Sustainable Healthy Diets: Metrics and Measures

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Agroscope Sustainability Symposium
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FAO principles: Sustainable healthy diets…

- ….are based on a great variety of unprocessed or minimally processed foods, balanced across food groups, while restricting highly processed foods and beverages.
- … include wholegrains, legumes, nuts and an abundance and variety of fruits and vegetables.
- … can include moderate amounts of eggs, dairy, poultry and fish; and small amounts of red meat.
- … include safe and clean drinking water as the fluid of choice.
- … reduce food loss and waste.

What are healthy nutrient dense foods?

Jeudi 26 janvier 2023

Une alimentation saine et durable: nous avons le choix 3 fois par jour

10e Conférence Agroscope sur la durabilité

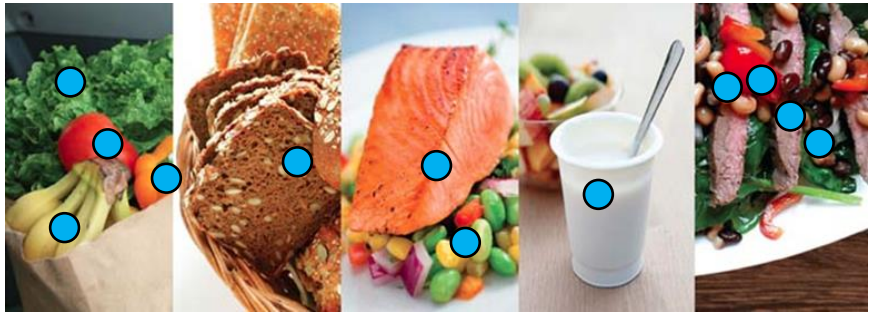
What are healthy nutrient dense foods?

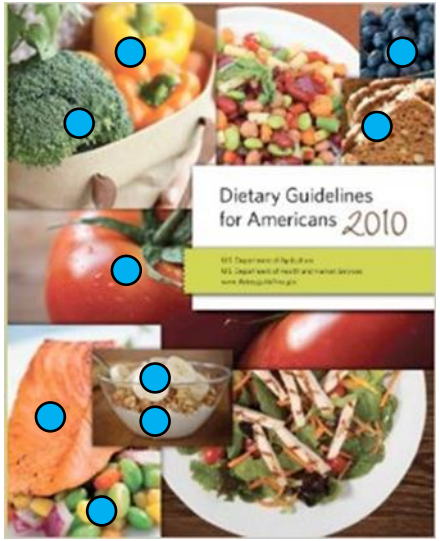
The concept of nutrient density @2010

What are healthy nutrient dense foods?

The concept of nutrient density @2010

Nutrient density in US Dietary Guidelines





FAO does not mention “affordable” – why?

SUSTAINABLE HEALTHY DIETS...

REGARDING THE HEALTH ASPECT

1 ...start early in life with: early initiation of breastfeeding, exclusive breastfeeding until six months of age, and continued breastfeeding until two years and beyond; combined with appropriate complementary feeding.

2 ... are based on a great variety of unprocessed or minimally processed foods, balanced across food groups, while restricting highly processed food and drink products.[10]

3 ... include wholegrains, legumes, nuts and an abundance and variety of fruits and vegetables.[11]

4 ... can include moderate amounts of eggs, dairy, poultry and fish; and small amounts of red meat.

5 ... include safe and clean drinking water as the fluid of choice.

6 ... are adequate (i.e. reaching but not exceeding needs) in energy and nutrients for growth and development, and to meet the needs for an active and healthy life across the lifecycle.

7 ... are consistent with WHO guidelines to reduce the risk of diet-related NCDs, and ensure health and wellbeing for the general population.[12]

8 ... contain minimal levels, or none if possible, of pathogens, toxins and other agents that can cause foodborne disease.

REGARDING ENVIRONMENTAL IMPACT

9 ... maintain greenhouse gas emissions, water and land use, nitrogen and phosphorus application and chemical pollution within set targets.

10 ... preserve biodiversity, including that of crops, livestock, forest-derived foods and aquatic genetic resources, and avoid overfishing and overhunting.

11 ...minimize the use of antibiotics and hormones in food production.

12 ... minimize the use of plastics and derivatives in food packaging.

REGARDING SOCIOCULTURAL ASPECTS

13 ...reduce food loss and waste.

14 ... are built on and respect local culture, culinary practices, knowledge and consumption patterns, and values on the way food is sourced, produced and consumed.

15 ... are accessible and desirable.

16 ... avoid adverse gender-related impacts, especially with regard to time allocation (e.g. for buying and preparing food, water and fuel acquisition).

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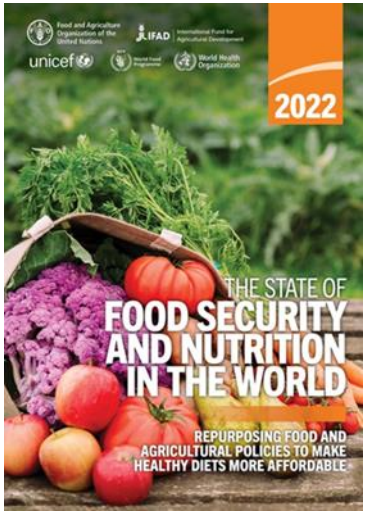
Sustainability includes an *economic* component

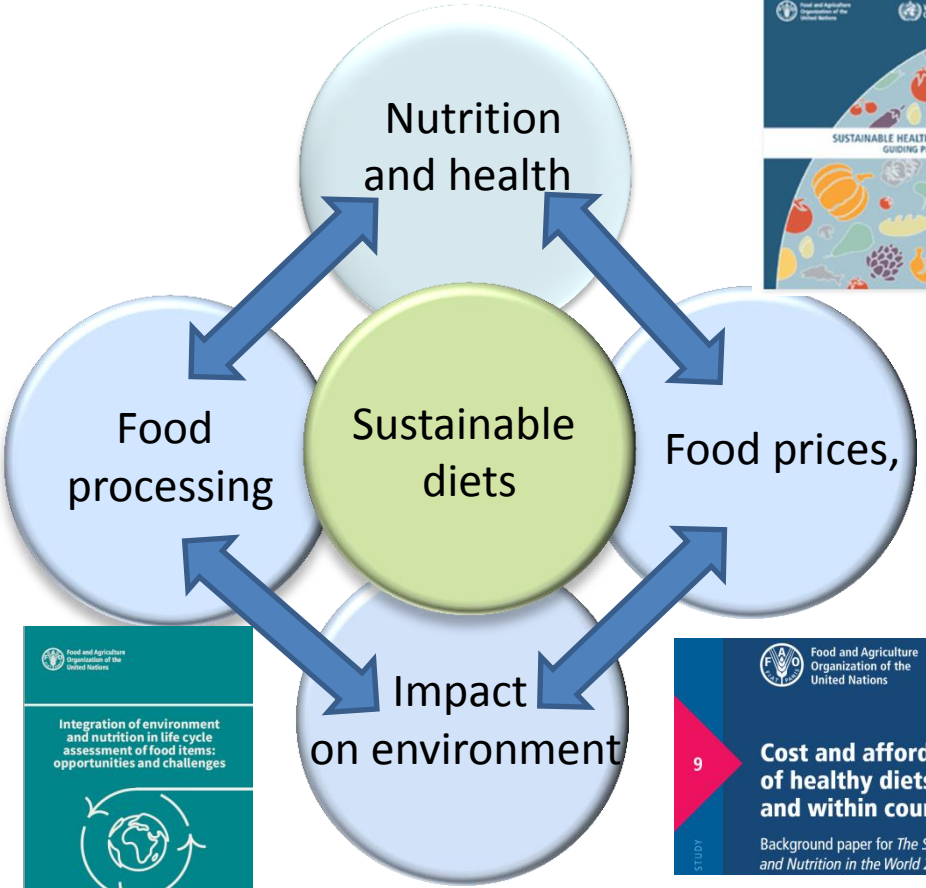


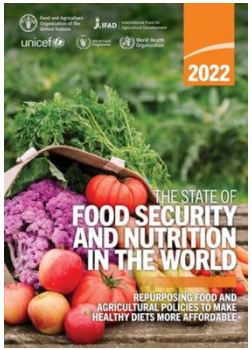
- The four domains of sustainable healthy diets are nutrition, *economics*, society and the environment.
- Sustainable healthy diets need to be nutrient-rich, *affordable*, socially acceptable and culturally appropriate, and with low impact on the environment.
  - Drewnowski, A.; Darmon, N.; Monsivais, P. Affordable Nutrient Density: Toward Economic Indicators of Sustainable Healthy Diets. Sustainability 2021, 13, 9300. https://doi.org/10.3390/su13169300

Four sustainability dimensions - not two or three

Food and Agriculture Organization of the United Nations

Ultra-processed foods, diet quality, and health using the NOVA classification system





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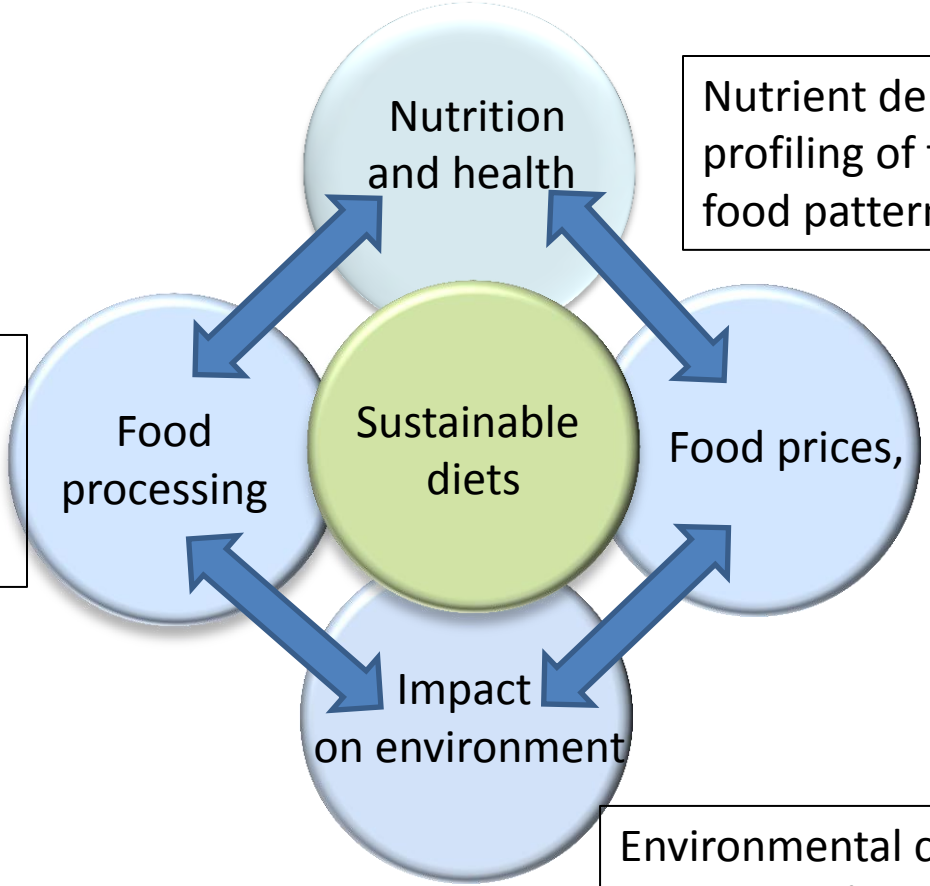
All four domains need metrics and measures



Nutrient density: Nutrient profiling of foods, meals and food patterns

Minimally processed, processed, and ultra-processed foods: NOVA

Affordability: Kcal or nutrients/penny in relation to wages

Environmental cost: What is the nutrition-relevant functional unit nFU?

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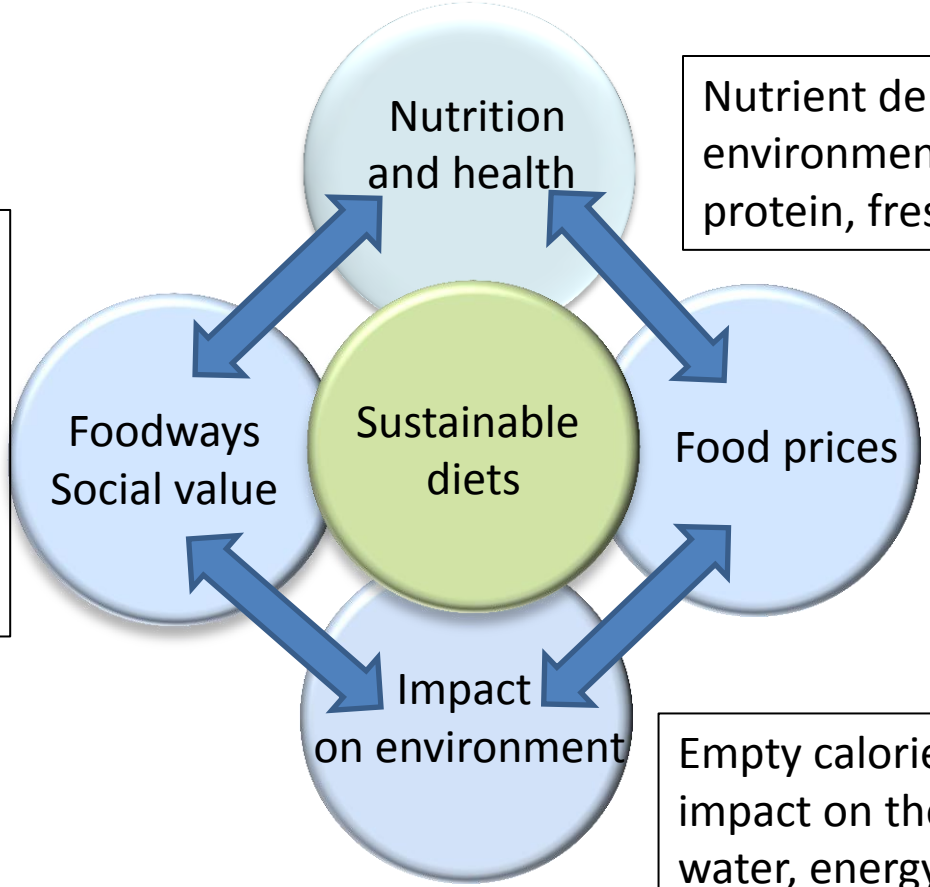
The four domains are *not* additive



Nutrient dense foods have high environmental cost (animal protein, fresh produce)

Minimally processed foods are expensive and generate more waste at consumer level. UPF are low cost but can have low nutritional value

Lowest cost foods (oil, sugar) are nutrient poor but have low carbon cost

Empty calories (sugar) have low impact on the environment (land, water, energy use)

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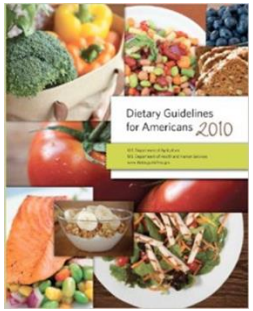
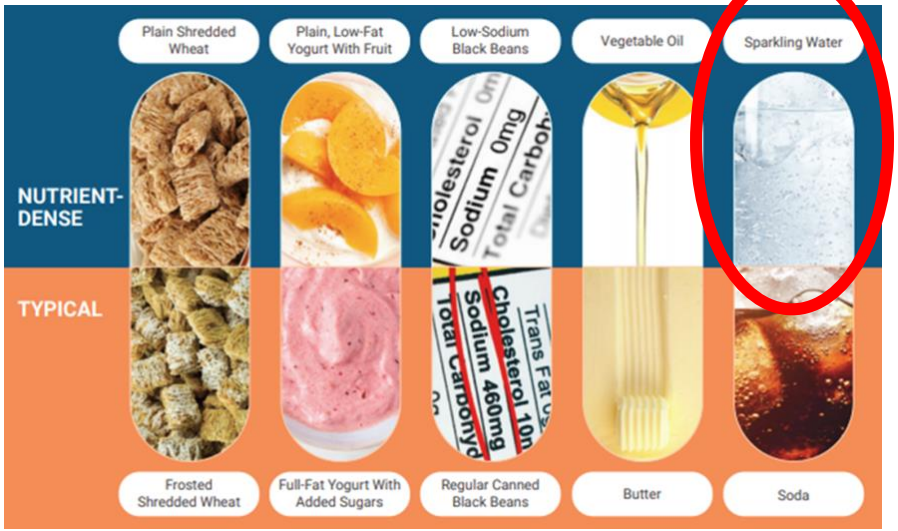
One:
Measuring nutrient density of foods

What is nutrient density?

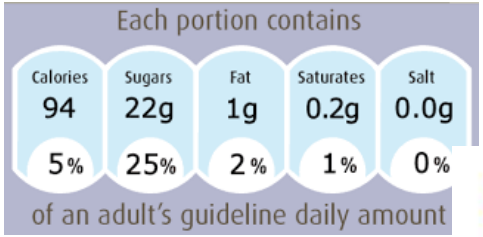




Nutrient-by-nutrient models

Nutrient-by-nutrient models

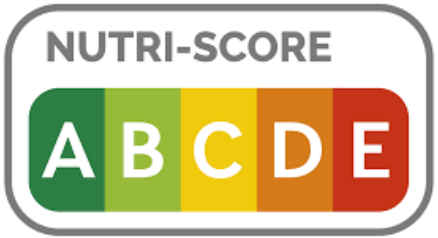
- Calories.
- Total, added, or free sugar.
- Total fat, saturated fat, trans fat.
- Salt (sodium).



Nutrient-by-nutrient profiles for Front of Pack labels (FoPL) FOP went from neutral Guideline Daily Amounts, to colored Traffic Lights and to black warning signs

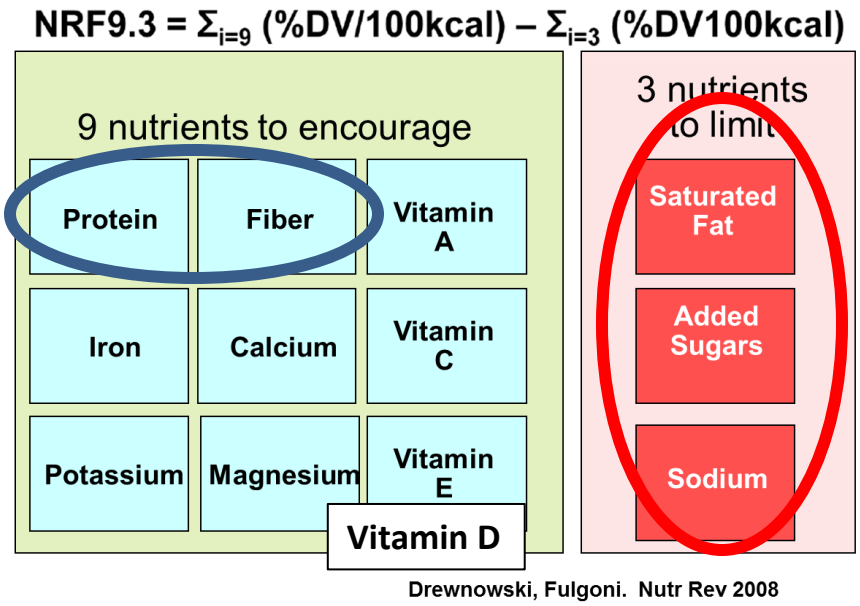
Composite nutrient profiles for FoPL

- Foods are rated (or ranked) based on their **overall nutritional value** per reference amount.
  - 100g, 100 kcal, or serving size
- Each food is awarded a **single score** based on:
  - **Negative nutrients** only (saturated, fat, total, added or free sugars, sodium)
  - **Positive nutrients only** (protein, fiber, vitamins and minerals).
  - A **balance** of positive and negative nutrients (compensatory models).
- Models can be across-the-board or category specific.
- NP models can include dietary components



The NRF index and Nutri-Score

The Nutrient Rich Foods (NRF) Index



Drewnowski, Fulgoni. Nutr Rev 2008

Nutri-Score point system

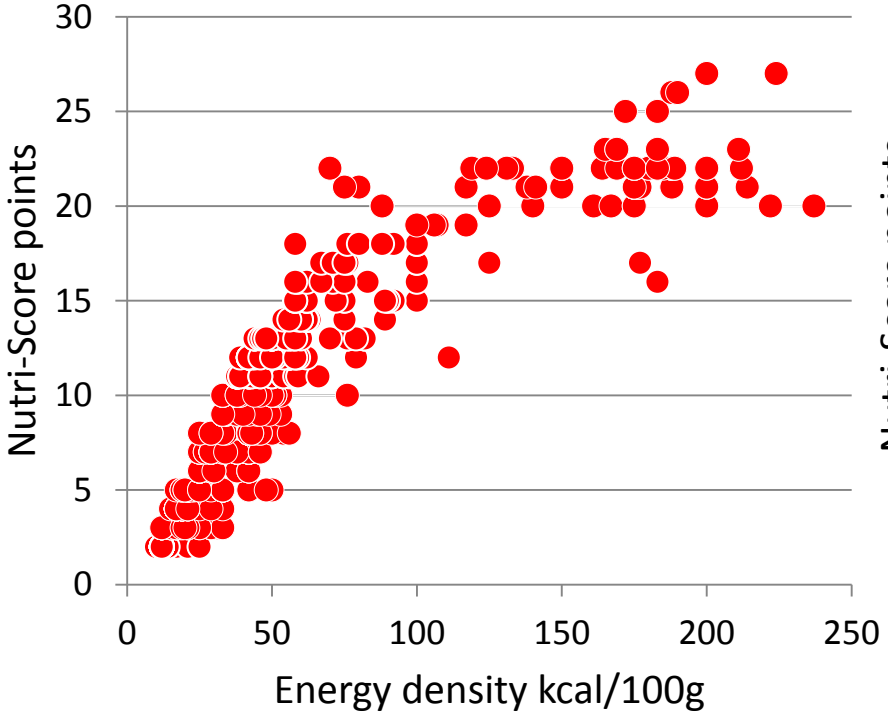
Negative points: N score				Positive points: P score			Points awarded
Energy (kj/100g)	Saturated fat (g/100g)	Total sugar (g/100g)	Total sodium (mg/100g)	Fruits and vegetables, legumes and nuts (%)	Fibers (g/100g)	Proteins (g/100g)	
≤ 335	≤ 1	≤ 4,5	≤ 90	≤ 40	≤ 0,9	≤ 1,6	0
> 335	> 1	> 4,5	> 90	> 40	> 0,9	> 1,6	1
> 670	> 2	> 9	> 180	> 60	> 1,9	> 3,2	2
> 1005	> 3	> 13,5	> 270	-	> 2,8	> 4,8	3
> 1340	> 4	> 18	> 360	-	> 3,7	> 6,4	4
> 1675	> 5	> 22,5	> 450	> 80	> 4,7	> 8,0	5
> 2010	> 6	> 27	> 540				6
> 2345	> 7	> 31	> 630				7
> 2680	> 8	> 36	> 720				8
> 3015	> 9	> 40	> 810				9
> 3350	> 10	> 45	> 900				10

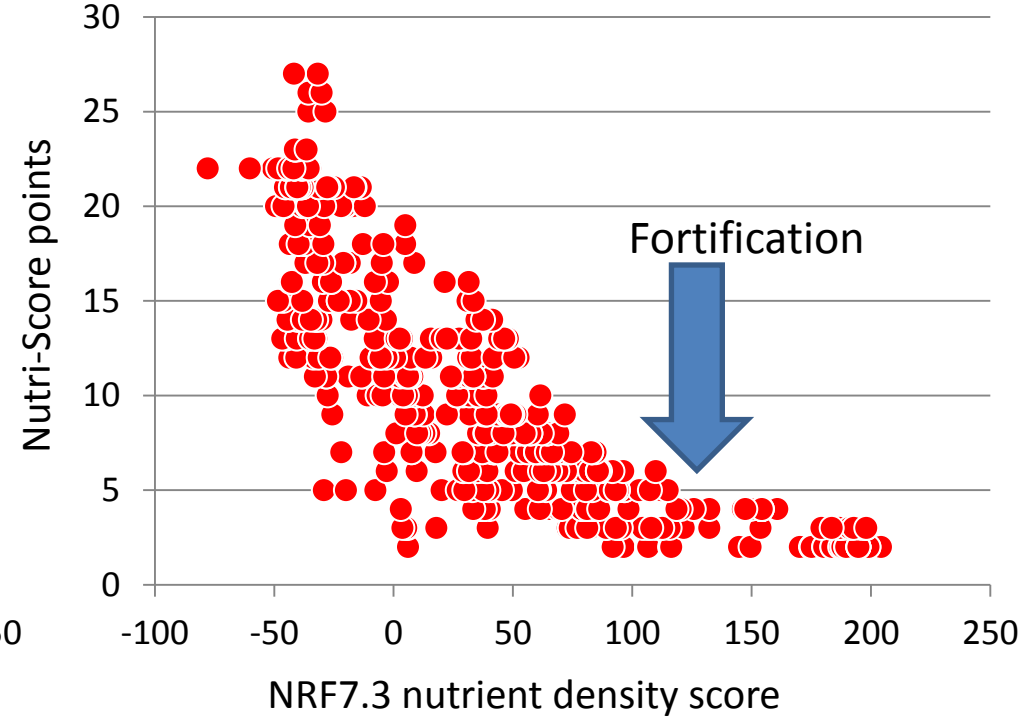
Nutrition Reviews, Volume 66, Issue 1, 1 January 2008

Nutri-Score captures energy density

Nutri-Score(beverage version) and NRF are inversely linked

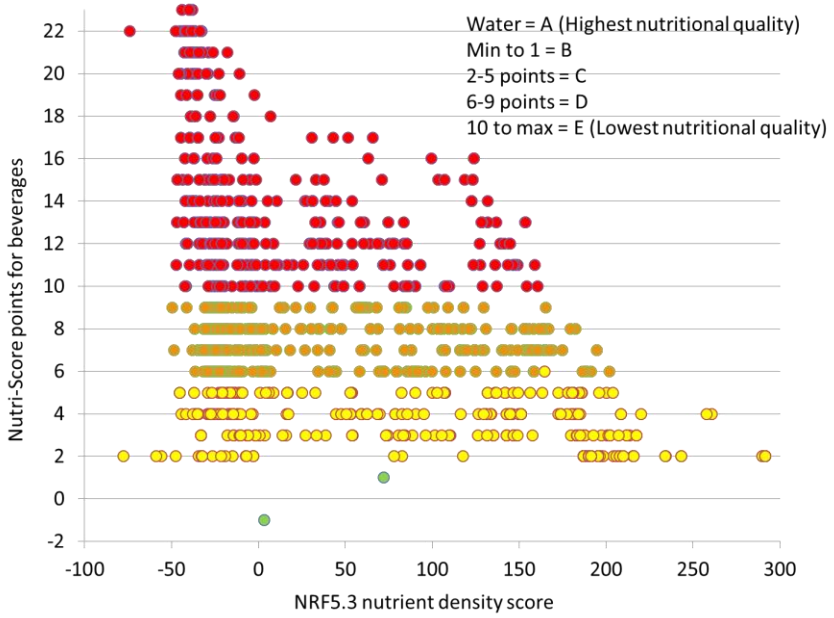
Data for 641 plant based milk alternatives in the USDA BFPDB (Advances in Nutrition 2021)



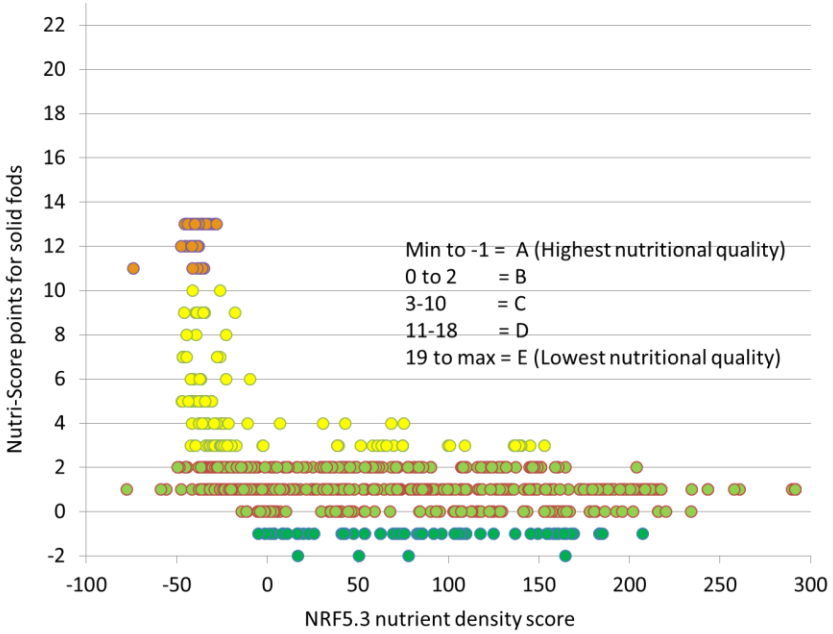


Nutri-Score for plant based “milks”

Score depends on policy decisions -- plant based beverages are treated as solids in France



Plant-based beverages treated as liquids



Plant-based beverages treated as solids

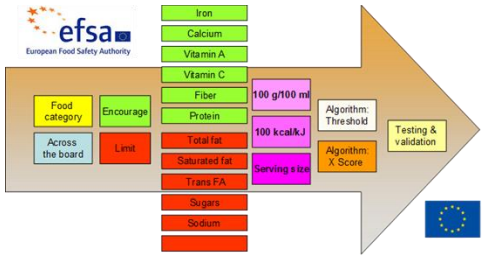
NRF 9.3 also captures micronutrients

Special Article

Nutrient profiling of foods: creating a nutrient-rich food index

Adam Drewnowski and Victor Fulgoni III

Nutrient profiling of foods, described as the science of ranking foods based on their nutrient content, is fast becoming the basis for regulating nutrition labels, health claims, and marketing and advertising to children. A number of nutrient profile models have now been developed by research scientists, regulatory agencies, and by the food industry. Whereas some of these models have focused on nutrients to limit, others have emphasized nutrients known to be beneficial to health, or some combination of both. Although nutrient profile models are often tailored to specific goals, the development process ought to follow the same science-driven rules. These include the selection of index nutrients and reference amounts, the development of an appropriate algorithm for calculating nutrient density, and the validation of the chosen nutrient profile model against healthy diets. It is extremely important that nutrient profiles be validated rather than merely compared to prevailing public opinion. Regulatory agencies should act only when they are satisfied that the scientific process has been followed, that the algorithms are transparent, and that the profile model has been validated with respect to objective measures of a healthy diet.



The Nutrient Rich Foods (NRF) Index

NRF9.3 = $\Sigma_{i=9}$ (%DV/100kcal) – $\Sigma_{i=3}$ (%DV100kcal)

9 nutrients to encourage

Protein	Fiber	Vitamin A
Iron	Calcium	Vitamin C
Potassium	Magnesium	Vitamin E

Vitamin D

3 nutrients to limit

- Saturated Fat
- Added Sugars
- Sodium

Drewnowski, Fulgoni. Nutr Rev 2008

Nutrition Reviews, Volume 66, Issue 1, 1 January 2008, Pages 23–39, https://doi.org/10.1111/j.1753-4887.2007.00003.x

A family of NRFn.3 profiling models

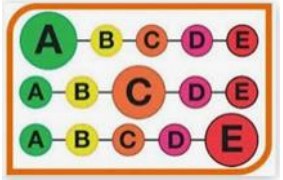
NR	Macronutrients	Vitamins	Minerals	**Reference**
Nutrients to encourage – positive NRn subscore				
NR5	Protein, fiber	Vit C	Ca, Fe	AFSSA 2008
Priority	Protein (PDCAAS)	Folate, vit A, vit B_{12}	Ca, Fe, Zn	Beal et al.
NR6	Protein, fiber	Vit A, C	Ca, Fe	Drewnowski et al 2008
NR9	Protein, fiber	Vit A, C, E (D)	Ca, Fe, Mg, K	Drewnowski et al 2008
NR12	Protein, fiber	Vit A, C, E, B_1, B_2, B_{12}	Ca, Fe, Zn, K	Drewnowski et al 2008
NR14	Protein, fiber	Vit C, D, E, B_1, B_2, B_{12}, , folate	Ca, Fe, Zn, K	Drewnowski et al 2008
NNR15	Pro, fiber, MUFA	Vit C, D, E, B_1, B_2, B_{12}, folate	Ca, Fe, Zn, K	Drewnowski 2005
Nutrients to limit – negative LIM subscore				
LIM	**Saturated fat, added sugar**		**Sodium (Na)**	Drewnowski 2008, Darmon 2006
LIMt	**Saturated fat, total sugar**		**Sodium (Na)**	Drewnowski 2008, Darmon 2006

Nutrient standards from FDA, Andes, WHO, FAO,

NRFn.3 = NRn - LIM

Nutrient profiling for LMIC?

- The purpose of nutrient profiling is to promote dietary guidelines and improve population health.
- HIC health issues are obesity, diabetes, and CVD. Dietary guidelines recommend reducing calories, fat, sugar and salt.
- Nutrient density is defined by the *absence* of calories, fat, sugar and salt.
- Should this be true for LMIC where undernutritio and hidden hunger remain a problem?
- Is water the “highest nutritional quality” beverag for Africa?

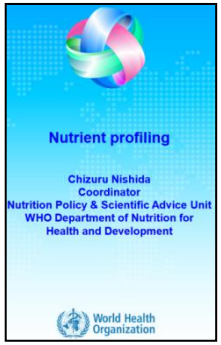


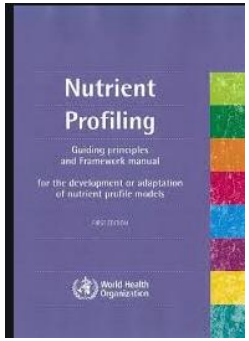
Foods (points)	Beverages (points)	Colour	
Min to -1	Water	Dark green	*Highest nutritional quality*
0 to 2	Min to 1	Light green	
3 to 10	2 to 5	Yellow	
11 to 18	6 to 9	Light orange	
19 to max	10 to max	Dark orange	*Lowest nu quality*

Santé Publique France 2017, Nutri-Score Logo

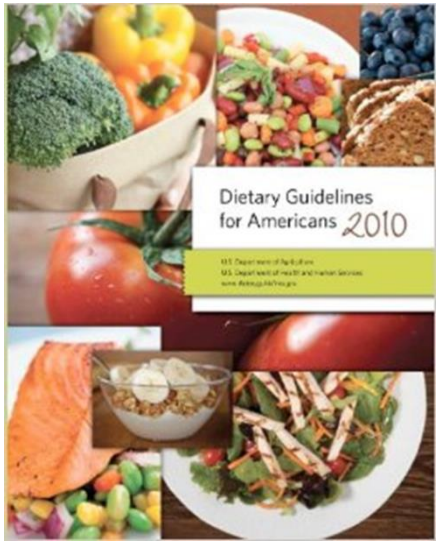
Summary: nutrient profiling metrics

- Educational and Regulatory
  - Front-of-pack letters, symbols, and logos.
  - Nutrition or health claims (EU, US).
  - Marketing to children (FSA-Ofcom)
- Innovation and reformulation:
  - Product (re)formulation by food industry.
  - Screening of product portfolios (ATNI).
- Development of new metrics for:
  - Affordable nutrient density
  - Environmental impact (GHGE)
  - Shared social value.

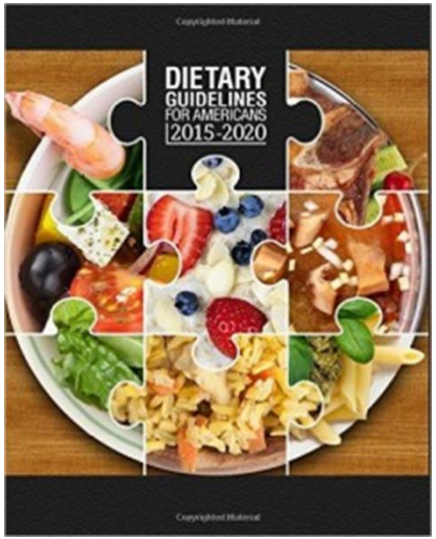




Two:
What is *affordable* nutrient density?



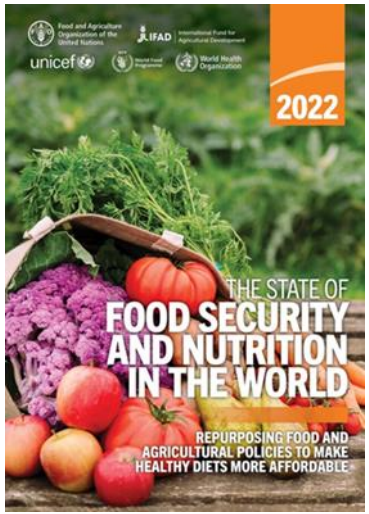
Monsivais, P. and Drewnowski, A. 2007. The Rising Cost of Low-Energy-Density Foods. *Journal of American Dietetic Association* 107:2071-2076.



Food expenditures determine nutrient density

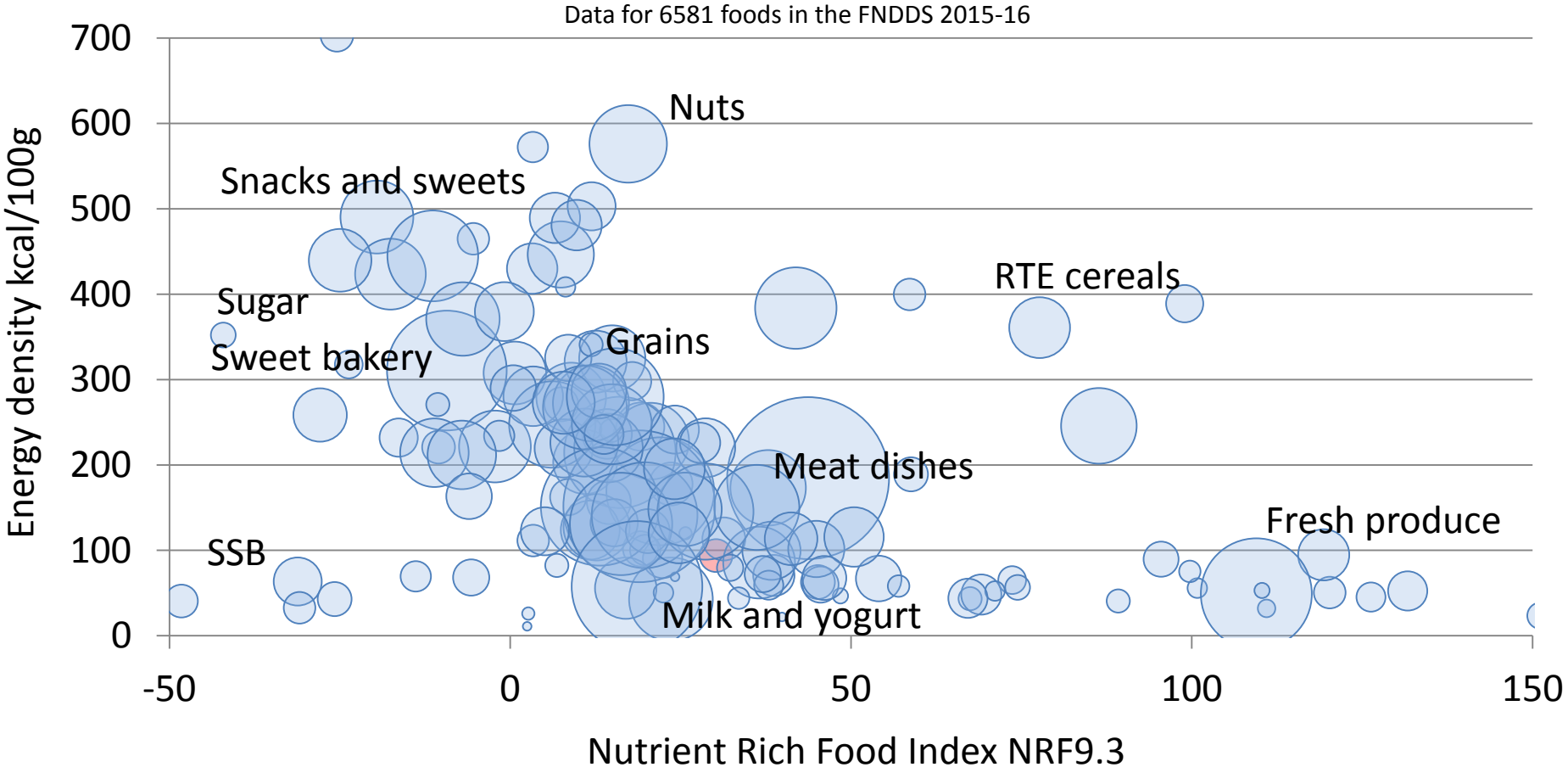
A new focus on *affordable* nutrient density

Energy sufficient	Nutrient adequate (minimum diversity)	Healthy (FAO/Dietary Guidelines)
Starchy staples	Starchy staples	Whole grains
Vegetable oils	Animal source foods	Total protein foods, dairy, seafood
Sugar	Legumes	Legumes, beans, plant proteins
	Vegetables	Vegetables (dark green)
	Fruits	Fruits (whole)
	Fats and oils	PUFA+MUFA/SFA ratio
		Limit starchy staples, sugar, satfat
Lowest cost ~1$	Medium cost 3$	Highest cost 5$ (FAO report)

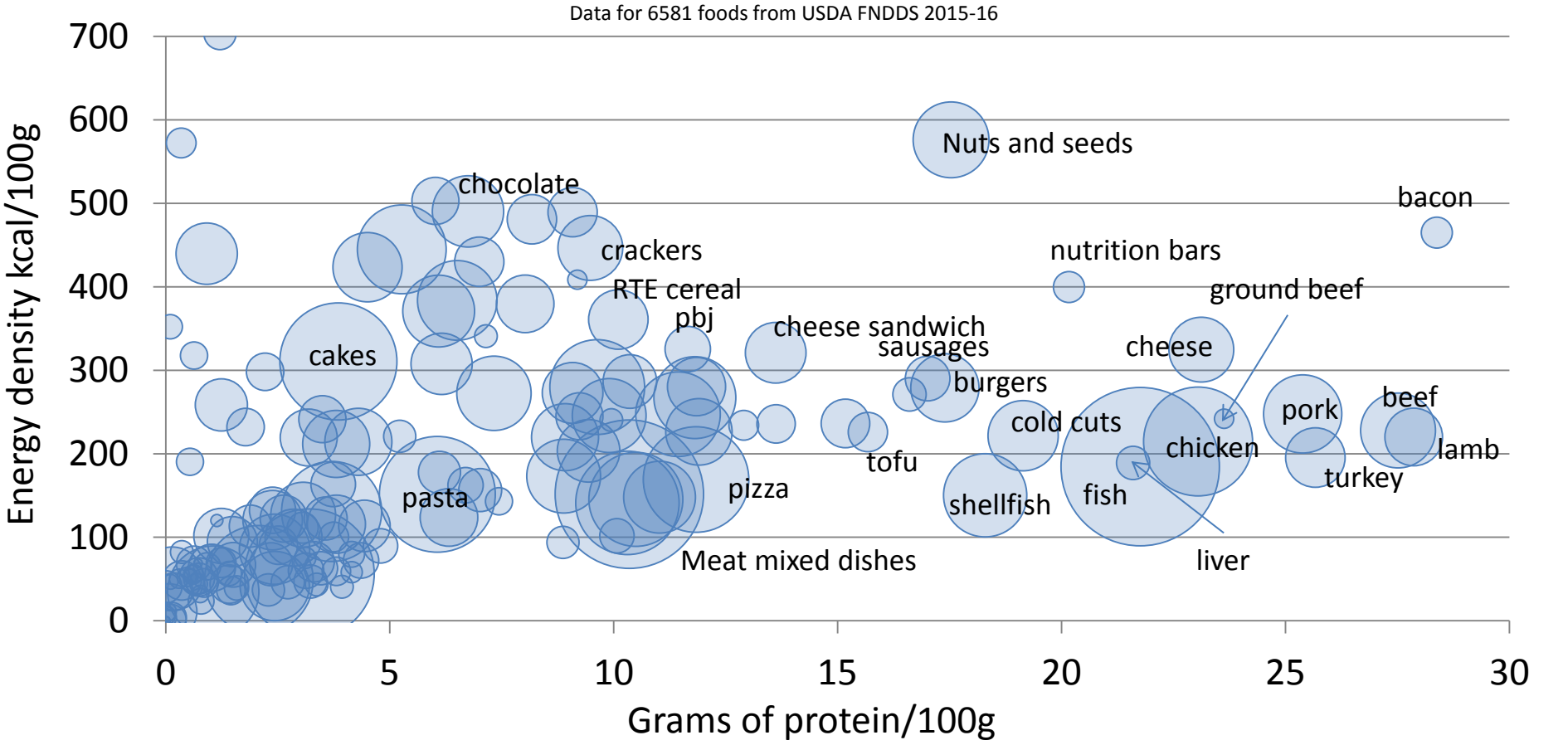


Will Masters: Food Price in Nutrition project

NRF9.3 nutrient density of 6581 foods

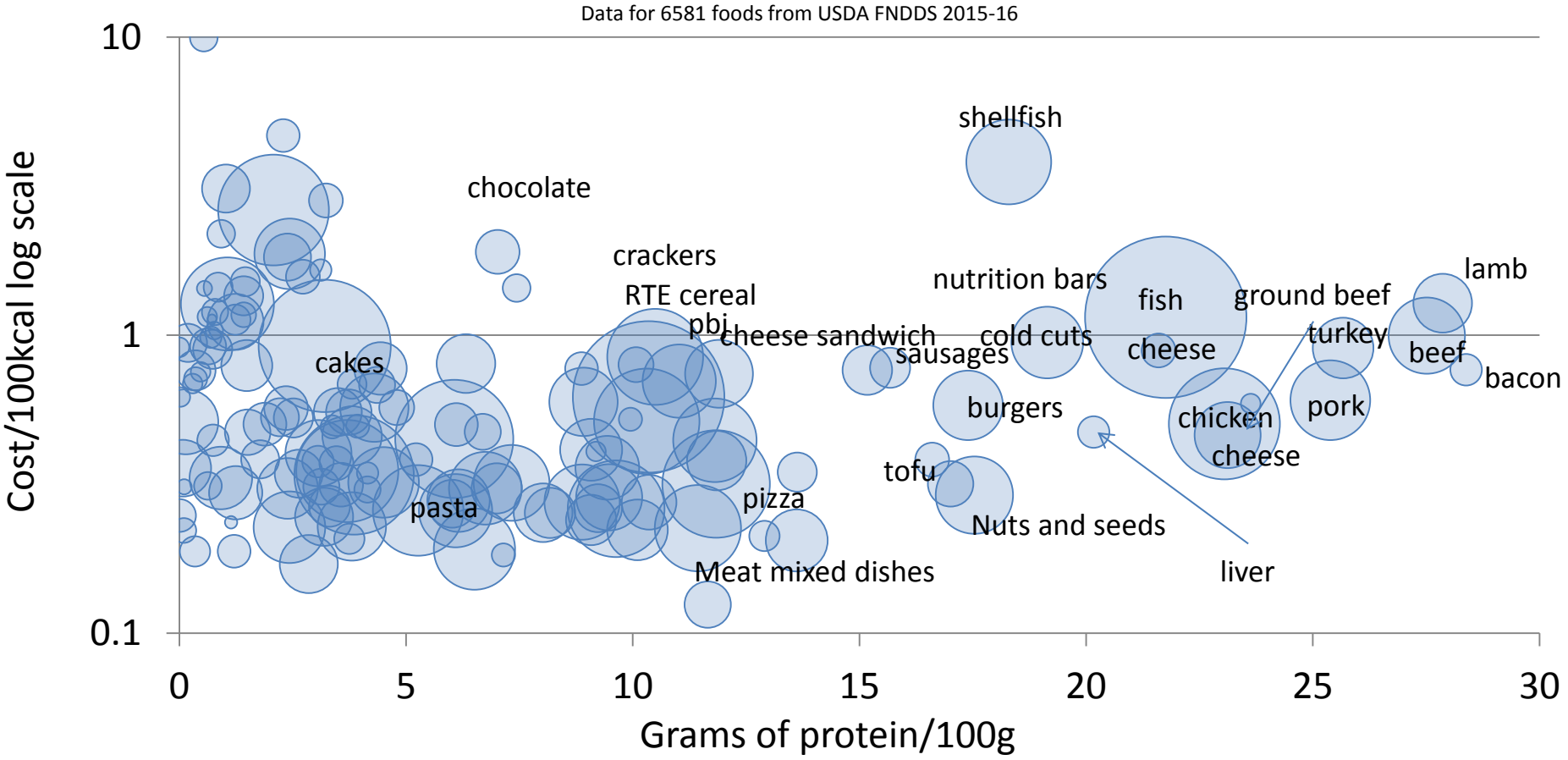


Focus on affordable protein: animal and plant



Size of bubble denotes number of foods in each USDA WWEIA category

Focus on affordable protein: animal and plant

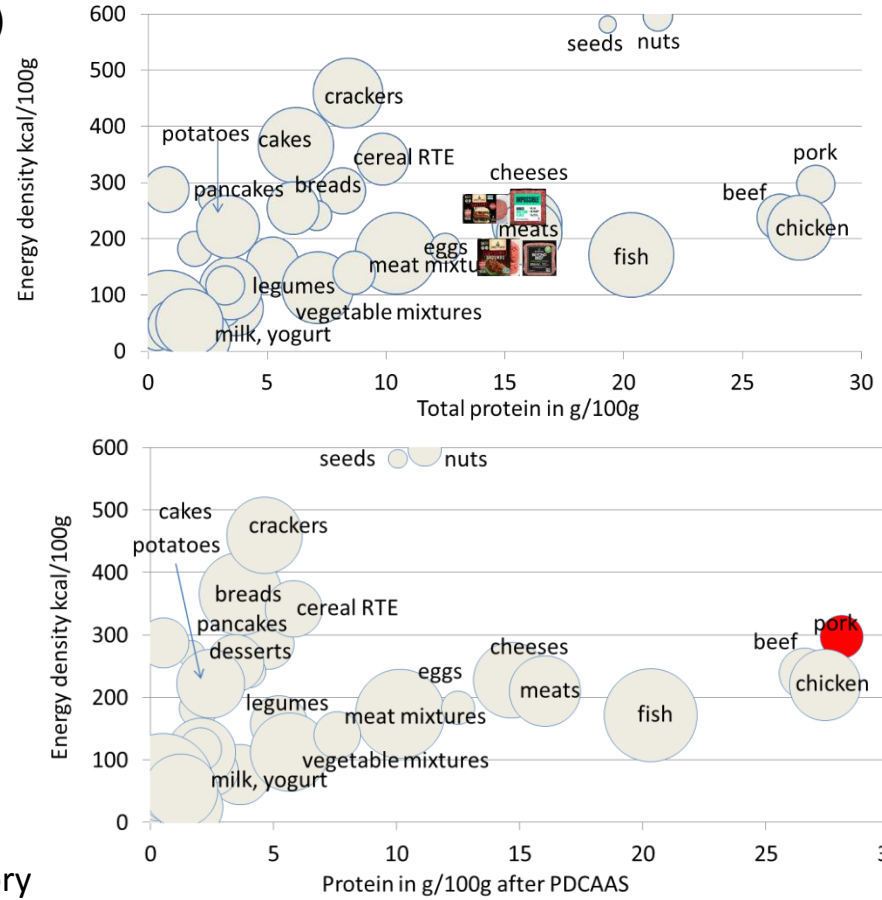


Size of bubble denotes number of foods in each USDA WWEIA category

The protein quality issue: PDCAAS

Protein Digestibility Corrected Amino Acid Score (PDCAAS)

Protein source	Factor	Protein source	Factor
Cow's milk, eggs	1.0	Peas/legumes	0.70
Casein, whey	1.0	Fruits, fresh	0.64
Pork	0.98	Cereals	0.59
Beef	0.92	Nuts (pecans)	0.71
Soy	0.91-1.0	Peanuts	0.52
Chickpeas, soybeans	0.78	Rice	0.50
Black beans	0.75	Dried fruit	0.48
Vegetables	0.73	Wheat	0.42

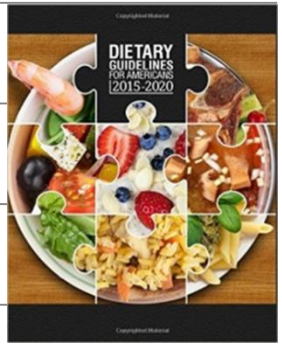


Animal proteins are not affected by PDCAAS - compare e.g. relative places for nuts and seeds and grains after PDCAAS

Size of bubble denotes number of foods in each WWEIA category

Yes, fresh produce is nutrient rich

Data for 2751 foods from USDA Thrifty Food Plan with 2021 national food prices



Energy density kcal/100g

700
600
500
400
300
200
100
0

Nuts and seeds
RTE cereals
RTE cereals low sugar
Soft drinks
Citrus fruit
Red/orange veg
Carrots
Vegetable juice
Broccoli
Cabbage
Dk green vegetables
lettuce

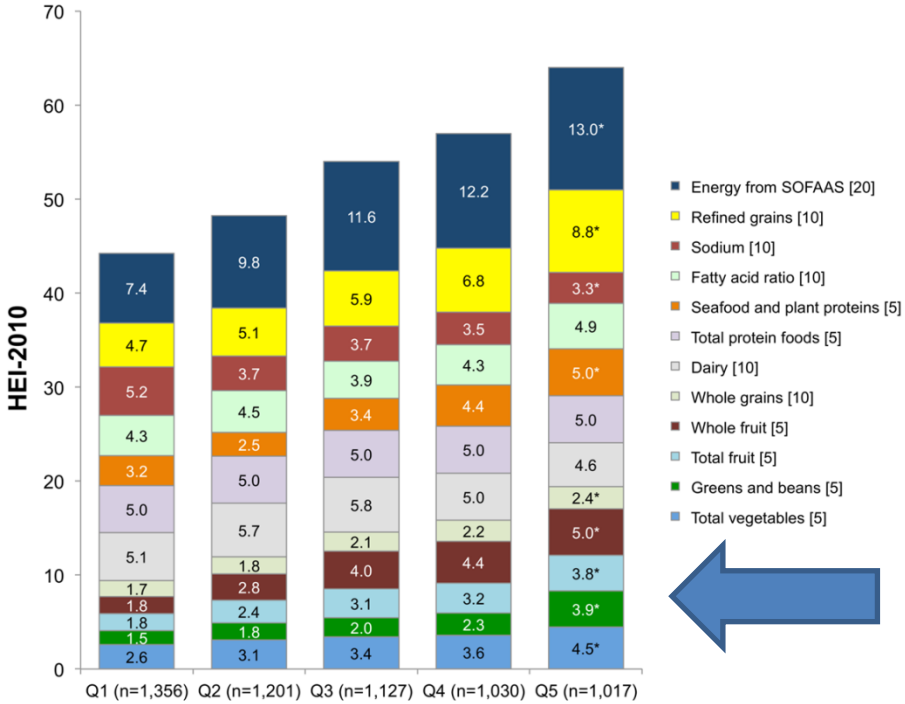
-50
0
50
100
150
200
250

Nutrient Rich Food Index 9.3

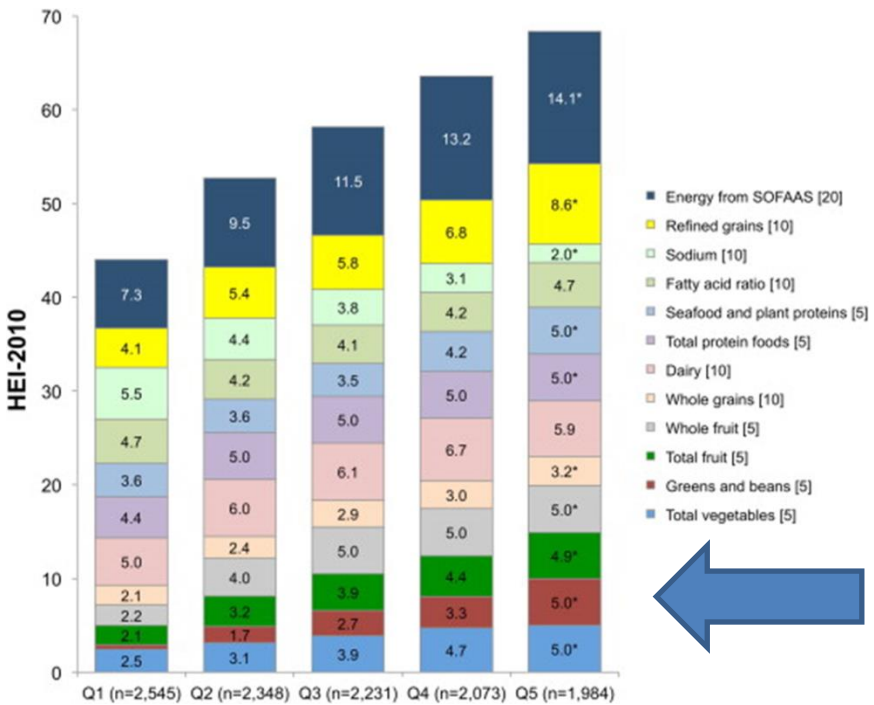
Size of bubble denotes number of foods in each USDA WWEIA category

Healthier diets cost more

HEI 2010 scores by diet cost quintiles Rehm et al Preventive Medicine 2015



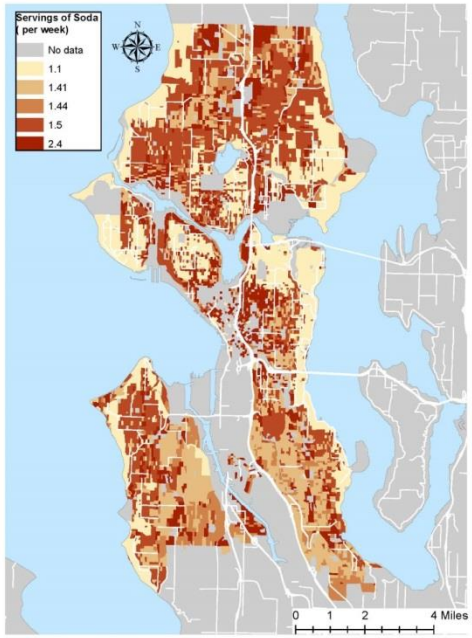
Men



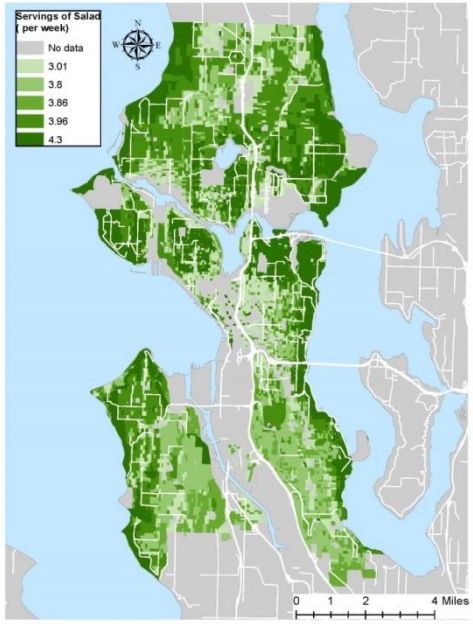
Women

Diet quality depends on where you live

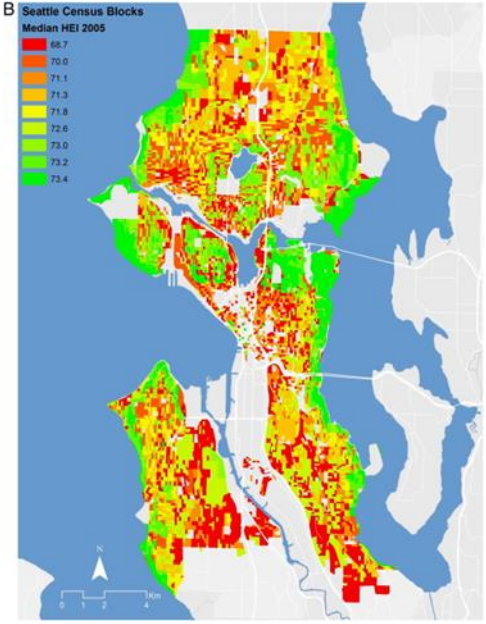
Soda (SSB) and salad consumption (servings/wk) and HEI scores by Seattle census block



Soda drinkers



Salad eaters



HEI 2010 diet quality

Soda, salad, and socioeconomic status: Findings from the Seattle Obesity Study (SOS)

Adam Drewnowski[a,b], James Buszkiewicz[a,*], Anju Aggarwal[b]

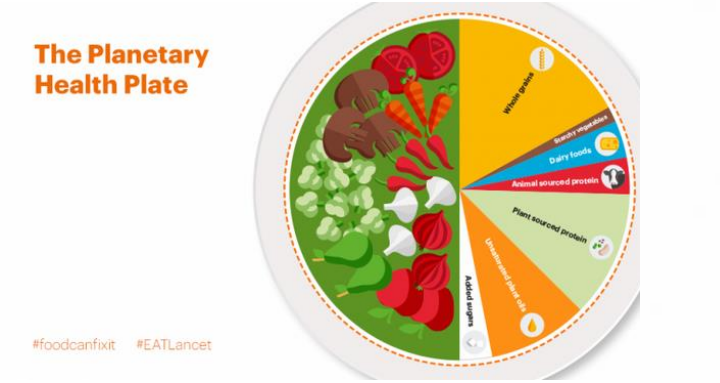
[a] Department of Epidemiology, School of Public Health, University of Washington, Box 353410, Seattle, WA 98195, USA
[b] Center for Public Health Nutrition, School of Public Health, University of Washington, Seattle, WA, USA

Three:
Nutrition sensitive Lifecycle Analysis
nLCA

FAO 2021 report on nLCA

- Lifecycle assessments (LCA) evaluate the environmental impact of different products, usually on mass-volume basis.
- **The main function/purpose of food items is to provide calories and nutrients – not weight.**
- Nutrition provided by different food items varies widely on a mass/volume basis
- We need to define the all-important nutritional 'functional unit' (FU) for nLCA analyses.
- **We need a nutritional LCA (nLCA). What will it be?**
    - FAO report: 30 experts from 18 countries, May-Nov 2021.

Plants will save the planet: EAT-Lancet



Health and nutritional aspects of sustainable diet strategies and their association with environmental impacts: a global modelling analysis with country-level detail

Marco Springmann, Keith Wiebe, Daniel Mason-D'Croz, Timothy B Sulser, Mike Rayner, Peter Scarborough

The Planetary Health Diet

	Macronutrient intake grams per day (possible range)	Caloric intake kcal per day
Whole grains		
Rice, wheat, corn and other	232	811
Tubers or starchy vegetables		
Potatoes and cassava	50 (0–100)	39
Vegetables		
All vegetables	300 (200–600)	78
Fruits		
All fruits	200 (100–300)	126
Dairy foods		
Whole milk or equivalents	250 (0–500)	153
Protein sources		
Beef, lamb and pork	14 (0–28)	30
Chicken and other poultry	29 (0–58)	62
Eggs	13 (0–25)	19
Fish	28 (0–100)	40
Legumes	75 (0–100)	284
Nuts	50 (0–75)	291
Added fats		
Unsaturated oils	40 (20–80)	354
Saturated oils	11.8 (0–11.8)	96
Added sugars		
All sugars	31 (0–31)	120

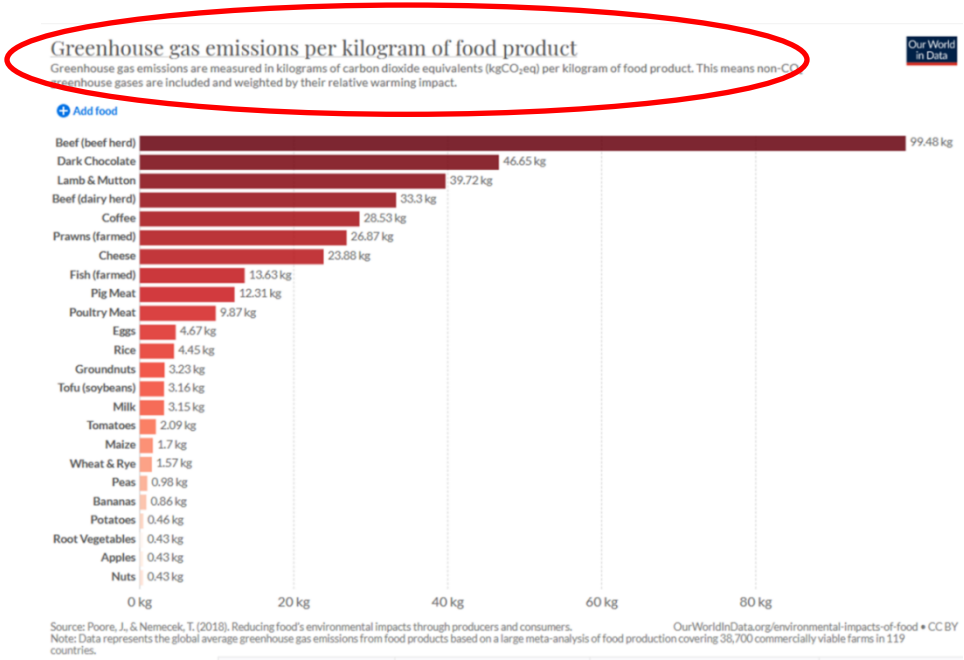
Rice, wheat, corn
Potatoes, cassava
Vegetables,
Fruits

Dairy 153 kcal

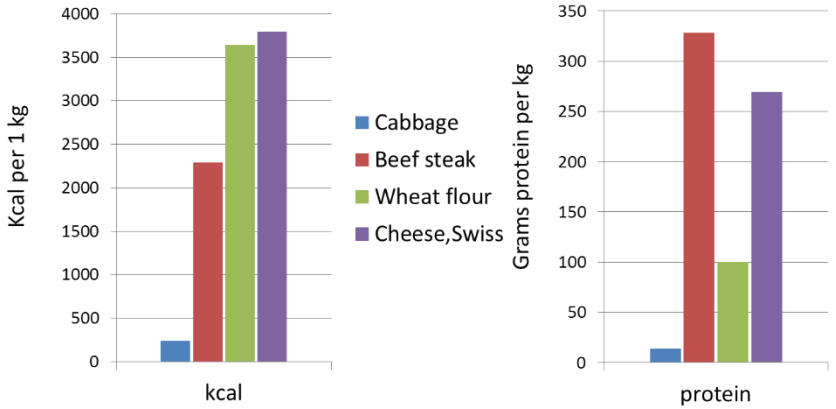
Beef, pork – 30 kcal
Legumes, nuts – 575 kcal

Environmental cost is measured per kilo

The notion that all plant foods are planet friendly rests on the GHGE per kg metric



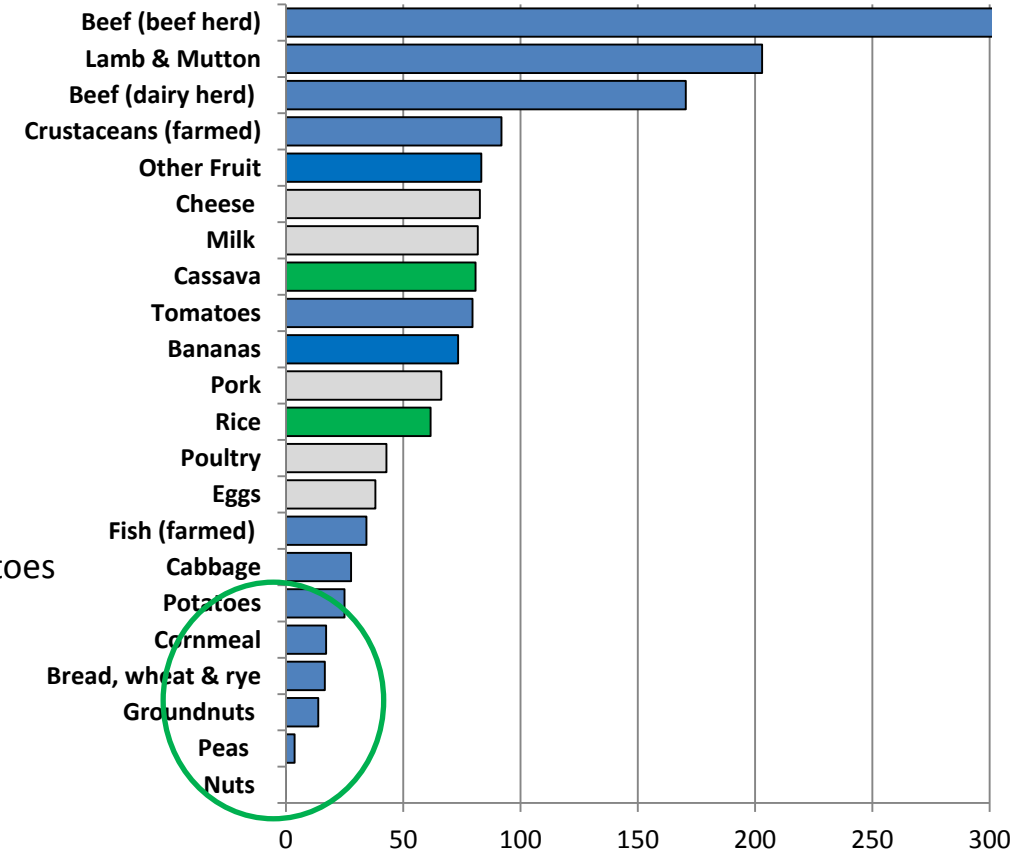
Kilogram is not a good metric of nutrition



Median GHGE per 1000g PDCAAS protein

Recalculated data from Poore and Nemecek 2018

- Planet friendly protein
  - Nuts, peas, peanuts, bread, corn,potatoes
  - Cassava < milk, cheese
  - Rice < pork, poultry, eggs



FAO proposes novel functional units - nFU

LCA metrics: GHGE, land use, water use

- Kilogram
- 1000 kcal
- 100g protein
- 1000 mg Zn?
- NRF 6.3 score
- NRF 9.3 score
- Nutrient profiles
- Health outcomes
- NCD risks
- *Affordability/ monetary cost*

Mass-volume

Calories or protein or a nutrient

Nutrient density - Composite scores

Individual and population health risks

Not considered by FAO

Table S1. Functional units (FUs) used.

	Mass / Volume FU	Nutrition FU	Nutrient Density
Starch-Rich			
Wheat & Rye	1 kg of bread (variable protein wheat)		2695 kcal kg^{-1}
Maize	1 kg of meal (for polenta)		416 kcal kg^{-1}
Oats	1 kg of rolled oats	1000 kcal	2605 kcal kg^{-1}
Rice	1 kg of full grain white or brown rice	energy	3685 kcal kg^{-1}
Potatoes	1 kg of soil free tuber		730 kcal kg^{-1}
Cassava	1 kg of soil free tuber		975 kcal kg^{-1}
Protein-Rich			
Peas	1 kg of dry pea without pod		215 g kg^{-1}
Other Pulses	1 kg of dry pulse without pod		220 g kg^{-1}
Nuts	1 kg of shell free, dry nut		160 g kg^{-1}
Groundnuts	1 kg of shell free, roasted nut		260 g kg^{-1}
Soybeans	1 kg of tofu (~16% protein)		160 g kg^{-1}
Cheese	1 kg of cheese		225 g kg^{-1}
Eggs	1 kg of eggs		110 g kg^{-1}
Poultry Meat		100 g protein	175 g kg^{-1}
Pig Meat	1 kg of fat and bone-free meat and		160 g kg^{-1}
Lamb & Mutton	edible offal		200 g kg^{-1}
Beef			200 g kg^{-1}
Fish	1 kg of edible fish		230 g kg^{-1}
Crustaceans	1 kg of head-free meat (shell-free for large shrimp)		150 g kg^{-1}

NRFn.3 nutrient profiles as the new nFU?

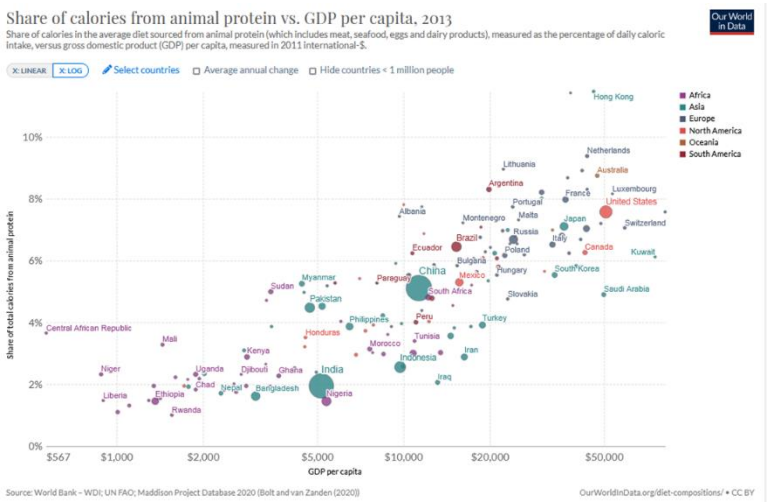
Table 12: Examples of greenhouse gas emissions (kg CO_2e) of various food items across a selection of functional units based on NRF indices

Food item	Type of food	kg CO_2 e/NRF 6.0	kg CO_2 e/NRF 9.3	kg CO_2 e/ NRF 9.3 (all sugars)	kg CO_2 e/ NRF 11.0	kg CO_2 e/NRF 15.3	kg CO_2 e/NRF 20.3
Ham shoulder medium fat boiled	Red meat	1.52	2.71	2.80	0.79	0.79	0.68
Beef rump steak prepared	Red meat	4.15	2.76	2.76	1.29	1.20	1.02
Potatoes w/o skins boiled average	Starchy vegetables	0.07	0.06	0.06	0.06	0.05	0.05
Eggs (chicken) boiled average	Eggs	0.59	0.44	0.44	0.22	0.15	0.14
Chicken with skin prepared	Poultry	2.41	2.76	2.76	1.22	1.15	0.74
Milk whole	Dairy	0.82	0.83	1.37	0.35	0.38	0.34
Milk skimmed	Dairy	0.87	0.62	0.94	0.35	0.33	0.30
Cheese Gouda 48+ average	Dairy	0.70	1.70	1.70	0.41	0.52	0.47
Shrimps Dutch peeled boiled	Fish	2.91	2.19	2.20	0.19	0.20	0.19

Four:
The two protein transitions

The two protein transitions: animal vs. plant

- Low-income countries replace plant with animal proteins – for reasons of nutrient adequacy and better health.
- High income countries replace animal proteins with plant proteins – also for reasons of nutrient density and better health (tipping point at >40,000 USD?).
- This is predicted by Bennett's Law 1941.
- HIC efforts to reduce animal proteins may be health oriented but may also reflect waning purchasing power of Western societies.



Animal protein and plant protein choices in SE Asia

TAYLOR'S UNIVERSITY

LIA CIRAD

UNIVERSITÉ TOULOUSE Jean Jaurès

ACN Bali, 4-7 Aug 2019

Socio Cultural Research in Protein Transition (SCRiPT)

Protein transition:
bridging theoretical models to enhance the link between nutrition and public health policies

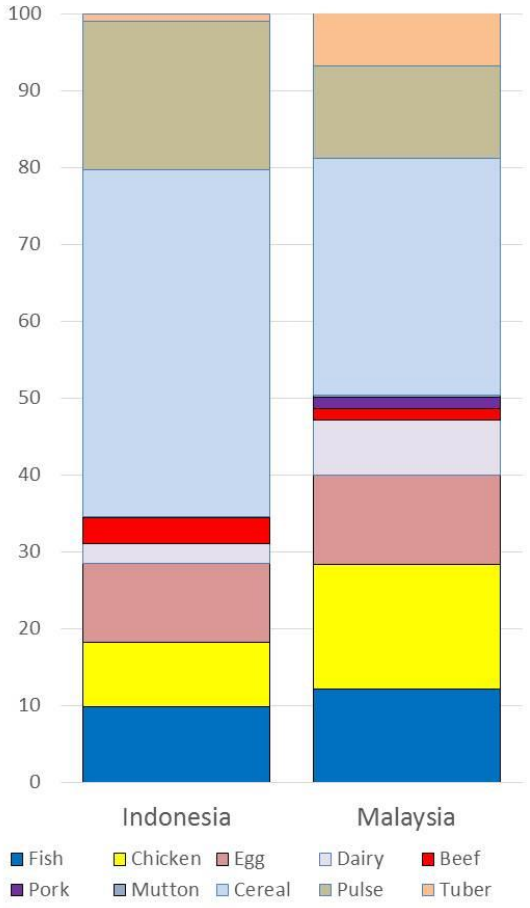
Nourishing Asia
13th ACN 2019
August 4-7
Bali, Indonesia

Prof. Dr. Jean-Pierre Poulain,
Dr. Cyrill Laporte, Dr. Elise Line Mognard, Dr. Helda Khusun, EmeritusProf. Dr. Mohd Ismail Noor, Prof. Dr. Norimah A. Karim, Associate Prof. Dr. Laurence Tibère, Ari Ragavan, Roselynne Anggraini, Dr. Judhiastuty Februhartanty, Yasmine Alem, Prof Dr. Neethiananthan, Prof. Dr. Adam Drewnowski

Asian FOOD Barometer

TTUC TTUC CRiT Kebangsaan Malaysia CERDOP SEAMEO RECFON UNIVERSITY of WASHINGTON Eat Well. Live Well. AJINOMOTO

India GDP 1,900 USD
Indonesia GDP 3,870 USD
Malaysia GDP 10,402 USD
China GDP 10,500 USD



Front Nutr. 2022 Feb 11;9:762459. doi: 10.3389/fnut.2022.762459. eCollection 2022.

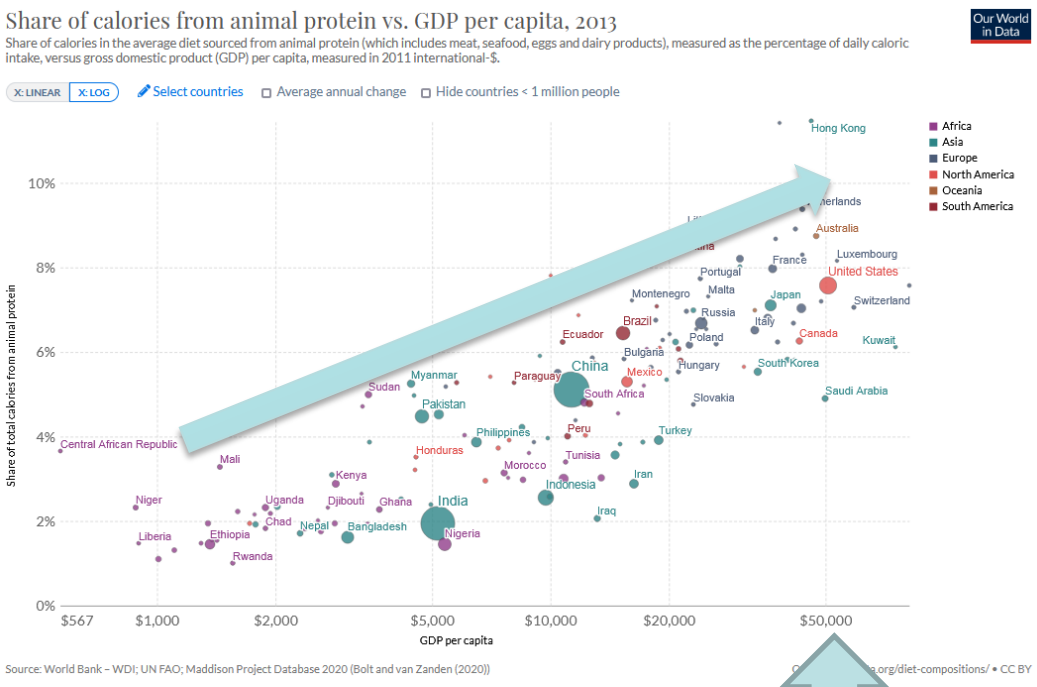
Animal and Plant Protein Food Sources in Indonesia Differ Across Socio-Demographic Groups: Socio-Cultural Research in Protein Transition in Indonesia and Malaysia

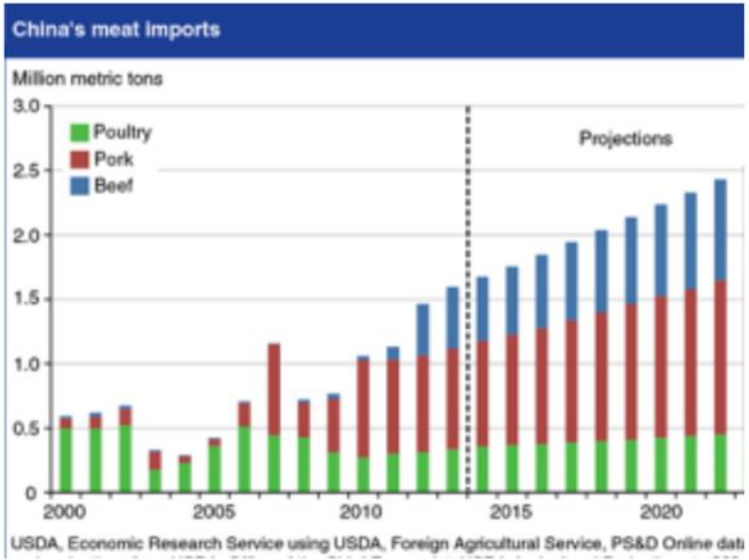
Helda Khusun [1], Judhiastuty Februhartanty [1], Roselynne Anggraini [1], Elise Mognard [2 3], Yasmine Alem [2 3 4], Mohd Ismail Noor [5], Norimah Karim [5], Cyrille Laporte [4], Jean-Pierre Poulain [2 3 4], Pablo Monsivais [6], Adam Drewnowski [7]

Affiliations + expand

PMID: 35242792 PMCID: PMC8886573 DOI: 10.3389/fnut.2022.762459
Free PMC article

Growing demand for animal protein: Bennett's Law





Is there a tipping point around here?

Finally:
The role of minimally processed vs. processed and ultra-processed foods

Foods classified as ultra-processed

- Percent energy from ultra-processed foods (UPF) has been linked to higher risks of obesity, type 2 diabetes, metabolic syndrome, hypertension, cardiovascular disease, depressive symptoms, cancer, and all-cause mortality.
- **What is the connection?**

What is NOVA about, really?

- UPFs are **industrial formulations** of food-derived substances that contain little or no whole food and often include synthetic **flavorings, colorings, emulsifiers, etc**.
- UPF contain **additives** designed to make the final product **palatable or more appealing** (flavors, flavor enhancers, colors, emulsifiers, sweeteners, thickeners etc.
- UPF have unique **non-nutritional attributes**, assembled into ready-to-consume **hyper-palatable** foods, that are **quasi-addictive** and promote overconsumption.
- UPFs are typically **energy-dense** products, high in **calories, added sugar, saturated fats, and salt, and low in dietary fiber, protein, vitamins, and minerals**.


Public Health Nutr. 2019 Apr;22(5):936-941. doi: 10.1017/S1368980018003762. Epub 2019 Feb 12.

Ultra-processed foods: what they are and how to identify them

Carlos A Monteiro [1], Geoffrey Cannon [2], Renata B Levy [2], Jean-Claude Moubarac [3], Maria Lc Louzada [2], Fernanda Rauber [2], Neha Khandpur [2], Gustavo Cediel [2], Daniela Neri [2], Euridice Martinez-Steele [2], Larissa G Baraldi [2], Patricia C Jaime [1]


Ultraprocessed foods and cardiovascular health: it's not just about the nutrients

Mark Lawrence

The American Journal of Clinical Nutrition, Volume 113, Issue 2, February 2021, Pages 257–258, https://doi.org/10.1093/ajcn/nqaa333
Published: 09 December 2020

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Nutrients. 2019 Aug; 11(8): 1902. PMCID: PMC6723973
Published online 2019 Aug 15. doi: 10.3390/nu11081902 PMID: 31443142

Ultra-Processed Foods Are Not "Real Food" but Really Affect Your Health

Amelia Marti[1,2,3]


Ultraprocessed food consumption and risk of overweight and obesity: the University of Navarra Follow-Up (SUN) cohort study

Raquel de Deus Mendonça, Adriano Marçal Pimenta, Alfredo Gea, Carmen de la Fuente-Arrillaga, Miguel Angel Martinez-Gonzalez, Aline Cristine Souza Lopes, Maira Bes-Rastrollo

The American Journal of Clinical Nutrition, Volume 104, Issue 5, November 2016, Pages 1433–1440, https://doi-org.offcampus.lib.washington.edu/10.3945/ajcn.116.135004
Published: 12 October 2016 **Article history**

NOVA categories in 2015-16 FNDDS

Ultra-processed food consumption among US adults from 2001 to 2018

Filippa Juul ✉, Niyati Parekh, Euridice Martinez-Steele, Carlos Augusto Monteiro, Virginia W Chang

The American Journal of Clinical Nutrition, Volume 115, Issue 1, January 2022, Pages 211–221, https://doi-org.offcampus.lib.washington.edu/10.1093/ajcn/nqab305
Published: 14 October 2021 **Article history**

Juul et al. published in AJCN January 2022.
Data codes available on application and approval.

NOVA	Examples
Unprocessed	Fresh, dry, or frozen fruit, vegetables, grains, legumes, meat, fish, and milk;
Processed	Canned fish, vegetables, artisanal cheeses, and products made by adding salt, sugar, oil, or other culinary ingredients to minimally processed foods
Ultra-processed	Instant and canned soups; reconstituted meat and fish; ready-made sauces, gravies, and dressings; French fries and chips, RTE and dry-mix desserts; confectionery; sweet and savory snacks, granola and protein bars, sugar sweetened and diet soda, fruit drinks, bottled tea and coffee, energy drinks, and dairy-based drinks; flavored yogurt; commercial cakes, cookies, and pies; dry cake and pancake mixes; breads; sweet breakfast cereals; frozen and RTE meals; ice cream, frozen yogurt, ices; meatless patties and fish sticks
Culinary ingredients	Table sugar, oils, fats, and salt

Are NOVA assignments consistent?

NOVA category assignments for 8032 FNDDS 2015-16 foods published in Nature Food 2021

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Article | Published: 14 October 2021

Food Compass is a nutrient profiling system using expanded characteristics for assessing healthfulness of foods

Dariush Mozaffarian, Naglaa H. El-Abbadi, Meghan O'Hearn, Josh Erndt-Marino, William A. Masters, Paul Jacques, Peilin Shi, Jeffrey B. Blumberg & Renata Micha

Nature Food 2, 809–818 (2021) | Cite this article

75216120	3000_Vegetables	Corn, yellow, cooked, NS as to form, fat added in cooking, NS as to type of fat	30	4.5	B	4
75216122	3000_Vegetables	Corn, yellow, cooked, from frozen, fat added in cooking, NS as to type of fat	30	4.5	B	4
		e with margarine	30	4	B	4
		fast food, with gravy	30	4	C	4
		esh, peel not eaten, made with butter	30	4	C	4
		fresh, peel not eaten, made with butter	30	4	C	4
			29	4	C	4
		fresh, NFS	29	4	C	4
		fresh, made with milk	29	4	C	4
			29	3.5	C	4
		h, batter-dipped, baked or fried	29	3	C	4
		h fresh, with meat	29	3.5	C	4
		dry mix, made with milk, with cheese	29	3.5	C	4
			29	4	C	4
		ten, with vegetables	29	4	B	4
		t eaten, with butter	29	4	C	4
		ten, with sour cream	29	4	C	4
75303022	3000_Vegetables	Corn with peppers, red or green, cooked, made with butter	29	4.5	B	4
75216160	3000_Vegetables	Corn, yellow and white, cooked, NS as to form, NS as to fat added in cooking	28	4.5	B	4
75216162	3000_Vegetables	Corn, yellow and white, cooked, from frozen, NS as to fat added in cooking	28	4.5	B	4
75216180	3000_Vegetables	Corn, yellow and white, cooked, NS as to form, fat added in cooking, NS as to type of fat	28	4.5	B	4
16182	3000_Vegetables	Corn, yellow and white, cooked, from frozen, fat added in cooking, NS as to type of fat	28	4.5	B	4
71601050	3000_Vegetables	Potato salad with egg, made with any type of fat free dressing	28	4.5	B	4
71305050	3000_Vegetables	Potato, scalloped, from dry mix	28	3.5	C	4
71305070	3000_Vegetables	Potato, scalloped, ready-to-heat	28	3.5	D	4
71106020	3000_Vegetables	Potato from Puerto Rican style stuffed pot roast, with gravy	27	4.5	B	4
71106050	3000_Vegetables	Potato from Puerto Rican beef stew, with gravy	27	4.5	B	4
71507010	3000_Vegetables	Potato, baked, peel not eaten, with sour cream	27	4	C	4
71508030	3000_Vegetables	Potato, baked, peel eaten, with chili	27	4	C	4
71702000	3000_Vegetables	Potato pudding	27	3.5	C	4
71507035	3000_Vegetables	Potato, baked, peel not eaten, with vegetables	27	4	C	4
71305080	3000_Vegetables	Potato, scalloped, ready-to-heat, with meat	27	3	D	4
75301122	3000_Vegetables	Beans, lima and corn, cooked, made with butter	27	4.5	A	4
71305060	3000_Vegetables	Potato, scalloped, from dry mix, with meat	27	3	D	4
71508020	3000_Vegetables	Potato, baked, peel eaten, with cheese	27	4	C	4
75216200	3000_Vegetables	Corn, white, cooked, NS as to form, NS as to fat added in cooking	26	4.5	B	4
75216202	3000_Vegetables	Corn, white, cooked, from frozen, NS as to fat added in cooking	26	4.5	B	4
75216220	3000_Vegetables	Corn, white, cooked, NS as to form, fat added in cooking, NS as to type of fat	26	4.5	B	4

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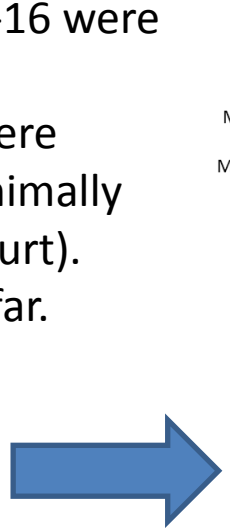
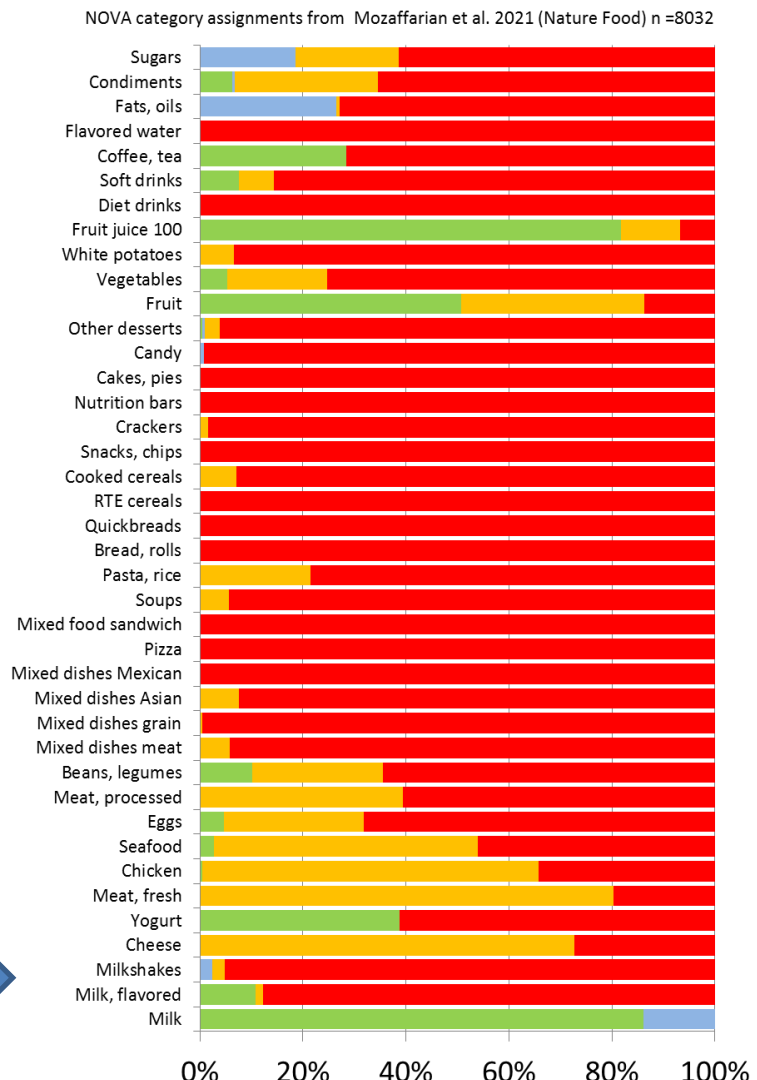
- As many as 6,227 foods out of 8,032 (77%) in the USDA FNDDS 2015-16 were classified as UPF.
- Only 339 foods (out of 8,032) were classified as unprocessed or minimally processed (fruit, juice, milk, yogurt).
- Nobody has questioned this so far.

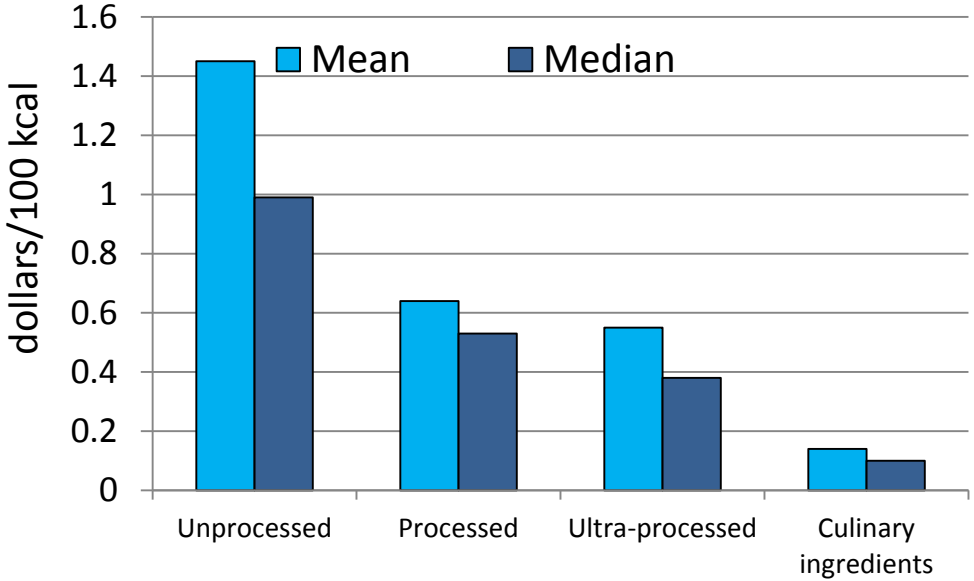




NOVA explained:
Foods falling into the UPF category have lower NRF scores and are inexpensive

Foods classed as UPF cost less per 100 kcal

Table 2 from Gupta et al 2019

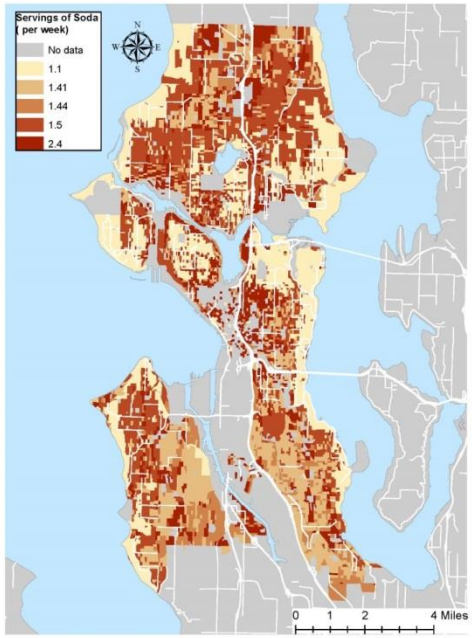


Gupta S, Hawk T, Aggarwal A, Drewnowski A. Characterizing Ultra-Processed Foods by Energy Density, Nutrient Density, and Cost. Front Nutr. 2019 May 28;6:70. doi: 10.3389/fnut.2019.00070. PMID: 31231655; PMCID: PMC6558394.

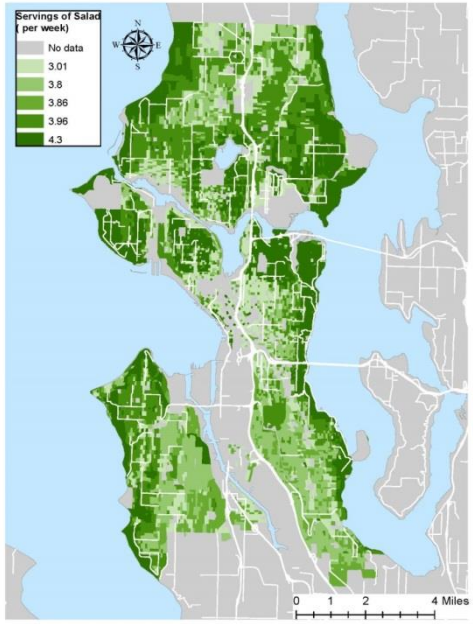
- Many low-cost refined grains, vegetable oils, added sugars and sodium fall into the category of ultra-processed foods.
- These foods are inexpensive, if nutrient poor
- Percent energy from UPF is linked to lower food expenditures.
- Low-cost foods of minimal nutritional value are often “chosen” by lower income groups.
- Lower-income groups have cheaper diets and worse health outcomes.

Diet quality (UPF) depends on where you live

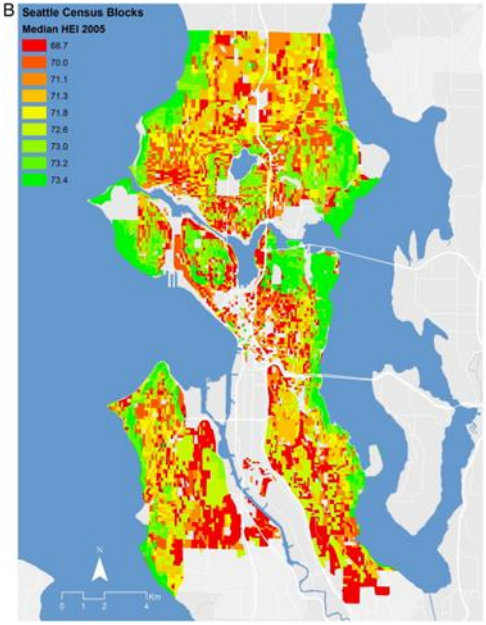
Soda (SSB) and salad consumption (servings/wk) and HEI scores by Seattle census block



Soda drinkers



Salad eaters



HEI 2010 diet quality

Soda, salad, and socioeconomic status: Findings from the Seattle Obesity Study (SOS)

Adam Drewnowski[a,b], James Buszkiewicz[a,*], Anju Aggarwal[b]

[a] Department of Epidemiology, School of Public Health, University of Washington, Box 353410, Seattle, WA 98195, USA
[b] Center for Public Health Nutrition, School of Public Health, University of Washington, Seattle, WA, USA

Thank you

Adam Drewnowski, PhD
Director, Center for Public Health Nutrition,
Professor of Epidemiology, University of Washington, Seattle, WA, USA

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Innovations in nutrient profiling