Nutrition in CKD

By
Prof. Ali Taha Alkoriaty
Professor of internal medicine and nephrology
Head of internal medicine department
Suhag faculty of medicine

Agenda

- Definition
- Prevalence
- Factors contributing to malnutrition
- Risk of malnutrition
- Nutritional assessment
- Nutritional therapy
- Conclusion and Recommendations

Definition

Kidney disease wasting (KDW) or protein energy malnutrition (PEM)

KDW is defined as a lack in supply of sufficient energy or protein to meet the daily body demands as a result of many causes.

prevalence

- Estimates of “malnourishment” in dialysis varies.
- One range is 8-37%.
- Upper limits of various studies range 40-67%.
- 30% of ESRD population are at less than ideal body weight.
- >40% of patients have hypoalbuminemia
- Cachexia causes 1.9 deaths per 1000 dialysis patient/year.

Restrictions to diet

Catabolism (Dialysis & acidosis, AKI)

Travel time = missed meals

Frequent hosp admission

Mood & depression

Co-morbidities:
- Cancer
- Diabetes (gastroparesis)

Nutrient losses (Dialysis)
- Protein
- Vits & mins

Anaemia & fatigue

Factors contributing to risk of malnutrition

Infection e.g. peritonitis

Socio-economic factors:
- Low budget ?employment

Uraemia:
- Sickness
- Taste changes
- Reduced appetite

WHY DIET IS IMPORTANT ?

- **Maintain optimal nutritional status**
- **Prevent protein energy malnutrition**
- **Slow the rate of disease progression**
- **Prevention/treatment of complications and other medical conditions**
  - DM
  - HTN
  - Dyslipidemias and CVD
  - Anemia
  - Metabolic acidosis
  - Secondary hyperparathyroidism

SEQUELAE OF MALNUTRITION

- **Increase susceptibility to infection.**
- **Impaired wound healing.**
- **Poor rehabilitation.**
- **Increase hospitalization rate.**
- **Increase morbidity and mortality rate.**

Nutrition Assessment

Frequency of screening for under nutrition in CKD

- **We recommend that screening should be performed**
  - *Weekly* for inpatients
  - *2-3 monthly* for outpatients with eGFR <20 but not on dialysis
  - *Within one month* of commencement of dialysis then 6-8 weeks later
- **Screening may need to occur more frequently** if risk of undernutrition is increased (for example by intercurrent

How can we do assessment of the nutritional status?

- ***History and physical examination looking for loss of weight and muscle wasting***
- ***SGA (Subjective Global Assessment)***
- ***Dietary history***
- ***Anthropometry***
- ***Biochemical / laboratory tests***

Conventional subjective global assessment (SGA)

History and symptoms:

1- % of weight loss in the last 6 months

2- Dietary nutrient intake

3- Presence of anorexia, nausea, vomiting, diarrhea or abdominal pain

4- Functional capacity

5- Metabolic demands in the view of activity

Physical Examination:

- Skin fold thickness (at the biceps and triceps), an estimate of body fat.
- Mid arm circumference (estimate of muscle mass).
- Values below the 25th % for **skin & mid arm** are at risk for malnutrition.
- Presence of sacral or ankle odema.
- Presence of ascites.
- conversely, there is consensus that **BMI** values less than 18.5 and recent weight loss greater than 10% of usual body weight are indicators of malnutrition.

II-Nutritional assessment

Include:

-Adequacy of intake

-Appetite / taste changes

-Chewing/swallowing ability

-Cultural/ethnic considerations

-Dietary restrictions

-Eating patterns

-Food intolerances/allergies

-Hydration status including fluid intake

II-Nutritional assessment

A- Food intake:

- **Food questionnaire:** the 24 h recall helps the patients to remember food intake in the previous day and to quantate it.
- **Food record:** quantitative and qualitative data on food intake and is usually collected for an average 3 days including 2 two week day and one week end day (3 days should include dialysis and non-dialysis day).
- **A food diary** is very useful, especially if the patient weighs the portions of food. The intake of protein, fat and carbohydrate can then be calculated from standard food tables.

II-Nutritional assessment

B- Food intake:

The semi-quantitative food –frequency questionnaire (SFFQ): is used to assess the frequency of consumption of food items and groups during a specific reference time period, which may or may not be the period the patient actually bases his(her) recalls on.

Patient Name: **ID #:** **Date:**

HISTORY

WEIGHT/WEIGHT CHANGE: ***(Included in K/DOQI SGA)*** — **Rate 1-7**

1. **Baseline Wt:** _____(Dry weight from 6 months ago)
   Current Wt: _____(Dry weight today)
   Actual Wt loss/past 6 mo: _____ **% loss:**_____(actual loss from baseline or last SGA)
2. **Weight change over past two weeks:** _____No change _____Increase _____Decrease

DIETARY INTAKE No Change_____(Adequate) No Change_____(Inadequate)

1. Change: Sub optimal Intake: _____ Protein _____ Kcal _____ Duration_____
   Full Liquid: _____ Hypocaloric Liquid _____ Starvation _____

GASTROINTESTINAL SYMPTOMS ***(Included in K/DOQI SGA-anorexia or causes of anorexia)***

Symptom:	**Frequency:***	**Duration:+**
_____ None	_____	_____
_____ Anorexia	_____	_____
_____ Nausea	_____	_____
_____ Vomiting	_____	_____
_____ Diarrhea	_____	_____
	Never, daily, 2-3 times/wk, 1-2 times/wk	> 2 weeks, < 2 weeks

FUNCTIONAL CAPACITY — b

Description	**Duration:**
_____ No Dysfunction	_____
_____ Change in function	_____
_____ Difficulty with ambulation	_____
_____ Difficulty with activity (Patient specific "normal")	_____
_____ Light activity	_____
_____ Bed/chair ridden with little or no activity	_____
_____ Improvement in function	_____

DISEASE STATE/COMORBIDITIES AS RELATED TO NUTRITIONAL NEEDS

Primary Diagnosis_____Comorbidities_____
Normal requirements _____Increased requirements_____ Decreased requirements _____
Acute Metabolic Stress: _____None _____Low _____Moderate _____High

PHYSICAL EXAM

_____ Loss of subcutaneous fat (Below eye, triceps, biceps, chest) ***(Included in K/DOQI SGA)*** _____Some areas _____All areas

_____ Muscle wasting (Temple, clavicle, scapula, ribs, quadriceps, calf, knee, interosseous ***(Included in K/DOQI SGA)*** _____Some areas _____All areas

_____ Edema (Related to undernutrition/use to evaluate weight change)

OVERALL SGA RATING

Very mild risk to well-nourished=6 or 7 most categories or significant, continued improvement.
Mild-moderate = 3, 4, or 5 ratings. No clear sign of normal status or severe malnutrition.
Severely Malnourished = 1 or 2 ratings in most categories/significant physical signs of malnutrition.

III-Anthropometry

K/DOQI guidelines :

The anthropometric measurement that are valid for assessing nutritional status:

1. For body fat : triceps (biceps) skin fold(TSF) .
2. For muscle mass : mid arm muscle circumference (MAMC) &mid arm circumference (MAC).
3. For obesity : BMI
4. % of usual body weight (UBW) and % of standard body weight (SBW).

This measures should be taken immediately post-dialysis at right side of the body.

III-Anthropometry

- The results of these measurements are compared to reference standards obtained from healthy adults during the National Health and Nutrition Examination Surveys (NHANES II) from 1976 to 1980.

- These norms in relatively "healthy" dialysis patients allows all patients to be evaluated.
- As a general rule,
  - values **>95 %** of normal = adequate nutrition
  - values **70%** and **95 %** = risk of malnutrition
  - values **<70 %** = significant malnutrition

IV. Laboratory Tests:

- Serum albumin
- Predialysis serum urea nitrogen (SUN)
- Urea nitrogen appearance (UNA)
- Protein equivalent of total nitrogen appearance (PNA)
- Serum prealbumin
- Serum creatinine
- Serum transferrin.
- Growth factors: IGF1, leptin

Biochemical markers for nutritional assessment

Biochemical Marker	Relationship	Remark
Serum albumin	Very strong predictor of outcome, minimum value 3.0–3.5/dl depending on measurement method	
Serum cholesterol	A value of <150 mg/dl is suggestive of malnutrition	
Serum transferrin	A value <2,000 mg/l may suggest malnutrition	Also influenced by infection and iron status
Serum prealbumin	In hemodialysis patients, prealbumin <0.3 g/l may suggest malnutrition	Acute decline in renal function may be associated with an increase in prealbumin, making the assessment difficult

❖ Albumin as a Predictor

- ❖ *Strong predictor of morbidity and mortality (CANUSA study)*

- ❖ *However,*

- ➢ *Albumin is affected by non-nutritional factors*
- ➢ *Albumin may not increase in response to nutritional intervention*

Nutritional deficiency indicators in dialysis patients

Parameter	Change from normal
Body weight (tissue, non-fluid)	Decreased
Growth and height (in children)	Decreased
Muscle mass	Decreased
Total body nitrogen	Decreased
Protein catabolism	Increased
Serum albumin	Decreased
Transferrin, prealbumin	Decreased
Essential amino acids	Decreased
Essential/non-essential amino acids	Decreased
Non-essential amino acids	Increased
Total body fluid weight	Increased
Free carnitine	Decreased
Acyl-carnitine	Increased
Acyl/free carnitine	Increased
Leptin	Increased

Indices of Malnutrition in Hemodialysis Patients

Serum albumin concentration less than 4.0 g/dL (40 g/L)
Continuous decline in estimated dry weight
Protein catabolic rate less than 0.8 g/kg per day
Body weight less than 80 percent of ideal weight
Low serum creatinine and urea concentrations in patients without residual renal function
Marked reduction in anthropometric measurements
Cholesterol concentration less than 150 mg/dL (3.9 mmol/L)
Transferrin concentration less than 150 mg/dL
Insulin growth factor-1 concentration less than 300 µg/L
Low predialysis serum potassium (and possibly phosphorous) concentration
Low serum prealbumin concentration (less than 30 mg/dL)

MANAGEMENT

Aims of Dietetic intervention…

1. To optimise nutritional status
2. To keep renal biochemistry within safe limits
   - K^+
   - $PO4^-$
3. To prevent fluid overload & aid BP control
4. To make dietary advice as practical as possible to aid compliance


Nurse
Doctor
Social worker
Psychologist
Others
Dietitian
Multidisciplinary Team

THE RENAL DIET

- Sufficient in protein
- Adequate in calories
- Restricted in sodium, potassium, phosphorus, and fluids(Dialysis).

Energy

Adequate energy intake essential to optimize nutritional status

Nutritional parameter	Stages 1–4	Stage 5	
	CKD	*HD*	*PD*
Calories (*kcal/kg/d*)	35 < 60 yrs 30–35 ≥ 60 yrs	35 < 60 yrs 30–35 ≥ 60 yrs	35 < 60 yrs 30–35 ≥ 60 yrs includecalories from dialysate

Regular physical activity should be encouraged, and energy intake should be increased according to the level of physical activity (Opinion).

Protein

Essential for ❖ *to build and repair body tissues*
❖ *fighting infection*

Target Protein Intake for

Nutritional parameter	Stages 1–4	Stage 5	
	CKD	*HD*	*PD*
Protein (*gm/kg/d*)	0.6–0.75 50% HBV	1.2 50% HBV	1.2–1.3 50% HBV

➢ increase protein intake of 1.5g/kg/day for patients with infections or catabolic stress

1 gm protein = 4 kcal.

Protein

There are two kinds of proteins.

"Higher quality" (HBV) :-

proteins are found in animal products like meat, poultry, fish and eggs. They are the easiest proteins for your body to use.

"Lower quality" (LBV) :-

proteins are found in vegetables and grains.

A well balanced diet for kidney patients should include **both** kinds of proteins every day.

- ***Low protein diet is helpful in controlling hyperphosphatemia, metabolic acidosis and hyperkalemia.***

- ***Dietary protein restriction may protect against the progression of CKD by hemodynamically mediated reductions in intraglomerular pressure and by changes in cytokine expression and matrix synthesis.***

- ***some high protein foods contain high levels of phosphorus.***

lipids

Nutritional parameter	Stages 1–4	Stage 5	
	CKD	*HD*	*PD*
Fat (*% total kcal*)	Patients considered at highest risk for cardiovascular disease;		

- ***requirement of fat (30 % total cal) Minimize the ↑ in TG & Cholesterol***

- ***The diet should contain an appropriate proportion of mono and polyunsaturated fatty acids and saturated fatty acid, i.e., in 1:1:1 ratio.***

- ***Monounsaturated fat (omega-9) is considered "good" fats because they may lower low-density lipoprotein (LDL) cholesterol and may help raise high-density lipoprotein cholesterol.***

1 gm Lipid = 9 kcal.

- ***Good sources of monounsaturated fats are: Olive oil, canola oil and peanut oil.***

- ***Polyunsaturated fat are considered "good" fats because they help lower LDL cholesterol when used in place of saturated fat. Good sources of polyunsaturated fat (omega 6) are: Corn oil, safflower oil, sunflower oil and sunflower seeds.***

- ***Saturated fat: Full cream milk dishes should be avoided as they contain saturated fats. Avoid coconut and coconut milk (high in saturated fat).***

- ***Dyslipidemia should be treated in early stages of CKD.***

Carbohydrates

Nutritional parameter	Stages 1–4	Stage 5	
	CKD	*HD*	*PD*
CHO (*% total kcal*)	55 – 60%		50 -60%

- *65% complex sugar*
- *35% simple sugar*

- *The patient should be encouraged to eat complex sugar rather than purified carbohydrates to reduce triglyceride synthesis and to improve glucose tolerance*

1 gm CHO = 4 kcal.

Sodium

Serum Sodium (nl 135-145 mEq/L)

- **Plays vital role in regulation of fluid balance and blood pressure**
  - ***Restriction helps compliance in fluid intake***

Nutritional parameter	Stages 1–4	Stage 5	
	CKD	*HD*	*PD*
Sodium (*mg/d*)	2000	2000	2000

- ***Guidelines for general population= max 6g NaCl per day***

Sodium

- *Avoid adding salt at the table*
- *Use small amount in cooking or none at all*
- *Reduce intake of salty foods (e.g., cheese, smoked food, savoury snacks)*
- *Limit intake of packet, processed foods*
- *Encourage use of pepper, herbs and spices as alternative flavourings*

Fluids

- ***The requirement for sodium and water varies markedly, and each patient must be managed individually***

Nutritional parameter	Stages 1–4	Stage 5	
	CKD	***HD***	***PD***
Fluid (*ml/d*)	**Unrestricted with normal urine output**	**1,000 + urine output**	**Monitored; 1,500–2,000**

Restricting fluid intake

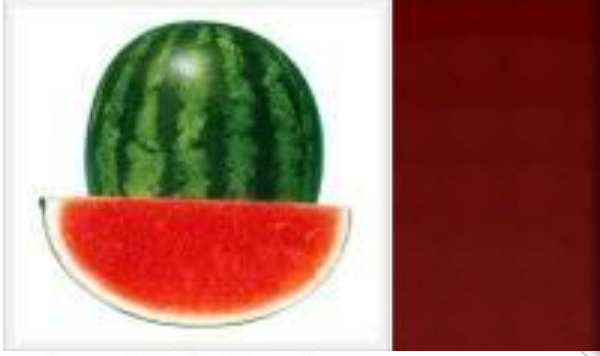
1. **Avoid foods that contain a lot of fluid, such as sauces, custard and gravy.**
2. **Divide your fluid allowance throughout the day.**
3. **Take some of your drugs with food to avoid having to take them with water.**
4. **Avoid salty or spicy foods. They make you thirsty.**
5. **Rather than drinking, suck ice cubes or slices of lemon to quench your thirst.**
6. **Use a small cup or glass.**

Potassium

(3.5-5.5 mEq/L)

Nutritional parameter	Stages 1–4	Stage 5	
	CKD	*HD*	*PD*
Potassium (*mg/d*)	Correlated to laboratory values	2,000–3,000 **40 mg/ kg IBW**	3,000–4,000

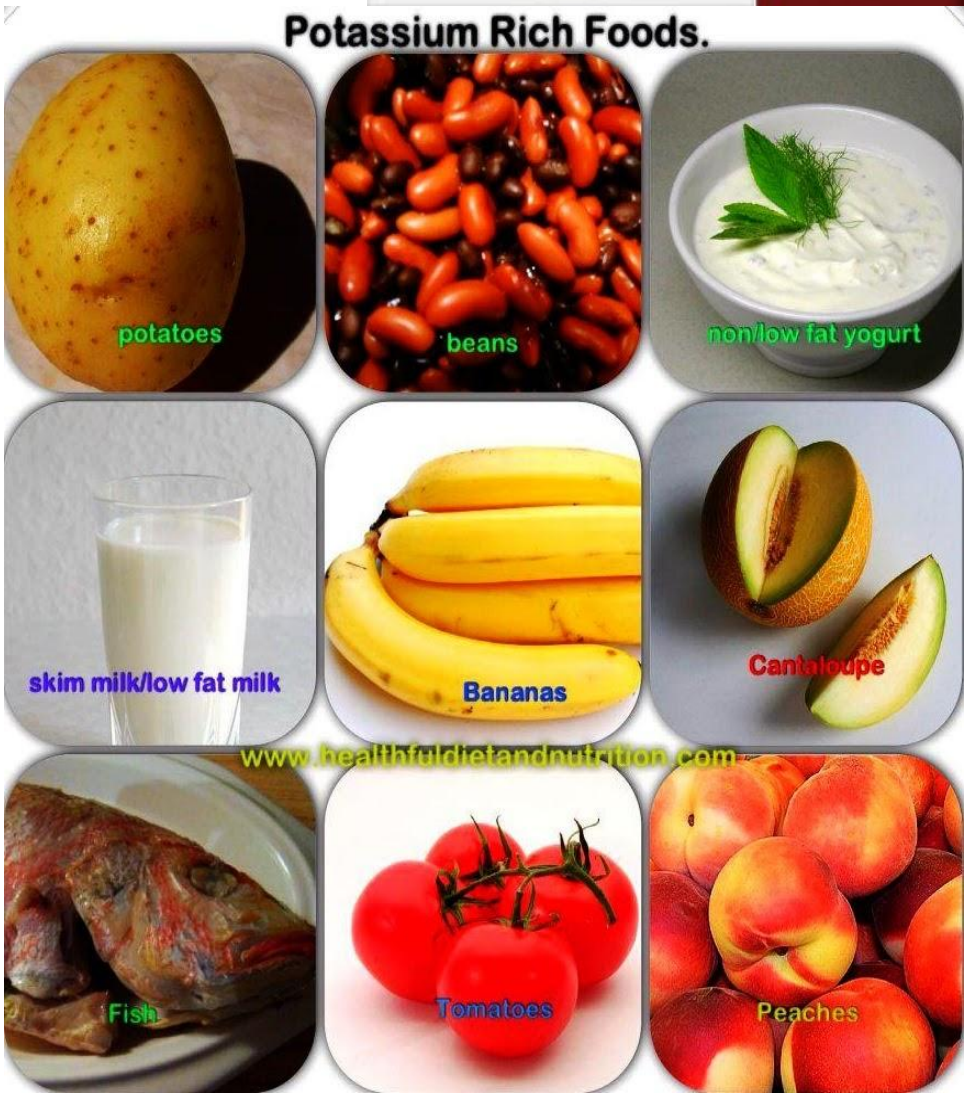
Potassium



Large amounts of potassium are found in

fruits and vegetables (like bananas, melons, oranges, potatoes, tomatoes, dried fruits, nuts, avocados, deep-colored and leafy green vegetables and some juices)

- **Milk** is high in potassium. Limit milk to I cup per da
- **dried beans and peas**
- **protein-rich foods,** such as meat, poultry, pork and fish.*



Page, accessed at http://www.nal.usda.gov/fnic/cgi-bin/nut_search.pl.

Potassium Sources	Milligrams (mg)	Potassium Sources	Milligrams (mg)
Apricots, 3 medium	272	Orange juice, 8 oz	473
Artichoke, 1 cup, raw	644	Papaya, 1 whole	781
Avocado, Jerusalem, 1 medium	976	Potato, baked with skin, medium	1081
Banana, 1 cup	537	Pumpkin, 1 cup, cooked	564
Beans, canned white, 1 cup	1189	Prunes (dried plums), 1 cup, stewed	796
Beet greens, boiled, ½ cup	653	Prune juice, 1 cup	707
Broccoli, 1 cup chopped	457	Raisins, 1/3 cup	362
Cantaloupe, 1 cup	427	Refried beans, canned, 1 cup	673
Grapefruit juice, sweetened, 1 cup	405	Spinach, 1 cup, cooked	574
Halibut, cooked, ½ fillet	916	Sweet potato, canned, 1 cup	796
Kidney beans, 1 cup	713	Tomato, 1 medium	426
Kiwifruit, 1 medium	252	Tomato juice, 6 oz	417
Lima beans, cooked, 1 cup	955	Tomato puree, ½ cup	1328
Milk, 1 cup, skim	382	Tomato sauce, 1 cup	940
Milk, 1 cup, chocolate	425	Tropical trail mix, 1 cup	993
Milkshake, 16 oz, vanilla	579	Vegetable juice cocktail, 1 cup, canned	467
Nectarine, 1 medium	273	Winter squash, 1 cup	896
Orange, 1 medium	237	Yogurt, 8 oz, low fat	443

http:// WWW.nal.usda.gov/fnic/foodcomp/Data/SR17/wtrank/sr17w301.pdf;2005

Calcium

Calcium (8.4-9.5 mg/dL)

Nutritional parameter	Stages 1–4	Stage 5	
	CKD	***HD***	***PD***
Calcium (*mg/d*)	1,200	<2,000 from diet and medications	<2,000 from diet and medications

- ***Dietary calcium intake is low because many foods high in calcium high in phosphorus.***
- ***The total intake of elemental calcium should not exceed 2000 mg/day including calcium obtained from calcium-based phosphate binders.***
- ***Treatment with Vita. D analogues may decrease the daily calcium requirement by enhancing intestinal calcium absorption.***

Calcium

Calcium Sources	Milligrams (mg)	Calcium Sources	Milligrams (mg)
Milk, fluid, chocolate, low fat, 1 cup	288	Tofu made with calcium, ¼ block	164
Milkshake, thick, vanilla, 11 oz	457	Total brand cereal, ¾ cup	1104
Molasses, blackstrap, 1 tablespoon	172	Sardines, canned with bones, 3 oz	325
Pudding, chocolate, 4 oz, ready to serve	102	Spinach, canned, 1 cup	272
Ricotta cheese, part skim, 1 cup	669	Turnip greens, frozen, cooked, 1 cup	249
Soybeans, green, cooked, 1 cup	261	Yogurt, low fat with fruit, 1 cup	345
Broccoli, cooked, 1 cup	156	Collards, 1 cup, cooked	266
Cheddar cheese, 1 oz	204	Eggnog, 1 cup	330
Cheese sauce, 1 cup	756	Enchilada with cheese, 1	324
Cheese, Swiss, 1 oz	224	Milk, canned evaporated, 1 cup	742
Clam chowder, New England, 1 cup	186	Milk, fluid, 1%, 1 cup	290

http:// WWW.nal.usda.gov/fnic/foodcomp/Data/SR17/wtrank/sr17w301.pdf;2005

Phosphorus

(***normal serum phosphate*** 3.5-5.5 mg/dL)

Phosphorus control essential for prevention and management of renal bone disease, arterial stiffening and vascular calcification

Nutritional parameter		**Stages 1–4**	**Stage 5**	
		CKD	***HD***	***PD***
Phosphorus	***(mg/d)***	Correlated to lab values	800–1,000	

High Phosphorus Foods

The following has..	This much phosphorus
1 oz meat	65 mg
2 tablespoons peanut butter	100 mg
½ cup milk	110 mg
1 cup Hawaiian Punch	115 mg
1 oz cheese	100 – 150 mg
½ cup beans (pinto, lima)	125 mg
2/3 cup bran flakes	150 mg
Fast food small cheeseburger	176 mg
3 tablespoon (1 oz) sunflower seeds	328 mg
Fast food sausage & egg biscuit	490 mg

Phosphorus

To control phosphorus level, you will need to:-

There are three main strategies for correcting hyperphosphatemia:

I.Diet: restricting dietary phosphate intake.

- **Read ingredient labels to find phosphorus additives**

II.Enhancing elimination: removing phosphate with adequate dialysis.

- **A standard 4 h haemodialysis treatment removes between 600 and 1200 mg/day.**
- **Among patient with refractory Hyperphosphatemia, nocturnal HD is an option among those who are welling to accept this form of dialysis**

III.Minimising phosphate absorption: reducing intestinal absorption using phosphate binders.

- **Take phosphate binder with your meals and snacks.**

Vitamins and mineral

- **Patients on dialysis (stage 5) are known to lose certain water-soluble vitamins.**

- **However, patients in renal failure have decreased excretion of vitamin A, and vitamin A toxicity has been reported in some cases. Therefore, patients on dialysis should receive a multivitamin supplement that avoids excessive vitamin A.**

- **Iron supplementation may be necessary for patients receiving erythropoietin.**

- **There are also data to suggest that dialysis results in increased risk for zinc deficiency; patients taking zinc supplements reported improvements in taste alterations and sensitivity.**

➢ Enteral tube

- *the use of enteral feeding via a Naso Gastric tube (NGT) / Percutaneous Endoscopic Gastrostomy (PEG) is considered in selected cases if nutrient intake is suboptimal despite oral supplements. (1C).*

➢ TPN

- *When intensive dietary support, oral supplements and enteral nutrition have failed, a course of parenteral nutrition is recommended*

UK Renal Association May 2016

Renal transplantation

Immediately post transplant:

1. High protein diet & boil drinking water

2. Food hygiene – food storage/ handling/ preparation

Long term:

Healthy eating & weight maintenance

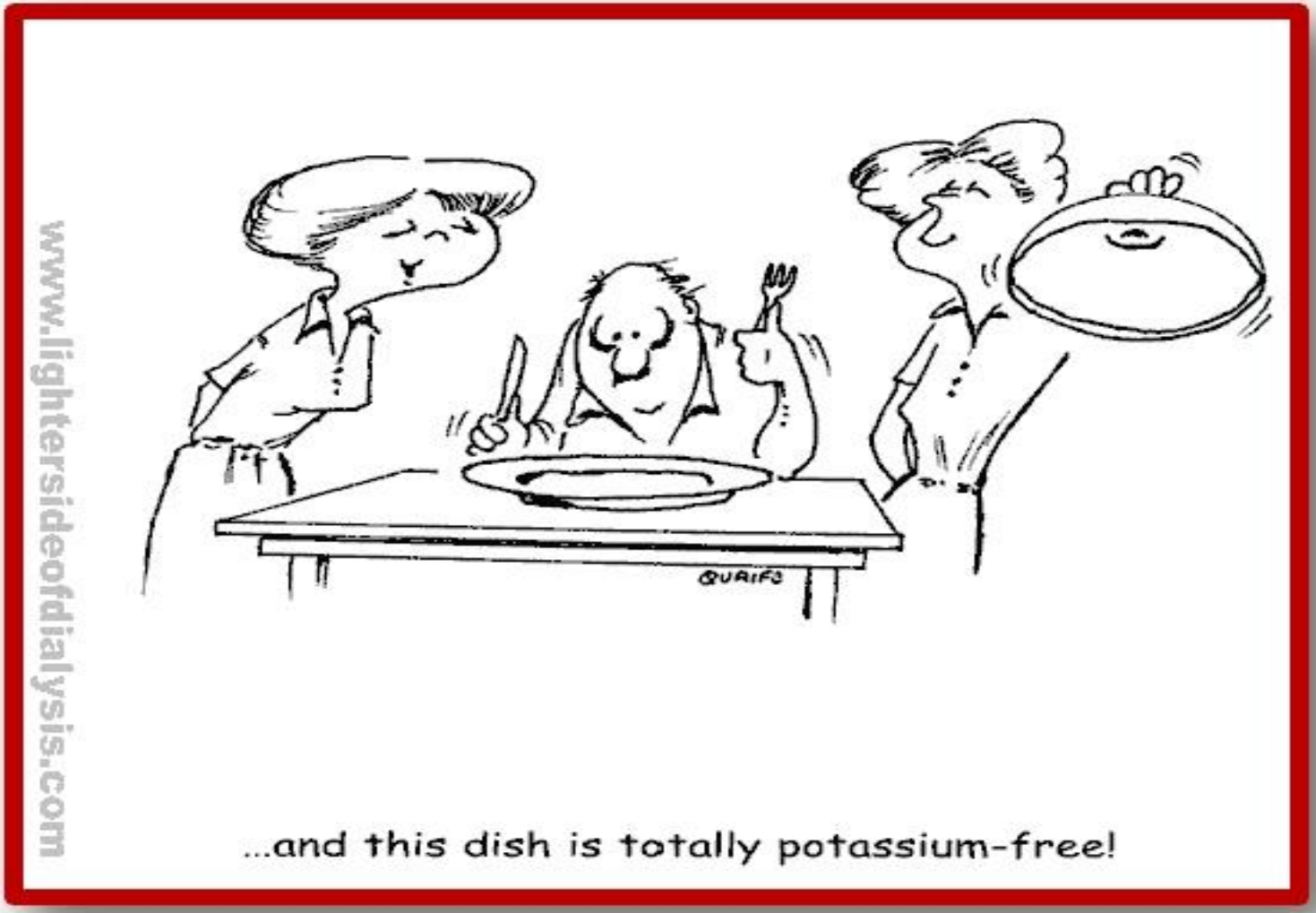
- *5-a-day Fruit & veg*
- *Reduce fats/sugars*
- *Minimise saturated fats (choose MUFA)*
- *Physical activity*

N.B. Failing transplant as per CKD/Low clearance

Conclusion

- **Malnutrition is common in HD patients**
- **There is no one gold standard measure which can be used in any patient population to accurately assess nutritional status.**
- **Many diagnostic parameters are available**
- **Many nutritional intervensions methods are also available**

THANK YOU


www.lightersideofdialysis.com
...and this dish is totally potassium-free!