Nutrition Management for Kidney Disease

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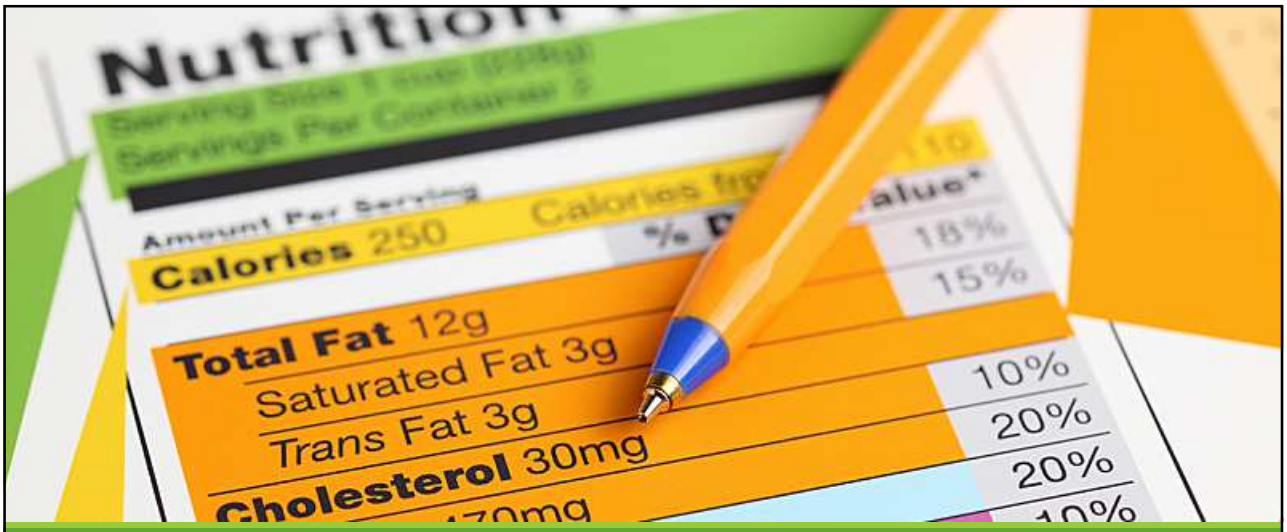
Introduction

- Nutrition Needs for CKD
- Nutrition Concerns related to:
  - Bone and Mineral Disease
  - Malnutrition / Protein Energy Wasting
- Nutrition Supplements

Objectives

- Review the nutrition needs for people with kidney disease
- Discuss nutrition concerns for people on dialysis
- Understand the elements of Bone and Mineral Metabolism
- Comprehend dietary impact on BMM
- Identify causes of malnutrition and protein energy wasting
- Review nutritional supplements related to dialysis



Nutrition Management for Kidney Disease

Nutrition Needs: CKD (Stage 4)

- Protein: 0.8 g/kg; avoid high protein intake >1.3 g/kg
- Energy: 25-35 kcal/kg
- Sodium: <2000 mg
- Potassium: Unrestricted unless K+ is high
- Phosphorus: 800-1000 mg/d; maintain blood PO4/PTH WNL
- Calcium: DRI; maintain serum calcium WNL
- Fluids: Usually unlimited

Nutrition Needs: CKD (Stage 4) continued

Vitamins	Supplement water-soluble vitamins at DRI including:
	Folate
	B-6 (pyridoxine)
	B-12 (cobalamin)
	Biotin
	Monitor Vit D status and supplement as indicated

Nutrition Needs: Hemodialysis

- Protein: 1.2 g/kg for stable; 1.2 – 1.3 g/kg acutely ill or PEW
- Energy: 30-35 kcal/kg>60 years; 35 kcal/kg <60 yrs
- Sodium: 2000 mg/day
- Potassium: 2000-3000 mg/day; adjust to serum levels
- Phosphorus: 10-17 mg/kg/day; monitor serum levels; binders as needed
- Calcium: < 1000 mg/day; maintain serum calcium WNL
- Fluids: 750 – 1500 cc/day; limit IDWG
- Vitamins: Supplement with MVI made specifically for dialysis patients; recommend one with Vit D3

Peritoneal Dialysis

Protein	• 1.2 – 1.3 g/kg
Energy	• 30 – 35 kcal/kg >60 yrs; 35 kcal/kg; including kcal from dialysate
Sodium	• 2000 mg/day; monitor fluid balance
Potassium	• 3000 – 4000 mg; adjust to serum levels
Phosphorus	• 10-17 mg/kg/day; adjust to meet protein needs; monitor serum levels, use binders as needed
Calcium	• <800 mg/day: maintain serum calcium WNL
Fluids	• Maintain balance
Vitamins	• Supplement with MVI made specifically for dialysis patients

Nutrition Care and Transplant

	Acute Post Transplant Period	Chronic Period
Protein	1.3 – 2 g/kg SBW or Adj BW	0.8 – 1 gm/kg
Energy	30 – 35 kcal/kg SBW or Adj BW	Adjust to maintain desirable BW
Sodium	Restrict as BP, fluid status, or medications dictate	2 – 4 gm with HTN and/or edema
Potassium	2 – 4 g if hyperkalemic	Unrestricted unless hyperkalemic
Phosphorus	DRI; may need supplementation to normalize serum levels	DRI
Calcium	1,200 – 1,500 mg/day	1,200 – 1,500 mg/day
Fluids	Generally unrestricted	Generally unrestricted
Vitamins	DRI	DRI

NUTRITION CONCERNS

BONE AND MINERAL DISORDER

CKD – Mineral Bone Disorders

A systemic disorder as a result of CKD

Associated with increased morbidity and mortality

Causes of Bone & Mineral Abnormalities

Disease process

Iatrogenic – caused by therapeutic interventions

Bone & Mineral Abnormalities

Includes one or any combination of the following:

Biochemical abnormalities
- Calcium
- Phosphorus
- PTH
- FGF23 (fibroblast growth factor)

Altered Vitamin D metabolism

Abnormalities of bone turnover

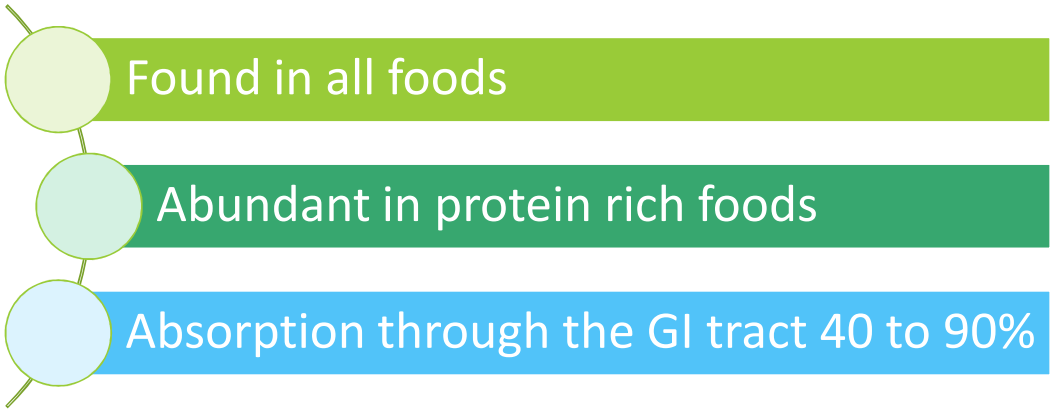
Vascular and/or other soft tissue calcification

Total Serum Calcium

Total Calcium
- Small percentage of total body calcium in the blood
- KDOQI recommended serum calcium range 8.4-9.5

Approximately 40% of total serum calcium is bound to plasma proteins (albumin)

Phosphorus



Phosphorus

High dietary phosphorus burden worsens hyperparathyroidism and renal osteodystrophy

- High serum phosphorus concentrations suppress serum calcium
- Inhibits the renal 1-alpha-hydroxylation of vitamin D
- Ca x P to precipitate in tissues

These factors can promote increased release of PTH

Parathyroid Hormone (PTH)

PTH acts to increase the concentration of calcium in the blood

PTH secretion is stimulated in response to:

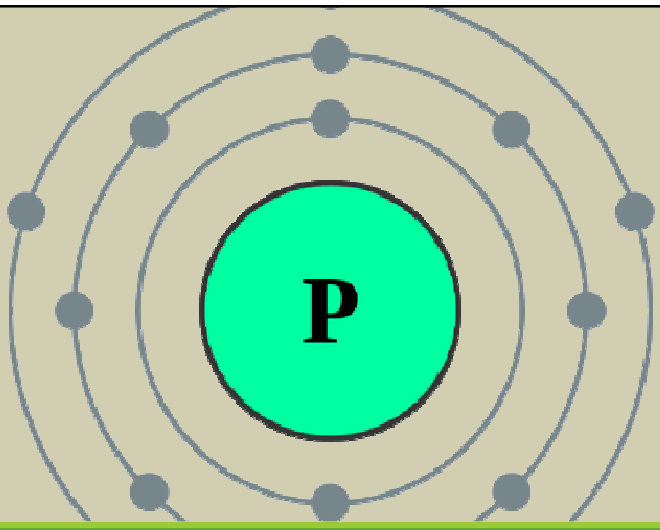
- Reduced renal function
- Hyperphosphatemia
- Decreased calcitriol production
- Hypocalcemia

Composite Bone and Mineral

Uncorrected Calcium <= 10

Phosphorus 3.0 – 5.5

PTH 150 – 600



Is All Phosphorus Equal?

Organic vs. Inorganic Phosphorus

Organic P and Dietary Protein

Phosphorus is naturally found in foods that are rich in protein


Dairy Products

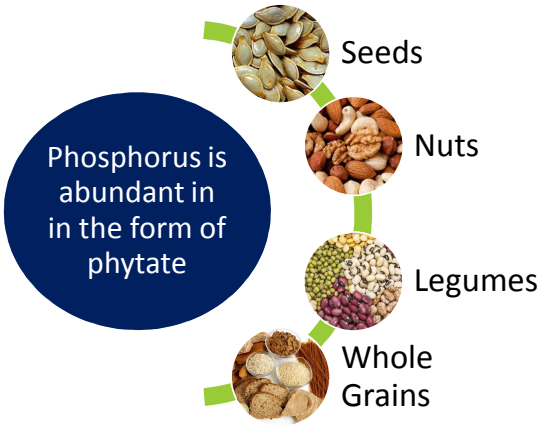

Meat


Poultry


Fish

****40 – 60% of organic P from dietary protein is absorbed**

Organic P and Plant Foods

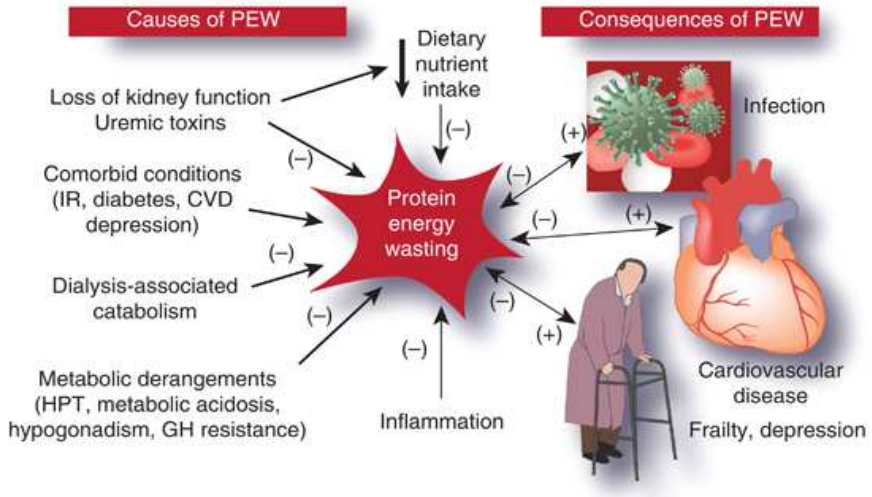


<50% of phosphorus from plant-derived food is absorbed

Inorganic P Additives

- Phosphate additives are not protein bound
- Phosphate additives are salts
- Phosphate additives are readily absorbed in the gut

>90% of P additives are absorbed in the GI tract



Malnutrition and Protein Energy Wasting

Malnutrition

Can result from:

- Inadequate or unbalanced diet
- Digestive difficulties
- Absorption problems
- Hypercatabolism
- Other medical conditions

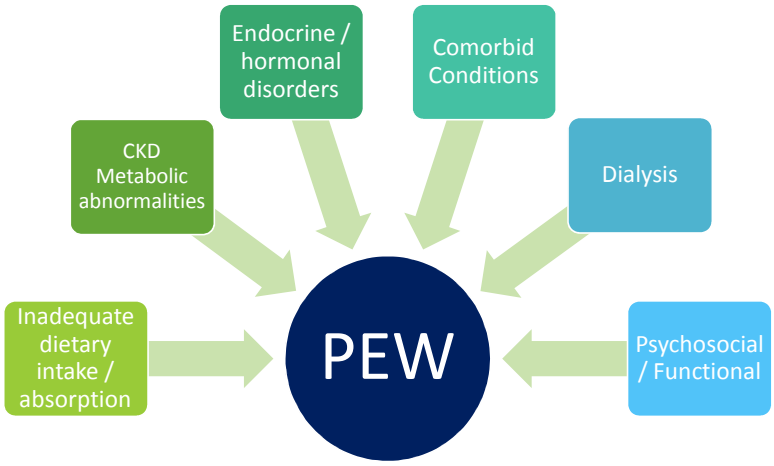
Protein-Energy Wasting

The International Society of Renal Nutrition and Metabolism (ISRNM) describes **Protein-Energy Wasting (PEW)** as decreased body stores of protein and energy in CKD/AKI; often associated with decreased functional capacity related to metabolic stress. Often associated with decreased quality of life.

Characteristics of PEW

- ⬇ Muscle / fat stores / BMI
- ⬇ Visceral protein
- ⬆ Morbidity and mortality
- ⬆ Inflammatory markers

Causes of PEW

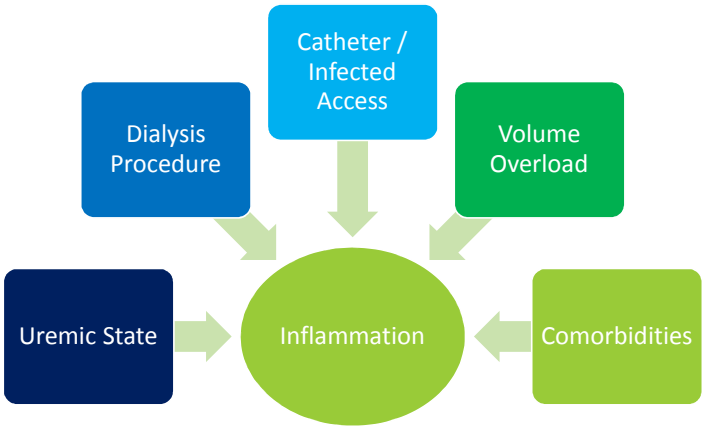


Causes of PEW
Inadequate Dietary Intake and Absorption

Causes of PEW
Inadequate Dietary Intake and Absorption

- Diet Restriction
- Anorexia
- Oral Manifestations
- GI Dysfunction and Impaired Motility

Causes of PEW
Metabolic Abnormalities



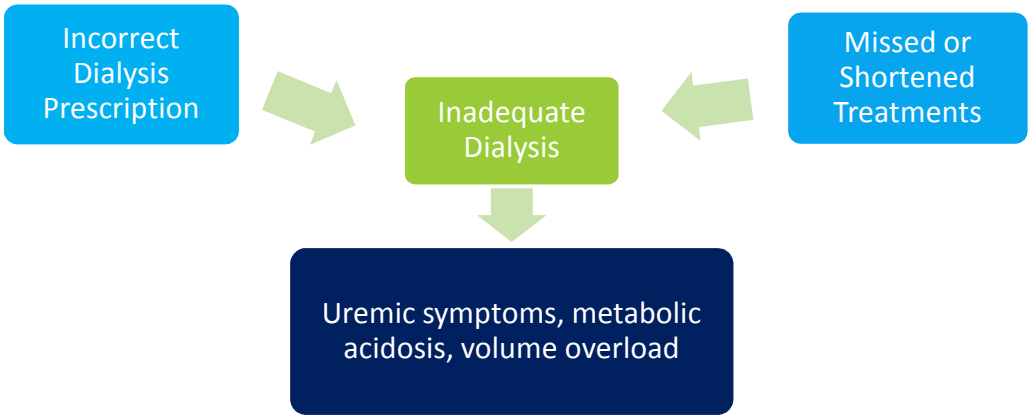
Causes of PEW
Endocrine/Hormonal Disorders

- Insulin Resistance
- Acidosis
- Hyperparathyroidism & Vit D Deficiency

Causes of PEW
Comorbid Conditions

- Diabetes
- CVD & Heart Failure
- Inter-current Infections

Causes of PEW
Dialysis – Inadequate Treatment



Causes of PEW
Dialysis – Post Treatment Fatigue

Patients may feel too tired to:

- Grocery shop
- Prepare meals
- Eat meals
- Clean up after meals

Causes of PEW
Psychosocial / Functional

- Depression
- Financial Issues
- Compromised Activities of Daily Living

Nutritional Supplements

Vitamins Supplementation in Dialysis

FAT-SOLUBLE VITAMINS

Vitamin A – Not recommended in the dialysis population

Vitamin E – Conflicting evidence on supplementation

Vitamin K – May be a need for supplementation

Vitamin D3 – Supplement at 300-1000 IU

WATER-SOLUBLE VITAMINS

Renal specific MVIs to include:

Thiamine (B-1): RDA of 1.2 mg/d

Riboflavin (B-2): RDA of 1.3 mg/d

Pyridoxamine (B-6): 10 mg/d

Cobalamin (B-12) RDA of 2.4 mcg/d

Folic Acid: 1 mg/d

Niacin: RDA of 16 mg/d

Supplements For Anemia Management

- CKD (Stage 4) – N/A
- HD – Individualized (IV iron preferred route)
- PD – 10-15 mg/d (Either IV or oral)

Interpretation of Iron Status Parameters*

Parameter	Iron Deficiency	Inflammation	Combination
Serum iron	Decreased	Decreased	Decreased
Transferrin saturation	Decreased	Decreased	Decreased
TIBC	Increased	Decreased	Normal
Ferritin	Decreased	Increased	Normal to increased
MCV/MCH	Decreased	N/A	N/A

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Fish Oil / Omega-3 Fatty Acids

Dietary Sources: wild caught mackerel, salmon, herring, anchovy; walnuts, vegetable oils (canola, soybean, flaxseed/linseed, olive)

Strong Scientific Evidence Regarding Benefits:

- Small reduction in hypertension
- Reduction in hypertriglyceridemia

Good Scientific Evidence Regarding Benefits:

- Primary CVD prevention
- Protection from cyclosporine toxicity in organ transplant patients
- Rheumatoid arthritis

ENTERAL NUTRITION SUPPLEMENTS

This list is not all-inclusive. Availability and nutrient content of supplements may change regularly. Manufacturers' Web sites recommend checking product labels for the most up-to-date information.

Products	Amt	kcal	CHO (gm)	PRO (gm)	Fat (gm)	Na^+ (mg)	K^+ (mg)	P (mg)	Ca^{++} (mg)	Characteristics
Boost GluControl*	8 oz	250	20	14	11.7	260	260	220	276	S, O, DM
Boost Regular	8 oz	240	41	10	4	130	400	300	300	S, O
Boost Smoothie	8 oz	240	44	9	3	80	230	200	300	S, O
Enlive	8 oz	300	65	10	0	60	40	20	60	HC, clear liquid
Nepro Carb Steady	8 oz	425	39.4	19.1	22.7	250	250	165	250	C, V, O, T, S, DM
NovaSource Renal	8 oz	475	47.3	17.4	24.1	210	192	154	308	C, HC, HP, V, O, T, S
ReGen (Frozen) Reg	4 oz	250	30	10	10	90	25	45	22	HC, HP, V, S, O
Sugar Free	4 oz	230	21	10	11	20	25	45	22	HC, HP, V, S, O, DM
ReGen (Shelf Stable)	6 oz	375	47	12	17	180	23	68	15	HC, HP, V, S, O
Sugar Free	6 oz	345	35	14	16	188	30	90	15	HC, HP, V, S, O, DM
Resource Broth Plus	6 oz	120	22	7	0	370	125	11	10	S, O
Resource Breeze	8 oz	250	53.5	9	0	<80	<20	160	10	S, O
Suplena Carb Steady	8 oz	425	47.8	10.6	22.7	185	265	165	250	C, V, O, T, S, CKD, DM
UnJury Chicken Soup	1 scp	90	1	21	0	780	160	20	100	S, O, HP

*Boost GluControl is now Boost Glucose Control. The composition is slightly different than reported here. See http://www.nestle-nutrition.com/Products/Default.aspx

V=volume restricted, **C**=complete, **S**=supplement to food, **O**=appropriate for oral, **T**=appropriate for tube, **DM**=appropriate for persons with diabetes, **HP**=high protein, **HC**=high calorie, **CKD**=appropriate for persons with CKD

Reference: Internet/manufacturers' product information

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SPECIALTY NUTRITION BARS/COOKIES

Manufacturers' Web sites recommend checking product labels for the most up-to-date information.

Product	Amt	kcal	CHO g	PRO g	Fat g	Na^+ mg	K^+ mg	P mg	Ca^{++} mg	Uses
Extend Bar[1]	40 g	150	21	12	2-3	180	50	10%*	6%*	S, O, DM
Glucerna Mini Snack Bar[2]	20 g	80	12	4	2.5	60	50	10%*	10%*	S, O, DM, V
Glucerna Meal Bar	58 g	220	34	10	7	180	140	35%*	35%*	S, O, DM, V
Glucerna Snack Bar[2]	40 g	150	25	6	4-5	150	80	150	2%*	C, O, DM, V
ProFortified Cookie[3]	1 cookie	250	27-28	6-9	10-14	160-200	110-150	38-60	60	S, O, V
VitalProteinRx[4]										
Chocolate Brownie	60 g	210	25	20	6	105	240	100	200	S, O, V, HP,
Lemon Zest	60 g	210	25	20	6	140	45	100	150	DM
Peanut Butter	60 g	220	23	20	8	230	135	150	250	
Zone Nutrition Bars[5]										
Fudge Graham	50 g	210	23	14	7	210	90	200	200	S, O, V, HP
Choc Peanut Butter	50 g	210	25	14	7	250	120	200	200	
Snack Size	20.5 g	80	10	5	2.5	110	40	80	80	
Double Dark Choc	45 g	190	22	12	6	190	160	100	20%*	

***Note:** Calcium and phosphorus values are sometimes based on % of daily value in a 2000 calorie diet or 1000 mg per day.
V=volume restricted, **C**=complete, **S**=supplement to food, **O**=appropriate for oral, **DM**=appropriate for persons with diabetes, **HP**=high protein

References: [1] http://www.extendbar.com [2] http://glucerna.com/product [3] http://www.nutra-balance-products.com
[4] http://www.myvitalremedymd.com [5] http://zoneperfect.com/products (other flavors available)

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MODULAR PRODUCTS

Manufacturers' Web sites recommend checking product labels for the most up-to-date information.

Product	Amt	kcal	CHO g	Pro g	Fat g	Na^+ mg	K^+ mg	P mg	Ca^{++} mg	Adds
LiquaCel[1]	1 oz	70	1	16	0	30	10	0	6	Protein
NutraPro[2]	26 gm	80	2	16	1	N/A	N/A	N/A	N/A	Protein
ProCel[1]	1 scoop	28	<1	5	<0.5	11	35	23	40	Protein
ProMod[3]	1 oz	100	14	10	0.6	55	20	95	-	Pro/kcal
ProStat Profile[4]	1 oz	101	15	10	0	26	<3	4	-	Pro/kcal
ProStat 64[4]	1 oz	60	0	15	0	39	<4	<6	-	Protein
ProStat 101[4]	1 oz	101	10	15	0	39	<4	<6	-	Pro/kcal
ProStat AWC[4]	1 oz	108	10	17	0	39	<4	<6	-	Pro/kcal
ProStat RC[4]	1 oz	60	0	15	0	39	<4	<6	-	Pro/Zn/FOS
Proteinex 15[5]	1 oz	60	0	15	0	4	11	-	-	Protein
Proteinex 18[5]	1 oz	72	0	18	0	5	13	-	-	Protein
Resource Beneprotein[6]	1 scoop	25	0	6	0	10	35	15	30	Protein
Polycose Powder[3]	1 Tbsp	23	5.6	-	-	<7	<1	<1	Neg	CHO
MCT Oil	1 mL	5-8	-	-	-	-	-	-	-	Fat

References: Internet, manufacturers' product information
[1] http://www.globalhp.com [2] http://www.nutra-balance-products.com [3] http://abbottnutrition.com/products
[4] www.pro-stat.info [5] http://www.llorenspharm.com [6] http://www.nestle-nutrition.com

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Caution With The Following Supplements

Black Cohosh – May interact with antihypertensive and antiplatelet medications

Echinacea – Appears safe in general CKD population; however, it should not be used in transplant recipients taking immunosuppressant medications

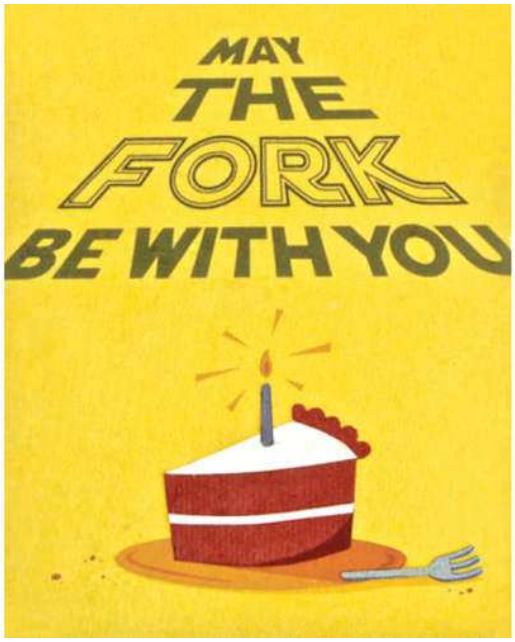
Ginseng – Increased BP; not recommended for use in CKD

Glucosamine and Chondroitin Sulfate – HD patients receiving heparin should avoid both because of increased risk of bleeding

Noni – Due to high potassium content, contraindicated in patients with CKD on a potassium-restricted diet

Saw Palmetto – HD patients receiving heparin should avoid because of increased risk of bleeding

St. John's Wort – Avoid in transplant recipients taking immunosuppressant medications because of possible organ rejection



References

Harvey, KS. 2013. Nutrition Management in Chronic Kidney Disease Stages 1 Through 4. In Byham-Gray, L (ed.). Nutrition Care in Kidney Disease. Pp 25-33. Academy of Nutrition and Dietetics.

Gonzalez, E. 2001. Renal Dynamics: Educational Update on Secondary Hyperparathyroidism. Abbott Park, IL: Abbott Laboratories.

Pocket Guide to Nutrition Assessment of the Patient with Kidney Disease. McCann, L (ed.). National Kidney Foundation 2015, pp. 4-1/4-17; 8-3/8-28. NY, NY.

Kalantar-Zadeh K, et al. 2010. Understanding Sources of Dietary Phosphorus in the Treatment of Patients with Chronic Kidney Disease. Clinical Journal of Am Society Nephrology 5: 519-530, 2010.

Parathyroid Hormone and Secondary Hyperparathyroidism in Chronic Kidney Disease. National Kidney Foundation 2012. NY, NY.

Moe, S. 1998. Hyperphosphatemia in the Dialysis Patient – Etiology and Clinical Significance. Genzyme Corporation.

Beindorff, ME, Ulerich, L. 2013. Nutrition Management of the Adult Renal Transplant Patient. In Byham-Gray, L (ed.). Nutrition Care in Kidney Disease. Pp 25-33. Academy of Nutrition and Dietetics.

Burrowes, JD. Dietary Supplements. In Byham-Gray, L (ed.). Nutrition Care in Kidney Disease. Pp 291-309. Academy of Nutrition and Dietetics.