Need for specialized nutrition to prevent accelerated muscle loss in CKD

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Conflicts of interest, last 5 years

Speaker fees:

Abbott Nutrition, Fresenius Medical Care, B Braun, Roche, Amgen, Shire

Research Grants/Research Financial Supports:

Baxter/Gambro, B Braun, Fresenius Medical Care,

Advisory Committments:

Abbott Nutrition, Nestlé, Otsuka

CKD Classification - K/DIGO 2012

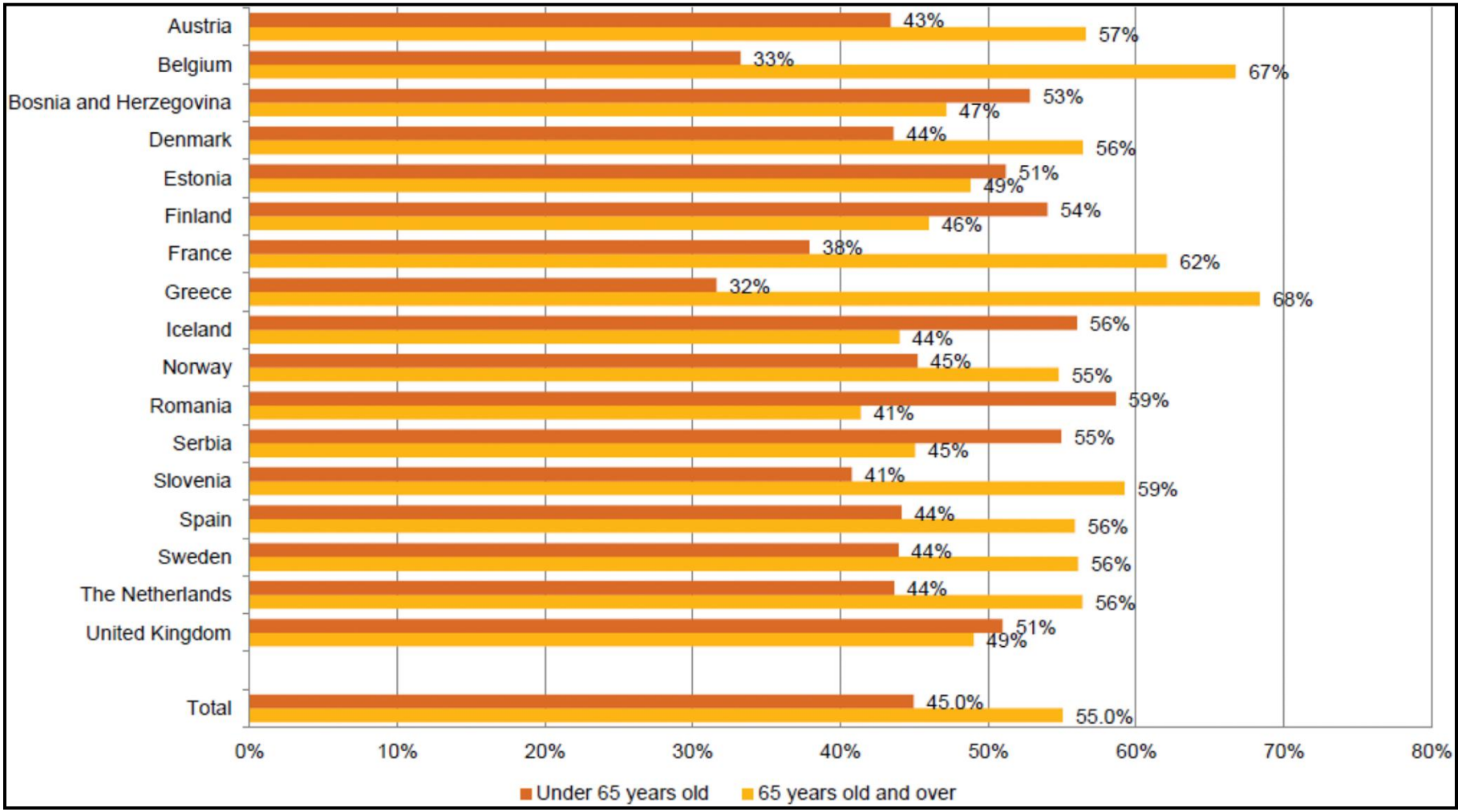
Prognosis of CKD by GFR and Albuminuria Categories: KDIGO 2012

Kidney Int Suppl 2013; 3: 19–62

GFR categories (ml/min/ 1.73m²) Description and range				Persistent albuminuria categories Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30-300 mg/g 3-30 mg/mmol	>300 mg/g >30 mg/mmol
	G1	Normal or high	≥90			
	G2	Mildly decreased	60-89			
	G3a	Mildly to moderately decreased	45-59			
	G3b	Moderately to severely decreased	30-44			
	G4	Severely decreased	15-29			
	G5	Kidney failure	<15			

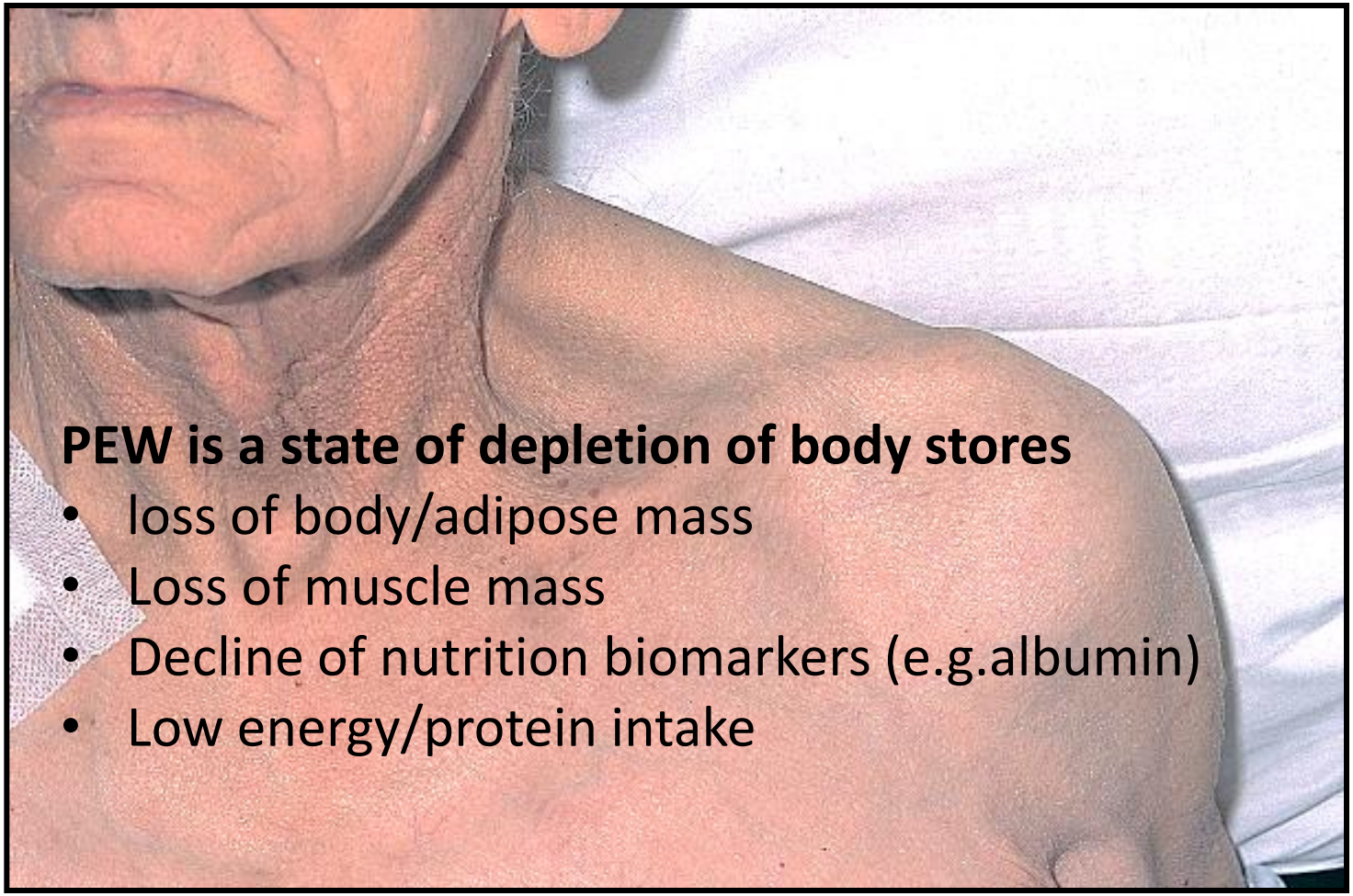
(red = very poor prognosis)

Incident dialysis patients in Europe: it grows old !



Johansson L. Teta D et al. Nephrol Dial Transplant. 2016;32(7):1127-1136

Protein-energy wasting (PEW) is prevalent in CKD

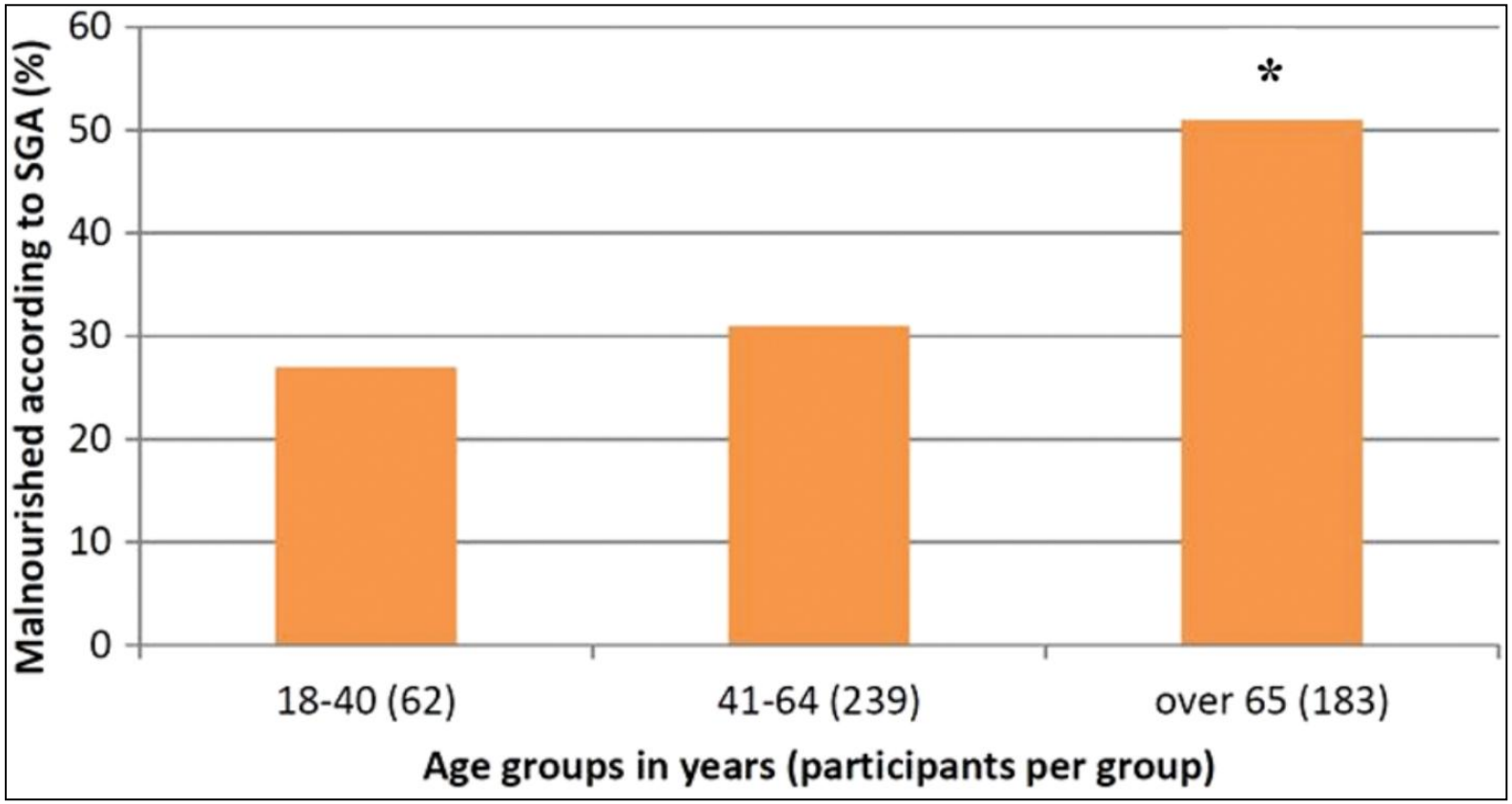


PEW is a state of depletion of body stores

- loss of body/adipose mass
- Loss of muscle mass
- Decline of nutrition biomarkers (e.g.albumin)
- Low energy/protein intake

Fouque D et al. on behalf of the ISRNM, Kidney Int 2008

Prevalence of malnutrition (PEW) in dialysis patients is very high



Johansson L, Teta D et al et al. Nephrol Dial Transplant 2016; 32(7): 1127-1136
Cianciaruso B et al. Nephrol Dial Transplant 1995; 10 (Suppl 6): 65-68

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Accelerated loss of lean body mass in incident dialysis patients with diabetes

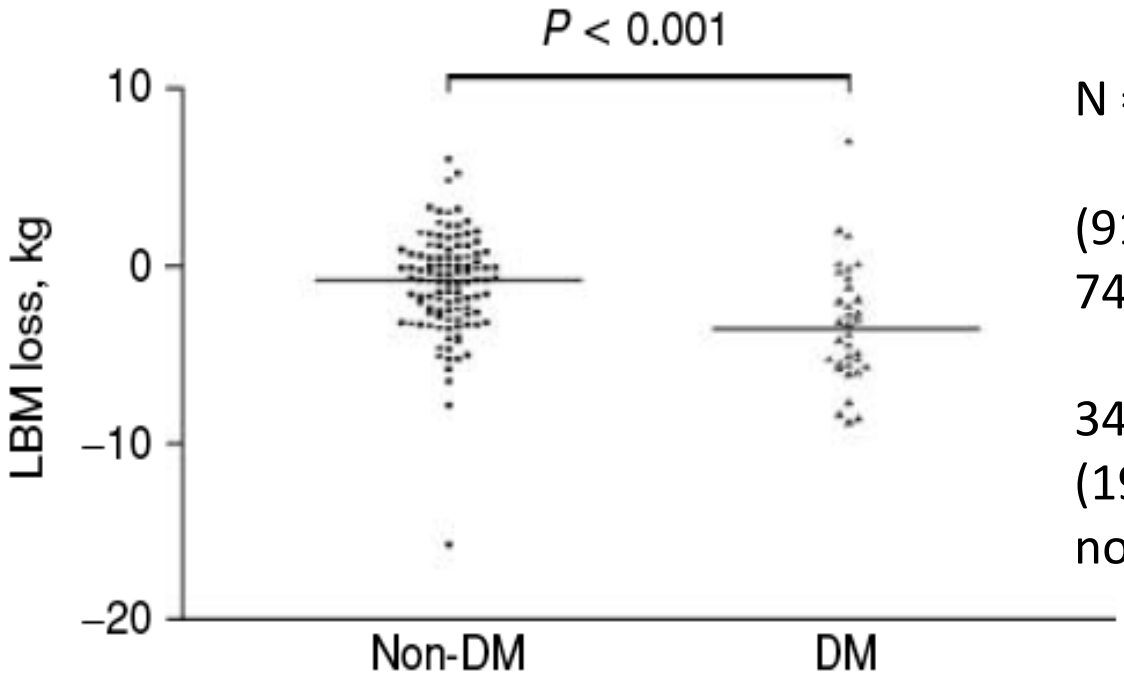


Fig. 1. Scatter plots grouped by nondiabetic (non-DM) and diabetic (DM) patients, showing individual lean body mass (LBM) loss in kg during 1 year of renal replacement therapy.

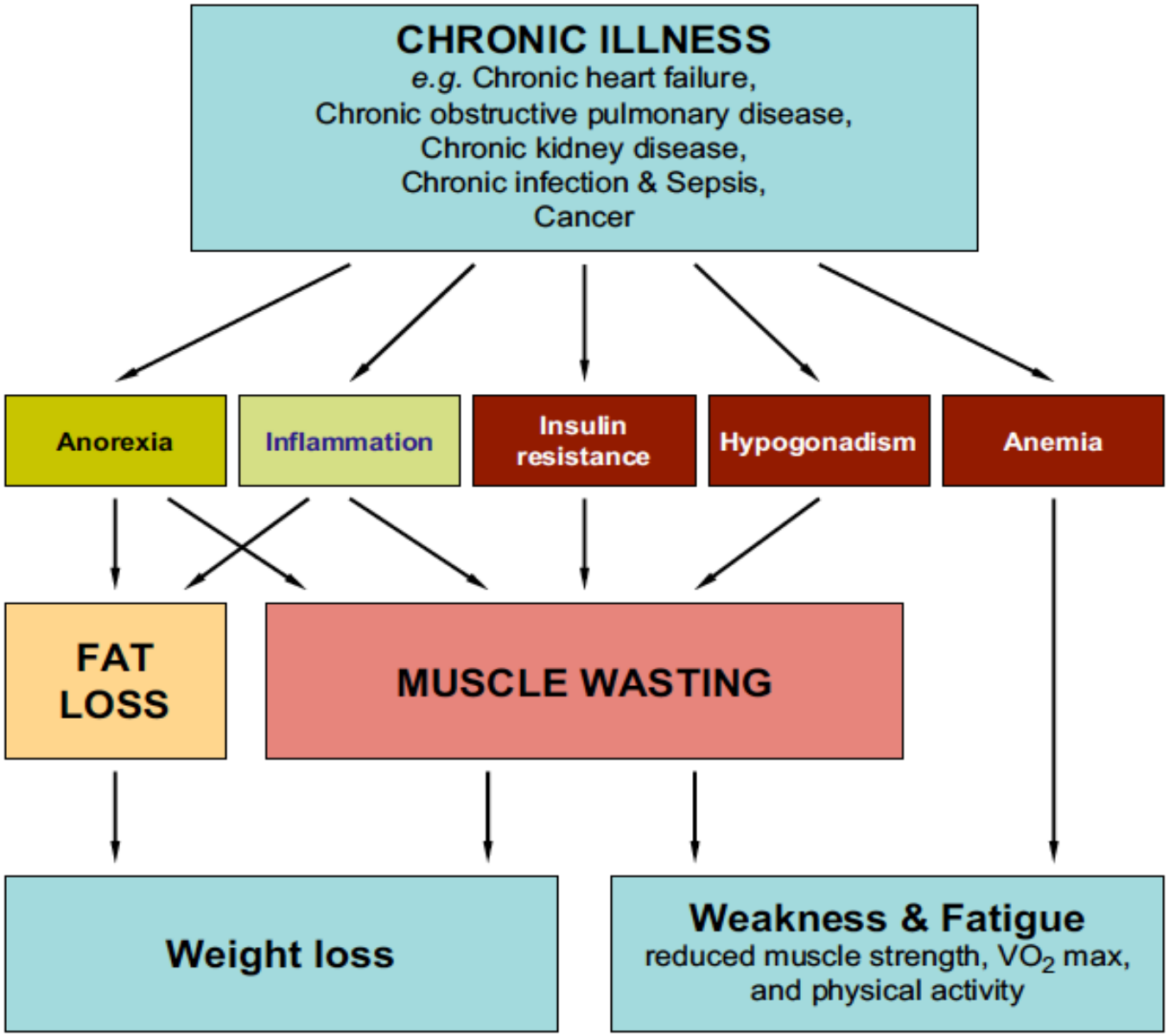
N = 142 incident ESRD patients

(91 males, 52.8 ± 1.0 years, 74.2 ± 1.2 kg body weight)

34 with diabetes mellitus (19 insulin-dependent and 15 non insulin dependent).

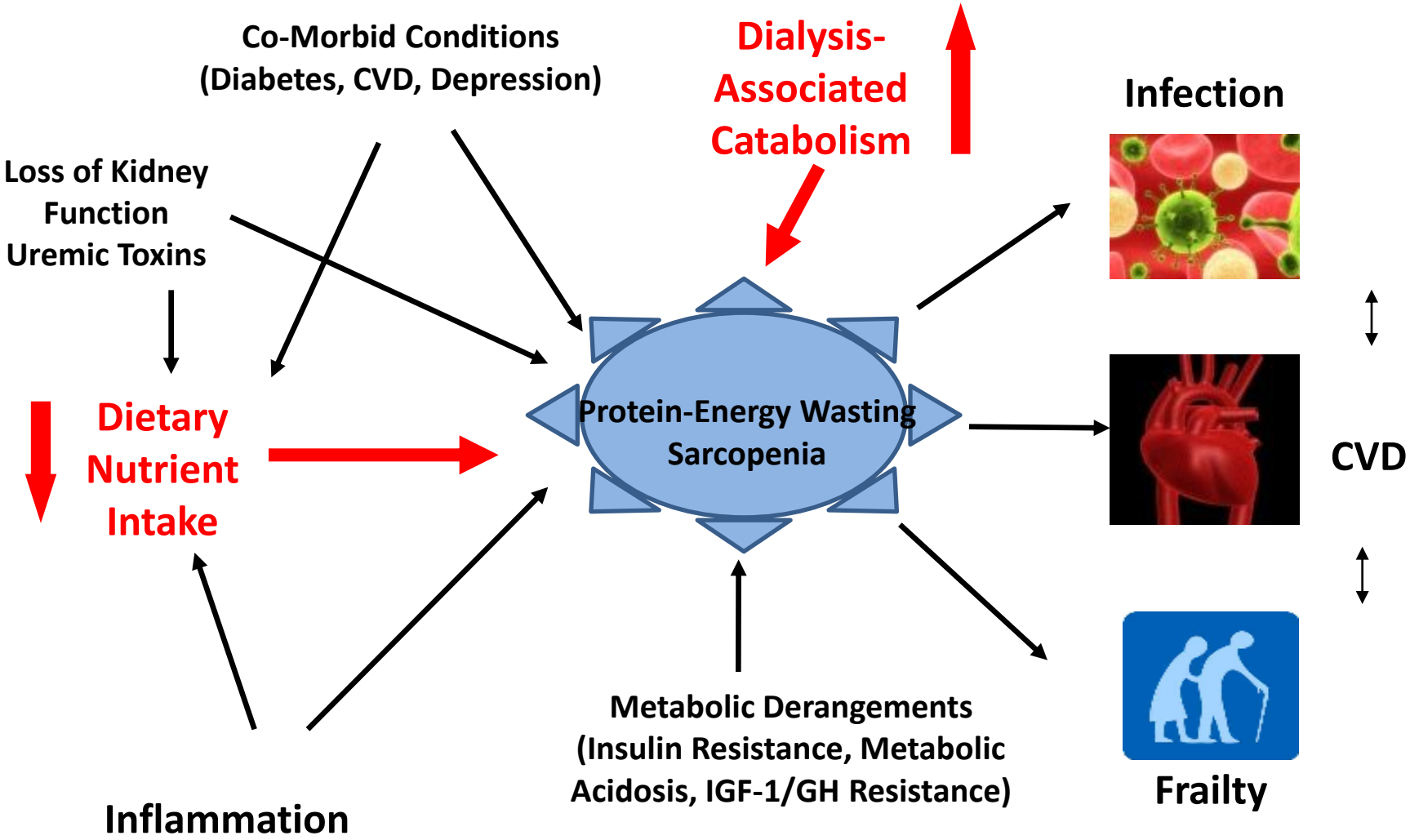
Pupim LB et al. Kidney Int 2005; 68: 2368-2374

Weight and muscle loss in chronic illness



Evans WJ et al.
Clin Nutr 2008

Etiology and Consequences of Protein Energy Wasting in CKD



Carrero JJ et al on behalf of ISRNM; J Ren Nutr 2013

Macronutrient requirements in dialysis patients

	ESPEN (1)	NKF (2)	EBPG (3)	ISRNM (4)
Protein g/kg*/day Prot of HBV 50%	**1.2 – 1.4**	**1.2**	**> 1.1**	**> 1.2**
Energy kcal/kg*/day	**35**	**< 60 y: 35** **> 60 y: 30**	**30-40**	**30-35**

*** Kg per ideal weight**

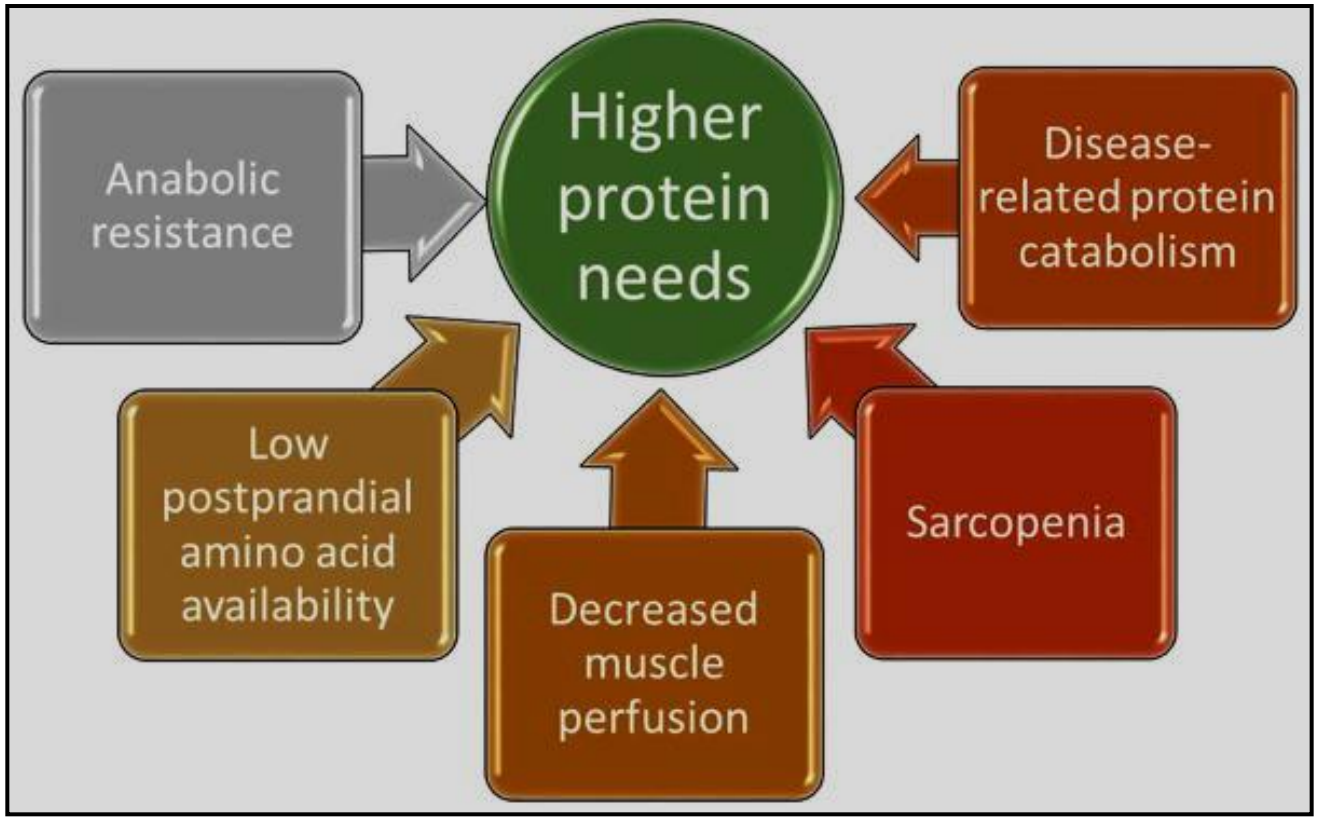
1 - Cano N et al. Clin Nutr, 2006 and 2009

2 - National Kidney foundation. Am J Kidney Dis, 2000

3 - Fouque D et al. EBPG. Nephrol Dial Transplant 2007

4 - Ikizler TA, Teta D et al. Kidney Int 2013

Recommendations from the PROT-AGE and ESPEN Expert Groups for the older



Bauer J et al. on the behalf of the PROT-AGE Group. J Am Dir Assoc 2013
Deutz NEP et al. Clin Nutr 2014; 33, 929-936;

Protein diets recommendations according to various CKD states

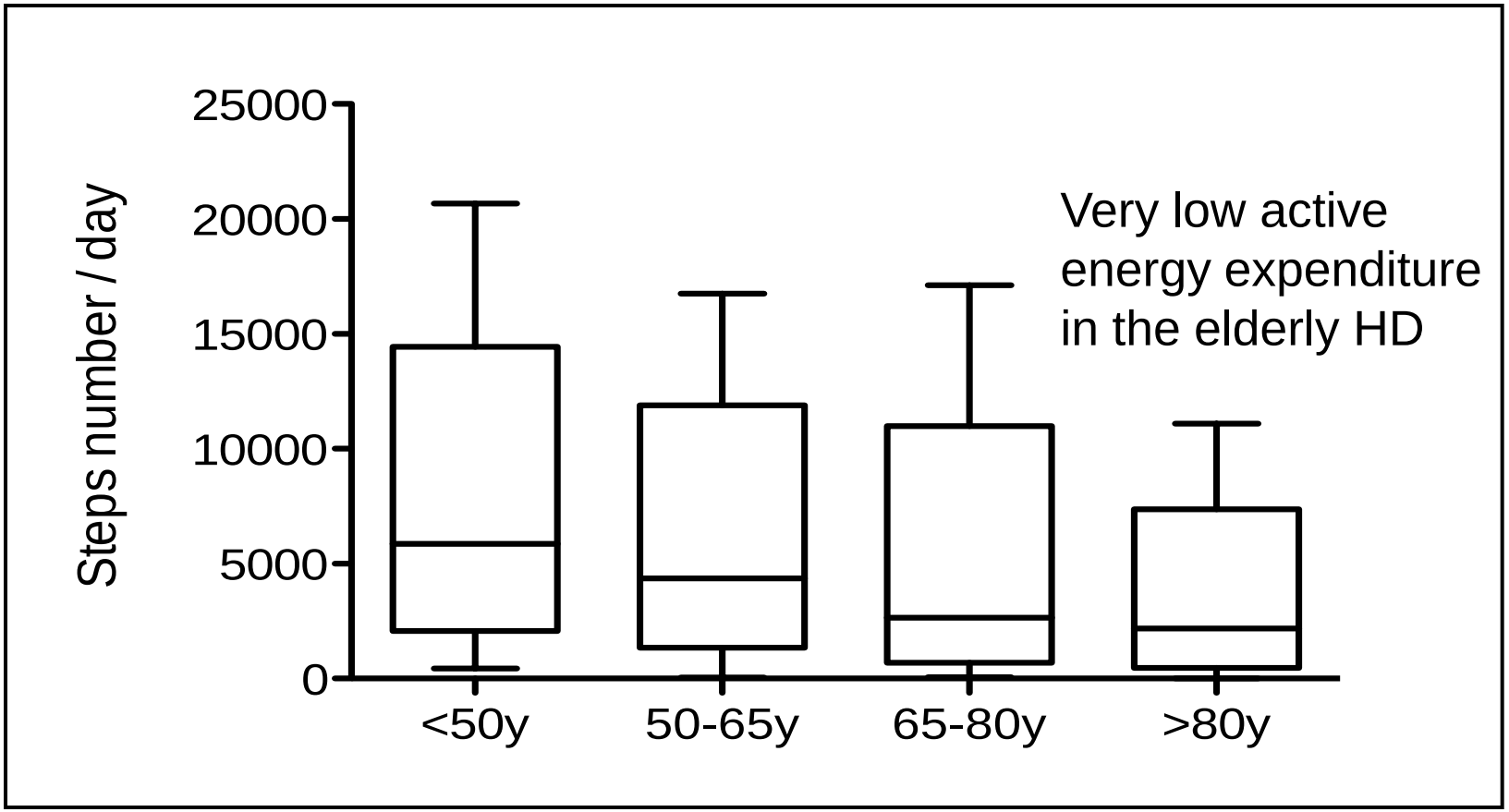
	CKD 3-4	Dialysis	Transplant*	Transplant
Diet	LPD	SPD	HPD	LPD
Prot (g/kg/d)	0.6-0.8	1.2-1.4	1.4	0.8
Energy (kcal/kg/d)	30-40	30-40	30-40	30-(40)
1. PEW	+	+++	++	+/-
2. Obese	++	+	+	+++

** first 3 months*

The older dialysis patient - drop in energy intakes

- 30-50% drops of energy intakes with aging (from 20 to 80 years-old)
- Predilection for energy-diluted foods such as grains, vegetables and fruits, in place of energy-dense and protein-rich nutrients
- Due to:
  - Anorexia
  - Lack of taste
  - Masticatory disability
  - Multiple medications
  - Depression
  - Loneliness
  - Dialysis as a stressor event
  - Frequent hospitalizations

Low physical activity: Steps number measured in 1133 HD patients



Panaye M, Kolko-Labadens A, Lasseur C, Paillasseur JL, Guillodo MP, Levanier M, Teta D, Fouque D. J Ren Nutr 2015

Energy expenditure in older dialysis patients

Energy expenditure may decrease in older dialysis patients due to:

- Lower resting energy expenditure (lower muscle mass)
- Lower active energy expenditure (sedentary behavior)

- 20% in elderly dialysis patients vs other patients

! However, older dialysis patients may be subjected to more hospitalizations, inflammation, and thus hypermetabolism, which **may counteract in part this lower energy expenditure**

Older dialysis patients:
Mismatch – actual intakes/ energy requirements

Nutritional management of older CKD patients

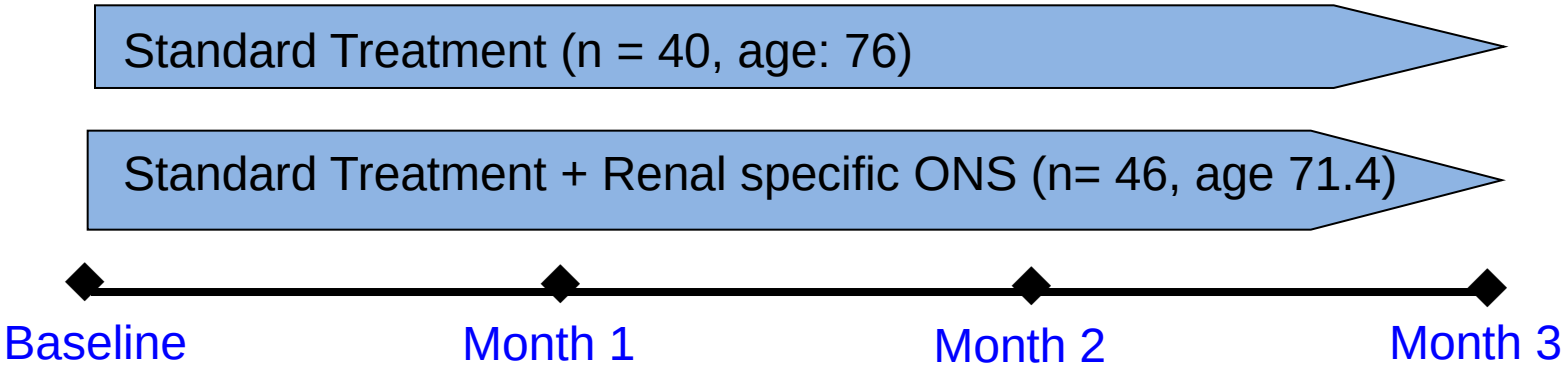
- No specific studies looking at nutritional interventions in exclusively in only older CKD patients
- Nutritional interventional studies include many older CKD **(mainly on dialysis)** patients
- Prevention strategies > Treatment strategies
- Spontaneously lower intakes of energy, protein, calcium, phosphorus
- Spontaneously lower intakes of vitamins and micronutrients
- Protein intake recommendations differ according to CKD status

Prevention of PEW in dialysis patients : effect of renal specific oral supplements

- Randomised, controlled trial, n = 86
- 18 centres (16 France, 1 Germany, 1 Switzerland)
- Inclusion: patients at risk of malnutrition: prot intake (nPNA) < 1.0 g/kg/d, with no PEW

Outcomes:

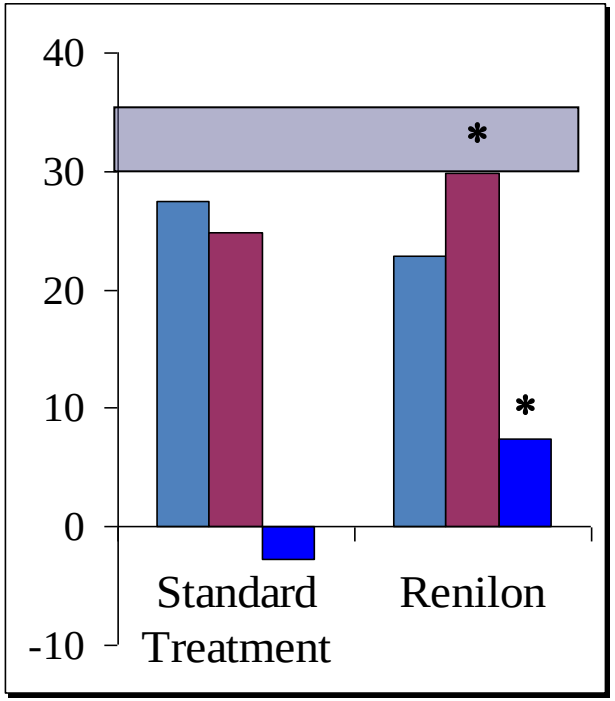
- Nutritional – dietary intake, dry body weight, BMI, SGA,
- Biochemical – Alb, PreAlb, nPCR, Cr, P, Ca
- Clinical – SF-36, phosphate binder use



Fouque D, McKenzie J, de Mutsert R, Azar R, Teta D, Plauth M, Cano N.
Nephrol Dial Transplant 2008; 23: 2902-2910

Oral supplements enabled HD patients to achieve recommended nutrient intakes

Total Energy Intake (kcal/kg/d)

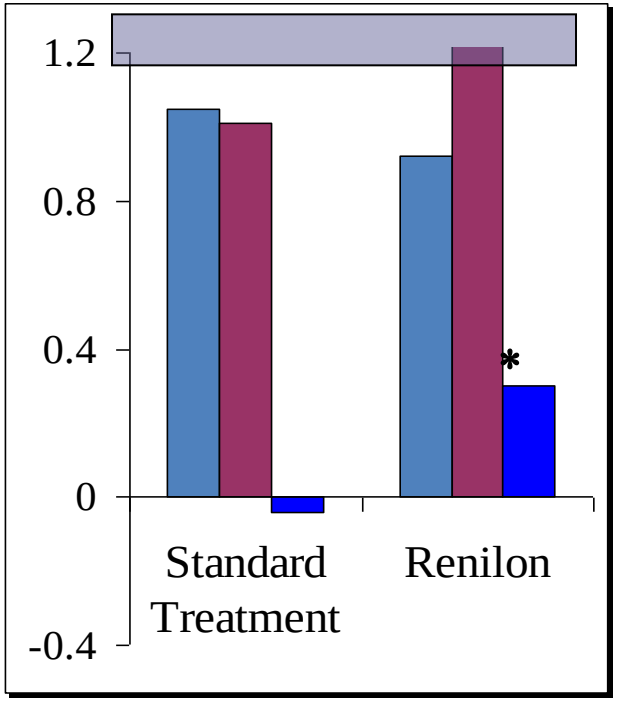


* p < 0.05 between groups

Recommended Intake (KDOQI/EDTA)

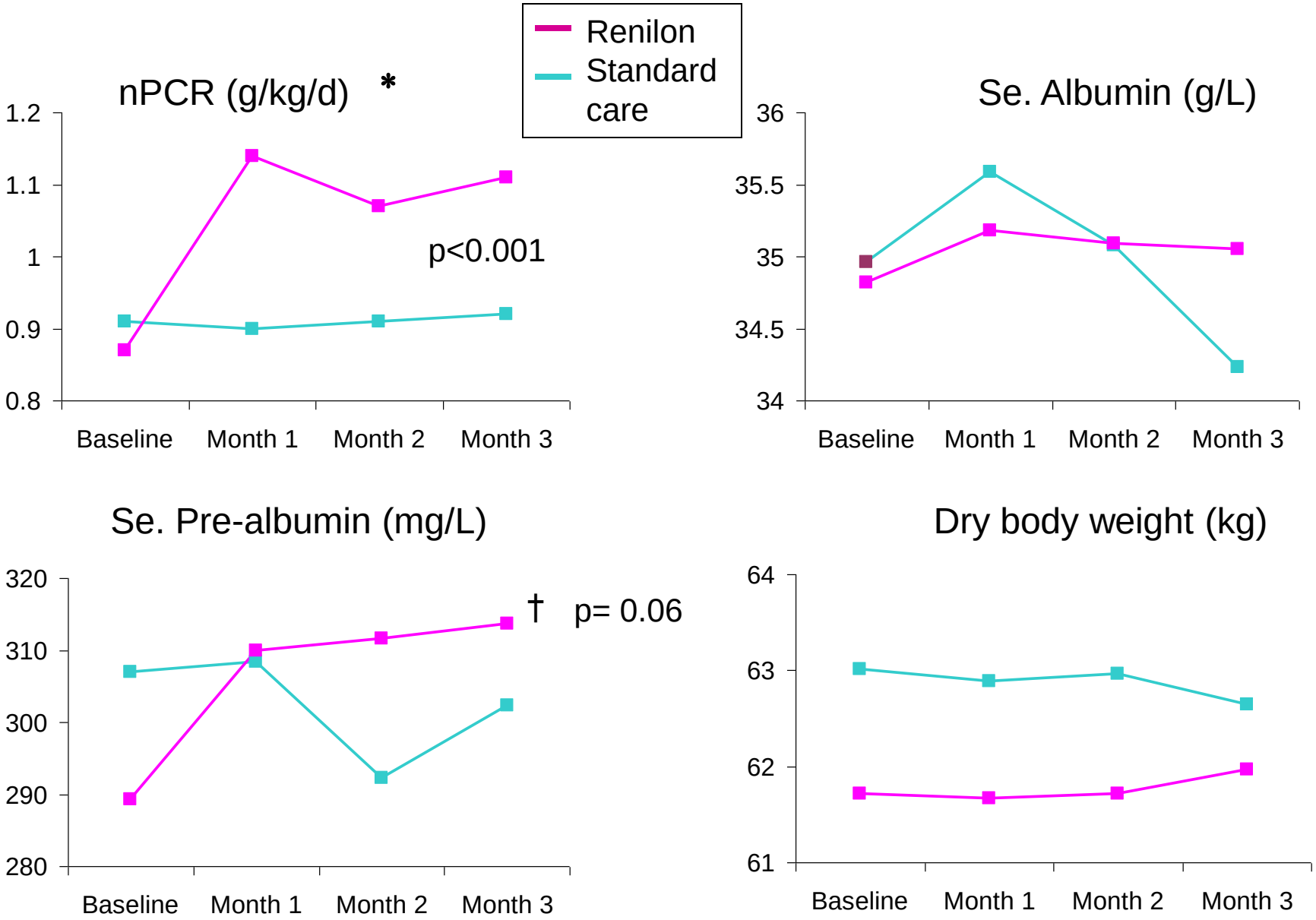
Baseline
Month 3
Month 3 - baseline

Total Protein Intake (g/kg/d)



Fouque D, McKenzie J, de Mutsert R, Azar R, Teta D, Plauth M, Cano N.
Nephrol Dial Transplant 2008; 23: 2902-2910

Indicators of nutritional status



In center provision of intradialytic meals

Rationale

1. In dialysis patients, energy, nutritional « gaps » between requirements and spontaneous intakes

- gap of Energy: 5-10 kcal/kg/day
- gap of Protein: 0.2-0.4 g/kg/day

2. Meals during HD may suppress HD-induced catabolic effect

Strategies to close the « nutritional gap »

• In center / intradialytic nutritional intakes

Kalantar Zadeh K, Ikizler TA. J Ren Nutr 2012

Protein metabolism during HD: effect of fasting vs fed state

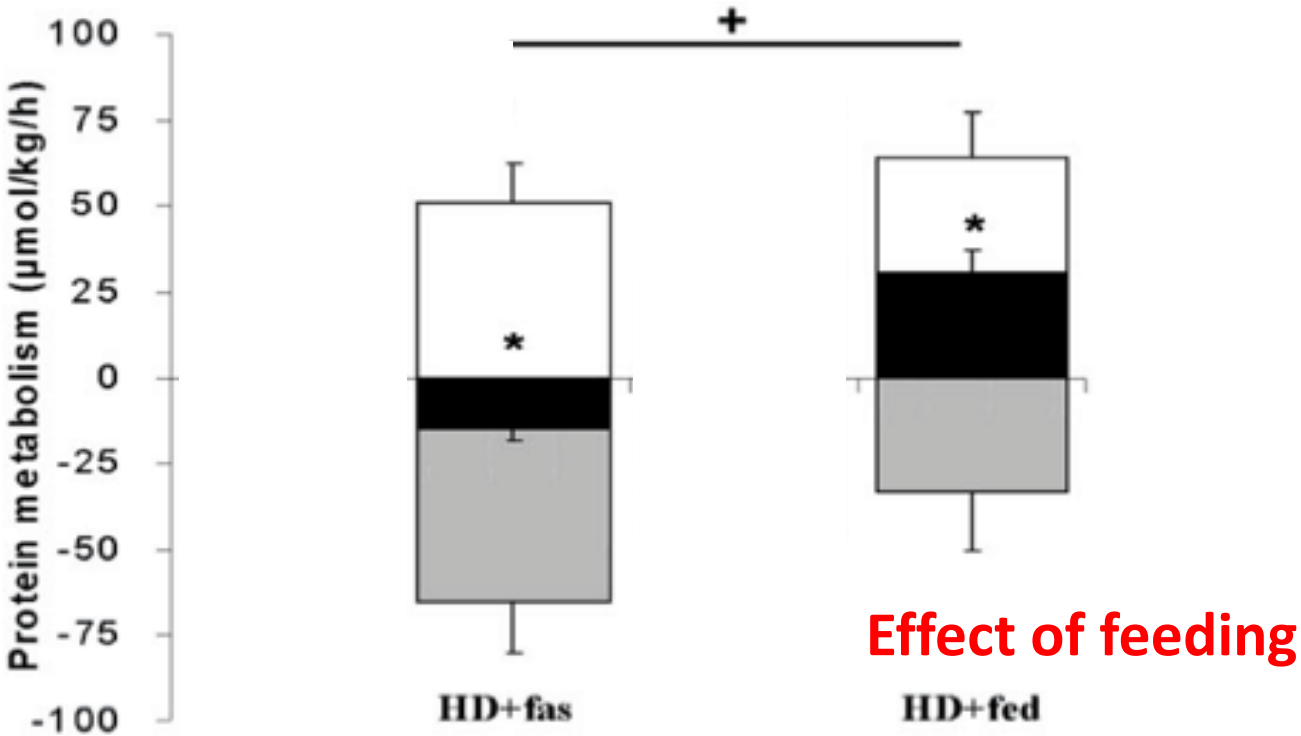
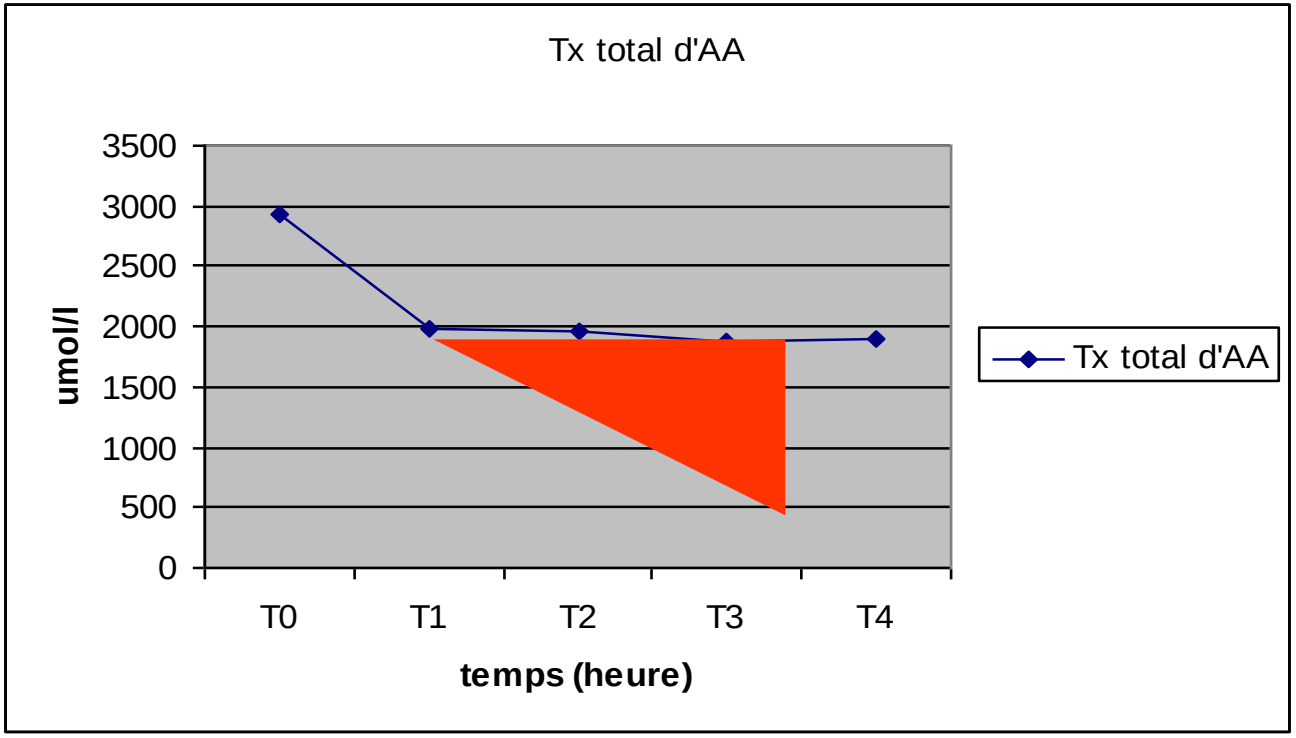


Fig. 5. Summary of whole body protein breakdown (gray bars), synthesis (open bars), and protein balance (filled bars) under all experimental conditions. *Whole body protein balance significantly different from 0. +Whole body protein balance significantly different between fasting and feeding. #Whole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

Veeneman Am J Physiol 2003

Plasma aminoacid concentrations decline during a high flux HD session (4h)



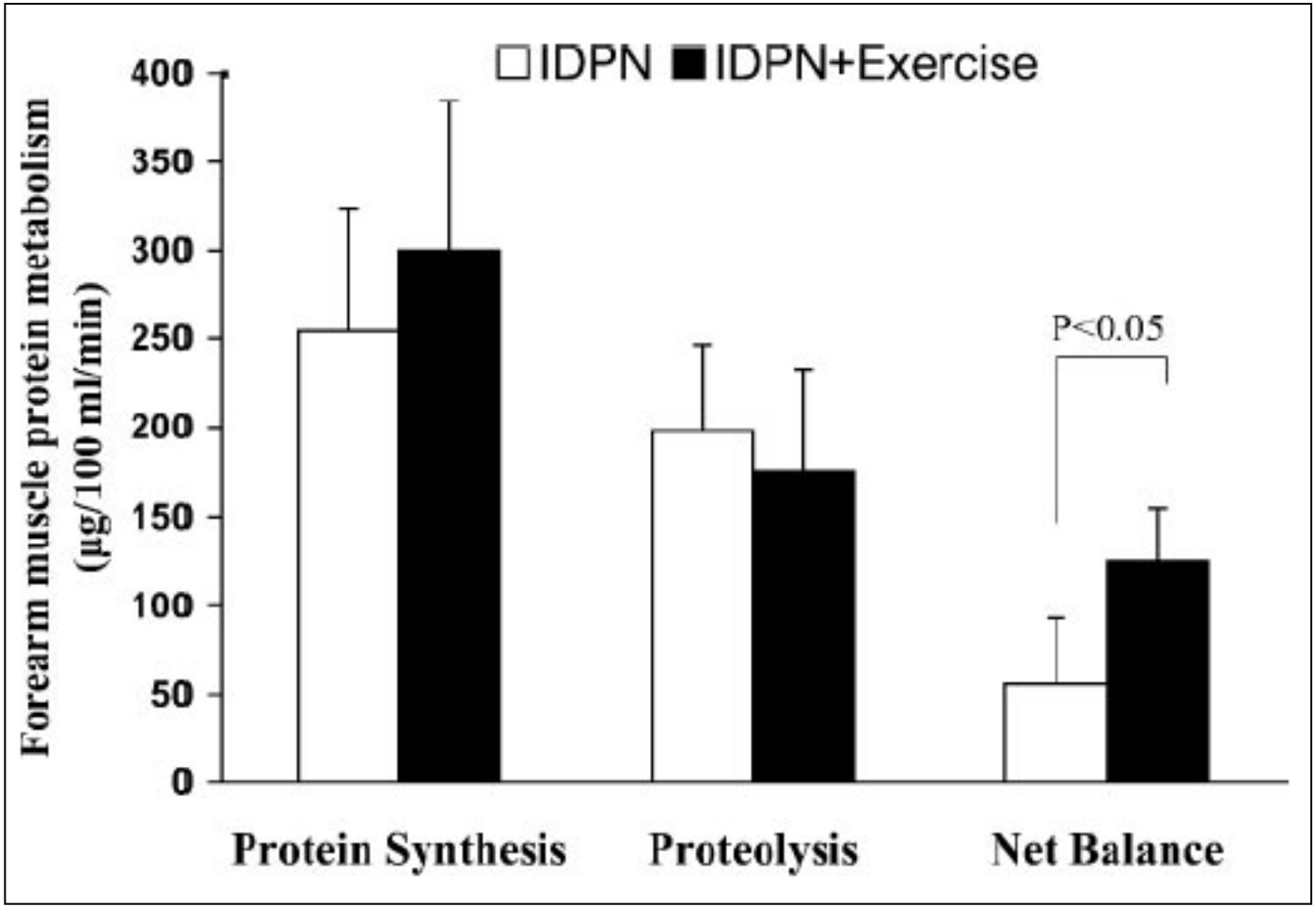
The decline in plasma AA is sensed by the muscle cell.
Muscle protein synthesis is blocked by a low extracellular AA concentration

P Deléaval, D Teta, D Fouque et al, 2007

Prevention of PEW: Snacks during HD: «Lausanne recipe»

	Kcal	Prot (g)	Glu (g)	Phos (mg)	K (mg)	Na (mg)
2 tartines	360	**8,6**	60	110	140	550
Sandwich Ham	380	**20**	47	215	205	1175
Sandwich Cheese	490	**21**	47	380	170	830
15 g protein powder + 2 tartines	420	**22**	60	220	145	550
250 ml (2 x) Renilon 7,5	500	**19**	50	15	0,8	150
200 ml Resource 2,0 fibre	400	**18**	44	180	320	120
200 ml Fortimel	200	**20**	21	400	400	100

Exercise augments the acute anabolic effects of IDPN in HD patients



Pupim L et al. Am J Physiol 2004

Resistance exercise may be more efficient than aerobic exercise to maintain lean body mass in CKD patients

Recommended intakes in micronutrients in dialysis patients: (addition necessary because of losses through dialysates)

ESPEN 2000 (1)	Pyridoxin, mg	10-15
	Vitamin C, mg	30-60
	Folic Acid, mg	1
	Vitamin D, IU	according to [Ca] & [PTH]
	Zinc, mg	15
	Selenium, µg	50-70
EBPG 2007 (2)	Thiamine, Riboflavin, cobalamine, Niacin, Biotine, pentothenic A & tocopherol should be supplemented (expert opinion)	

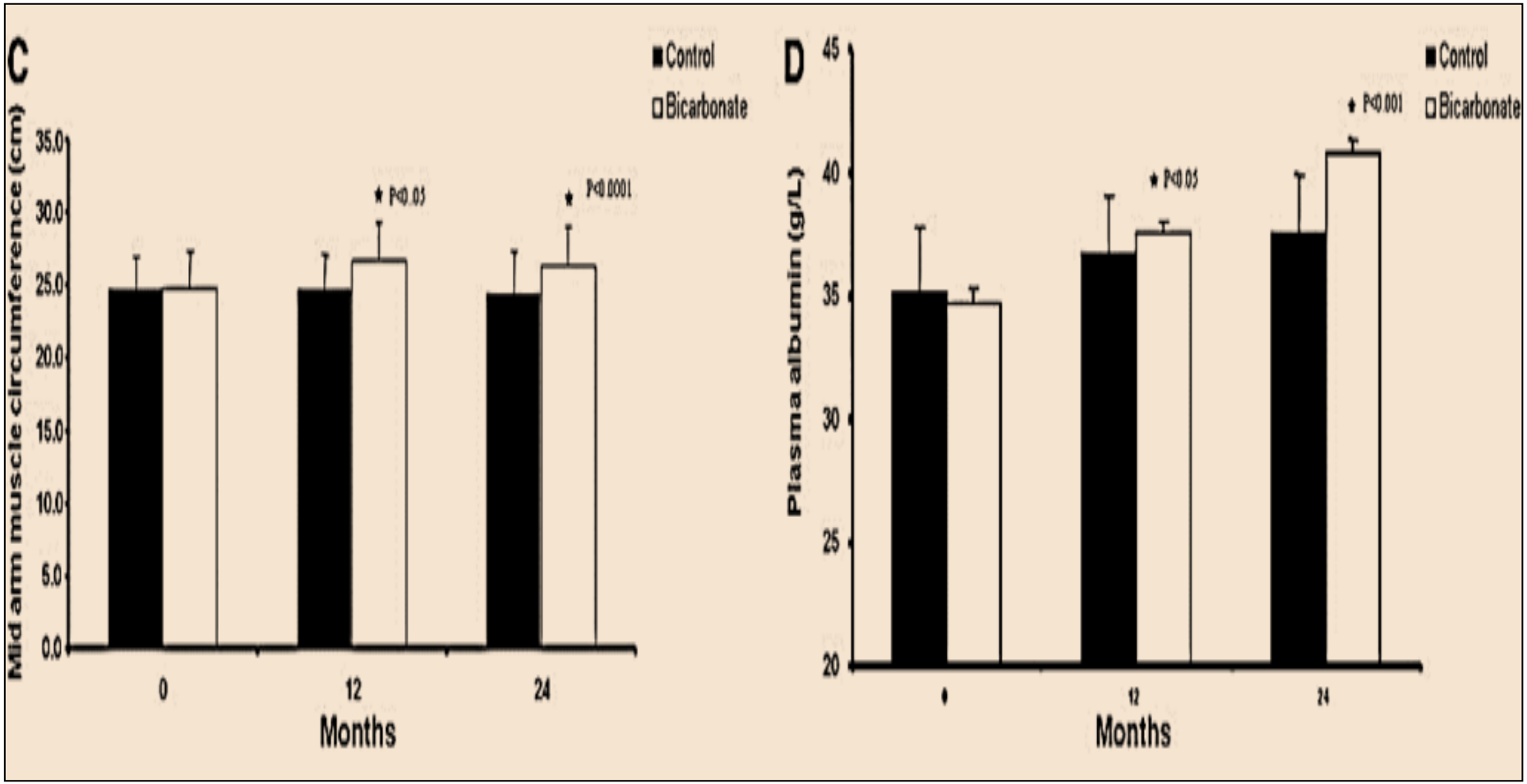
Toigo G et al. Clin Nutr, 2000
Fouque D et al. EBPG. Nephrol Dial Transplant 2007

If PEW established, use of ONS in HD patients is efficient to treat PEW: summary of RCT

Authors	n	Days	Nutritional significant effects
Acchiardo et al. (1982)	15	105	↑ albumin, transferrin, bone density
Allman et al. (1990)	21	180	↑ BW, lean body mass
Tietze et al. (1991)	19	120	↑ BW, arm muscle circumference
Eustace et al. (2000)	47	90	↑ albumin, grip strength, SF12 mental health
Hiroshige et al (2001)	44	180	↑ DEI, DPI, fat mass, fat free mass, albumin
Sharma et al. (2002)	40	30	↑ albumin
Leon et al. (2006)	180	365	↑ DEI, DPI, albumin
Cano et al. (2007)	186	365	↑ nPNA, BMI, albumin, prealbumin
Fouque et al. (2008)	86	90	↑ DEI, DPI, SGA, QOL
Moretti et al. (2009)	49	365	↑ nPNA, albumin

Ikizler TA, Teta D et al. on the behalf of the ISRNM Kidney Int 2013

Correction of metabolic acidosis improves protein metabolism and plasma albumin in pre-dialysis patients



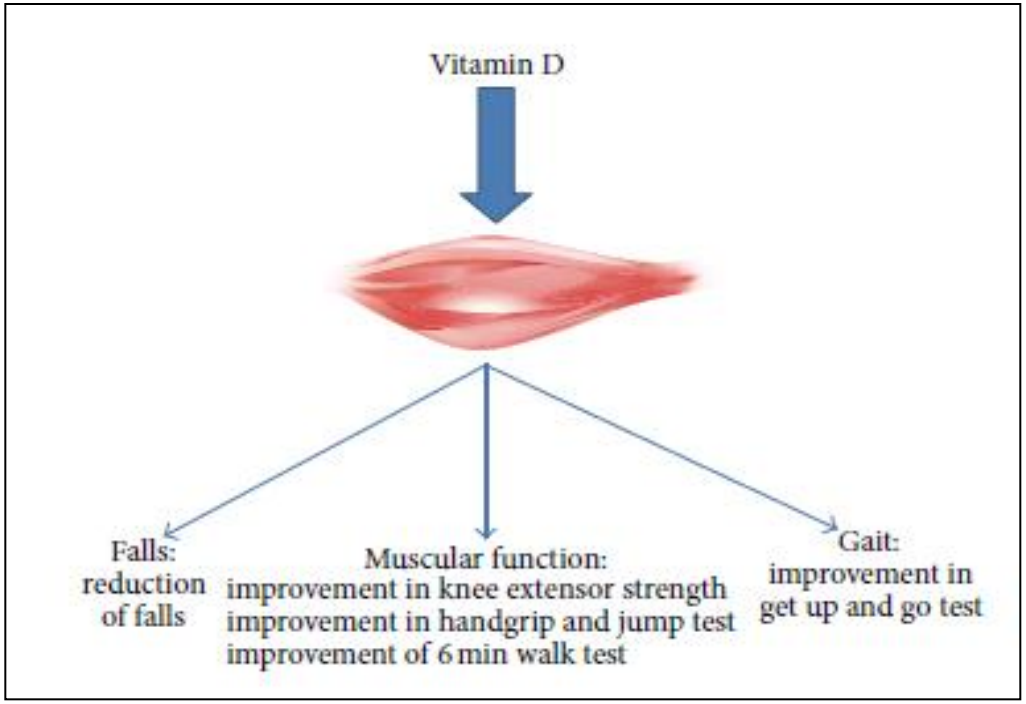
De Brito-Ashurst I et al. J Am Soc Nephrol 2009

Sarcopenia and specific nutrients: systematic review (PubMed)

Sarcopenia and	Items	Review
Calories	3	2
Energy	147	51
Protein	282	149
Amino acids	49	28
Creatine	9	4
Vitamin D	19	10
n-3 fatty acids	0	0
Exercise	249	142
Nutrition	147	42

Morley JE et al. J Am Dir Assoc 2010; 11: 391-396

Clinical effects of vitamin D on muscle, gait and falls in the elderly and in CKD



Halfon M, Phan O, Teta D : BioMed Research Int 2015

Gordon PL et al. J Ren Nutr 2012, 22: 423 – 433

Taskapan H et al. Clin Nephrol 2011, 76: 110–116

Zahed N et al. Saudi Journal of Kid Dis and Transplant 2014: 25: 998–1003

Prevention of muscle loss in older CKD patients

- Maintain energy requirements: 26-35 kcal/kg/day according to physical activity/clinial condition : individualization !
- Dialysis: High protein requirements : 1.2 - 1.5 g/kg/day
- Enriched-protein meals during dialysis
- If PEW established: ONS and/or IDPN are efficient
- Supplementation of micronutrients necessary
- Individualized prescription of electrolytes/calcium
- Correction of metabolic acidosis
- Non dialysis CKD: low protein diets (with enough calories)
- Other interventions (vitamine D – n-3 fatty acids) - low evidence

Thank you for your attention