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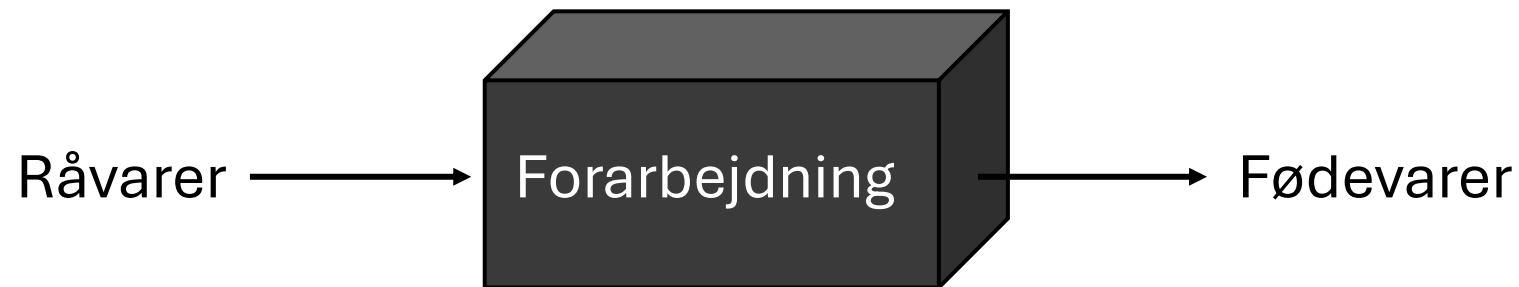
FORARBEJDEDE OG ULTRAFORARBEJDEDE FØDEVARER

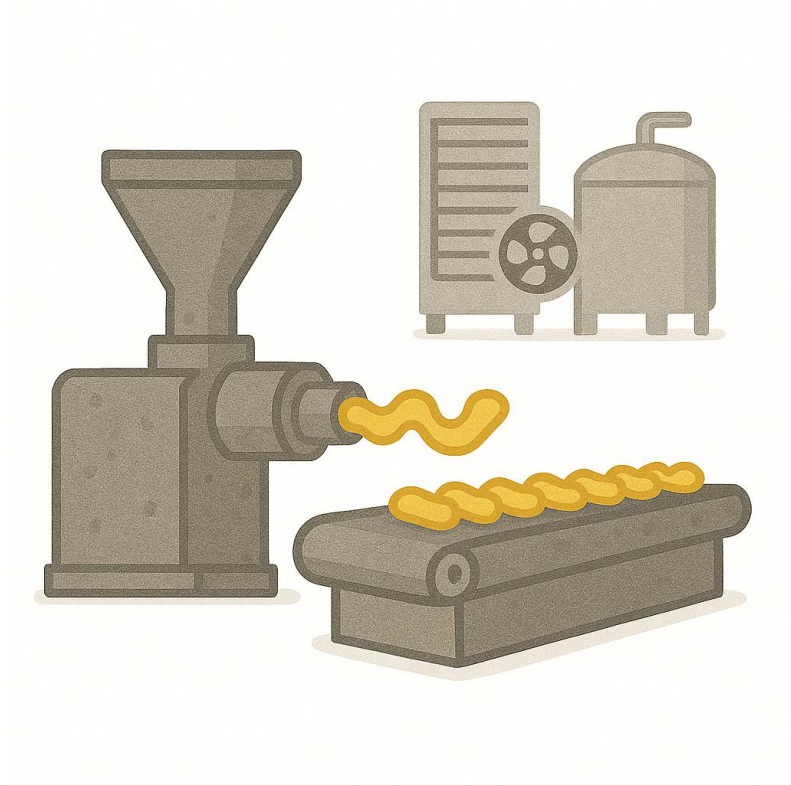
Hvad er op og ned?



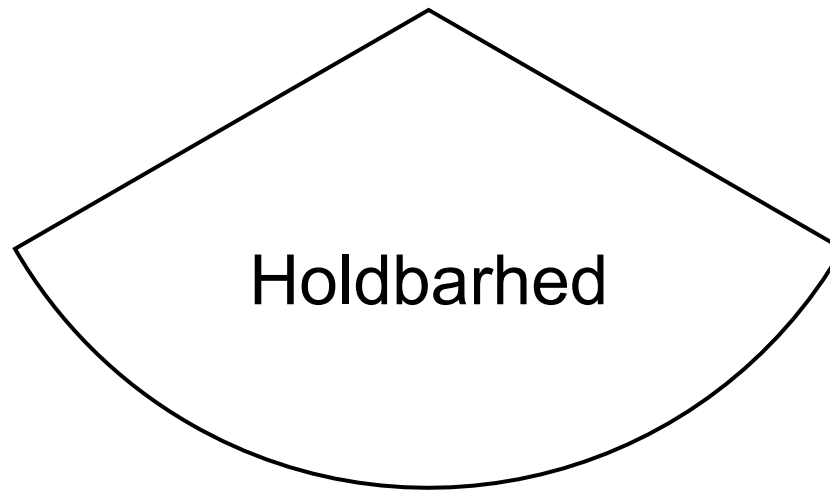
Hvad er fødevareforarbejdning?

Fødevareforarbejdning (eller bare "forarbejdning") dækker over de **fysiske, kemiske og biologiske metoder**, der anvendes til at **ændre råvarer til fødevarer**, eller til at ændre fødevarens egenskaber.





Hvorfor forarbejder vi vores fødevarer?



Hvad er ultra-forarbejdede fødevarer (UPF)?

NOVA-klassificeringen

Udarbejdet af den brasilianske læge Carlos Monteiro i 2009

Inddeler fødevarer i fire kategorier baseret på omfanget af forarbejdning – ikke næringsindhold:

1. Ubeh

Fr

2. Forar

Ol

3. Forar

Ost, saltede nødder, fiskekonserves.

4. Ultra-forarbejdede fødevarer

Ultraforarbejdede fødevarer er industrielle formuleringer typisk med **5 eller flere ingredienser**, der indeholder **ingredienser, som ikke normalt bruges i madlavning**, fx tilsætningsstoffer, smagsstoffer, farvestoffer, emulgatorer og teksturforbedrende stoffer – samt **ingredienser udvundet af fødevarer** (fx modificeret stivelse og isolerede proteiner).



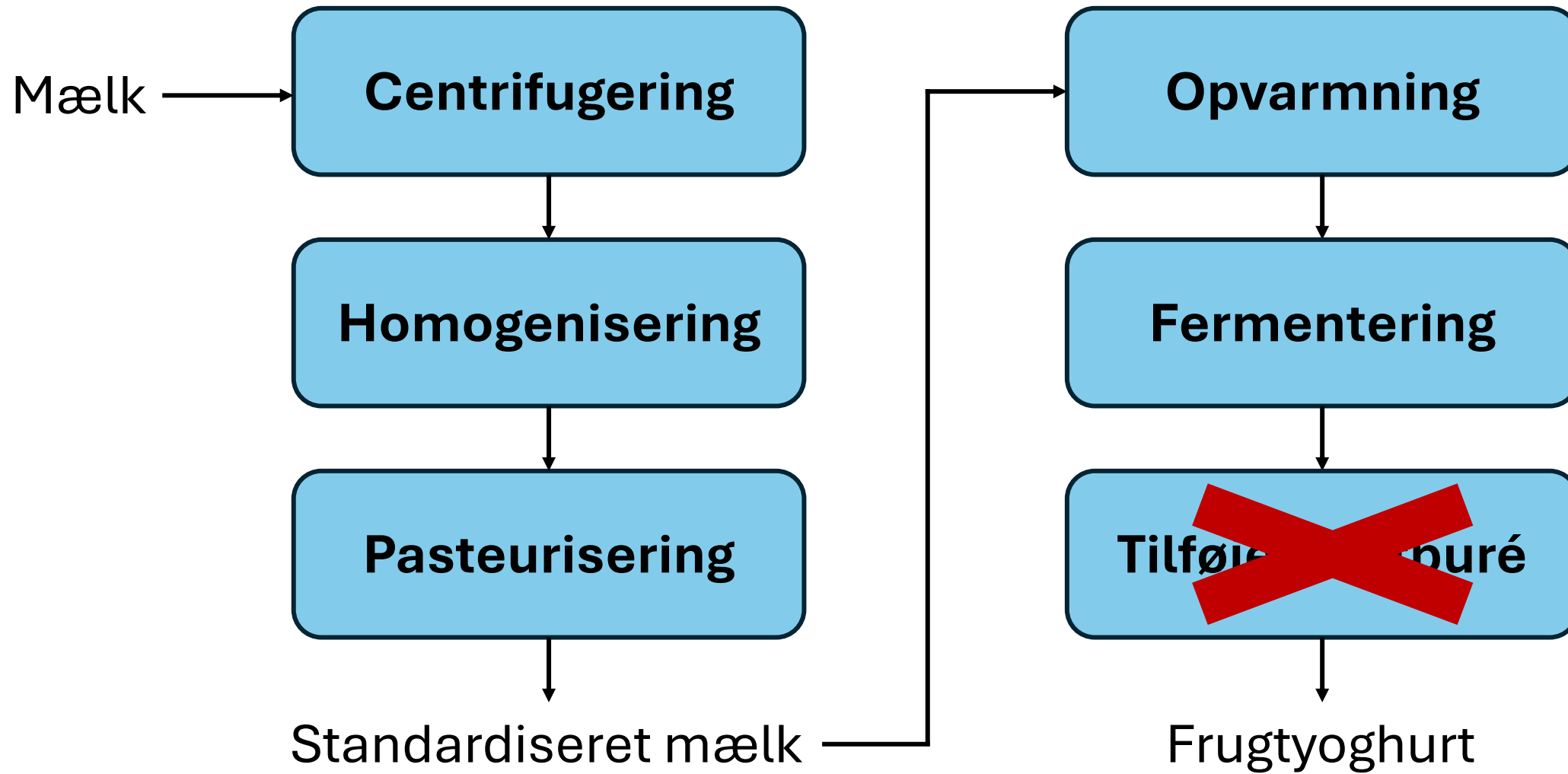
Hyper-palatable foods (HPF)

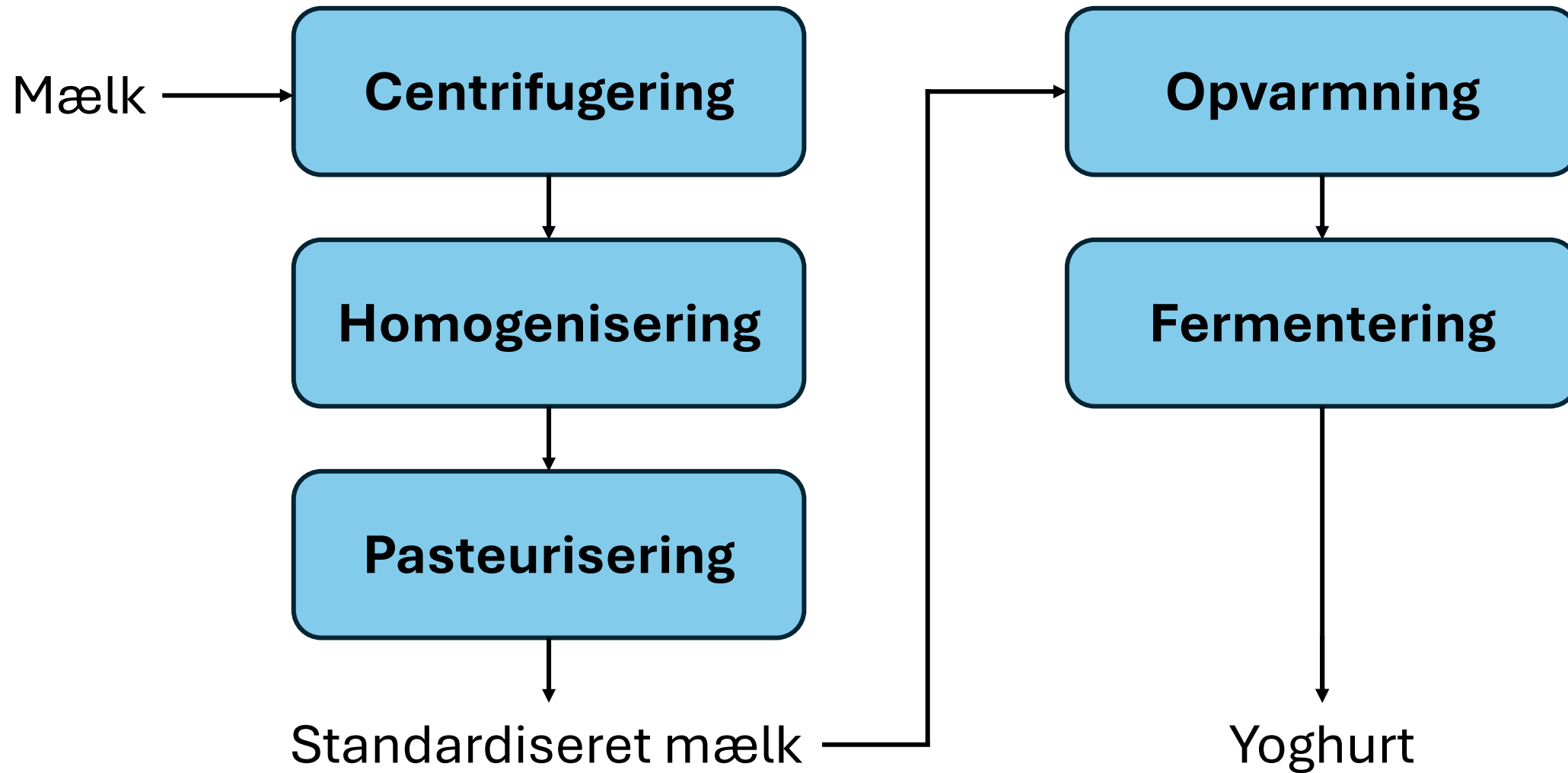


Forarbejdningsgrad



Forarbejdningsgrad







Ingredienser:

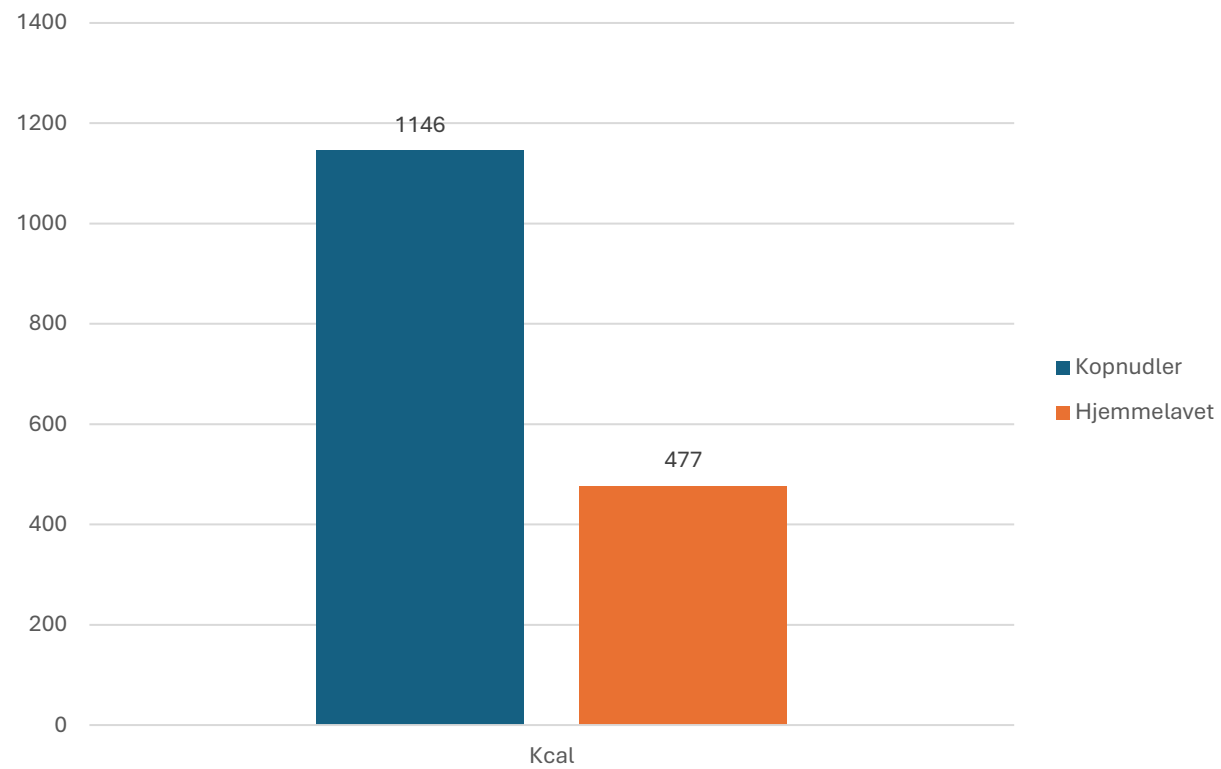
HVEDEmel (GLUTEN), palmeolie (palmeolie, antioxidant: E306), salt, tapiokastivelse, modificeret tapiokastivelse, hvidløg 1,7%, aroma, smagsforstærkere: E621, E635, sukker, chili 0,5%, forårsløg 0,1%, peber 0,1%, majsstivelse, syre: E296, fortykningsmiddel: E466, gærekstrakt, farve: E150c. Der kan være spor af KREBSDYR, FISK, SOJA, MÆLK, SELLERI og SESAMFRØ



Ikke-randomiseret overkrydnings-“studie” med *ad libitum* indtag

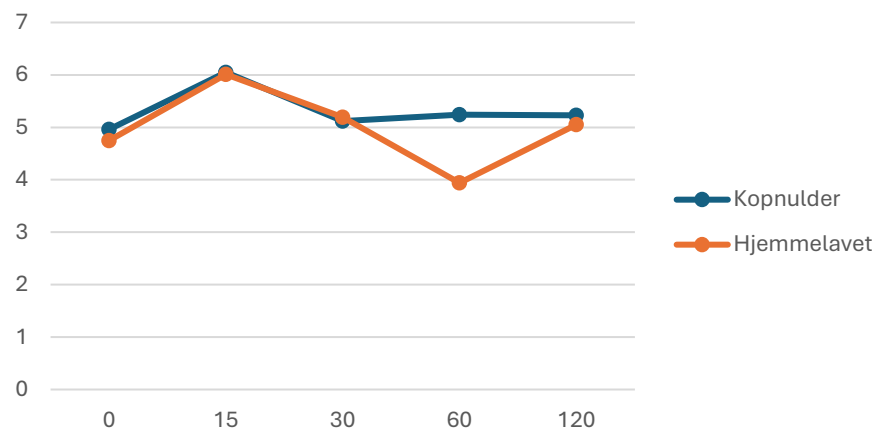


- Energiindtag
- Kostosammensætning
- Blodsukker
- Insulin

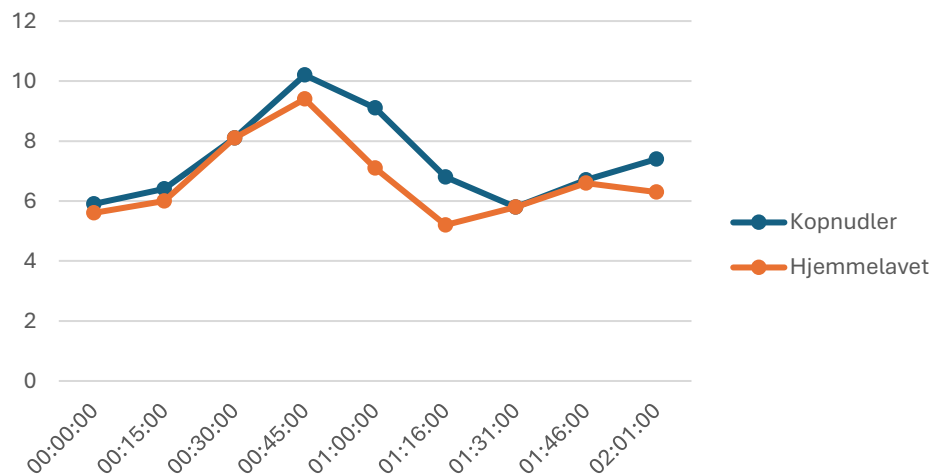


Måltid	Volume	kcal	Kulhydrat	Protein	Fedt	Fibre	Salt
kopnudler	936	1146	164	19	45	3	10
hjemmelavet	883	477	64	29	9	11	1

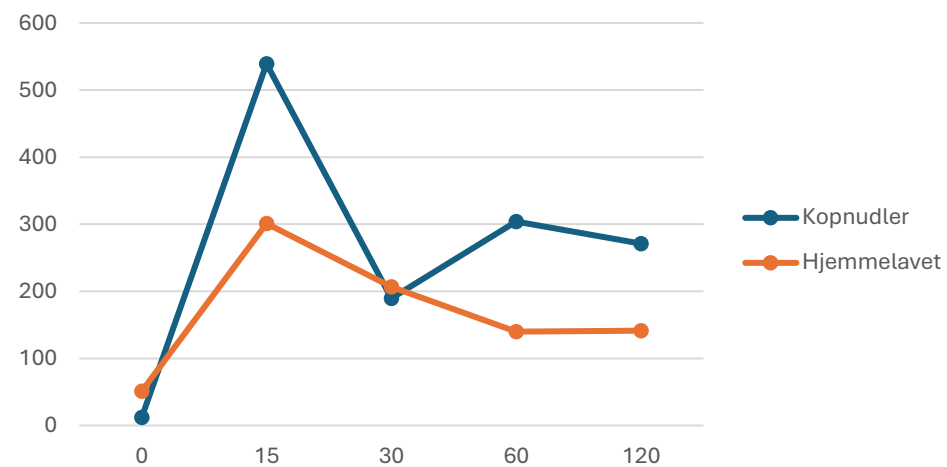
P-Glukose



CGM data



P(fPt)-Insulin



Cell Metabolism

Clinical and Translational Report

Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain: An Inpatient Randomized Controlled Trial of *Ad Libitum* Food Intake

Graphical Abstract



Authors

Kevin D. Hall, Alexis Ayuketah, Robert Brychta, ..., Peter J. Walter, Shanna Yang, Megan Zhou



Cell Metabolism

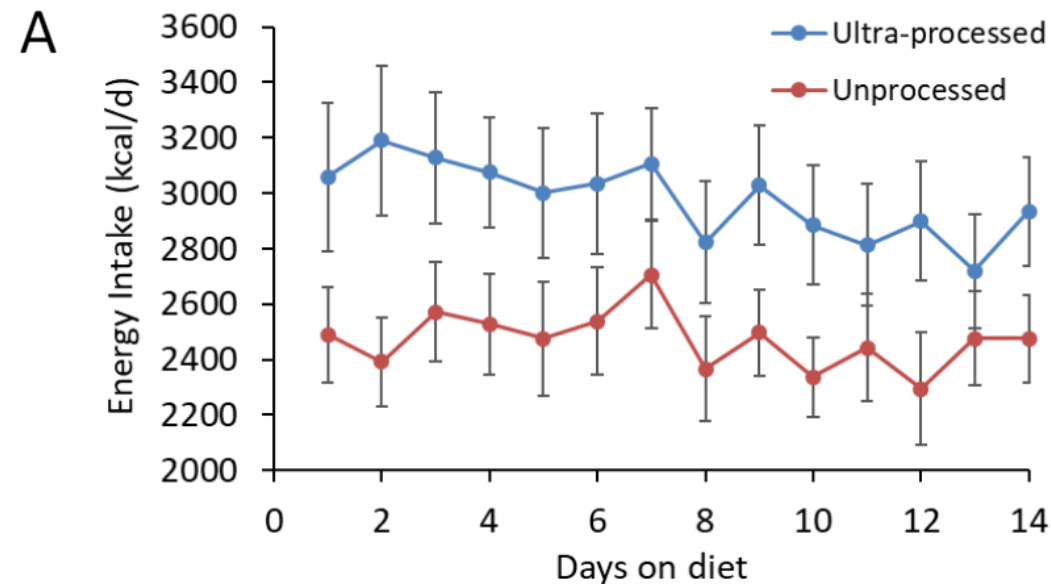
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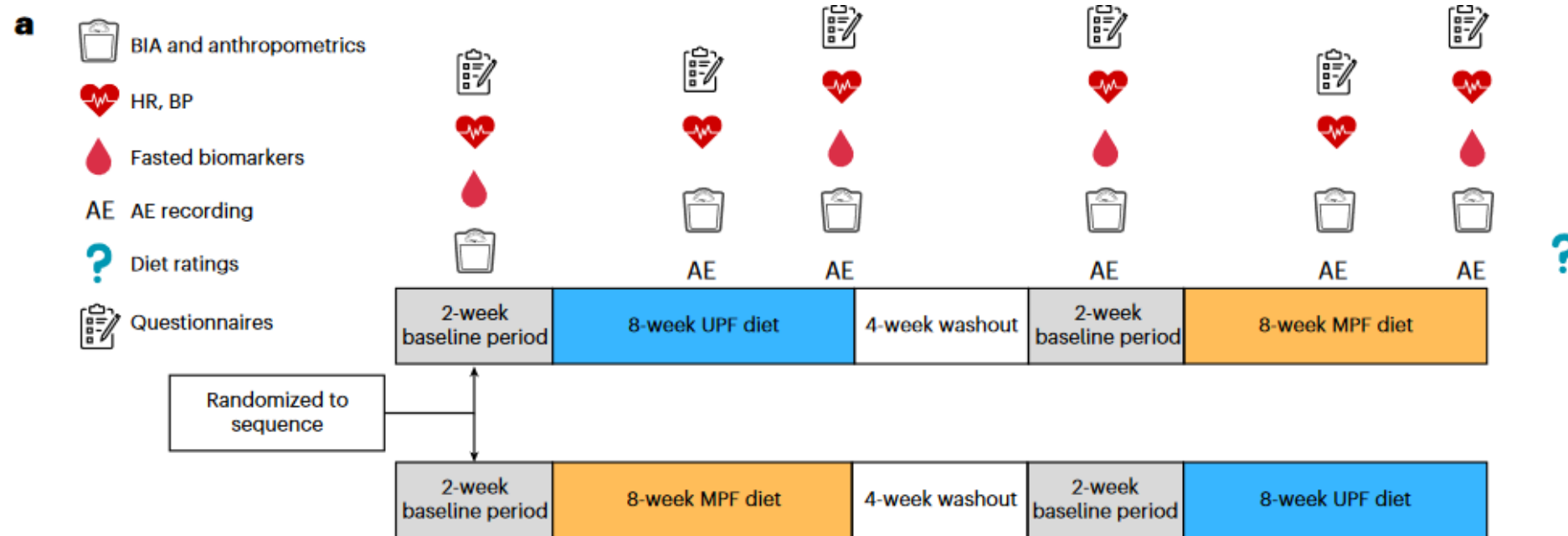
Authors

Kevin D. Hall, Alexis Ayuketah, Robert Brychta, ..., Peter J. Walter, Shanna Yang, Megan Zhou



~ 500 kcal/dag

Ultraprocessed or minimally processed diets following healthy dietary guidelines on weight and cardiometabolic health: a randomized, crossover trial



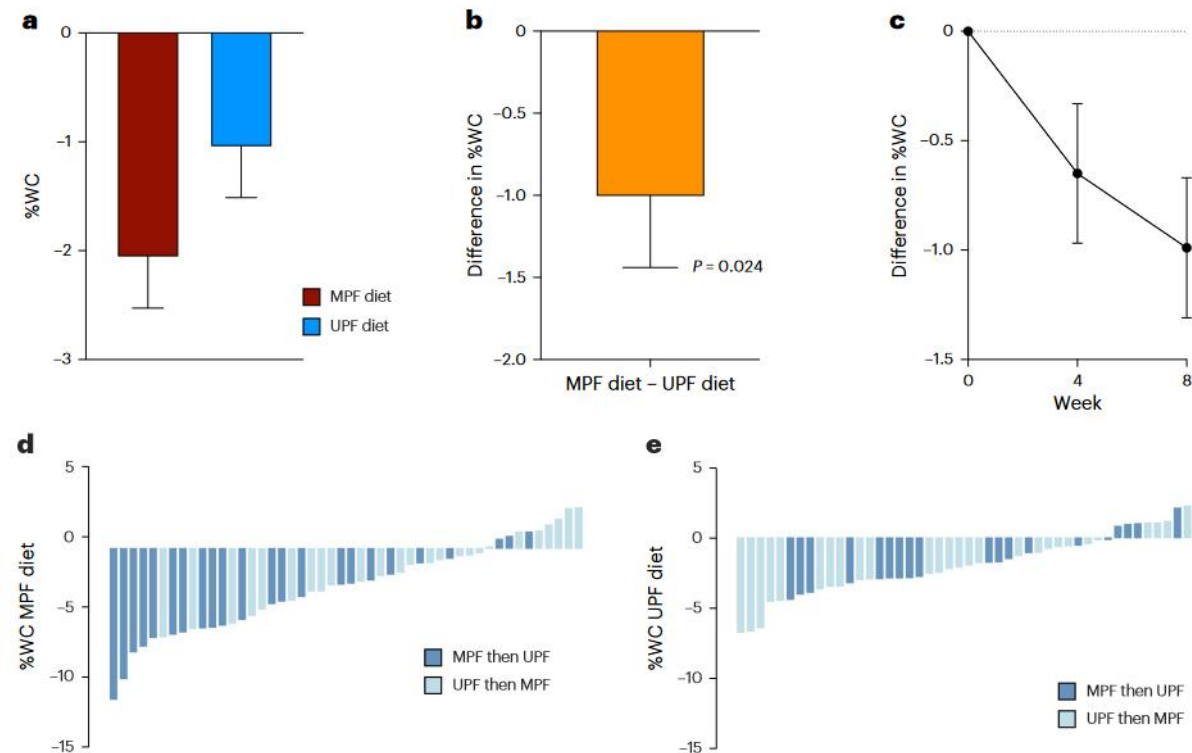
Article

Ultraprocessed or minimally p
diets following healthy dietary
on weight and cardiometaboli
randomized, crossover trial

per 2000 kcal of provided diet	Eatwell Guide recommendations	MPF diet	UPF diet
Energy (kcal/day)		2000	2000
Energy density (kcal/g)		1.37	1.70
UPF (kcal)	N/A	34.9	1812.6
UPF (%)	N/A	1.7%	90.7%
MPF (kcal)	N/A	1643.0	61.7
MPF (%)	N/A	82.1%	3.1%
Total fat (g)	78 g or less / 2000 kcal	76.6	70.1
Total fat (%)	35% of provided energy intake or below	34.2%	31.6%
Saturates (g)	24 g or less / 2000 kcal	21.5	19.0
Saturates (%)	10% of provided energy intake or below	9.6%	8.60%
Carbohydrate (g)	267 g / 2000 kcal	255.0	250.2
Carbohydrate (%)	Around 50% of provided energy intake	50.5%	50.0%
Total sugars (g)	Less than 18% of total energy	66.1	83.7
Total sugars (%)	Less than 90 g / 2000 kcal	13.1%	16.7%
Protein (g)	45 g / 2000 kcal	77.2	78.2
Protein (%)	Around 15% of provided energy intake ^{5*}	15.3%	15.6%
Salt (g)	Less than 6 g per day. Intake in line with current UK average intakes ⁶ , aiming for below 6 g per day	3.0	3.8
Fibre (g)	At least 30 g / 2000 kcal	35.9	32.4
Fruit and Veg (portions/day)	Five portions per day	6.1	5.1

MPF diet	UPF diet
*Participants provided with multiple fruits on the diet. Apples and bananas pictured for menus as example fruits.	*Participants provided with squash and artificially-sweetened beverages to consume at their discretion.
Breakfast Cinnamon and apple overnight oats	Breakfast Oat and fruit bars
	
Lunch Mexican chicken with flatbread	Lunch Chicken Wraps
	
Dinner Cottage pie with green beans and corn	Dinner Cottage pie, greens and corn
	
Snacks Fruit and nut bar, Fruit, Vanilla and berry yoghurt pot	Snacks Nut snacks, Yoghurts

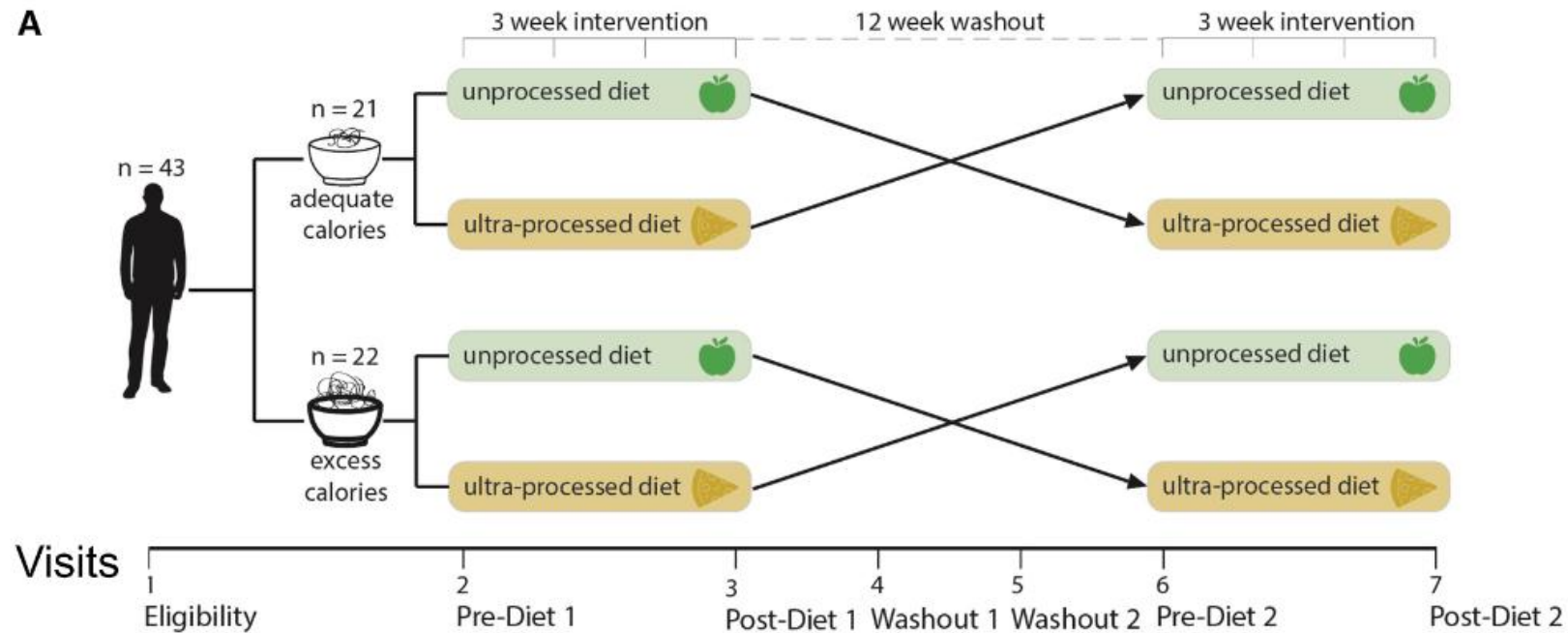
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Cell Metabolism

Clinical and Translational Report

Effect of ultra-processed food consumption on male reproductive and metabolic health



Cell Metabolism

Clinical and Translational Report

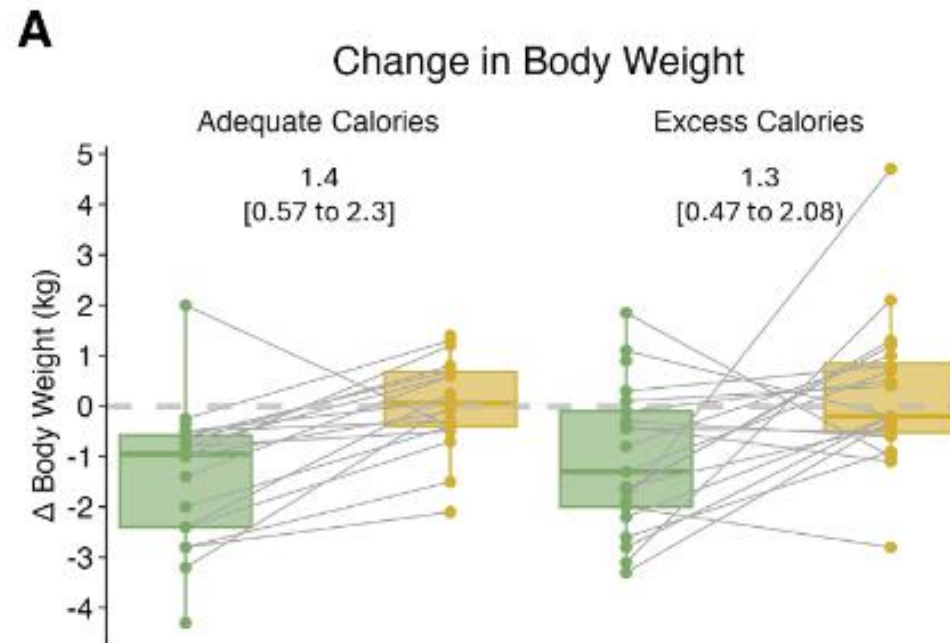
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Cell Metabolism

Clinical and Translational Report

Effect of ultra-processed food consumption on male reproductive and metabolic health



Studie	Design og intervention	Energiindtag (UPF vs. ikke-UPF)	Vægtændring (UPF vs ikke-UPF)
Hall et al 2019 N=20 (USA)	Crossover 2 uger ad libitum, samme næringsstoffer	+ 508 kcal/dag	+ 0.9 kg vs -0.9 kg
Hamano et al. 2024 N=9 (Japan)	Crossover 1 uge ad libitum, samme næringsstoffer	+ 813 kcal/dag	+ 2.1 kg vs + 1.0 kg
Dicken et al. 2025 N=55 (UK)	Crossover 8 uger ad libitum, følger UK kostråd	-290 vs – 504 kcal/dag	-1.05% kropsvægt vs - 2.06% kropsvægt
Preston et al. 2025 N=43	Crossover 2 x 3 uger ad libitum, samme næringsstoffer	Energibalance: ns Hyper-energi: ns	Energibalance: +1.4 kg Hyper-energi: +1.3 kg

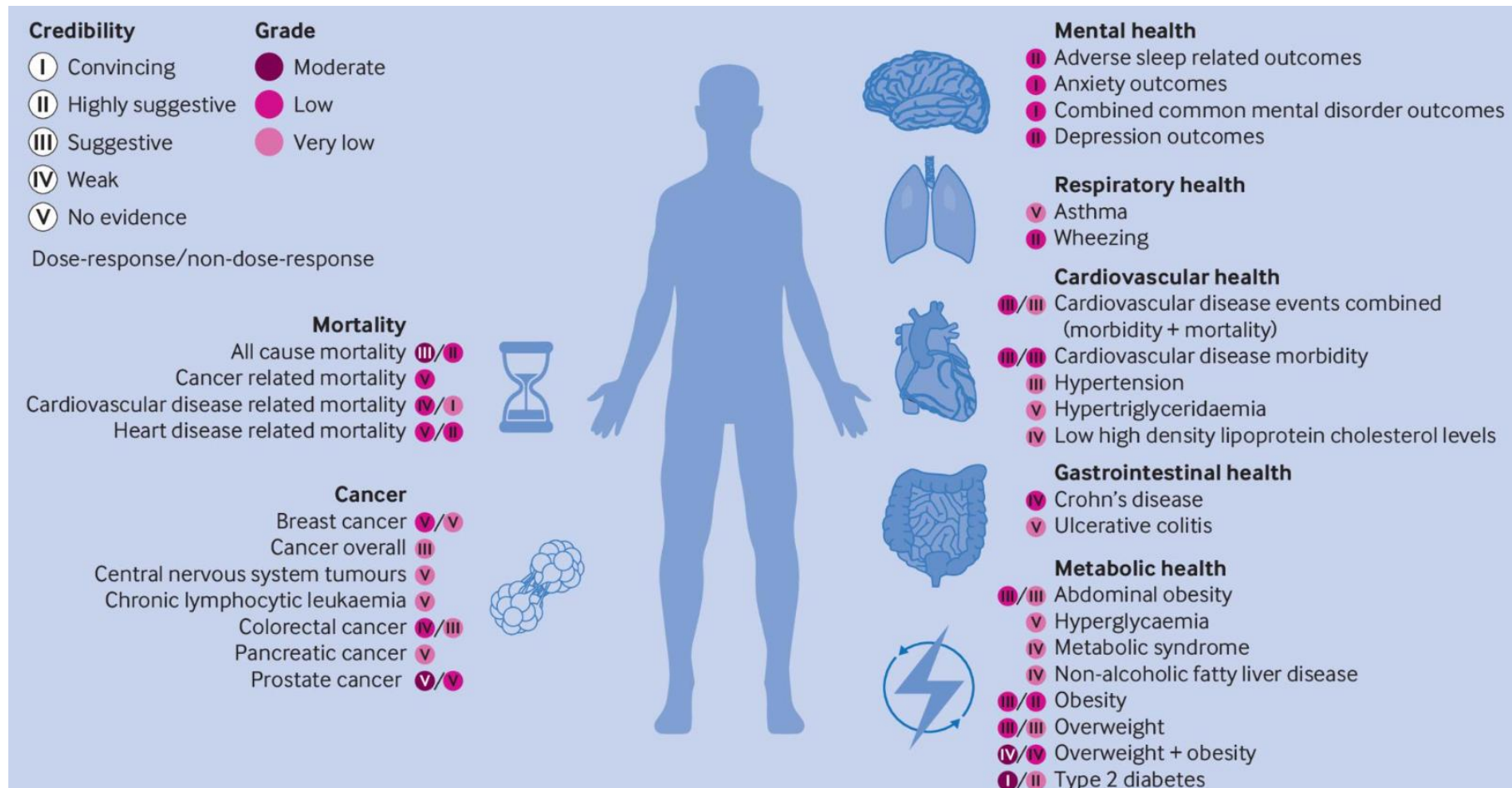


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Ultra-processed food exposure and adverse health outcomes: umbrella review of epidemiological meta-analyses

Melissa M Lane,¹ Elizabeth Gamage,¹ Shutong Du,^{2,3} Deborah N Ashtree,¹
Amelia J McGuinness,¹ Sarah Gauci,^{1,4} Phillip Baker,⁵ Mark Lawrence,⁶ Casey M Rebholz,^{2,3}
Bernard Srour,⁷ Mathilde Touvier,⁷ Felice N Jacka,^{1,8,9} Adrienne O'Neil,¹ Toby Segasby,¹⁰
Wolfgang Marx¹





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Wolfgang Marx¹

Outcome	Equivalent odds ratio (95% CI)	Equivalent odds ratio (95% CI)	k	Credibility	GRADE
Mortality					
All cause mortality (dose)	1.02 (1.01 to 1.03)		9	III	Moderate
Cardiovascular disease related mortality (dose)	1.05 (1.02 to 1.08)		5	IV	Low
Heart disease related mortality (dose)	1.18 (0.95 to 1.47)		2	V	Low
Cancer					
Breast cancer (dose)	1.03 (0.98 to 1.09)		3	V	Low
Colorectal cancer (dose)	1.04 (1.01 to 1.07)		5	IV	Low
Prostate cancer (dose)	0.99 (0.97 to 1.02)		3	V	Moderate
Cardiovascular Health					
Cardiovascular disease events combined (dose)	1.04 (1.02 to 1.06)		8	III	Low
Cardiovascular disease morbidity (dose)	1.04 (1.02 to 1.06)		2	III	Low
Metabolic Health					
Abdominal obesity (dose)	1.05 (1.02 to 1.07)		6	III	Low
Obesity (dose)	1.07 (1.03 to 1.11)		7	III	Low
Overweight (dose)	1.06 (1.03 to 1.10)		2	III	Low
Overweight + obesity (dose)	1.03 (1.01 to 1.06)		3	IV	Moderate
Type 2 diabetes (dose)	1.12 (1.11 to 1.13)		7	I	Moderate

0.9

1

1.5

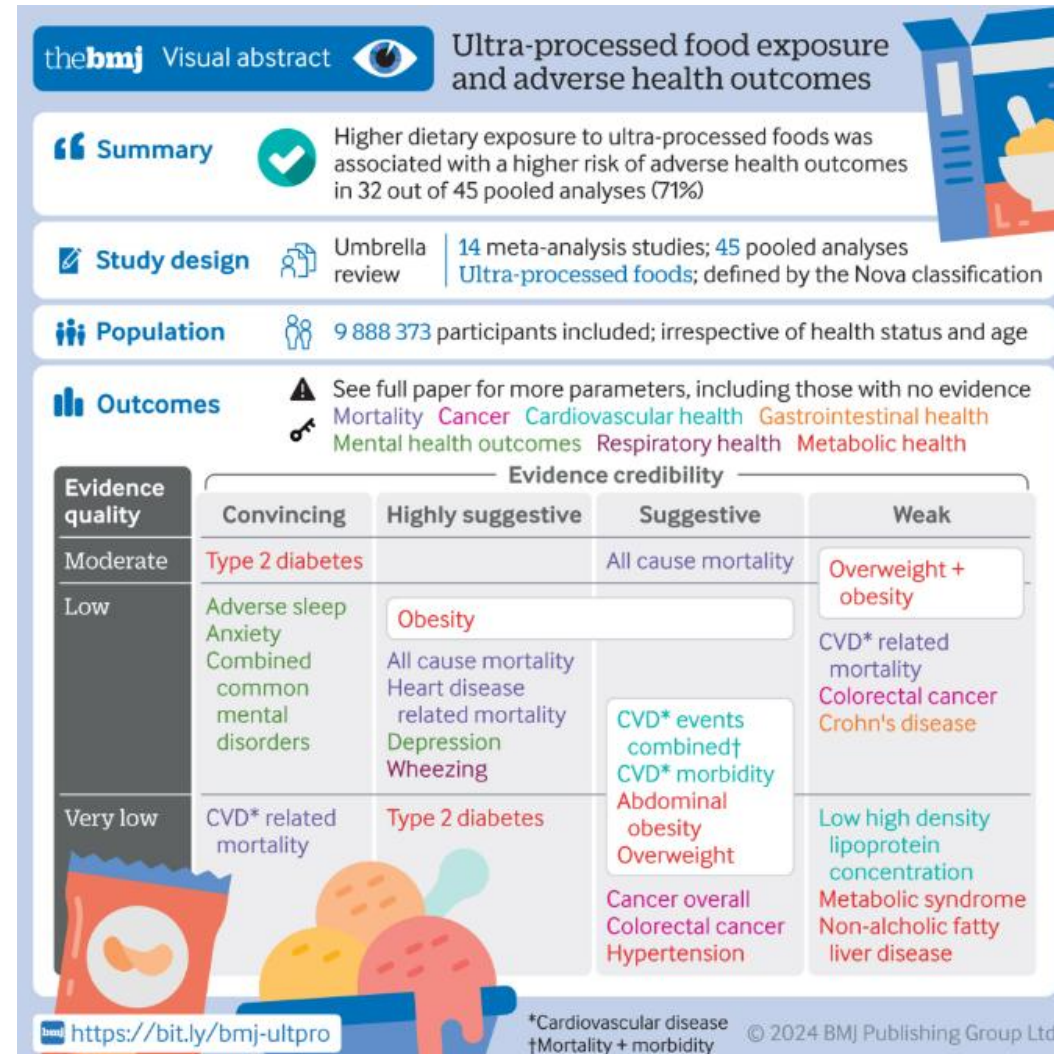


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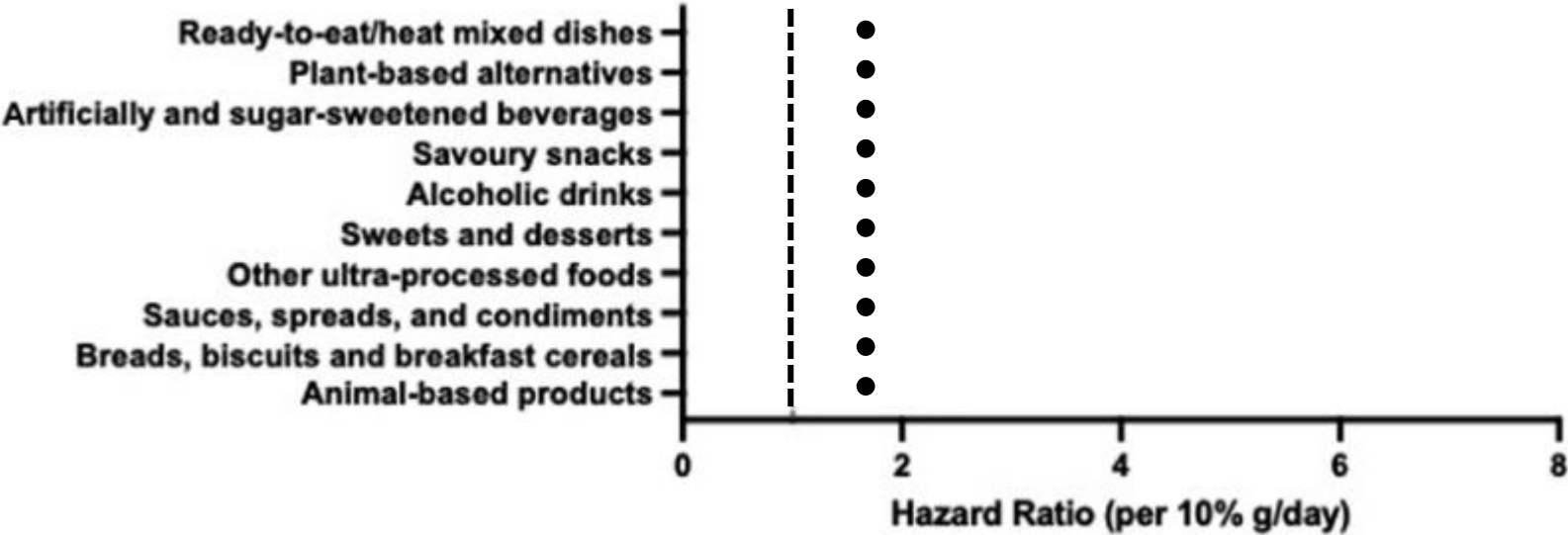
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Wolfgang Marx¹





Food consumption by degree of food processing and risk of type 2 diabetes mellitus: a prospective cohort analysis of the European Prospective Investigation into Cancer and Nutrition (EPIC)

Samuel J. Dicken,^{a,*} Christina C. Dahm,^b Daniel B. Ibsen,^{b,c,d} Anja Olsen,^{b,e} Anne Tjønneland,^{e,f} Mariem Louati-Hajji,^g Claire Cadeau,^g Chloé Marques,^g Matthias B. Schulze,^{h,i,j} Franziska Jannasch,^h Ivan Baldassari,^k Luca Manfredi,^l Maria Santucci de Magistris,^m Maria-Jose Sánchez,^{n,o,p} Carlota Castro-Espin,^{q,r} Daniel Rodríguez Palacios,^{s,t} Pilar Amiano,^{u,v} Marcela Guevara,^{w,x,y} Yvonne T. van der Schouw,^z Jolanda M. A. Boer,^{aa} W. M. Monique Verschuren,^{z,aa} Stephen J. Sharp,^{ab} Nita G. Forouhi,^{ab} Nicholas J. Wareham,^{ab} Eszter P. Vamos,^{ac} Kiara Chang,^{ac} Paolo Vineis,^{ad} Alicia K. Heath,^{ad} Marc J. Gunter,^{ad,ae} Geneviève Nicolas,^{ae} Elisabete Weiderpass,^{af} Inge Huybrechts,^{ae} and Rachel L. Batterham^{a,ag,ah}

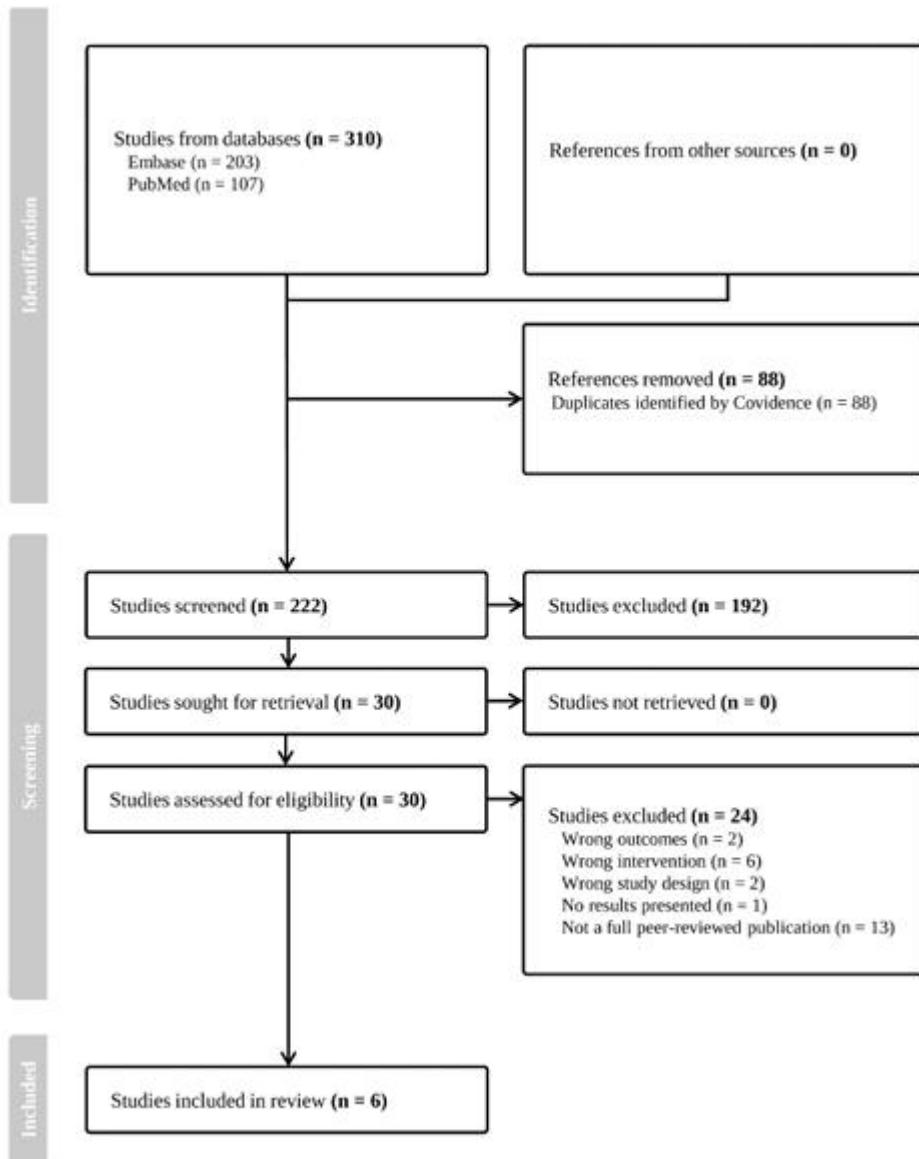


Why causal effects of ultra-processed foods cannot be identified: a systematic review of subtypes of ultra-processed foods and risk of type 2 diabetes

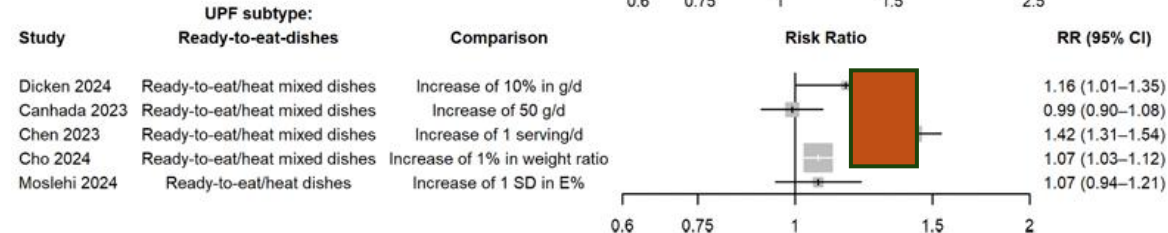
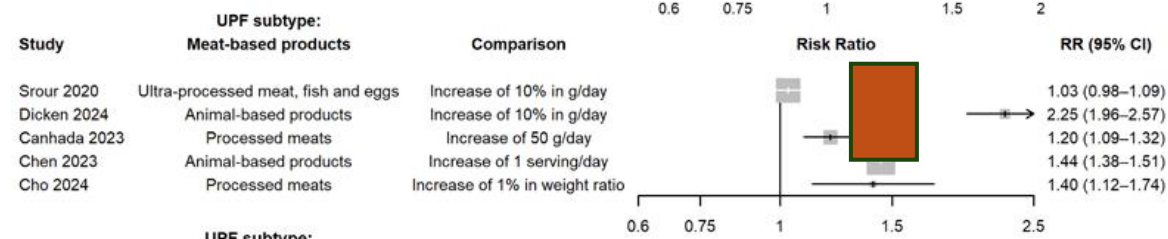
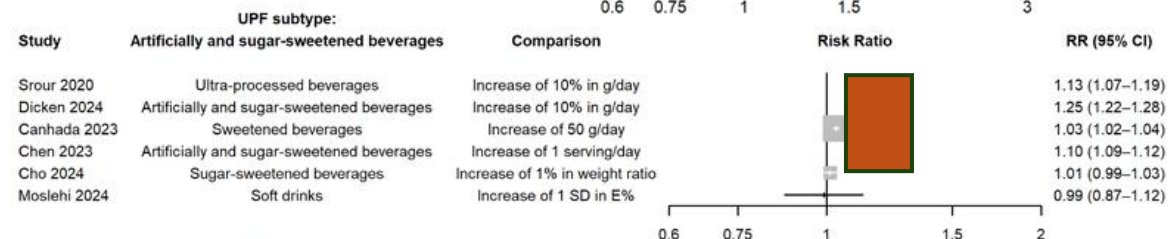
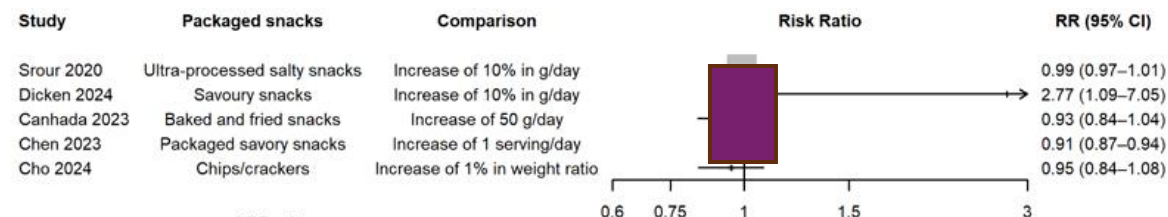
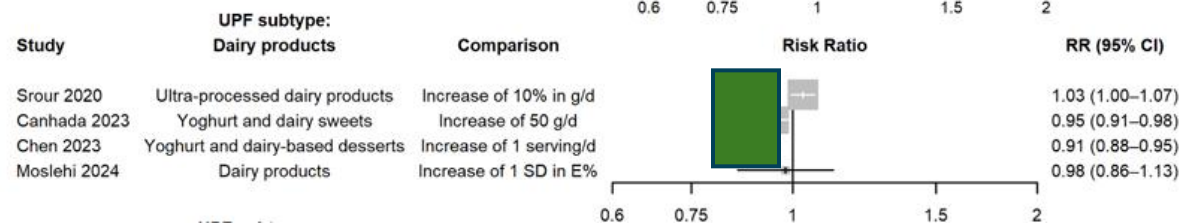
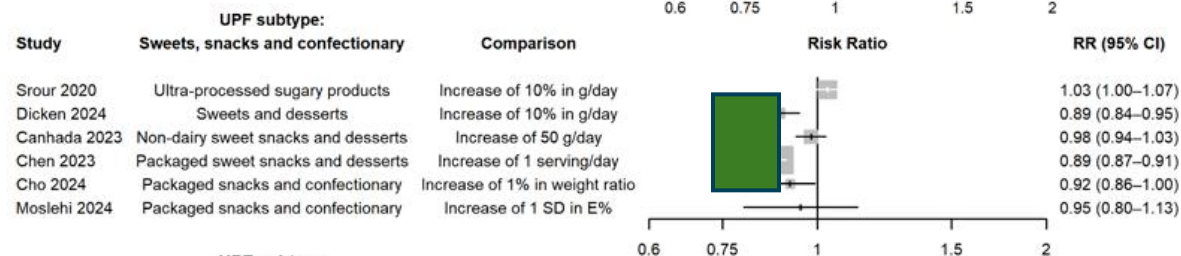
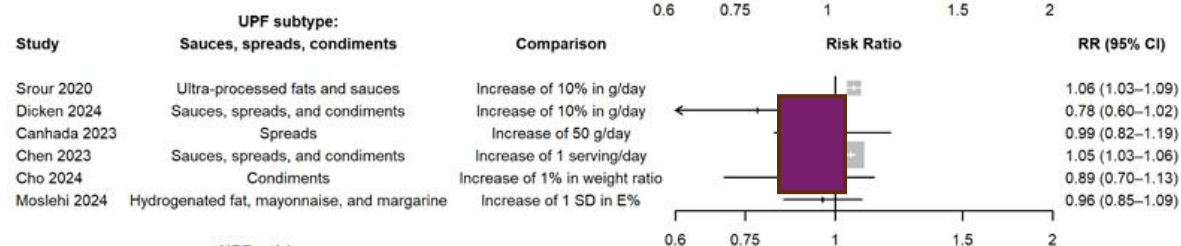
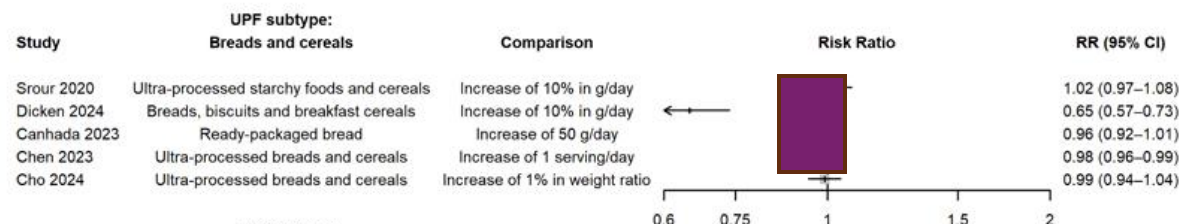
Michael Fridén^{1,2,3}, Maria Mai⁴, Anja Olsen^{4,5}, Christina C. Dahm⁴, Daniel B. Ibsen^{2,4}

1. Systematisk søgning

2. Analyse i kohorte data



1. Systematisk søgning



2. Analyse i kohorte data

1 Why causal effects of ultra-processed foods cannot be identified: a
2 systematic review of subtypes of ultra-processed foods and risk of type 2
3 diabetes

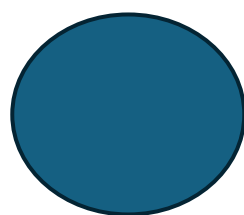
4
5 Michael Fridén^{1,2,3}, Maria Mai⁴, Anja Olsen^{4,5}, Christina C. Dahm⁴, Daniel B. Ibsen^{2,4}

“De forfærdelige 5”

- Rødt kød
- Forarbejdet kød
- Sodavand med sukker
- Raffinerede kornprodukter
- Grøntsager

Individuelle HR (95% CI)

- 1.15 (1.12, 1.20)
- 1.24 (1.16, 1.31)
- 1.04 (1.03, 1.05)
- 1.06 (1.02, 1.10)
- 0.96 (0.95, 0.98)



N = 52,201

15.4 års opfølgning



N T2D = 6733

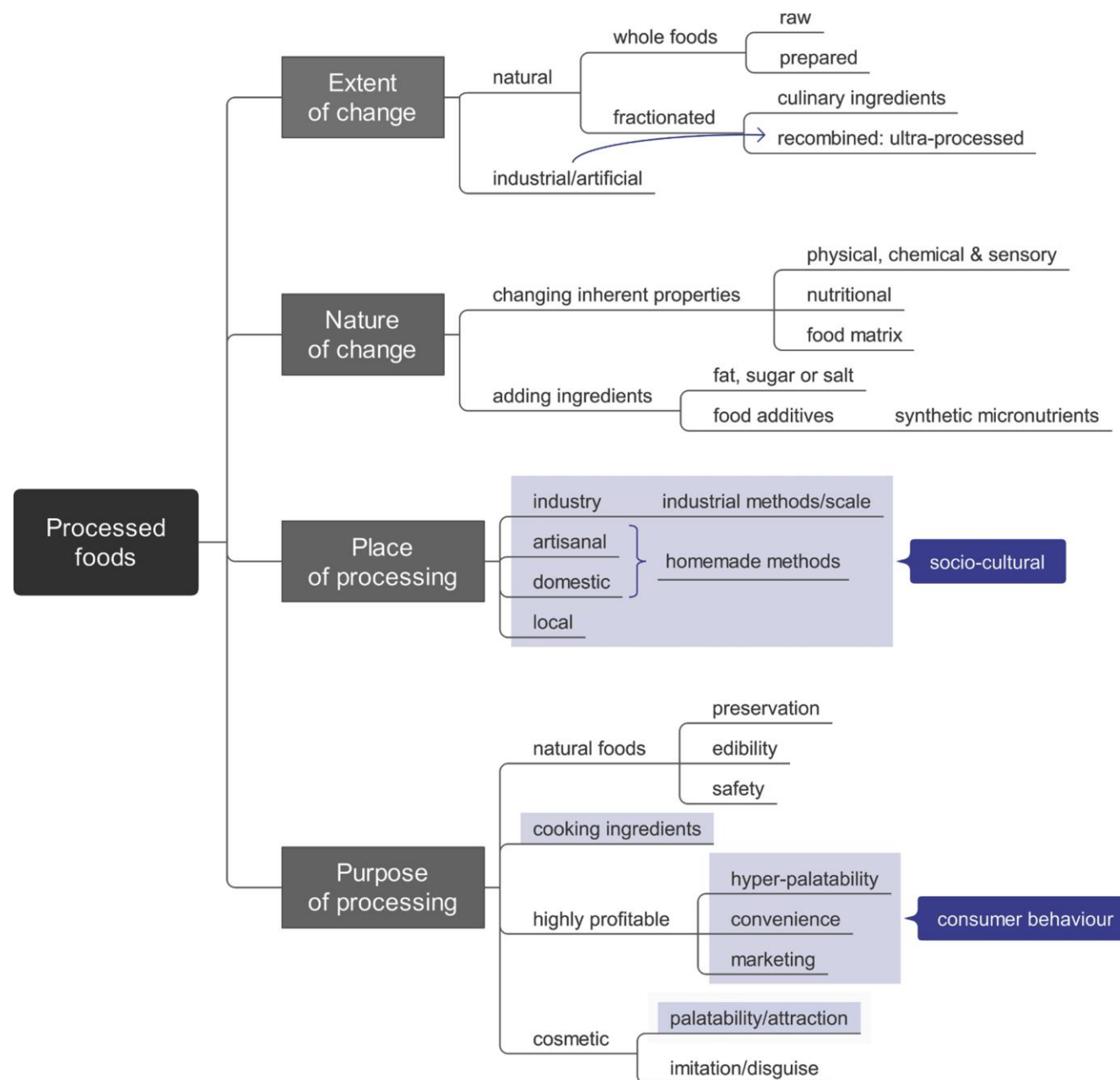


Højere indtag af De Forfærdelige 5 var forbundet med **14% højere risiko for T2D** (1.05, 1.23)



Processed food classification: Conceptualisation and challenges

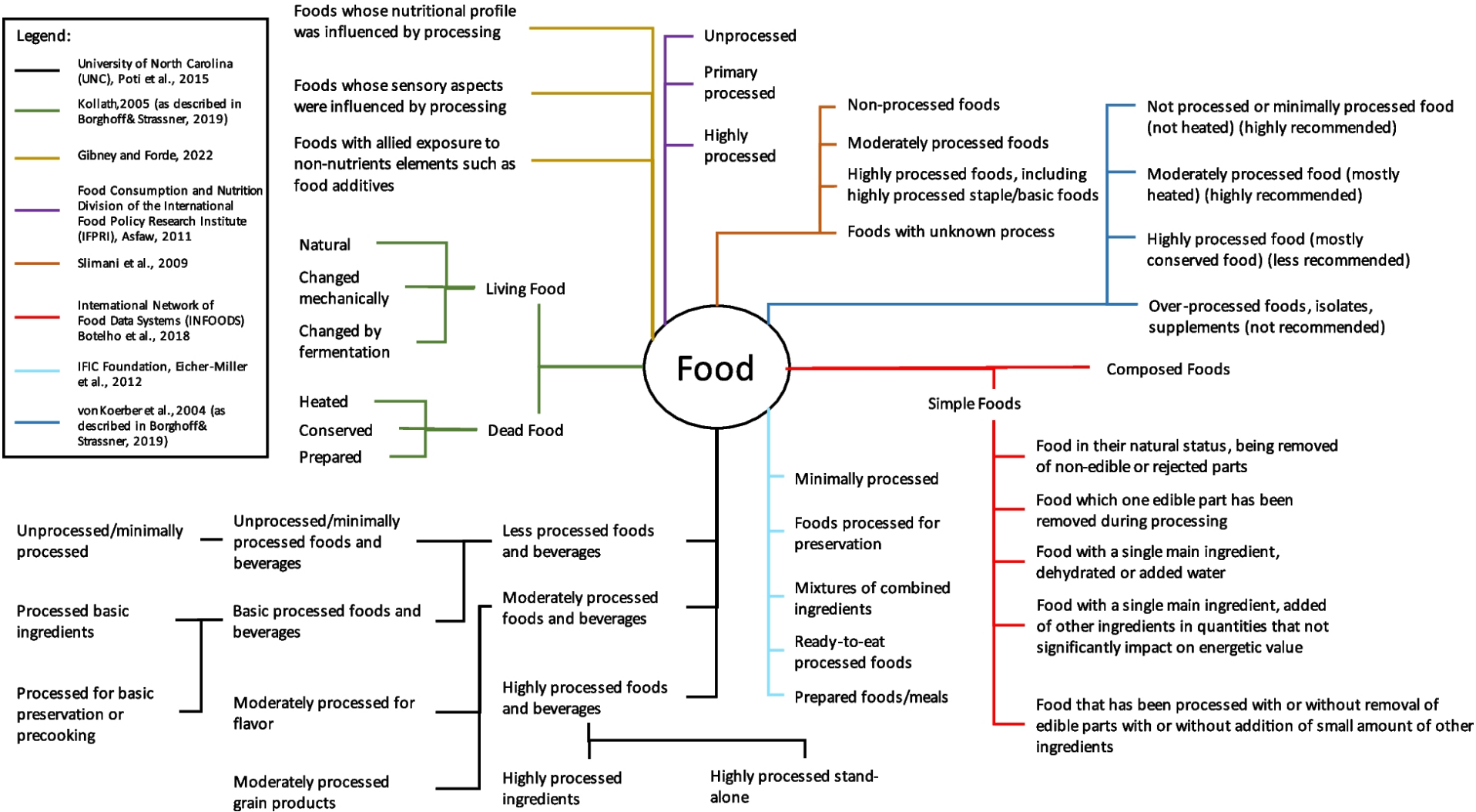
Christina R. Sadler ^{a, c} , Terri Grassby ^a, Kathryn Hart ^a, Monique Raats ^b, Milka Sokolović ^c,
Iada Timotiievic ^b



Towards a definition of food processing: conceptualization and relevant parameters

[Dusan Ristic](#)✉, [Denisse Bender](#), [Henry Jaeger](#), [Volker Heinz](#) & [Sergiy Smetana](#)

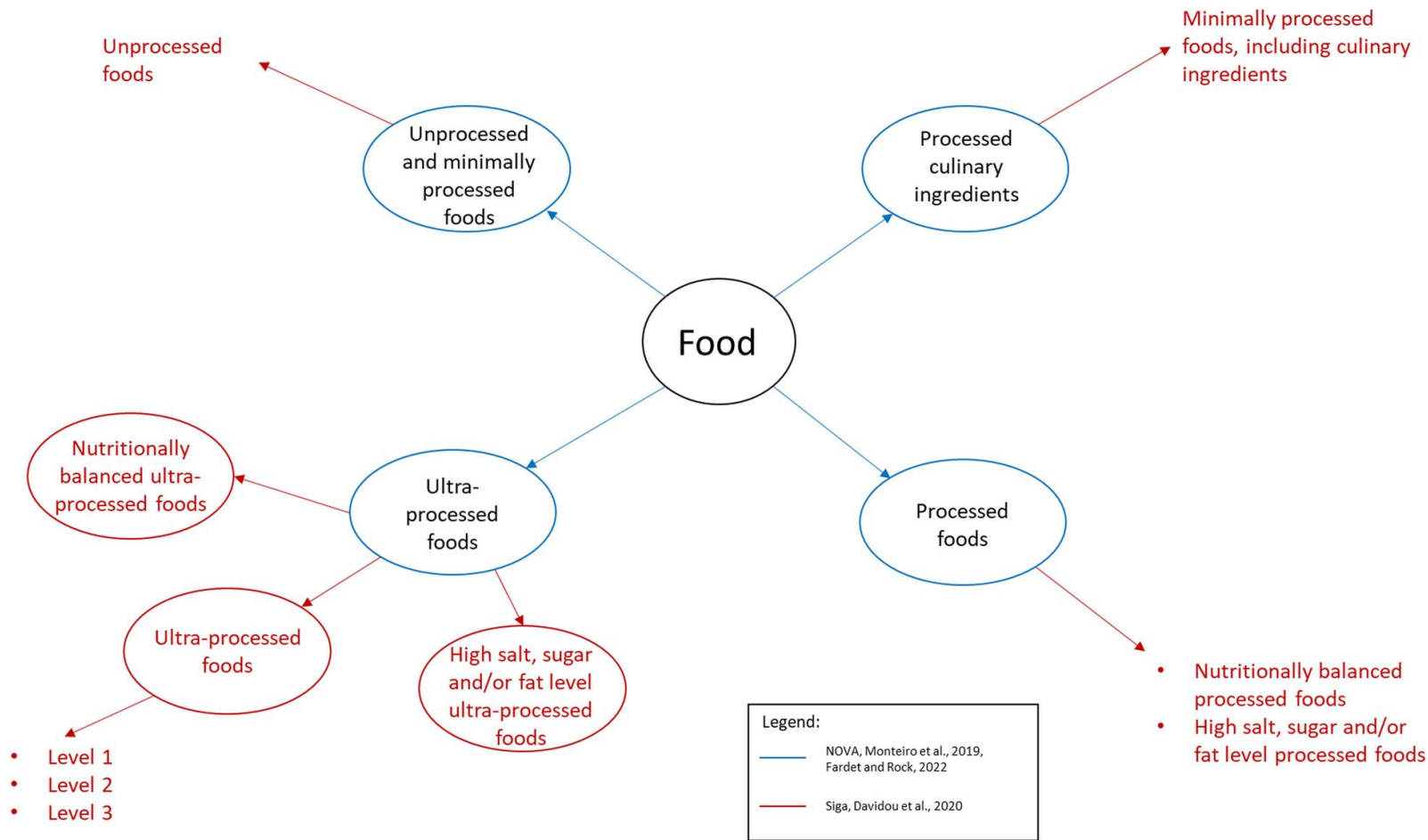
[Food Production, Processing and Nutrition](#) 6, Article number: 79 (2024) | [Cite this article](#)



Towards a definition of food processing: conceptualization and relevant parameters

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Food Production, Processing and Nutrition **6**, Article number: 79 (2024) | [Cite this article](#)



- Level 1
- Level 2
- Level 3

Tilsætningsstoffer – hvad og hvorfor

- Én samlet betegnelse for mange vidt forskellige stoffer
- Bruges til fx holdbarhed (brød), farve/smag (vingummi) og konsistens (suppe)
- Kun godkendte tilsætningsstoffer må bruges
 - Godkendes først når de er dokumenteret sikre
- Må kun anvendes i mængder, der er teknologisk nødvendige



Tilsætningsstoffer – hvad og hvorfor

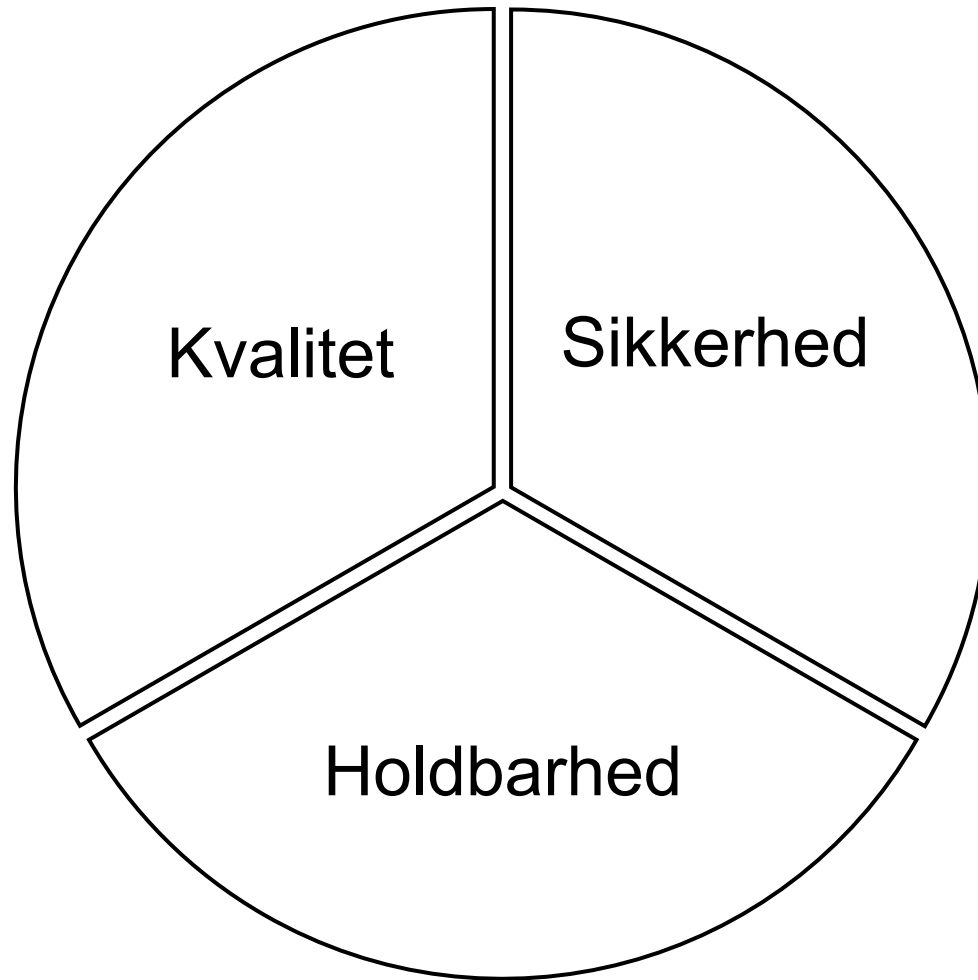
- EFSA vurderer sikkerheden af tilsætningsstoffer i EU, både nye stoffer og allerede godkendte, når der kommer ny viden.
- EU-Kommissionen træffer selve godkendelsesbeslutningen, så risikovurdering og risikohåndtering holdes adskilt.
- Alle godkendte tilsætningsstoffer får et E-nummer.



E-numre

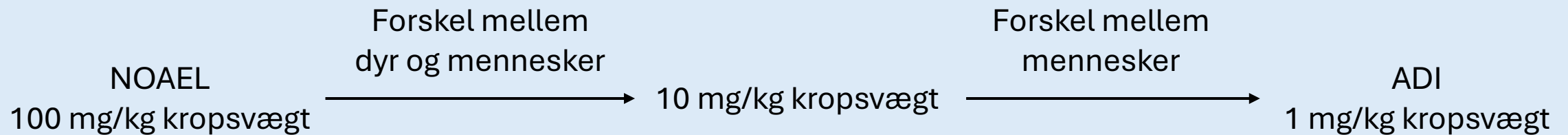


Hvorfor er der tilsætningsstoffer i maden?



Hvordan vurderes tilsætningsstoffer?

- Standardiserede toksikologiske tests, typisk på forsøgsdyr
- Tester for akut forgiftning, reproduktion/fosterudvikling, kroniske effekter, kræft og genotoksicitet
- Man fastlægger NOAEL – den højeste dosis uden skadelige effekter
- Herfra beregnes ADI (Acceptabelt Dagligt Indtag)



Cocktail effekt

Kan eksponering for flere stoffer på give negative effekter, selv om doserne for de enkelte stoffer ligger under eller omkring NOAEL?

Man taler om kombinationseffekter som kan være additive, synergistiske eller antagonistiske

Additiv

$$2 + 2 = 4$$

Synergistisk

$$2 + 2 = 5$$

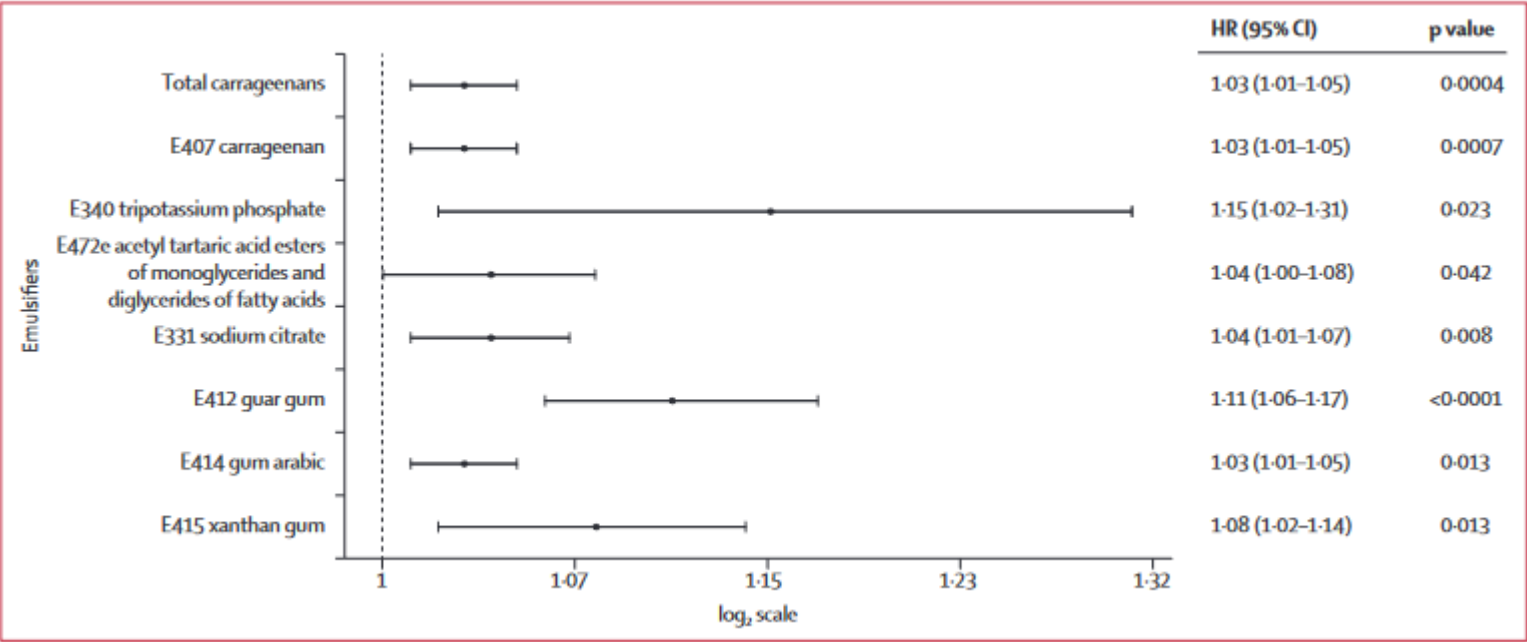
Antagonistisk

$$2 + 2 = 3$$

Food additive emulsifiers and the risk of type 2 diabetes: analysis of data from the NutriNet-Santé prospective cohort study

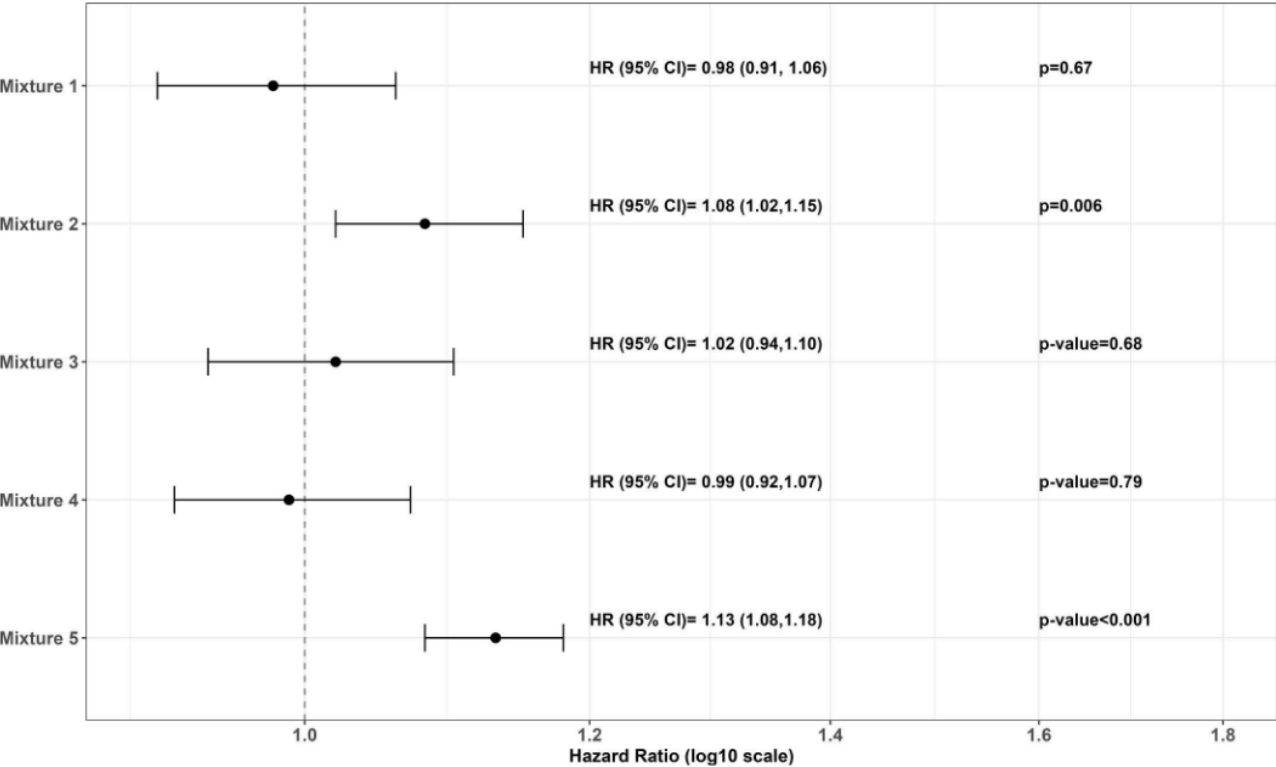


Clara Salame, Guillaume Javaux, Laury Sellem, Emilie Viennois, Fabien Szabo de Edelenyi, Cédric Agaësse, Alexandre De Sa, Inge Huybrechts, Fabrice Pierre, Xavier Coumoul, Chantal Julia, Emmanuelle Kesse-Guyot, Benjamin Allès, Léopold K Fezeu, Serge Hercberg, Mélanie Deschasaux-Tanguy, Emmanuel Cosson, Sopio Tatulashvili, Benoit Chassaing, Bernard Srour*, Mathilde Touvier*



Food additive mixtures and type 2 diabetes incidence: Results from the NutriNet-Santé prospective cohort

Marie Payen de la Garanderie^{1,2*}, Anaïs Hasenboehler^{1,2}, Nicolas Dechamp¹, Guillaume Javaux^{1,2}, Fabien Szabo de Edelenyi¹, Cédric Agaësse¹, Alexandre De Sa¹, Laurent Bourhis¹, Raphaël Porcher³, Fabrice Pierre^{2,4}, Xavier Coumoul^{2,5}, Emmanuelle Kesse-Guyot^{1,2}, Benjamin Allès¹, Léopold K. Fezeu¹, Emmanuel Cosson^{1,6}, Sopio Tatulashvili^{1,6}, Inge Huybrechts⁷, Serge Hercberg^{1,2,8}, Mélanie Deschasaux-Tanguy^{1,2}, Benoit Chassaing^{2,9}, Héloïse Rytter⁹, Bernard Srour^{1,2}, Mathilde Touvier^{1,2*}



Mixture 2 Food additive>Loading value

Modified starches	0.99
E440 Pectins	0.31
E412 Guar gum	0.26
E407 Carrageenan	0.24
E452 Polyphosphates	0.21
E202 Potassium sorbate	0.17
E100 Curcumin	0.16
E415 Xanthan gum	0.16

Mixture 5 Food additive>Loading value

E330 Citric acid	0.83
E331 Sodium citrates	0.63
E338 Phosphoric acid	0.59
E150d Sulphite ammonia caramel	0.59
E950 Acesulfame K	0.56
E951 Aspartame	0.41
E955 Sucralose	0.25
E414 Arabic gum	0.23
E296 Malic acid	0.19
E903 Carnauba wax	0.18
E160c Paprika extract, capsanthin, capsorubin	0.17
E163 Anthocyanins	0.15
E412 Guar gum	0.15
E440 Pectins	0.15

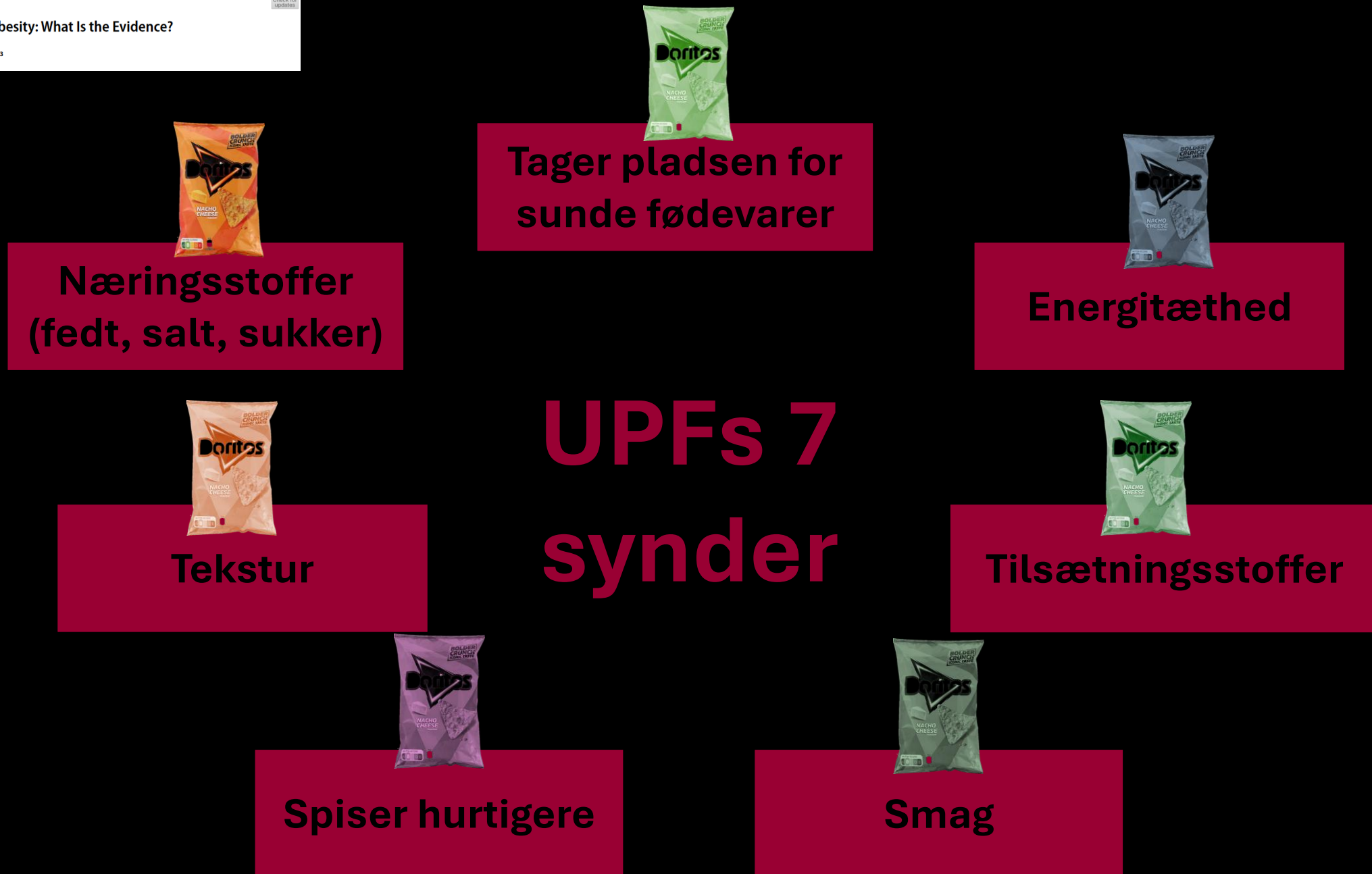


Ingredienser:

HVEDEmel (GLUTEN), palmeolie (palmeolie, antioxidant: E306), salt, tapiokastivelse, modificeret tapiokastivelse, hvidløg 1,7%, aroma, smagsforstærkere: E621, E635, sukker, chili 0,5%, forårsløg 0,1%, peber 0,1%, majsstivelse, syre: E296, fortykningsmiddel: E466, gærekstrakt, farve: E150c. Der kan være spor af KREBSDYR, FISK, SOJA, MÆLK, SELLERI og SESAMFRØ

Ultra-processed Food and Obesity: What Is the Evidence?

Samuel J. Dicken¹ · Rachel L. Batterham^{1,2,3}





Speed limits: the effects of industrial food processing and food texture on daily energy intake and eating behaviour in healthy adults

Marlou Lasschuijt¹ · Guido Camps¹ · Monica Mars¹ · Els Siebelink¹ · Kees de Graaf¹ · Dieuwerte Bolhuis²



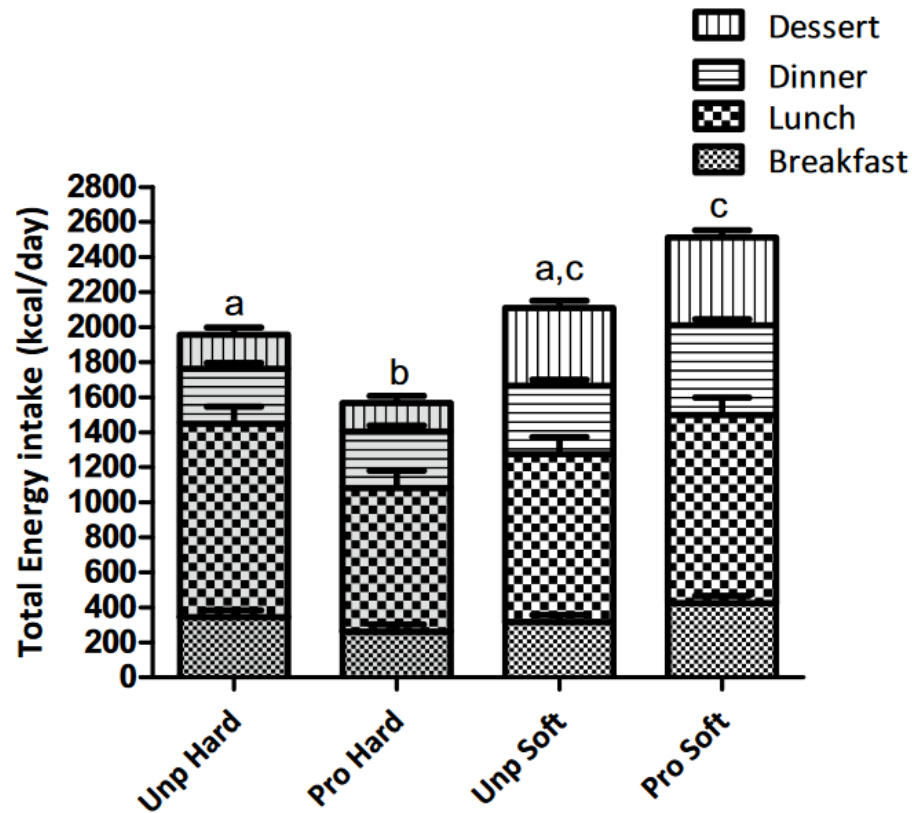
Table 2 Overview of the daily diets for each of the four study conditions, including the type of texture manipulation

Meal	Unprocessed		(Ultra-)processed		Type of texture manipulation
	Hard	Soft	Hard	Soft	
Breakfast	Fresh mixed fruit	Homemade smoothie	Canned mixed fruit	Store bought smoothie	Solid/liquid
Morning snack	Apple pieces	Apple sauce -no additives	Apple pieces	Store bought Apple juice	Solid/semi-solid/liquid
Lunch	Fresh Tagliatelle pasta with homemade tomato sauce, hard-steamed vegetables and large pieces of chicken fillet	Fresh tagliatelle pasta with homemade tomato sauce, soft-steamed vegetables and homemade pulled chicken	Store bought, pork meat tortellini with pre-canned tomato sauce, hard-cooked vegetables and grated cheese	Ready-to-eat macaroni Bolognese with grated cheese	Hardness and piece size
Afternoon snack	Dried mango	Raisins	Muesli bar pieces	Fruit bar pieces	Elasticity and hardness
Dinner	Potato parts with large pieces of pork fillet and whole hard-steamed green beans	Homemade mashed potato with eggs small pieces of soft-steamed green beans	Pre-flavoured and baked potato parts with large pieces of chicken schnitzel and whole, hard-steamed green beans	Mashed potato with chicken meatballs and small pieces of soft-steamed green beans	Hardness piece size
Dessert	Dried figs and almonds	Curd with added honey and crushed pecan nuts	Mass produced fig bread	Walnut and honey flavoured yoghurt	Solid versus semi-solid

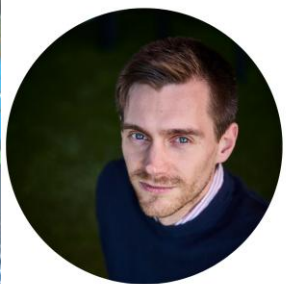


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Ultraforarbejdet med
NEJ TAK!



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