

# Dietary Approach to Management of Common Conditions in Primary Care

Hong Kong Primary Care Conference 2016  
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## Objectives

- Review Medical Nutrition Therapy (MNT) for
  1. Chronic kidney diseases
  2. Hypertension
  3. Gout

## CHRONIC KIDNEY DISEASES

## Goals for Management in CKD

- Achieve and maintain good nutritional status
- Prevent excessive accumulation of electrolytes, minerals and fluid
- Treat and minimize the effects of metabolic disorder and complications associated with renal disease
- Delay progression of renal failure

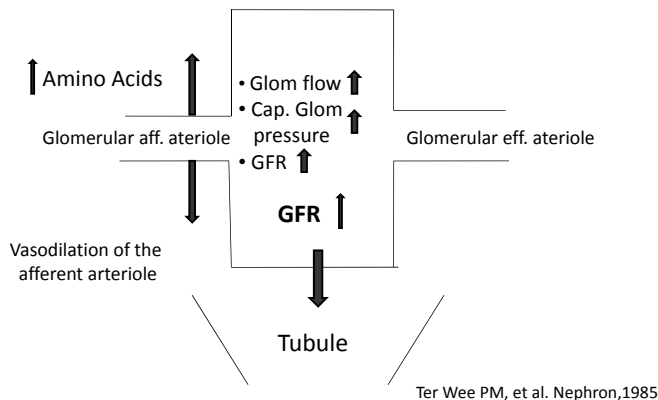
## Dietary Protein

### Protein Intake Recommendations in CKD

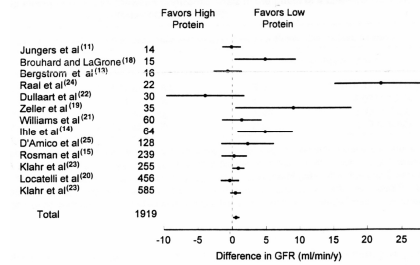
	Non-dialysis CKD	Hemodialysis	Peritoneal Dialysis
National Kidney Foundation K/DOQI	0.6-0.75 g/kg/day	>1.2 g/kg/day	1.2-1.3 g/kg/day
British Dietetic Association	N/A	>1.1 g/kg/day	>1.2 g/kg/day
ESPEN (Nutrition Support)	0.6-0.8 g/kg/day Illness 1.0g/kg	1.2-1.4 g/kg/day Illness >1.5g/kg/day	1.2-1.5 g/kg/day

- >50% of High Biological Value (ie complete protein sources, containing the full spectrum of EAA)

## Dietary Protein Increase Intracapillary Glomerular Pressure and GFR



## Low protein diet and CRF : outcome of GFR



- 24 controlled clinical trials, 13 randomized
- Main target: loss of GFR (ml/min/yr)
- Total : 2248 patients (1919 in randomized studies)
- loss of GFR : 0.53 ml/min/yr lower (95%CI, 0.08-0.98) in the diet group (p<0.05)

Kasiske et al, Am J Kidney Int 1998

## Low protein diets for chronic kidney disease in non diabetic adults (Review)



Fouque D, Laville M  
2009

- 10 studies were identified from over 40 studies.
- A total of 2000 patients were analyzed, 1002 had received reduced protein intake and 998 a higher protein intake.
- **Reducing protein intake in patients with CKD reduces the occurrence of renal death by 32% as compared to higher or unrestricted protein intake.**

## Benefits of Low Protein Diet

- Alleviation of uremic symptoms
- Metabolic benefits
  - Hyperphosphatemia
  - Hyperparathyroidism
  - Bone disease
- Reduction of proteinuria by 20-37%
- Reduction of insulin resistance
- Reduction in oxidative stress

Beale 1861; Lyon 1931; Chauveau P, et al. J Ren Nutr 2007

## When to Restrict Protein in CKD?

- Stage 1-2 (GFR 60-90mL/min/1.73m²)
  - RDA: 0.8g/kg/d
- Stage 3-5 (GFR < 60mL/min/1.73m²)
  - 0.6-0.75g/kg/d

Example:

- 66 year old Chinese man, serum creatinine 155
- Estimated GFR = 39.4 mL/min/1.73m²

## Protein Requirement in Dialysis

### Protein Intake Recommendations in CKD

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## Protein Requirement in Dialysis

- Protein loss:
  - Peritoneal Dialysis: 5-15g/d
  - Hemodialysis: 10-12g/treatment
- Increase needs during peritonitis, metabolic stress, malnutrition
  - Protein loss can remain high for 2-3 weeks after infection
  - Recommendation: 1.3-1.5g/kg
  - Albumin may take up to 2 months to recover

## Potassium

- **Goal:** Maintain Serum levels 3.5-5.0
- **Recommendation:**
  - CKD: Maintain normal serum levels
  - HD: 2-3g/d
  - PD: 3-4g/d
- Spread intake throughout the day
- 3.0-3.5: diet intervention
- <3.0: supplementation may be needed

## Dietary Management for Hyperkalemia

- Assess diet history and identify high potassium food sources
  - Vegetable soup, juices, TCM, herbal supplements
- Soaking and blanching of vegetables
- Low sodium alternatives
- Educate PD patients on moderate to high K diet

## Possible Non-Dietary Causes of Hyperkalemia

- Laboratory error: hemolysis
- Acidosis: Each 0.1 decrease in arterial pH may increase K by 0.6-1.0 mEq/L
- High serum glucose: shift between cell and serum
- Insulin deficiency in diabetes
- Inadequate dialysis
- Drug interactions: ACEI, steroids, cyclosporine to name a few
- Tissue destruction
- Catabolism/starvation: cell breakdown
- Decrease gut excretion: severe, long-term constipation
- Concomitant disease

JREN 1992

## Phosphorus

### **Goal:**

- Stages 3 and 4 CKD patients:
  - 0.87 - 1.49 mmol/L
- ESRD patients treated with HD or PD:
  - 1.13 to 1.78 mmol/L

### **Recommendation:**

- 800 to 1,000 mg/day (10-12g/g of protein)

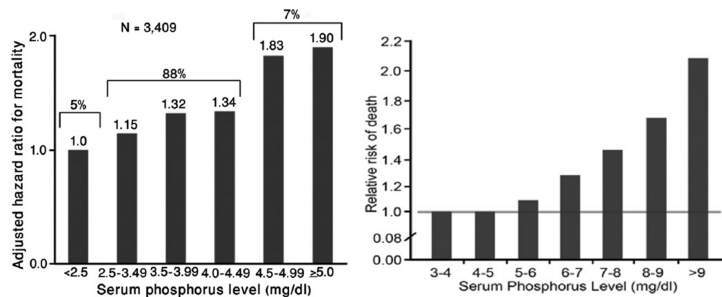
K/DOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease 2003

## Manifestations of Hyperphosphatemia

- Secondary Hyperparathyroidism
- Renal osteodystrophy
- Metastatic calcification and calciphylaxis
- Calcification and hardening of tissues in heart, arteries, joints, skin and lungs



## Elevated serum Phosphate Increases Mortality Risk



**Figure 1** - Mortality risk increases with serum phosphorus in patients with chronic kidney disease-stage 3 not on dialysis.

**Figure 2** - Mortality risk increases with increased serum phosphorous in dialysis patients.

Kestenbaum B et al. J Am Soc Nephrol, 2005; Block GA et al. J Am Soc Nephrol, 2004

## Phosphorus Removal in Dialysis

Diet	1000mg/d 7 x 1000 ( per wk)	= 7000mg per week
Absorption	7000mg x 60%	= 4200mg per week
Dialysis	800mg per HD tx 800mg x 3tx per week  315mg per PD tx 315mg x 7tx per week	= 2400mg per week  = 2205mg per week
Balance	4200 -(2205 to 2400)	= +1800-1995mg per week Or 257-285mg per day

K/DOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease 2003

## Phosphorus Binders

- No one PO<sub>4</sub> binding agent is effective, acceptable and/or appropriate for all pts
- The total dose of elemental calcium provided by the calcium-based phosphate binders should not exceed 1,500 mg/day
- Relative PO<sub>4</sub> binding power of available alternatives are estimated as follows:
  - ✓ Calcium Carbonate: 39 mg PO<sub>4</sub> bound by 1g CaCO<sub>3</sub>
  - ✓ Calcium Acetate: 45 mg PO<sub>4</sub> bound by 1g Ca+ Acetate
  - ✓ Sevelamer HCL: 64 mg PO<sub>4</sub> bound by 800 mg Sevelamer
  - ✓ Aluminum OH: 25 mg PO<sub>4</sub> bound by AlOH

K/DOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease 2003

## Phosphorus Rich Foods



What other factors should I consider?

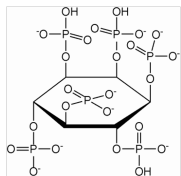
Not all phosphorus is created equal

## Animal vs Vegetarian Sources

- Relatively low bioavailability of P from plant derived sources
  - 40-60% animal source absorbed
  - 10-30% plant source absorbed
- With similar dietary protein/phosphorus intakes, vegetarian diet resulted in lower average serum phosphorus

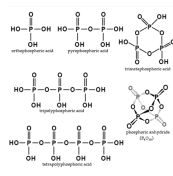
Moe S, et al. CJASN, 2011; 6 257-263

## Organic vs Inorganic



### Organic Phosphorus

- Derived from natural sources
- Major protein sources
- Slow absorb rate
- Only 10-60% absorbed
- Less bioavailable
- Bioavailable when digested or
- Degraded by enzymatic action



### Inorganic Phosphate

- Mostly from food additives
- Rapidly absorbed
- Almost 100% absorbed
- Highly bioavailable
- Rapidly dissociates in gut acidity
- No enzymatic degradation needed

Noori N, et al. 2010  
Kalantar-Zadeh K, et al. 2010.

## Common Phosphate food Additives

- 414 Acetylated Distarch Phosphate 乙酰化磷酸雙澱粉
- 342 Ammonium Phosphates 磷酸銨類
- 452 Ammonium Polyphosphates 多磷酸銨類; 聚磷酸銨類
- 442 Acid 磷酸銨鹽
- 450 Calcium Dihydrogen Diphosphate 二磷酸二鈣
- 341 Calcium Phosphates 磷酸鈣類
- 342 Diammonium Orthophosphate 正磷酸二銨
- 450 Dicalcium Diphosphate 二磷酸二鈣
- 450 (vi) Dicalcium Diphosphate 二磷酸二鈣
- 343 Magnesium Phosphates 磷酸鎂類
- 342 (i) Monoammonium Orthophosphate 正磷酸一銨
- 541 Sodium Aluminium Phosphate 磷酸鋁鈉
- 452 (iii) Sodium Calcium Polyphosphate 多磷酸鈣鈉; 聚磷酸鈣鈉
- 339 Sodium Phosphates 磷酸鈉類

食物安全中心食物添加劑國際編碼系統 2008  
[http://www.cfs.gov.hk/tc\\_chi/whatsnew/whatsnew\\_fstr/whatsnew\\_fstr\\_13\\_ins.html](http://www.cfs.gov.hk/tc_chi/whatsnew/whatsnew_fstr/whatsnew_fstr_13_ins.html)

## Contribution to additives

- Estimated that >50% of phosphorus in the Western diet is from additives
- Added P
  - 470mg/day in 1990
  - Up to 1000mg/day in 2000
- Foods containing phosphorus additives contained 70% more phosphorus than similar foods without additives

ADC 2013

## Common Food Products containing Phosphorus Additives



## Impact of Additives

Food	Total P/100g	In vitro digestible P/100g	Additives
Milk	122	75	none
Cottage cheese	146	71	none
Processed cheese	584	576	452, 399
Cheese spread	892	794	452, 399
Poultry, meat, fish	215	170	none
Ham	279	255	450, 451, 452

Karp H, et al. Differences Among Total and in Vitro Digestible Phosphorus Content of Meat and Milk Products. JREN, 2012; 22(3): 344-349

Food	Common Measure	Phosphorus (mg)	Protein (g)	mg P/ g protein	
<b>Beans, Legumes, Tofu</b>					GI Absorbed 10-30%
Beans, Kidney	1 cup	251	15	16.7	
Beans, Lima	1 cup	209	15	13.9	
Beans, Navy	1 cup	286	16	17.9	
<b>Nuts/Nut Butter</b>					GI Absorbed 10-30%
Almonds	1 oz.	139	6	23.2	
Macadamia	1 oz.	56	2	28.0	
Peanut Butter, Chunky	2 Tb	101	8	12.6	
Peanut Butter, Smooth	2 Tb	118	8	14.8	
Peanuts, Roasted	1 oz.	147	8	18.4	GI Absorbed 40-60%
Walnuts	1 oz.	98	4	24.5	
<b>Dairy and Milk</b>					GI Absorbed 40-60%
Milk, Whole	1 cup	227	8	28.4	
Yogurt, Lowfat	4 oz	162	6	27.0	
<b>Combination Foods</b>					GI Absorbed 80-100%
Bean/Cheese Burrito, FF	2 small	180	15	12.0	
Breakfast Biscuit, FF	1 egg/cheese/bacon	459	16.3	28.2	
Cheeseburger, FF	Single w/condiments	310	28.2	11.0	
Chicken Sandwich, FF	1 sandwich	405	29.4	13.8	
Fried Shrimp, FF	6 to 8 small	344	18.9	18.2	
Hot Fudge Sundae	1 small	227	5.6	40.5	
Pepperoni Pizza, 1 sl	Froz Pepperoni	222	16	13.9	

## Changes in Dietary Counseling

- Teach Label reading – look for the PHOS
- Educate on ALL phosphorus sources
  - Vegetarian vs animal source
  - Inorganic vs organic
  - Fresh versus fast/convenience foods
- Take PO4 binders at meal/ snack times to cover true feeding schedule, relative size/PO4 content of meals
- Consider both absolute dietary P content and the P-to-protein ratio as well as the content of food additives in foods and meals
- Reinforcement/same message
- Ongoing education and follow-up

## Fluid

**Goal:** Avoid fluid overload or excessive gains between dialysis

**Recommendation:**

- HD : output + 1000ml/d
- CKD/PD: Maintain balance
- Symptoms for fluid overload
  - Hypertension
  - Presence of peripheral edema
  - Difficulty breathing when supine
  - Gain >4% of body weight between dialysis

K/DOQI Clinical Practice Guidelines 2003

## Fluid management

- Helpful tips for patients
  - Plan daily fluid intake
  - Use visual reminder
  - Drink cold beverages
  - Sour – use lemons
  - Small cups/glasses
  - Sip and savor
  - Pay attention to oral hygiene

## Sodium

- **Goal:** BP control, reduce fluid retention, control weight gain between treatments
- **Recommendation:** CKD 1-3g /day  
HD/PD 2g/day
- Extra Na – thirst – fluid weight gain and more use of hypertonic solution – higher CHO load – hyperglyceridemia, hyperglycemia, weight gain, hyperinsulinemia
- Alteration in & possible loss of UF with frequent use of hypertonic solutions

K/DOQI Clinical Practice Guidelines 2003

## Dietary Intervention for Sodium

- Limit processed foods and use fresh ingredients
- Educate regarding appropriate seasoning alternatives
- Label reading
  - Entrees < 600mg
  - Single servings < 200mg

Claim	Amount
Low Sodium	<120mg/serving
Very low sodium	<30mg/serving
Sodium Free	<5mg/serving
Reduced Sodium	25% less than original

## Special Considerations for PD Low Transporters

- Ultrafiltrate well, dialyze poorly
  - Excellent fluid clearance
  - Poor solute clearance/risk of inadequate PD
- Nutrition
  - Monitor poor oral intakes
  - Do not over restrict fluid
  - Little protein loss/acceptable albumin
- Long duration, high-volume dwells

### Special Considerations for PD High Transporters

- Dialyze well, ultrafiltrate poorly
  - Large protein losses through membrane
  - Poor fluid clearance/higher glucose absorption
- Nutrition
  - Potential for higher weight gains
  - May need fluid restriction
  - May need protein supplement
- Frequent dwell, short duration

### Special Considerations for PD Weight Control

Calorie absorbed depend on:

- Type of PD and dwell time
- Peritoneal membrane type
- Fill volume and number of exchanges

Dextrose concentration

% absorbed: CCPD = 40%

CAPD 60%

Icodextrin = 40%

CHO/L: 1.5% = 15g

2.5% = 25g

4.25% = 42.5g

Icodextrin = ~2.5% dextrose

### CCPD calculations

- Night volume 10L (5 x 2L exchanges, 2.5%)
- Last fill 2L x 2.5%
- 1 day exchange, 2L of 1.5%
- How many kcal are absorbed?
- 503kcal
- Intervention: exercise as tolerated, education on kcal absorbed, limit high-sugar, high-fat foods

### Eating barriers

- Inactivity
- Age
- GI and gastroparesis
- Bloating/early satiety
- Edema, SOB
- Time to cook
- Loss of Appetite

### Hypertension

- Modifiable Dietary Risk Factors:
  - Overweight
  - Excessive sodium Intake
  - Alcohol Consumption
  - Physical inactivity
  - Potassium intake

### HYPERTENSION

## Overweight

- Prevalence of high blood pressure in people with BMI > 30 is 38% for men and 32% for women compared with 18% for men and 17% for women with normal BMI
- Every 1% weight reduction lowers systolic BP by an average of 1mm/Hg
- Weight loss of 10kg can reduce systolic BP by 6-10mm/Hg

National Institute of Health, 1998

## Hypertension and Sodium Intake

- Evidence supports a strong, direct relationship between sodium intake with blood pressure and vascular mortality
- More prominent in older adults
- In most individuals blood pressure is reduced within days to weeks of reducing sodium intake

## What's the average sodium intake in Hong Kong?

~4500-4800 mg/d

Woo J et al. J Epidemiol Community Health, 1998

## Effect of longer-term modest salt reduction on blood pressure: meta-analysis

### Cochrane Review criteria for sodium studies to include in analysis:

- random allocation of subjects to treatment/control groups
- >920 mg/day reduction in dietary sodium
- >4 weeks duration
- no concomitant interventions

Hypertensive subjects (20 trials), median age 50 (range 24-73)  
Normotensive subjects (11 trials), median age 47 (range 22-67)

He FJ, MacGregor GA. *Cochrane Database of Syst Rev*. 2004;Issue 1. Art. No.: CD004937. 2004;Issue 1. Art. No.: CD004937.

## Lower dietary salt reduced blood pressure in hypertensive adults

- 20 trials, 802 individuals
- dietary salt lowered by 4.5 g/day  
– from baseline of 7 - 11 g/d to 3.25 - 7.2 g/d
- blood pressure lowered by 5.1/2.7 mm Hg

He FJ, MacGregor GA. *Cochrane Database of Syst Rev*. 2004;Issue 1. Art. No.: CD004937.

## Lower dietary salt reduces blood pressure in normotensive adults

- 11 trials, 2,220 subjects
- dietary salt lowered by 4.25 g/day  
– from baseline of 7.25 - 11.5 g/d to 3.25 - 7.75 g/d
- blood pressure lowered by 2.0/1.0 mm Hg

He FJ, MacGregor GA. *Cochrane Database of Syst Rev*. 2004;Issue 1. Art. No.: CD004937.



## DASH Diet

- DASH (Dietary approach to Stop Hypertension)
- Tested dietary patterns rather than single nutrients
- Included common foods that can be incorporated into recommendations for the public
- Compatible with dietary recommendations for reducing risk of CVA, osteoporosis and cancer

FM Sacks et al. Clin. Cardiol, 1999

## DASH

FOOD GROUP	DAILY SERVINGS	SERVING SIZE
Whole grains	7-8 servings	1 slice bread 1 ounce dry cereal ½ cup cooked grain, pasta, or rice
Vegetables	4-5 servings	1 cup raw leafy vegetables ½ cup cooked or raw vegetables
Fruit	4-5 servings	1 medium fruit ½ cup fresh or frozen fruit
Low fat or fat free dairy products	2-3 servings	8 ounces of milk 1 cup yogurt 1 ½ ounce of cheese
Meat, poultry, and fish	2 or less	3 ounces cooked meats, poultry, or fish
Nuts, seeds, and dried beans	4-5 times a week	1/3 cup of nuts 2 tablespoons of seeds ½ cup of cooked dry beans
Fats and oils	2-3 servings	1 teaspoon vegetable oil 1 tablespoon low fat mayo

## DASH Diet Study

- Randomized controlled trial
- 459 adults with untreated hypertension <160/80-95mmHg
- After 3-week controlled diet typical of Americans
- Randomized to 8 week control diet vs fruits and vegetables diet vs DASH diet

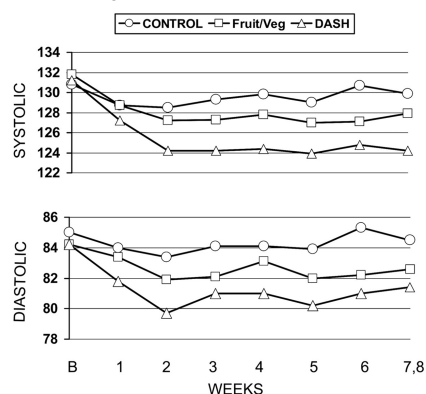
FM Sacks et al. Clin. Cardiol, 1999

## MENU

中餐餐單	水果	果仁	肉	五穀	蔬菜	豆類	奶類
早餐							
糙米燕麥粥				1 1/2			
全麥饅頭或銀絲卷1個			1				
水果1個	1						
午餐							
芥蘭菜粒蛋白肉碎炒飯			1/8		1/5		
			1 1/2				
果汁(鮮榨) 1/2杯	1			2			
青菜(焗熟) 1/2碗					1		
香蕉1隻	1						
低脂乳酪1杯							1
晚餐							
紅米飯1碗				2			
鮮茄豆腐魚湯					1/2		
脫脂奶湯底			1			1/2	
涼拌青瓜、黑木耳		1/4			1		1/4
如意卷心菜			1 1/4		1/2		
鮮菠蘿炒雞柳	1/2						
			1				
小食							
水果	1						
黑芝麻脫脂奶1杯		1/4					1
<b>Total</b>	<b>4 1/2</b>	<b>1 1/2</b>	<b>5 7/8</b>	<b>6 1/2</b>	<b>5 1/5</b>	<b>1 1/2</b>	<b>2 1/4</b>

Hong Kong Nephrology Group, 2011

Figure 3. BP by week during the DASH feeding study in 3 diets: control diet, fruits and vegetables diet, and the DASH diet.



Lawrence J. Appel et al. Hypertension. 2006;47:296-308



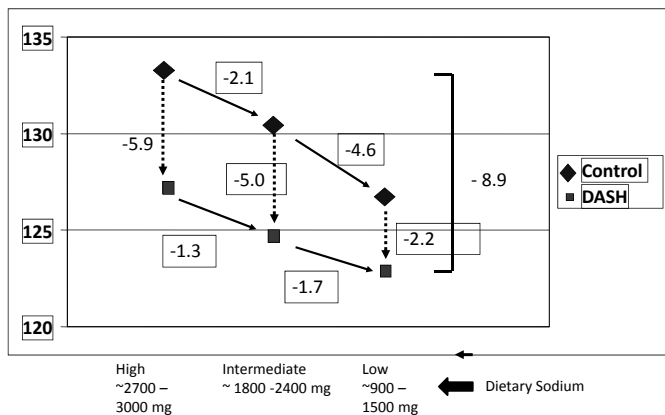
Copyright © American Heart Association, Inc. All rights reserved.

## DASH and Sodium Trial

- Randomized control trial
- 412 participants with blood pressure exceeded 120/80mmHg
- Control diet with typical intake in US vs DASH diet
- High, medium, Low sodium intake within the assigned diets
- 30 consecutive days

Sacks et al. N Engl J Med. 2001;344:3-10.

## DASH Diet and Reduced Sodium Intake



Sacks et al. N Engl J Med. 2001;344:3-10.

## Dietary Guidelines for Hypertension

1. Weight reduction
  - BMI < 25kg/m<sup>2</sup>
2. Limit sodium intake
  - Ideally to to 1.5 g/d of sodium or 3.8 g/d sodium chloride
3. DASH Diet
4. Increase Potassium Intake
  - 4.7 g/d which is the level provided in DASH diets
5. Alcohol consumption
  - ≤ 2 standard drinks for men and ≤ 1 standard drinks for women
6. Regular exercise
  - 30 minutes of moderate level activity at least 5 days a week

AHA Scientific Statement, 2006

## GOUT

## Modifiable Dietary Risk Factors of Gout

1. Food intake
  - Meat
  - Seafood
  - Low fat dairy
  - Sweet beverages
  - High purine vegetables
2. Alcohol consumption
3. Body weight

## Dietary factors and Risk of Gout

- 12-Year Period Prospective Cohort Study
- 47,150 men with no history of gout at baseline
- Assessed diet every 4 years with food-frequency questionnaire
- 730 new cases of gout

Choi HK et al. New Eng J Med, 2004; Choi HK et al. L BMJ, 2007; Choi HK et al. Arch Intern Med, 2009

## Dietary Factors vs Risk of Gout

Dietary Factors	Relative Risk
Seafood (<0.15 vs > 0.56servings/d)	1.51 (p = 0.02)
Meat (<0.81 vs > 1.92 servings/d)	1.41 (p = 0.02)
Dairy Products (<0.88 vs > 2.88 servings/d)	0.55 (p < 0.001)
Sugar sweetened soft drinks: 1 serving/d	1.45 (P = 0.002)
≥2 serving/d	1.85 (P = 0.002)
Vitamin C< 250mg/d vs: 250–499 mg/d	0.97
500–1499 mg/d	0.66
>1500 mg/d	0.55
	(P < 0.001)
Purine rich vegetables/Total protein intake	No association

Choi HK et al. New Eng J Med, 2004; Choi HK et al. L BMJ, 2007; Choi HK et al. Arch Intern Med, 2009

## Alcohol Consumption

- Alcohol increases uric acid production by:
  - Accelerating the degradation of ATP in the liver
  - Reducing the renal excretion of uric acid through the production of lactic acid

Daily Alcohol Consumption (g)	Increased Risk of Gout (P< 0.001)
10 -14.9	32%
15 – 29.9	49%
30 – 49.9	96%
≥ 50g	153%

Choi HK et al. Lancet, 2004

## Alcohol Consumption

- Beer, containing a substantial amount of guanosine that is degraded to uric acid, conferred a > 2 fold increased risk of gout over liquor
- Moderate intake of wine (4oz/d) did not show increase risk nor uric acid levels

Choi HK et al. Lancet, 2004

## Obesity

- In comparison with men with BMI 21.0-22.9 kg/m<sup>2</sup>

BMI (kg/m <sup>2</sup> )	Relative Risk (P < 0.001)
23–24.9	1.65
25.0 – 25.9	1.95
30.0 – 34.9	2.33
> 35.0	2.97

Choi HK et al. Arch Intern Med, 2005

## Dietary Recommendations for Gout

- Alcohol consumption increased the risk of incident gout, especially higher intake of beer and hard liquor.
- Several dietary factors including higher intake of meat, seafood, sugar sweetened/fructose beverages increased the risk of incident gout.
- Dairy intake were each associated with lower risk of incident gout and in some cases lower rate of gout flares.
- Randomized trials are needed to confirm the role of dietary factors in the prevention and treatment of gout

## Dietary Adherence

- Realistic, positive, easy to understand and actionable nutrition education messages
- Focus on single goal
- Individualization
- Work with the “food gatekeepers”

