



# Nutrition and Renal Disease Update

Denis FOUQUE

Department of Nephrology  
Centre de Recherche en Nutrition Humaine  
University Claude Bernard  
Lyon - France

# What have we learned ?

1. Chronic kidney disease: Dietary and nutritional data
2. ESRD: Nutritional status and survival
3. ESRD: Intravenous nutrition
4. ESRD: Oral nutrition
5. ESRD: Phosphate and calcium metabolism

# **Chronic kidney disease: Dietary and nutritional data**

# Nutritional profile during CKD

	Pre-ESRD	Dialysis	Transplant*	Transplant
Diet	LPD	SPD	HPD	LPD
Prot (g/kg/d)	0.7-0.8	1.2-1.4	1.4	0.8
Energy (kcal/kg/d)	30-40	30-40	30-40	30-40
1. Malnourished	+	++	++	+/-
2. Obese	++	+	+	++

\* first 3 months

# Controlling protein intake before dialysis

Adequate adaptation to a reduction in protein intake

Decrease load on remaining nephrons

Improve insulin resistance

Reduce oxidant stress

Ameliorate proteinuria

Reduce serum parathyroid hormone levels

Improve lipid profile

Additive effect of angiotensin-converting-enzyme inhibitors

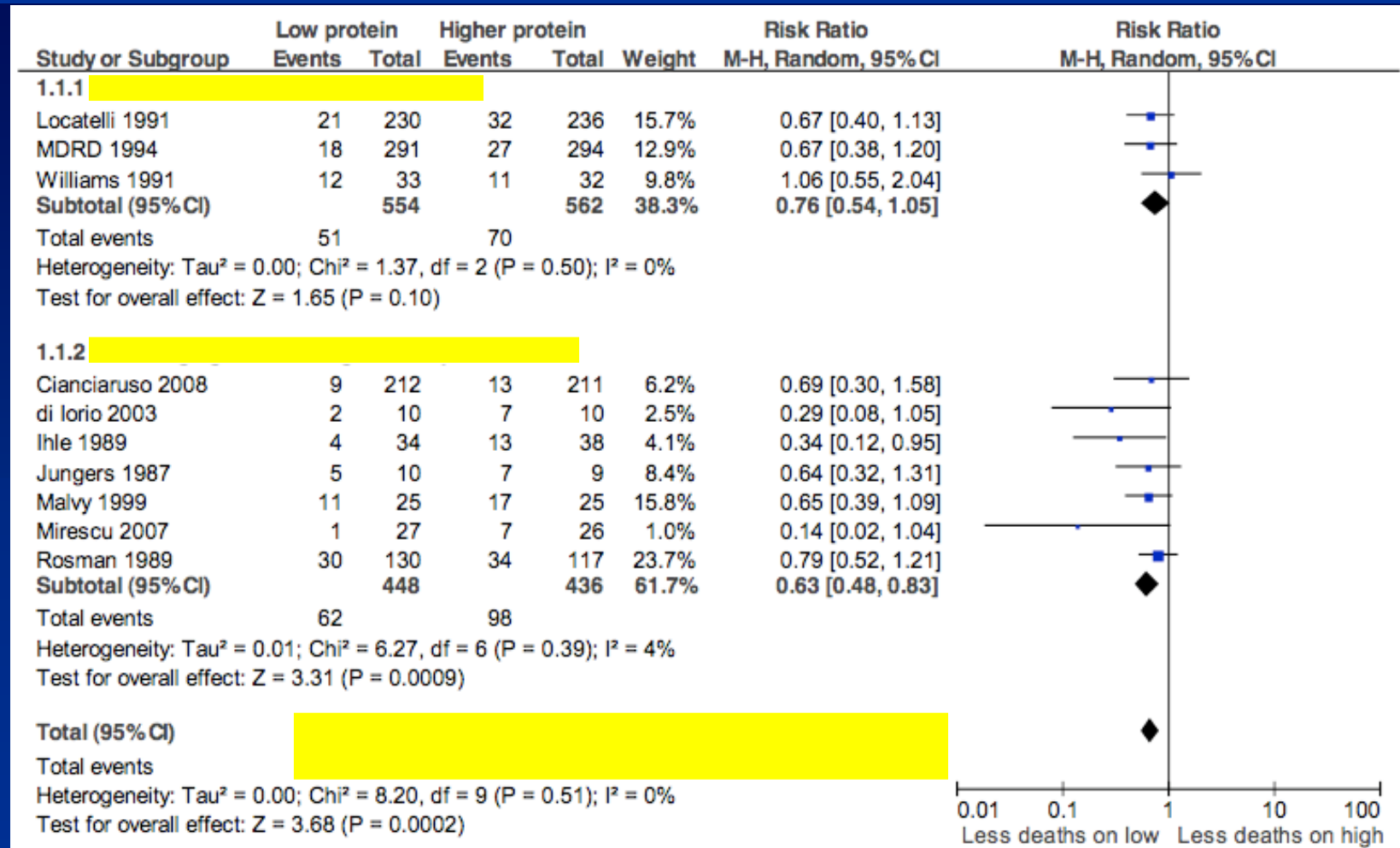
Decrease likelihood of patient death or delay initiation of dialysis by 40%

Favorable number needed to treat (one patient saved from death or initiation of dialysis every year for every 18 patients maintained on a low-protein diet)

Lack of serious objective reasons for not recommending a low-protein diet to most patients with chronic kidney disease

*Fouque Aparicio, Nature CPN June 2007*

# Controlling protein intake before dialysis



*Fouque et al, Cochrane Database in press 2009*

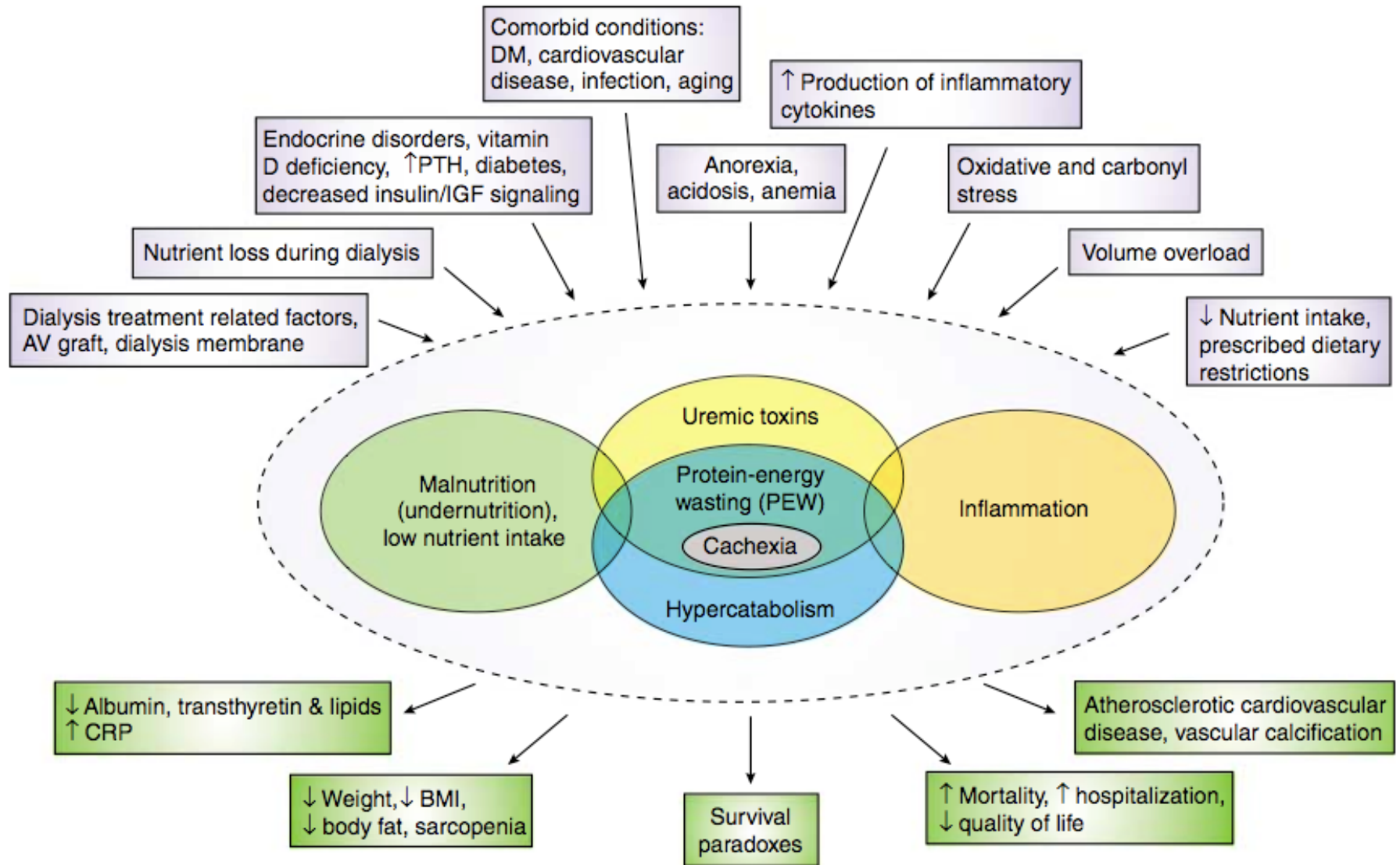
# **ESRD**

**Definition of Malnutrition status**

**and**

**How to predict survival**

# Protein Energy Wasting - 2008



# Protein Energy Wasting - 2008

Gr 1: Biology

Gr 2: Body Mass

Gr 3: Muscle

Gr 4: Dietary intake

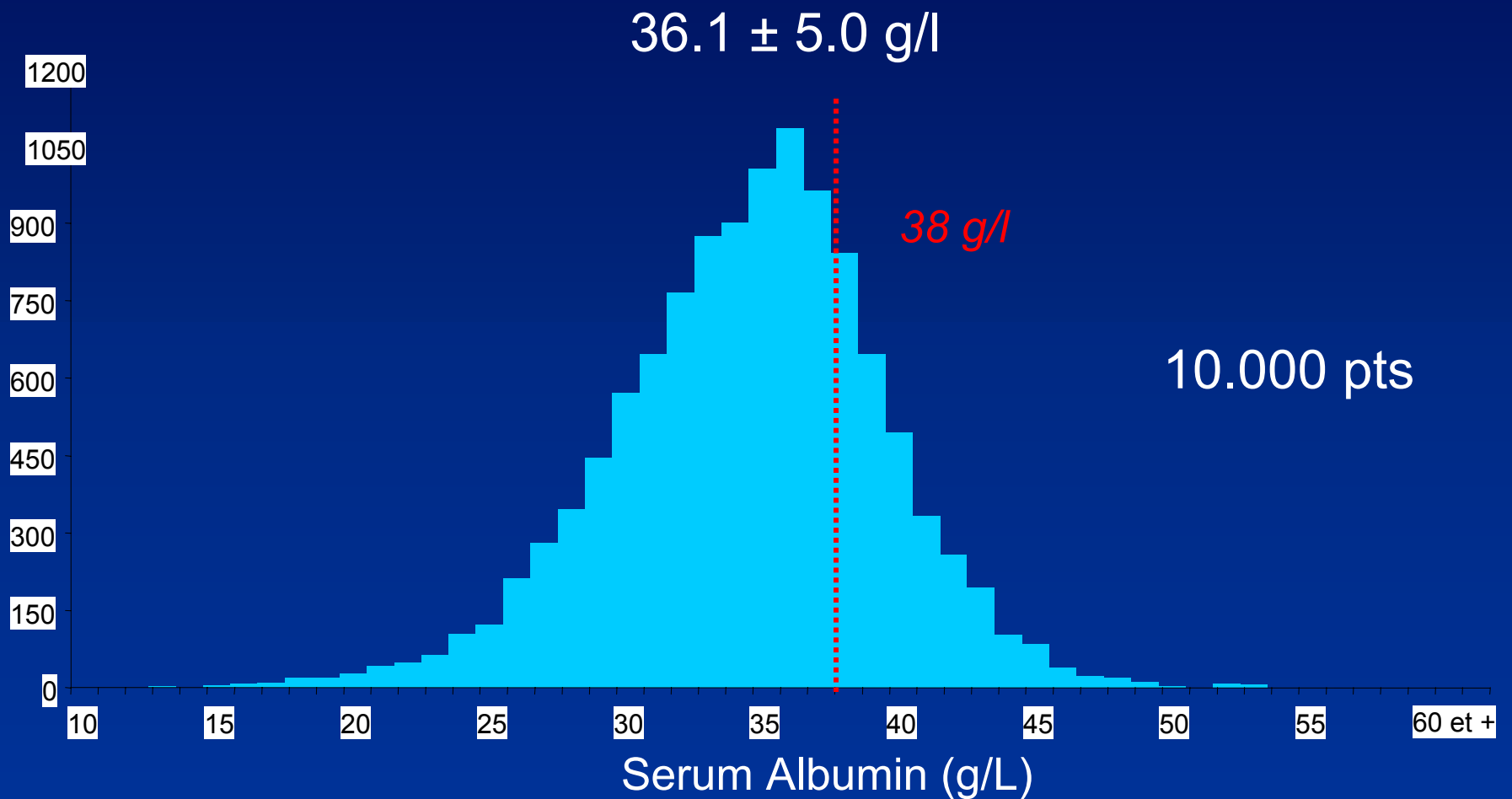
*At least one criterion in 3 of the 4 groups*

# Protein Energy Wasting - 2008

- Gr 1
  - Serum Albumin < 38 g/l (BCG)
  - Serum prealbumin < 300 mg/l
  - Serum cholesterol < 1 g/l
- Gr 2
  - Body Mass Index < 23 (*WHO: 18.5*)
  - Weight loss > 5 % (3 months)
  - Weight loss > 10 % (6 months)
  - Body Fat < 10 %

# Low serum albumin in French dialysis Pts

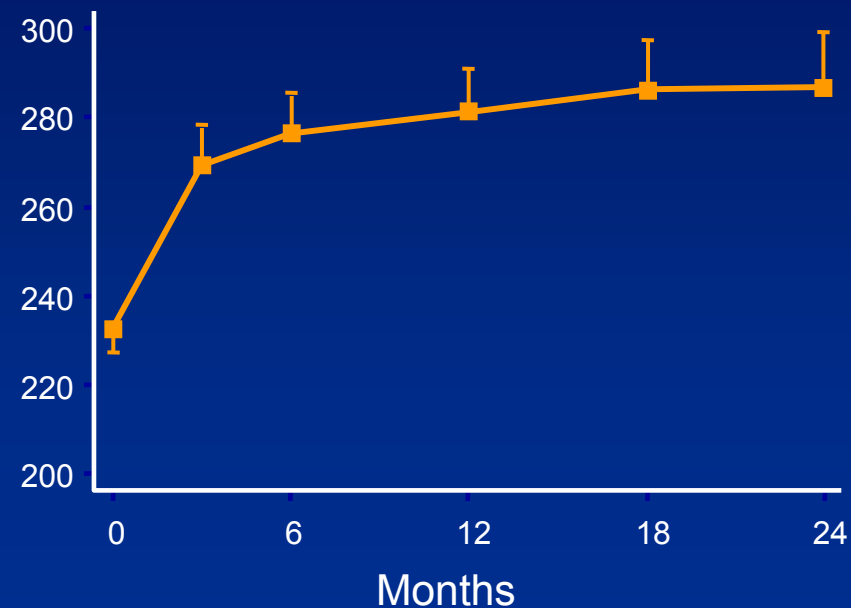
*Observatoire Phosphocalcique, Juillet 2008*



# Serum Prealbumin response to renutrition

FineS study, oral  $\pm$ IDPN support in malnourished MHD pts

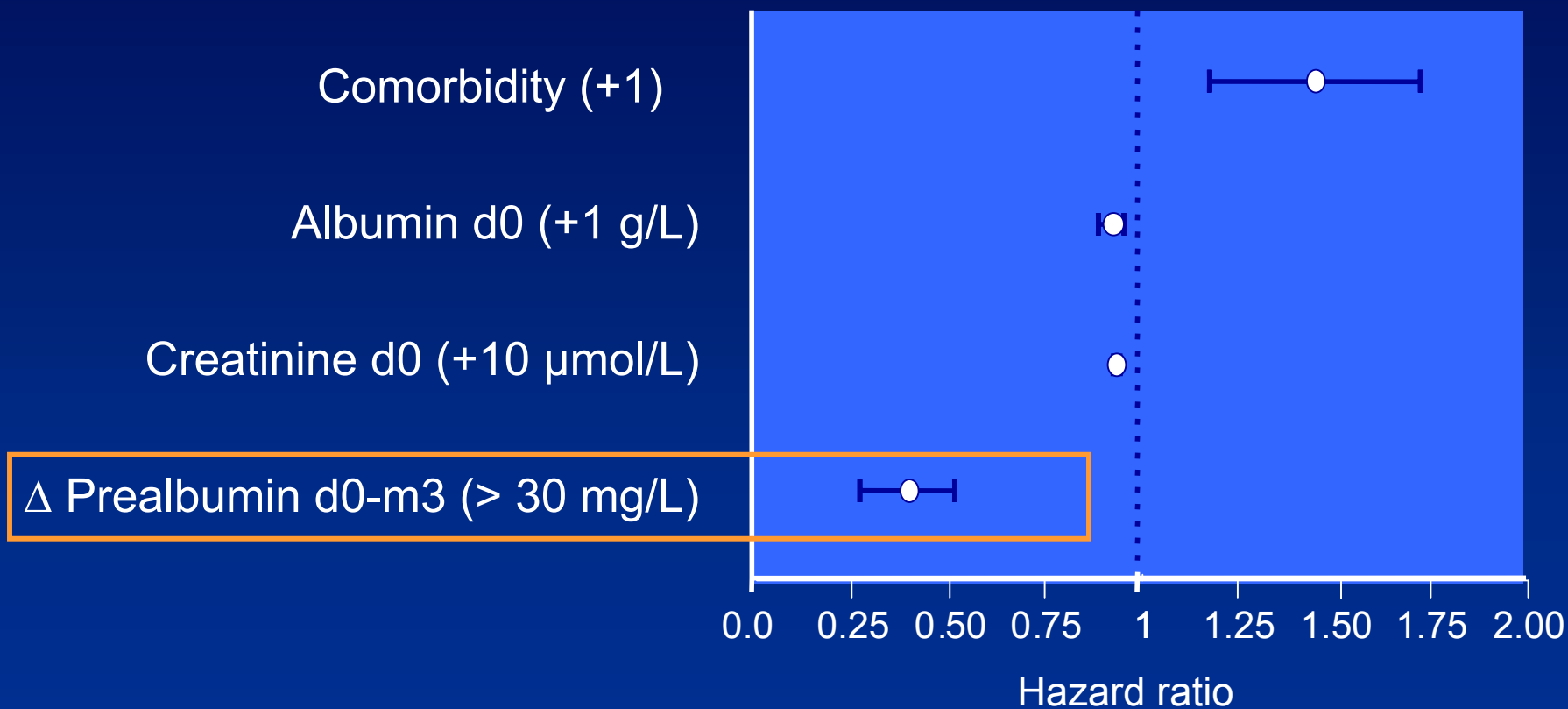
Serum prealbumin  
mg/L



+ 55 mg/l  
+ 23%

*Cano et al, J Am Soc Nephrol 2007*

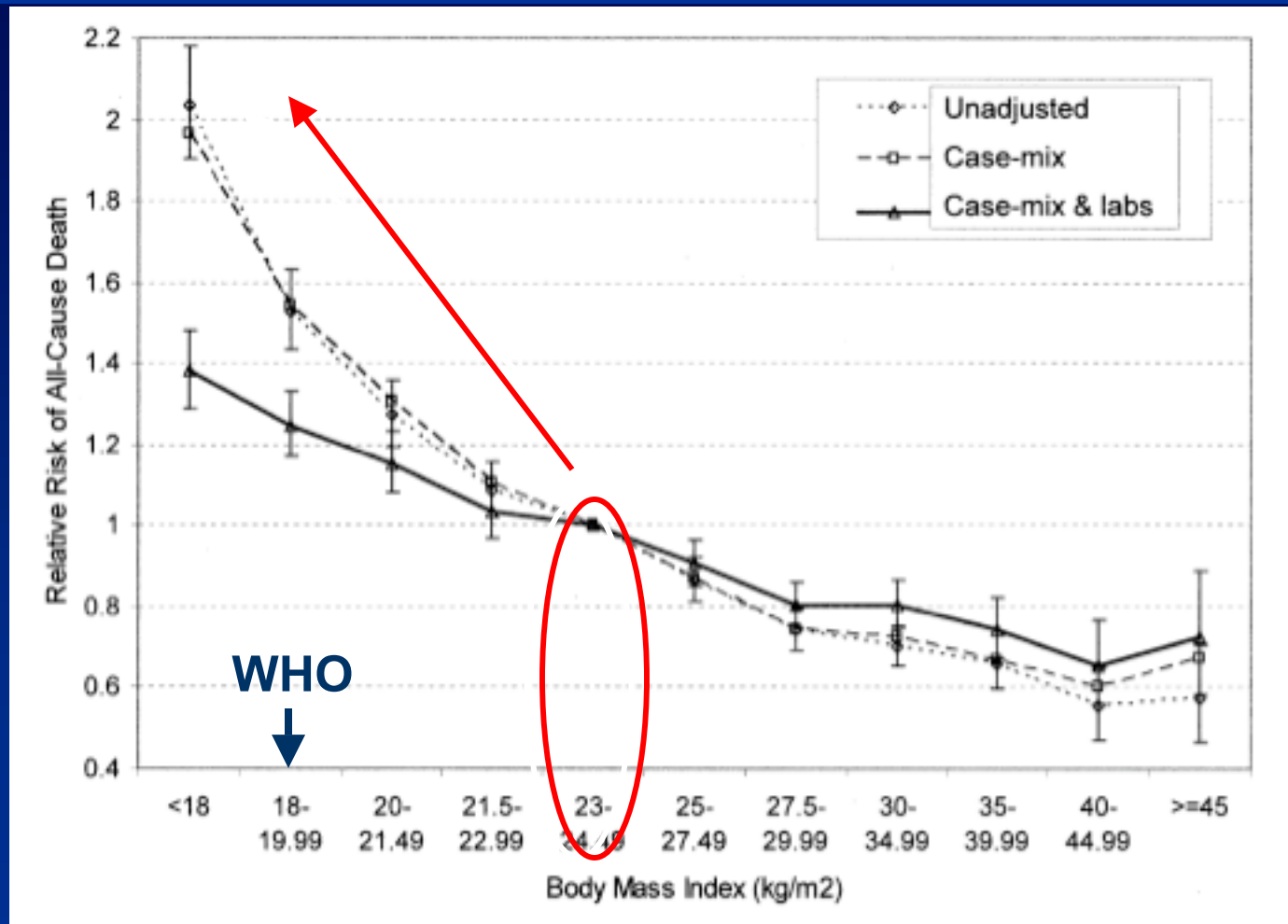
# Serum Prealbumin response to renutrition



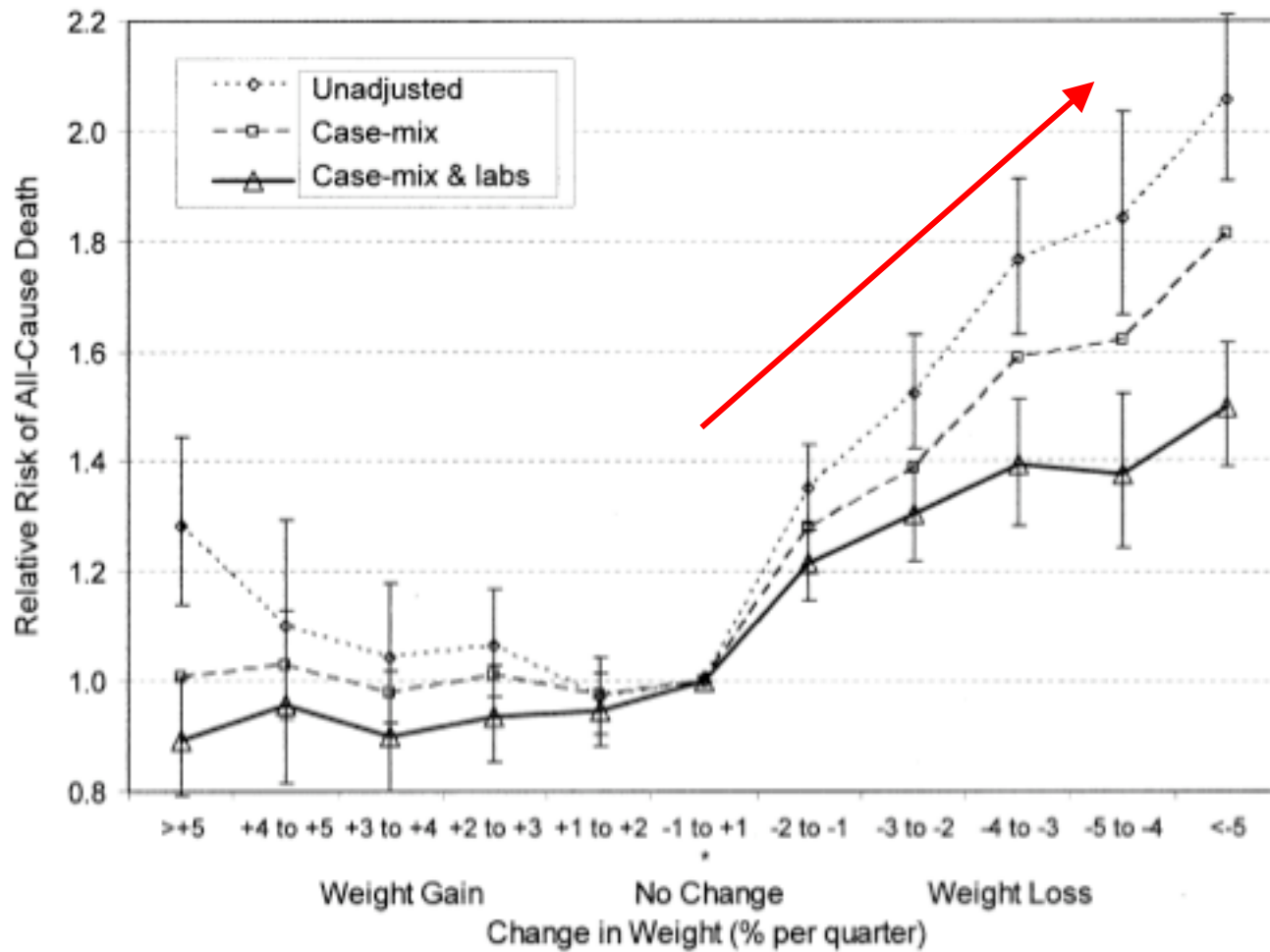
*Multivariate Cox*

*Cano et al, J Am Soc Nephrol 2007*

## Gr 2: Body Mass Index and mortality

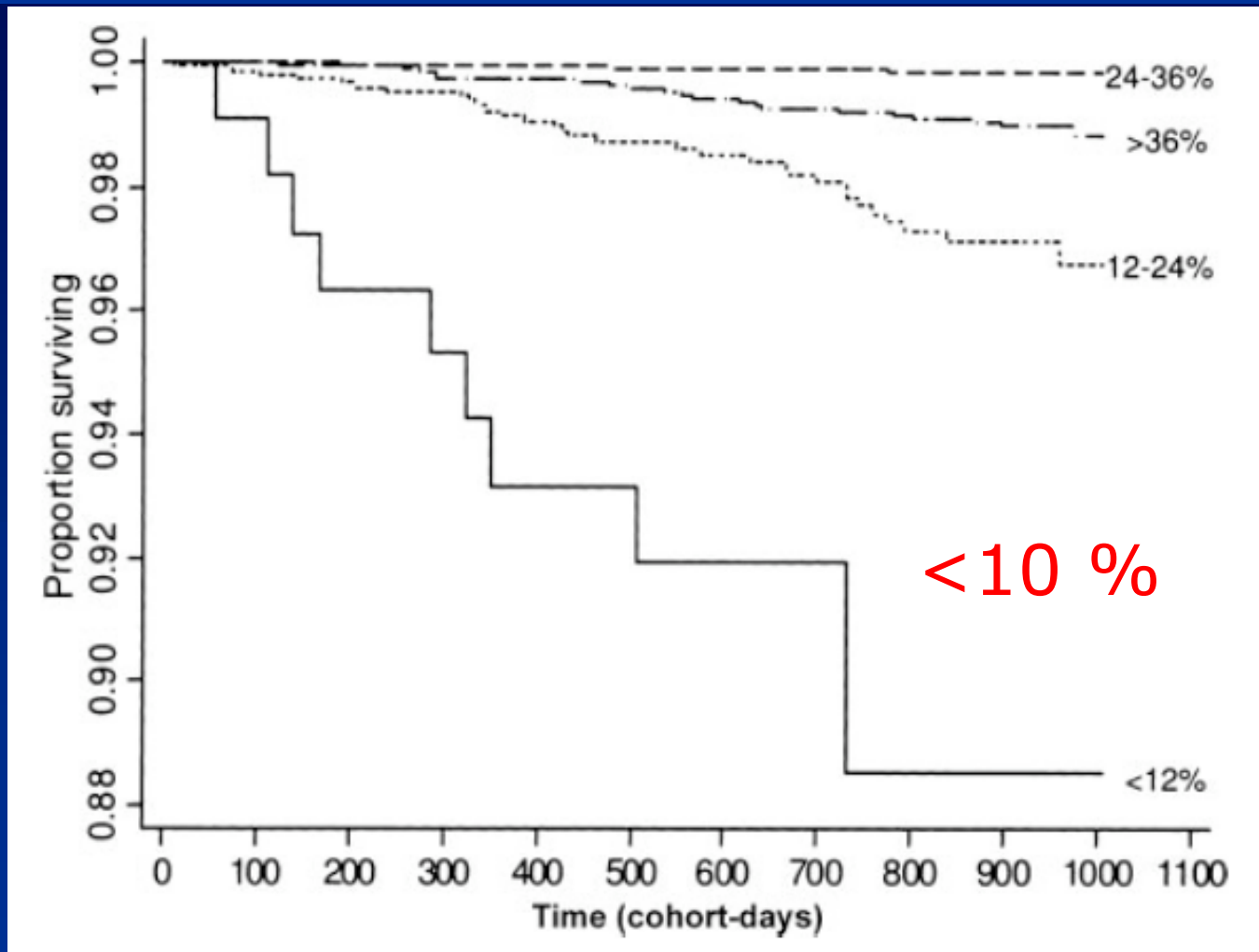


# Weight loss and mortality



*Kalantar et al, Am J Kidney Dis 2005*

# Fat Mass and mortality



*Kalantar et al, Am J Clin Nutr 2006*

# Protein Energy Wasting - 2008

- Loss of muscle mass > 5% (3 months)
- Loss of muscle mass > 10% (6 months)
- Gr 3
  - Reduced MAMC (>10% below 50th percentile)
  - **Predialysis S Creatinine (K-DOQIs)**
  - Creatinine kinetics (Garred et al.)
- Gr 4
  - **Unintentional Dietary Protein Intake**  
< 0.8 g/kg BW/day for 2 months
  - Unintentional Dietary Energy Intake  
< 25 kcal/kg BW/day for 2 months

## Gr 3: Serum creatinine

- ARNOS study in Rhône-Alpes
- 1400 MHD patients followed since 2005
- Survival analysis based on metabolic parameters
  
- Use of the new nomenclature (ISRNM 2008)
- Body composition parameters
- Predialysis S Creatinine (K-DOQI 2000)

# PEW: A new predictive nutritional score ?

*Moreau-Gaudry et al, ASN 2008*

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## 2. Which targets

1. Serum Albumin > 38 g/l
2. nPNA > 0.8 g/kg/day
3. BMI > 23
4. Serum Creatinine > 665  $\mu\text{mol/l}$

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## 3. Calculation

0 to 4

0 : No PEW

Above all targets

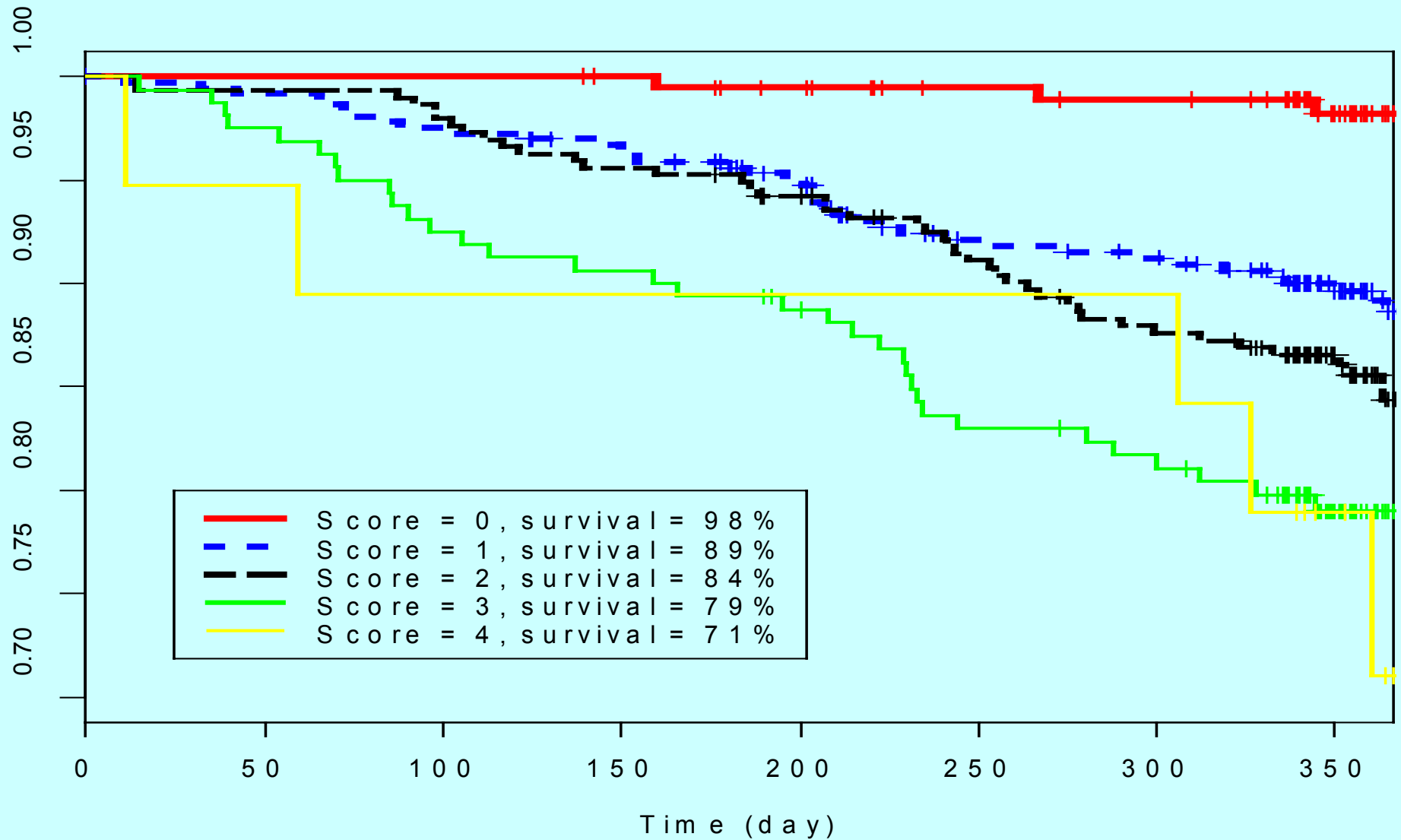
4 : Severe PEW

Under all targets

# A new predictive nutritional score

*Moreau-Gaudry et al, ASN 2008*

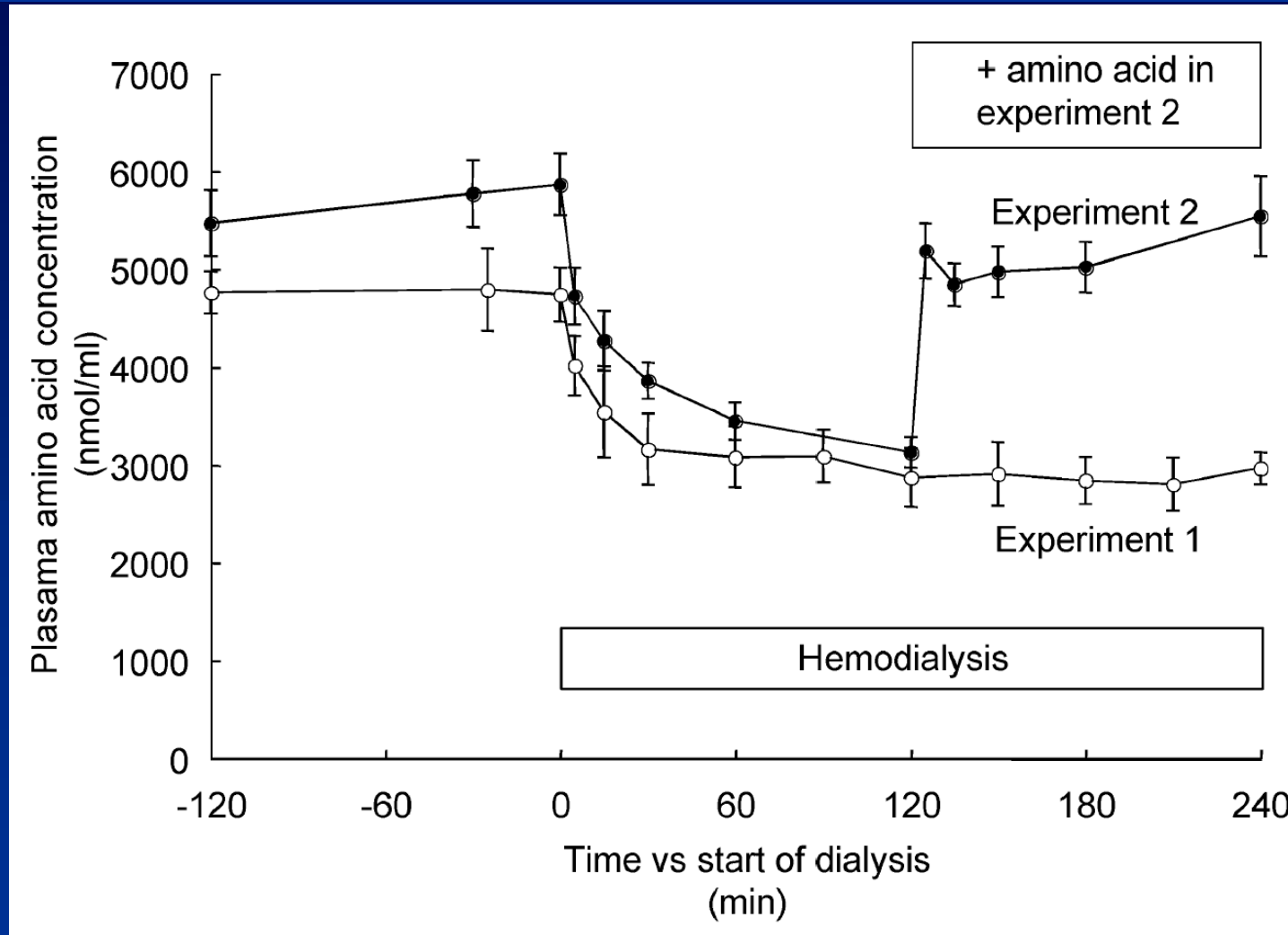
# A new predictive nutritional score



# ESRD: Intravenous nutrition

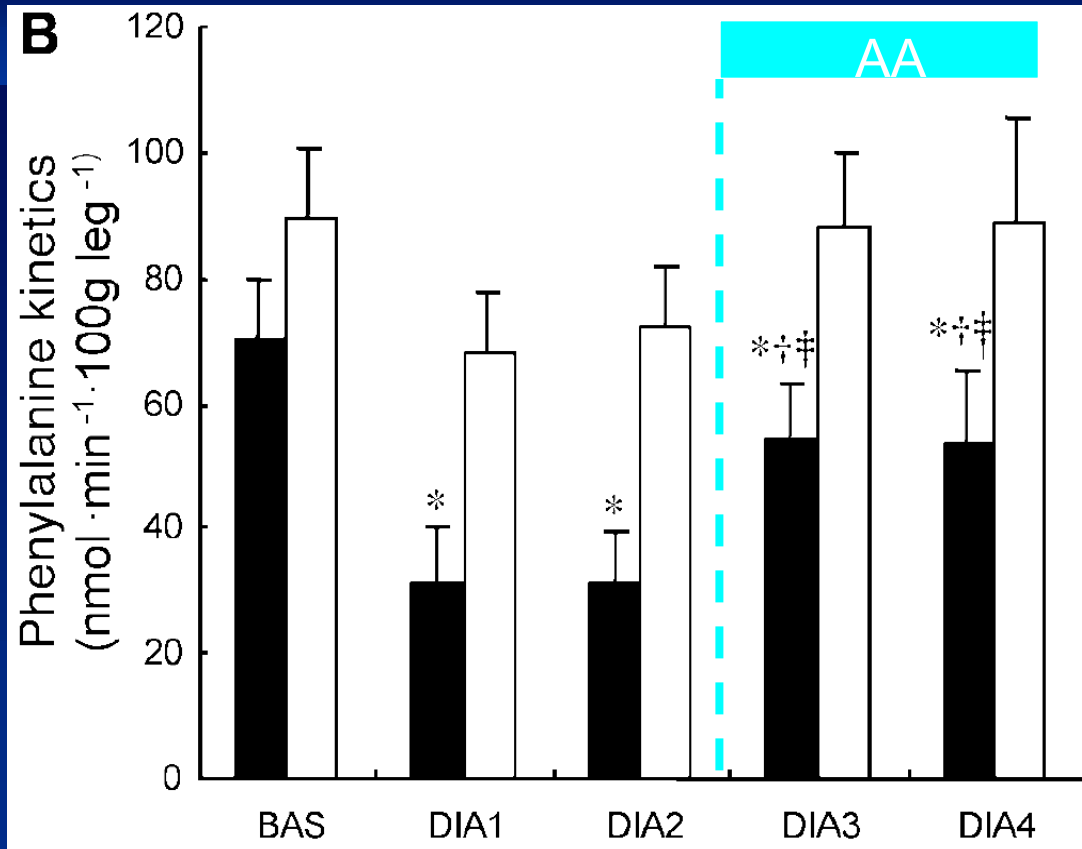
# Perdialytic AA infusion

Effect of AA replacement during one HD session in the pig



*Kobayashi et al. Am J Physiol 2003;284:E488-E498*

# Perdialytic AA infusion



Intracell AA [c] unchanged

Insulinemia: 2.2 → 5  $\mu\text{U/ml}$

Extracellular AA [c]:

- a signal inducing reduction then restart of protein synthesis
- positively linked to parallel changes in EIF2B activity

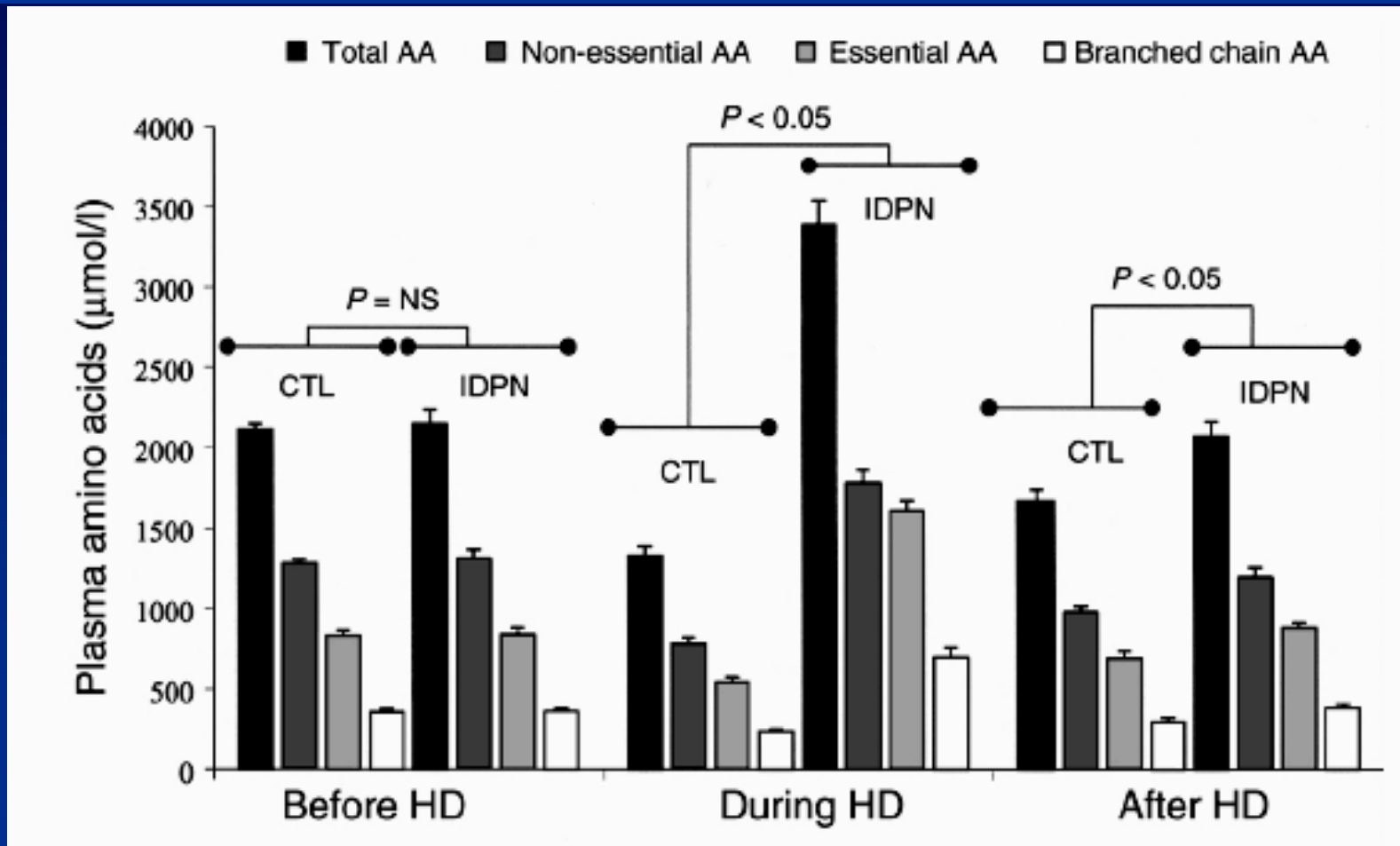
*Kobayashi et al. Am J Physiol 2003;284:E488-E498*

# Intradialytic parenteral nutrition

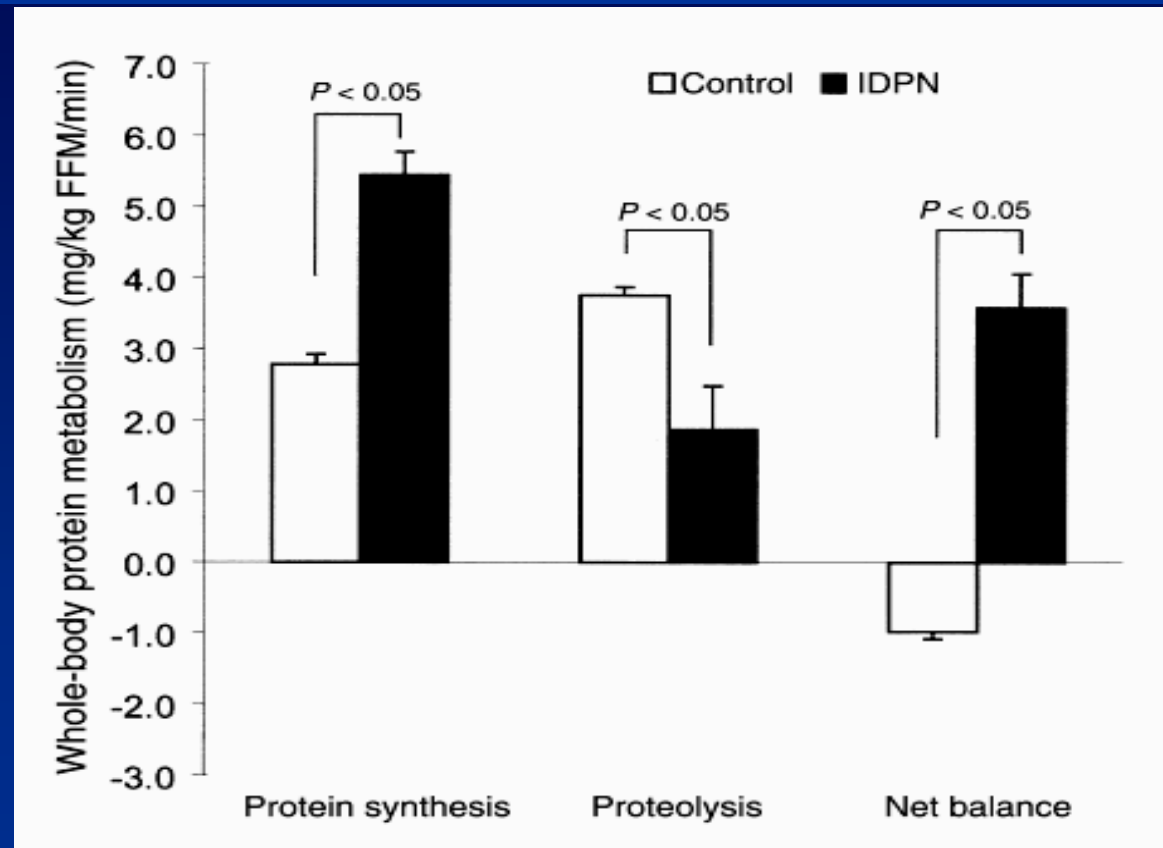
## IDPN standard composition

1. 600 ml (300 ml AA 15%, 150 ml IL20% and 150 Gluc 50%)
2. 150 ml/h
3. 190 kcal/hr

# IDPN: Metabolic Effects: Aminoacids

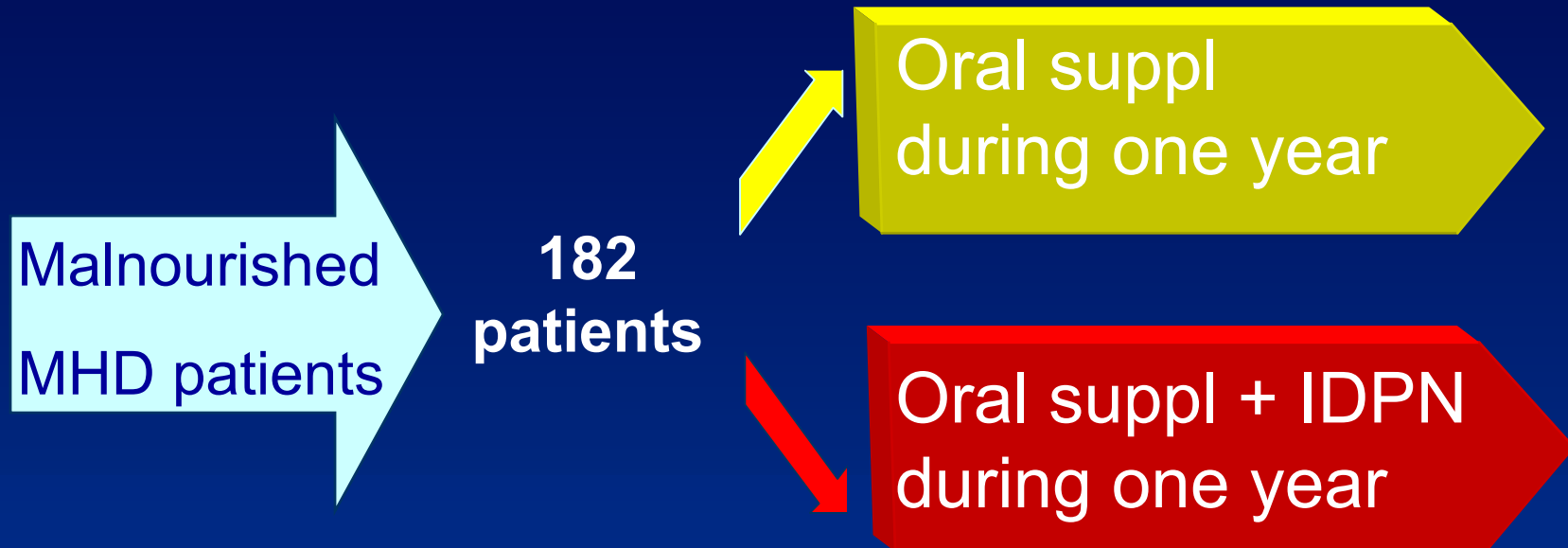


# IDPN: Metabolic Effects: Whole body



Equivalent to a 50 g protein gain e.g., 250 g of muscle as compared with a regular HD session

# FineS design



- Follow-up: two years (treatment period + one year)
- Visits at day 0 and month 3, 6, 12, 18 and 24

# Nutrient Supplement

- |                     |                    |                 |
|---------------------|--------------------|-----------------|
| 1. Oral supplement: | 5 kcal/kg/d        |                 |
|                     | 0.4 g protein/kg/d |                 |
| 2. IDPN :           | 14 kcal/kg/HD      | (6 kcal/kg/d)   |
|                     | 0.6 g AA/kg/HD     | (0.3 g AA/kg/d) |

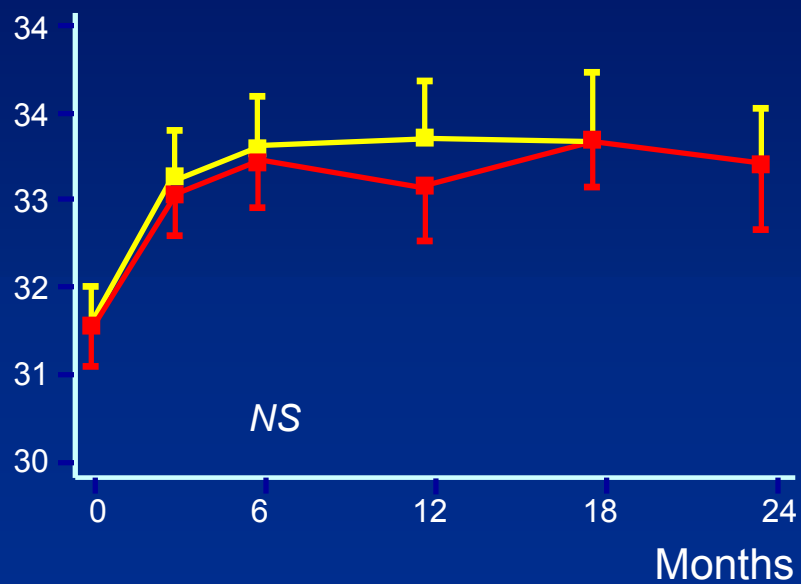
Nitrogen supply: standard AA solution

Energy supply: 50% standard fat emulsion  
50% glucose

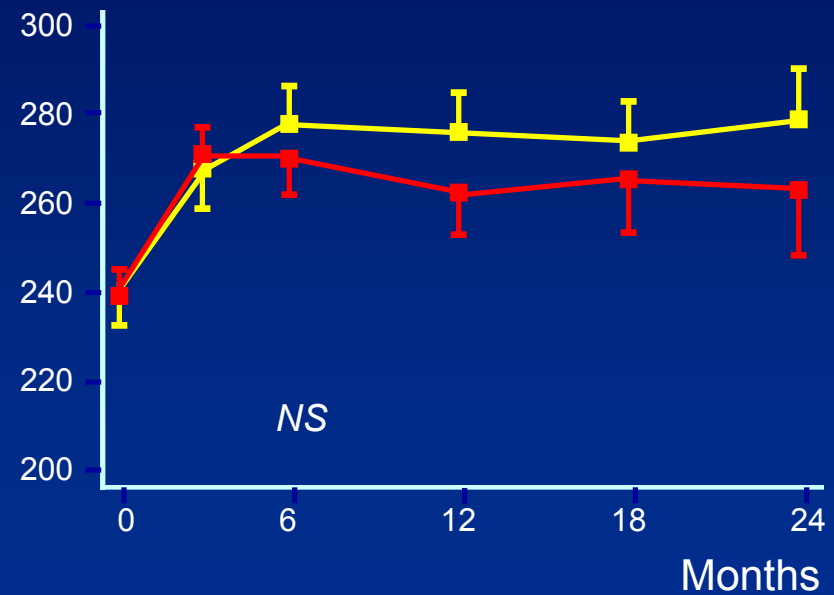
*Cano et al, J Am Soc Nephrol 2007*

# Nutritional Status

Serum albumin, g/L



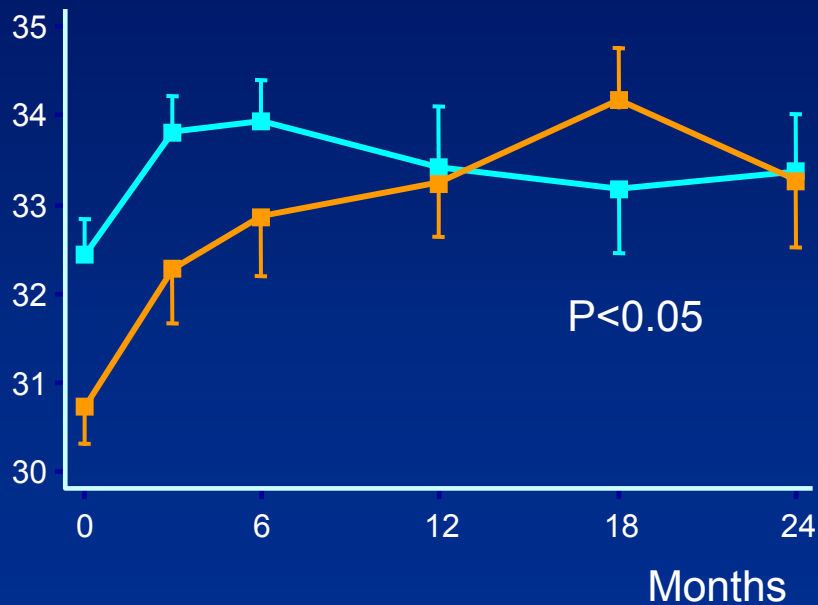
Serum prealbumin, mg/L



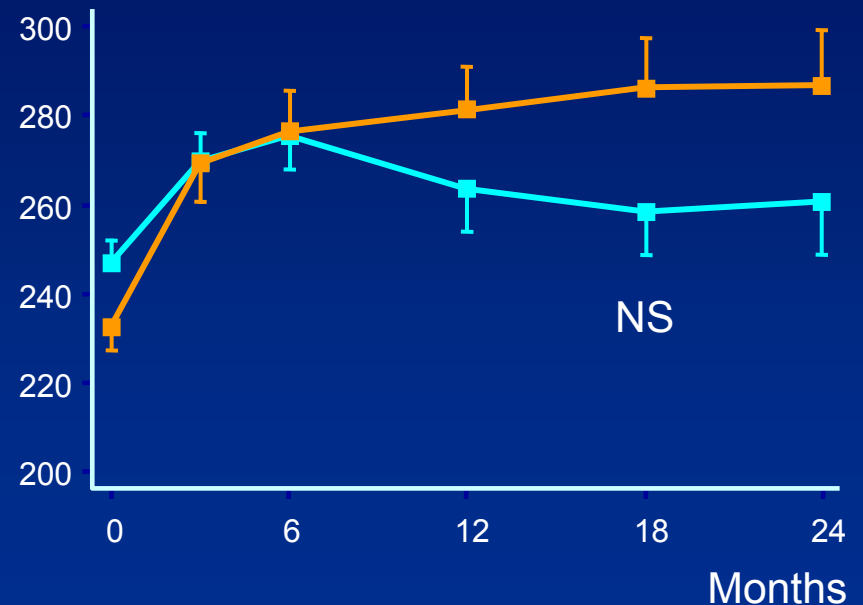
Control group ■—■  
IDPN group ■—■

# Nutritional Response and Inflammation

Serum albumin, g/L



Serum prealbumin, mg/L



CRP < 10 mg/L, n=88

CRP ≥ 10 mg/L, n=86

# ESRD: Oral-enteral nutrition

# Enteral Nutrition

1. Fasting and fed, during 1 HD and a non dialysis day
2. Oral supplement during the HD session as:
3. Every 30 min a sip of enriched yoghurt
4. Total of 0.6 g prot/kg + 15 kcal/kg (45 g prot, 1125 kcal)

# Perdialytic enteral Nutrition: Nitrogen balance

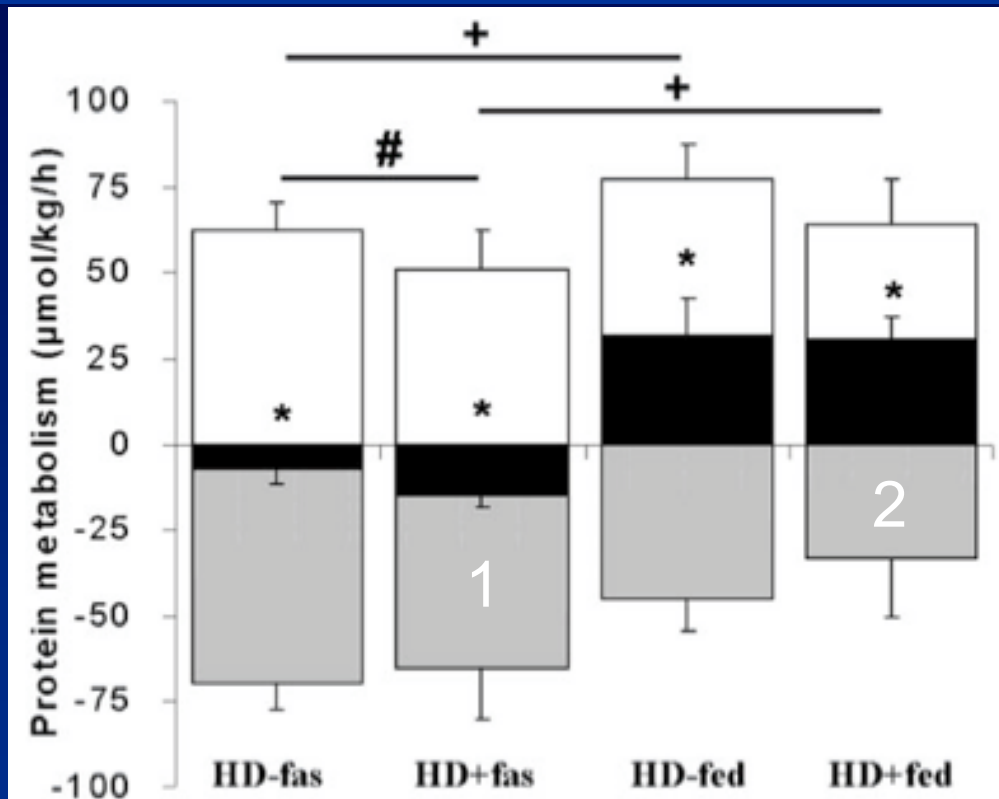
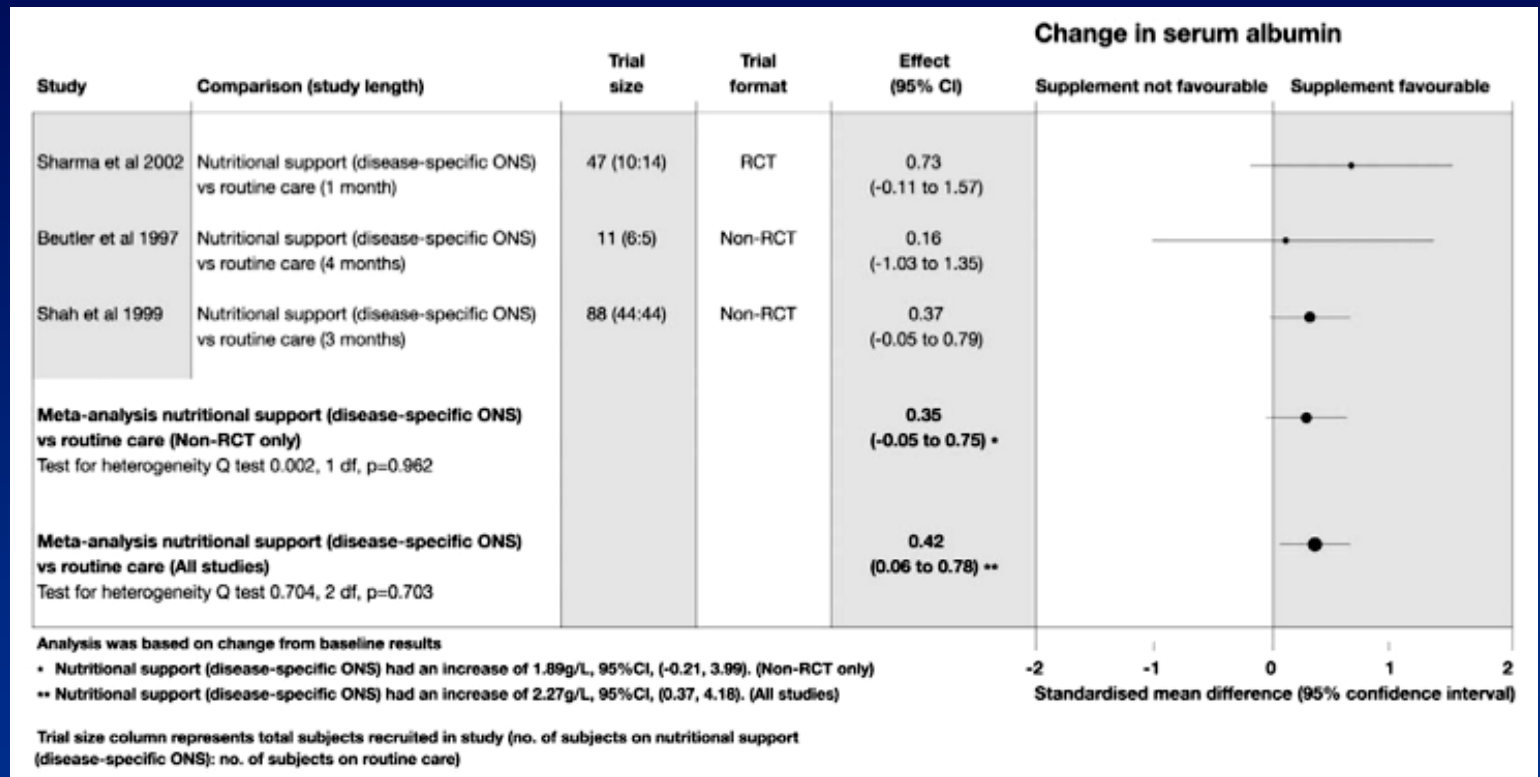


Fig. 5. Summary of whole body protein breakdown (gray bars), synthesis (open bars), and protein balance (filled bars) under all experimental conditions. \*Whole body protein balance significantly different from 0. +Whole body protein balance significantly different between fasting and feeding. #Whole body protein balance significantly different between the HD+ and HD- protocols.

# Oral supplements: Meta-analysis

18 trial  
5 RCT  
13 CCT

429 pts



- Increase in S Alb by 4 g/L (p<0.01)
- *RR of death : 5% /1 g/L S.Alb (Combe 2001)*

Stratton Am J Kidney Dis 2005

# Oral supplement

Renilon – specially formulated for HD patients

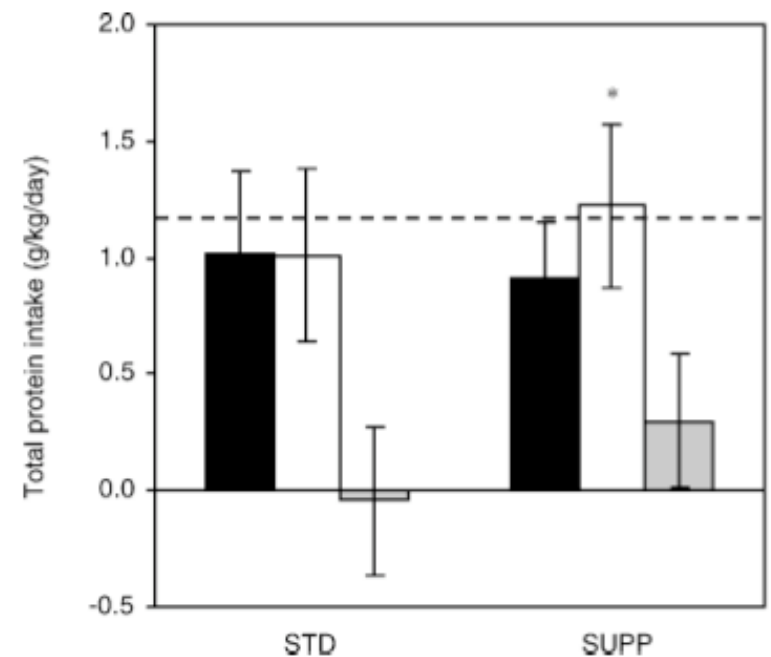
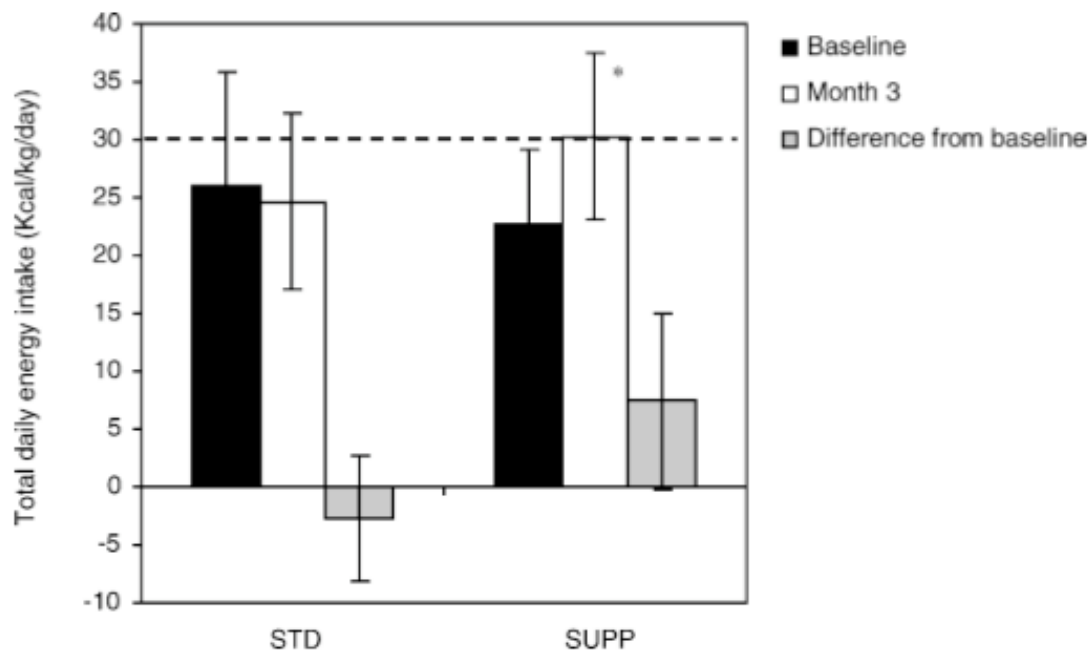
- High energy
- Low volume – 125ml
- Demineralised protein source
  - Low P, K and Na content

2 packs a day, 250 ml,  
500 kcal, 18.75 g prot

Renilon 7.5	
	per 100ml
Energy (kcal)	200
Protein (g)	7.5
P (mg)	6
Ca (mg)	16.3
Na (mg)	59
K (mg)	11

# Effect of supplement on energy and protein intakes

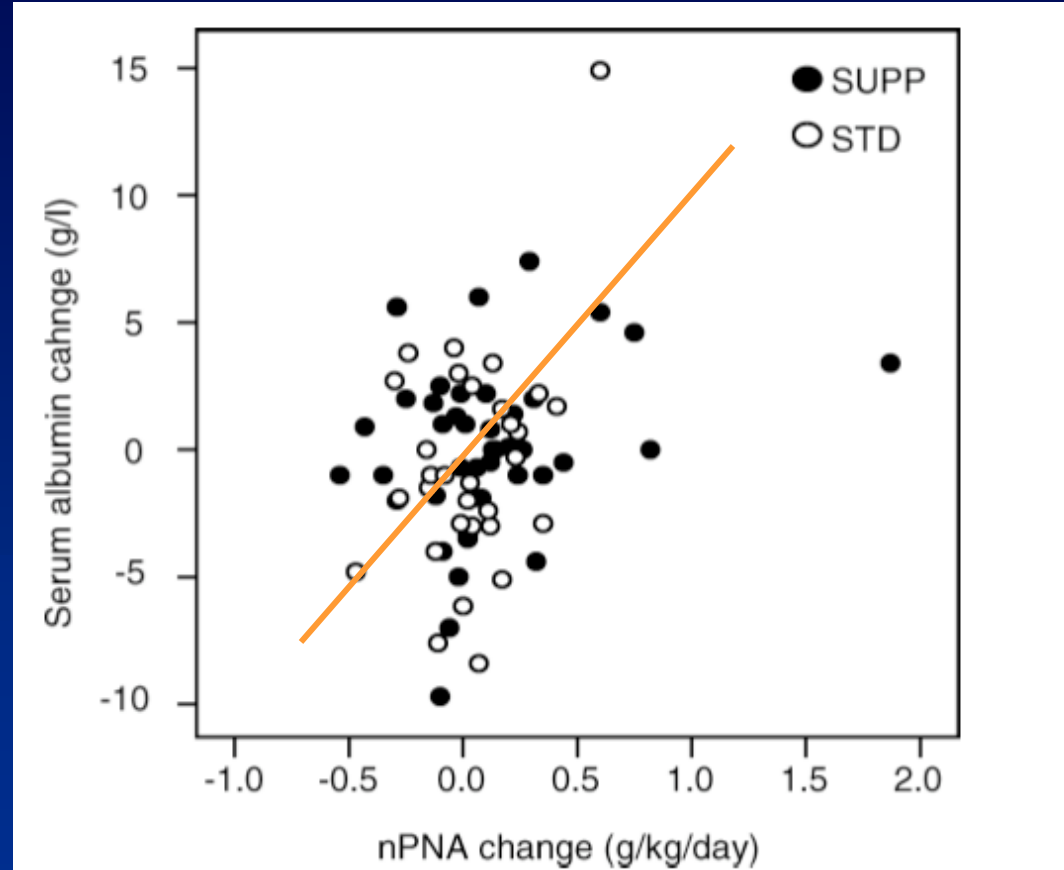
After three months



Energy

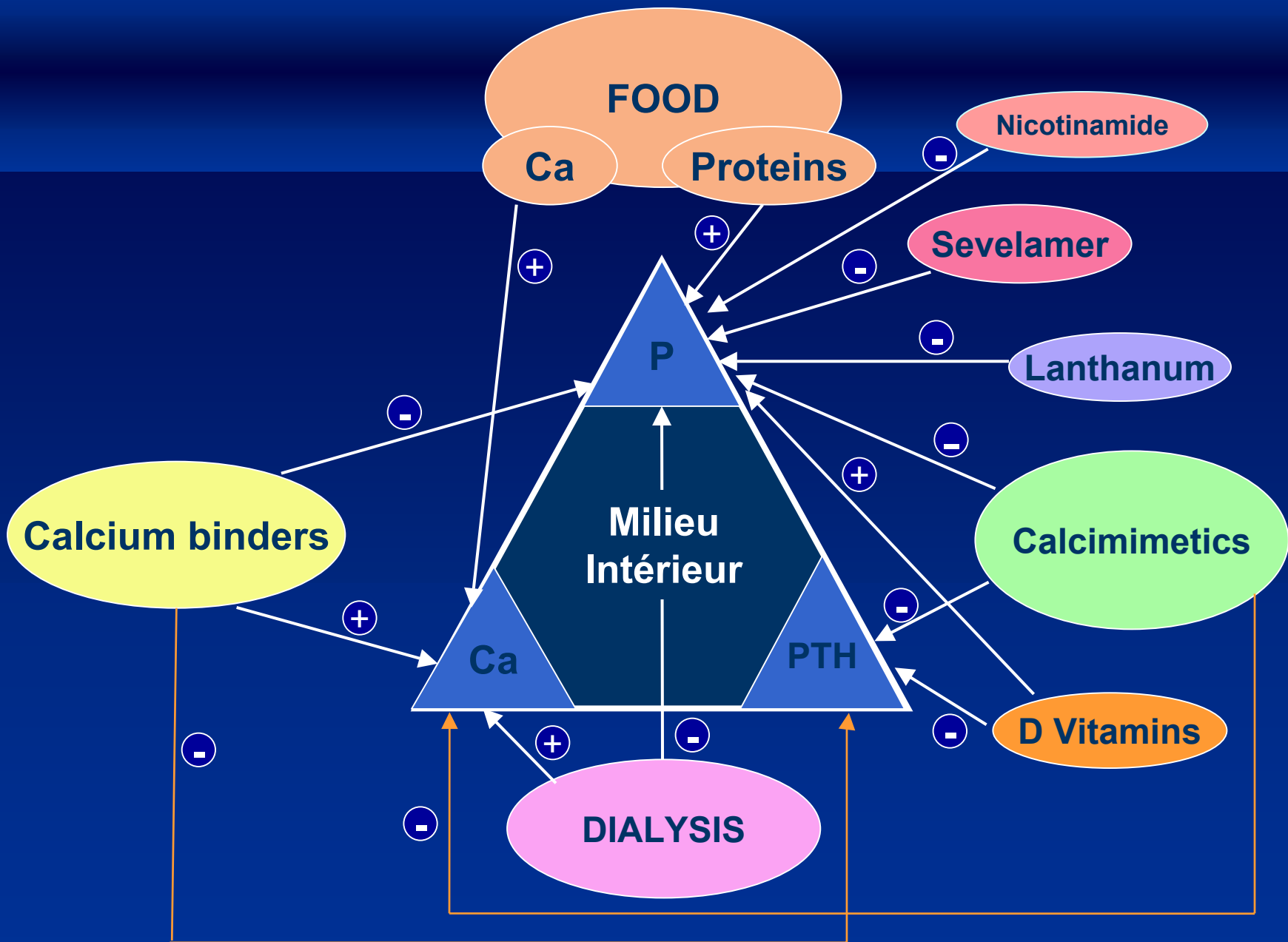
Protein

# Relationship between variations in Albumin and nPNA

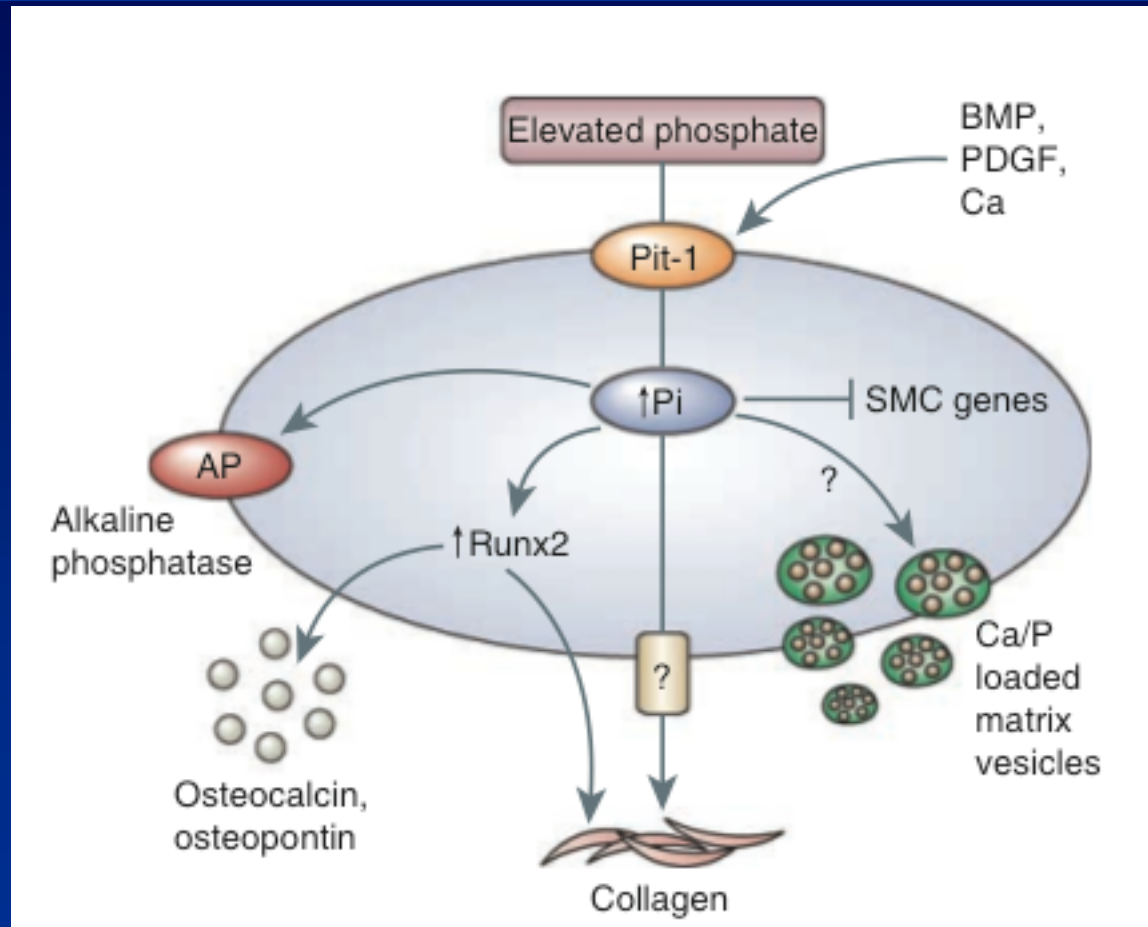


➔ No impact of inflammation (CrP < or > 10 mg/l)

# Phosphate and Calcium

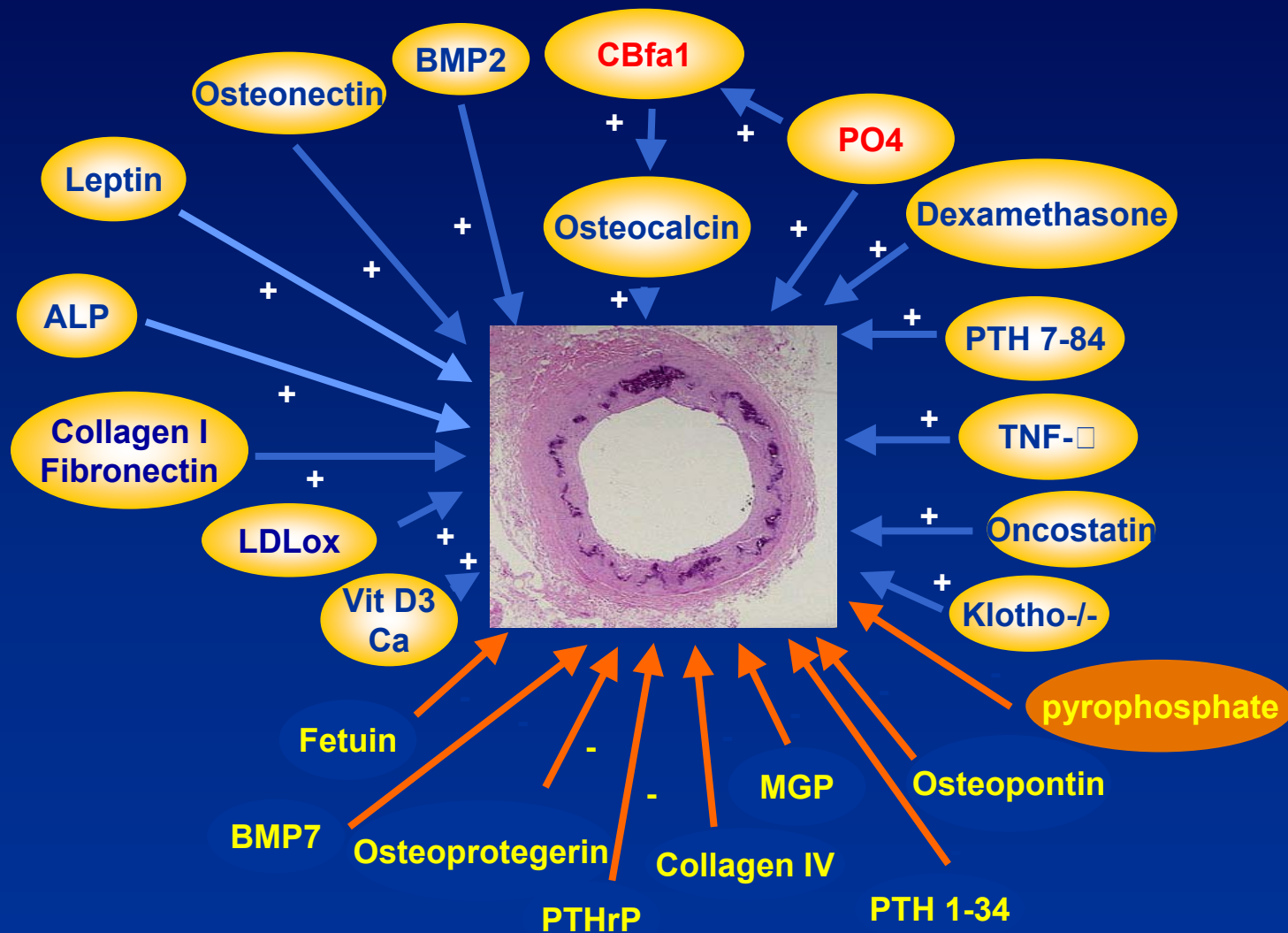


# Osteogenic SMC transformation



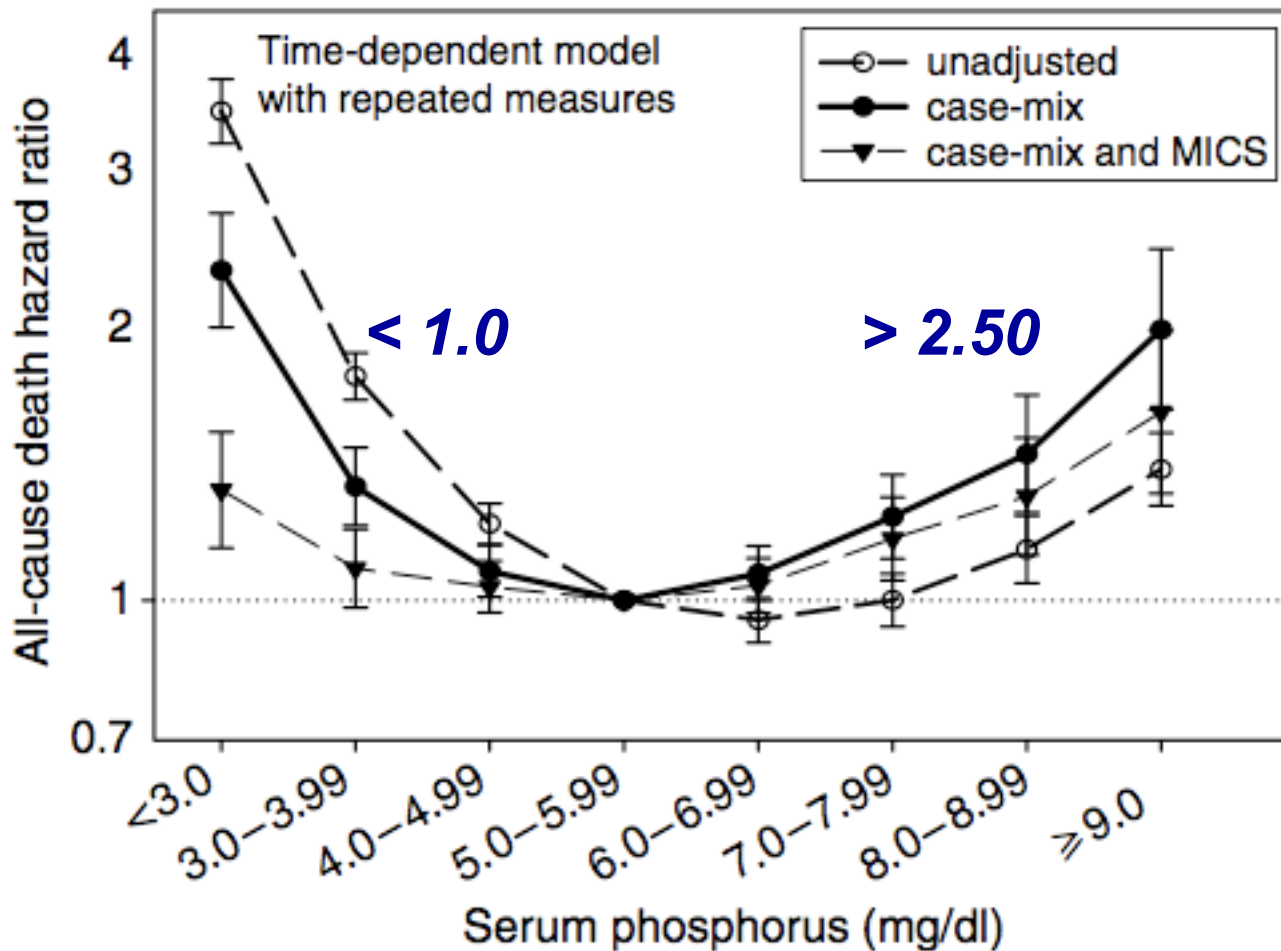
*Giachelli, Kidney Int May 2009*

# Inductors (+) and inhibitors (-) of vascular calcifications



courtesy G.London

# Serum phosphate and mortality



Da Vita, 54 000 pts, 2002

Kalantar et al. *Kidney Int* 2006

# Serum Phosphorus over time

1995: 2.00 mmol/l (Block,USA)

2002: 1.80 mmol/l (Kalantar,USA)

2002: 1.85 mmol/l (DOPPS)

2006: 1.60 mmol/l (Observ France)

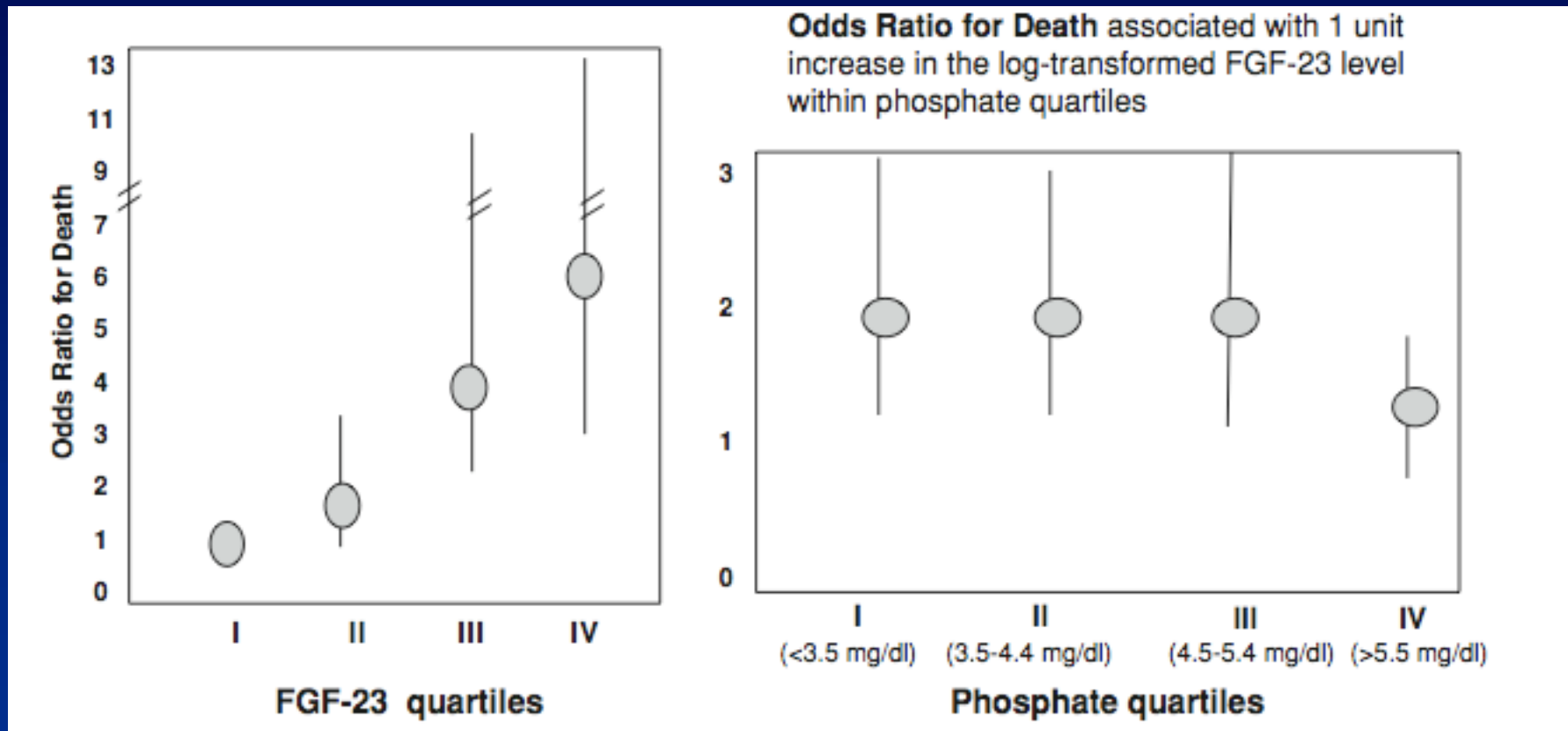
2006: 1.60 mmol/l (ARNOS)

2008: 1.56 mmol/l (Observ France)

*25 % improvement in a biological abnormality within 13 years*

*(Years of survey not publications)*

# FGF 23, MHD and survival



From Gutierrez, NEJM 2008

*Zocalli, NDT april 2009*

# What should we expect from the future?

What did he say ?

- Progressive kidney disease: nephroprotection
- Nutritional markers and survival: promising scores
- Nutritional support: efficient, IV and oral
- Serum phosphate: an enigma under scrutiny

Thank you for your attention!

