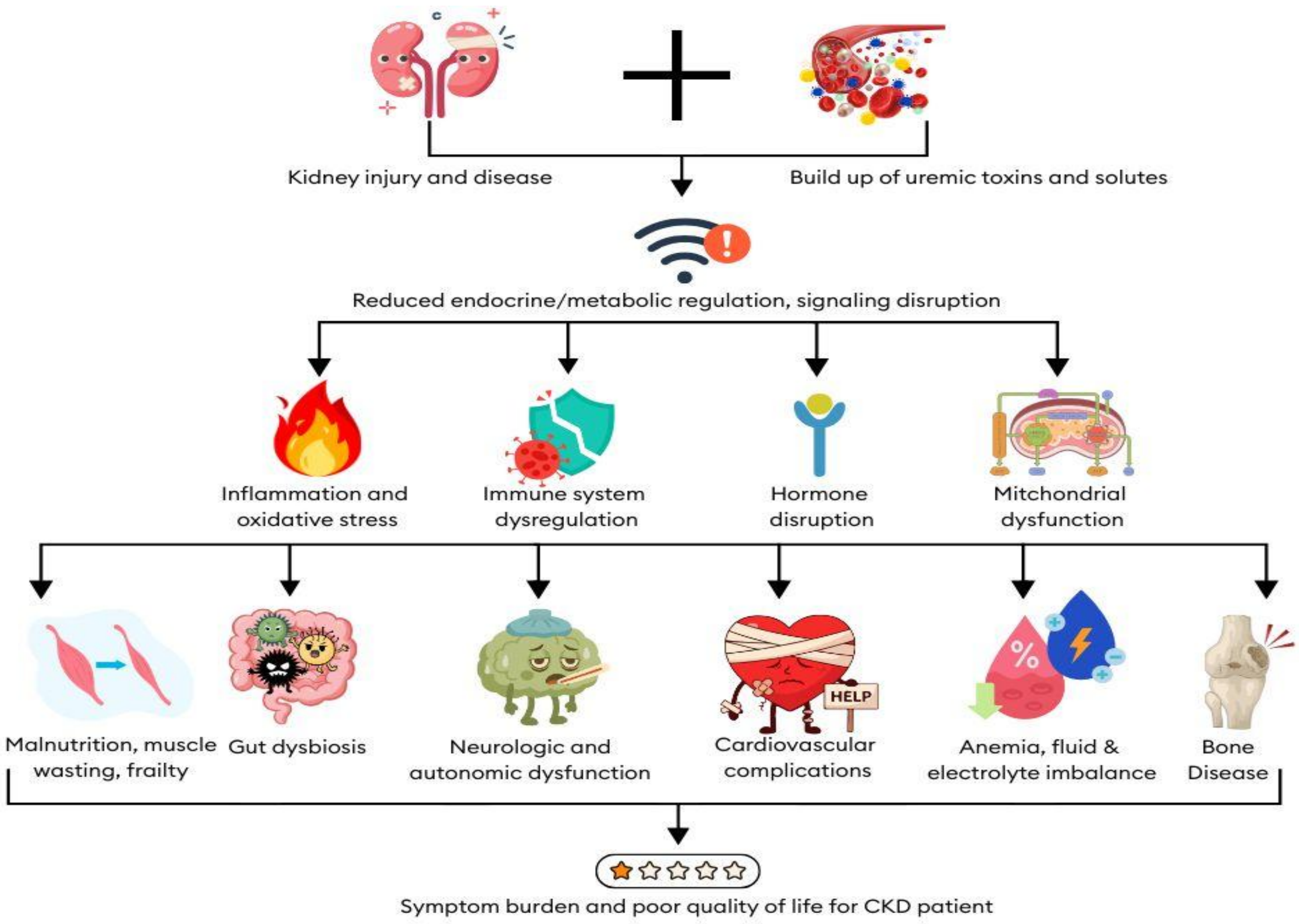
- Nutrition needs are different!
- The term “pre-dialysis” is not appropriate to use for stage 2-5 CKD patients not on dialysis

MNT for early CKD

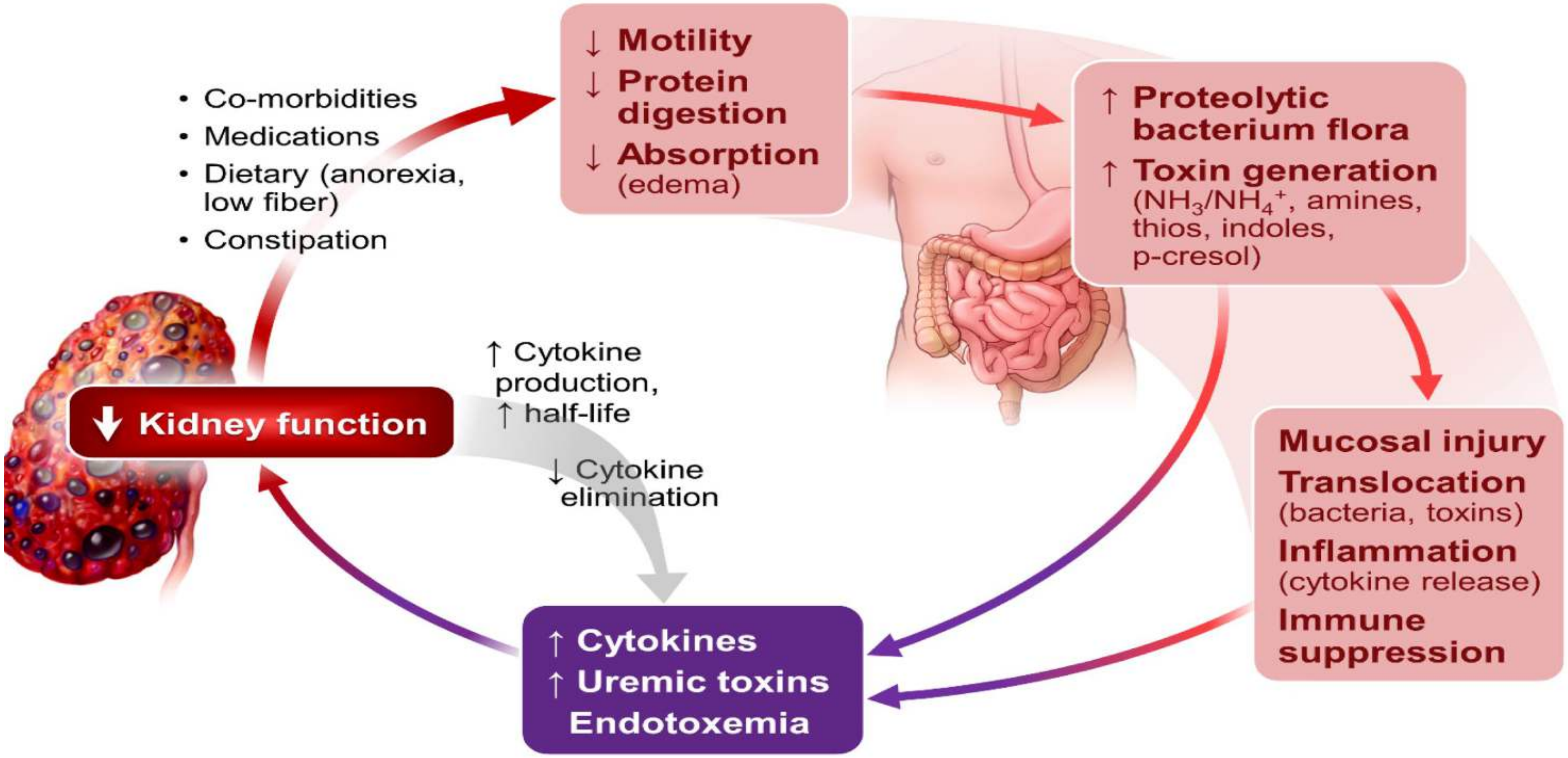
What is the goal of MNT in early CKD?[6]

- Individualizing care by assessing the patient
- Addressing modifiable risk factors
- Slow CKD progression
- Goals are to “optimize nutritional status, and to minimize risks imposed by comorbid conditions and alterations in metabolism on the progression of kidney disease (1C) and on adverse clinical outcomes (OPINION).”[7]

The systemic effect of CKD[6-9]



Kidney Gut Axis[10]



Modifiable risk factors for CKD[4,11,12]

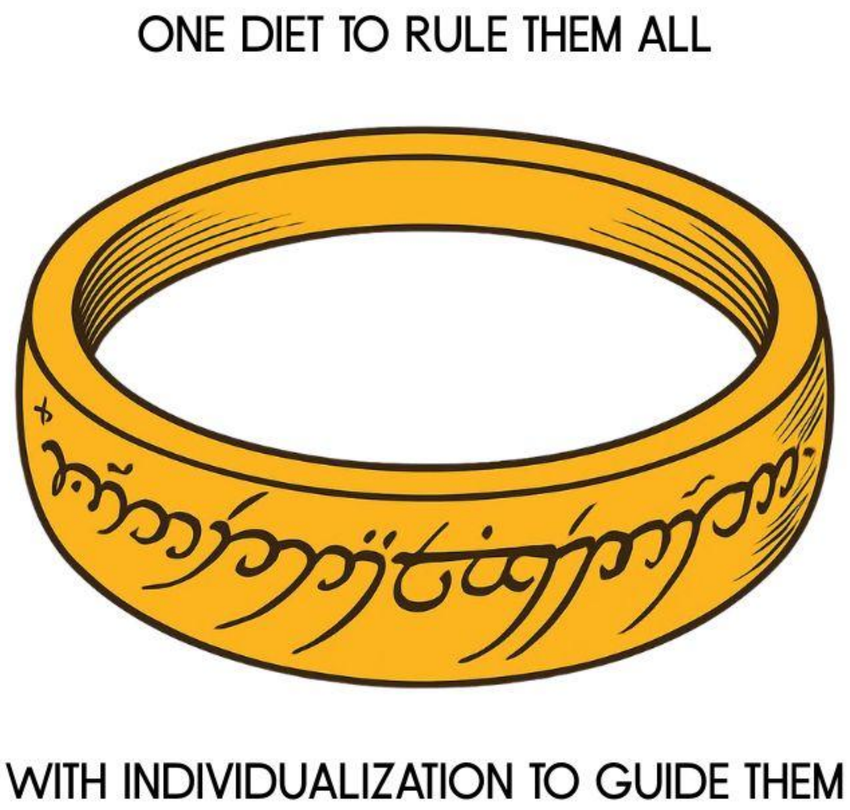
CVD	Diabetes	HTN	Multi-system/ chronic inflammatory conditions
Nephrotoxins	Obesity	Recurrent UTI or kidney stones	Smoking
	Thyroid disease	Vitamin D deficiency	

Traditional CKD diet[13-21]

- Blanket restriction of potassium, phosphorus, and sodium
- No consideration for diet quality/ nutrient density
- Individualization based on how closely the patient is following “the diet”
- Conflicting with longstanding cardiometabolic recommendations
- Weak evidence- at best- for dietary impact on serum potassium levels
- Low adherence by patients (is it even a viable option?)

No more siloed diets: 1 diet with individualization![14,21,23-25]

- The reality: people with chronic disease often have more than one
- Common "healthy" diet patterns and lifestyle changes improve outcomes for most chronic diseases
- Individualizing based on a comprehensive nutrition assessment is key



Systematic reviews on protein

- 2020 Cochrane Review: very low protein diets probably reduce the number of people with CKD 4 or 5, who progress to ESKD in non-diabetic patients.[26]
- 2023 Cochrane Review: Because there were insufficient data and difficulties in adherence to such a low protein diet, we are uncertain whether a low protein diet slows the progression of kidney disease for people with DKD not on dialysis. [27]

2020 KDOQI, 2024 KDIGO protein guidelines [4,14]

- 3.0.1 CKD 3-5 (metabolically stable) with close clinical supervision, to reduce risk for end-stage kidney disease (ESKD)/death (1A) and improve quality of life (QoL) (2C): **0.55–0.60 g /kg, or 0.28–0.43 g /kg with keto acid/amino acid analogs** to meet protein requirements (0.55–0.60 g/kg)

- 3.0.2 CKD 3-5 with diabetes, with close clinical supervision: **protein 0.6-0.8 g/kg** to maintain a stable nutritional status and optimize glycemic control (OPINION).

- 3.3.1.1: We suggest maintaining a protein intake of **0.8 g/kg** with CKD G3–G5 (2C)

- 3.3.1.1: Avoid high protein intake **(>1.3 g/kg)** in adults with CKD at risk of progression.

- 3.3.1.2: In adults with CKD who are willing and able, and who are at risk of kidney failure, consider: under close supervision **protein 0.3–0.4 g/kg supplemented with essential amino acids or ketoacid analogs** (up to 0.6 g/kg body weight/d).

- 3.3.1.3: **Do not prescribe low- or very low–protein diets in metabolically unstable people with CKD**

- 3.3.1.5**: In older adults with underlying conditions such as frailty and sarcopenia, consider higher protein and calorie dietary targets**.

What about plant-based diets?

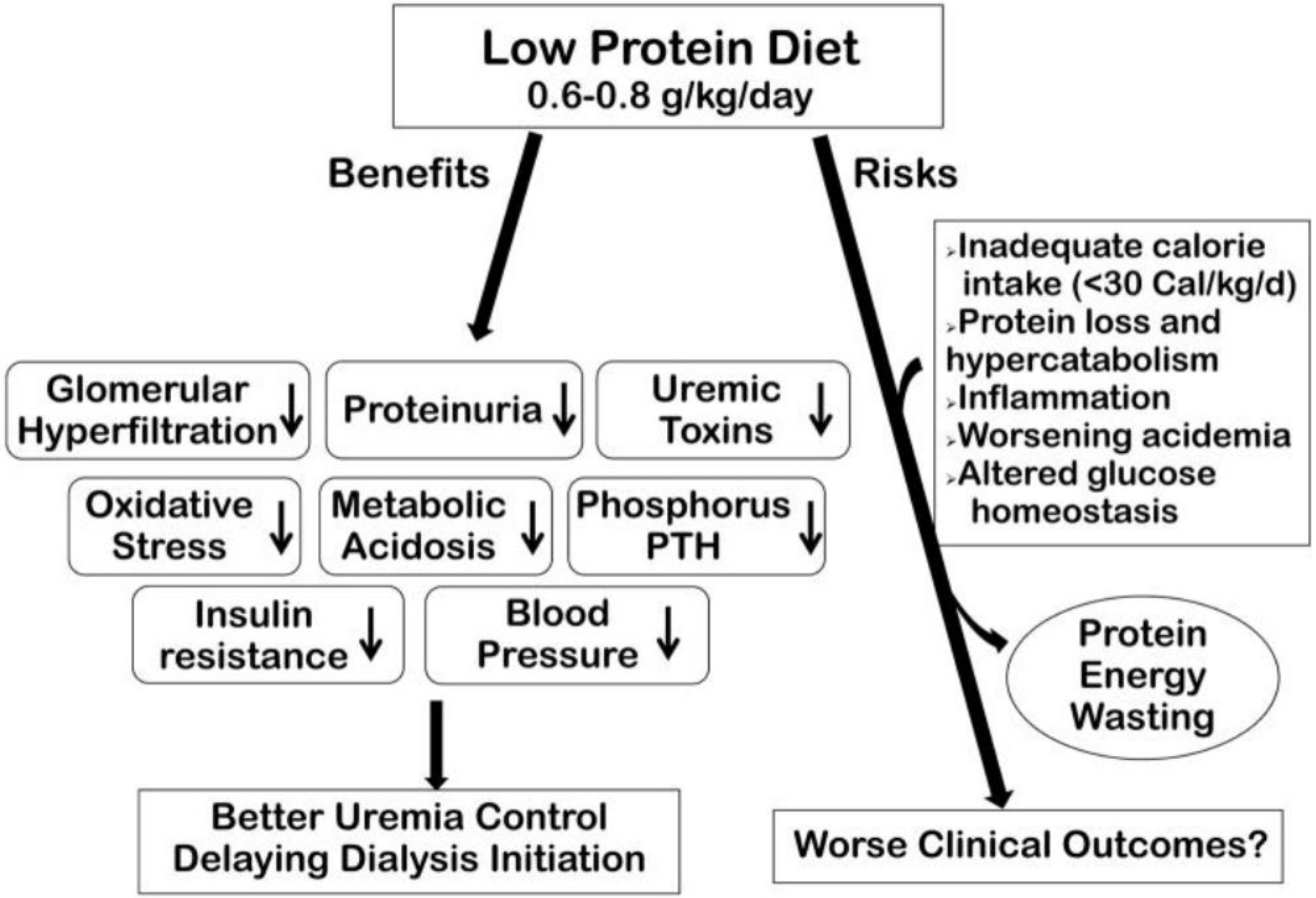
- Adopting PBD was significantly associated with 26% lower incidences of CKD. Higher intake of PBD showed a dose-dependent relationship with lower risk of CKD incidence and slower CKD progression. Unhealthy PBD may not confer renal protective effects compared to healthy PBD. [28]
- Many studies did not include patients with GFR> 60
- Types of CKD not considered (such as autoimmune)
- Significant nutrient gaps in PBD [29]

Micronutrient gaps in plant-based diets[29]

	RDA/AI		0.5 g Protein/kg/d					0.6 g Protein/kg/d				
Nutrient	Males	Females	LO	OM	VE	HPL	LPL	LO	OM	VE	HPL	LPL
Vitamins												
Vitamin A (μg)	**3,000**	2,333	7,991	7,503	8,108	7,256	7,282	8,168	7,590	7,708	7,260	7,459
Vitamin B1 (mg)	**1.2**	**1.1**	0.9	1.0	1.2	1.2	1.1	0.9	1.0	1.3	1.3	1.2
Vitamin B2 (mg)	**1.3**	**1.1**	1.7	1.0	1.4	1.5	1.4	2.0	1.2	1.4	1.5	1.6
Vitamin B3 (mg)	**16**	**14**	9	14	12	15	16	9	16	14	16	17
Vitamin B6 (mg)†	**5.0**†		0.9	1.1	1.0	1.4	1.4	0.9	1.3	1.2	1.5	1.5
Vitamin B12 (mcg)	**2.4**	**2.4**	1.9	2.0	1.6	3.0	2.7	2.7	2.8	0.6	3.3	3.9
Folate (mcg)	**400**		247	223	312	329	305	260	227	380	337	290
Vitamin K (mcg)	120*	90*	133	158	153	223	229	131	157	145	223	227
Biotin (mcg)	30*		26	9	19	11	10	31	10	30	11	12
Minerals												
Copper (mg)	**0.9**		1.0	0.9	1.5	2.5	1.1	1.0	1.0	1.7	1.4	1.2
Iron (mg)	**8**	**8-18**	8	8.7	11	13	14	8	8.7	12	14	15
Manganese (mg)	2.3*	1.8*	2.9	2.9	5.4	4.7	3.3	3.1	2.9	6.1	4.8	4.2
Selenium (mcg)	**55**		54	51	40	49	48	67	60	42	55	55
Zinc (mg)	**11**	**8**	5	5	6	7	5	5	6	7	7	6
Magnesium (mg)	**400-420**	**310-320**	202	172	289	296	200	212	182	330	310	273
Polyunsaturated fatty acids												
20:5 – EPA (g)	ND		0.00	0.10	0.00	0.0	0.05	0.00	0.14	0.00	0.06	0.06
22:6 – DHA (g)	ND		0.02	0.34	0.00	0.20	0.18	0.04	0.48	0.00	0.22	0.22
Omega-3 Fatty Acid (g)	0.6-1.2*		1.5	2.8	1.8	2.0	2.7	1.4	3.1	1.6	2.1	2.8
Omega-6 Fatty Acid (g)	5-10*		17	19	21	17	15	17	18	20	18	17
Other nutrients												
Choline (mg)	550*	425*	253	123	160	191	230	352	138	181	204	268
Fiber (g)	30-38*	21-25*	21	18	28	32	26	20	18	30	27	27

g, gram; LO, lacto-ovo vegetarian; μg, microgram; mg, milligram; ND, not defined; OM, omnivorous; PL, plant-dominate low protein (PLADO); VE, vegan.

The case for nourishment first [10]



Sodium/ blood pressure

- 2024 CKD management AND 2021 Blood pressure KDIGO guidelines: Sodium intake <2 g of sodium per day (2C) [4,30]

- 2020 KDOQI: <2.3g for blood pressure, volume control,(1C) proteinuria (2A), and body weight. (2B) [14]

- Blood pressure lowering effect of sodium – more effective when consuming a high potassium diet (3500-4700mg) [31]

- Inflammation, nitric oxide, sympathetic dysregulation are important pathways to consider for blood pressure [32]

Nephrotoxins

- Heavy metals- Cadmium, lead, mercury [35]
- Nephrotoxic medications and OTC drugs are commonly prescribed to CKD patients (NSAIDS, antivirals, omeprazole, immunosuppressants- often without any kidney function monitoring)[36]
- Herbs: Aristolochic acid, wormwood/ Artemisia [37]
- Aspergillus mycotoxins- Ochratoxin A [38]
- Industrial and environmental pollutants- glyphosate [39]
- Covid Vaccine/ infection [40,41, 56]

Obesity and CKD

- 2021 Cochrane Review: "All types of weight loss interventions had **uncertain effects on death and cardiovascular events** among overweight and obese adults with CKD as **no studies reported these outcome measures."** [42]
- Diet and lifestyle changes can reduce cardiometabolic risk independent from weight change [43]
- Significant bias and stigma in research and medical care [44,45]
- Weight loss interventions that reduce calorie intake without addressing underlying cause and assessing body composition are pernicious AND unethical [46,47]

Thyroid impact on CKD[48,53]

- GFR is ***reversibly*** reduced by about 40% in more than 55% of adults with hypothyroidism
- CKD patients have increased incidence of primary and subclinical hypothyroidism
- TSH alone is an inaccurate measure of thyroid function. T3 and T4 must also be assessed
- Several micronutrients needed for T4 to T3 conversion

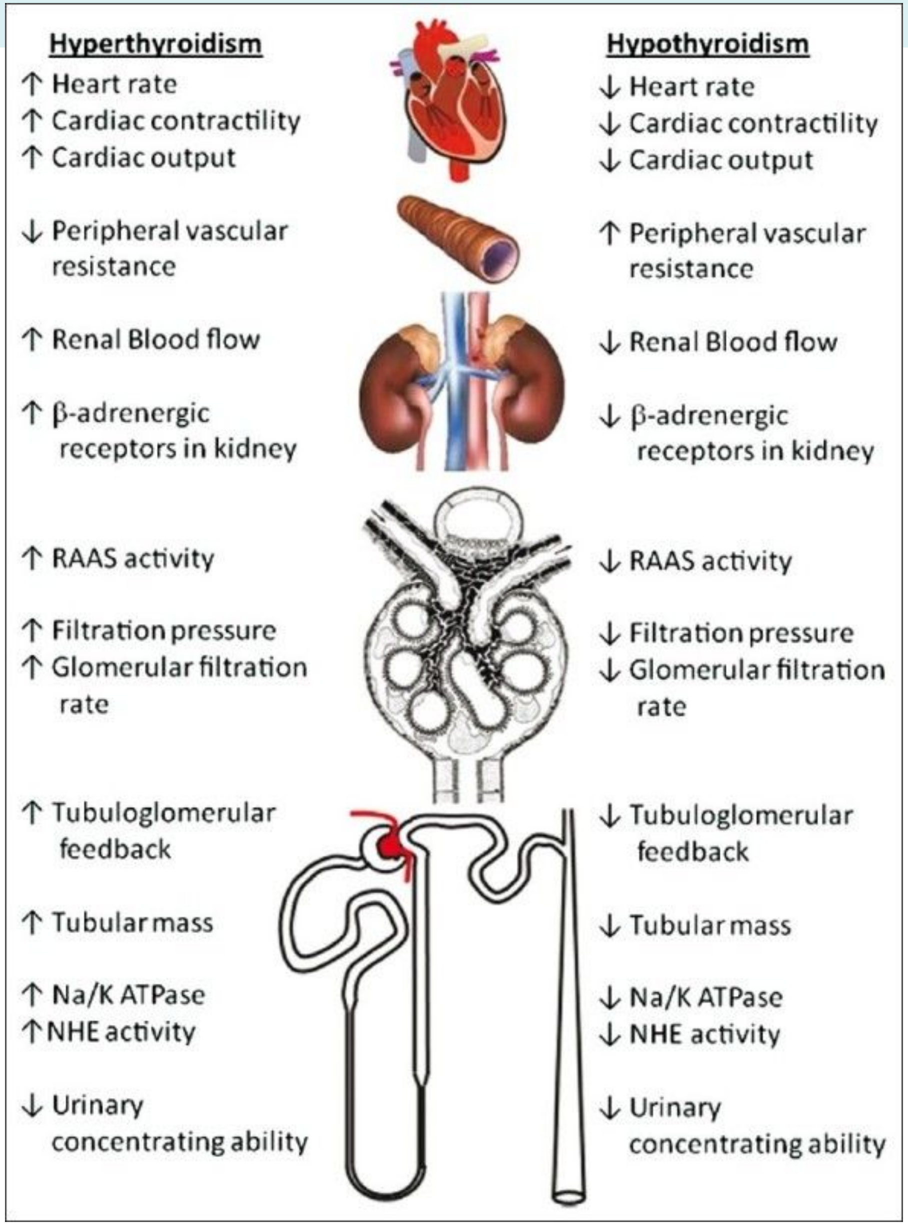


Figure 6. Thyroid impact on CKD[31]

Vitamin D Function[53]

- Calcium/ phosphate metabolism
- Immune and inflammation support
- Oxidative stress and mitochondrial function
- RAAS system and vascular health
- Red blood cell production and iron metabolism
- Gut barrier integrity, signaling to kidney
- Kidney fibrosis, proteinuria and glomerular barrier damage
- Hormone regulation

What the studies say about vitamin D

- Low levels of vitamin D are associated with CKD progression in DM patients[52]
- Associated with increased risk of CV mortality and CKD progression in patients with early-stage CKD[53]
- Studies supplementing vitamin D not showing changes in outcomes [54]
  - No one knows optimal vitamin D levels
  - Too many contributing factors
  - Supplementing in daily doses vs 1 large dose monthly or weekly seems to make a difference
  - Still LOTS to learn!
- Despite this- correcting vitamin D deficiency still recommended!

CKD considerations

- Healthy dietary and lifestyle patterns are appropriate for ALL stages of CKD when individualized
- No protein restriction for stage 2, might be helpful for stage 3
- No potassium restrictions
- Watch for nephrotoxins
- Endocrine and metabolic dysfunction in CKD increase the risk of low calorie and other diet restrictions causing worse outcomes
- Blood pressure is more than sodium
- Assess thyroid function (remember T3!!)
- Replenish vitamin D

When to refer to a CKD dietitian

- CKD specific MNT: VLPD, LPD, auto-immune CKD, PKD
- Foundational approaches haven’t improved outcomes/ met patient goals
- Patient needs/ goals are beyond your personal expertise
  - Gut health
  - Deep dive strategies like genetic snps or micronutrient functional testing
  - Toxins
  - Autoimmune
  - PKD

Takeaways

- Mono-therapy for CKD (or any chronic disease) is not effective- an approach that considers all dysfunctional aspects is essential
- Start with foundations that are proven across the spectrum of chronic disease
- Individualize recommendations based on patient risk factors, conditions, symptoms, goals and resources
- Refer out when patient goals/ needs no longer match your expertise

Questions?

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