

Nutrition et maladie rénale chronique: mythes et réalité

Pr. Denis FOUQUE

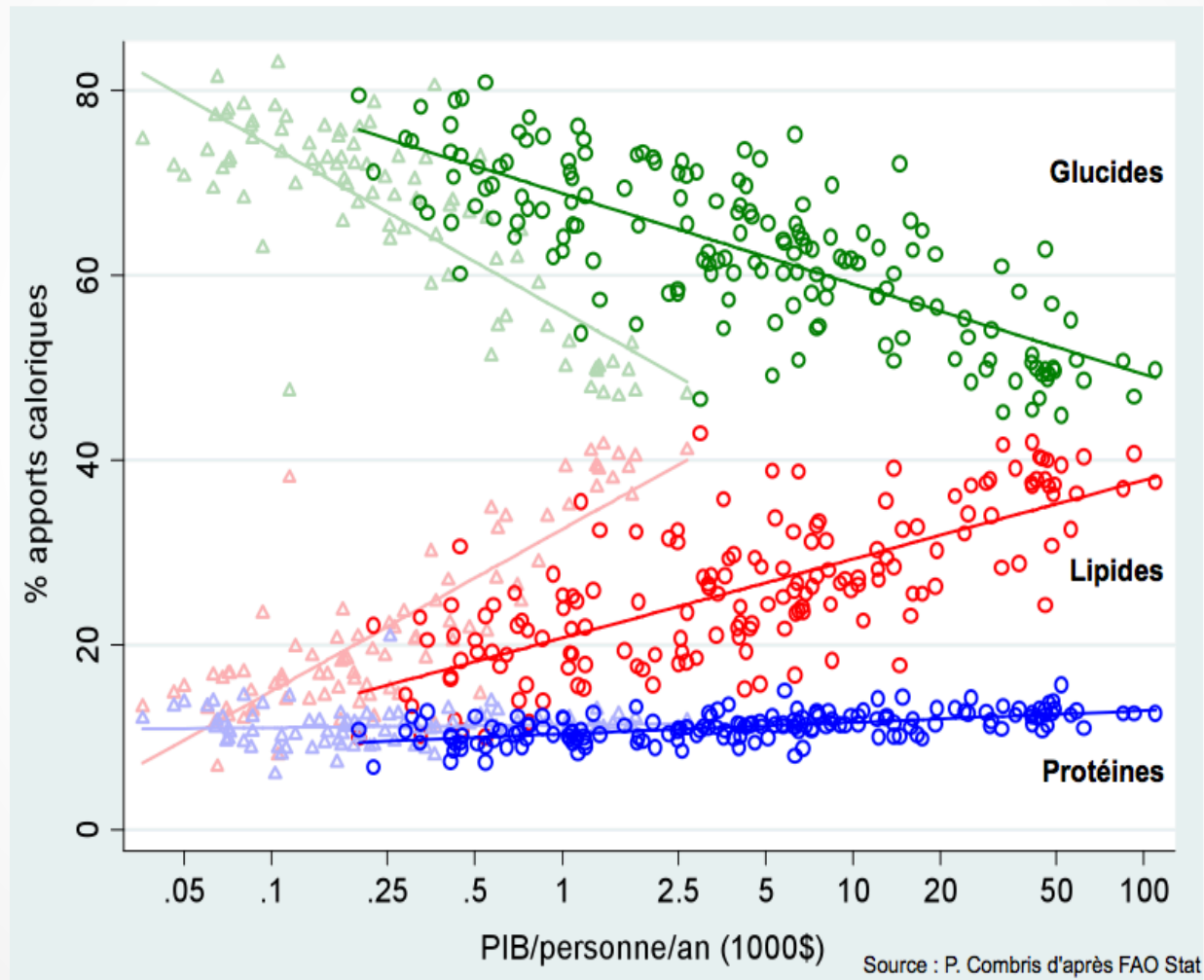
Service de Néphrologie Lyon-Sud
Université de Lyon - Claude Bernard

Apports Nutritionnels

Adultes en pays occidentaux:

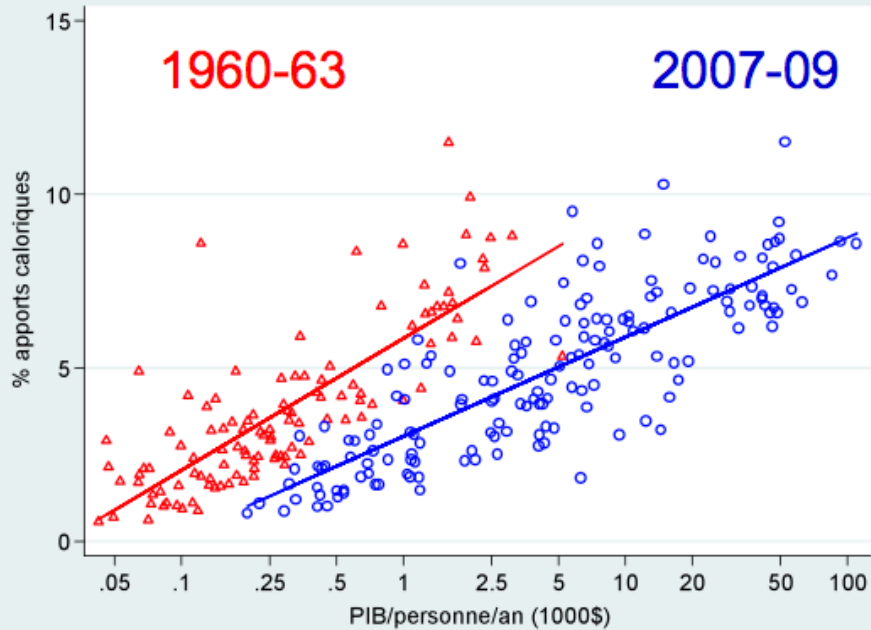
- 1.3 – 1.4 g protéines/kg/j
- 35 - 40 kcal/kg/j
- 9 -12 g sel
- 1200 - 1800 mg phosphate
- 1000 mg calcium

Apports énergétiques 2007-09

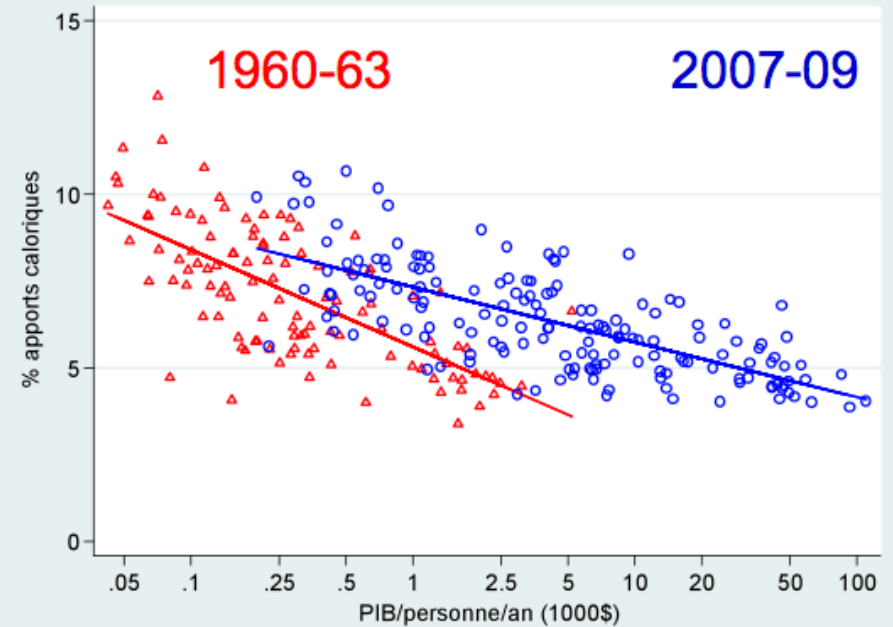


Protéines animales et végétales

Protéines animales

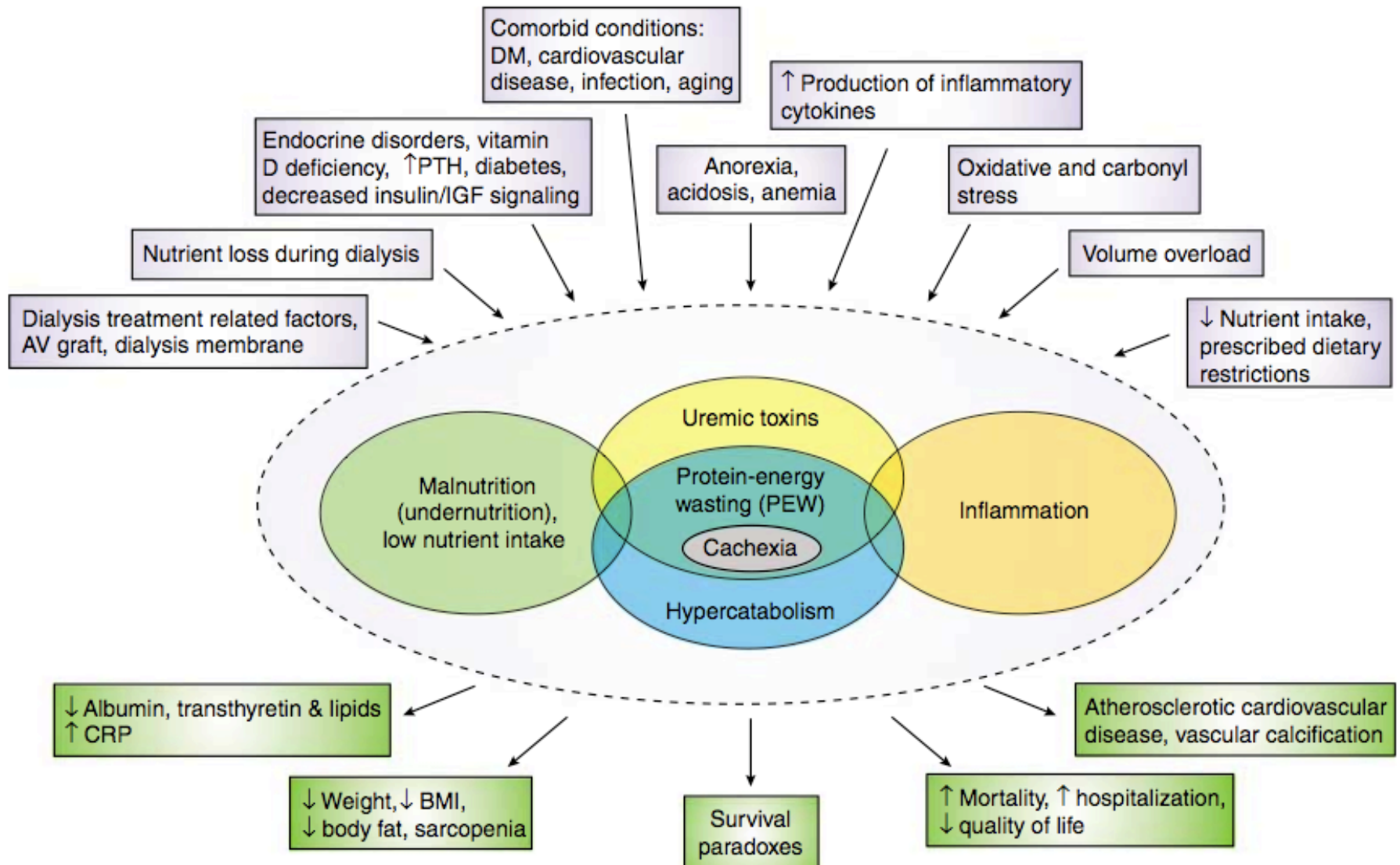


Protéines végétales



Source : P. Combris d'après FAO Stat

Dénutrition protéino-énergétique



Les protéines en excès entraînent une aggravation de la maladie rénale

| caseine | 45% | 30% | 20% |
|--------------------|-----------|-----------|-------------|
| Proteinurie (mg/j) | 186 ±23 | 248 ±32 | 141 ±42 * |
| S insulin | 14.6 ±1.9 | 12.0 ±1.4 | 11.7 ±1.9 * |

Expression dans le rein

| caseine | 45% | 30% | 20% |
|-------------|-----------|----------|------------|
| SREBP1 | 2.2 ±0.2 | 2.2 ±0.2 | 1.0 ±0.2 * |
| TNF-alpha | 3.5 ±0.6 | 2.7 ±0.4 | 1.1 ±0.3 * |
| IL-6 | 2.1 ±0.3 | 2.0 ±0.2 | 1.0 ±0.1 * |
| IV collagen | 1.65 ±0.2 | 2.0 ±0.3 | 1.0 ±0.2 * |
| TGF-beta | 1.9 ±0.2 | 1.4 ±0.2 | 1.0 ±0.1 * |

Lipides



inflammation



Matrice



fibrose



Profil diététique et progression de la MRC

From: The Impact of Protein Intake on Renal Function Decline in Women with Normal Renal Function or Mild Renal Insufficiency

Ann Intern Med. 2003;138(6):460-467. doi:10.7326/0003-4819-138-6-200303180-00009

Table 3. Multivariate Linear Regression Results for Change in Estimated Glomerular Filtration Rate per 10-g Increase in Nondairy Animal, Dairy, or Vegetable Protein*

| Protein Type | Change in Estimated GFR | |
|-----------------|--|--|
| | Participants with Normal Renal Function (<i>n</i> = 1135)† | Participants with Mild Renal Insufficiency (<i>n</i> = 489)‡ |
| | <i>mL/min per 1.73 m²</i> | |
| Nondairy animal | 0.09 (−1.08 to 1.26) | −1.21 (−2.34 to −0.33) |
| Dairy | 1.29 (−0.98 to 3.56) | −0.05 (−1.48 to 1.38) |
| Vegetable | 1.83 (−1.25 to 4.98) | 1.03 (−2.08 to 4.14) |

Profil diététique et progression de la MRC

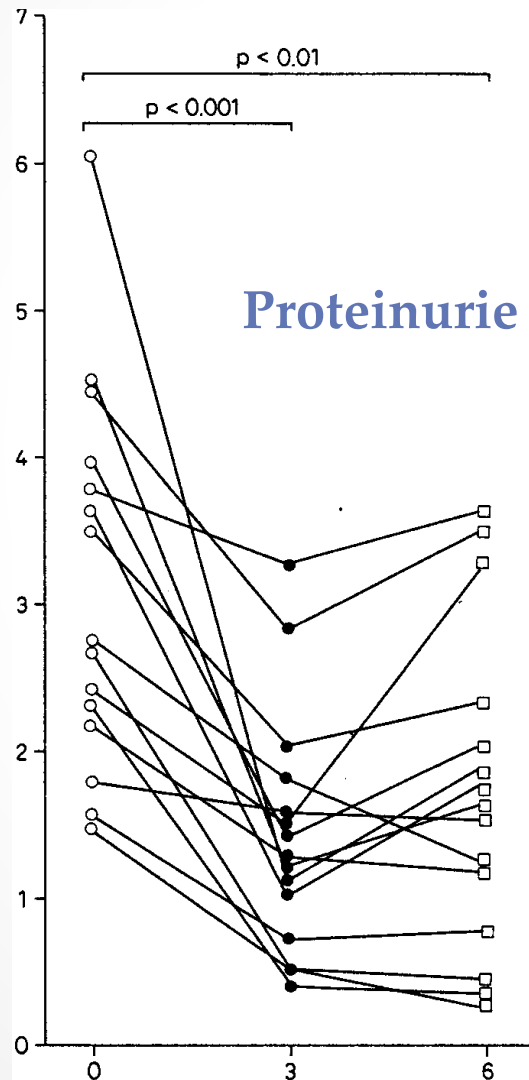
| | Q1 | Q2 | Q3 | Q4 |
|---|------------------|------------------|------------------|------------------|
| Western | | | | |
| Age and energy intake adjusted | 1.00 (reference) | 1.37 (0.98-1.93) | 1.84 (1.29-2.64) | 1.95 (1.27-2.97) |
| Multivariable ^a | 1.00 (reference) | 1.22 (0.87-1.73) | 1.57 (1.08-2.28) | 1.48 (0.95-2.30) |
| Multivariable + analgesic medication use ^b | 1.00 (reference) | 1.22 (0.86-1.72) | 1.52 (1.04-2.20) | 1.40 (0.90-2.19) |
| Multivariable + high cholesterol or lipid-lowering drug | 1.00 (reference) | 1.23 (0.87-1.73) | 1.57 (1.08-2.26) | 1.46 (0.94-2.28) |
| Multivariable + diabetes duration | 1.00 (reference) | 1.22 (0.86-1.72) | 1.58 (1.09-2.29) | 1.46 (0.94-2.28) |
| Prudent | | | | |
| Age and energy intake adjusted | 1.00 (reference) | 1.44 (1.05-1.97) | 1.06 (0.76-1.48) | 0.78 (0.53-1.13) |
| Multivariable ^a | 1.00 (reference) | 1.43 (1.04-1.98) | 1.07 (0.76-1.51) | 0.81 (0.55-1.19) |
| Multivariable + analgesic medication use ^b | 1.00 (reference) | 1.44 (1.04-1.98) | 1.10 (0.78-1.56) | 0.82 (0.56-1.21) |
| Multivariable + high cholesterol or lipid-lowering drug | 1.00 (reference) | 1.45 (1.05-2.00) | 1.09 (0.77-1.54) | 0.84 (0.57-1.23) |
| Multivariable + diabetes duration | 1.00 (reference) | 1.44 (1.04-1.98) | 1.07 (0.76-1.51) | 0.81 (0.55-1.19) |
| DASH-style | | | | |
| Age and energy intake adjusted | 1.00 (reference) | 0.87 (0.64-1.18) | 0.79 (0.58-1.09) | 0.51 (0.36-0.72) |
| Multivariable ^a | 1.00 (reference) | 0.86 (0.63-1.17) | 0.79 (0.57-1.09) | 0.55 (0.38-0.80) |
| Multivariable + analgesic medication use ^b | 1.00 (reference) | 0.88 (0.65-1.21) | 0.82 (0.60-1.13) | 0.57 (0.39-0.83) |
| Multivariable + high cholesterol or lipid lowering drug | 1.00 (reference) | 0.86 (0.63-1.18) | 0.79 (0.58-1.09) | 0.55 (0.38-0.79) |
| Multivariable + diabetes duration | 1.00 (reference) | 0.87 (0.64-1.18) | 0.79 (0.58-1.09) | 0.55 (0.38-0.80) |

Nurses health study, n= 3200, 1990-2000

Lin J et al. *Am J Kidney Dis*, 2011; 57: 245-254.

Bénéfices d'une réduction des protéines

Réduire la protéinurie



0.3 g prot/kg + ceto-analogs

Baisser l'urée sanguine

Après 3 mois à 0,3 g/kg/j + cétoanalogues

TABLE 1

Biochemical and physiologic indexes before and after 3 mo of a low-protein diet¹

| | Before | After |
|--|-----------------|-----------------------------|
| Serum creatinine ($\mu\text{mol/L}$) | 463 \pm 37 | 438 \pm 62 |
| GFR (mL/min) | 13.2 \pm 2.8 | 10.8 \pm 2.0 |
| Plasma urea (mmol/L) | 24.3 \pm 1.8 | 10.6 \pm 1.7 ² |
| Urinary urea (mmol/d) | 171 \pm 10 | 68 \pm 5 ² |
| Uric acid ($\mu\text{mol/L}$) | 556 \pm 31 | 405 \pm 30 ³ |
| Total calcium (mmol/L) | 2.29 \pm 0.07 | 2.38 \pm 0.06 |
| Phosphorus (mmol/L) | 1.45 \pm 0.22 | 1.34 \pm 0.10 |
| PTH (ng/L) | 273 \pm 139 | 172 \pm 86 |
| Arterial pH | 7.39 \pm 0.01 | 7.40 \pm 0.01 |
| Arterial bicarbonate (mmol/L) | 24.2 \pm 1.2 | 24.5 \pm 1.3 |
| Triacylglycerol (mmol/L) | 2.7 \pm 0.6 | 2.1 \pm 0.4 |
| Cholesterol (mmol/L) | 6.3 \pm 0.7 | 5.1 \pm 0.4 |

Baisser l'urée urinaire

Excrétion urinaire d'urée (mmol/j)

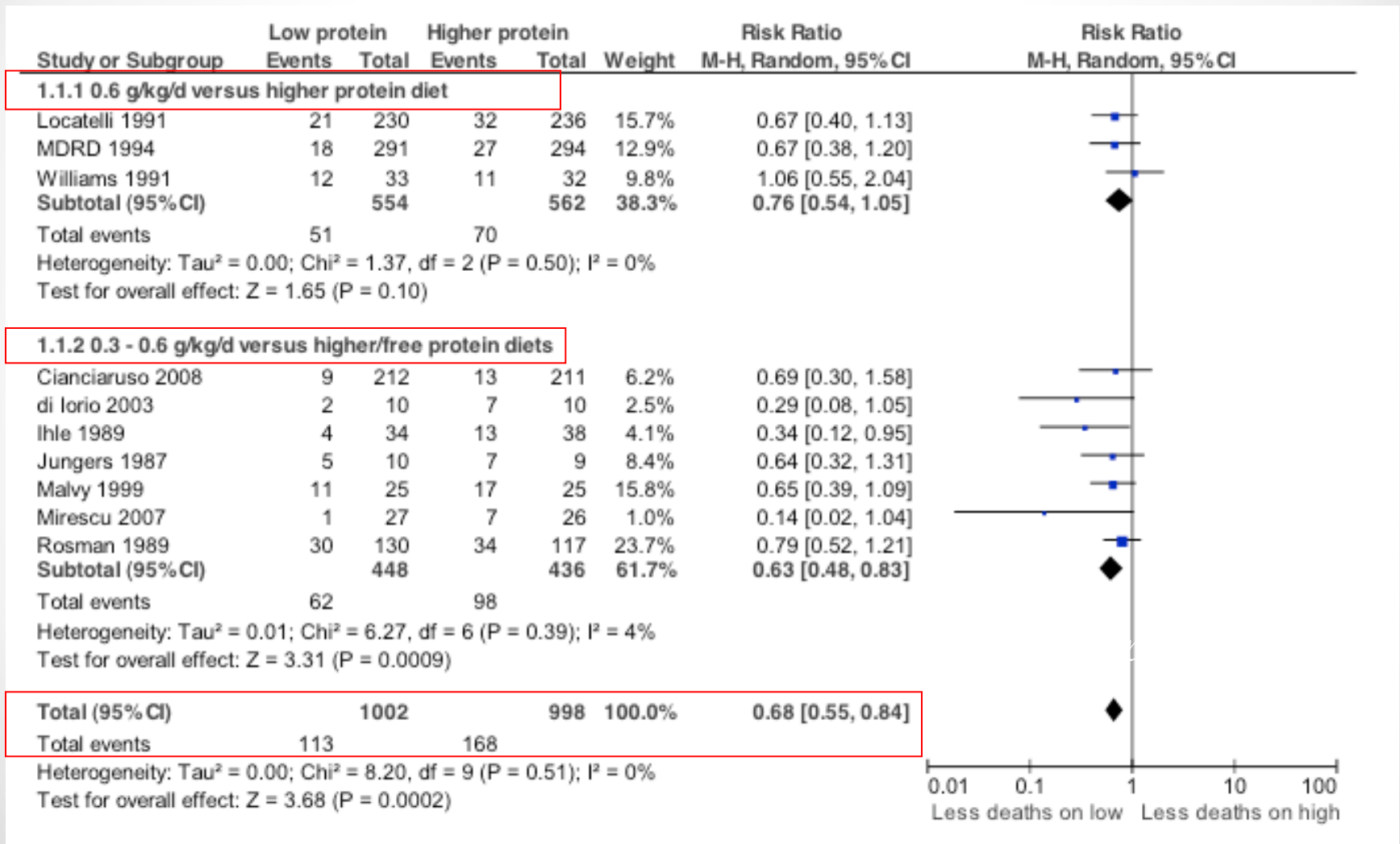
-15

15

45

75

Retarder le début des dialyses



Maintenir l'état nutritionnel

Apport minimal 0.46 g/kg/j (FAO/OMS, RDA)
+30% pour protéines variables = 0.60
+30% sécurité (niveau population) = 0.80

En MRC:

- Balances Azotées (Kopple) 0.6-0.7
- Flux de Leucine (Maroni, Fouque) g/kg/j
- Analyses métaboliques (Aparicio)
(os, risque CV, acidose, protéinurie,
insulinorésistance...)

Maintenir l'état nutritionnel en hémodialyse

Pas de différence selon l'apport prédialyse

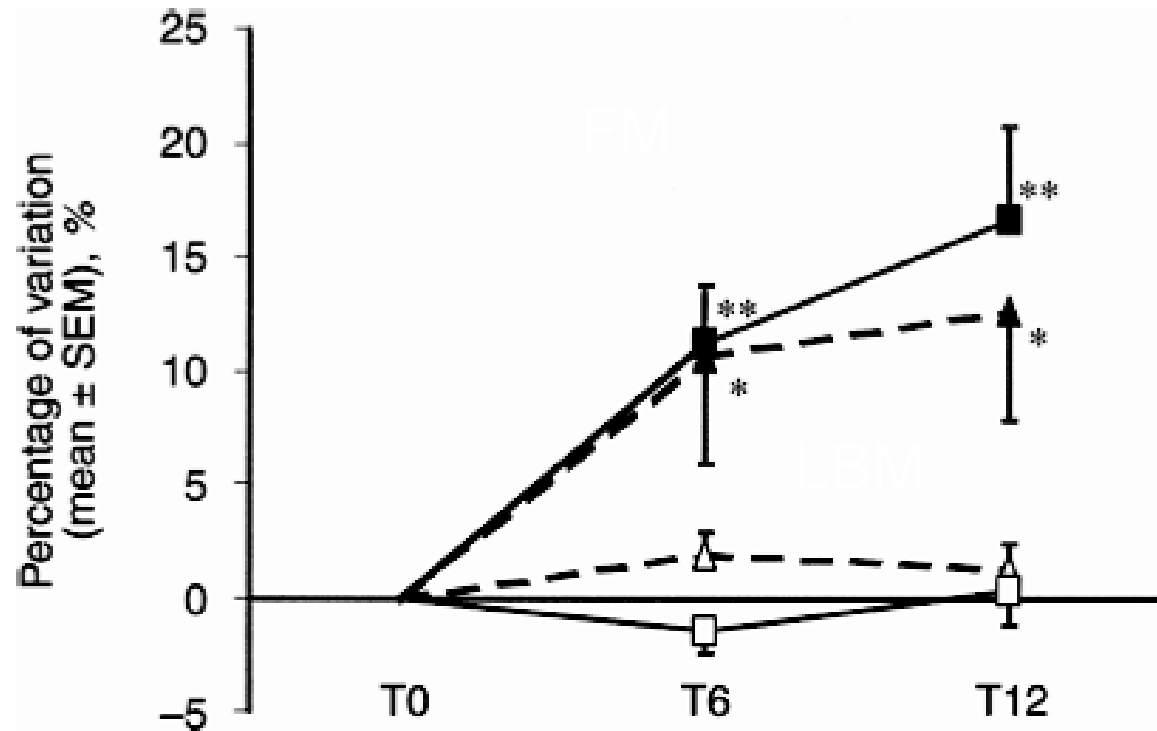


Fig. 2. Evolution of body composition (fat mass and lean body mass). A significant increase occurred in fat mass over the first year of hemodialysis in the two groups of patients (* $P < 0.05$; ** $P < 0.005$). No change was observed in lean mass during the same period. Symbols are: (■), control fat mass; (□), control lean mass; (△), SVLPD lean mass; and (▲), SVLPD fat mass.

Diminuer l'inflammation

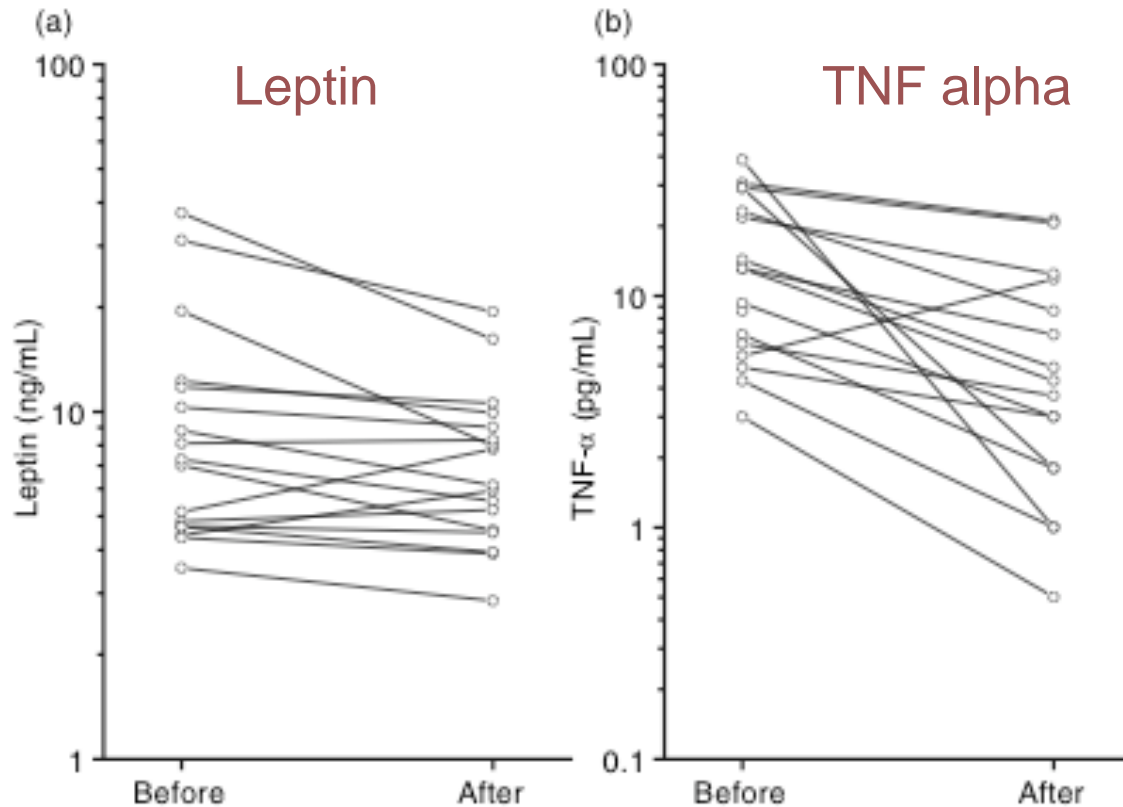
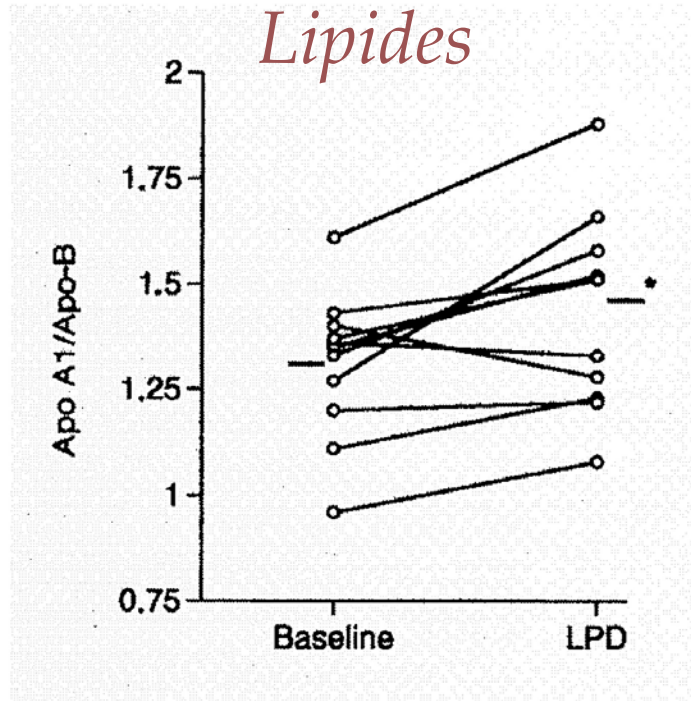


Fig. 1 (a) Plasma leptin and (b) tumour necrosis factor (TNF)-alpha levels before and after 16 weeks of a low protein diet.

1,05 à 0,68 g protein /kg/jour

Kozłowska et al, Nephrology 2004

Améliorer le profil lipidique



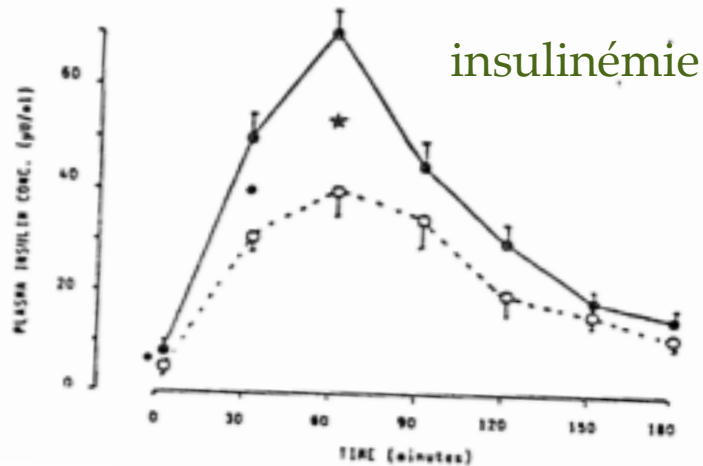
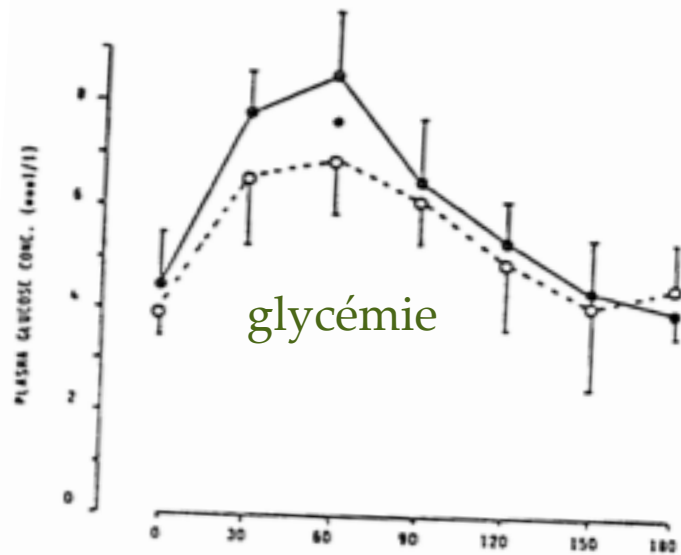
En réponse à la diminution des lipides saturés apportés par la viande

Fig. 1. The variation in the ratio of serum Apo-AI to Apo-B before (baseline) and after a 3-month low LPD period. The horizontal lines represent the mean value for each period (n = 11), *Significant increase from baseline; *p < 0.025.

Améliorer l'insulino-résistance

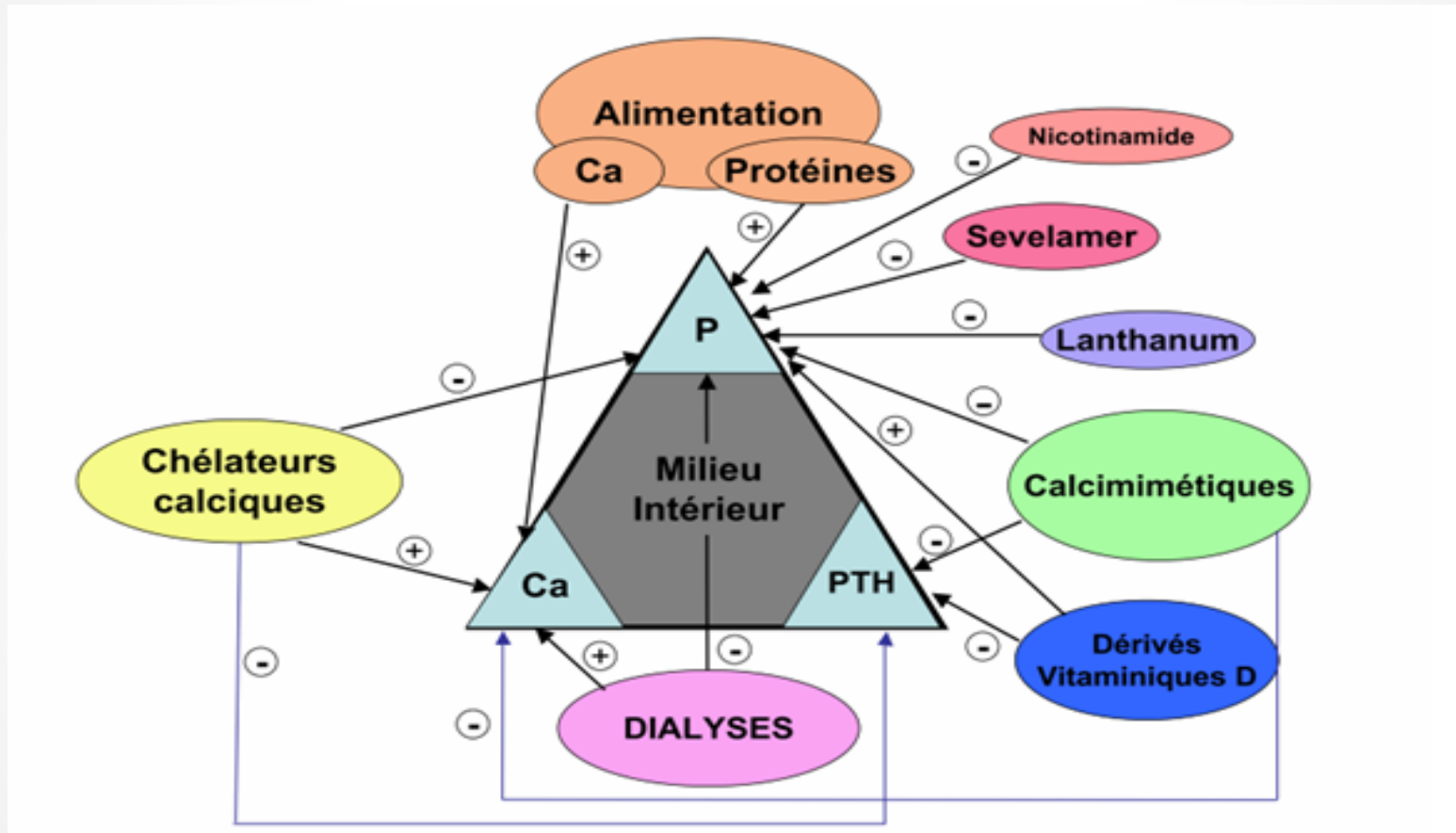
Amélioration de la
glycémie et de
l'insulinémie (après
HGPO)

1 g/kg/j à 0.3 g/kg/j
+céto
pdt 4 mois



Améliorer les anomalies phosphocalciques

Métabolisme du calcium et du phosphore en MRC



Réduire la charge de l'organisme en phosphore

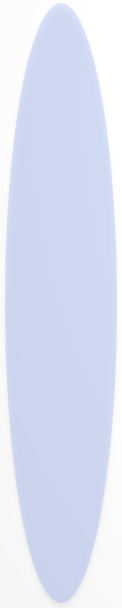
De 15 à 8 mg/kg/j

TABLE 1

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| Triacylglycerol (mmol/L) | 2.7 \pm 0.6 | 2.1 \pm 0.4 |
| Cholesterol (mmol/L) | 6.3 \pm 0.7 | 5.1 \pm 0.4 |

Apports classiques de phosphore: les fromages



Marché de Sallanches: difficile de résister...



Apports masqués de phosphore

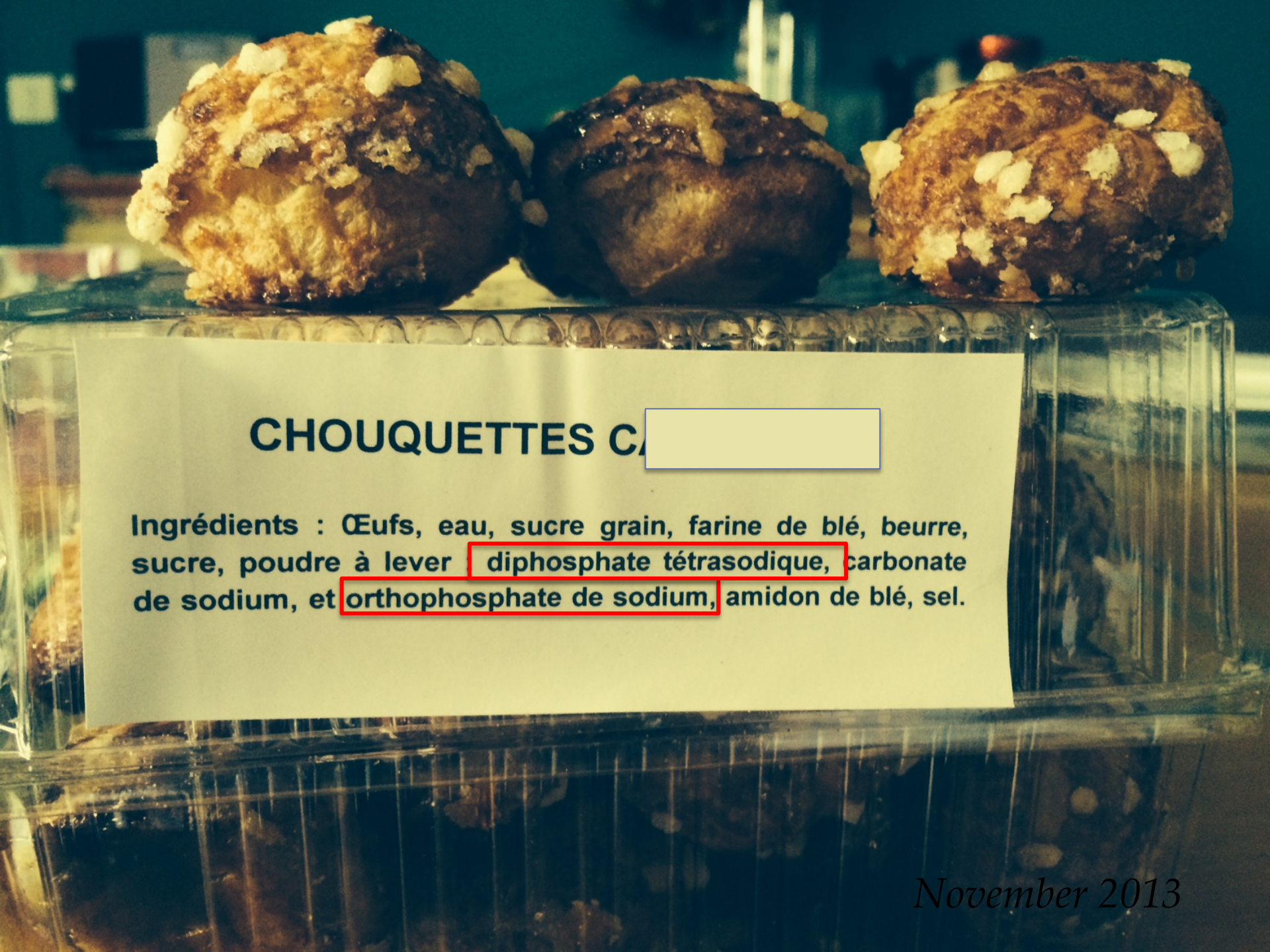


Saucisses et phosphore

146 mg à 12 mg par portion de 55g

| aliment | apports par portion | %apports par portion |
|---|---------------------|----------------------|
| ++ Salami de dinde cuit (portion : 55g) | 146mg | 21% |
| ++ Saucisson de foie (portion : 55g) | 127mg | 18% |
| ++ Jambon de dinde (portion : 55g) | 126mg | 18% |
| ++ Saucisse de dinde (portion : 55g) | 111mg | 16% |
| ++ Pâté de foie (portion : 55g) | 110mg | 16% |
| ++ Chipolata (portion : 55g) | 101mg | 14% |
| ++ Roulé de dinde (portion : 55g) | 101mg | 14% |
| ++ Saucisse fumée (portion : 55g) | 94mg | 13% |
| ++ Pain de viande au poivre (portion : 55g) | 94mg | 13% |
| ++ Boeuf froid tranché (fin) (portion : 55g) | 92mg | 13% |
| ++ Braunschweiger (portion : 55g) | 92mg | 13% |
| ++ Saucisse fumée (porc) (portion : 55g) | 89mg | 13% |
| ++ Saucisse fumée (boeuf) (portion : 55g) | 88mg | 13% |
| ++ Blanc de dinde rôtie (portion : 55g) | 87mg | 12% |
| ++ Jambon haché (portion : 55g) | 86mg | 12% |
| ++ Jambon tranché (portion : 55g) | 84mg | 12% |
| ++ Chorizo (portion : 55g) | 83mg | 12% |
| ++ Saucisse de veau (portion : 55g) | 83mg | 12% |
| ++ Saucisse bratwurst (portion : 55g) | 82mg | 12% |
| ++ Saucisse de boeuf (portion : 55g) | 78mg | 11% |
| ++ Saucisson de bologne (portion : 55g) | 76mg | 11% |
| ++ Saucisson de bière (porc et boeuf) (portion : 55g) | 74mg | 11% |
| ++ Saucisson de bologne (dinde) (portion : 55g) | 72mg | 10% |

| | | |
|---|------|-----|
| ++ Salami sec (portion : 30g) | 69mg | 10% |
| ++ Saucisse fumée (porc et boeuf) (portion : 55g) | 67mg | 10% |
| ++ Roulé de poulet (portion : 55g) | 67mg | 10% |
| ++ Salami de boeuf cuit (portion : 55g) | 62mg | 9% |
| ++ Cervelas (portion : 55g) | 61mg | 9% |
| ++ Saucisse porc et boeuf (portion : 55g) | 59mg | 8% |
| ++ Saucisse fumée (poulet) (portion : 55g) | 59mg | 8% |
| ++ Saucisson de bière (portion : 55g) | 57mg | 8% |
| ++ Saucisse knackwurst (portion : 55g) | 54mg | 8% |
| ++ Saucisse de bière (boeuf) (portion : 55g) | 53mg | 8% |
| ++ Mortadelle (portion : 55g) | 53mg | 8% |
| ++ Saucisse de bologne (boeuf) (portion : 55g) | 48mg | 7% |
| ++ Rôti de viande froide (portion : 55g) | 47mg | 7% |
| ++ Salami de boeuf sec (portion : 30g) | 43mg | 6% |
| ++ Fromage de tête (portion : 55g) | 32mg | 5% |
| ++ Boudin (portion : 55g) | 12mg | 2% |

Three chocolate chip cookies are displayed on a glass surface. The cookies are round, golden-brown, and topped with white chocolate chips. They are arranged in a row. Below them is a glass display case with a white label.

CHOUQUETTES CA

Ingrédients : Œufs, eau, sucre grain, farine de blé, beurre, sucre, poudre à lever diphosphate tétrasodique, carbonate de sodium, et orthophosphate de sodium, amidon de blé, sel.

November 2013

Phosphates ajoutés

- Augmente la durée de conservation
- Augmente la quantité d'eau retenue dans la viande « plus gouteuse » (augmente le poids ... 10 à 15%)
- Maintien une couleur « naturelle »
- Disodium-phosphate, polyphosphate(s), pyrophosphate(s)

| Triphosphates | |
|---------------|-------------------------------|
| N° | Descriptif |
| E 451 I | Triphosphate pentasodique |
| E 451 II | Triphosphate pentapotassique |
| E 452 I | Polyphosphates sodiques |
| E 452 II | Polyphosphates potassiques |
| E 452 III | Polyphosphates calco-sodiques |
| E 452 IV | Polyphosphates calciques |
| E 459 | Béta-cyclodextrine |

Phosphates ajoutés

- Sodas, colas, fanta,...
- Coca-Cola: +30% d'acide phosphorique en 2005
- Coca-Cola 170 mg/L
- Coca-Cola light 70 mg/L

- Barres chocolatées (Mars, Nuts,...)
- Nutella
- Fromages fondus, crèmes de gruyère
- Riz incollable

En résumé

| | VLPD | | FD | |
|--|-------------|-------------------------|------------|------------|
| | Baseline | 6 months | Baseline | 6 months |
| Body weight, kg | 67.5 ± 10.2 | 67.1 ± 11.0 | 65.1 ± 7.3 | 65.6 ± 7.3 |
| GFR, ml/min/1.73 m ² | 17.1 ± 5.5 | 17.8 ± 6.6 | 17.6 ± 5.3 | 16.1 ± 5.8 |
| Urea, mg/dl | 146 ± 39 | 48 ± 19 ^{a,o} | 160 ± 37 | 165 ± 34 |
| Albumin, g/dl | 3.9 ± 0.4 | 3.9 ± 0.4 | 3.9 ± 0.4 | 4.0 ± 0.3 |
| Hemoglobin, g/dl | 11.6 ± 0.8 | 11.5 ± 0.8 | 11.5 ± 1.2 | 11.3 ± 1.0 |
| TC, mg/dl | 223 ± 36 | 169 ± 26 ^{a,b} | 214 ± 39 | 217 ± 36 |
| TG, mg/dl | 170 ± 40 | 140 ± 28 ^{a,b} | 170 ± 38 | 217 ± 36 |
| CaxP, mg ² /dl ² | 41 ± 10 | 31 ± 8 ^{b,c} | 38 ± 5 | 39 ± 5 |
| PTH, pg/ml | 175 ± 115 | 109 ± 73 ^{a,d} | 190 ± 72 | 189 ± 82 |
| UK, mEq/day | 52 ± 17 | 51 ± 17 | 48 ± 14 | 49 ± 15 |
| Proteinuria, g/day | 1.34 ± 1.2 | 0.87 ± 0.8 ^a | 0.79 ± 0.9 | 0.86 ± 0.7 |

Tout est là!

Bellizzi et al, Kidney Int 2007

Conclusion

- Protéger ses reins malades impose:
 - De diminuer les protéines animales
 - De maintenir les apports caloriques
 - D'apprendre une diététique spécialisée
- Ce qui permet de:
 - Réduire de nombreuses anomalies hormonales
 - Réduire le nombre de médicaments
 - Contrôler la protéinurie et l'urémie
 - Retarder le début des dialyses
- Seulement la moitié à 2/3 des patients suivent ces conseils

Merci pour votre attention

