Επηρεάζεται η εξέλιξη της ΧΝΝ με τη διατροφή;

Καλλιόπη Άννα Πούλια

Επίκουρη Καθηγήτρια Κλινικής Διαιτολογίας

Εργαστήριο Διαιτολογίας και ποιότητας Ζωης

Τμήμα Επιστήμης τροφίμων και διατροφής του ανθρώπου

Γεωπονικό Πανεπιστήμιο Αθηνών

Γεν. Γραμματέας Grespen

CoDirector LLL ESPEN

27ο Πανελλήνιο Συνέδριο ΝΕΦΡΟΛΟΓΙΑΣ

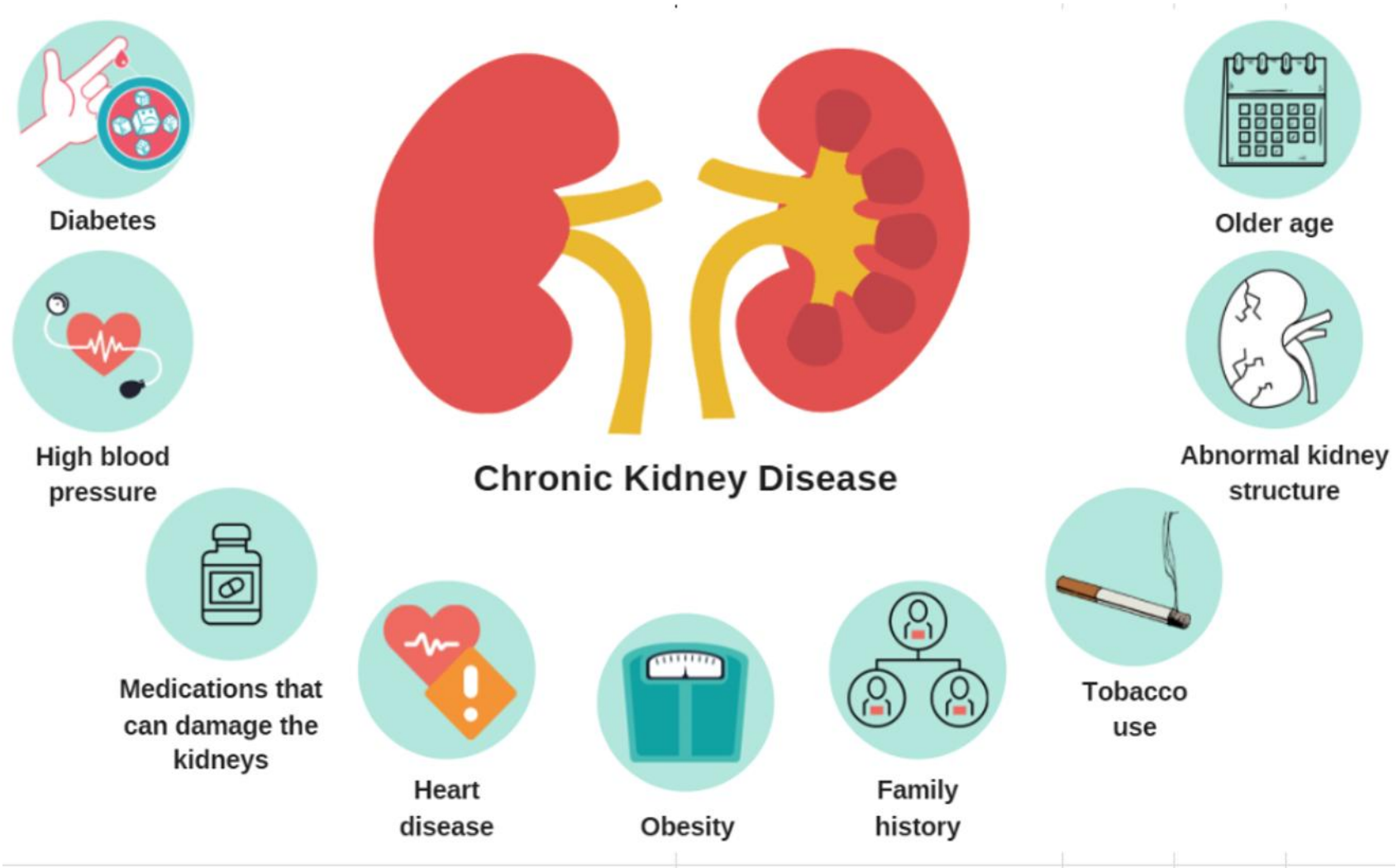
ΓΕΩΠΟΝΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
AGRICULTURAL UNIVERSITY OF ATHENS

Hellenic Society for Clinical Nutrition and Metabolism

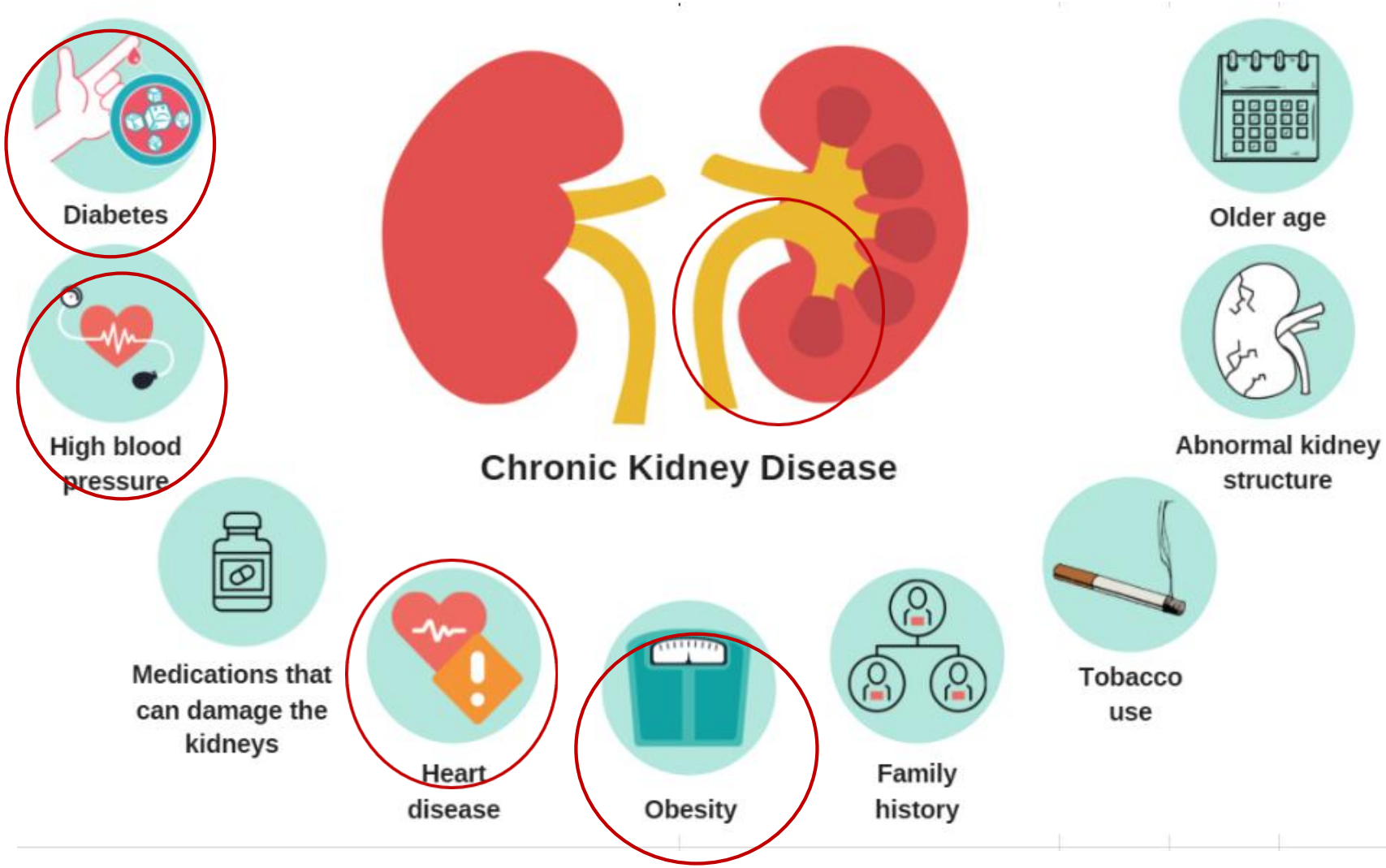
Δήλωση σύγκρουσης συμφερόντων

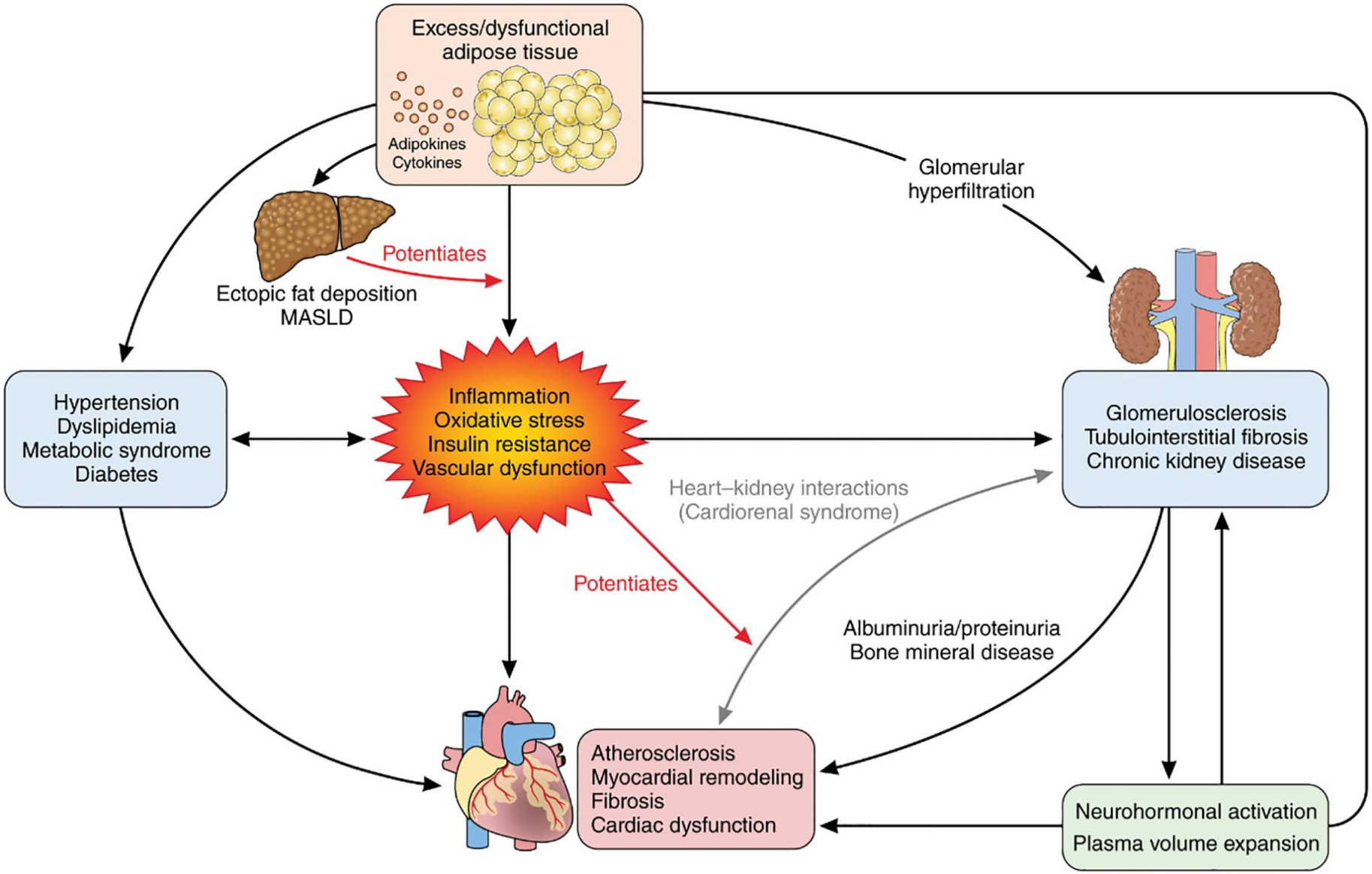
- Δεν υπάρχει καμία σύγκρουση συμφερόντων

Παράγοντες κινδύνου για τη ΧΝΝ



Παράγοντες κινδύνου για τη ΧΝΝ

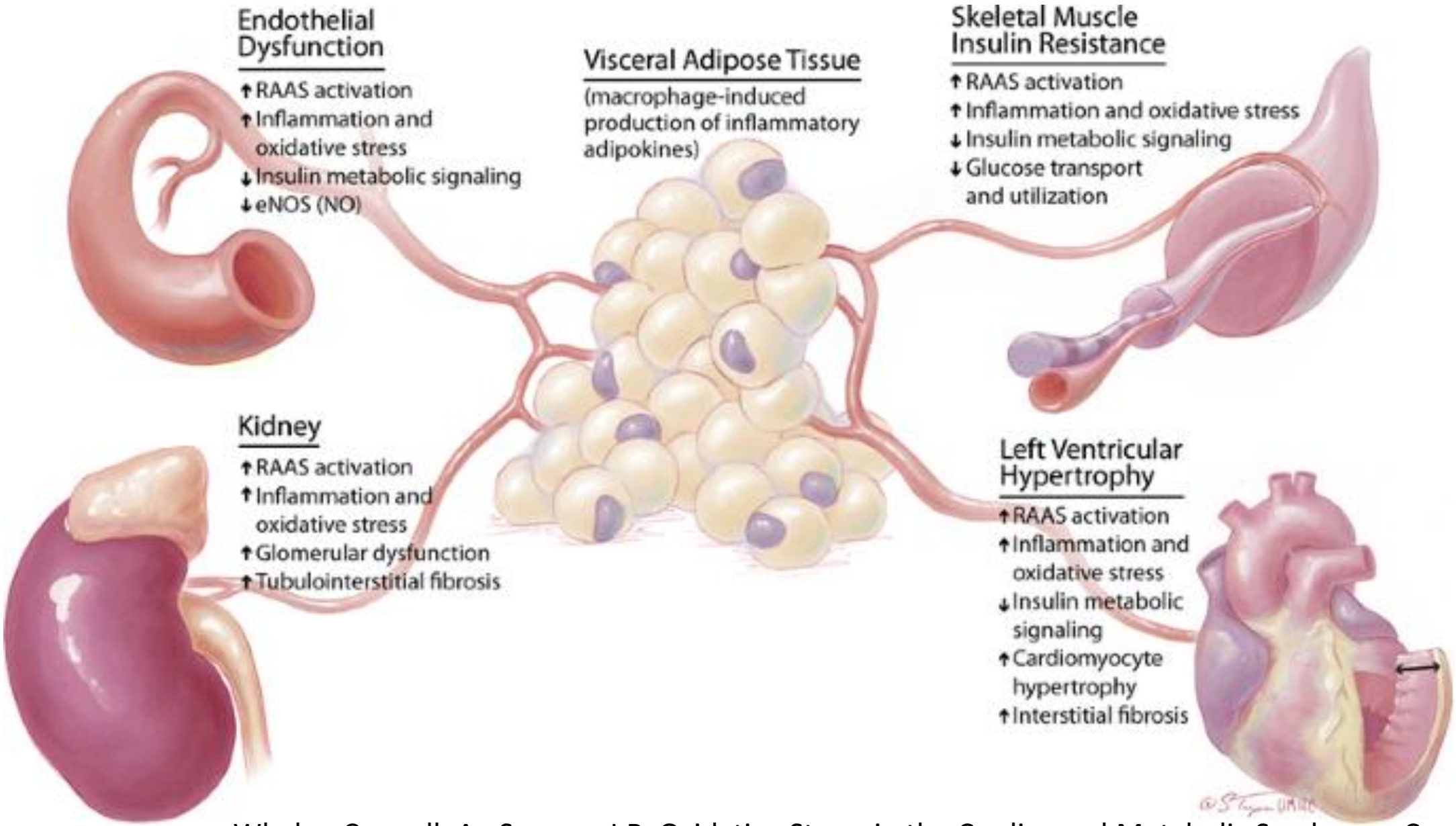




Περίσσεια - δυσλειτουργία του λιπώδους ιστού

- Έκτοπη εναπόθεση λίπους
- Αντίσταση στην ινσουλίνη
- Συστηματική φλεγμονή
- Οξειδωτικό stress

Ndumele CE et al on behalf of the American Heart Association, Circulation. 2023



Whaley-Connell, A., Sowers, J.R. Oxidative Stress in the Cardiorenal Metabolic Syndrome. Curr Hypertens Rep 14, 360–365 (2012).

How does diet affect kidney outcomes?

CJASN
Clinical Journal of American Society of Nephrology

Systematic review & meta-analysis

18 cohort studies

630,108 adults

Median follow up 10.4 years

Low risk of bias in included studies

Evidence certainty

CKD	Moderate
eGFR decline rate	Low
Incident albuminuria	Low

Healthy dietary patterns

Encouraged higher intake of

- Fruits and vegetables
- Legumes
- Nuts
- Whole grains
- Fish
- Low-fat dairy

Encouraged lower intake of

- Red meat
- Sodium
- Processed meat
- Sugar-sweetened beverages

A healthy dietary pattern

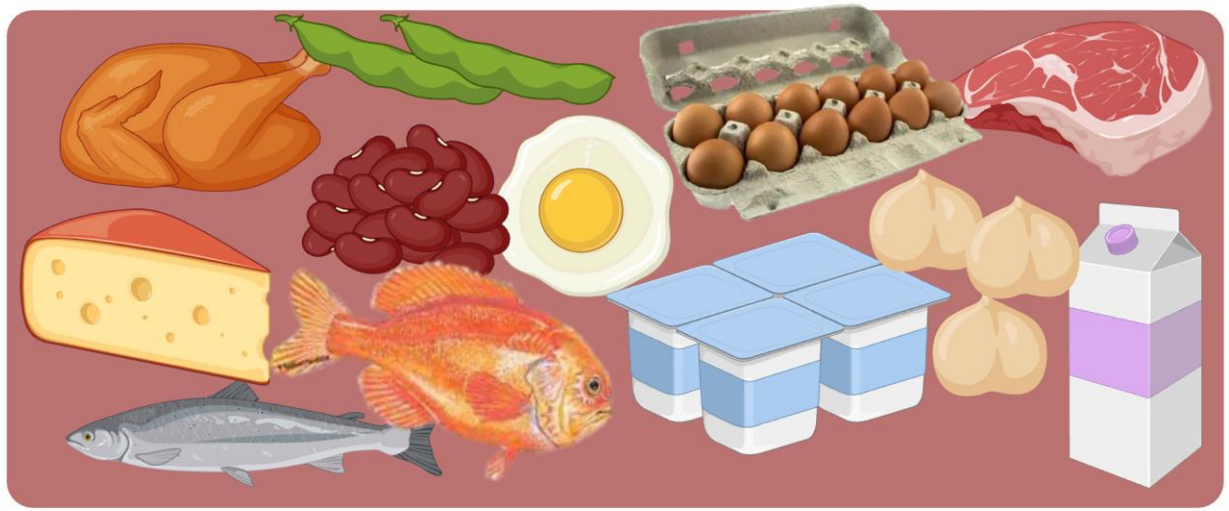
was associated with **a lower incidence of CKD** (OR 0.71, 0.60 – 0.82)

was associated with **a lower incidence of albuminuria** (OR 0.77, 0.59-0.99)

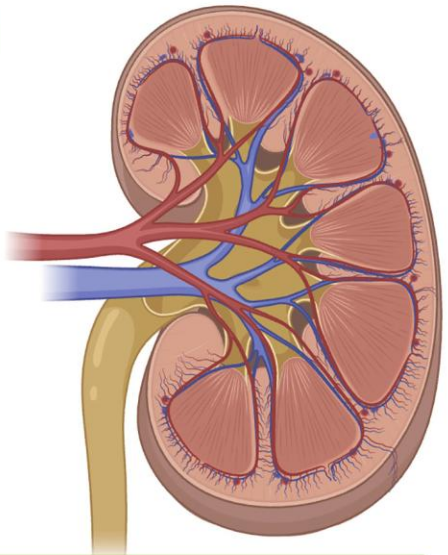
was not associated with **rate of eGFR decline** (OR 0.70, 0.49 – 1.01)

Conclusions A healthy dietary pattern may prevent chronic kidney disease and albuminuria.

Katrina E. Bach, Jaimon T. Kelly, Suetonia C. Palmer, et al. ***Healthy dietary patterns and incidence of chronic kidney disease: A meta-analysis of cohort studies.*** CJASN doi: https://doi.org/10.2215/CJN.00530119. **Visual Abstract by Michelle Lim, MBChB**



Healthy diet and LPD for non-dialysis CKD patients



Nitrogenous waste
Phosphate
Uremic toxins
Metabolic Acidosis
Oxidative stress
Systemic Inflammation
Blood pressure

Braz. J. Nephrol. 47 (4) • Oct-Dec 2025 •
https://doi.org/10.1590/2175-8239-JBN-2025-0065en

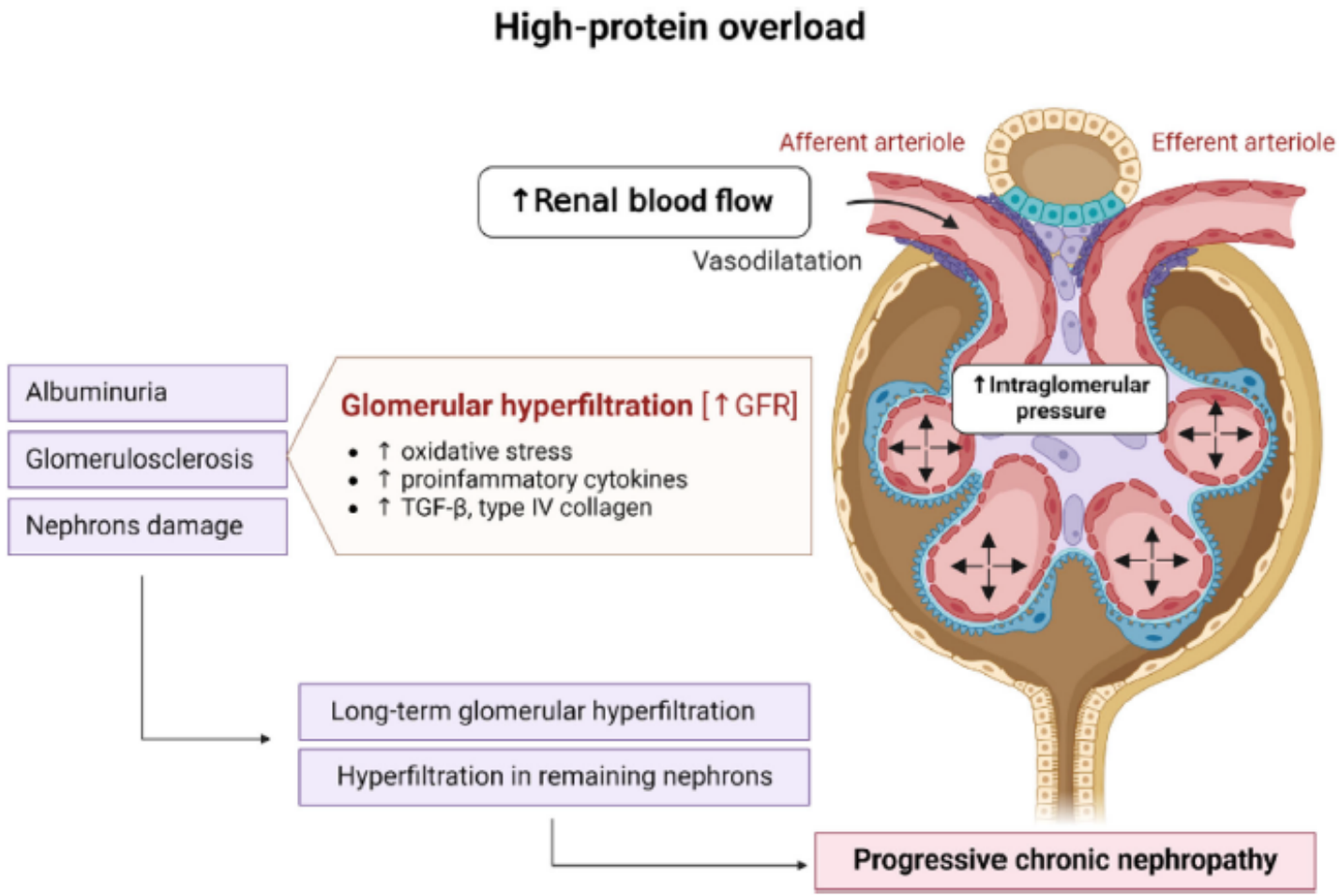
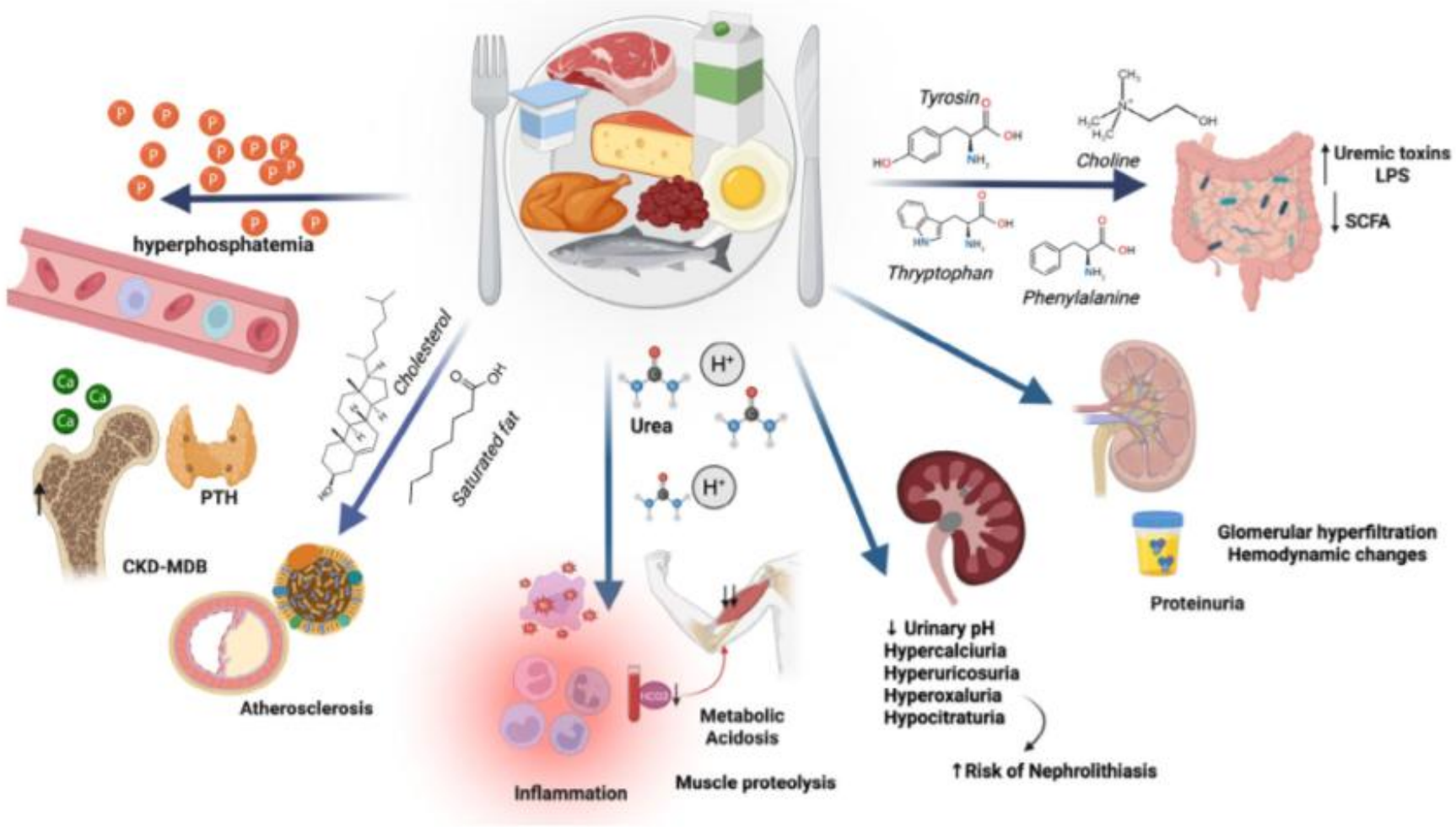


Fig. 2 *Effects of high protein intake on nephrons. High protein overload can lead to vasodilation of the afferent arteriole, increasing renal blood flow and intraglomerular pressure, ultimately resulting in glomerular hyperfiltration. This hyperfiltration elevates oxygen consumption, which may heighten oxidative stress and trigger the upregulation of pro-inflammatory cytokines and profibrotic factors. Over time, this process can result in albuminuria, glomerular and tubular damage, and an increased burden on the remaining nephrons. Consequently, hyperfiltration may adversely impact kidney health over time, particularly in individuals at risk for or already affected by CKD. TGF-β, transforming growth factor-β. Source: Created by BioRender.com.*

Journal of Internal Medicine, 2025, 298; 319–335

Αυξημένη πρόσληψη πρωτεΐνης και ΧΝΝ



Journal of Internal Medicine, 2025, 298; 319–335

Low-protein diet adherence and CKD progression during long-term follow-up

Focus of study was the impact of adherence to a low-protein diet (LPD) on the progression of CKD in a cohort of Brazilian patients.

Methods

N=438 non-dialysis CKD
Single center 2010–2024

Adherent LPD group

Non-adherent LPD group

CKD progression: annual eGFR decline (linear mixed model)

Results

Estimated mean annual change in eGFR

LPD adherent

–0.29

mL/min/1.73 m²

LPD non-adherent

–1.40

mL/min/1.73 m²

Absolute adjusted difference between groups

–1.10

mL/min/1.73 m²

(95% CI 0.34–1.87, p = 0.0048)

Brum, I. S. C. *et al.*
NDT (2025)
@NDTSocial

Adherence to a LPD was associated with a significantly slower decline in eGFR over time in patients with CKD stages 3–5 (not requiring dialysis), indicating a potential nephroprotective effect.

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National Kidney Foundation

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KDOQI CLINICAL PRACTICE GUIDELINE FOR NUTRITION IN CKD: 2020 UPDATE

Alp Ikizler, Jerrilynn D. Burrowes, Laura D. Byham-Gray, Katrina L. Campbell, Juan-Jesus Carrero, Winnie Chan, Denis Fouque, Allon N. Friedman, Sana Ghaddar, D. Jordi Goldstein-Fuchs, George A. Kaysen, Joel D. Kopple, Daniel Teta, Angela Yee-Moon Wang, and Lilian Cuppari

Protein Restriction, CKD Patients Not on Dialysis and Without Diabetes

3.0.1 In adults with CKD 3-5 who are metabolically stable, we recommend, under close clinical supervision, protein restriction with or without keto acid analogs, to reduce risk for end-stage kidney disease (ESKD)/death (1A) and improve quality of life (QoL) (2C):

- a low-protein diet providing 0.55–0.60 g dietary protein/kg body weight/day, or
- a very low-protein diet providing 0.28–0.43 g dietary protein/kg body weight/day with additional keto acid/amino acid analogs to meet protein requirements (0.55–0.60 g /kg body weight/day)

Protein Restriction, CKD Patients Not on Dialysis and With Diabetes

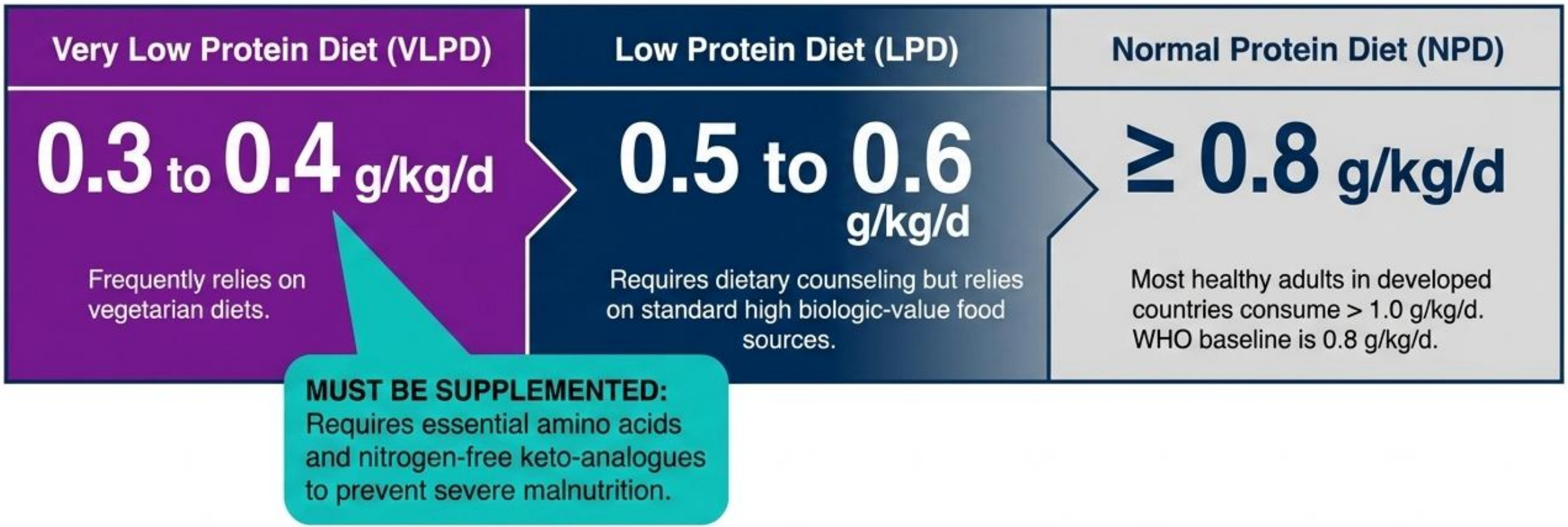
3.0.2 In the adult with CKD 3-5 and who has diabetes, it is reasonable to prescribe, under close clinical supervision, a dietary protein intake of 0.6 - 0.8 g/kg body weight per day to maintain a stable nutritional status and optimize glycemic control (OPINION).

Dietary Protein Restriction in Non-Diabetic CKD: A Cochrane Evidence Synthesis

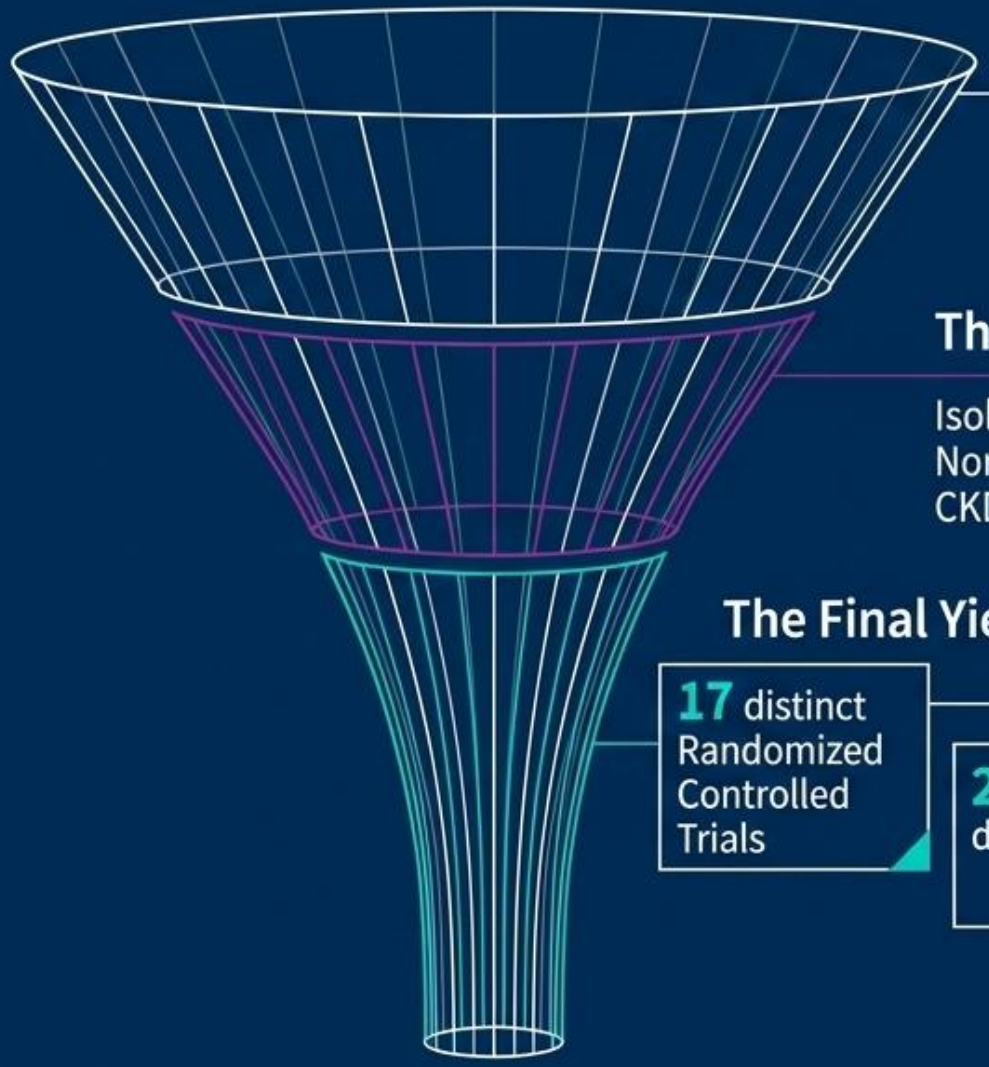
Distilling 17 RCTs to resolve the clinical controversy surrounding Low and Very Low Protein Diets for delaying End-Stage Kidney Disease (ESKD).

Source Material	Target Population	Core Question
Cochrane Database of Systematic Reviews 2018 (Hahn D, Hodson EM, Fouque D).	Non-diabetic adults with Chronic Kidney Disease (Stages 3 to 5).	Does dietary protein restriction effectively slow GFR decline and delay the need for dialysis without compromising nutritional safety?

The Dosage Spectrum: Defining Protein Restriction



The Evidence Funnel: Distilling the Global Data



The Global Search

Extensive database sweeps (CENTRAL, MEDLINE, EMBASE, ICTRP) for RCTs of protein restriction lasting ≥ 12 months.

The Clinical Filter

Isolating strict criteria:
Non-diabetic adults only.
CKD Stages 3 to 5 (not yet on dialysis).

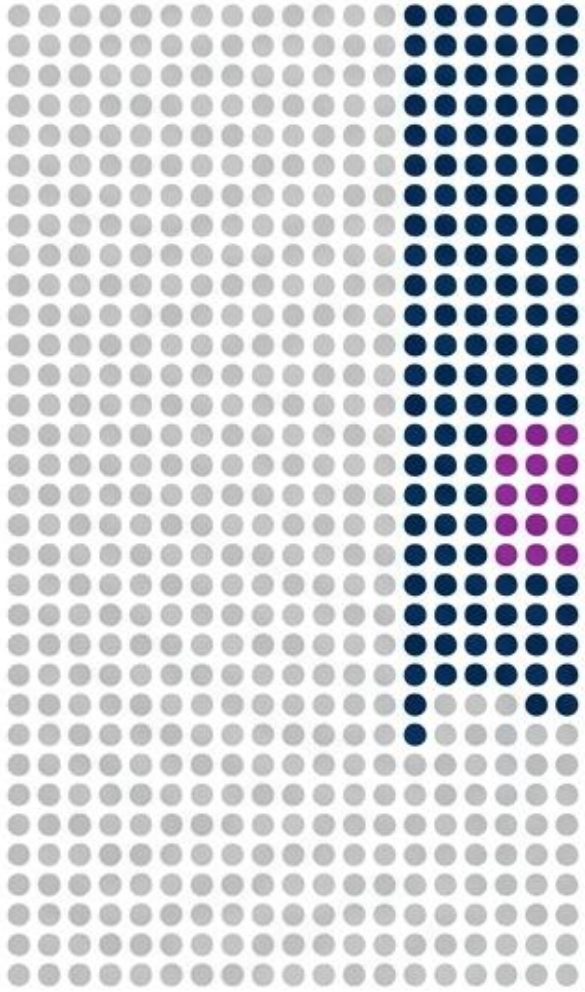
The Final Yield

- **17** distinct Randomized Controlled Trials
- **21** separate data sets
- **2,996** total analyzed participants
- Follow-up durations: 12 to 50 months

Risk of Bias Assessment

All studies assessed at low risk for detection bias regarding GFR (laboratory outcome), outcome), but high risk for performance bias (open-label dietary interventions).

The Reality of Low Protein Diets: Little to No Difference



ESKD Outcome

144/1000 reached ESKD on NPD. On LPD, an estimated **151/1000** reached ESKD.

7 MORE patients per 1,000 reached ESKD (Risk Ratio 1.05)

Key Metrics Panel

ESKD Progression:
RR 1.05 (0.73 to 1.53)
— Low Certainty Evidence (⊕⊕⊖⊖)

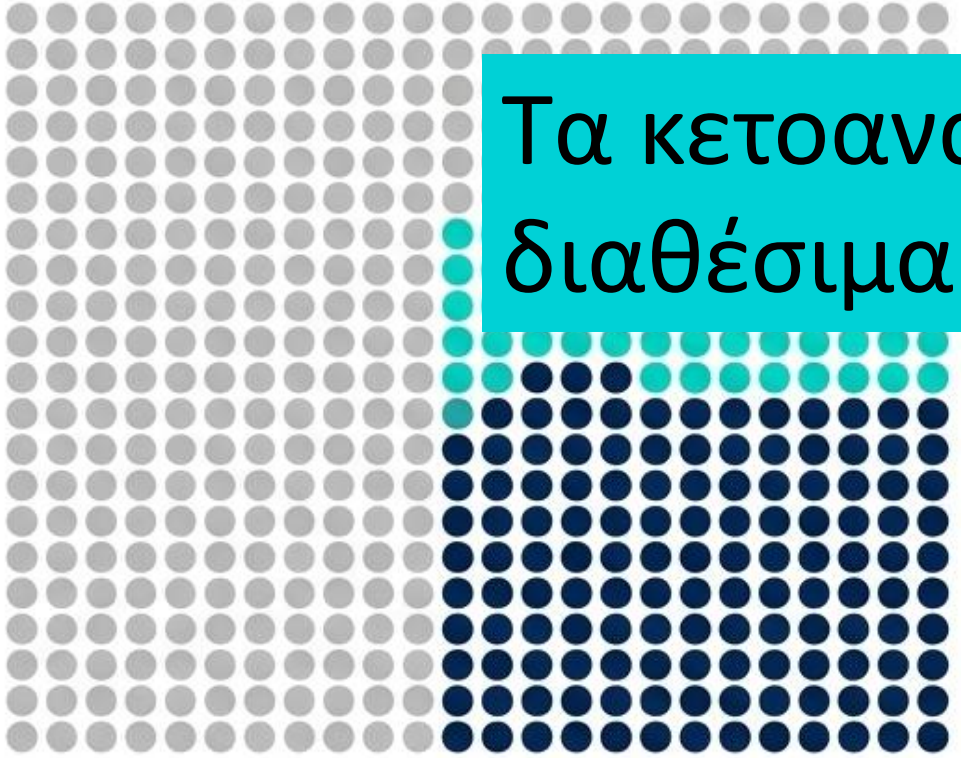
Death (All Causes):
13 fewer deaths per 1,000 (RR 0.77)
— Moderate Certainty (⊕⊕⊕⊖)

GFR Change:
Standardized Mean Difference -0.18
— Very Low Certainty (⊕⊖⊖⊕)

Bottom Line: Restricting intake to 0.5-0.6 g/kg/d fails to definitively delay the need for dialysis.

The Breakthrough: Very Low Protein Diets Delay ESKD

"1000 Patients" Dot Array



Τα κετοανάλογα δεν είναι διαθέσιμα στην Ελλάδα

165 FEWER

patients per 1,000 progressed to dialysis (Risk Ratio 0.64).

Key Metrics Panel

ession:
9 to 0.85) — Moderate
dence (⊕⊕⊕⊖)

auses):
10 more deaths per 1,000 (RR 1.26) — Moderate Certainty (⊕⊕⊕⊖)

GFR Change:
Standardized Mean Difference 0.12 — Low Certainty (⊕⊕⊖⊖)

Bottom Line: Dropping protein **intake to 0.3-0.4 g/kg/d** (with keto-analogues) **significantly reduces the number of patients progressing to** End-Stage Kidney Disease.

Δίαιτες χαμηλές σε πρωτεΐνη

Προσοχή

Επαρκής ενέργεια για να διασφαλίζεται η καλή διατροφική κατάσταση του ασθενούς!

Είναι ενδεδειγμένη η δίαιτα χαμηλής πρωτεΐνης;

Ναι σε συγκεκριμένους ασθενείς με ΧΝΝ

- Αν δεν υπάρχει **PEW**
- **Αν ο ασθενής δεν είναι βαρέως πάσχων**
- **Αν δεν έχει ο ασθενής PEW στους επανελέγχους (παρακολούθηση από εξειδικευμένους διαιτολόγους)**
- **Αν εξασφαλίζεται η επαρκής ενεργειακή πρόσληψη**

ΧΝΝ και ηλικιωμένοι

- **Διάγνωση δυσθρεψίας ή PEW**
- **ΧΝΝ πρώιμων σταδίων (π.χ. Σταδίου 3a-3b)**
- **Σταθερή ή αργή εξέλιξη της ΧΝΝ**
- **Συννοσηρότητες και μικρό προσδόκιμο ζωής (π.χ. σε περίπτωση νεοπλασιών)**

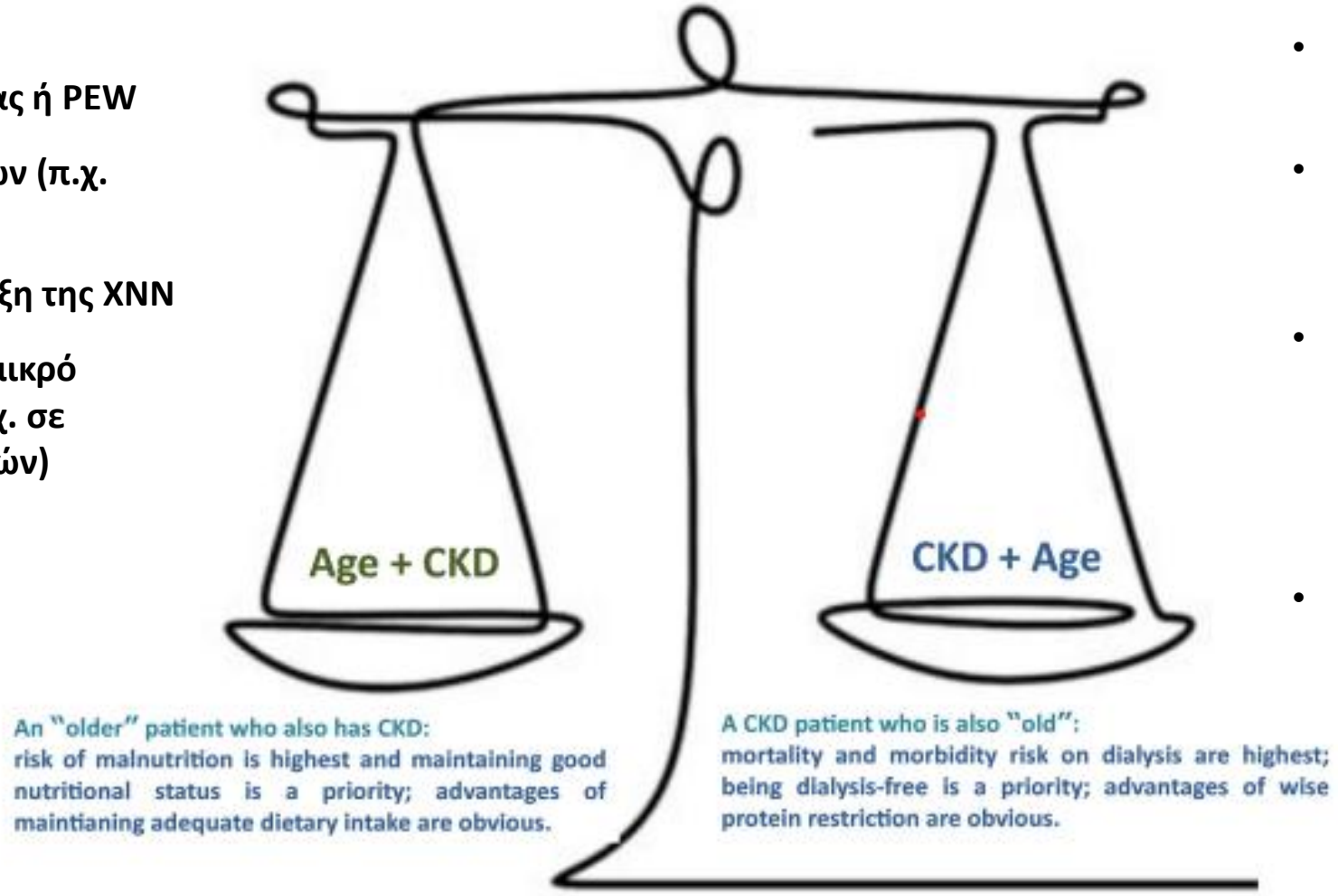
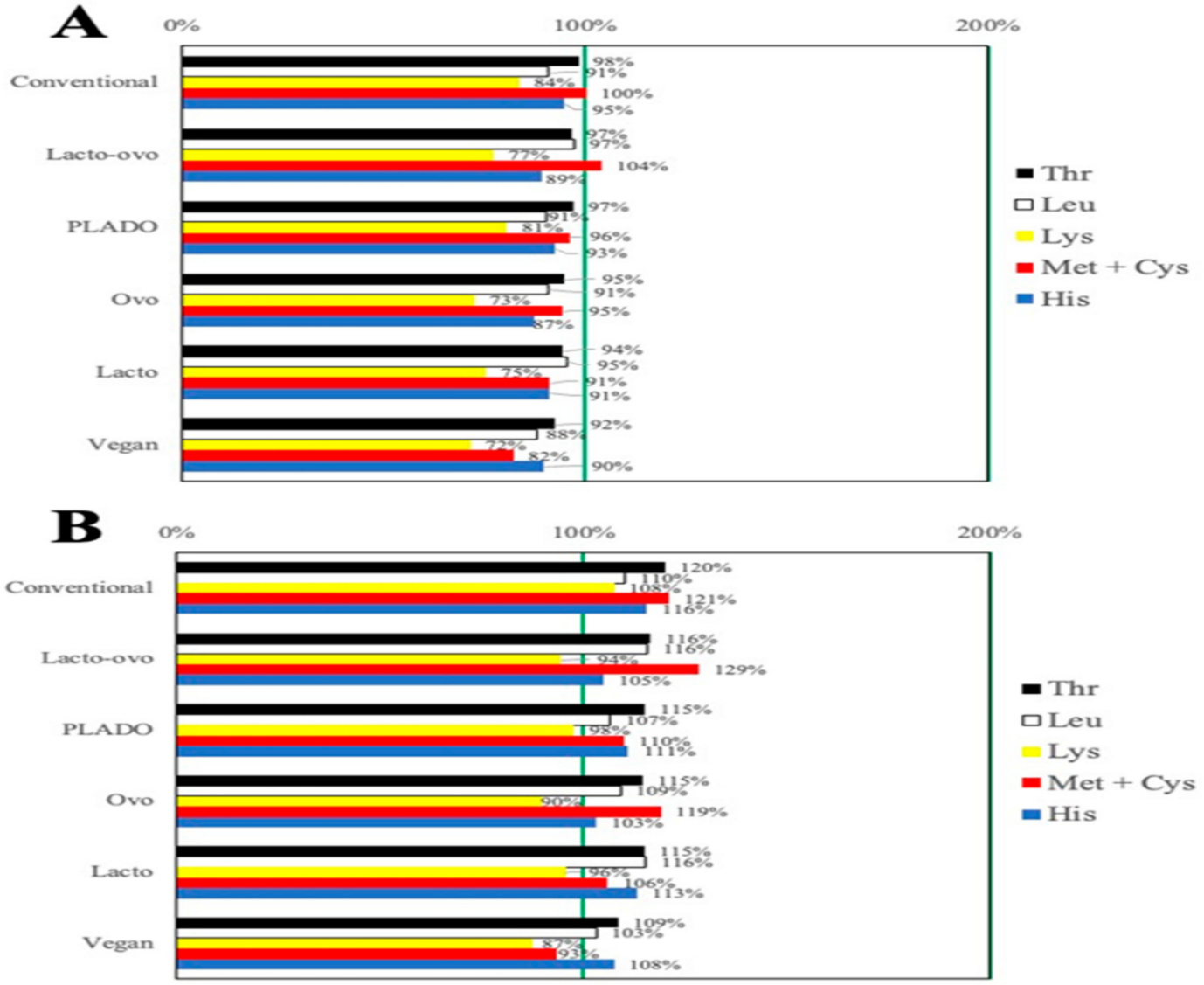


Fig. 2. Balancing age and CKD.

- **Προχωρημένη ΧΝΝ (π.χ. Στάδιο 4-5)**
- **Ταχεία εξέλιξη της ΧΝΝ ελλείψει αναγνωρισμένου αιτίου**
- **Συμπτώματα ουραιμικής συνδρομής σχετιζόμενα με την απόφαση καθυστέρησης ένταξης σε αιμοκάθαρση**
- **Καλή διατροφική κατάσταση**

Clinical Nutrition 42 (2023) 443-457

Διατροφική επάρκεια διαιτολογίων χαμηλής πρωτεΐνης



A: 0,5g/kg

B: 0,6 g/kg

Nutrients **2021**, *13*(10), 3341

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KDOQI CLINICAL PRACTICE GUIDELINE FOR NUTRITION IN CKD: 2020 UPDATE

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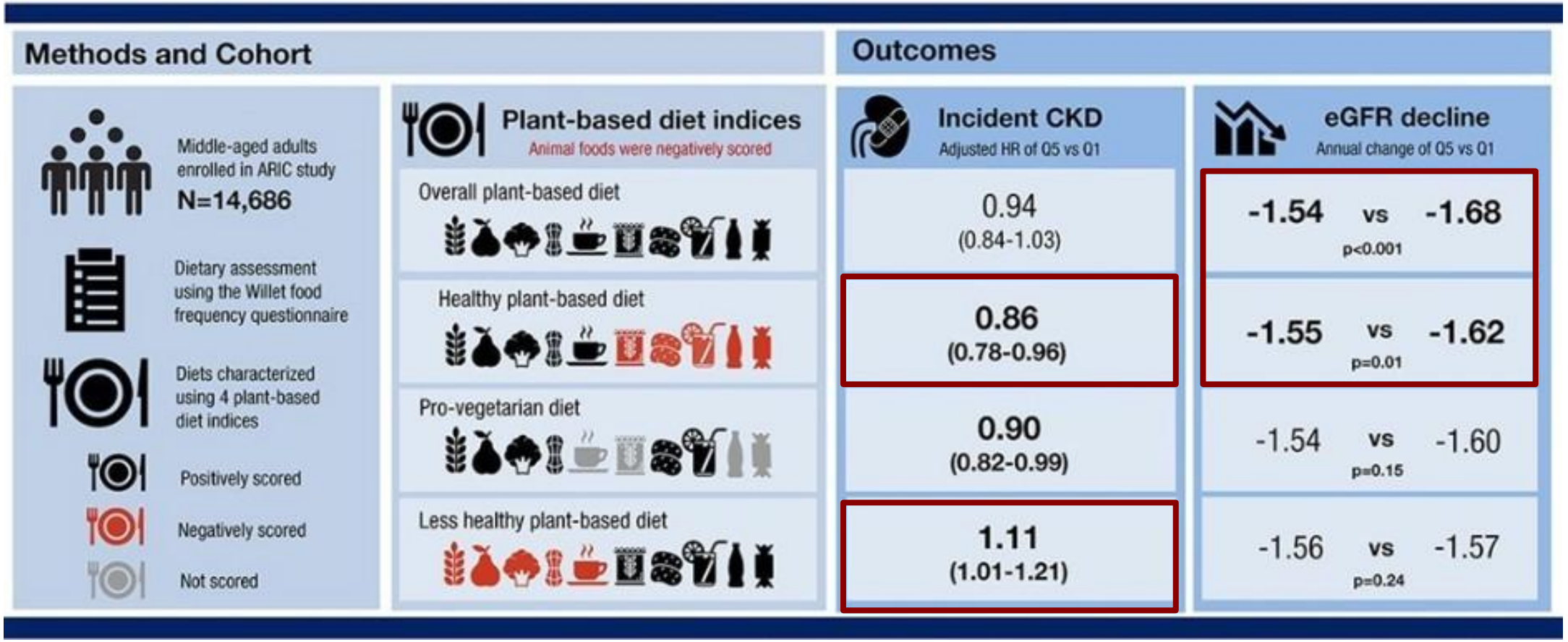
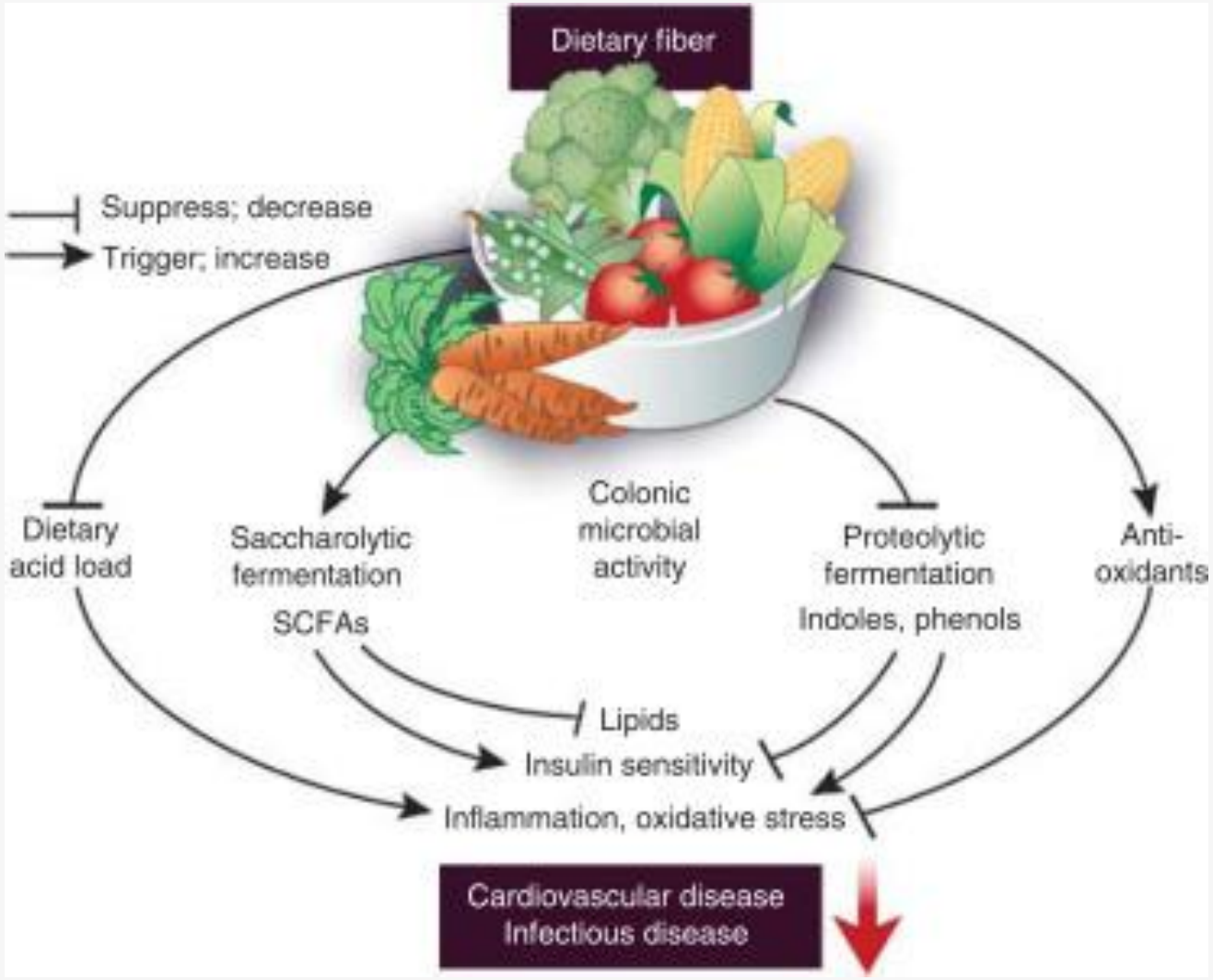
Δεν υπάρχει επισήμανση για τις πρωτεΐνες υψηλής βιολογικής αξίας

Δίαιτα βασισμένη σε φυτικά τρόφιμα



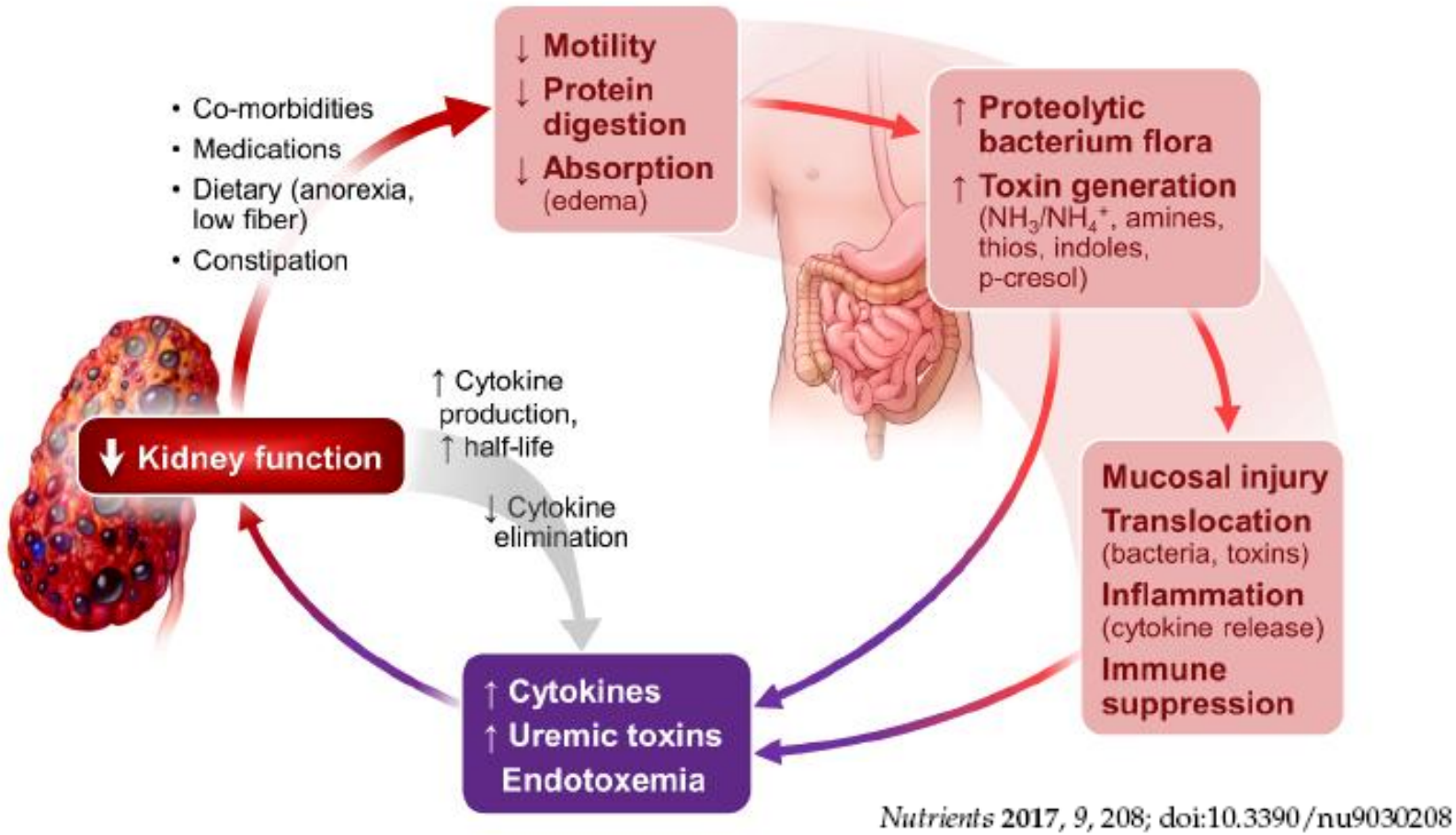
Kim H et al, Clin J Am Soc Nephrol 2019



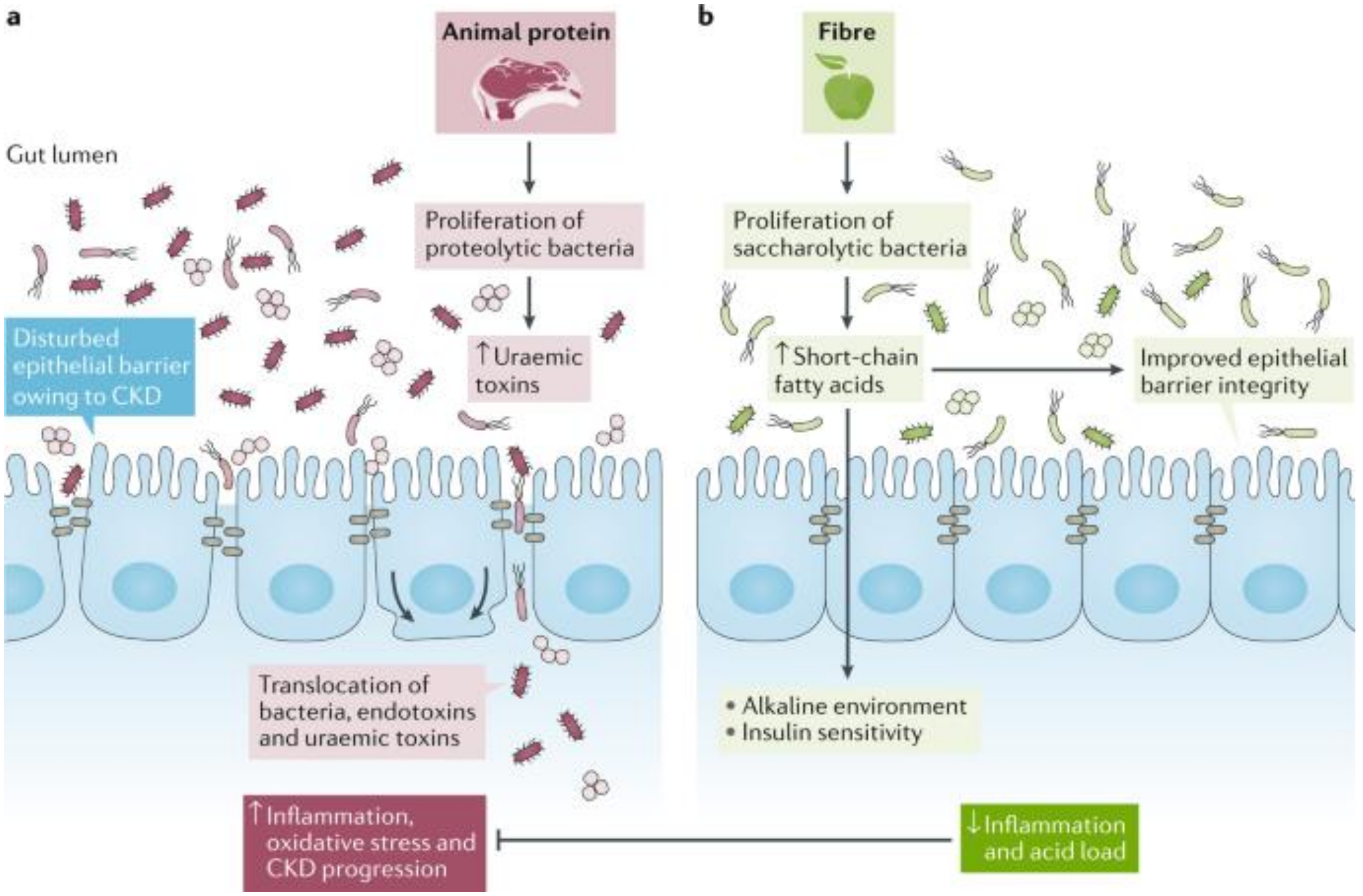
Διαιτητικές ίνες και καρδιαγγειακός κίνδυνος

- Evenepoel P, Meijers B. Dietary fiber and protein: nutritional therapy in chronic kidney disease and beyond Kidney International,2012; 81, 227-229

Φυτικές ίνες και ΧΝΝ

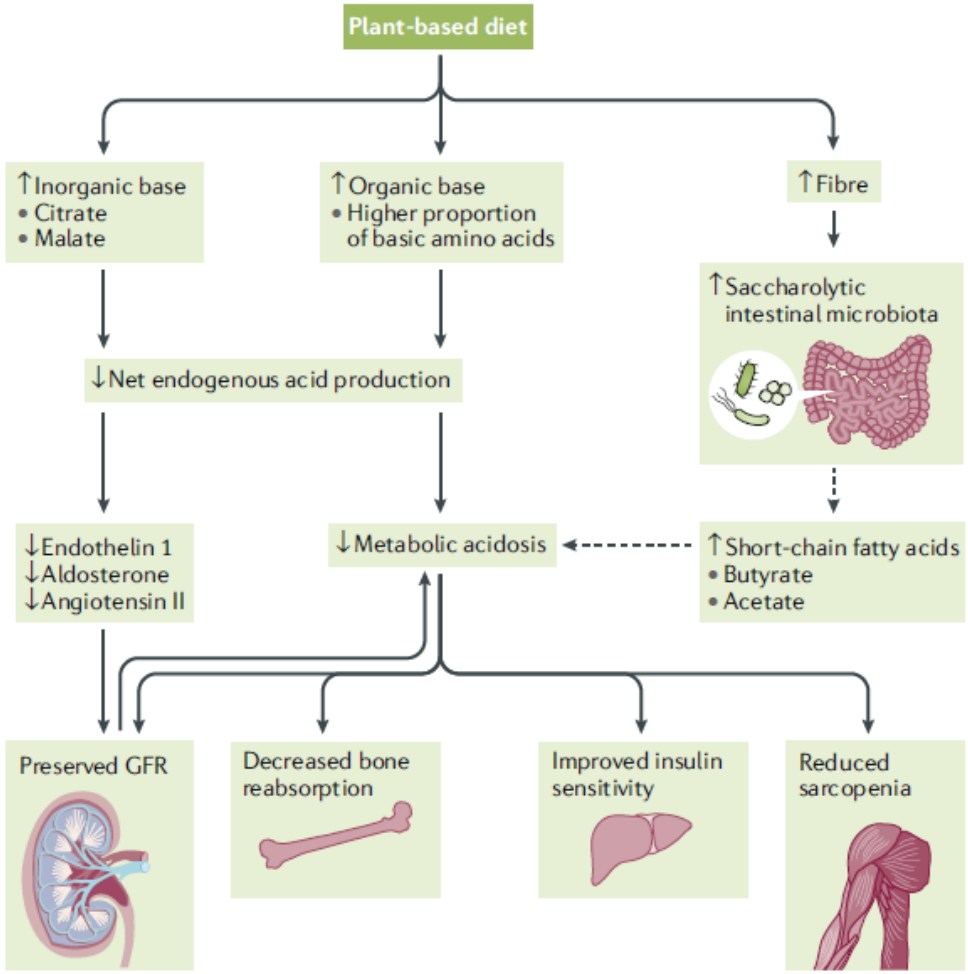


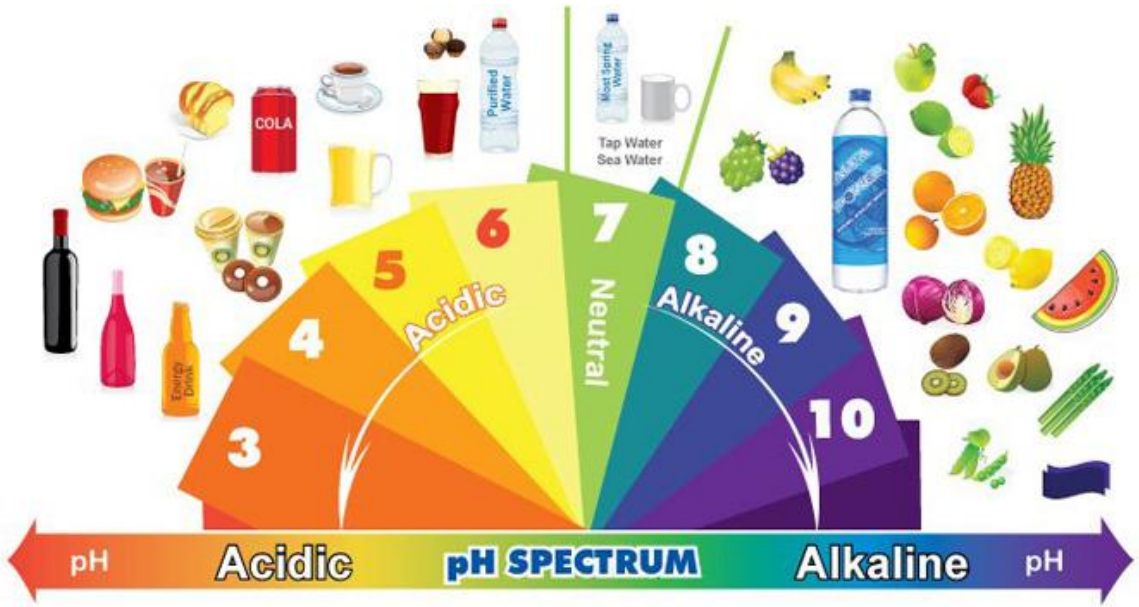
Nutrients **2017**, *9*, 208; doi:10.3390/nu9030208



Carrero, J.J., González-Ortiz, A., Avesani, C.M. et al. Plant-based diets to manage the risks and complications of chronic kidney disease. Nat Rev Nephrol 16, 525–542 (2020).

Φυτικές δίαιτες και οξεοβασική ισορροπία





Carrero, J.J., González-Ortiz, A., Avesani, C.M. et al. Plant-based diets to manage the risks and complications of chronic kidney disease. Nat Rev Nephrol 16, 525–542 (2020).

nutrients

MDPI

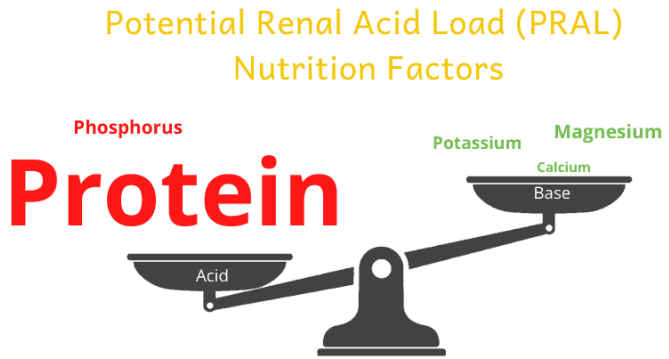
Article

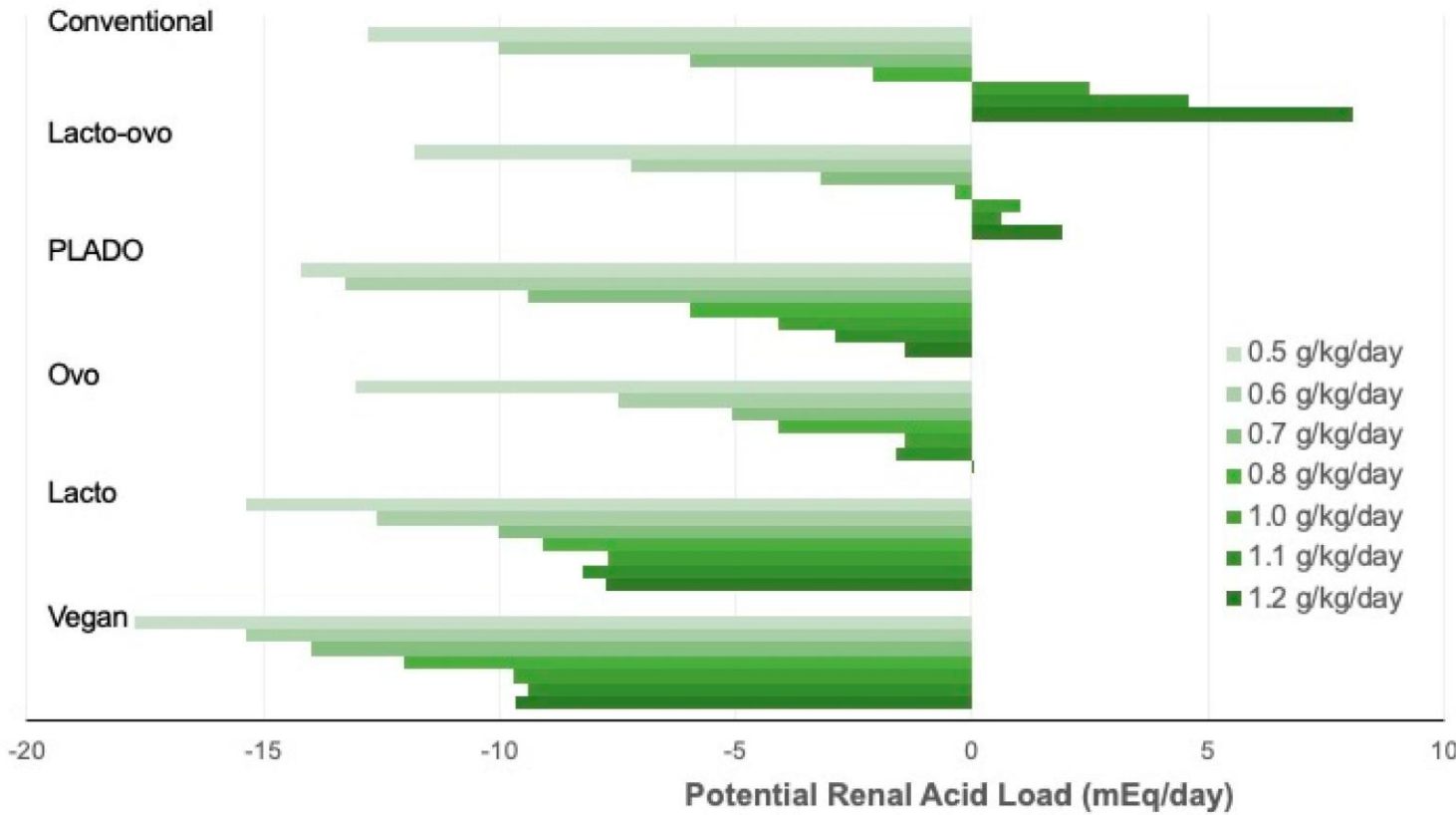
Nutritional Adequacy of Animal-Based and Plant-Based Asian Diets for Chronic Kidney Disease Patients: A Modeling Study

Ban-Hock Khor [1], Dina A. Tallman [2,3], Tilakavati Karupaiah [4], Pramod Khosla [2], Maria Chan [5] and Joel D. Kopple [6,7,*]

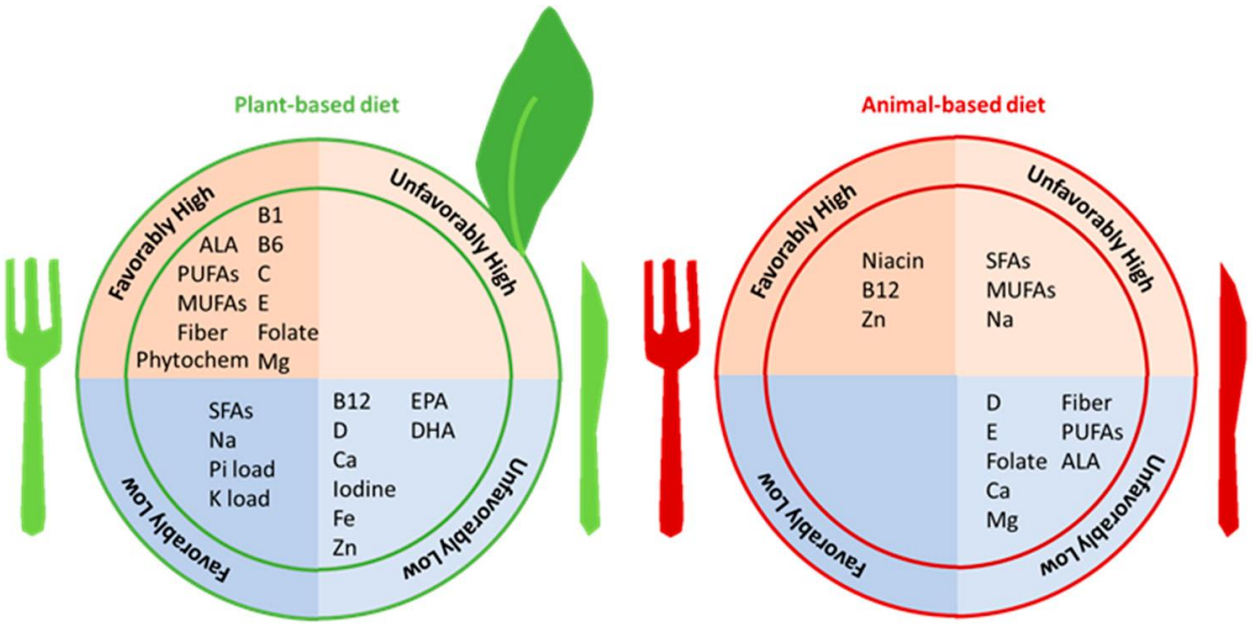
Δυνητικό νεφρικό όξινο φορτίο (Potential Renal Acid Load, PRAL)

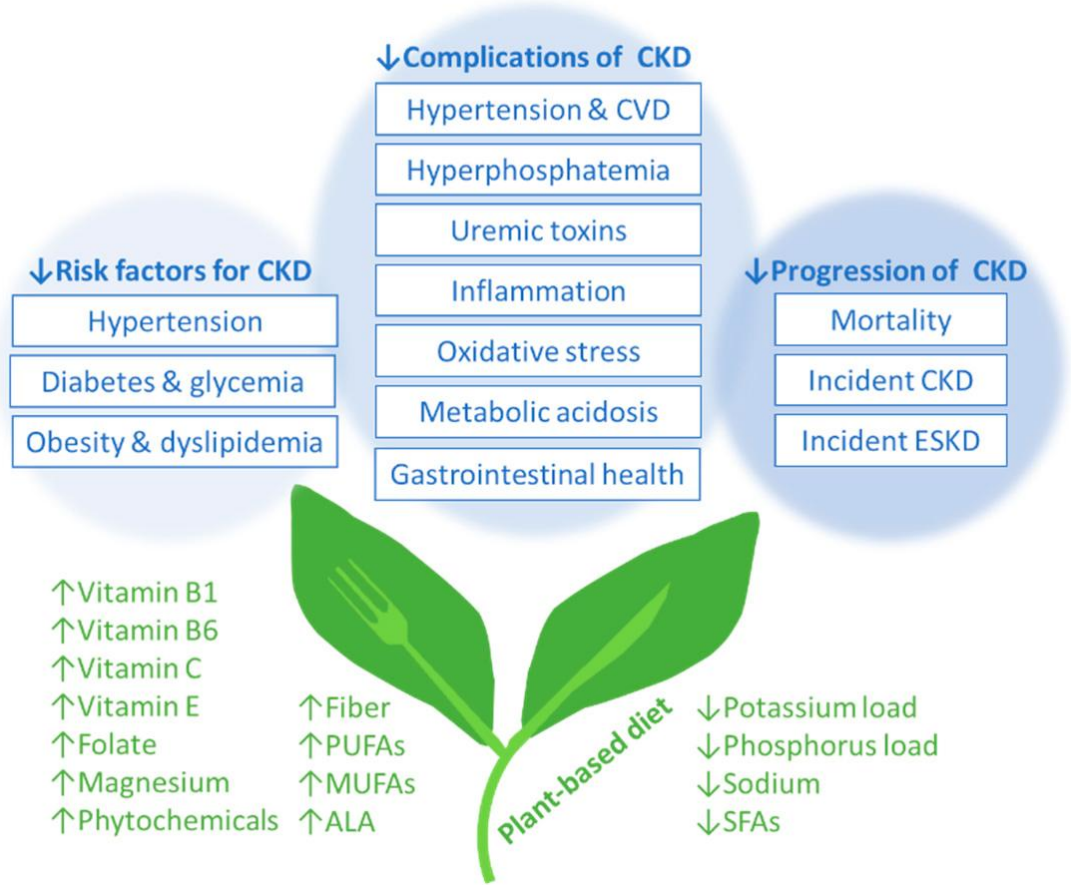
PRAL (mEq/d) = 0.49 Πρωτεΐνη (g/d) + 0.037 φώσφορος (mg/d) - 0.021 κάλιο (mg/d) - 0.026 μαγνήσιο (mg/d) - 0.013 ασβέστιο (mg/d)





Nutrients 2021, 13, 3341. https://doi.org/10.3390/nu13103341

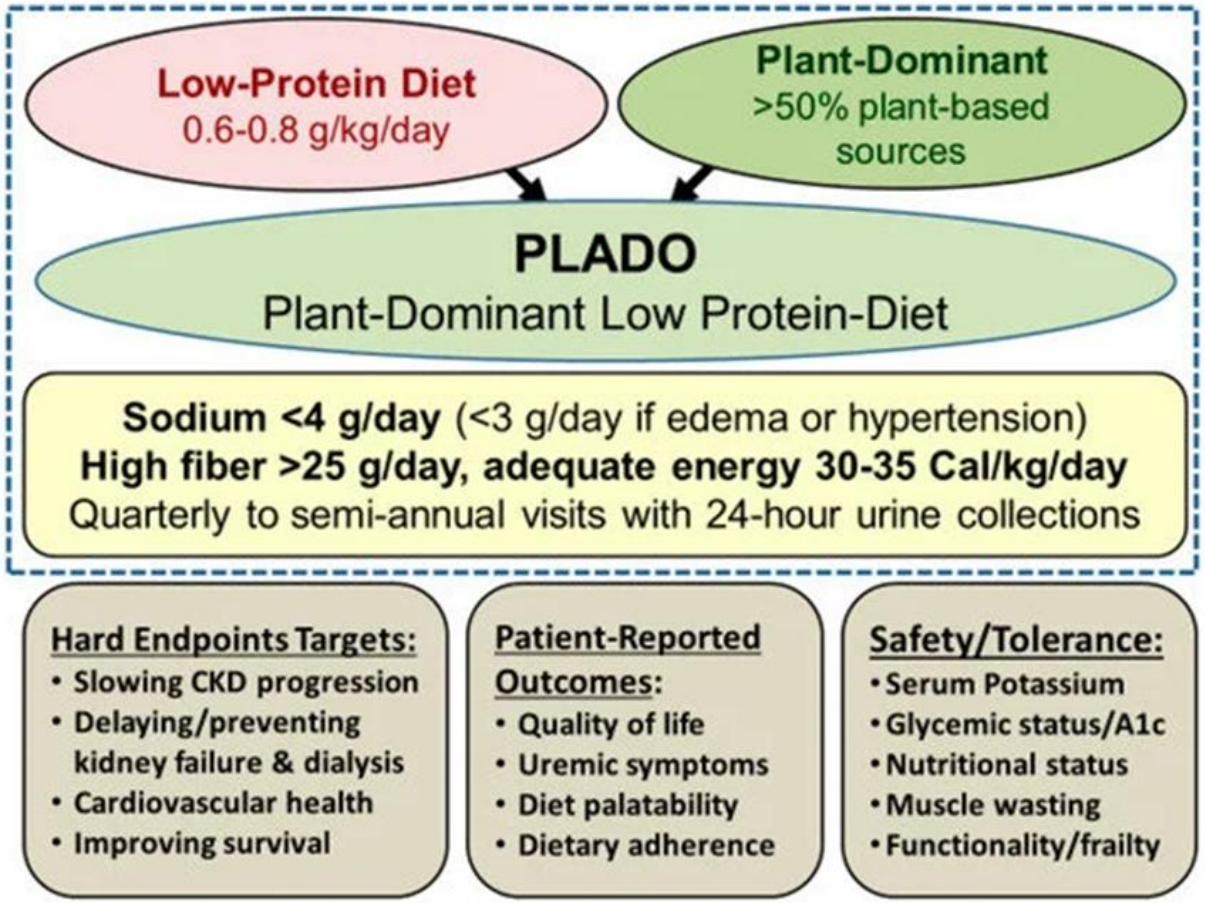




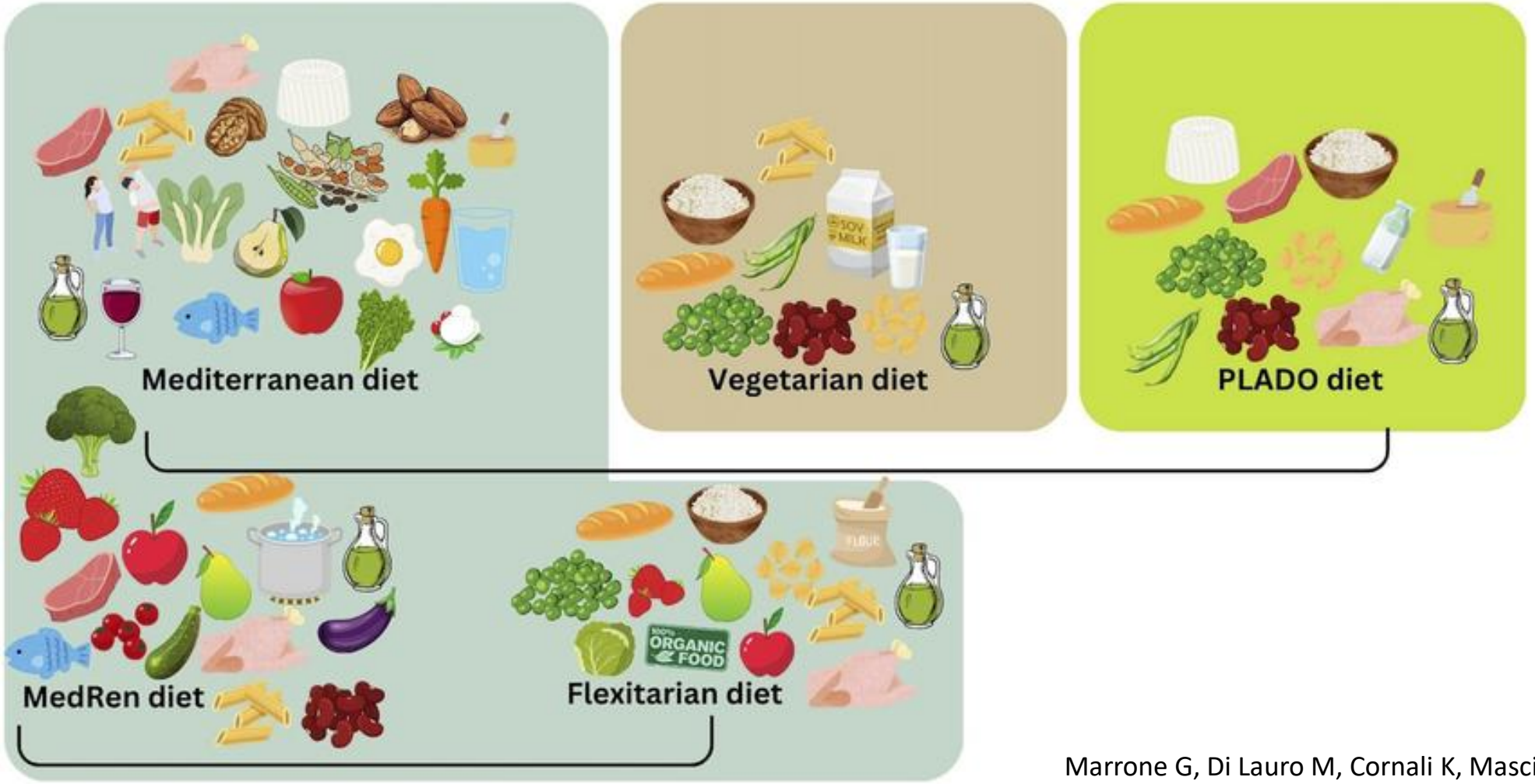
Plant based vs Animal Based diet

Nutrients **2024**, 16, 66. https://doi.org/10.3390/nu16010066

Δίαιτα βασισμένη σε φυτικά τρόφιμα χαμηλής πρωτεΐνης (Plant Dominant Low protein diet - PLADO



CKD Sustainable Nutritional Patterns



Marrone G, Di Lauro M, Cornali K, Masci C, Vanni G, Vita C and Noce A (2025) Sustainability and role of plant-based diets in chronic kidney disease prevention and treatment.
Front. Pharmacol. 16:1562409.
doi: 10.3389/fphar.2025.1562409

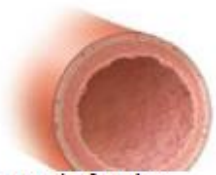
Δίαιτα χαμηλή σε νάτριο & θερμίδες

Η απώλεια βάρους ↓ **τη δραστηριότητα του ΣΝΣ**

Η απώλεια βάρους, η χαμηλή πρόσληψη νατρίου και η υγιεινή διατροφή ↓ **τη σκληρότητα των αρτηριών**

↓ **Α. Π.**

Η υγιεινή διατροφή **βελτιώνει τη νεφρική απέκκριση νατρίου**



Η απώλεια βάρους, η χαμηλή πρόσληψη νατρίου και η υγιεινή διατροφή **βελτιώνουν τη λειτουργικότητα των μικρών αγγείων και μειώνουν τις περιφερικές αντιστάσεις**

↓ **Σπλαγχνικού λίπους**

Sacks & Campos N Engl J Med 2010:362:2102-12.

Δίαιτα DASH

DASH Eating Plan—No. of Daily Servings for Different Calorie Levels

Food Groups	Servings/d		
	1600 Calories/d	2000 Calories/d	2600 Calories/d
Grains*	6	6-8	10-11
Vegetables	3-4	4-5	5-6
Fruits	4	4-5	5-6
Fat-free or low-fat milk and milk products	2-3	2-3	3
Lean meats, poultry, and fish	3-6	≤6	6
Nuts, seeds, and legumes	3/wk	4-5/wk	1
Fats and oils	2	2-3	3
Sweets and added sugars	0	≤5/wk	≤2

Μελέτη DASH

Moore T, et al. Hypertension 2001;38:155-8.

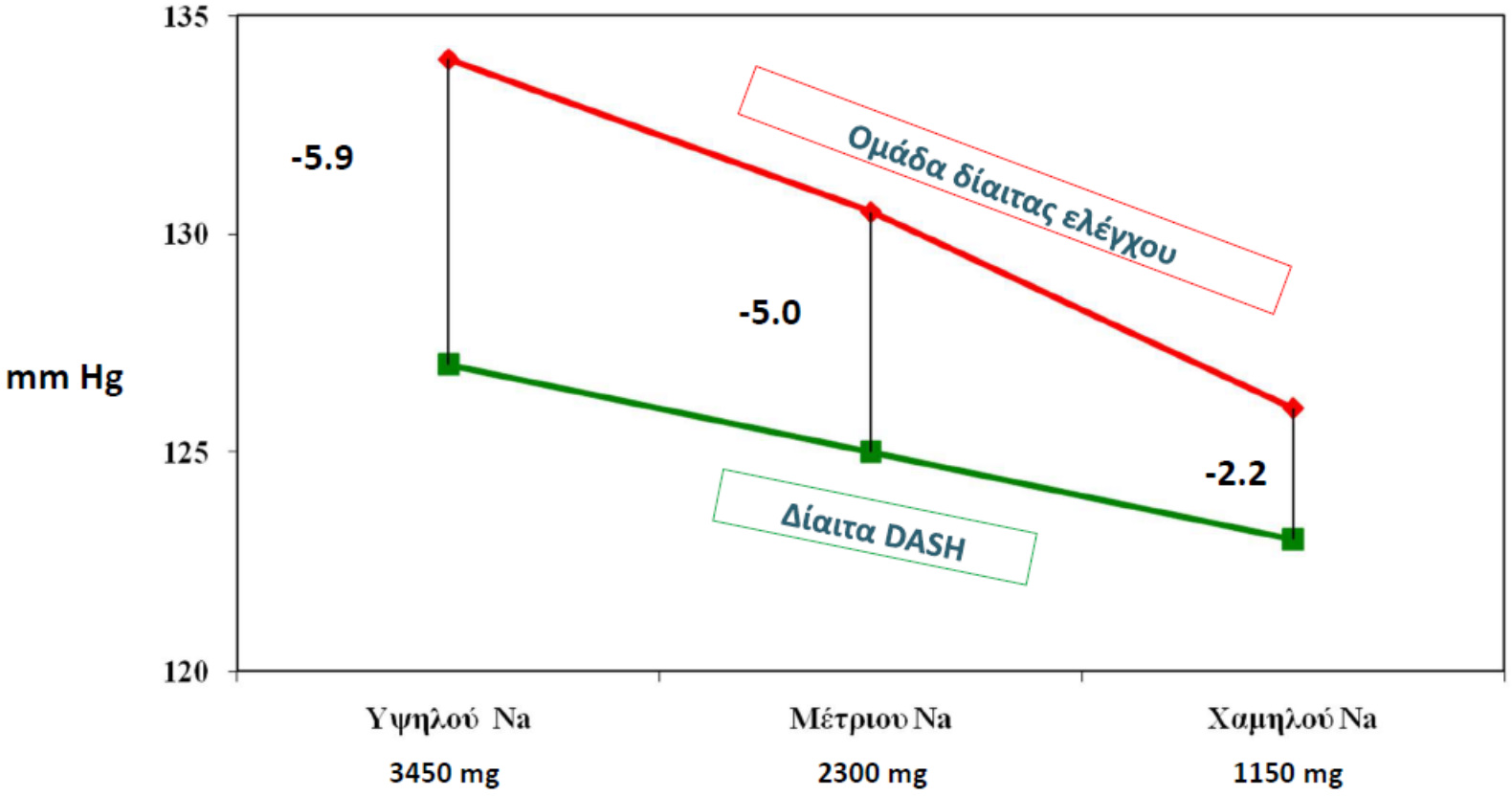
459 ενήλικες με ΣΑΠ <160 mmHg και ΔΑΠ 80 - 95mmHg, χωρίς φαρμακευτική αγωγή.

Στις 2100 θερμίδες

Table 1. Nutrient Goals and Food Group Distribution of DASH Diets*

	Control Diet	Fruits-and-Vegetables Diet	Combination Diet
Nutrient goal			
Fat, % kJ (% kcal)	37	37	27
Saturated fat	16	16	6
Protein, %kJ (% kcal)	15	15	18
Fiber, g/d	9	31	31
Cholesterol, mg	300	300	150
Potassium, mg/d	1700	4700	4700
Magnesium, mg/d	165	500	500
Calcium, mg/d	450	450	1240
Sodium, mg/d	3000	3000	3000
Food group distribution, servings/day			
Fruits and juices	1.6	5.2	5.2
Vegetables	2.0	3.3	4.4
Low-fat dairy	0.1	0.0	2.0
Regular fat dairy	0.4	0.3	0.7
Meats, fish, fowl	2.5	2.5	1.6

Αλλαγές στην ΣΑΠ ανάλογα με την πρόσληψη νατρίου στη μελέτη DASH



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

The Effect of the Mediterranean Diet on Hypertension: A Systematic Review and Meta-Analysis

Mariela Nissensohn, PhD[1,2]; Blanca Román-Viñas, MD, PhD[2,3,4]; Almudena Sánchez-Villegas, PhD[1,2]; Suzanne Piscopo, PhD[5]; Lluis Serra-Majem, MD, PhD[1,2]

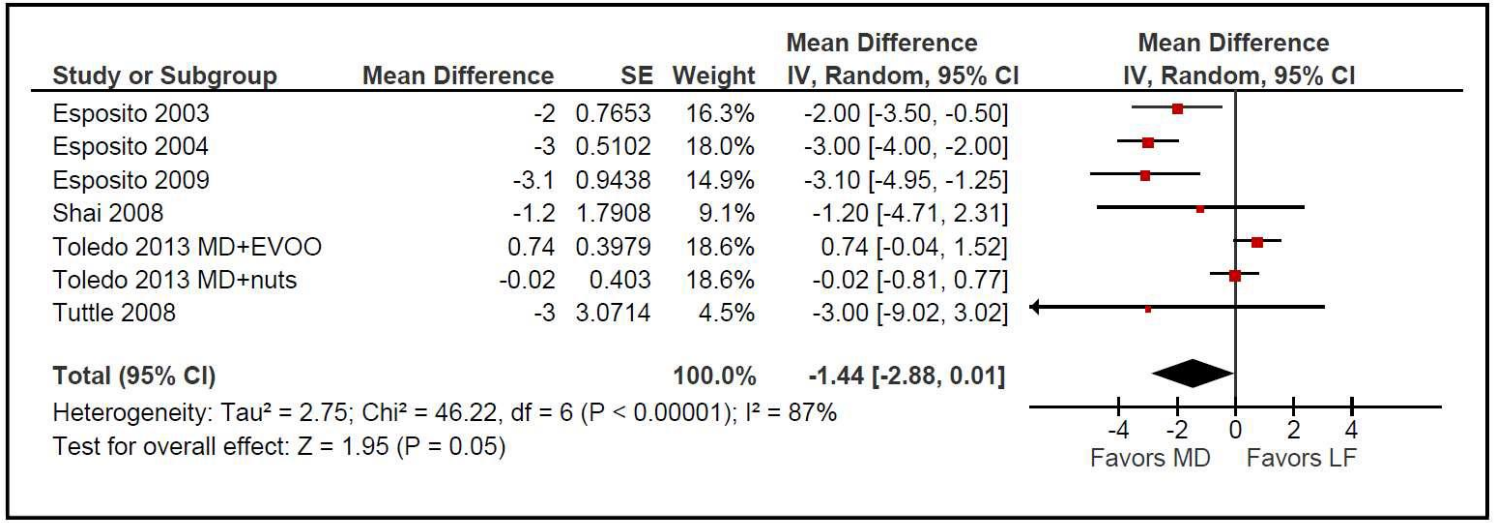


Figure 2. Systolic blood pressure Forest plot. CI indicates confidence interval; EVOO, extra virgin olive oil; LF, low fat; MD, Mediterranean diet.

J Nutr Educ Behav. 2016 Jan;48(1):42-53.e1.

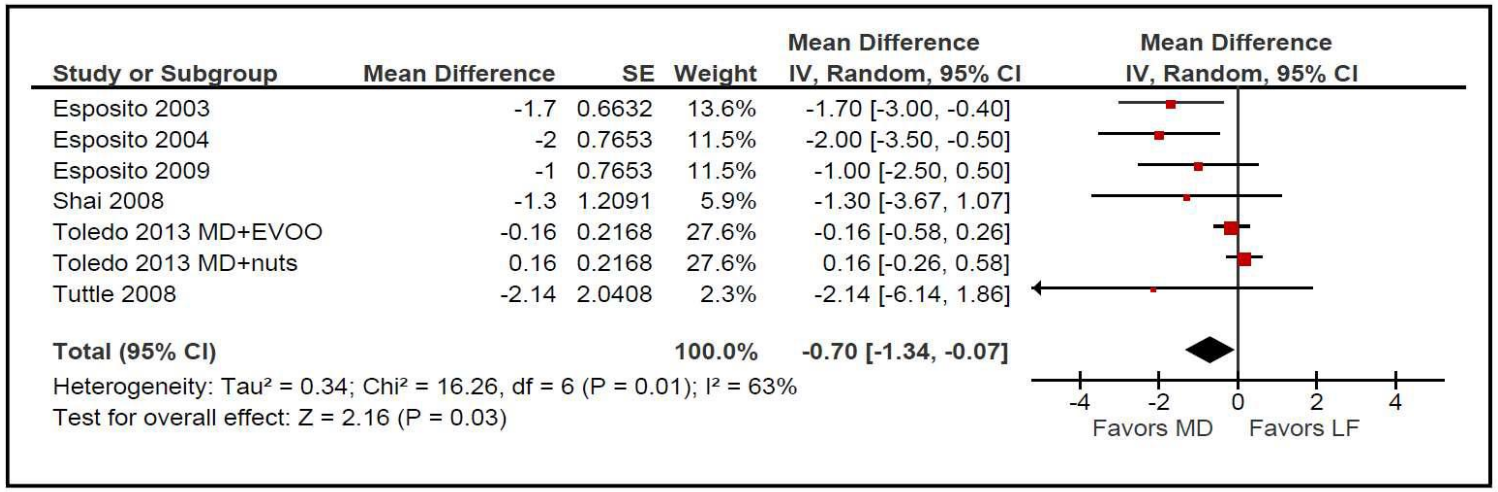
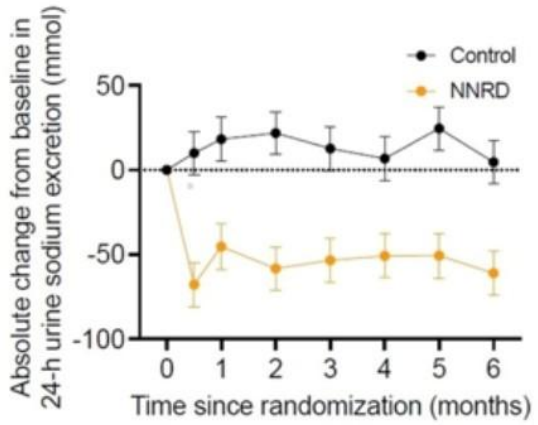
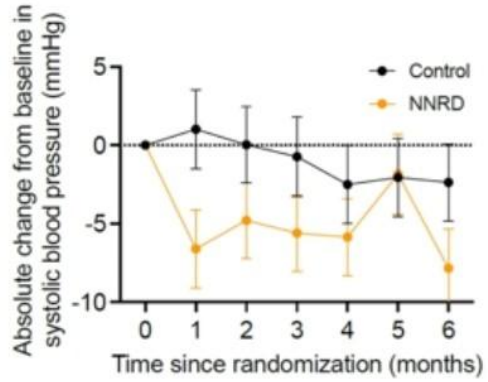


Figure 3. Diastolic blood pressure Forest plot. CI indicates confidence interval; EVOO, extra virgin olive oil; LF, low fat; MD, Mediterranean diet.

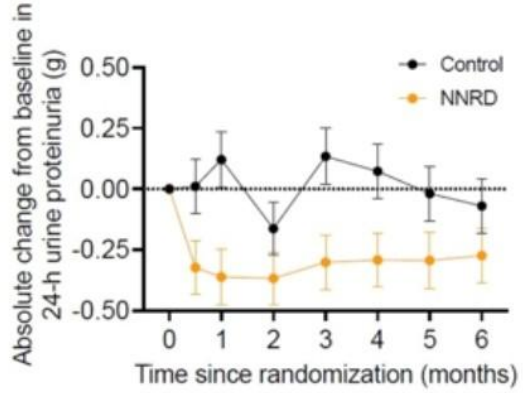
New Nordic Renal Nutrition Diet XNN σταδίου 3 και 4, RCT-26 εβδ (n:60) 80% plant-based diet, 20% animal-based diet



↓ Sodium intake



Improvement SBP



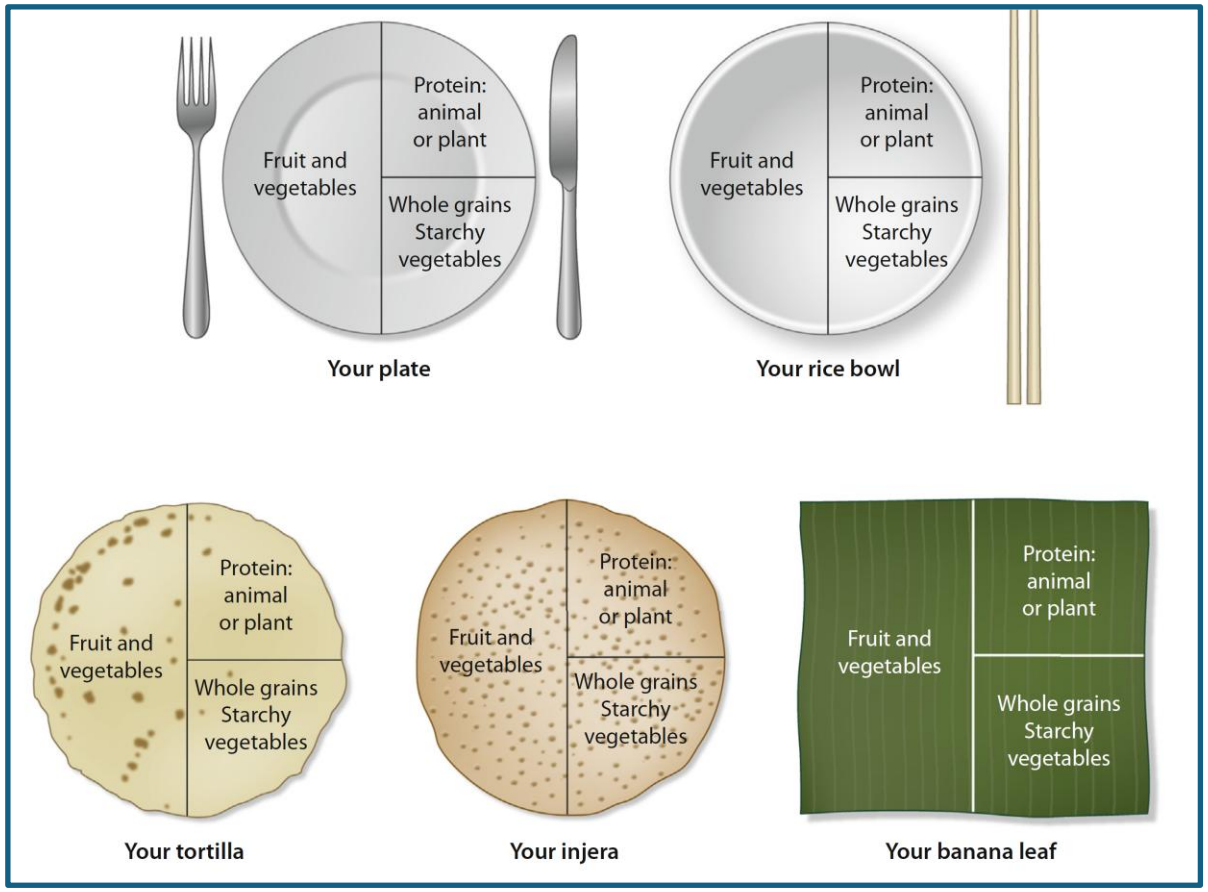
↓ Proteinuria

Other metabolic benefits:

- No significant change in potassium serum levels
- ↓ Serum urea
- ↓ HbA1c
- ↑ Serum Albumin
- Improved acid-base markers

Hansen et al, Am J Clin Nutr 2023

KDIGO 2020 CLINICAL PRACTICE GUIDELINE FOR DIABETES MANAGEMENT IN CHRONIC KIDNEY DISEASE



Animal proteins

Meat, poultry, fish, seafood, eggs:
28 g (1 oz) = 6–8 g protein
1 egg = 6–8 g protein

Dairy, milk, yogurt, cheese:
250 ml (8 oz) = 8–10 g protein
28 g (1 oz) cheese = 6–8 g protein

Plant proteins

Legumes, dried beans, nuts, seeds:
100 g (0.5 cup) cooked = 7–10 g protein

Whole grains, cereals:
100 g (0.5 cup) cooked = 3–6 g protein

Starchy vegetables, breads:
2–4 g protein

Η επιλογή της ποσότητας πρωτεϊνών της δίαιτας πρέπει να εξατομικεύεται αναλόγως:

- Της κατάστασης βάρους
- Του γλυκαιμικού ελέγχου.
- Του σταδίου της ΧΝΝ.
- Του κινδύνου ή της παρουσίας δυσθρεψίας/σαρκοπενίας.
- Της ηλικίας και του προσδόκιμου επιβίωσης.

Clinical Practice Guideline for Diabetes Management in Chronic Kidney Disease

LIFESTYLE INTERVENTIONS IN PATIENTS WITH DIABETES & CKD

RECOMMENDATION

- ★ We suggest maintaining a protein intake of 0.8 g protein/kg (weight)/day for those with diabetes and CKD not treated with dialysis **2C**
- ★ We suggest that sodium intake be <2 g of sodium/day (< 5 g of sodium chloride/day) in patients with diabetes and CKD **2C**
- ★ We recommend that patients with diabetes and CKD be advised to undertake moderate-intensity physical activity for a cumulative duration of at least 150 minutes/week, or to a level compatible with their cardiovascular and physical tolerance **1D**
- ★ We recommend advising patients with diabetes and CKD who use tobacco to quit using tobacco products **1D**

NUTRITION INTAKE

Encourage a **varied diet** high in vegetables, fruits, whole grains, fiber, legumes, plant-based proteins, unsaturated fats, and nuts

Reduce intake of processed meats, refined carbohydrates, and sweetened beverages

Aim for **1.0 – 1.2 g protein/kg/day** in patients treated with **hemodialysis**, and particularly **peritoneal dialysis**

Shared decision-making should be a cornerstone of patient-centered nutrition management. Accredited nutrition providers, registered dietitians and diabetes educators, community health workers, peer counselors, or other health workers should be engaged in the multidisciplinary nutrition care of patients with diabetes and CKD

Health care providers should consider cultural differences, food intolerances, variations in food resources, cooking skills, comorbidities, and cost when recommending dietary options to patients and their families.

PHYSICAL ACTIVITY

Recommendations for physical activity should consider **age, ethnic background, presence of other comorbidities, and access to resources**

Advise patients to **avoid sedentary behavior**

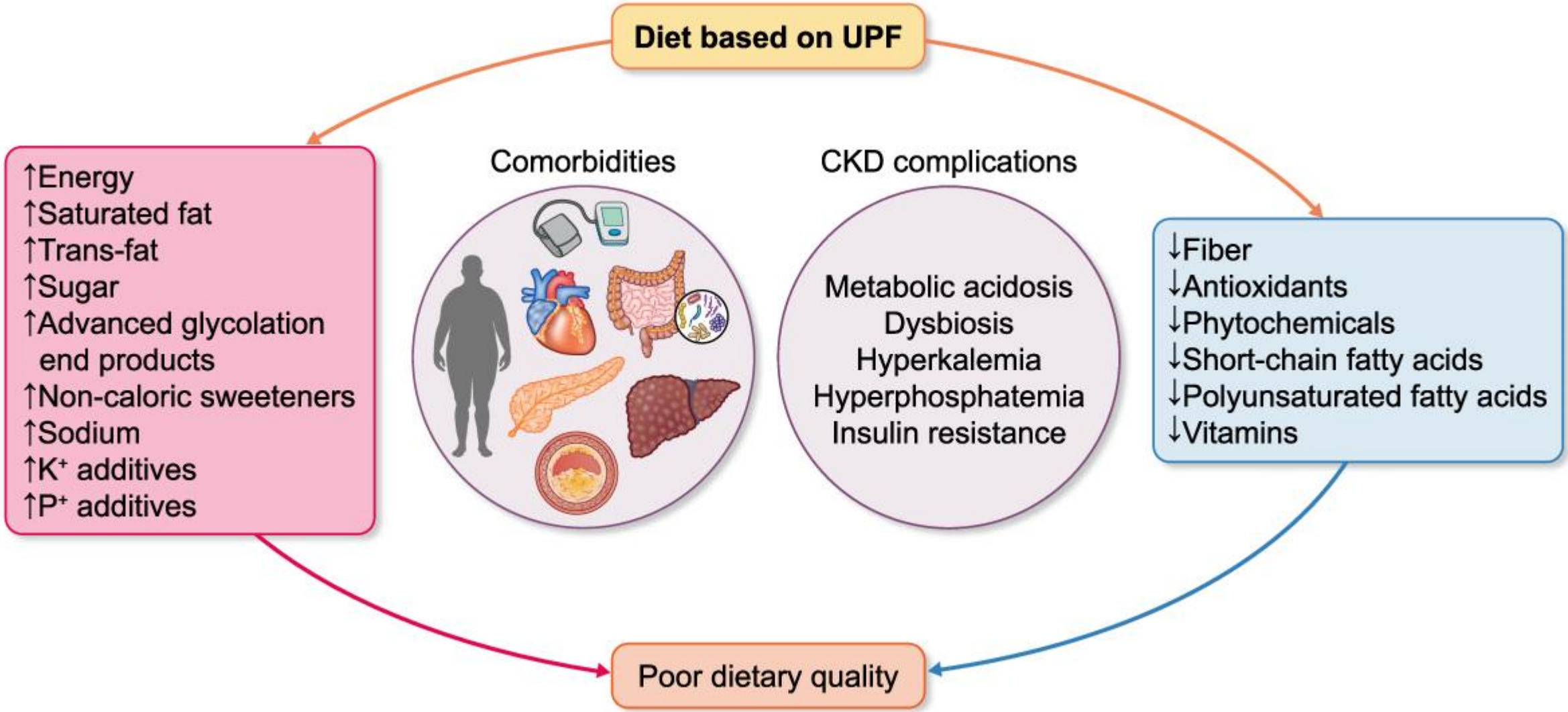
Tailor advice on intensity of physical activity and type of exercises for patients at higher risk of falls

Encourage patients with obesity, diabetes, and CKD to **lose weight,** particularly if eGFR ≥30 ml/min/1.73 m²

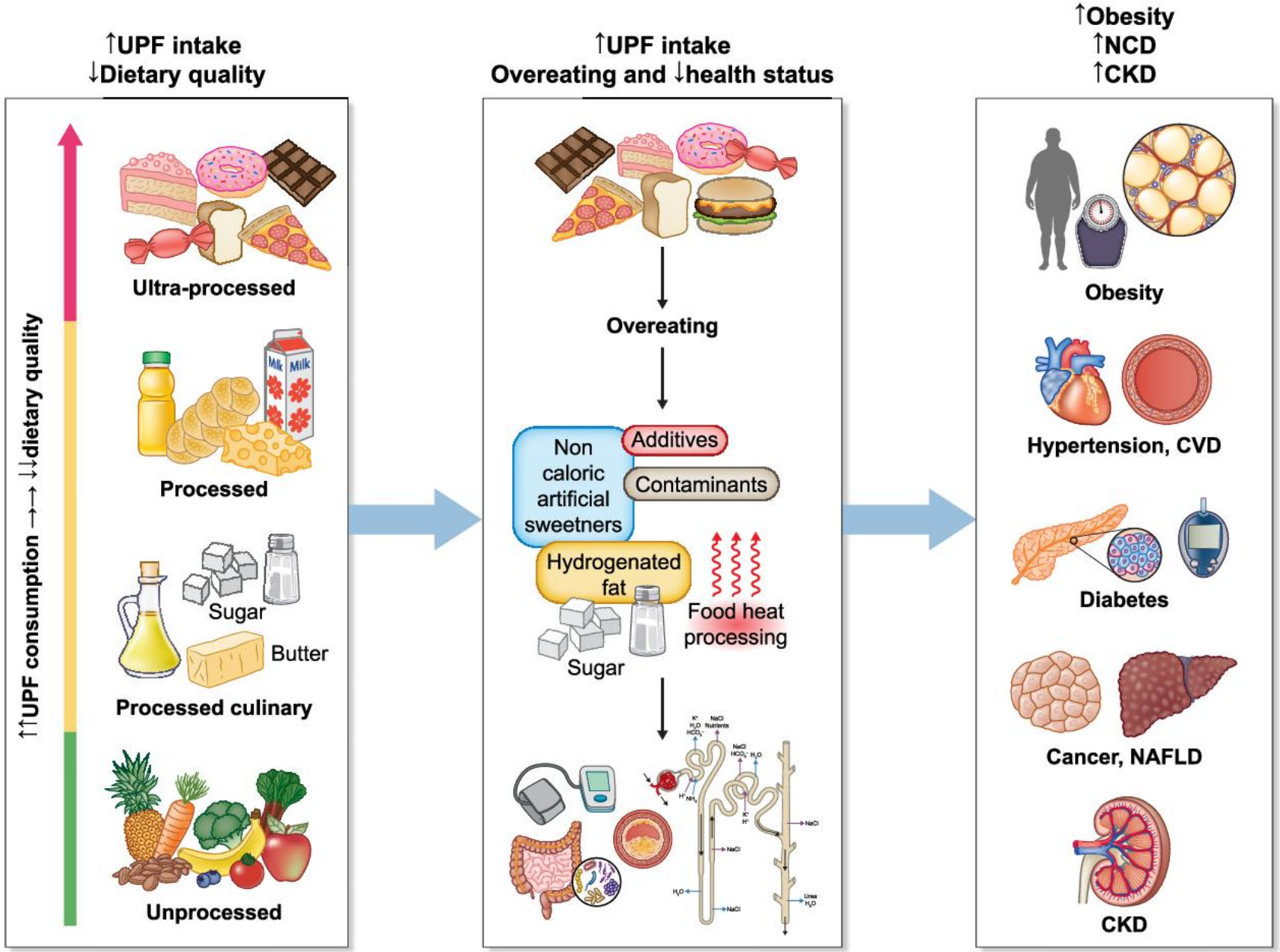
Developed with support from Novo Nordisk

Original infographic by Dr Michelle Lim @whatsthegfr

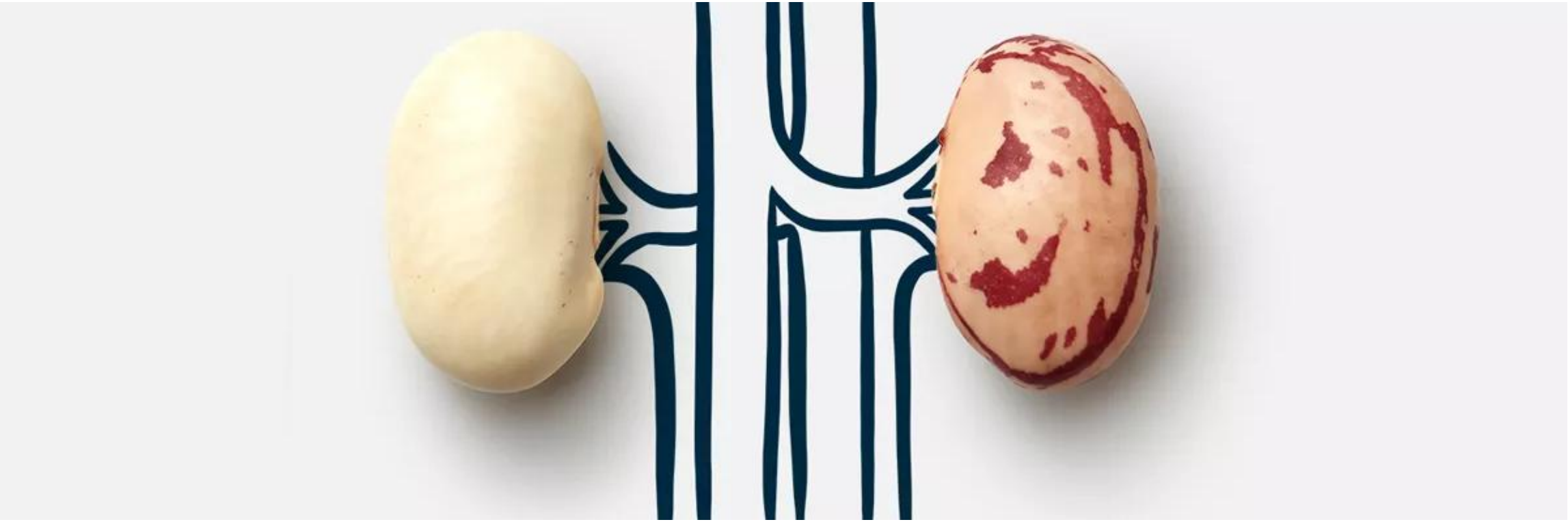
Πως μεταφράζονται αυτά σε τρόφιμα?



Avesani et al, Clinical Kidney Journal 2023



Avesani et al, Clinical Kidney Journal 2023



Σας ευχαριστώ πολύ για την προσοχή σας!