

SALT, BONES & PEW

A Renal Nutrition Update

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May 1st 2009

2009: Is it time for an Assault on Salt ?



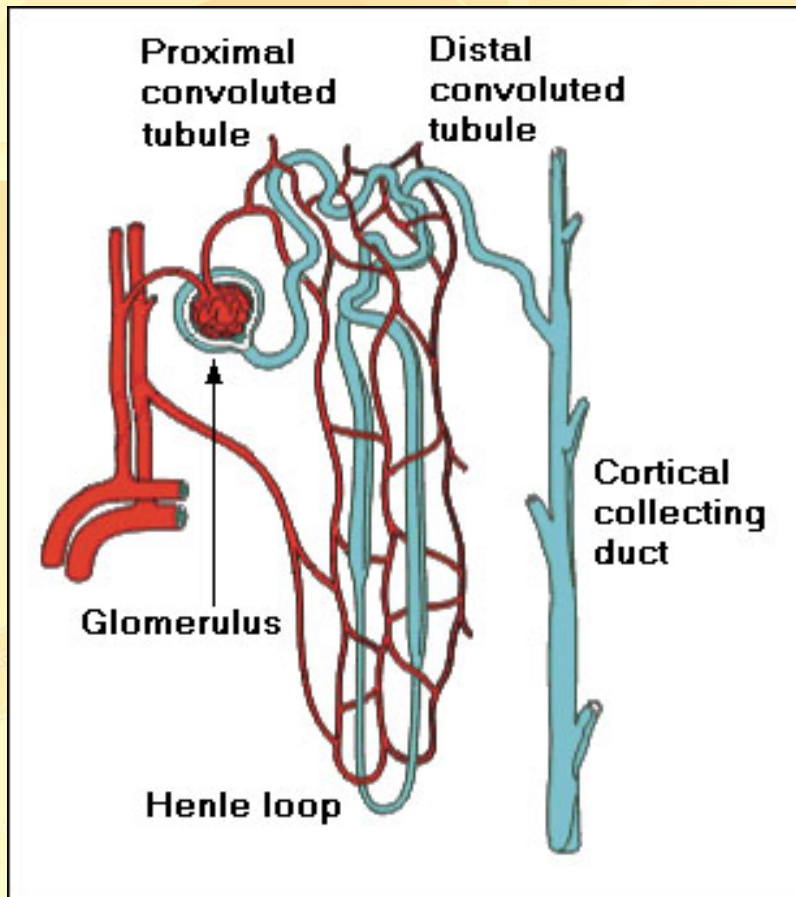
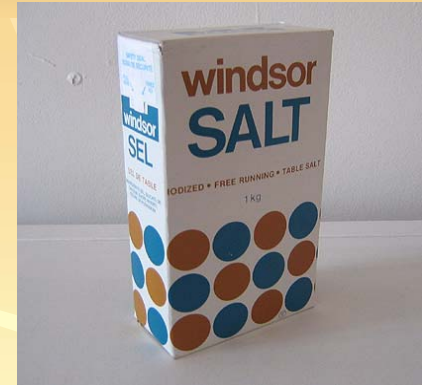
Susan I. Barr, PhD, RD, FDC

Salt: Who Needs It?



- All of us!
- Major extracellular electrolyte
 - Maintains plasma volume
 - Determinant of membrane potential
 - Active transport

How is it Lost?



■ Kidney

- Filters 25,000 mmol/d (575,000 mg)
- Reabsorbs >99%
- Aldosterone increases Na reabsorption in collecting duct
- Renal losses can be as low as ~200 mg/d

How is it lost?



- Sweat

- Variable; can be high (e.g., 800 - 1000 mg/L)
- Less capacity to conserve than via kidney
- Sodium content is higher when sweat rate is higher



Sodium Public Health Goals, adults



- Institute of Medicine: <2300 mg
- Blood Pressure Canada: 1200-2300 mg/d
- Dietary Guidelines for Americans, 2005
 - <2300 mg/d
 - <1500 mg/d for middle-aged and older adults, hypertensives, blacks
- American Heart Association, 2009
 - <1500 mg/d for all

Adequate Intake for Sodium

- **AI:**
 - 1500 mg/day (adults 19-50 yrs old)
 - 1300 mg/day (adults 51-70 yrs old)
 - 1200 mg/day (adults 71+ yrs old)

- **UL (upper limit): 2300 mg/day**



American Heart Association (2009) is recommending
<1500 mg/day for all

Blood Pressure Reduction



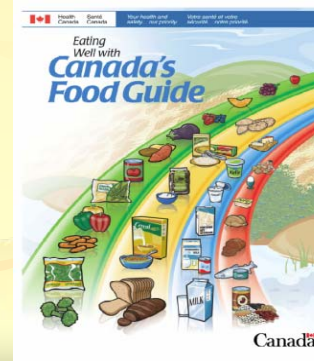
- 5-20 mm Hg for **10 kg weight loss** in the overweight/obese adult.
- 8-14 mm Hg for a diet rich in **vegetables, fruit and low fat dairy** products – “**DASH diet**”
- 4-9 mm Hg for including regular daily aerobic **activity**
- 2-8 mm Hg for reduction in dietary **sodium to <UL**
- 2-4 mm HG for **limiting alcohol** consumption to <2 drinks/day for men or 1 drink/day for women

Canada's Food Guide, My Pyramid and the DASH diet

	DASH* (~2100 kcal)	Food Guide¶	MyPyramid (2000 kcal)
Fruits and Vegetables	9.6	7-10	4.5 cups (9)
Low-fat Dairy	2.7	2-3	3
Whole Grains	4	3-4	3+
Fish	0.5	0.3	--

* J Am Diet Assoc 2003;103:488-96

¶ Servings for adult men and women

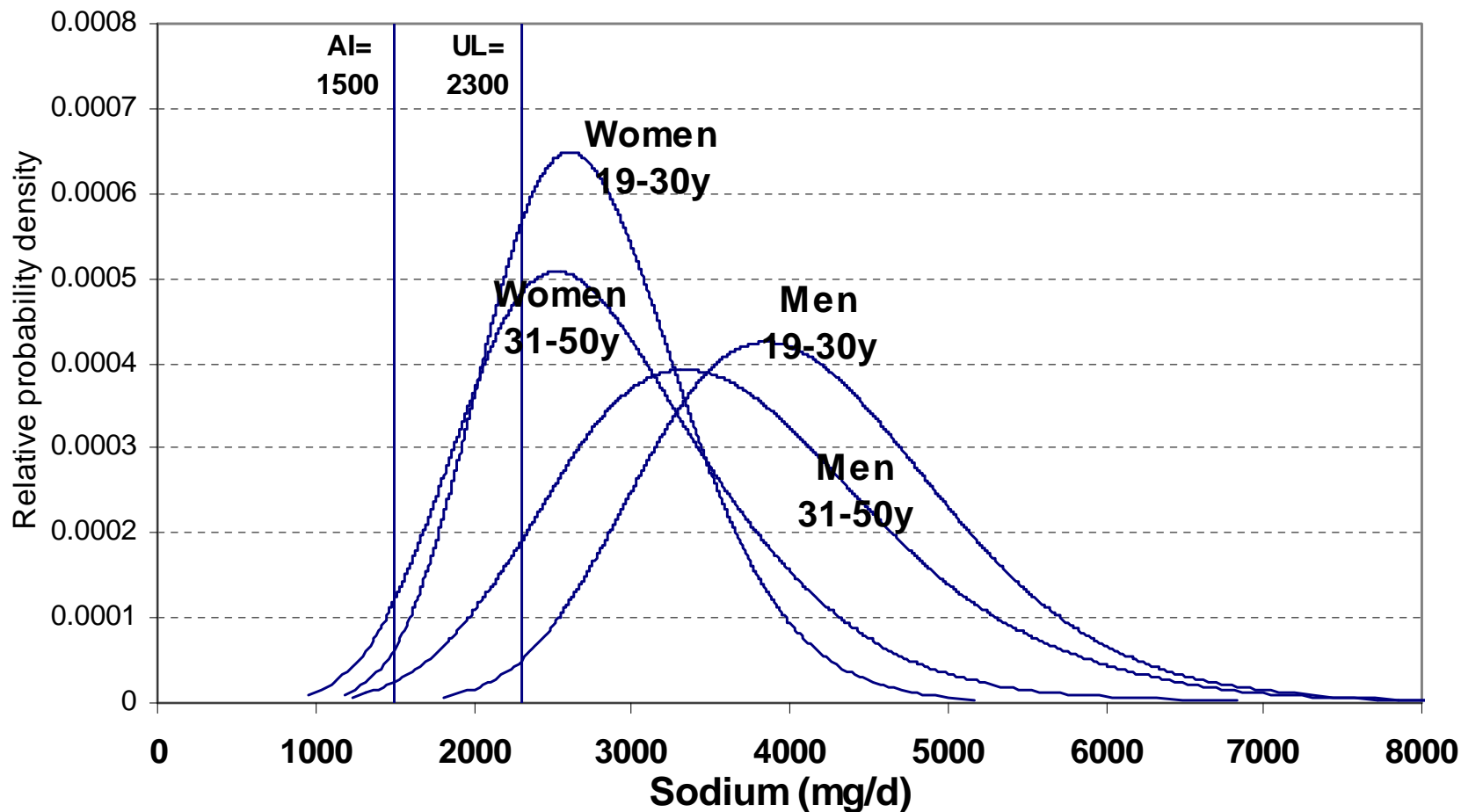


Mean Sodium Intakes, mg/d, Canada and the USA

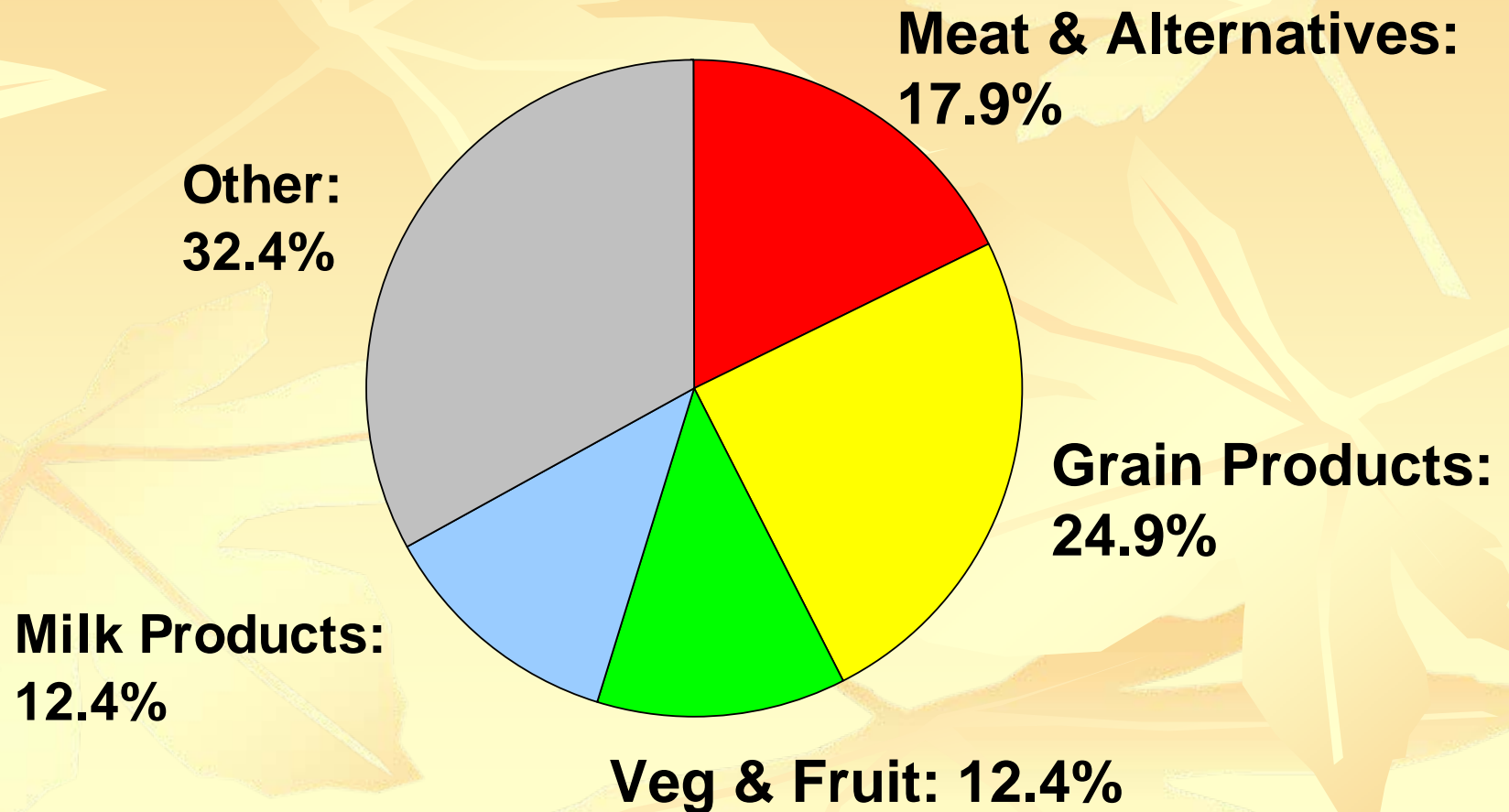
Age	MEN		WOMEN	
	Canada	USA	Canada	USA
19-30	4066	4141	2793	3098
31-50	3607	4252	2806	3011
51-70	3334	3645	2573	2652
71+	2882	3051	2300	2504

Garragat D. Sodium consumption at all ages. Health Reports 2007;18(2):47-52, and
 What We Eat in America, NHANES 2001-02.
<http://www.ars.usda.gov/SP2UserFiles/Place/12355000/pdf/usualintaketables2001-02.pdf>

Canadians' usual sodium intake distributions



Sodium Sources: BC Nutrition Survey



2009 Canadian "Salt Lick Award" Goes to Country's Pizza Producers

- Two slices Pizza Hut pepperoni lovers large stuffed crust pizza: 3000 mg
- Pizza Hut Personal pan pizza (6"): 1280-2250
- One large slice "Pizza Pizza" meat supreme: 2400 mg



Initiatives in Canada and the US

Canada



United States



- Health Canada
Multistakeholder Working Group on Sodium Reduction
- To develop and oversee implementation of a strategy to lower Canadians' sodium intakes to within the range recommended by the DRIs
- <http://www.hc-sc.gc.ca/fn-an/nutrition/sodium/index-eng.php>
- IOM established ad hoc committee on Strategies to Reduce Sodium Intake
- review and recommend how to reduce dietary sodium intake to levels recommended by the Dietary Guidelines for Americans.
- <http://www.iom.edu/CMS/3788/59128.aspx>

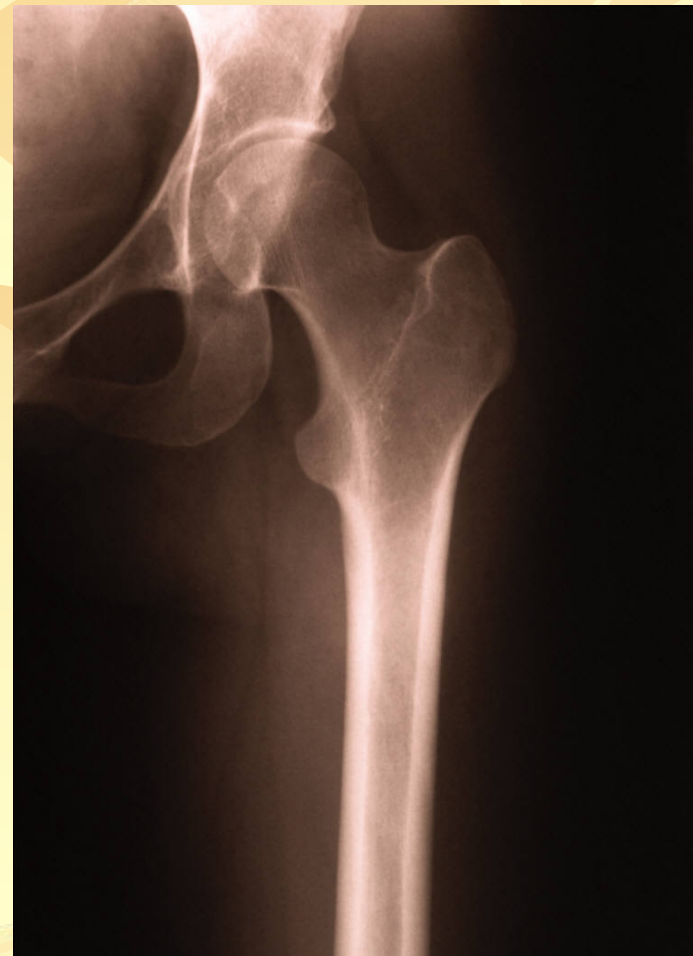
SHOULD THERE BE AN ASSAULT ON SALT?

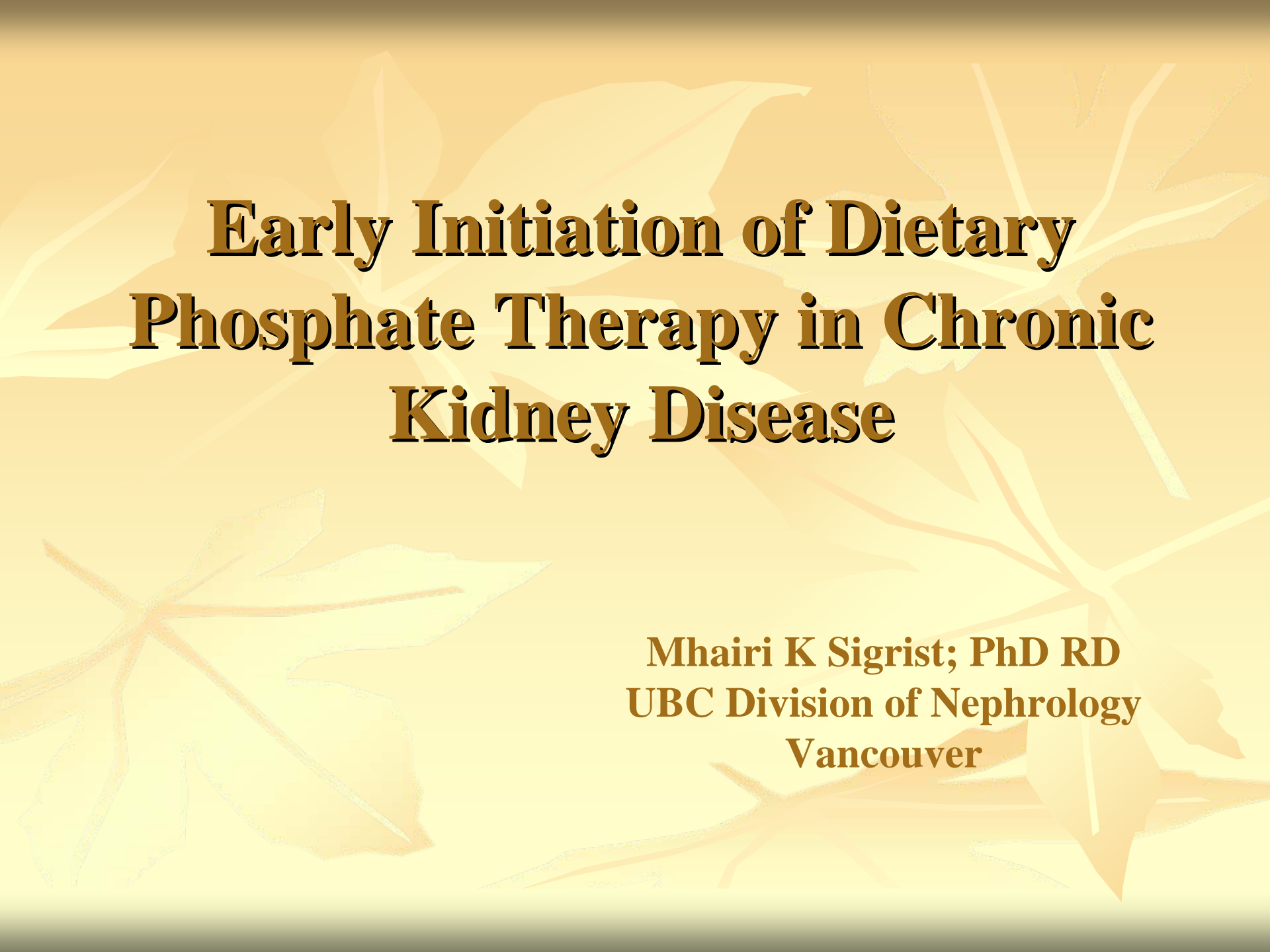
“ YES! ”

- Consumer awareness is important
- Is sodium restriction the only “fix” for hypertension?
- Efforts could be made by manufacturers to reduce sodium in the food supply.

BONES

- Early initiation of dietary phosphate therapy in CKD
- Vitamin D





Early Initiation of Dietary Phosphate Therapy in Chronic Kidney Disease

**Mhairi K Sigrist; PhD RD
UBC Division of Nephrology
Vancouver**

Overview

- Benefits of early dietary phosphate restrictions
- Introduction to FGF-23
- Studies of dietary phosphate in CKD 3 & 4
- Recommendations for clinical practice

Scale of the problem

Number of CKD patients in Canada



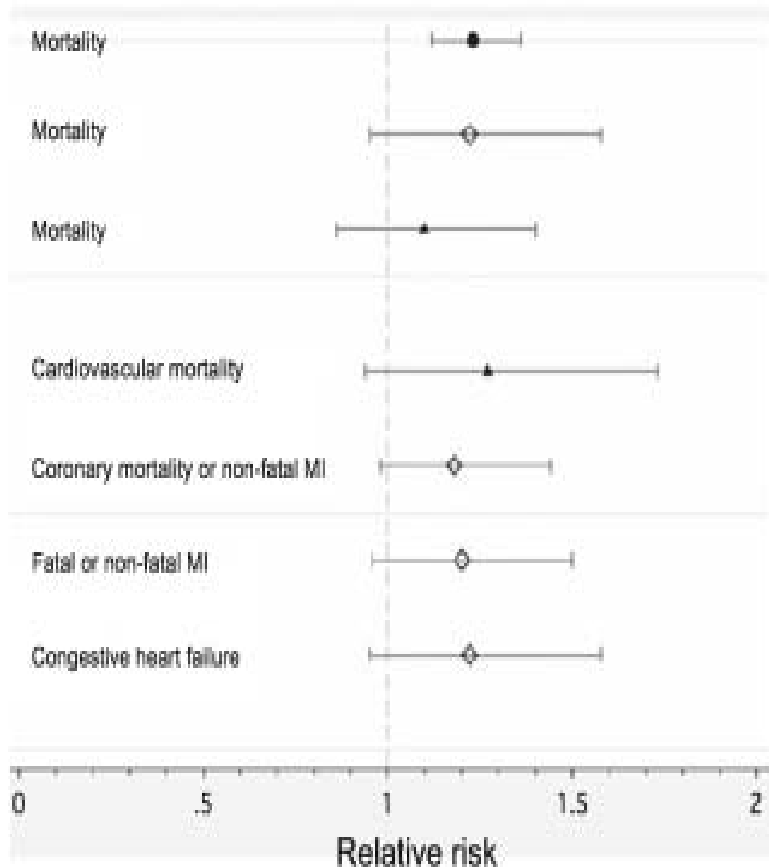
Stage 5 - 24,421

Stage 4 - 49,086

Stage 3 - 930,398

CORR (Canadian Organ Replacement Registry): 2005

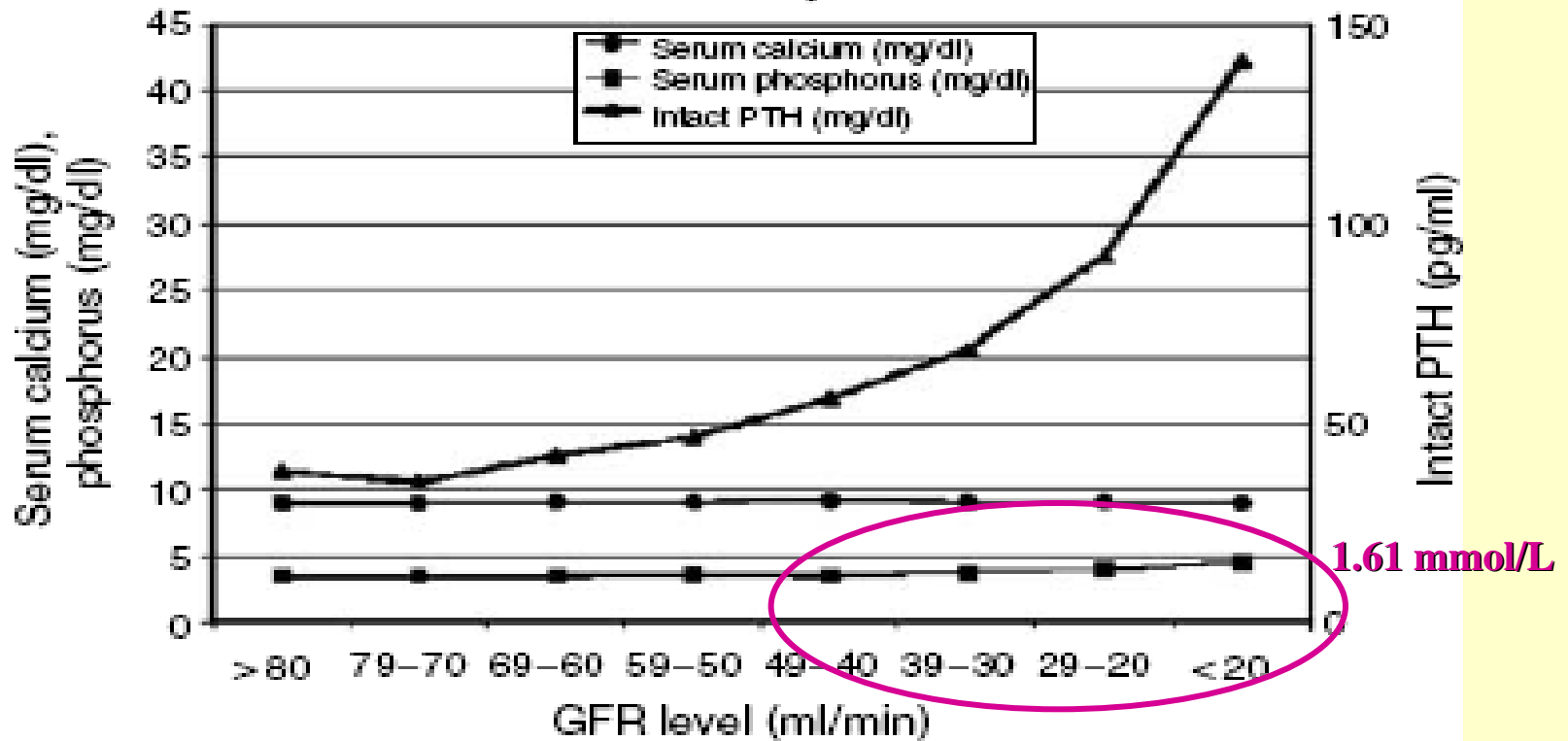
Phosphate and CV mortality



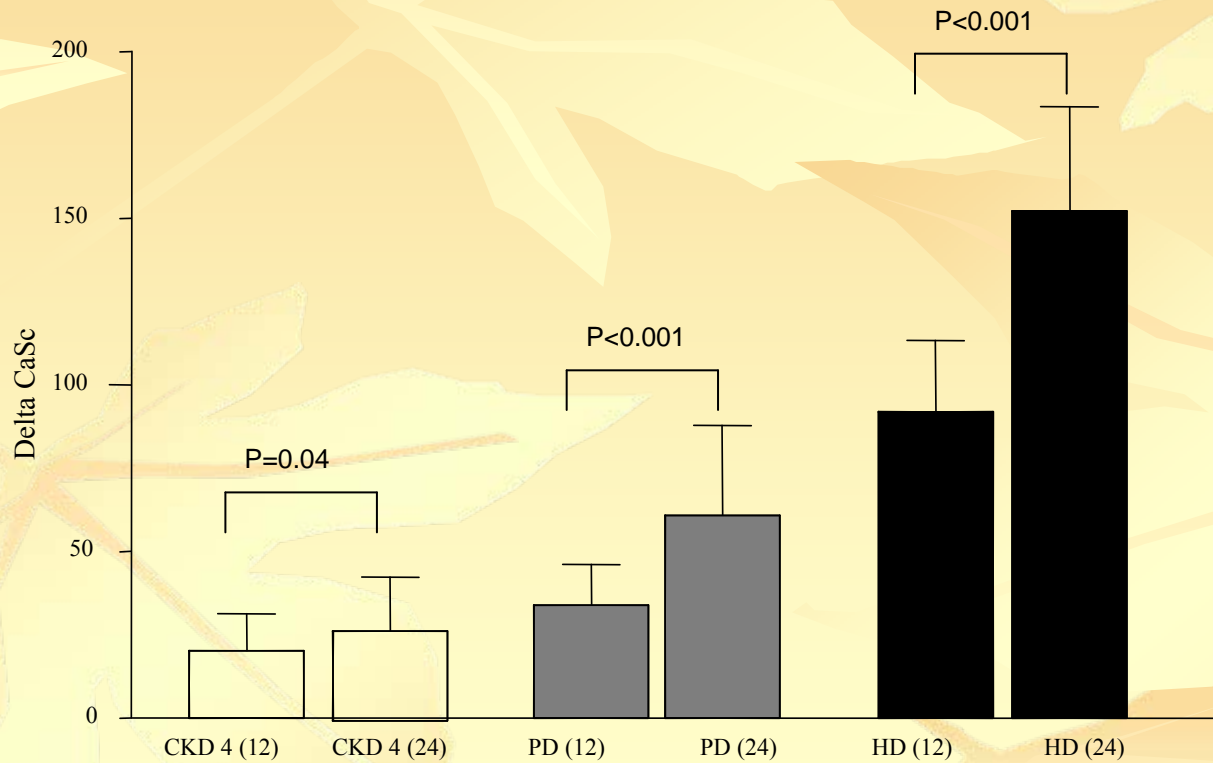
	Kestenbaum	Tonelli	Menon
Number of subjects	3490	4127	839
Mean age (years)	71.2	59.0	52.0
Male (%)	96.1	86.0	61.0
Caucasian (%)	90.8	93.0	85.0
Diabetes (%)	45.2	14.0	5.0
Coronary heart disease (%)	60.9	100.0	9.8
Estimated GFR (ml/minute/1.73 m ²)	47.2	71.9	32.5
Mean serum phosphate (mg/dl)	1.10	1.06	1.23
Intraquartile range serum phosphate (mg/dl)	3.0–3.8	3.0–3.6	3.4–4.2
Median follow-up (months)	25.2	59.7	123.0

Mineral homeostasis at different stages of CKD

Median values of serum calcium, phosphorus, and intact PTH by GFR levels



Progression of Calcification



P<0.001 for all modality groups from baseline to 12 months and from 12 months to 24 months.

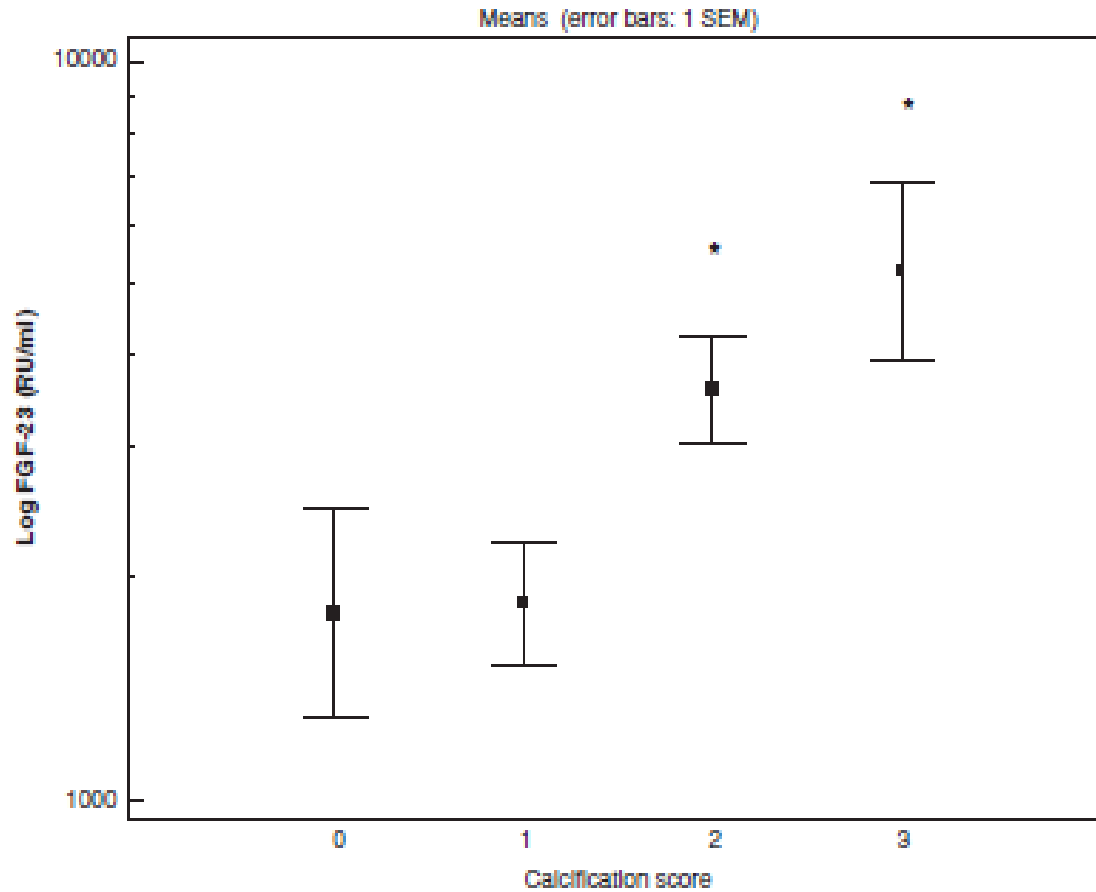
Potential benefits of early phosphate restrictions

- Vascular protection
- Reduce Cardiovascular Events
- Slow progression of Renal Failure
- Slow the onset of secondary hyperparathyroidism

Fibroblast Growth Factor-23 (FGF-23)

- Discovered 8 years ago
- Potentially key in the pathogenesis of mineral metabolism and bone structure
- Enhances the urinary excretion of phosphate, by reducing phosphate reabsorption in the proximal tubules
- Suppresses renal 1-hydroxylase activity and decreases serum 1,25 vitamin D levels
- High FGF-23 levels in early CKD may contribute to the development of secondary hyperparathyroidism

FGF-23 and Vascular Calcification



Study of dietary phosphate in CKD

- **Hypothesis:**

Alterations in phosphate intake over 7 days (by diet alone and with the addition of phosphate binders) result in measurable changes in serum FGF-23, serum phosphate and phosphate excretion.

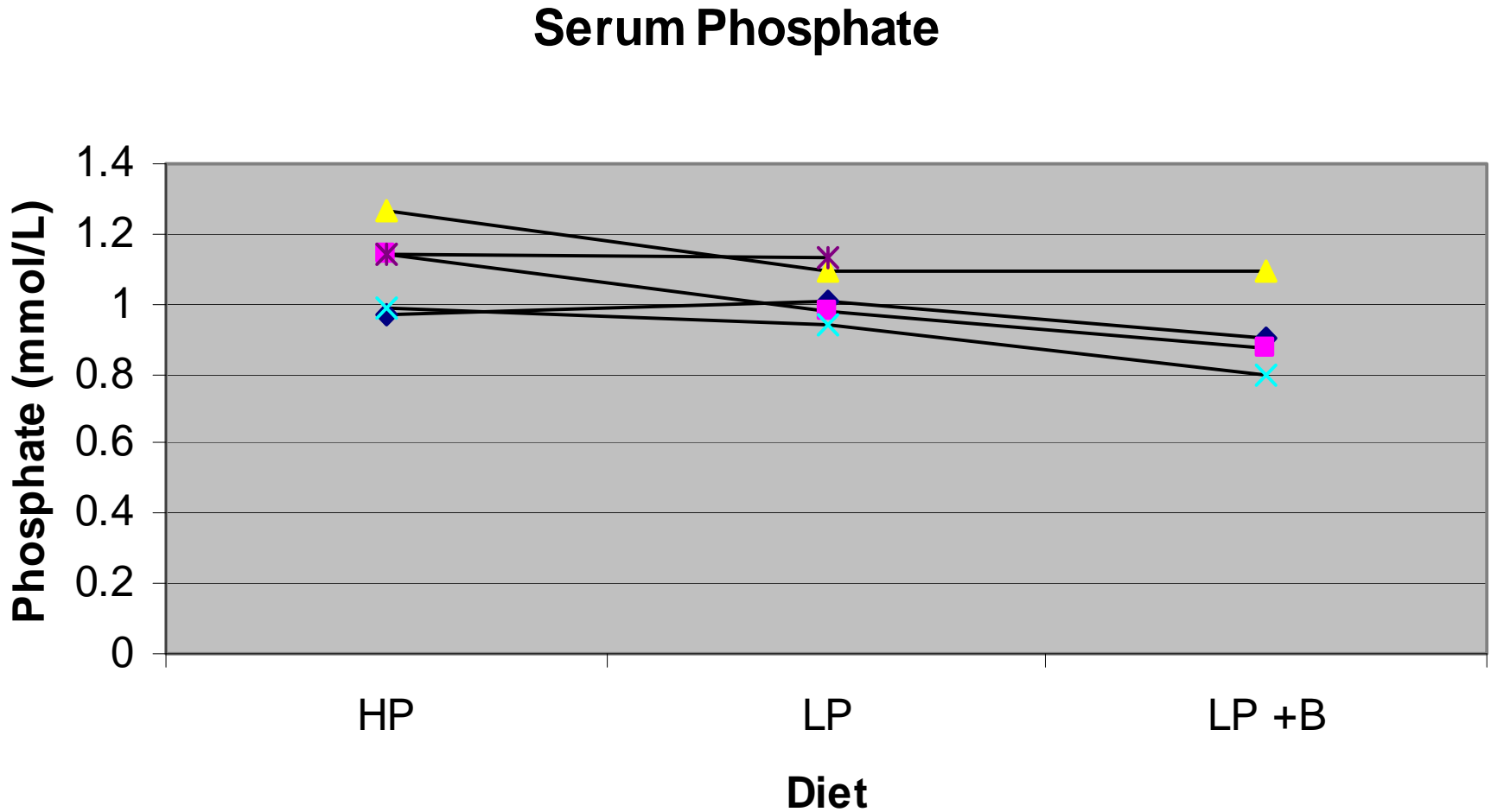
- **Objective:**

To measure levels of serum FGF-23, calcium, phosphate, PTH, 25 and 1,25 vitamin D and fractional phosphate excretion before and after a high phosphate diet, low phosphate diet and a low phosphate diet with phosphate binders

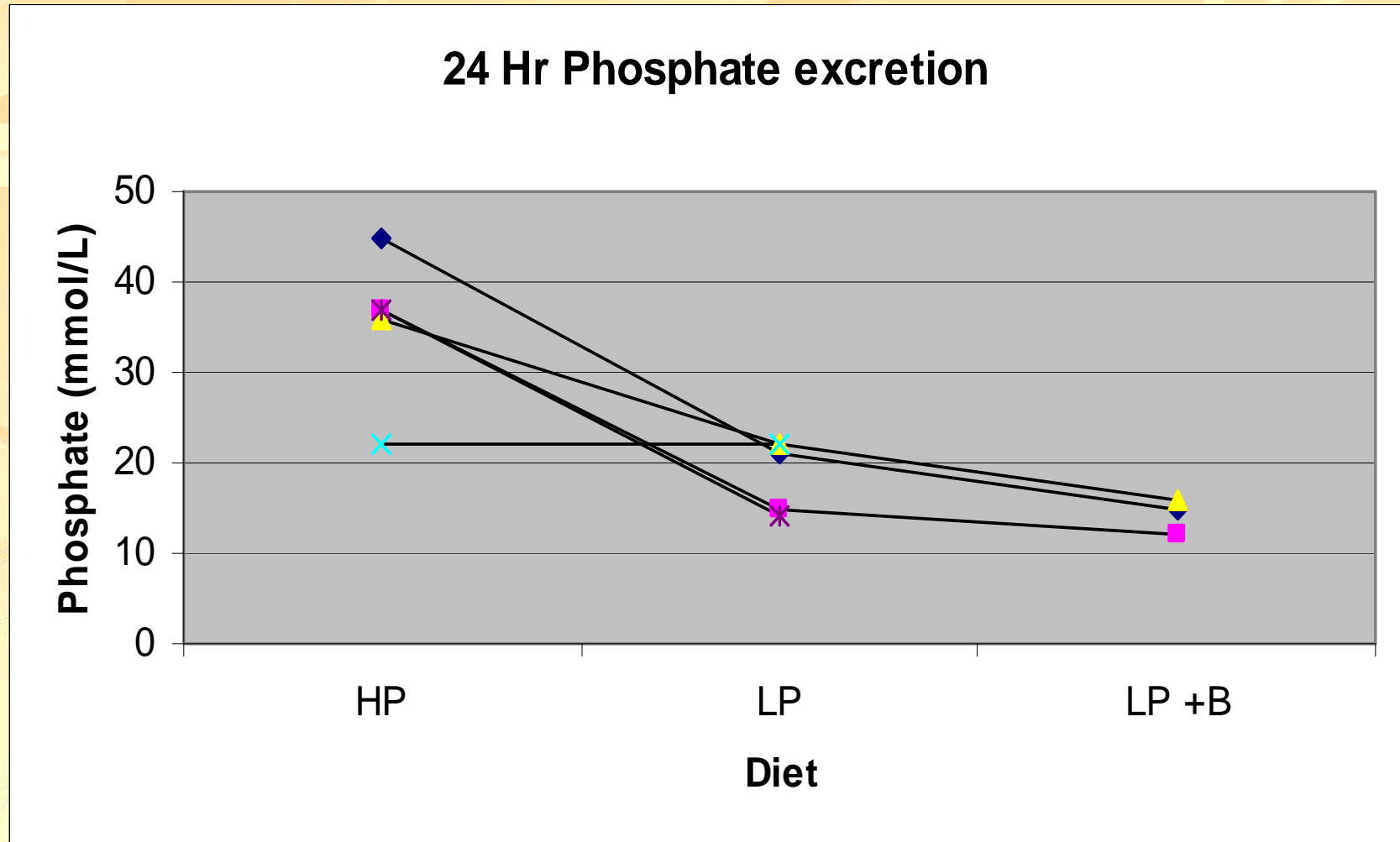
Methods

- 30 CKD stage 3 and 4 patients
 - Normal serum phosphate stable over three months (> 0.87 mmol/L and < 1.70 mmol/L)
 - Body mass index >20 kg/m²
 - No phosphate binders or active vitamin D
 - No Primary parathyroid defects
- 20 day dietary manipulation

Preliminary Results- Serum Phosphate



Preliminary Results- Urine Phosphate



Recommendations

Broad spectrum phosphate lowering advice that dovetails with sodium reductions.

- Avoid processed meals
- Canned meats and canned oily fish
- Reduce cheddar & processed cheeses
- Products known to have phosphate additives (**100% absorption**) part-baked bakery products, dry cake and brownie mix, pancake mix, pop



Wholegrain products



- Avoid all-bran, bran muffins and seeds
- **Do not avoid wholegrain** rice, pasta and bread (60% absorption) particularly in diabetes, obesity and lipid abnormalities

Phosphorous in common foods

Phosphate restriction 800-1000 mg/day

Food (weight)	Phosphorous (mg)	Phosphorous absorbed (mg)
White Pasta (100g)	75	45
Whole-wheat pasta (100g)	88	52
White rice (100g)	42	25
Brown Rice (100g)	76	45
White bread (2 Slices)	49	29
Whole-wheat bread (2 slices)	113	67
Cinnamon-raisin Bagel (71g)	71	42
Pumpkin Seeds (28g)	328	196
Choc cake from dry mix (150g)	405	243
Bran muffin (113g)	424	254
All- bran (70g)	805	483

Summary

- FGF-23 is an important phosphaturic hormone which may prove to be clinically relevant
- Elevated phosphate in the normal range is associated with higher mortality
- Dietary phosphate restrictions without dramatic reductions in protein and fiber are called for in CKD 3&4 regardless of serum phosphate levels
- Further studies are needed to elucidate the importance of phosphate restriction on FGF-23 and whether we can change the outcome in CKD patients

Vitamin D

What we do and do not know



A Levin MD FRCPC
Professor of Medicine
University of British Columbia

Key points



- Vitamin D is an important hormone in health and disease
- Lack of Vit D assoc. with :
 - HTN
 - Insulin resistance
 - Metabolic syndrome
 - Diabetes
 - Mortality
 - Inflammation

Key points

- Vascular stiffness highest in those with the lowest GFR
- Vitamin D levels are correlated with arterial stiffness in HD
- Improved survival in HD pts treated with any Vitamin D

Key points

- In CKD, elevated PTH is a marker of disease progression
- Diabetics lose ability to synthesize vitamin D earlier than non-diabetics
- Treatment for Mineral Bone Disease (MBD) includes a cocktail of interventions

Key points

- Serum Vitamin D testing only suitable for study purposes (\$40/test) as labs not standardized
- Stage 4 + 5 need activated vitamin D
- Vitamin D supplementation is recommended 3x/wk rather than daily to pulse for bone health

Entity of CKD Malnutrition

Eileen Moore, CNSD, RD, LD
Renal Program Clinical Manager
Pentec Health Inc.

Proposed New Nomenclature: Protein-Energy Wasting (PEW)

- Lab Chemistries
- Body mass
- Muscle mass
- Dietary Intake



CATEGORY CRITERIA For DIAGNOSIS of CKD-5 PEW



Lab: Serum Alb < 38 (BCG)

Body Mass: BMI < 23

Muscle Mass: Subjective Global Assessment

Dietary Intake: <0.8 g protein/kg/d x 2 mo
<25 Kcal/kg/d x 2 mo

UREMIA

INFLUENCE on APPETITE REGULATION

- Elevated Leptin Levels inhibit food Intake and stimulates energy expenditure
- Elevated Cholecystokinin (CCK) induces satiety state and inhibits gastric emptying
- Delayed gastric emptying in >50% of non diabetic patients

INFLAMMATION

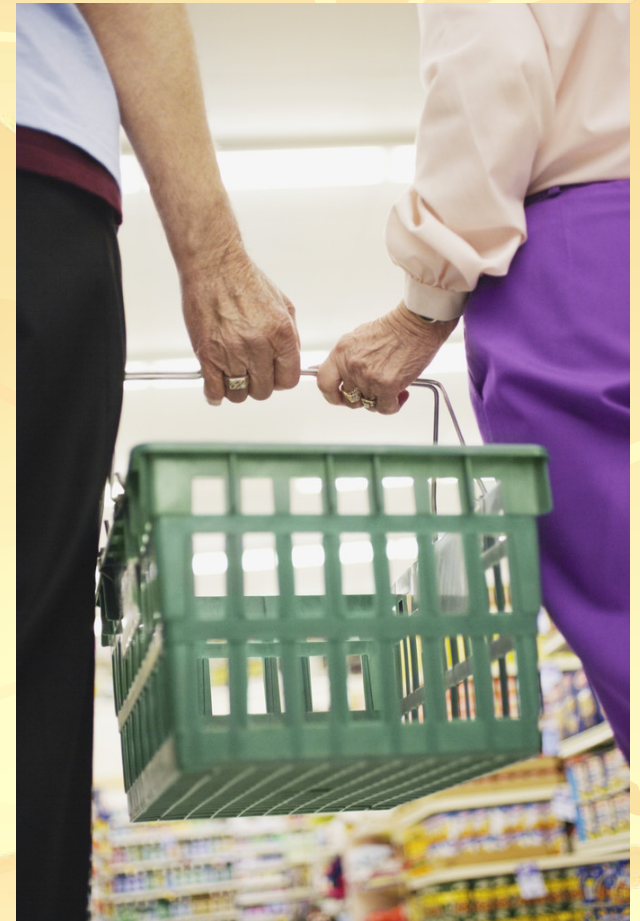
INFLUENCE on APPETITE REGULATION

Elevated Anorexigens: TNF α and IL-6

- Elicit Taste Aversion
- Stimulate Glucagon and CCK release
- Stimulate Leptin production
- Decreases gastric emptying and gastric/intestinal motility

BARRIERS TO REPLETION

- Poor Nutritional Knowledge
- Difficulty Chewing
- Help needed with Shopping and Cooking
- Low fluid intake
- Inadequate dialysis & acidosis
- Difficulty swallowing, GI symptoms
- Poor appetite
- Depression



Morbidity & Mortality in CKD-5

Albumin & Relative Risk of Death (RRD)

<u>Risk</u>	<u>Albumin</u>	<u>Relative Risk of Death</u>
Mild	>40	Reference Group
Mod	35-40	2 x
Severe	30-35	5 x
Most Severe	<25-30	7 - 8 x

2/3 of the patients had Albumin < 40

>12,000 patients

Lowrie and Lew Data; 1990

PROTEIN

- nPNA <0.8 or >1.4
 - associated with greater mortality
- nPNA 1-1.4
 - Showed Best Survival
- nPNA is influenced by inflammation
- High nPNA indicates catabolism

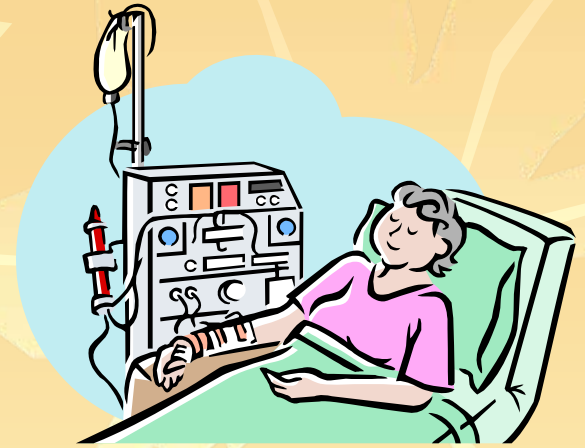


Typical Approach

- Identification of Malnutrition
- Intensive counselling
- Intervention with oral supplements
- Intradialytic Parenteral Nutrition (IDPN)



IDPN



- Hemodialysis is a catabolic procedure
- IDPN increases albumin synthesis and promotes positive nitrogen balance
- IDPN corrects the underlying imbalance of amino acids so the renal patient will eat better, not necessarily to give calories and protein
- The temperature of the IDPN solution is important, as a cold product can cause a drop in BP and cause nausea (Cold Shock Syndrome)



THANK-YOU

