

MNT Of Kidney Diseases

Assistant Prof. Mayasah A. Sadiq FICMS-FM

Functions of the Kidney

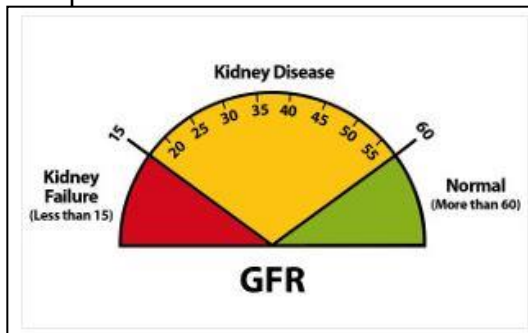
- Excretion of metabolic waste through urine
- Water and Electrolyte Homeostasis
- Acid/base balance
- Maintenance of bone health
- Activation of vitamin D
- Calcium/phosphorus homeostasis
- Blood Pressure Regulation(Renin-Angiotensin-Aldosterone)
- Stimulate red blood cell production(Erythropoietin).

Consequences of Kidney Disease

- Decreased excretion of nutrients/waste
- Abnormal calcium/phosphorus metabolism leading to bone disease
- Weight loss and malnutrition
- Fluid and electrolyte imbalances
- Cardiovascular disease and mortality

Review: Complications may increase as kidney function declines

Fewer nephrons lead to	Complication	Evidenced by
Inadequate erythropoietin	Anemia	Low hemoglobin
Reduced urinary excretion of potassium	Hyperkalemia	High potassium
Reduced urinary excretion of hydrogen ion	Metabolic acidosis	Low serum bicarbonate
Inadequate activation of vitamin D	Bone disorders, soft tissue and vascular calcification	<ul style="list-style-type: none"> • Low 25(OH) Vit D • High serum phosphorus • Abnormal calcium • Abnormal parathyroid hormone (PTH)



Chronic Kidney Disease CKD

- Is defined as either kidney damage or GFR < 60mL/min for at least 3 months
- Kidney damage is defined as pathologic abnormalities or markers of damage, including abnormalities in blood or urine tests, or imaging studies.
- Approx. 50% of dialysis patients have diabetes
- Note: Insulin requirements decrease with progressive CKD due to inefficient excretion of insulin

- Blood pressure control may slow CKD progression.
 - Limit sodium to 2,300 milligrams.
 - Diabetes control early may lower CKD risk.
 - Target A1c is individualized, based on age, comorbid conditions, and frequency of hypoglycemia.
- In people with lower GFRs, hypoglycemia may be a sign that kidney disease has progressed.

Brief Review

- Urine albumin is a marker of kidney damage.
 - Higher levels are associated with more rapid progression of CKD.
 - Weight loss, sodium restriction, certain blood pressure medications, avoidance of excessive protein intake, and tobacco cessation may reduce urine albumin.
- CKD increases risk of cardiovascular disease (CVD).

Uremic Syndrome

- Nausea
- Vomiting
- Metallic taste
- Itching
- Lack of energy

Healthy eating patterns and kidney disease

- High intakes of red and processed meat may increase risk of developing CKD; and nuts, low-fat dairy or legumes may lower risk (excluded DM).
- A healthier diet with less sodium and higher potassium was associated with reduced risk of mortality or self-reported dialysis initiation.
- Healthy eating patterns with adequate vegetable and fruits and limited alcohol may delay CKD progression and improve survival.
- Meta-analysis found higher fruit and vegetable, fish, legume, whole grain and fiber intake and reduced red meat, sodium and refined sugar intake is associated with lower mortality in CKD.

Goals of CKD Management

- Achieve/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

Glomerular Filtration Rate

- Cockcroft–Gault formula: GFR
(ml/min/1.73m²) = (140 – age) × (weight) × (0.85 if female) / (72 × serum creatinine)

Five stages of chronic kidney disease

- Stage 1 with normal or high GFR (GFR > 90 mL/min)
- Stage 2 Mild CKD (GFR = 60-89 mL/min)
- Stage 3A Moderate CKD (GFR = 45-59 mL/min)
- Stage 3B Moderate CKD (GFR = 30-44 mL/min)
- Stage 4 Severe CKD (GFR = 15-29 mL/min)
- Stage 5 End Stage CKD (GFR <15 mL/min)

- Medical Nutrition Therapy Recommendations
(Stages 3 to 5)

Low Albumin

Non-nutritional factors

- Infection
- Inflammation
- Co-morbidities
- Fluid overload
- Inadequate dialysis
- Blood loss
- Metabolic acidosis

Calories

- Recommended energy intake 30 to 35 day kcals/kg
- Spares body protein
- Maintains neutral nitrogen balance
- Promotes higher serum albumin levels

PROTEIN

Dietary Protein Restriction

- Reduces nitrogenous waste
- Reduces inorganic ions
- Reduces metabolic/ clinical disturbance (uremia)
- Slows rate of decline in GFR

Which type of protein is best for CKD?

Animal protein

- May contribute to acidosis (due to sulfur-amino acids) and uremic toxins in CKD.
- More than half of dietary phosphorus is from animal protein in our diets.
- High intakes of processed and red meat may be associated with CVD.

Plant protein

- May contribute to bicarbonate levels.
- May be associated with fewer uremic toxins.
- May improve lipid levels.
- May be associated with lower mortality in CKD.

What is HBV protein?

- High biological value (HBV) proteins **contain all of the essential amino acids we need.**
- Proteins Have Different Biological Values •
- They're mainly found in animal sources — e.g. meat, fish, poultry, eggs, cheese and milk.
- Soya beans and quinoa are plant-based HBV protein foods

Protein guidelines

- (Average Intake 1.2 g per kg/day)
- 0.75 grams per kg/day for CKD stages 1 - 3
- 0.6 grams per kg/day for CKD stages 4, 5
- 50% of the dietary protein should be HBV
- HBV protein produces less nitrogenous waste
- 45 to 60 grams protein per day
- No Protein Restriction for Dialysis Patients:
- 1.2 g per kg/day hemodialysis
- 10-12 grams lost per HD treatment
- 1.3 g per kg/day peritoneal dialysis
- 5-15 grams lost per PD treatment

Challenges with High Protein Foods Also high in phosphorus and potassium

- Milk
- Cheese
- Beans
- Peanut butter

Nutritional Interventions

- Encourage patients to eat
- Adjust or liberalize diet as appropriate
- Frequent small meals/snacks
- High protein foods first if they get full quickly
- Calorie dense foods
- Consider use of nutritional supplements

Sodium

- Dietary sodium restriction prevents
- Excessive thirst
- Edema
- Hypertension
- CHF
- Sodium restriction 2000 mg/day
- Range from 1000mg to 4000mg
- Varies depending on co-morbidities
- More liberal sodium with frequent dialysis
- Sodium excretion falls at GFR 20mL/min

Sources of dietary sodium

- Pre-prepared foods
- Processed foods
- Canned, bottled, packaged foods.

SODIUM

- 1 tsp salt 2,300 mg sodium

2 gram Sodium

- Diet Fresh foods
- Limit
- Cured/pickled foods
- Processed
- Canned/bottled/packaged
- Instant cereals, mixes
- Avoid salt substitutes (potassium chloride)
- Flavor foods with spices, vinegar, lemon juice, pepper

Potassium

- Potassium Restriction Indications
- Urine output < 1 liter per day
- GFR < 10 mL/min
- ACE inhibitors, beta blockers, lasix
- Hyperglycemia
- Serum potassium >5.0 mEq/L
- Dietary Potassium Restriction 2 grams/day
- Serum Potassium Goal 3.5- 5.0 mEq/L

Potassium in the Diet

- **High (gt 400 mg/serving)**
- Banana
- Potato
- Avocado
- Orange juice
- **Moderate (gt200 mg/serving)**
- Berries
- Broccoli
- Tomato

Low Potassium Fruit Vegetables

- gt100 mg/serving
- Cranberries
- Apple
- Corn
- Lettuce
- Pineapple
- String beans

SUMMARY: Preparation may impact potassium content of vegetables

Generally speaking, potassium contents vary, when cooking:

- Canned < boiled < baked
- Frozen boiled < fresh boiled
- Boiled < microwaved
- Smaller pieces < larger pieces (chopped vs. spears)

Generally speaking, for raw vegetables:

- Smaller pieces < larger pieces (grated vs. chopped)
- Juice has more based on comparable serving size (how many pieces does it take to make one half cup?)

A few tips for vegetables when someone has hyperkalemia

- Choose lower potassium vegetables.
- Buy frozen vegetables without added sauces or seasoning.
- Boil vegetables instead of microwaving them.
- Choose no-added salt canned vegetables, drain and rinse.
- Drain and rinse regular canned vegetables to lower sodium (and maybe some potassium).
- Top sandwiches with veggies such as green leaf lettuce, sliced cucumbers, grated carrots, and others.

Tips for fruit when someone has hyperkalemia

- Choose lower potassium fruits.
- If a higher potassium fruit is preferred, eat a small amount.
- Canned fruits have less potassium than fresh. Drain and rinse.
- Use peeled fruit for fruit salad.
- Although the fruit “nectars” are lower in potassium, they have added sugar and are lower in fiber.

Managing Bone Health

- Altered Bone Turnover in CKD
- Kidney Failure leads to
- Decreased production of active Vit D
- Low serum calcium
- Phosphorus retention
- Elevated PTH
- Secondary Hyperparathyroidism
- Mineral and Bone Disorder

Phosphorus

- High serum phosphorus
- Bone decalcification
- Soft tissue calcifications
- Hyperparathyroidism
- Phosphorus restriction for GFR <25mL/min
- Normal dietary phosphorus 1000 to 1800 mg/day
- Dietary restriction 560 to 850 mg/day
- Phosphate binders
- Bind phosphorus in the GI tract
- Must take with meals
- Phoslo (calcium containing)
- Renvela (Sevelamer) (calcium free)
- Fosrenol (chewable)

Calcium in CKD

- Maintain serum calcium 8.4 -10.2 mg/dL
- Optimal 9.6 mg/dL
- Dietary Calcium
- 1200 -1500 mg/day (stages 3 and 4)

Fluid Restriction CKD Stage 4 or 5

- Fluid any food that is liquid at room temp
- Excess fluid buildup
- Edema, SOB, HTN, CHF
- Delays wound healing
- Fluid restriction estimations are based upon
- Urinary output
- Disease state
- Treatment modality (dialysis, etc.)

Fluid Allowance Tips

- Approx 48oz/day
- Pre-measure mealtime liquids
- Drink very hot or very cold beverages
- Drinking from smaller cups
- Use spray bottle to mist mouth
- Freeze juice in ice cube tray and eat like popsicles

What about beverages?

- Water should be the preferred choice.
- Milk and fruit juice should be consumed within recommended food group amounts and calorie needs.
- Beverages with added sugars should be reduced and not replaced with low-calorie versions; drink water instead.
- Currently, sweetened beverages account for 35% of calories from beverages in the diet.

Vitamin Mineral Supplements Dietary restrictions result in a diet deficient in nutrients

- Vitamin C 90 mg/day
- Over 75% of kidney disease patients have increased homocysteine levels.
- Folic acid 1 mg/day
- B6 5 mg/day
- No Vitamin A due to its accumulation in CKD
- Vitamin D in its active form
- 1,25 dihydroxycholecalciferol
- 1,25 (OH₂)D₃
- PROCRIT[®] iron supplementation: is a man-made form of erythropoietin that causes your bone marrow to make more red blood cells
- Suggestion **Nephrocaps**: Each Softgel Contains: Vitamin C 100 mg, folate 1 mg, niacin 20 mg, thiamine 1.5 mg, riboflavin 1.7 mg, Vitamin B-6 10 mg, Vitamin B-12 6 mcg, pantothenic acid 5 mg and biotin 150 mcg

Herbal Supplements

- Use may be unsafe for CKD patients
- Poor clearance
- Purity, safety, effectiveness unknown
- No regulation, no testing requirements
- Subject to contamination
- Lead
- mercury
- Herbs can interact with medications
- Renal patients take gt 10 meds/day
- Renal toxicity
- E.g. Parsley capsules

Tips for eating healthy in CKD

- Prepare foods from scratch(to use only the most basic ingredients, with nothing premade).
- Choose foods without food additives.
- Prepare foods without salt, and if needed, add a small amount at the table.
- Use liquid vegetable oil instead of solid fats.
- Use less meat, poultry, or fish in recipes.
- Increase vegetable intake.

Brief Summary

- Healthy eating patterns may be beneficial in CKD.
- Foods rich in fiber are important for gut health.
- Limiting sodium is part of a healthy eating pattern.
- Preparation of vegetables and fruit impacts potassium content (canned < frozen < fresh).
- Vegetables and fruit generate bicarbonate.
- Foods rich in protein contribute to phosphorus and potassium intake. Some have added sodium.
 - Animal proteins contribute to acid load.

Nutrition Management For Kidney Stones

Causes of Kidney stones

- **Dehydration**
- **High Sodium Intake**
- **High Doses of Vitamin C** supplementation (> 1000mg)
- **High Urinary Calcium-** possible due to toxicity from high supplement intake or Vit D toxicity – levels > 150mg
- **High oxalates** in the urine increases the risk of calcium oxalate kidney stones. Vitamin B6 deficiencies also increase levels of oxalates in the urine
- Decrease in Urine PH levels
- **High Uric Acid Levels:** Elevated uric acid is also associated with gout and cardiovascular disease & uric acid stones. High uric acid is most commonly seen with high fructose consumption.

“Its Most Important to Find out the cause of kidney stone”

Types of Kidney Stones

- Calcium Oxalate Stones
- Uric Acid Stones
- Calcium Phosphate stones
- Cystine Stones

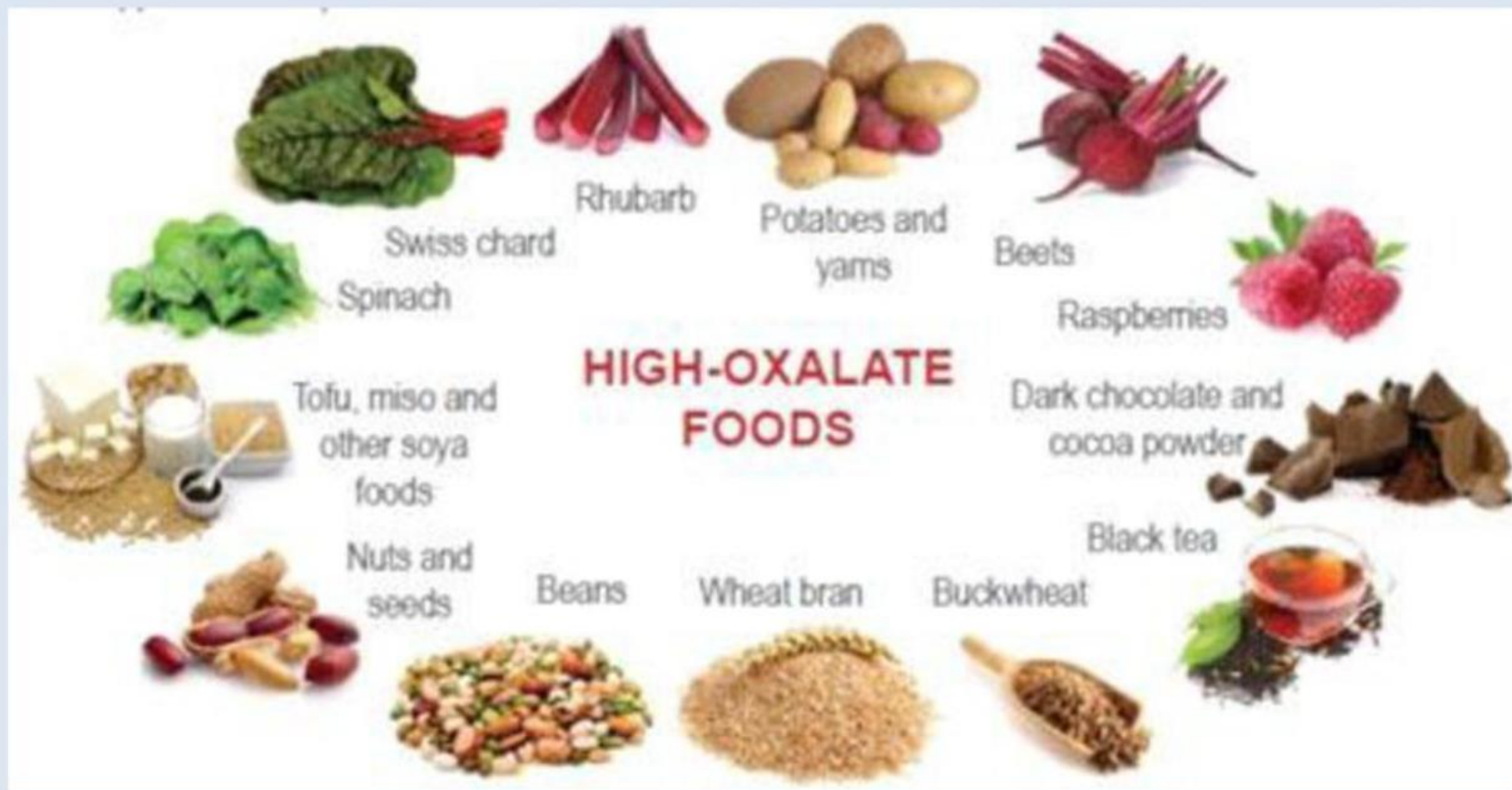
Calcium Oxalate Stones

Low Oxalate Diet (LOD)

- Oxalates are abundant in many plant foods
- When the gut is inflamed or becomes permeable excess oxalate from foods can be absorbed
- When present in high amounts can lead to oxidative damage, depletion of glutathione, and inflammation
- Excess oxalates form crystals after binding with calcium
- Symptoms include: Pain, Burning, Frequent Urination, Eye Poking, Family history of Kidney Stones, Vulvodynia
- Avoid High Oxalate Foods
 - Spinach, Greens, Nuts, Soy, Beets
- Avoid Calcium and High Doses of Vitamin C



Limit High Oxalates foods



Fluid Intake



- Drinking lots of water helps flush out toxins that accumulate in the kidney.
- Drinking water is an excellent preventive measure to avoid formation of kidney stones.
- Ensure plenty of fluids in take to prevent urine from becoming concentrated.
- Drink at least 64-96 Oz of water/ day

Limit Salt Intake



- Reduce the amount of salt you eat
- Aim for no more than 2500mg of salt / day
- Avoid all processed foods.
- Sodium, often from salt, causes the kidneys to excrete more calcium into the urine.
- High concentrations of calcium in the urine combine with oxalate and phosphorus to form stones.
- Reducing sodium intake is preferred to reducing calcium intake
- Limit Dairy products intake to 2 serving per day of low fat products.
- Include plant based protein sources- such Quinoa, lentils, pulses, dried beans- also low in oxalates

Getting Enough Calcium from Foods

- Calcium from food does not increase the risk of calcium oxalate stones. Calcium in the digestive tract binds to oxalate from food and keeps it from entering the blood, and then the urinary tract, where it can form stones.
- People who form calcium oxalate stones should include 800 mg of calcium in their diet every day, not only for kidney stone prevention but also to maintain bone density.
- A cup of low-fat milk contains 300 mg of calcium. Other dairy products such as yogurt are also high in calcium.
- For people who have lactose intolerance and must avoid dairy products, orange juice fortified with calcium or dairy with reduced lactose content may be alternatives.
- Calcium supplements may increase the risk of calcium oxalate stones if they are not taken with food. Always take calcium supplements with meals,

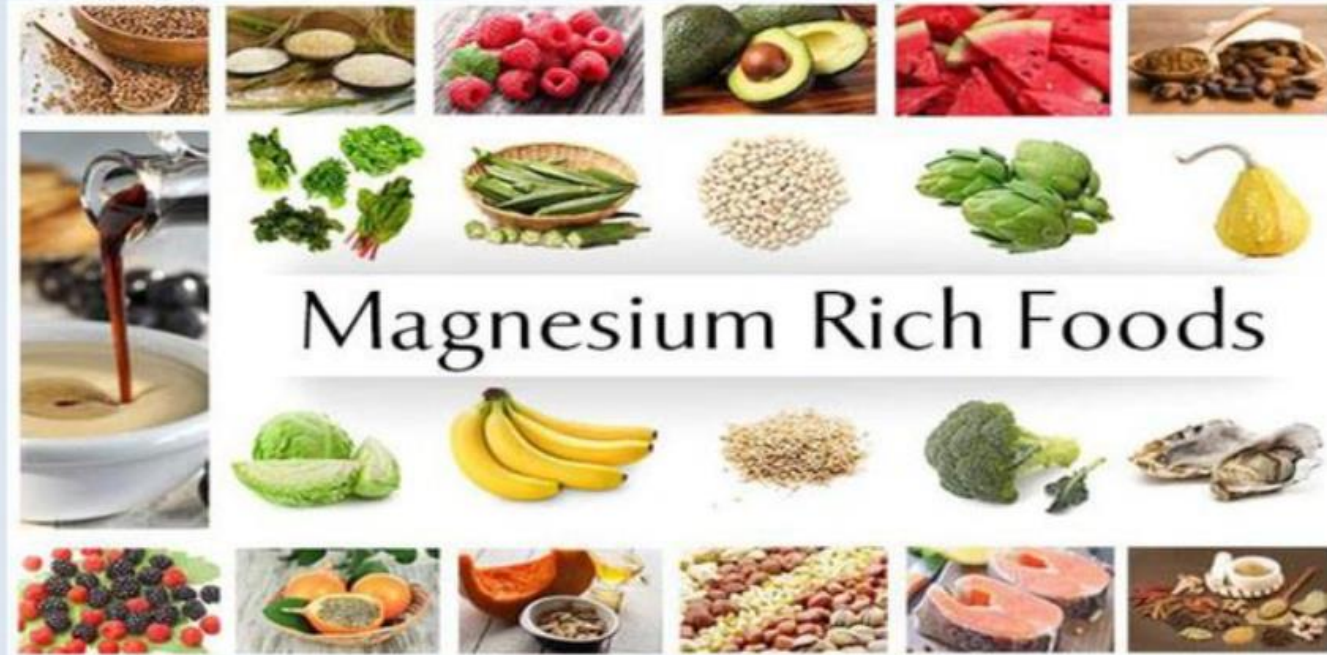
Low Purine Diet for Uric Acid Stones

- Purine is natural substance that is found in mainly in animal protein foods
- When body digest purine , it produces a waste product – Uric acid
- Build up of uric acid crystals leads to kidney stones and also leads to gout.
- Foods to limit on low purine diet- legumes, beans, high fat foods.

Low purine Foods

- Rely on plant based proteins- (myth that beans are high in uric acid)
- Eat several servings of fiber rich plant foods- such as whole grains , vegetables & fruits
- Minimize intake of refined carbohydrates (white products, sugar, high fructose corn syrup)
- Drink 2-3 L of water/day
- Maintain Healthy Body weight

Magnesium for Kidney Stones



- Intake of foods rich in magnesium is very helpful in preventing formation of kidney stones and in dissolving existing stones. Foods like banana, brazil nut, strawberry, artichoke, low fat yoghurt, pumpkin seeds, soybeans, black tea, cashew and pine nut can be added to the diet for better results in dissolving kidney stones naturally.

GOUT

Defenition

- Gout is a hereditary condition of disturbed uric acid metabolism in which urate salts gets deposited in articular, periarticular and subcutaneous tissues.

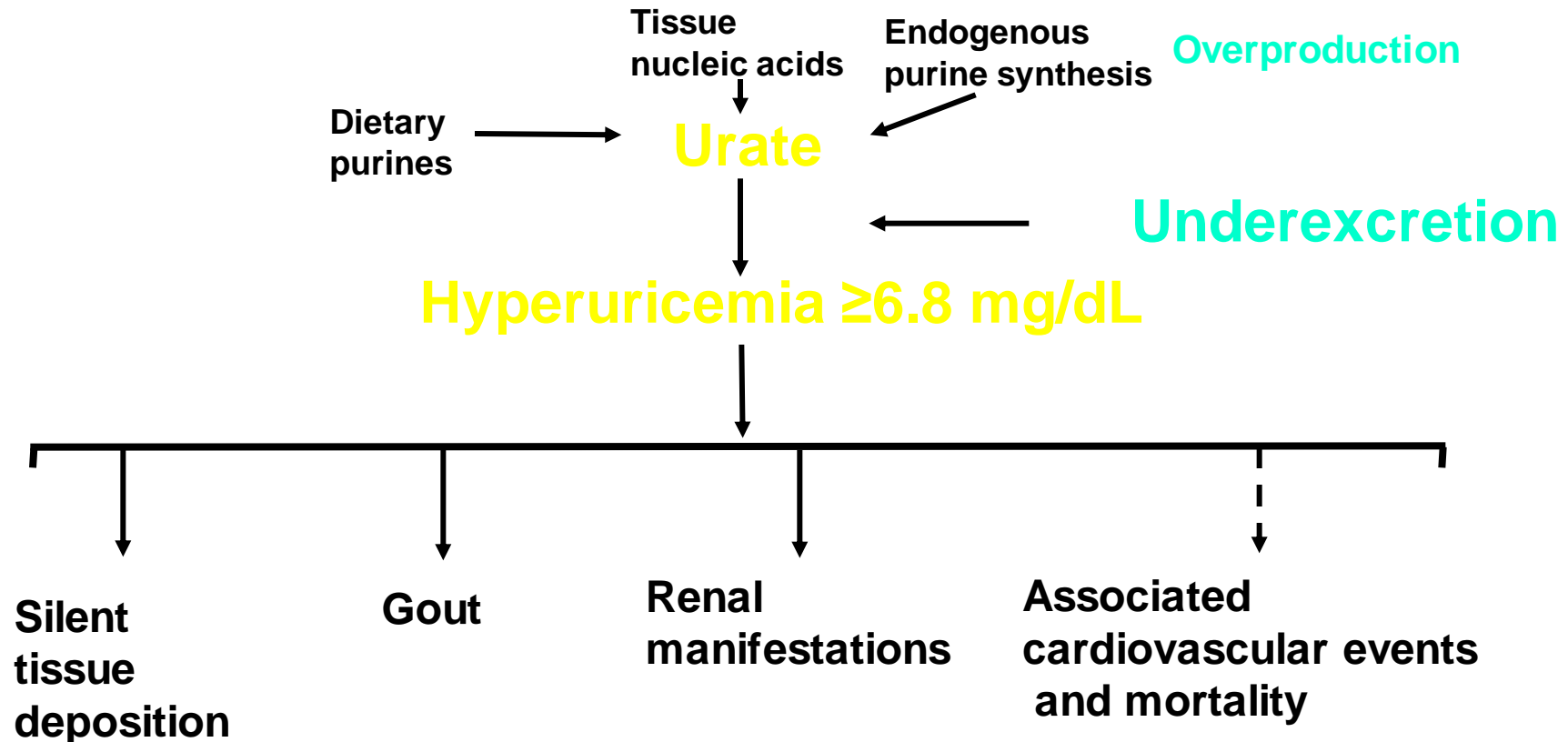
Box 1. Risk factors for hyperuricaemia and gout.¹

- Male gender
- Family history and/or genetic factors
- Metabolic syndrome
- Hypertension
- Insulin resistance
- Obesity
- Dietary factors (increased risk)
 - alcohol (particularly beer)
 - purine-rich foods (red meat and seafood)
 - fructose and sugar-sweetened soft drinks
- Dietary factors (reduced risk)
 - cherries
 - vitamin C
 - dairy products
 - coffee
- Medication
 - diuretics (loops and thiazides)
 - ciclosporin
 - pyrazinamide
 - ethambutol
- Impaired renal function
- Osteoarthritis (gout only)
- Chronic lead poisoning
- Myeloproliferative disorders

Hyperuricemia

Biologically significant hyperuricemia (≥ 6.8 mg/dL) is less than laboratory defined hyperuricemia (≥ 8.0 mg/dL)

The Hyperuricemia Cascade





- **Classifications:**

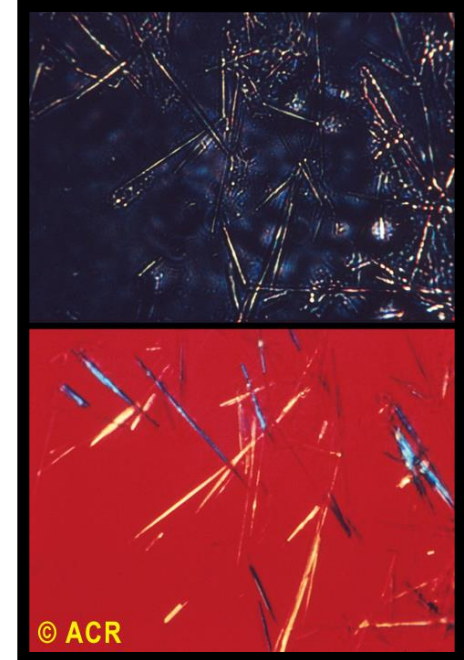
- Primary Gout – 90%
 - Overproduction
 - Under excretion
- Secondary Gout – 10%

- **Progression**

- Asymptomatic Hyperuricemia
- Acute gouty arthritis
- Intercritical Gout
- Chronic / Tophaceous Gout

Hallmarks of Gout

- Group of conditions which may be characterized by
 - An elevation of serum uric acid (usually)
 - Recurrent attacks (flares) of an acute inflammatory arthritis with monosodium urate crystals demonstrated in synovial fluid leukocytes
 - Bone and joint destruction in some cases
 - Aggregates of uric acid crystals (tophi) in and around joints, soft tissues, and various organs
 - Tophus in bone leading to erosions in some cases
 - Kidney disease and stones





Clinical Manifestations

- Gouty arthritis in one or more joints (but less than four)
- Great toe joint most common first manifestation; other joints may be the foot, ankle, knee, or wrist
- Joints are tender & cyanotic
- May be precipitated by trauma, surgery, alcohol ingestion, or infection



Clinical Manifestations

- Onset usually nocturnal, with sudden swelling and excruciating pain
- May have low grade fever
- Usually subsides within 2-10 days
- Joints are normal, with no symptoms between attacks

DIAGNOSTIC

- History and physical examination
- Family history of gout
- Blood test-
 - Elevated serum uric acid levels
- Urine test-
 - Elevated 24-hr urine for uric acid levels
- X-ray
 - Presence of sodium urate crystals in synovial fluid

Prevention:

- **modifiable risk factors include** ⁽⁵⁾
 - high-purine diet
 - alcohol use
 - obesity
 - diuretic therapy
- **consumption of dairy products** may be protective ⁽⁵⁾
- **long-term coffee** consumption associated with lower risk of incident gout ^(level 2 [mid-level] evidence)
- **higher vitamin C** intake associated with lower risk of gout ^(level 2 [mid-level] evidence)

Non-pharmacological treatment

- Patients may be advised to reduce their intake of foods high in purines (e.g., organ meats), avoid alcohol, increase fluid intake, and lose weight if obese.
- Joint rest for 1 to 2 days should be encouraged, and local application of ice may be beneficial.

MNT OF GOUT

Foods to Choose



- Low-fat or nonfat dairy products (such as skim milk, low-fat yogurt)



- Fresh fruits & most vegetables



- Eggs or egg substitute
- Whole grains (such as whole wheat bread, whole grain pasta, brown rice, popcorn, barley, quinoa)
- Nuts, nut butter, and soy



Foods to Limit or Avoid



- Limit meat, fish, and poultry to 4-6 oz per day
 - Avoid high-purine animal foods (such as anchovies, sardines, haddock, cod, tuna, shellfish, bacon, organ meats, wild game) and gravy and sauces made with meat



- Avoid alcoholic beverages (especially beer)
 - Discuss alcohol intake with your doctor

- Avoid foods and drinks high in sugar or high fructose corn syrup (such as soda, juice, sports drinks, ice cream, candy, sweetened breakfast cereal)



- Limit dried beans, peas, and lentils to 1 cup cooked per day
- Limit oatmeal to $\frac{2}{3}$ cup uncooked per day
- Limit higher-purine vegetables (mushrooms, asparagus, cauliflower, spinach, green peas) to $\frac{1}{2}$ cup per day

Nephrotic syndrome (NS)

- Commonest glomerular disease affecting children
- Frequently encountered in general paediatrics
- Characterised by
- Significant proteinuria (early morning urine protein to creatinine ratio $> 200\text{mg}/\text{mmol}$) leading to
- Hypoalbuminaemia (plasma albumin of $< 25\text{g}/\text{l}$)

- NS defined by the clinical triad of
- Oedema
- Nephrotic range proteinuria and
- Hypoalbuminaemia
- Typically accompanied by
- Dyslipidaemia with elevated plasma cholesterol and triglycerides

Congenital or acquired NS

- Congenital disease
- May be due to a genetic mutation or secondary to a congenital infection
- Acquired disease
- More common and is usually idiopathic
- Categorised according to the response to corticosteroid treatment as
- Either steroid sensitive or steroid resistant disease

- If the child does respond to prednisolone with infrequent relapses, then there are likely to be a few long term dietary problems
- However, children who frequently relapse and are
- Steroid dependent may require long term dietary advice to monitor and maintain nutritional status and prevent obesity.
- Growth and endocrine function are important issues in the long term management of such patients

Initial advice

- Growth parameters should always be recorded and dry weight estimated, as surface area is used to calculate the prednisolone dosage
- A dietitian should be involved in the initial management both to review the dietary history as well as advising on the practicalities of the moderate fluid restriction that is
- Often required in the initial oedematous phase while awaiting the response to steroids

Nutritional management NS

- Both high- and low-protein diets have been advocated in the past for children with NS.
- Apart from salt restriction and general healthy eating, no specific dietary advice is currently considered necessary for children with SSNS

Nutritional management NSDiet

- A balanced diet, adequate in protein (1.5-2 g/kg) and calories is recommended
- Patients with persistent proteinuria should receive 2-2.5 g/kg of protein daily
- It 30 calories should be derived from fat and saturated fats avoided

Nutritional management NS

- Pathogenesis of oedema in NS
- Hypoalbuminaemia leads to an imbalance of Starling equilibrium by reducing the oncotic pressure, causing retained fluid to escape from the circulation into the interstitial space and leading to progressive oedema
- This fall in oncotic pressure also causes a contraction of the circulating blood volume, resulting in maximal salt and water retention
- Sodium retention will cause further extracellular fluid expansion with exacerbation of generalized oedema
- A no added salt diet is therefore an appropriate measure

No added salt diet

- Can be done by omitting the addition of salt to food at the table and reducing the intake of highly salted manufactured foods, particularly snack foods such as crisps
- Salt should not be added to salads and fruits, and snacks containing high salt should be avoided
- Very low sodium diets and the use of low sodium specialist products should not be necessary

- Since treatment with corticosteroids stimulates appetite, parents should be advised regarding
- Ensuring physical activity and preventing excessive weight gain.
- Normal activity and school attendance should be ensured
- The child should continue to participate in all activities and sports

Dyslipidemia

- Is an expected finding in children with NS and
- May resolve when patients are in remission.
- Children who have refractory nephrosis often have persistent dyslipidemia
- Treatment includes
- Dietary counseling to limit dietary fat to 30 of calories, saturated fat to 10 of calories, and 300 mg/day dietary cholesterol

Fat intake

- The use of monounsaturated or polyunsaturated margarines and oils are also advocated as part of the general healthy eating advice with a reduction of a saturated fat intake

Steroid resistant nephrotic syndrome

- This group of patients is usually very heterogenous with an underlying renal pathology that does not respond to at least four weeks of daily prednisolone treatment
- Prolonged initial steroid dosage combined with oedema, 'anorexia, and catabolic state may require a period of nutritional support either with oral or nasogastric tube fed supplements

Steroid resistant nephrotic syndrome

- Vitamin supplementation and iron treatment may also be indicated
- Such children are often hospitalised for long periods and the clinical course may be complicated by diarrhoea and other nosocomial infections from the ward.

Thank You