Food additives containing potassium, phosphorus, and sodium in ultra-processed foods: Potential harms to individuals with chronic kidney disease

Valeria Cecchini, CLINTEC, Karolinska Institutet

Ultra-processed food according to the NOVA System

The NOVA food classification system

Unprocessed or minimally processed	Processed culinary ingredients	Processed foods	UPFs
• No processing or minimal processing techniques, such as fractioning, grinding, pasteurisation, etc.	• Obtained from Group 1 (pressing, extracting, etc) • Used to season and cook Group 1 foods	• Foods made by adding group 2 to group 1 • Additives are present to increase shelf-life	• Industrially manufactured products + additives for cosmetic functions • Addition of hydrogenated fat, dextrose, isolates.

Group 1

Group 2

Group 3

Group 4

Processing level

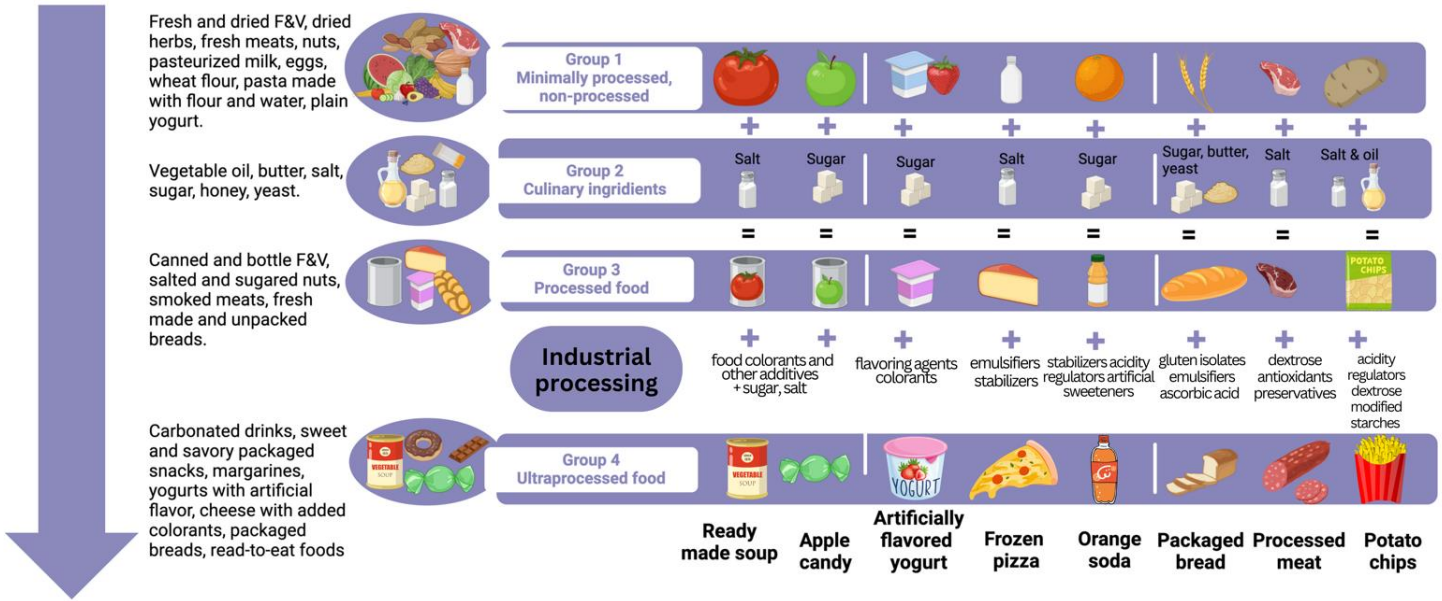
Diet quality

Food classification based on extent and purpose of industrial processing

Culinary preparations are not included in NOVA

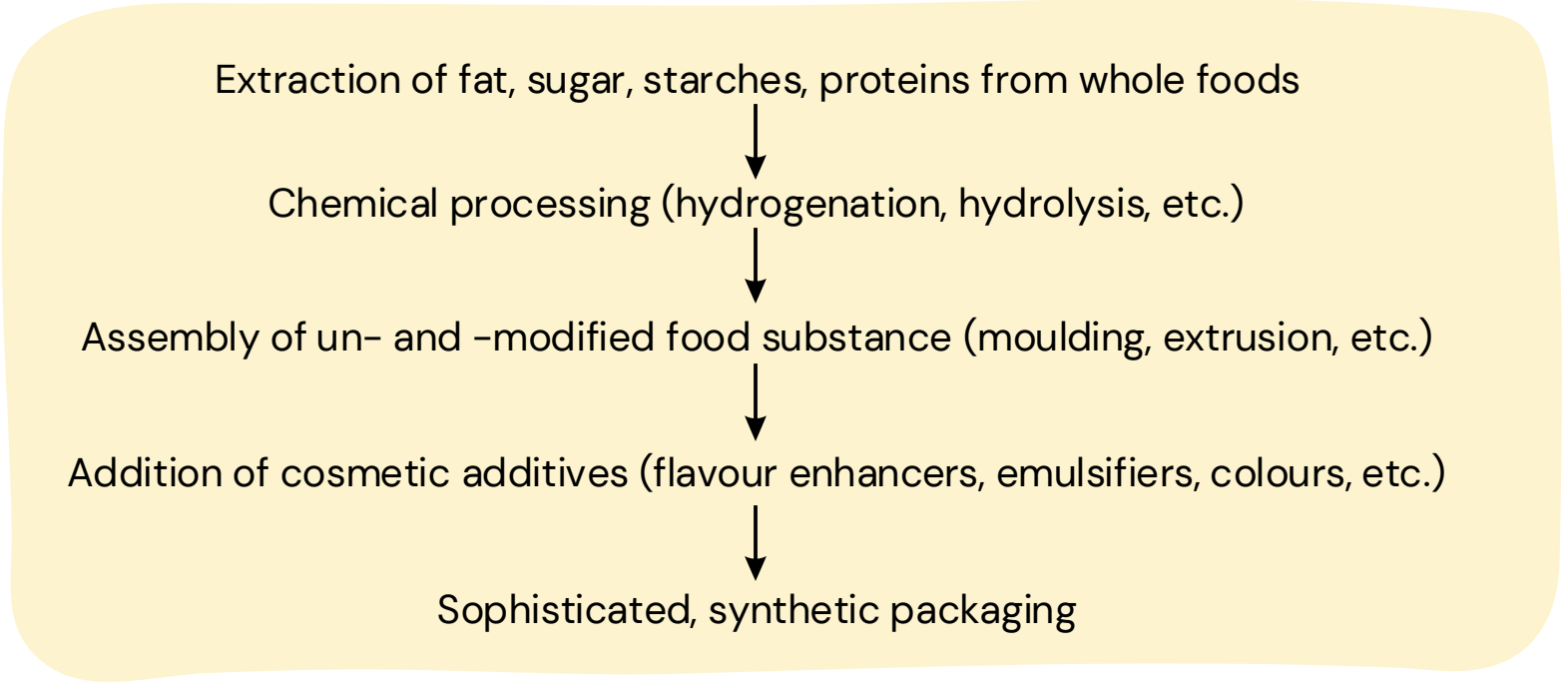
Monteiro CA et al, FAO;2019

The NOVA food classification system



Avesani CM, et al., 2025 accepted to Clin J Am Soc Nephrol

UPFs manufacturing



Monteiro CA et al., Public Health Nutr. 2019

Hallmarks of UPFs

Hyper-palatability

Conveniency

Multitude of ingredients

Ready-to-eat/heat

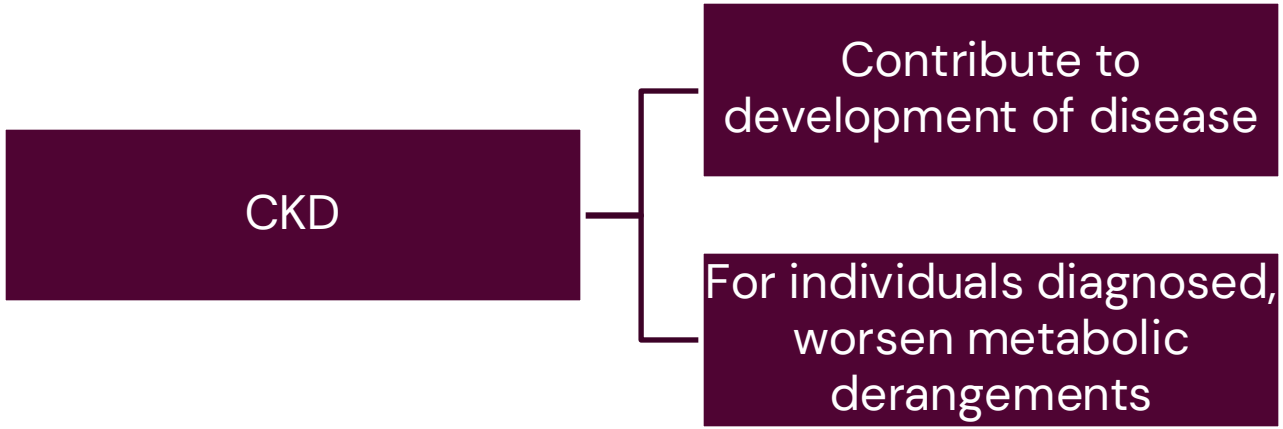
Unperishable

Low-cost=highly profitable

Responsible for replacing all other NOVA groups

UPFs potential health risks

- High UPFs consumption → linked to type 2 diabetes, cardiovascular disease, obesity, cancer, chronic kidney disease (CKD)



Hypothesis

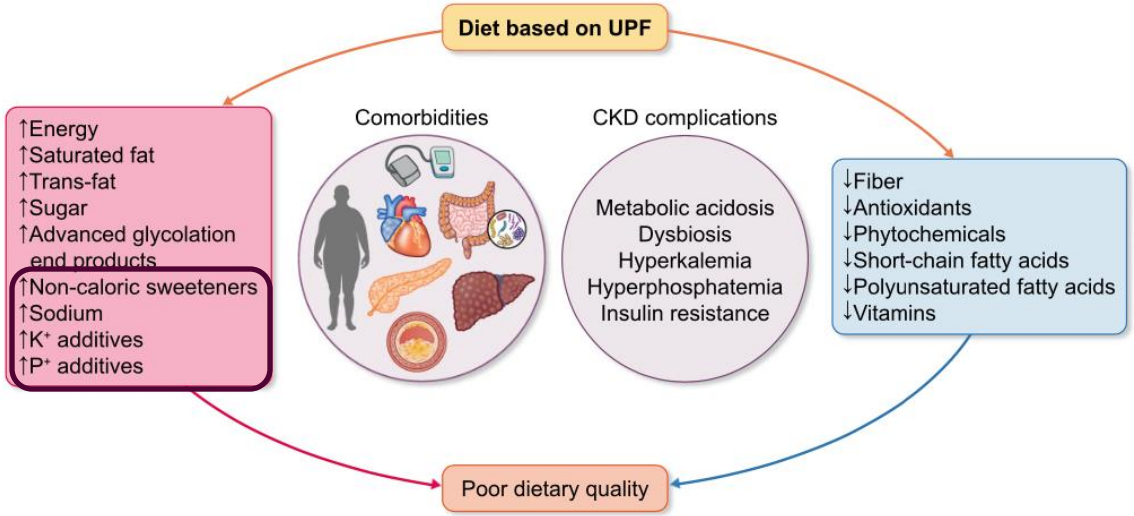


Figure 2: Intersection of a diet based on UPFs in driving complications related to CKD.

Avesani CM, et al. Clin Kidney J, 2023

Food additives and health outcomes

What are food additives?

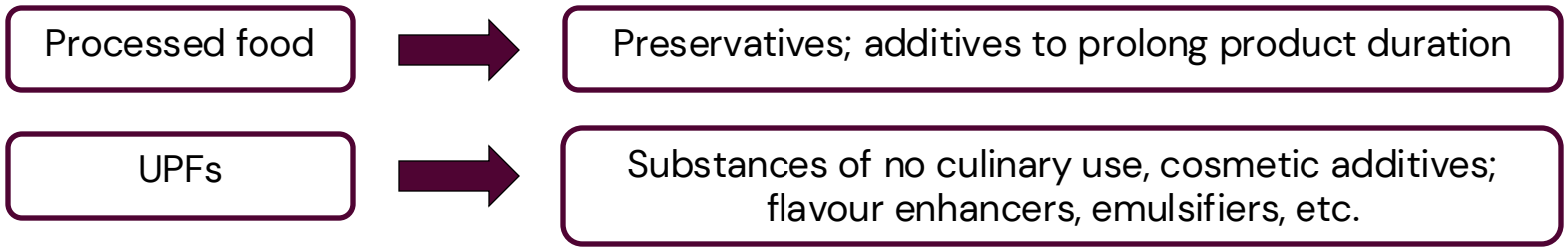
- Sustances that are not consumed on their own or commonly used as culinary ingredients
- They can be found in both **processed** and **ultra-processed foods (UPFs)**

- European Union (EU) legislation allows food additives for 26 technological purposes
- Food additives can be added during food production, processing, packaging

The European Parliament; OJEU. 2008.

Additives in UPFs

- UPFs are formulations of ingredients often created by a serie of industrial processes
- Additives can be found mainly in processed and UPFs for different purposes



Monteiro, CA et al. 2019. Ultra-processed foods, diet quality, and health using the NOVA classification system. Rome, FAO.

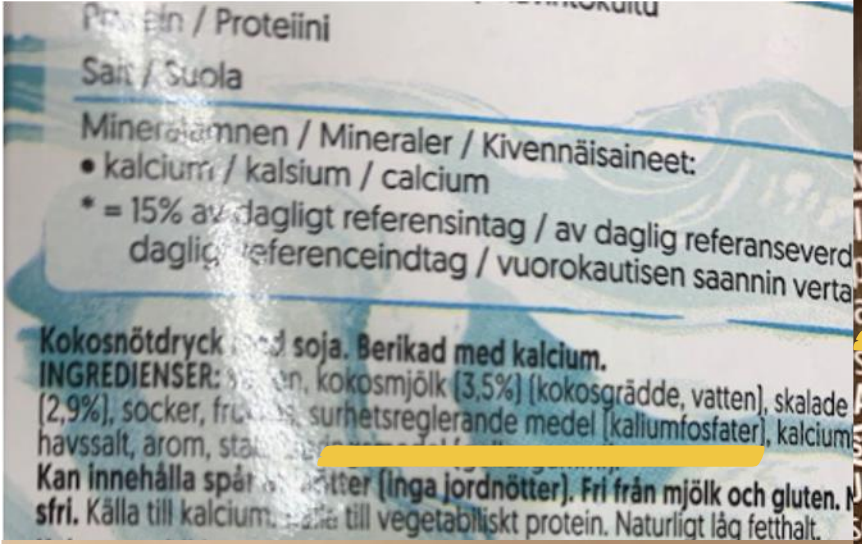
Food additives in UPFs

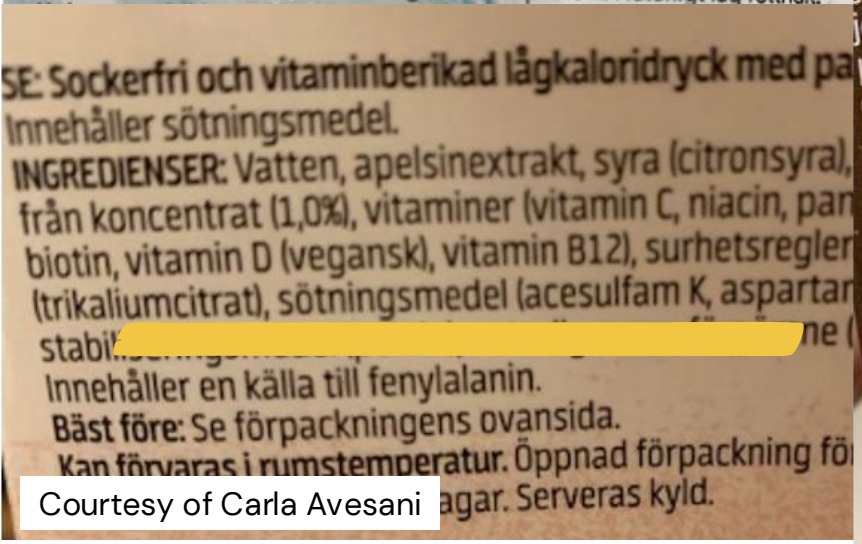
- Food additives for cosmetic functions are a hallmark of UPFs
- For NOVA, 12 classes of food additives with cosmetic functions as markers of UPFs

Classes of cosmetic food additives		
Flavours	Flavour enhancers	Colours
Emulsifiers	Emulsifying salts	Sweeteners
Thickeners	Anti-foaming agents	Bulking agents
Carbonating agents	Foaming agents	Gelling ang glazing agents

- More than 330 authorised FAs in the European Union (E-numbers, e.g., E202, E500, etc.)

Monteiro et al., Public Health Nutr, 2019


Protein / Proteiini
Salt / Suola
Mineralämnen / Mineraler / Kivennäisaineet:
• kalcium / kalsium / calcium
* = 15% av dagligt referensintag / av daglig referanseverd
daglig referenceindtag / vuorokautisen saannin verta
Kokosnötdryck soja. Berikad med kalcium.
INGREDIENSER: kokosmjölk (3,5%) (kokosgrädde, vatten), skalade
(2,9%), socker, fr surhetsreglerande medel (kaliumfosfater), kalcium
havssalt, arom, sta
Kan innehålla spå nötter (inga jordnötter). Fri från mjölk och gluten.
sfri. Källa till kalcium till vegetabiliskt protein. Naturligt låg fetthalt.


SE: Sockerfri och vitaminberikad lågkaloridryck med pa
Innehåller sötningsmedel.
INGREDIENSER: Vatten, apelsinextrakt, syra (citronsyra),
från koncentrat (1,0%), vitaminer (vitamin C, niacin, pan
biotin, vitamin D (vegansk), vitamin B12), surhetsregler
(trikaliumcitrat), sötningsmedel (acesulfam K, aspartar
stabi
Innehåller en källa till fenylalanin.
Bäst före: Se förpackningens ovansida.
Kan förvaras i rumstemperatur. Öppnad förpackning fö
agar. Serveras kyld.


KAURAJUOMA KAHVIIN, TÄYDENNETTY V
ILLA, UHT, 1 L. AINEKSET: Kaurapohja (vesi,
osi- ja auringonkukkaöljy, kalsium, suola),
aliumfosfaatit), jodi, vitamiinit (riboflaviini
Saitaa 10 % kauraa. Kasviperäinen tuote. So
AVISTETTAVA.
SWE HAVREDRYCK FÖR KAFFE, BERIKAD MED
JHT, 1 L. INGREDIENSER: Havrebas (vatten, gl
solrosolja, kalcium, salt), vatten, surhetsregle
jod, vitaminer (riboflavin (B2), B12 och D2).
Innehåller 10 % havre. Växtbaserad produkt.
OMSKAKAS.
RAVINTOSISÄLTÖ/NÄRINGSVÄRDE/ 100 ml:
Energia/energi
Rasva/fett
josta tyydyttynyttä / varav mättat fett
Hiilihydraatit/kolhydrat
josta sokereita / varav sockerarter
Proteiini/protein
Suola/salt
D-vitamiini/vitamin D
Riboflaviini (B2)/riboflavin (B2)
B12-vitamiini/vitamin B12
Kalsium/kalcium
Jodi/jod
/ av dagligt refe


HAVREDALS
RENA SIFFROR
Havredals är uppfunnet i Haverdal, utvecklat i Uppland, producerat i Sverige med svensk havre och rapsolja.
INGREDIENSER
Havrebas (vatten, havre 11%), rapsolja, surhetsreglerande medel (dikaliumfos fat), kalcium, stabiliseringsmedel (E473), salt, vitaminer (riboflavin, D, B12)
NÄRINGSINNEHÅLL PER 100 G

Energi (kJ)	267 kJ
Energi (kcal)	63 kcal
Fett	2,5 g
Varav mättat	0,3 g
Kolhydrater	8,9 g
Varav sockerarter från havre	4,2 g
Protein	0,9 g
Salt	0,10 g
Vitamin D	1,0 µg (20%*)
Riboflavin	0,15 mg (11%*)
Vitamin B12	0,27 µg (11%*)
Kalcium	120 mg (15%*)

ANVÄNDNING
SKUMMAD I KAFFE
Skummas väl kyld och rejält omskakad. Ger ett fint skum med en mellanhög krona.
SOM DEN ÄR
Produkten fungerar också utmärkt utan att skummas och blandar sig väl i bryggkaffet.
BÄST FÖRE
Se toppen av förpackningen. Förvaras kylt efter öppnande i högst +8 grader C. Hållbar i minst 5 dagar efter öppnande.
ÅTERVINNING

Courtesy of Carla Avesani

2025-05-30

Food additives: insights from Response-K Study

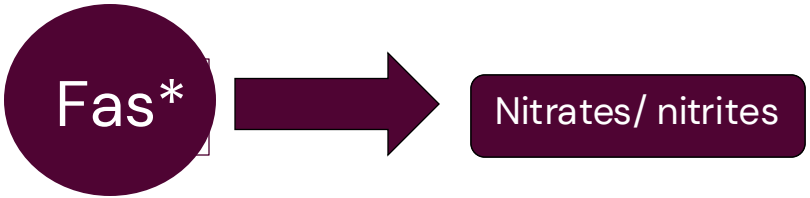
Post-prandial effect of potassium study. Healthy meal with no ultraprocessed food and no food additives. Photo: Carla Avesani

Data from bromatology laboratory	Potassium (mg)
Breakfast without additives	880.54
Breakfast with additives	14

Data from Dietist N Software	otassium (mg)
Breakf ut addi	983.5
Breakfast with additives	719.8

These are hidden sources of potassium

Concerns about food additives



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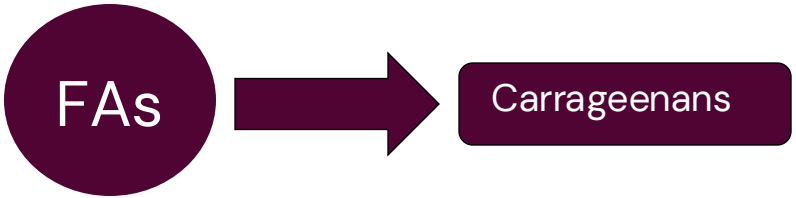
Chazelas E. *et al.* Nitrites and nitrates from food additives and natural sources and **cancer risk**: results from the NutriNet-Santé cohort. Int J Epidemiol (2022)

*Food additives

Concerns about food additives



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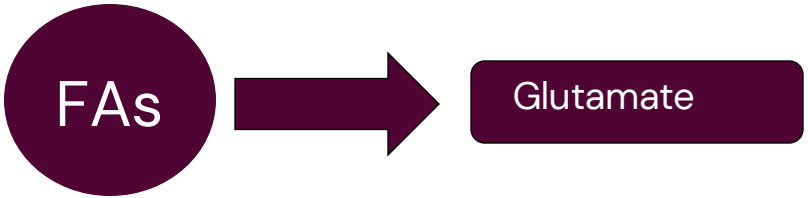
Bhattacharyya, S. *et al*. Common food additive **carrageenan inhibits proglucagon expression and GLP-1** secretion by human enteroendocrine L-cells. *Nutr. Diabetes* (2024)

Concerns about food additives



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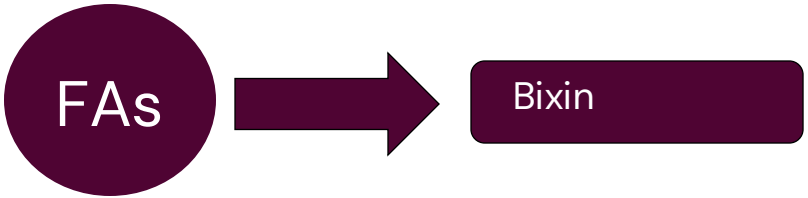
Hasenböhler A. *et al*. Food additive monosodium glutamate and risk of **cardiovascular diseases** - NutriNet-Santé cohort, Eur J Public Health (2024)

Concerns about food additives



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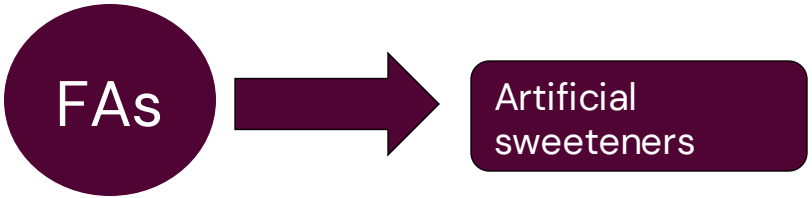
Concerns about food additives



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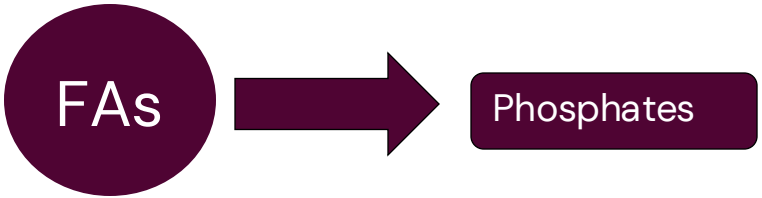
Concerns about food additives



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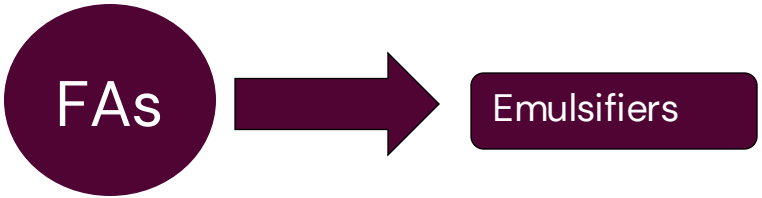
McCarty, M. F. *et al*. Bioavailable dietary phosphate, a mediator of **cardiovascular disease,** may be decreased with plant-based diets, phosphate binders, niacin, and avoidance of phosphate additives. *Nutrition* (2014).

Concerns about food additives



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Sellem, L. *et al*. Food additive emulsifiers and risk of **cardiovascular disease** in the NutriNet-Santé cohort: prospective cohort study. BMJ (2023)

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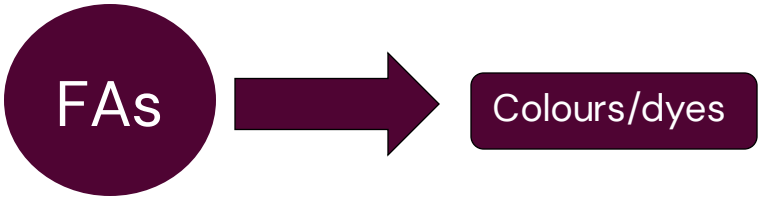
Concerns about food additives



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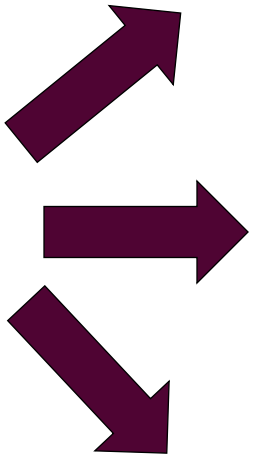
Summarising...

FAs have been linked to



- Mortality
- Cancers
- Cardiometabolic alterations
- Gut microbiota alterations
- Endocrine alterations
- Inflammation
- Oxidative stress

Concerns about food additives

Food additives: distribution and co-occurrence in 126,000 food products of the French market

Eloi Chazelas ✉, Mélanie Deschasaux, Bernard Srour, Emmanuelle Kesse-Guyot, Chantal Julia, Benjamin Alles, Nathalie Druesne-Pecollo, Pilar Galan, Serge Hercberg, Paule Latino-Martel, Younes Esseddik, Fabien Szabo, Pierre Slamich, Stephane Gigandet & Mathilde Touvier

Scientific Reports **10**, Article number: 3980 (2020) | Cite this article

Article | Open access | Published: 04 October 2021

Exposure to food additive mixtures in 106,000 French adults from the NutriNet-Santé cohort

Eloi Chazelas ✉, Nathalie Druesne-Pecollo, Younes Esseddik, Fabien Szabo de Edelenyi, Cédric Agaesse, Alexandre De Sa, Rebecca Lutchia, Pauline Rebouillat, Bernard Srour, Charlotte Debras, Gaëlle Wendeu-Foyet, Inge Huybrechts, Fabrice Pierre, Xavier Coumoul, Chantal Julia, Emmanuelle Kesse-Guyot, Benjamin Allès, Pilar Galan, Serge Hercberg, Mélanie Deschasaux-Tanguy & Mathilde Touvier

Scientific Reports **11**, Article number: 19680 (2021) | Cite this article

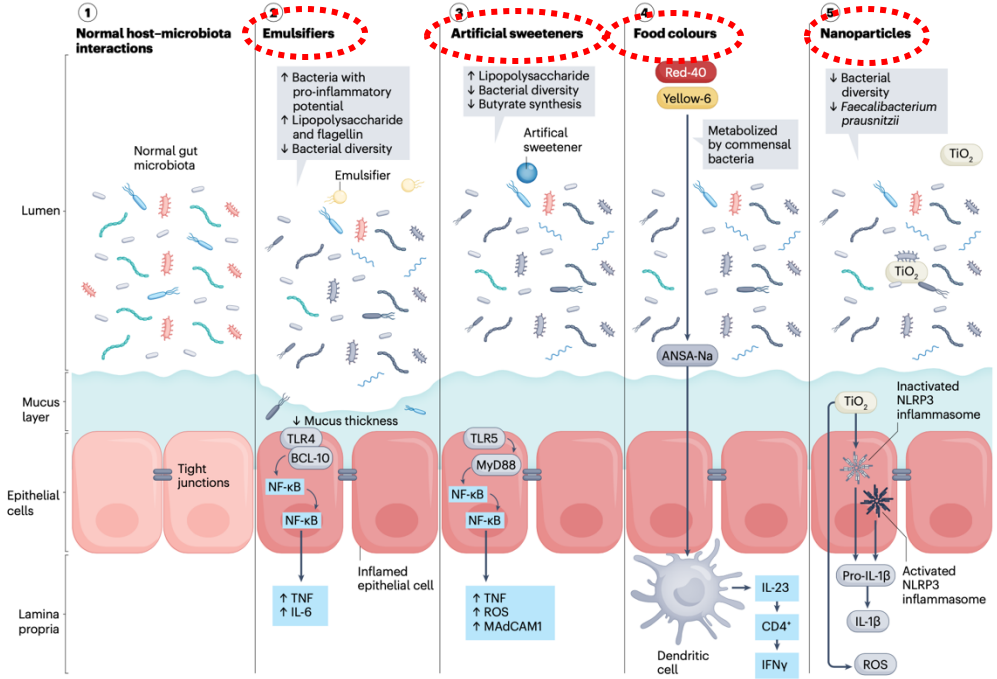
Concerns about food additives

- **Population:** 106,489 adults (69% women) mean age 42.9 years
- **Methodology:** 24-hour dietary records over the first two years of follow-up, detailing all consumed foods and beverages, including brand information
- This data was cross-referenced with three large-scale composition databases to identify the presence and quantity of 90 specific food additives
- **48 additives** were consumed by more than 10% of participants (modified starches and citric acid were consumed by over 90% of the cohort)

Commonly consumed FAs with potential health concerns:
•Several additives with potential adverse health effects have been suggested by recent experimental studies, were widely consumed:

- Lecithins: 86.6% of participants
- Mono- and diglycerides of fatty acids: 78.1%
- Carrageenan: 77.5%
- Sodium nitrite: 73.9%
- Di-, tri-, and polyphosphates: 70.1%
- Potassium sorbate: 65.8%
- Potassium metabisulphite: 44.8%
- Acesulfame K: 34.0%
- Cochineal: 33.9%
- Potassium nitrate: 31.6%
- Sulfite ammonia caramel: 28.8%
- Bixin: 19.5%
- Monosodium glutamate: 15.1%
- Sucralose: 13.5%

Food additives and the gut microbiome



- Increase in lipopolysaccharide, metabolites = alteration of gut microbiome
- Higher permeability
- Inflammation

Whelan et al, Nature Reviews Gastroenterology & Hepatology, 2024

Courtesy of Carla Avesani

Food additives in the context of CKD

Concerns about K- and P-based additives

Understanding Sources of Dietary Phosphorus in the Treatment of Patients with Chronic Kidney Disease

Kamyar Kalantar-Zadeh,*†‡ Lisa Gutekunst,§ Rajnish Mehrotra,† Csaba P. Kovesdy,‖¶ Rachelle Bross,*† Christian S. Shinaberger,*†‡ Nazanin Noori,*† Raimund Hirschberg,† Debbie Benner,** Allen R. Nissenson,†** and Joel D. Kopple*† ††

*Harold Simmons Center for Chronic Disease Research and Epidemiology, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, California; †David Geffen School of Medicine and Departments of ‡Epidemiology and ††Community Health Sciences, School of Public Health, University of California, Los Angeles, Los Angeles, California; §Cleve-Hill DaVita Dialysis, Buffalo, New York; ‖Division of Nephrology, Salem Veterans Affairs Medical Center, Salem, Virginia; ¶Division of Nephrology, University of Virginia, Charlottesville, Virginia; and **DaVita Inc., El Segundo, California

PRACTICAL ASPECTS

Potassium Additives and Bioavailability: Are We Missing Something in Hyperkalemia Management?

Kelly Picard, BSC, RD J Ren Nutr. 2019 Jul;29(4):350-353

Phosphorus bioavailability:

Food additives: 90%

Animal products: 40-60%

Plant foods: 20%-50%

Potassium bioavailability:

Food additives: 90-100%

Fruit and vegetables: 50-60%

Concerns about K- and P-based additives

Potassium

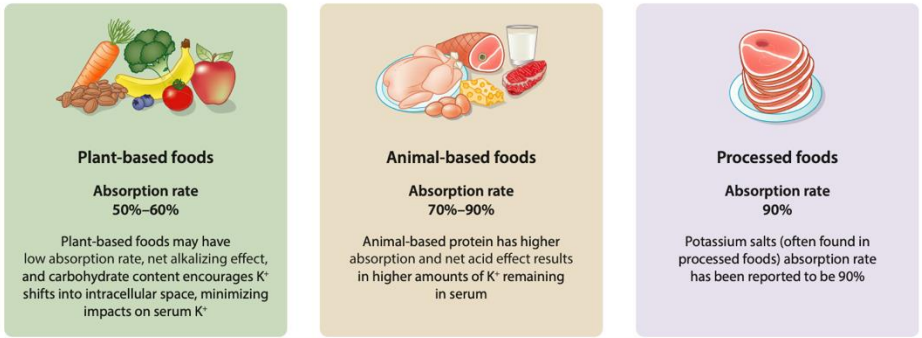


Figure 33 | Potassium absorption rates of plant-based, animal-based, and processed foods. Data from Picard K, Griffiths M, Mager DR, Richard C. Handouts for low-potassium diets disproportionately restrict fruits and vegetables. *J Ren Nutr*. 2021;31:210–214.[592]

6.3 Statements on Phosphorus

Dietary Phosphorus Amount

6.3.1 In adults with CKD 3-5D, we recommend adjusting dietary phosphorus intake to maintain serum phosphate levels in the normal range (1B).

Dietary Phosphorus Source

6.3.2 In adults with CKD 1-5D or posttransplantation, it is reasonable when making decisions about phosphorus restriction treatment to consider the bioavailability of phosphorus sources (eg, animal, vegetable, additives) (OPINION).

Phosphorus Intake With Hypophosphatemia

6.3.3 For adults with CKD posttransplantation with hypophosphatemia, it is reasonable to consider prescribing high-phosphorus intake (diet or supplements) in order to replete serum phosphate (OPINION).

KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Stevens, P et al. Kidney International

Ikizler TA, et al. KDOQI clinical practice guideline for nutrition in CKD: 2020 update. Am J Kidney Dis. 2020

Prevalence of K-, P- and Na-based additives

- Prevalence of P-based food additives → 36% (4% dairy snacks-67% meat products)
- Most commonly used: lecithin (E 322), pyrophosphate (E 450), and triphosphate (E 451)

- Prevalence of K-based food additives → 37.6%
- Most commonly used: E202; E252, E340, E450, E452, E508, and E950

- Prevalence of Na-based additives →53.5%
- Most commonly used: sodium carboxymethylcellulose (E466)

Bayram, H. et al; J Food Compos Analysis. 2021.
Tuominen M, et a;. J Ren Nutr. 2022
Martinez Pineda, et al.; Nutrients 2021

Food additives in the context of chronic kidney disease

Perspective | Open access | Published: 21 March 2025

Food additives containing potassium, phosphorus, and sodium in ultra-processed foods: potential harms to individuals with chronic kidney disease

Valeria Cecchini, Alice Sabatino, Barbara Contzen & Carla Maria Avesani

- Do they worsen the metabolic complications that occur as kidney function declines?
- Food processing → bioavailability

Cecchini V et al., Eur J Clin Nutr, 2025

Food additives in the context of chronic kidney disease

- Revision of the EU regulation regarding food additives, Commission Regulation (EU) No. 1129/2011
- Molecular weight analysis
- 41 potassium additives, 44 phosphorus additives and 88 sodium additives
- Different formulations are allowed in every food category

Cecchini V et al., Eur J Clin Nutr, 2025

Food additives in the context of chronic kidney disease

Table 1. Number of authorised food additives containing potassium, phosphorus, and sodium in the European Union, their purposes and potential harmful effects to kidney health.

Mineral	N of authorised additives	Food categories	Purposes	Potential harmful effects
Potassium	41			
	Group I[a]: E 261, E 326, E 332, E 336, E 337, E 351, E 402, E 407, E 407a, E 415, E 418, E 440, E 470a, E 472c, E 501, E 508, E515, E 525, and E 577	Potassium-containing additives are authorised in food categories 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, and 18	Preservation, antioxidation, emulsification, stabilisation, thickening, gelling, acidity regulators, leavening, sodium replacement, flavour enhancer, colour stabiliser, and sweetening	These additives can exacerbate hyperkalemia
	Other additives that may be regulated combined: E 202, E 212, E 224, E 228, E 249, E 252, E 283, E 340, E 357, E 522, E 555, E 622, E 628, and E 632			
Phosphorus	44			
	Group I: E 322, E 1200, E 1410, E 1412, E 1413, E 1414, and E 1442 **Group II**[b]: E 101	Phosphorus-containing additives are authorised in food categories 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, and 18	Preservation, emulsification, stabilisation, thickening, gelling, antioxidation, acidity regulators, leavening, and colouring	These additives can exacerbate hyperphosphatemia and bone-mineral diseases
	Other additives that may be regulated combined: E 338, E 339, E 340, E 341, E 343, E 450, E 451, and E 452, E 626, E 627, E 628, E 630, E 631, E 632, E 633, E 634, and E 635			
Sodium	88			
	Group I: E 262, E 301, E 325, E 331, E 335, E 337, E 350, E 401, E 407, E 407a, E 415, E 418, E 440, E 466, E 469, E 470a, E 472c, E 500, E 514, E 524, E 576, E 640, E 1404, E 1450, E 1451 **Group II**: E 101 **Group III**[c]: E 104, E 110, E 122, E 124, E 129, E 131, E 132, E 133, E 142, E 151, E 155	Sodium-containing additives are authorised in food categories 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, and 18	Preservation, antioxidation, emulsification, stabilisation, thickening, gelling, leavening, acidity regulator, anti-caking, colour stabiliser, and flavour enhancer	These additives can increase blood pressure, renal plasma flow, and glomerular filtration pressure
	Other additives that may be regulated combined: E 211, E 215, E 219, E 221, E 222, E 223, E 250, E 251, E 281, E 339, E 356, E 481, E 521, E 554, E 621, E627, E 631, and E 635			

Food categories: 1 Dairy products and analogues; 2 Fats and oils and fat and oil emulsions; 3 Edible ices; 4 Fruit and vegetables; 5 Confectionery; 6 Cereals and cereal products; 7 Bakery wares; 8 Meat; 9 Fish and fisheries products; 10 Egg and egg products; 11 Sugars, syrups, honey and table-top sweeteners; 12 Salts, spices, soups, sauces, salads and protein products; 13 Foods intended for particular nutritional uses as defined by Directive 2009/39/EC; 14 Beverages; 15 Ready-to-eat savouries and snacks; 16 Desserts excluding products covered in categories 1, 3 and 4; 17 Food supplements as defined in Directive 2002/46/EC excluding food supplements for infants and young children; 18 Processed foods not covered by categories 1 to 17, excluding foods for infants and young children.

[a]Group I: no maximum numerical limit is established. However, these substances must be utilised following good manufacturing practices. Their usage should be limited to what is essential to fulfil their intended purpose, guaranteeing that the consumers are not deceived.

[b]Group II: food colours allowed at *Quantum satis*.

[c]Group III: food colours with combined maximum limit.

Cecchini V et al., Eur J Clin Nutr, 2025

K-based additives

- 41 K-additives authorised in Europe
- Found the most in breaded products, meat products, non-alcoholic beverages, ready-to-eat products, and cereal derivatives

LKC * (<25% by Weight of K)			MKC * (25–39% by Weight of K)			HKC * (≥40% by Weight of K)		
E-Number	Name	Potassium Weight (%)	E-Number	Name	Potassium Weight (%)	E-Number	Name	Potassium Weight (%)
E 212	Potassium benzoate	18.1	E 202	Potassium sorbate	25.8	E 249	Potassium nitrite	43.6
E 228	Potassium hydrogen sulphite	9.1	E 224	Potassium metabisulphite	31.7	E 340	Potassium diphosphates	44.0
E 261	Potassium acetate	39.4	E 252	Potassium nitrate	38.3	E 340	Potassium triphosphates	53.6
E 261	Potassium diacetate	15.8	E 283	Potassium propionate	34.5	E 450	Tetrapotassium diphosphate	45.0
E 326	Potassium lactate	20.1	E 332	Potassium citrates	35.8	E 501ii	Potassium hydrogen carbonate	56.0
E 332	Potassium citrates	16.8	E 336	Potassium ditartrates	32.9	E 508	Potassium chloride	51.9
E 336	Potassium tartrates	16.8	E 340	Potassium monophosphates	28.4	E 515	Potassium sulphates	44.4
E 337	Sodium potassium tartrate	13.7	E 351	Potassium malate	26.0	E 525	Potassium hydroxide	62.7

P-based additives

44 P-based additives authorised in the EU

Low content (<25% by weight)				Medium content (25-39% by weight)				High content (≥40% by weight)			
E-number Phosphorus	Name	Formula	Weight (%)	E-number	Name	Formula	Weight (%)	E-	Name	Formula	Weight (%)
E 101 (ii)	Riboflavin-5'-phosphate	$C_{17}H_{20}N_4$									
E 339 (i)	Monosodium phosphate	Monohyd $NaH_2PO_4 \cdot H_2O$				phosphate	NaH_2PO_4				
E 339 (i)	Monosodium phosphate	Dihydrate: $NaH_2PO_4 \cdot 2H_2O$	19.7	E 341 (i)	Monocalcium phosphate	Anhydrous: $Ca(H_2PO_4)_2$	25.9				
E 339 (ii)	Disodium phosphate	Na_2HPO_4	21.8	E 343 (i)	Monomagnesium phosphate	$Mg(H_2PO_4)_2$	27.8				
E 339 (iii)	Trisodium phosphate	Na_3PO_4	18.9	E 343 (ii)	Dimagnesium phosphate	$MgHPO_4$	25.2				
E 340 (i)	Monopotassium phosphate	KH_2PO_4	22.8	E 450 (i)	Disodium diphosphate	$Na_2H_2P_2O_7$	27.6				
E 340 (ii)	Dipotassium phosphate	K_2HPO_4	17.6	E 450 (ii)	Trisodium diphosphate	Anhydrous: $Na_3HP_2O_7$	25.1				
E 340 (iii)	Tripotassium phosphate	K_3PO_4	14.6	E 450 (vii)	Calcium dihydrogen diphosphate	$CaH_2P_2O_7$	28.4				
E 341 (i)	Monocalcium phosphate	Monohydrate: $Ca(H_2PO_4)_2 \cdot H_2O$	24.3	E 451 (i)	Pentasodium triphosphate	$Na_5O_{10}P_3$	25.0				
E 341 (ii)	Dicalcium phosphate	Anhydrous: $CaHPO_4$	22.3	E 541	Sodium aluminium phosphate, acidic	Anhydrous: $Na_3Al_2H_{15}(PO_4)_8$	27.6				
E 341 (ii)	Dicalcium phosphate	Dihydrate: $CaHPO_4 \cdot 2H_2O$	17.6	E 541	Sodium aluminium phosphate, acidic	Tetrahydrate: $NaAl_3H_{14}(PO_4)_8 \cdot 4H_2O$	26.1				
E 341 (iii)	Tricalcium phosphate	$Ca_3(PO_4)_2$	19.8								
E 450 (ii)	Trisodium diphosphate	Monohydrate: $Na_3HP_2O_7 \cdot H_2O$	23.4								

Cecchini V et al., Eur J Clin Nutr, 2025

Sodium-based additives

88 Na-based additives authorised in the EU

Sodium											
E 101 (ii)	Riboflavin-5'-phosphate	$C_{17}H_{20}N_4$ P			sulphite	: Na_2SO_3		339 (iii)	Trisodium phosphate	Na_3PO_4	42.0
E 102	Tartrazine	$C_{16}H_9N_4Na_3O_9S_2$	11.5	E 250	Sodium nitrite	$NaNO_2$	33.0	E 500 (i)	Sodium carbonate	Na_2CO_3	43.4
E 104	Quinoline yellow	$C_{18}H_9NNa_2O_8S_2$	9.6	E 251	Sodium nitrate	$NaNO_3$	26.8	E 524	Sodium hydroxide	NaOH	57.5

Cecchini V et al., Eur J Clin Nutr, 2025

What can we do with this knowledge?

Table 5: Strategies to address ultra-processed food consumption in chronic kidney disease stages 3 to 5

Action	How
Assess UPF consumption	Use one of these: - 24-hour food recall. - Dietary records. - Food-frequency questionnaire. - Nova UPF screener.

Avesani CM, et al., 2025 accepted to Clin J Am Soc Nephrol

What can we do with this knowledge?

Table 5: Strategies to address ultra-processed food consumption in chronic kidney disease stages 3 to 5

Identify underline causes for high UPF consumption	Perform nutrition anamneses asking on: - Cooking skills and possible economic challenges. - Living situation (alone or with others that can buy and prepare food). - Physical weakness or fatigue that makes cooking difficult. - Dietary restrictions to control fruits and vegetable intake leading to replace these for UPF.

Avesani CM, et al., 2025 accepted to Clin J Am Soc Nephrol

What can we do with this knowledge?

Table 5: Strategies to address ultra-processed food consumption in chronic kidney disease stages 3 to 5

Work on solutions depending on the underline causes	- **Engage caregivers and / or social workers for support if needed.** - **Simplify cooking routines for promoting cooking at home.** - **Assist patients and caregivers to make grocery shopping lists with products suitable for their clinical condition and food habits.** - **Ease fruits and vegetable restrictions when medically appropriate.**

Avesani CM, et al., 2025 accepted to Clin J Am Soc Nephrol

What can we do with this knowledge?

Table 5: Strategies to address ultra-processed food consumption in chronic kidney disease stages 3 to 5

Invest on food literacy	- **Educate patients and caregivers to read food labels for identifying food additives.** - **Develop educational infographics on how to identify UPF and additives in food label.** - **If needed, assist patients and caregivers to choose UPF with fewer additives containing potassium, phosphorus and sodium.**
Equip healthcare professionals with knowledge about UPFs	Team training using teaching micro-sessions lasting 15 minutes. Include the discussion of UPF intake in the syllabus of educational courses.

Avesani CM, et al., 2025 accepted to Clin J Am Soc Nephrol

What can we do with this knowledge?

Table 5: Strategies to address ultra-processed food consumption in chronic kidney disease stages 3 to 5

Differentiate among UPFs with higher versus lower risk for driving to metabolic derangements	UPF with higher risk: processed meats (luncheon meats), instant noodles, chips with artificial flavors, sweetened beverages (carbonated and non-carbonated sodas, fruits drinks not coming from 100% fruits juices, and sports drinks), packaged heat mixed dishes and ready-to-eat dishes and refined breads. UPF with lower risk: Dark and whole grain breads, yoghurts not artificially flavored, spreads, non-dairy sweet and snacks. Part of ready-to-eat dishes are not UPF as long as they are made from whole food and do not contain food additives.

Avesani CM, et al., 2025 accepted to Clin J Am Soc Nephrol

What do we do with this knowledge?

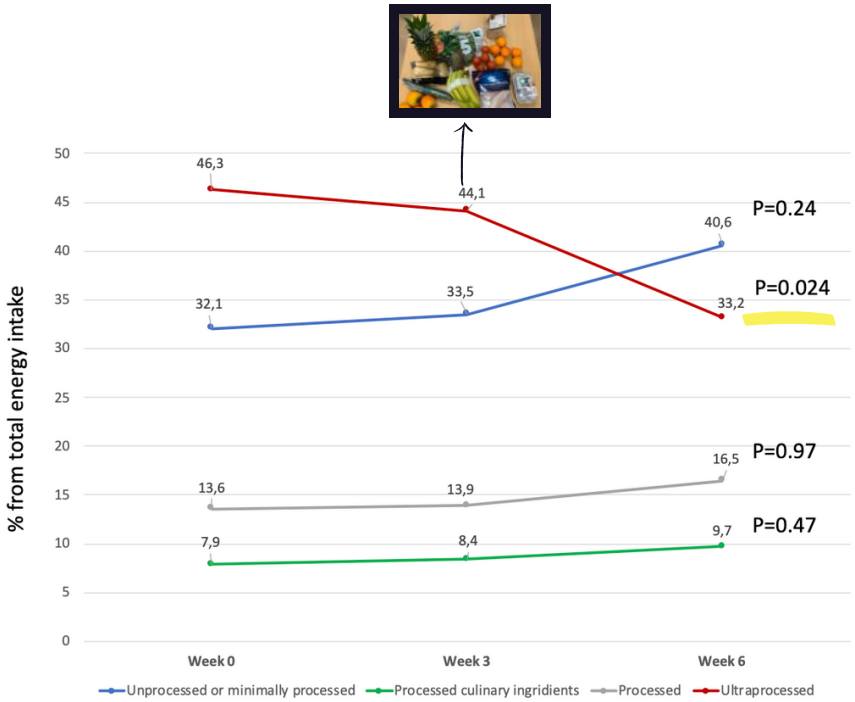
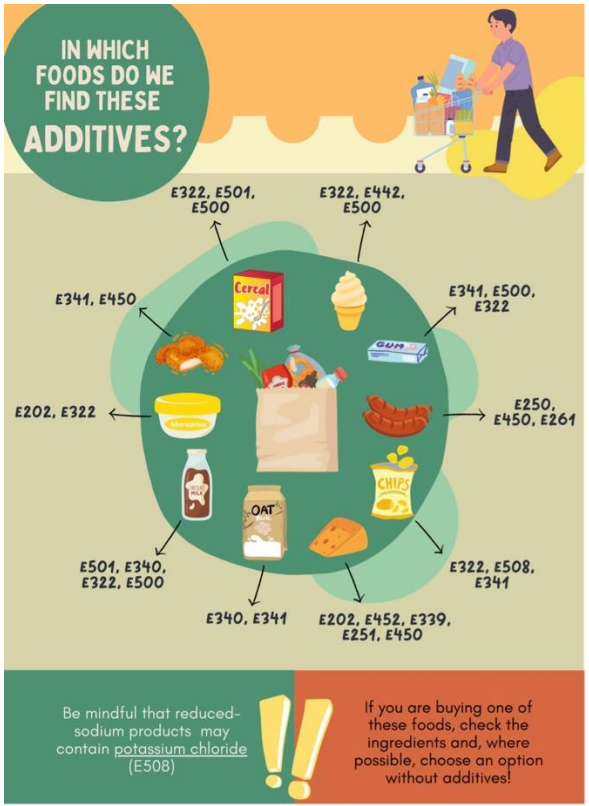


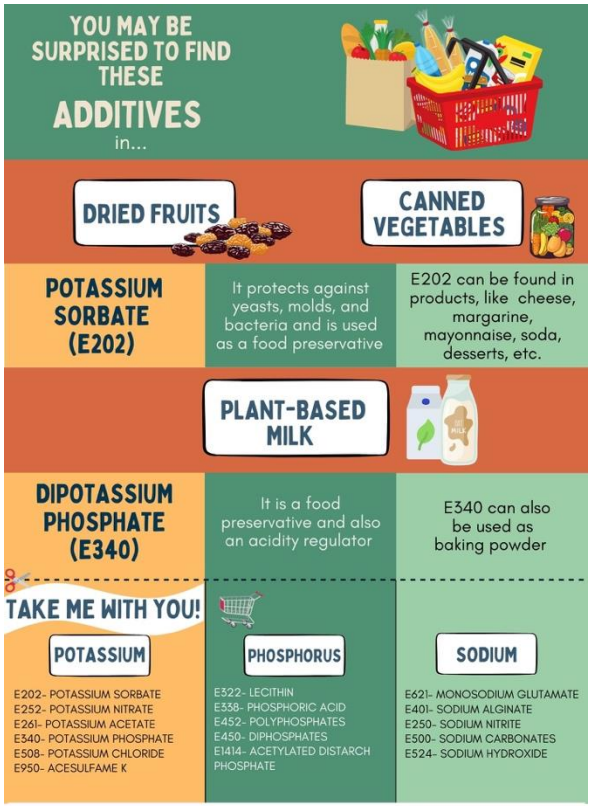
Figure 1. Percentage of total energy intake from food consumed according to the NOVA food classification system.

- 24-hour food recalls classified according to NOVA (n=78)
- Significant reduction in UPF intake after the medically tailored food basket

Avesani CM et al., Am J Clin Nutr, 2024

Educational leaflets





Conclusions

- Exact amount of additives in foods is unknown:
- Nutritional labels do not feature K and P content → unknown quantity in final products
- Mandatory labelling
- Future studies exploring which additives are detrimental to health, in which doses, and the role of UPFs' composition in these associations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