# RATIONAL USE OF DIETARY SUPPLEMENTS IN CKD PATIENTS

Simin Dashti-Khavidaki;

Professor of Pharmacotherapy;

TUMS

# CASE PRESENTATION

- A 37 year-old, 50kg  woman with uncontrolled BP was referred to the Pharmacotherapy clinic in IKHC to check her medications.

- PMH : She suffered IgA nephropathy since she was 25 years old. Her serum creatinine increased gradually over years and reached 2.5 mg/dL about 5 months ago.

# DRUG HISTORY

## Drugs

- Tab Losartan 25 mg BD
- Tab Atorvastatin 20mg daily
- Tab Allopurinol 100 mg daily
- Amp Eprex  4000 IU weekly

## Supplements

- Tab Ketalog 2 pills Daily
- Cap Omega-3  3g daily
- Tab Nephrotonic 1 daily
- Tab Sideral 1 daily
- Pearl Calcitriol 1 daily
- Pear Vit D 50000U Q4Weeks

# LABORATORY TESTS

| | | | |
|---|---|---|---|
| K: 4.9 mEq/L | Hb: 11.6 g/dL | TC: 222 mg/dL | BUN : 57 mg/dL |
| P: 4.9 mEq/L | MCV: 80 $f$L | HDL-C: 82mg/dL | Cr: 3.5 mg/dL |
| Mg: 2 mg/dL | | LDL-C: 127 mg/dL | Uric acid: 6.1 mg/dL |
| | | TG: 67 mg/dL | 25OH Vit D: 28 ng/mL |
| Ferritin: 36 ng/mL | Iron: 45mcg/dL | TIBC: 125 mcg/dL | |

24h urine collection

| |
|---|
| Urine Volume: 1000 ml |
| Urine Cr: 0.8 g |
| Urine Protein: 4.1 g |

CrCl≈17.3 ml/min
CKD-EPI: 16.5ml/min/1.73m$^2$

# MACRONUTRIENTS

# Statement on Energy Intake

25-35 kcal/kg /day


# Protein Amount

- For G3-G5: 0.8 g/kg
- HD/PD: 1-1.2g/kg/d
- If proteinuria?

- Avoid >1.3g/kg

# Protein Type

Insufficient evidence to recommend a particular protein type (plant vs animal) in terms of the effects on nutritional status, Ca or P levels, or the blood lipid profile

Dietary Supplements
Pure protein
Renoral


# Protein Amount

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

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

# "metabolically stable" indicates

- absence of any **active inflammatory** or infectious diseases
- no **hospitalization** within 2 weeks
- absence of poorly controlled **diabetes**
- consumptive diseases such as **cancer**
- absence of **antibiotic**
- absence of **immunosuppressive** medications
- absence of significant short-term **loss of body weight**.

# VLPD + KAs

Different compositions of KAAs and EAAs have been tested in the setting of CKD, with most of them containing below components. Collectively, these supplements are referred as KAs.

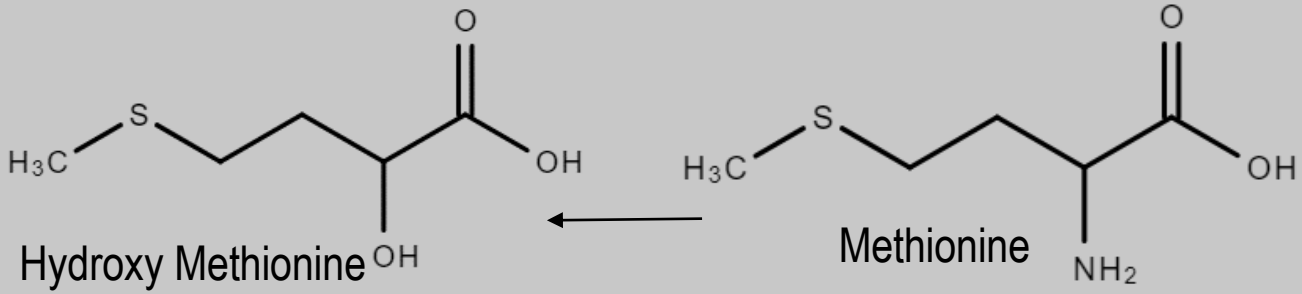
- 4 KAs (of the EAAs isoleucine, leucine, phenylalanine, and valine)
- 1 hydroxy acid (of the EAA methionine)
- 4 amino acids considered essential in CKD (tryptophan, threonine, histidine, and tyrosine).

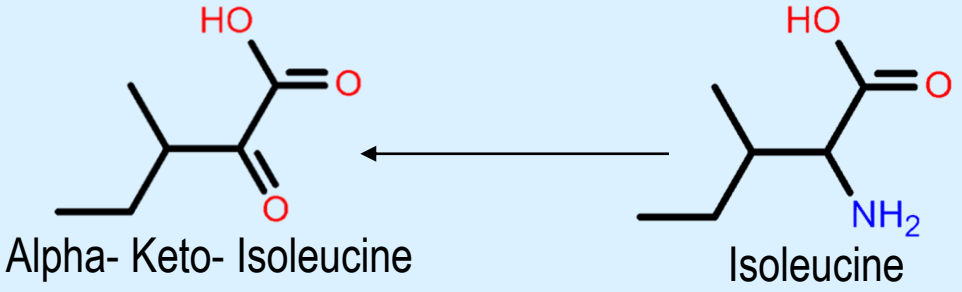
# VLPD + KAs


**Usage:**
**Take 3-6 tablets daily or as directed by your physician.**
**Take the tablets with meals.**
**Storage condition:**
**Keep bottle tightly closed. Store below 30°C and protect from moisture and light.**
**Keep out of reach of children.**

630 mg

| | |
|---|---|
| • Alpha- Ketoanalogue to Isoleucine, Calcium Salt (Calcium-3-methyl-2-oxo-valerate) | 67mg |
| • Alpha- Ketoanalogue to Leucine, Calcium Salt (Calcium-4-methyl-2-oxo-valerate) | 101mg |
| • Alpha Ketoanalogue to Phenylalanine, Calcium Salt (Calcium -2-oxo-3-phenylpropionate) | 68mg |
| • Alpha Ketoanalogue to Valine, Calcium Salt (Calcium-3-methyl-2-oxo-butyrate) | 86 mg |
| • Alpha Hydroxy analogue to Methionine, Calcium Salt (Calcium-DL-2-Hydroxy-4-(methylthio)butyrate) | 59 mg |
| • L-Lysine Acetate USP | 105 mg |
| • L-Threonine USP | 53 mg |
| • L-Tryptophan USP | 23 mg |
| • L-Histidine USP | 38 mg |
| • L-Tyrosine USP | 30 mg |
| • Total Nitrogen content | 36 mg |
| • Calcium 1 | 50 mg |



# VLPD + KAs: Outcomes

- **Survival/renal death:** mixed results
- **Estimated GFR:** could help preserve kidney function in patients with stages 3-5 CKD.
- **Dietary intake:** Because of low protein intake, patient adherence is low with this diet
- **Electrolyte levels**

decrease serum phosphate levels and improve some markers of bone metabolism (calcium and PTH).

# Back to the Patient

Patient weight: 50 kg $\Rightarrow$ KAs = 0.2 g/kg/ d $\times$ (50Kg) = 10 g

For our patient we need 10g KAs and each tablet contains 0.63 g amino acid then:

Our patient need **16 tablet**

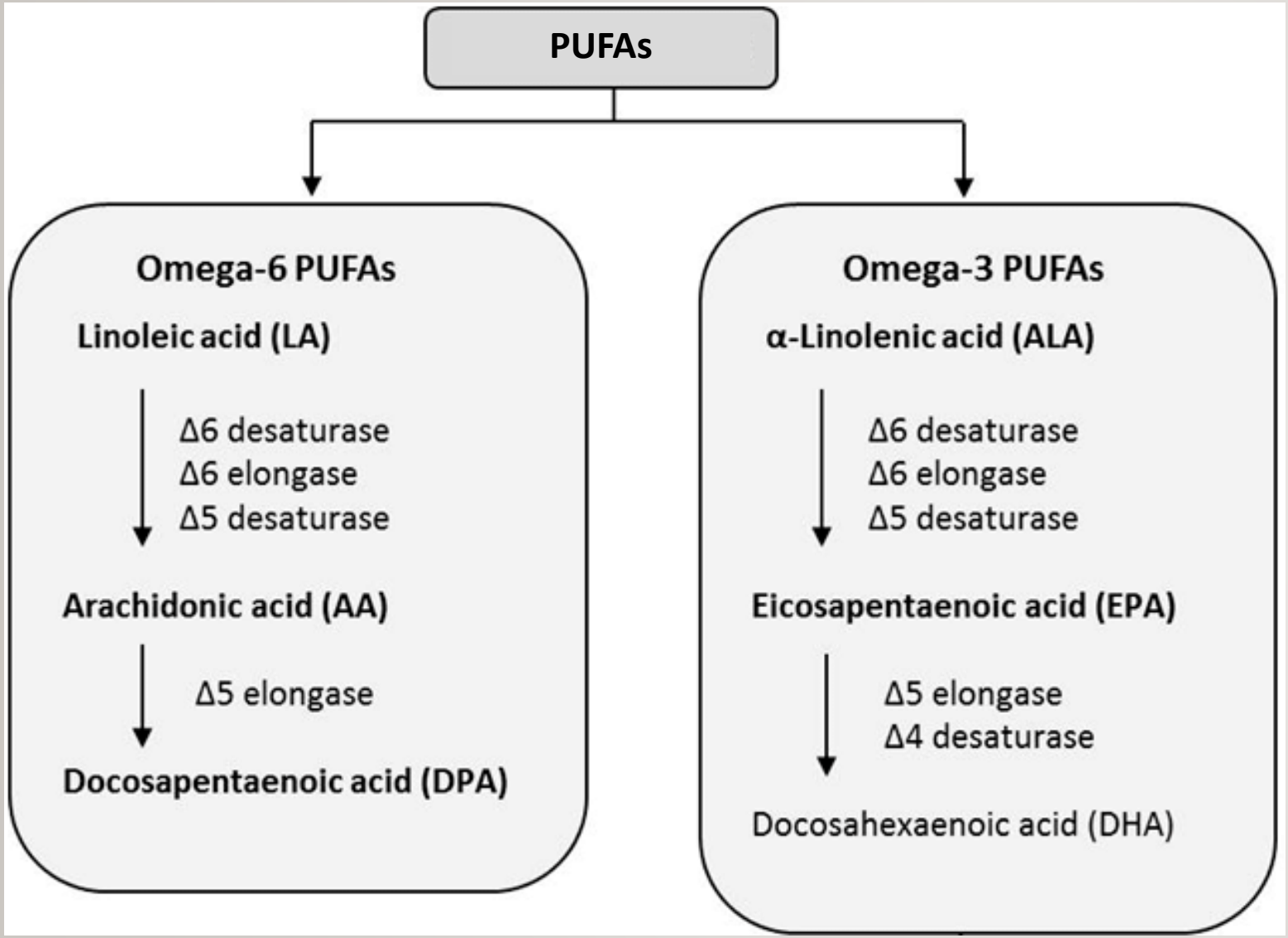
# Back to the Patient

## Drugs

- Tab Losartan 25 mg BD
- Tab Atorvastatin 20mg daily
- Tab Allopurinol 100 mg daily
- Amp Eprex  4000 IU weekly

## Supplements

- Tab Ketalog 2 pills Daily
- Cap Omega-3  3g daily
- Tab Nephrotonic 1 daily
- Tab Sideral 1 daily
- Pearl Calcitriol 1 daily
- Pear Vit D 50000U Q4Weeks




**Long Chain Omega-3 Polyunsaturated Fatty Acids (LC n-3 PUFA),**

**Docosahexaenoic acid** (DHA)

**+**

**Eicosapentaenoic acid** (EPA)

Polyunsaturated Fatty Acids and Their Potential Therapeutic Role in Cardiovascular System Disorders—A Review : October 2018 : DOI:10.3390/nu10101561

- LC n-3 PUFAs are obtained primarily from dietary sources such as cold-water fish (i.e., fish oil) or linoleic acid, which is derived from flaxseed or certain other vegetable oils.

- In recent decades, LC n-3 PUFA have demonstrated biological effects on eicosanoid production, cell membrane physiology, signal transduction, metabolism, apoptosis, oxidation, and inflammation.

- Cod liver oil supplements provide vitamin A and vitamin D in addition to LC Omega-3s.

# Statements on LC n-3 PUFAs

| | |
|---|---|
| for Lipid Profile | • ↓TG: yes<br>• ↓LDL-C, ↑HDL-C may be |
| for AV Graft and fistula patency | • No |
| to lower mortality of cardiovascular risk | • No |

KDOQI CLINICAL PRACTICE GUIDELINE FOR NUTRITION IN CKD: 2020 UPDATE : S58

# LABORATORY TESTS

| | | | |
|---|---|---|---|
| K: 4.9 mEq/L | Hb: 11.6 g/dL | TC: 222 mg/dL | BUN : 57 mg/dL |
| P: 4.9 mEq/L | MCV: 80 $f$L | HDL-C: 82mg/dL | Cr: 3.5 mg/dL |
| Mg: 2 mg/dL | | LDL-C: 127 mg/dL | Uric acid: 6.1 mg/dL |
| | | TG: 67 mg/dL | 25OH Vit D: 28 ng/mL |
| Ferritin: 36 ng/mL | Iron: 45mcg/dL | TIBC: 125 mcg/dL | |

24h urine collection

| |
|---|
| Urine Volume: 1000 ml |
| Urine Cr: 0.8 g |
| Urine Protein: 4.1 g |

CrCl≈17.3 ml/min
CKD-EPI: 16.5ml/min/1.73m$^2$


114,500 تومان


50 Soft Gelatin Capsules
Dietary Supplement
COD-VIGEL® 1000
Each Soft Gelatin Capsule contains:
Cod Liver Oil 1000mg
Average values per capsule:
Vitamin A 1000 IU
Vitamin D3 100 IU
Omega 3 fatty acids:
EPA 80mg
DHA 100mg

82,300 تومان


**Recommended Daily Intake:**
Adults and children over 12 years of age, one to two softgels daily. Do not exceed recommended daily intake unless advised by a suitably qualified person.
**For external use;** pierce softgel and apply contents onto the skin, massaging gently until absorbed.

| **Each Softgel Contains:** | **%RDA** |
|---|---|
| Flax Seed Oil *(Linum usitatissimum)*..... | 1000mg..... * |

RDA: Recommended Daily Allowance
* : RDA Not Yet Established

**Other Ingredients:** Glycerol, Gelatin.

Using during pregnancy and lactation is prohibited


| Average amount per 1 capsule | | % NRV* |
|---|---|---|
| Omega-3 fatty acids | 500 mg | –** |
| *providing:* | | |
| DHA (Docosahexaenoic acid) | 250 mg | –** |
| EPA (Eicosapentaenoic acid) | 181 mg | –** |
| Vitamin E | 12 mg | 100 |

*Nutrient Reference Value according to Regulation (EU) 1169/2011 II **No reference value available

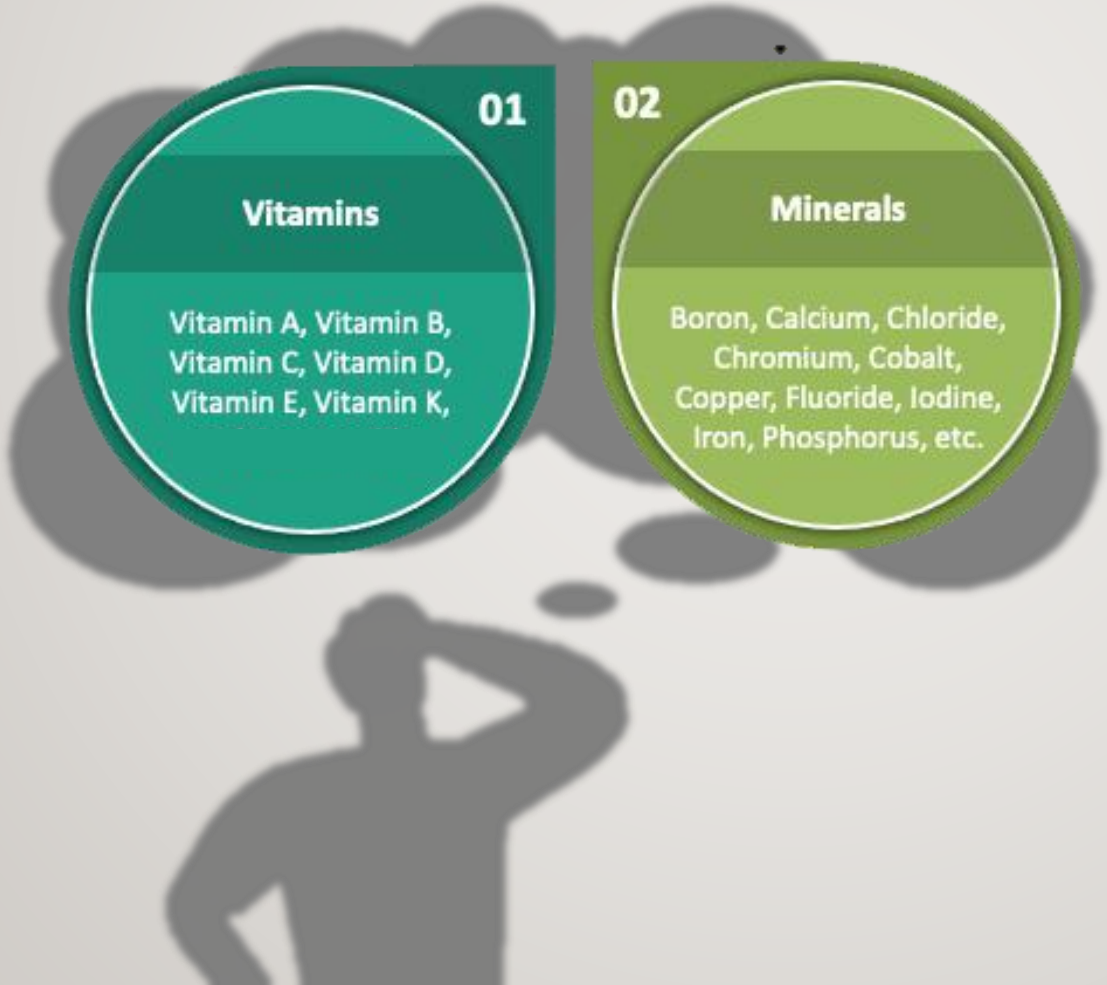

## Product Information

Serving size: 1 Softgel

| Nutritional Information | Av. Per serving | %RDA* |
|---|---|---|
| Fish Oil | 1000 mg | - |
| Providing: | | |
| EPA (Eicosapentaenoic Acid) | 500 mg | - |
| DHA (Docosahexaenoic Acid) | 100 mg | - |

***RDA:** Recommended Daily Allowance, **mg:** milligram

# Micronutrients



# Back to the Patient

## Drugs

- Tab Losartan 25 mg BD
- Tab Atorvastatin 20mg daily
- Tab Allopurinol 100 mg daily
- Amp Eprex  4000 IU weekly

## Supplements

- Tab Ketalog 2 pills Daily
- Cap Omega-3  3g daily
- Tab Nephrotonic 1 daily
- Tab Sideral 1 daily
- Pearl Calcitriol 1 daily
- Pear Vit D 50000Unit Q4Weeks

| کشور سازنده | شرکت سازنده | نام محصول | دارو |
|---|---|---|---|
| ایران | فارن شیمی | Kidney Duralife |   |
| ایران | زیست اروند فارمد | Renal Fact |   |
| ایران | رازان فارمد ایرانیان | Nephrofol |   |

| کشور سازنده | شرکت سازنده | نام محصول | دارو |
|---|---|---|---|
| ایران | زهراوی | Nephrotonic | 27   |
| ایران | اسوه | Nephrovit |   |
| ایران | امین | Nephraheal |   |

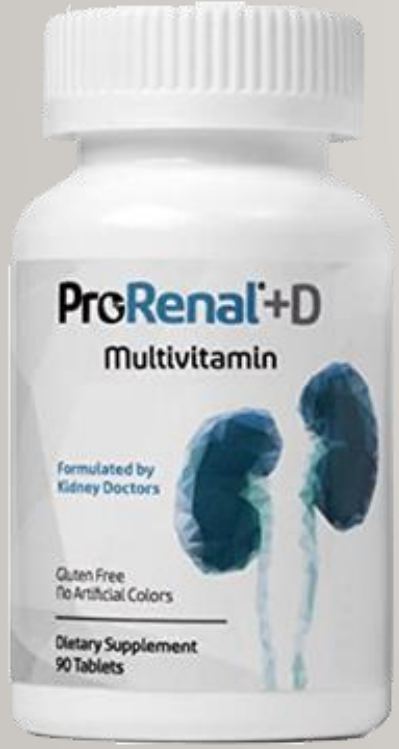
| کشور سازنده | شرکت سازنده | نام محصول | دارو |
|---|---|---|---|
| ایران | روز دارو | Renal Aid |   |
| آمریکا | نفروسوتیکالز | ProRenal |   |
| ایران | دانا | Nephromin plus |   |


Clinicians
Research Based
SPECIFIC HEALTH SUPPORT
Renal Vit
DIETARY SUPPLEMENT
Specialised nutrient support where renal function is not optimal
30
CAPSULES


Reliable 1
LABORATORIES
Renal Vitamin
Vitamin C & B Complex
FOR THE DISTINCTIVE NUTRITIONAL NEEDS OF RENAL PATIENTS
100 TABLETS


PipingRock
KIDNEY CARE
SUPPORT FORMULA†
Expertly formulated nutritional support for kidney care†
Dietary Supplement
60 Quick Release Capsules
†These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure or prevent any disease.


Renal Caps
Dietary Supplement
CYPRESS
PHARMACEUTICAL, INC.


ProRenal+D
Multivitamin
Formulated by Kidney Doctors
Gluten Free
No Artificial Colors
Dietary Supplement
90 Tablets


60258-160-01
RENA-VITE
Tablets
Dietary Supplement
CYPRESS
PHARMACEUTICAL, INC.
100 Tablets


DAV PHARMACY
Renocap
DAV AYURVEDIC PRODUCT


NaturalCare
Kidney Care
Dietary Supplement
Kidney Support Formula
60 Vegetarian Capsules
For Men and Women


Rugby
New Formula
Nephro-Vite
VITAMIN B AND C COMPLEX
DIETARY SUPPLEMENT
100 TABLETS

# Micronutrients

## ❖Vitamin C Supplementation

In adults with **CKD 1-5D** or post-transplantation who are at risk of vitamin C deficiency, it is reasonable to consider supplementation to meet the recommended intake of at least 90 mg/d for men and 75 mg/d for women.

| | Vit B1 | Vit B2 | Vit B3 | Vit B5 | Vit B6 | Vit B7 | Vit B9 | Vit B12 | Vit E | Vit C | Zinc | Vit D | Copper | Iron (fomarat) | selenium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nephrovit | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrotonic | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1 mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephraheal | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephromin | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Renal Aid | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 600 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrofol | 1.5 mg | 1.8 mg | 20 mg | 5 mg | 10 mg | 20mcg | 400 mcg | 2.4 mcg | 15 mg | 60 mg | 8 mg | | | | |
| ProRenal | 1.5 mg | 2 | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9mg | 8 mg | 55mcg |
| Dura life | 1.5 mg | 1.7 mg | 20 mg | 5 mg | 10 mg | 300mcg | 1 mg | 2.4 mcg | 25 mg | 60 mg | 15 mg | | 0.9mg | 8mg | 55mcg |
| Renal fact | 1.5 mg | 2 mg | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9 mg | 8mg | 55mcg |

Vit : vitamin , mcg : microgram

# Vitamin B Family

**There are 8 types of vitamin B:**

- Thiamin (B1)
- Riboflavin (B2)
- Niacin (B3)
- Pantothenic acid (B5)
- Pyridoxine (B6)
- Biotin (B7)
- Folate or ‘Folic acid' (B9)
- Cyanocobalamin (B12).

**Homocysteine is an intermediary amino acid formed by the conversion of methionine to cysteine**

**Elevations in plasma homocysteine levels can result from:**

- **Vitamin deficiencies (B12, folic acid, B6)**
- **Genetic factors**
- **CKD**
- **Drugs**
- **Smoking**

http://www.uptodate.com/ : **Overview of homocysteine**

- Both cross-sectional and prospective studies have linked elevated levels of homocysteine to increased risk for CHD.

- However, numerous prospective randomized trials of folate supplementation to lower serum homocysteine have demonstrated no reduction in major cardiovascular outcomes (e.g., death, MI, stroke).

## ❖Folic Acid Supplementation for Hyper-homocysteinemia

In adults with **CKD 3-5D** or post-transplantation who have hyper-homocysteinemia associated with kidney disease, we recommend not to routinely supplement folate with or without B-complex since there is no evidence demonstrating reduction in adverse cardiovascular outcomes.

## ❖Folic Acid Supplementation for Folic Acid Deficiency and Insufficiency

| | Vit B1 | Vit B2 | Vit B3 | Vit B5 | Vit B6 | Vit B7 | Vit B9 | Vit B12 | Vit E | Vit C | Zinc | Vit D | Copper | Iron (fomarat) | selenium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nephrovit | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrotonic | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1 mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephraheal | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephromin | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Renal Aid | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 600 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrofol | 1.5 mg | 1.8 mg | 20 mg | 5 mg | 10 mg | 20mcg | 400 mcg | 2.4 mcg | 15 mg | 60 mg | 8 mg | | | | |
| ProRenal | 1.5 mg | 2 | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9mg | 8 mg | 55mcg |
| Dura life | 1.5 mg | 1.7 mg | 20 mg | 5 mg | 10 mg | 300mcg | 1 mg | 2.4 mcg | 25 mg | 60 mg | 15 mg | | 0.9mg | 8mg | 55mcg |
| Renal fact | 1.5 mg | 2 mg | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9 mg | 8mg | 55mcg |

Vit : vitamin , mcg : microgram

## ❖ Vitamin D Deficiency and Insufficiency

In adults with **CKD 1-5D** or post-transplantation, we suggest prescribing vitamin D supplementation in the form of cholecalciferol or ergocalciferol to correct 25(OH)D deficiency/insufficiency.

## ❖ Vitamin D Supplementation with Proteinuria

In adults with **CKD 1-5** with nephrotic range proteinuria, it is reasonable to consider supplementation of cholecalciferol, ergocalciferol, or other safe and effective 25(OH)D precursors.

# Vitamin D and its Analogs

In adult patients with **CKD G3a–G5** not on dialysis, we suggest that calcitriol and vitamin D analogs not be routinely used.

It is reasonable to reserve the use of calcitriol and vitamin D analogs for patients with **CKD G4–G5** with severe and progressive hyperparathyroidism.

KDIGO 2017 Clinical Practice Guideline Update for the Diagnosis, Evaluation, Prevention, and Treatment of Chronic Kidney Disease–Mineral and Bone Disorder (CKD-MBD) : page 33 , 35

# Back to the Patient

## Drugs

- Tab Losartan 25 mg BD
- Tab Atorvastatin 20mg daily
- Tab Allopurinol 100 mg daily
- Amp Eprex  4000 IU weekly

## Supplements

- Tab Ketalog 2 pills Daily
- Cap Omega-3  3g daily
- Tab Nephrotonic 1 daily
- Pearl Calcitriol 1 daily
- Pear Vit D 50000U Q4Weeks
- Tab Sideral 1 daily

| | Vit B1 | Vit B2 | Vit B3 | Vit B5 | Vit B6 | Vit B7 | Vit B9 | Vit B12 | Vit E | Vit C | Zinc | Vit D | Copper | Iron (fomarat) | selenium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nephrovit | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrotonic | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1 mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephraheal | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephromin | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Renal Aid | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 600 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrofol | 1.5 mg | 1.8 mg | 20 mg | 5 mg | 10 mg | 20mcg | 400 mcg | 2.4 mcg | 15 mg | 60 mg | 8 mg | | | | |
| ProRenal | 1.5 mg | 2 | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9mg | 8 mg | 55mcg |
| Dura life | 1.5 mg | 1.7 mg | 20 mg | 5 mg | 10 mg | 300mcg | 1 mg | 2.4 mcg | 25 mg | 60 mg | 15 mg | | 0.9mg | 8mg | 55mcg |
| Renal fact | 1.5 mg | 2 mg | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9 mg | 8mg | 55mcg |

Vit : vitamin , mcg : microgram

## ❖Vitamins A Supplementation

- ✓ In adults with **CKD 5D** (on MHD or PD), it is reasonable to not routinely supplement vitamin A because of the potential for vitamin toxicity.

- ✓ However, if supplementation is warranted, care should be taken to avoid excessive doses, and patients should be monitored for toxicity.

- ✓ Signs of chronic toxicity may include:
  - ataxia, alopecia, hyperlipidemia, hepatotoxicity, bone and muscle pain, visual impairments, hypercalcemia (rarely)

http://www.uptodate.com/ : **Overview of vitamin A**

## ❖Vitamins E Supplementation and Toxicity

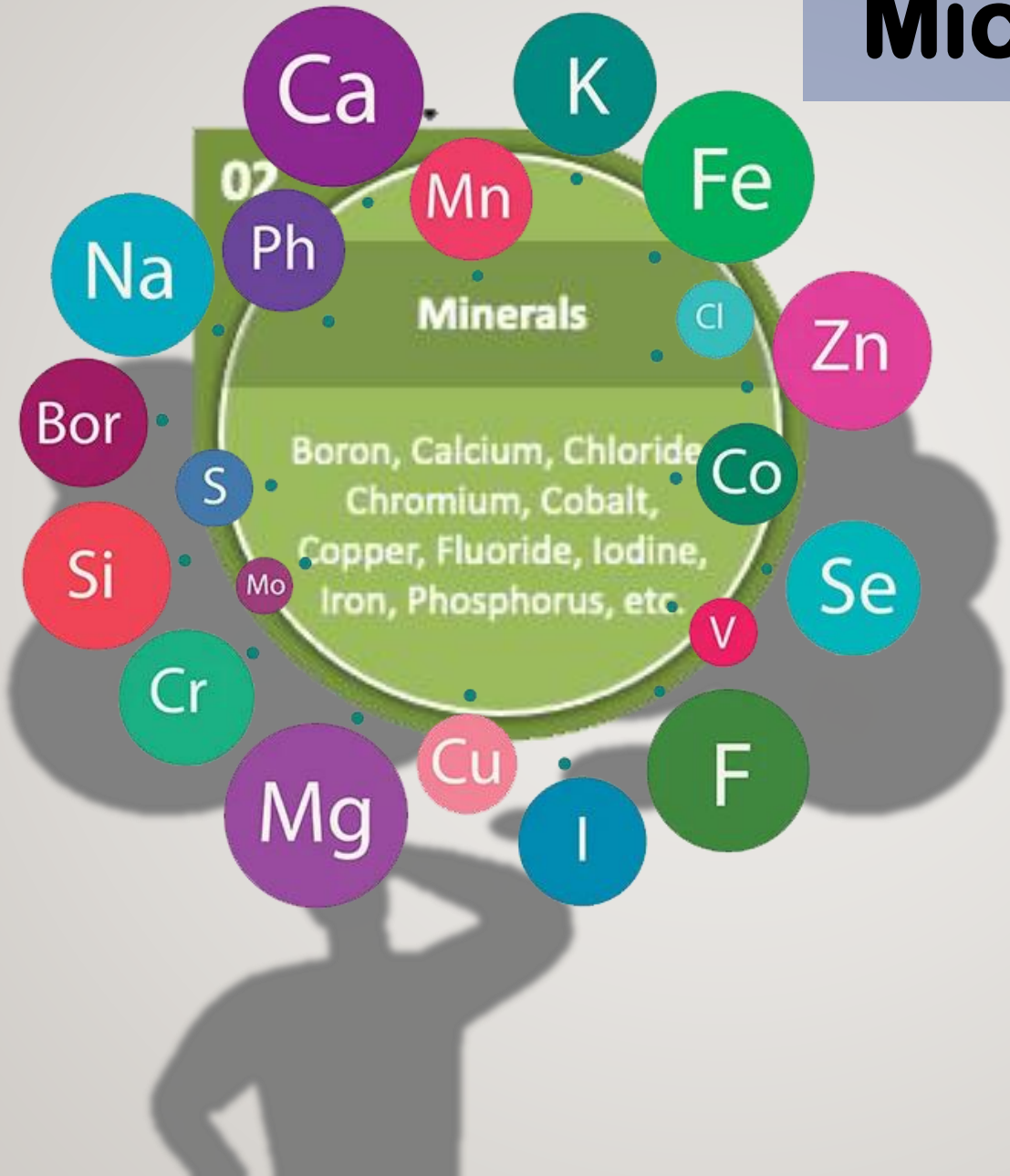
In adults with **CKD 5D** (MHD or PD), it is reasonable to not routinely supplement vitamin E because of the potential for vitamin toxicity.

| | Vit B1 | Vit B2 | Vit B3 | Vit B5 | Vit B6 | Vit B7 | Vit B9 | Vit B12 | Vit E | Vit C | Zinc | Vit D | Copper | Iron (fomarat) | selenium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nephrovit | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrotonic | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1 mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephraheal | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephromin | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Renal Aid | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 600 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrofol | 1.5 mg | 1.8 mg | 20 mg | 5 mg | 10 mg | 20mcg | 400 mcg | 2.4 mcg | 15 mg | 60 mg | 8 mg | | | | |
| ProRenal | 1.5 mg | 2 | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9mg | 8 mg | 55mcg |
| Dura life | 1.5 mg | 1.7 mg | 20 mg | 5 mg | 10 mg | 300mcg | 1 mg | 2.4 mcg | 25 mg | 60 mg | 15 mg | | 0.9mg | 8mg | 55mcg |
| Renal fact | 1.5 mg | 2 mg | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9 mg | 8mg | 55mcg |

Vit : vitamin , mcg : microgram

# Back to the Patient

# Micronutrients



# Back to the Patient

## Drugs

- Tab Losartan 25 mg BD
- Tab Atorvastatin 20mg daily
- Tab Allopurinol 100 mg daily
- Amp Eprex  4000 IU weekly

## Supplements

- Tab Ketalog 2 pills Daily
- Cap Omega-3  3g daily
- Tab Nephrotonic 1 daily
- Pearl Calcitriol 1 daily
- Pear Vit D 50000U Q4Weeks
- Tab Sideral 1 daily

# Iron

- Absolute iron deficiency in patients with CKD is defined by TSAT<20% and ferritin level <100 ng/mL.

- Functional iron deficiency is defined by TSAT <20% and ferritin level >100 ng/mL in CKD without KRT and >200 ng/mL in patients with CKD treated by dialysis.

Iron Therapy Challenges for the Treatment of Nondialysis CKD Patients : Clin J Am Soc Nephrol. 2016 Jul 7; 11(7): 1269–1280. : doi: 10.2215/CJN.00080116
Recent and Emerging Therapies for Iron Deficiency in Anemia of CKD: A Review : https://doi.org/10.1053/j.ajkd.2021.09.017

# LABORATORY TESTS

Back to the Patient

| | | | |
|---|---|---|---|
| K: 4.9 mEq/L | Hb: 11.6 g/dL | TC: 222 mg/dL | BUN : 57 mg/dL |
| P: 4.9 mEq/L | MCV: 80 $f$L | HDL-C: 82mg/dL | Cr: 3.5 mg/dL |
| Mg: 2 mg/dL | | LDL-C: 127 mg/dL | Uric acid: 6.1 mg/dL |
| | | TG: 67 mg/dL | 25OH Vit D: 28 ng/mL |
| Ferritin: 36ng/mL | Iron: 45mcg/dL | TIBC: 125 mcg/dL | TSAT=36% |

24h urine collection

| |
|---|
| Urine Volume: 1000 ml |
| Urine Cr: 0.8 g |
| Urine Protein: 4.1 g |

CrCl≈17.3 ml/min
CKD-EPI: 16.5ml/min/1.73m$^2$

## Iron Deficiency in Anemia of CKD

- Iron supplementation is recommended for all CKD patients with anemia who receive ESA.

Iron Therapy Challenges for the Treatment of Nondialysis CKD Patients : Clin J Am Soc Nephrol. 2016 Jul 7; 11(7): 1269–1280. : doi: 10.2215/CJN.00080116
Recent and Emerging Therapies for Iron Deficiency in Anemia of CKD: A Review : https://doi.org/10.1053/j.ajkd.2021.09.017

- Iron supplementation can be administered by IV and oral routes.
- KDIGO recommends that, for patients with ND-CKD who require iron supplementation, the route of iron administration should be selected on the basis of:
  - severity of iron deficiency,
  - availability of venous access,
  - response to prior oral iron therapy,
  - side effects with prior oral or iv iron therapy,
  - patient adherence,
  - cost.

- Typical AEs associated with oral iron administration: nausea, vomiting, constipation, and a metallic taste

Iron Therapy Challenges for the Treatment of Nondialysis CKD Patients : Clin J Am Soc Nephrol. 2016 Jul 7; 11(7): 1269–1280. : doi: 10.2215/CJN.00080116
Recent and Emerging Therapies for Iron Deficiency in Anemia of CKD: A Review : https://doi.org/10.1053/j.ajkd.2021.09.017

## Hemodialysis patients

Intravenous iron is the preferred route of administration in hemodialysis patients due to lower intestinal iron absorption, greater iron losses, elevated levels of hepcidin.

Iron Therapy Challenges for the Treatment of Nondialysis CKD Patients : Clin J Am Soc Nephrol. 2016 Jul 7; 11(7): 1269–1280. : doi: 10.2215/CJN.00080116
Recent and Emerging Therapies for Iron Deficiency in Anemia of CKD: A Review : https://doi.org/10.1053/j.ajkd.2021.09.017

## Novel iron formulations

use Fe3+, which does not require administration on an empty stomach and causes less dyspepsia, and the bioavailability of which is not decreased by agents that decrease stomach acidity such as H2 blockers and PPIs.

Iron Therapy Challenges for the Treatment of Nondialysis CKD Patients : Clin J Am Soc Nephrol. 2016 Jul 7; 11(7): 1269–1280. : doi: 10.2215/CJN.00080116
Recent and Emerging Therapies for Iron Deficiency in Anemia of CKD: A Review : https://doi.org/10.1053/j.ajkd.2021.09.017

# Sucrosomial Iron

-The sucrosome is a novel drug-delivery method that has been applied to oral iron repletion.

-Sucrose esterified with fatty acids and combined with lecithin forms a phospholipid bilayer encasing ferric pyrophosphate. The bilayer is further coated with tricalcium phosphate and starch, permitting it to pass through the stomach acid. Downstream, it is endocytosed through Peyer's patch microfold cells.

-30mg/day.

Iron Therapy Challenges for the Treatment of Nondialysis CKD Patients : Clin J Am Soc Nephrol. 2016 Jul 7; 11(7): 1269–1280. : doi: 10.2215/CJN.00080116
Recent and Emerging Therapies for Iron Deficiency in Anemia of CKD: A Review : https://doi.org/10.1053/j.ajkd.2021.09.017


**DIRECTIONS:** Take 1 capsule a day

| Mean contents | In 100 g | In 1 capsules | NRVs% |
|---|---|---|---|
| Iron | 5,04 g | 30 mg | 214,3% |
| Ascorbic Acid (Vit. C) | 11,76 g | 70 mg | 87,5% |

*NRVs: Nutrient Reference Values*


**MEAN CONTENTS**

| | per 100 g | per 1 cps | NRVs% |
|---|---|---|---|
| Iron | 4,000 g | 14 mg | 100% |
| Ascorbic Acid (Vit. C) | 17,14 g | 60 mg | 75% |
| Cyanocobalamin (Vit. B12) | 0,11 mg | 0,375 mcg | 15% |

*NRVs = Nutrient Reference Values*

# Ferric Maltol

-Ferric maltol consists of one Fe3+ ion complexed to 3 maltol moieties.

-This structure protects the Fe3+ ion while passing through the stomach and provides high bioavailability when the complex is dissociated at the enterocyte, where Fe3+ is reduced to Fe2+ and then absorbed via DMT1.


Iron Therapy Challenges for the Treatment of Nondialysis CKD Patients : Clin J Am Soc Nephrol. 2016 Jul 7; 11(7): 1269–1280. : doi: 10.2215/CJN.00080116
Recent and Emerging Therapies for Iron Deficiency in Anemia of CKD: A Review : https://doi.org/10.1053/j.ajkd.2021.09.017

# Ferric Citrate

*In ferric citrate preparation, Fe3+ is complexed to a polymer of tricarboxylic acid (citrate) and water.

*Originally introduced as a phosphate binder, but subsequently obtained FDA approval as a treatment for iron-deficiency anemia in patients with **CKD without KRT**.

*It reduced high serum P levels (≥4.5 mg/dL) but did not reduce serum P levels when it is in the population reference range.

*In patients with **CKD 5D**, ferric citrate is indicated for phosphate binding but is used on an off-label basis as an iron supplement.

Iron Therapy Challenges for the Treatment of Nondialysis CKD Patients : Clin J Am Soc Nephrol. 2016 Jul 7; 11(7): 1269–1280. : doi: 10.2215/CJN.00080116
Recent and Emerging Therapies for Iron Deficiency in Anemia of CKD: A Review : https://doi.org/10.1053/j.ajkd.2021.09.017

# Summary of Oral Irons Formulations

| Characteristic | Ferrous Sulfate | Ferrous Fumarate | Ferrous Gluconate | Ferric Citrate | Ferric Maltol | Sucrosomial Iron |
|---|---|---|---|---|---|---|
| Side effect | | | | | | |
| Dyspepsia | ++ | ++ | ++ | + | + | + |
| Constipation | + | + | + | + | + | + |
| Available as OTC | Yes | Yes | Yes | No | No | Yes |
| Phosphate binder | No | No | No | Yes | No | No |
| Approximate minimum annual cost, USD | $10.80[a] | $237.60[a] | $37.60[a] | $8,294.40[b] | $7,200.00[b] | $720.00[b] |

Iron Therapy Challenges for the Treatment of Nondialysis CKD Patients : Clin J Am Soc Nephrol. 2016 Jul 7; 11(7): 1269–1280. : doi: 10.2215/CJN.00080116
Recent and Emerging Therapies for Iron Deficiency in Anemia of CKD: A Review : https://doi.org/10.1053/j.ajkd.2021.09.017

# Summary Intravenous Iron Formulations

| Agent | MW, Da | Maximum Weekly Dose | Minimum Infusion Time, min | [Fe], mg/mL | Black Box Warning | Severe Hypersensitivity | Hypophosphatemia |
|---|---|---|---|---|---|---|---|
| Ferumoxytol | 731,000 | 510 mg | 15 | 30 | Yes | 0.2% | 0.4% |
| Ferric carboxymaltose | 150,000 | 750 or 1,000 mg | 15 | 50 | No | 1.6% | ~40% |
| Ferric derisomaltose | 150,000 | 1,000 mg or 20 mg/kg if <50 kg | 15 | 100 | No | 0.3% | 3.5% |

Iron Therapy Challenges for the Treatment of Nondialysis CKD Patients : Clin J Am Soc Nephrol. 2016 Jul 7; 11(7): 1269–1280. : doi: 10.2215/CJN.00080116
Recent and Emerging Therapies for Iron Deficiency in Anemia of CKD: A Review : https://doi.org/10.1053/j.ajkd.2021.09.017

# Back to the Patient

## Drugs

- Tab Losartan 25 mg BD
- Tab Atorvastatin 20mg daily
- Tab Allopurinol 100 mg daily
- Amp Eprex  4000 IU weekly

## Supplements

- Tab Ketalog 2 pills Daily
- Cap Omega-3  3g daily
- Tab Nephrotonic 1 daily
- Pearl Calcitriol 1 daily
- Pear Vit D 50000U Q4Weeks
- Tab Sideral 1 daily

## ESA Therapy

In 2011, the FDA recommendation to consider initiating ESA treatment when Hb is <10 g/dl and symptoms of anemia are present.

Iron Therapy Challenges for the Treatment of Nondialysis CKD Patients : Clin J Am Soc Nephrol. 2016 Jul 7; 11(7): 1269–1280. : doi: 10.2215/CJN.00080116
Recent and Emerging Therapies for Iron Deficiency in Anemia of CKD: A Review : https://doi.org/10.1053/j.ajkd.2021.09.017

# LABORATORY TESTS

Back to the Patient

| | | | |
|---|---|---|---|
| K: 4.9 mEq/L | Hb: 11.6 g/dL | TC: 222 mg/dL | BUN : 57 mg/dL |
| P: 4.9 mEq/L | MCV: 80 $f$L | HDL-C: 82mg/dL | Cr: 3.5 mg/dL |
| Mg: 2 mg/dL | | LDL-C: 127 mg/dL | Uric acid: 6.1 mg/dL |
| | | TG: 67 mg/dL | 25OH Vit D: 28 ng/mL |
| Ferritin: 36ng/mL | Iron: 45mcg/dL | TIBC: 125 mcg/dL | TSAT=36% |

24h urine collection

| |
|---|
| Urine Volume: 1000 ml |
| Urine Cr: 0.8 g |
| Urine Protein: 4.1 g |

CrCl≈17.3 ml/min
CKD-EPI: 16.5ml/min/1.73m$^2$

# Zinc Supplementation

In adults with **CKD 1-5D**, we suggest to

not routinely supplement zinc (2C).

there is little evidence that it improves nutritional, inflammatory, or micronutrient status

# Zinc Supplementation

| | Vit B1 | Vit B2 | Vit B3 | Vit B5 | Vit B6 | Vit B7 (biotin) | Vit B9 (folat) | Vit B12 | Vit E | Vit C | Zinc | Vit D | Copper | Iron (fomarat) | selenium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nephrovit | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrotonic | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1 mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephraheal | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephromin | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Renal Aid | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 600 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrofol | 1.5 mg | 1.8 mg | 20 mg | 5 mg | 10 mg | 20mcg | 400 mcg | 2.4 mcg | 15 mg | 60 mg | 8 mg | | | | |
| ProRenal | 1.5 mg | 2 | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9mg | 8 mg | 55mcg |
| Dura life | 1.5 mg | 1.7 mg | 20 mg | 5 mg | 10 mg | 300mcg | 1 mg | 2.4 mcg | 25 mg | 60 mg | 15 mg | | 0.9mg | 8mg | 55mcg |
| Renal fact | 1.5 mg | 2 mg | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9 mg | 8mg | 55mcg |

Vit : vitamin , mcg : microgram

# Zinc, Copper, Iron Interplay

# Copper Supplementation

When CKRT is required for more than two weeks, blood copper determination should probably be recommended. It has been suggested to intravenously administer about 3 mg/d of copper to prevent deficiencies.

No suggestion by KDOQI for outpatient CKD.

# Copper Supplementation

| | Vit B1 | Vit B2 | Vit B3 | Vit B5 | Vit B6 | Vit B7 (biotin) | Vit B9 (folat) | Vit B12 | Vit E | Vit C | Zinc | Vit D | Copper | Iron (fomarat) | selenium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nephrovit | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrotonic | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1 mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephraheal | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephromin | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Renal Aid | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 600 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrofol | 1.5 mg | 1.8 mg | 20 mg | 5 mg | 10 mg | 20mcg | 400 mcg | 2.4 mcg | 15 mg | 60 mg | 8 mg | | | | |
| ProRenal | 1.5 mg | 2 | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9mg | 8 mg | 55mcg |
| Dura life | 1.5 mg | 1.7 mg | 20 mg | 5 mg | 10 mg | 300mcg | 1 mg | 2.4 mcg | 25 mg | 60 mg | 15 mg | | 0.9mg | 8mg | 55mcg |
| Renal fact | 1.5 mg | 2 mg | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9 mg | 8mg | 55mcg |

Vit : vitamin , mcg : microgram

# Selenium Supplementation

In adults with **CKD 1-5D**, we suggest to

not routinely supplement selenium.

there is little evidence that it improves nutritional, inflammatory, or micronutrient status

# Selenium Supplementation

| | Vit B1 | Vit B2 | Vit B3 | Vit B5 | Vit B6 | Vit B7 | Vit B9 | Vit B12 | Vit E | Vit C | Zinc | Vit D | Copper | Iron (fomarat) | selenium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nephrovit | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrotonic | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1 mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephraheal | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 500 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephromin | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 1mg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Renal Aid | 1.5 mg | 1.7 mg | 20 mg | 10 mg | 10 mg | 300mcg | 600 mcg | 6 mcg | 50 mg | 60 mg | 25 mg | | | | |
| Nephrofol | 1.5 mg | 1.8 mg | 20 mg | 5 mg | 10 mg | 20mcg | 400 mcg | 2.4 mcg | 15 mg | 60 mg | 8 mg | | | | |
| ProRenal | 1.5 mg | 2 | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9mg | 8 mg | 55mcg |
| Dura life | 1.5 mg | 1.7 mg | 20 mg | 5 mg | 10 mg | 300mcg | 1 mg | 2.4 mcg | 25 mg | 60 mg | 15 mg | | 0.9mg | 8mg | 55mcg |
| Renal fact | 1.5 mg | 2 mg | 20 mg | 5 mg | 10 mg | 30mcg | 800 mcg | 2.4 mcg | | 60 mg | 8 mg | 1000 IU | 0.9 mg | 8mg | 55mcg |

Vit : vitamin , mcg : microgram

# Calcium Supplementation

In adults not taking active vitamin D analogs, total elemental calcium intake of 800-1,000 mg/d (including dietary calcium, calcium supplementation and calcium-based phosphate binders) is suggested.

- ✓ consideration of concurrent use of vitamin D analogs and calcimimetics in order to avoid hypercalcemia or calcium overload.

# Sodium Supplementation

limiting sodium intake to less than 100 mmol/d (or <2.3 g/d)

to reduce blood pressure and improve volume control.

# Back to the Patient

# $HCO3^-$ Supplementation

- In adults with **CKD 3-5D**, reducing net acid production is recommended through increased bicarbonate or a citric acid/sodium citrate solution supplementation to reduce the rate of decline of residual kidney function.

- In adults with **CKD 3-5D**, it is reasonable to maintain serum bicarbonate levels at 24-26 mmol/L.

# Thank You For Your Attention