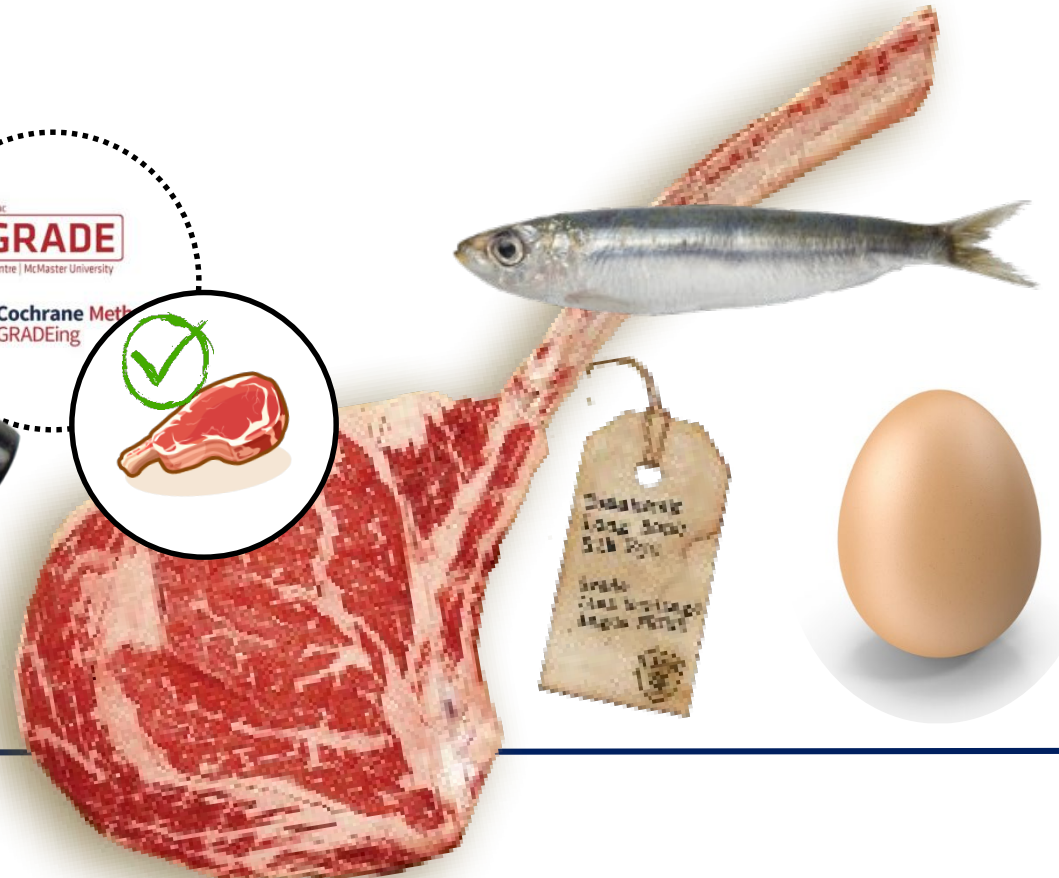


# Animal source foods

## Health foods - or causing chronic disease?



Prof. dr. ir. Frédéric LEROY



Research Group of  
Industrial Microbiology and Food Biotechnology

# Have we reached 'peak meat'?



## The End of Meat - Dr. Marco Springmann - How changes towards more plant-based diets would affect our health and climate (EN)

1 year ago | More



Blackrabbit Images PRO

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This presentation was a part of The End of Meat conference on August 27th in Berlin, Germany.

**Oxford University** @UniofOxford  
What if we all turned vegan by 2050? It's the way to beat climate change argues Dr Marco Springmann [po.st/HIUvuP](https://po.st/HIUvuP)



### BIO

Marco Springmann is a senior researcher on environmental sustainability and public health at the University of Oxford. He is interested in sustainable diets and the health, environmental, and economic dimensions of the global food system, which he communicated at our Meals of Tomorrow event at Shambala 2018.

### EVENTS

▶ SHAMBALA 2018

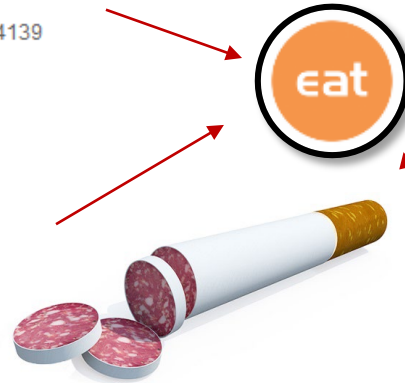
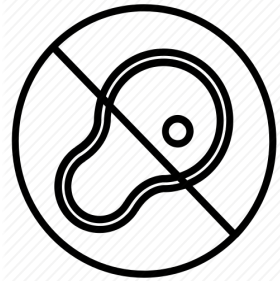
# Radical agendas (yet endorsed at the highest policy levels)



## Health-motivated taxes on red and processed meat: A modelling study on optimal tax levels and associated health impacts

Marco Springmann, Daniel Mason-D'Croz, Sherman Robinson, Keith Wiebe, H. Charles J. Godfray, Mike Rayner, Peter Scarborough

Published: November 6, 2018 • <https://doi.org/10.1371/journal.pone.0204139>



“How about restaurants in 10-15 years start treating carnivores the same way that smokers are treated? If they want to eat meat, they can do it outside the restaurant.”

### Christiana Figueres

Former Executive Secretary of the United Nations Framework Convention on Climate Change and convener of Mission 2020



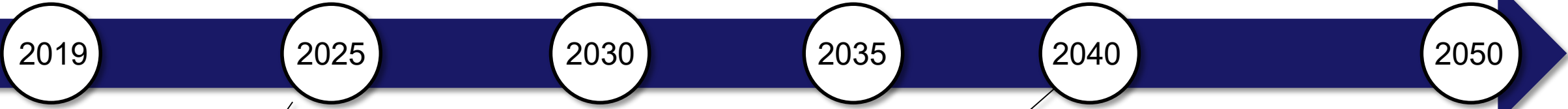
Gunhild A. Stordalen Retweeted  
**World Economic Forum** @wef · 8 Apr 2018  
A new report says we should tax meat-eaters like smokers [wef.ch/2Gs0fyC](http://wef.ch/2Gs0fyC)  
#health



WORLD  
RESOURCES  
INSTITUTE



# What is the timeline and what is it supposed to imply?



Gunhild A. Stordalen @G\_stordalen

Interesting read on disruption in the protein market: CEO of @ImpossibleFoods: "We plan to take a double-digit portion of the beef market within five years, and then we can push that industry, which is fragile and has low margins, into a death spiral" [bit.ly/2mkxJJg](https://bit.ly/2mkxJJg)

## RethinkX

The drop in cost of #PrecisionFermentation plus the rise in cost of beef will bring about the collapse of the dairy and cattle industry by 2030.

## Most 'meat' in 2040 will not come from dead animals, says report

Report by the global consultancy AT Kearney



HOME SERVICES NEWS EDUCATION ABOUT US



Since its founding, Impossible Foods intentionally designed a robust supply chain that is highly scalable, with products sourced from abundant plant crops. Impossible Foods has a clear, long-term roadmap to exponentially expand capacity, and the Series E funding will accelerate the scaleup.

The company's goal is to eliminate the need for animals in the food chain by 2035.



Eat-Lancet



UN Climate Change @UNFCCC · Oct 10

- Barcelona ✓
- Copenhagen ✓
- Guadalajara ✓
- Lima ✓
- London ✓
- Los Angeles ✓
- Milan ✓
- Oslo ✓
- Paris ✓
- Quezon City ✓
- Seoul ✓
- Stockholm ✓
- Tokyo ✓
- Toronto ✓

CONSUMPTION INTERVENTION	PROGRESSIVE TARGET IN 2030	AMBITIOUS TARGET IN 2030
<b>C40 CITIES</b> Dietary change (this intervention is characterised by three major changes which are described in more detail)	<b>16 kg</b> of meat per person per year <sup>21</sup>	<b>0 kg</b> meat consumption
	<b>90 kg</b> dairy consumption (milk or derivative equivalent) per person per year <sup>22</sup>	<b>0 kg</b> dairy consumption (milk or derivative equivalent) per person per year
<b>C40 CITIES HEADLINE REPORT</b>	<b>2,500 kcal</b> per person per day	<b>2,500 kcal</b> per person per day

These cities have just committed to achieve a planetary health diet for all by 2030.



Gunhild A. Stordalen @G\_stordalen · 6 Oct 2017

@richardbranson invests in healthy sustainable food & predicts all meat to be either clean or plant-based by 2050: [bit.ly/2y5uFnP](https://bit.ly/2y5uFnP)





**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN  
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL  
COMMITTEE AND THE COMMITTEE OF THE REGIONS**

**A Farm to Fork Strategy**

**for a fair, healthy and environmentally-friendly food system**

Brussels, 20.5.2020  
COM(2020) 381 final

Reversing the rise in overweight and obesity rates across the EU by 2030 is critical. Moving to a more plant-based diet with less red and processed meat and with more fruits and vegetables will reduce not only risks of life-threatening diseases, but also the environmental impact of the food system<sup>35</sup>. It is estimated that in the EU in 2017 over 950,000 deaths (one

<sup>32</sup> Agriculture, forestry and fisheries statistics, 2019 edition, Statistical Books, Eurostat.

<sup>33</sup> Red meat includes beef, pig meat, lamb, and goat meat and all processed meats.

<sup>34</sup> Willett W. et al (2019), 'Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems', in *Lancet*, Vol. 393, pp. 447–92.

FAO and WHO (2019), Sustainable healthy diets – guiding principles.



## NUTRITIONISM

The Science and Politics  
of Dietary Advice



Gyorgy Scrinis

“Nutritionism [...] is characterized by a reductive focus on the nutrient composition of foods as the means for understanding their healthfulness, as well as by a reductive interpretation of the role of these nutrients in bodily health. A key feature of this reductive interpretation of nutrients is that in some instances [...] it conceals or overrides concerns with the production and processing quality of a food and its ingredients”



Gyorgy Scrinis

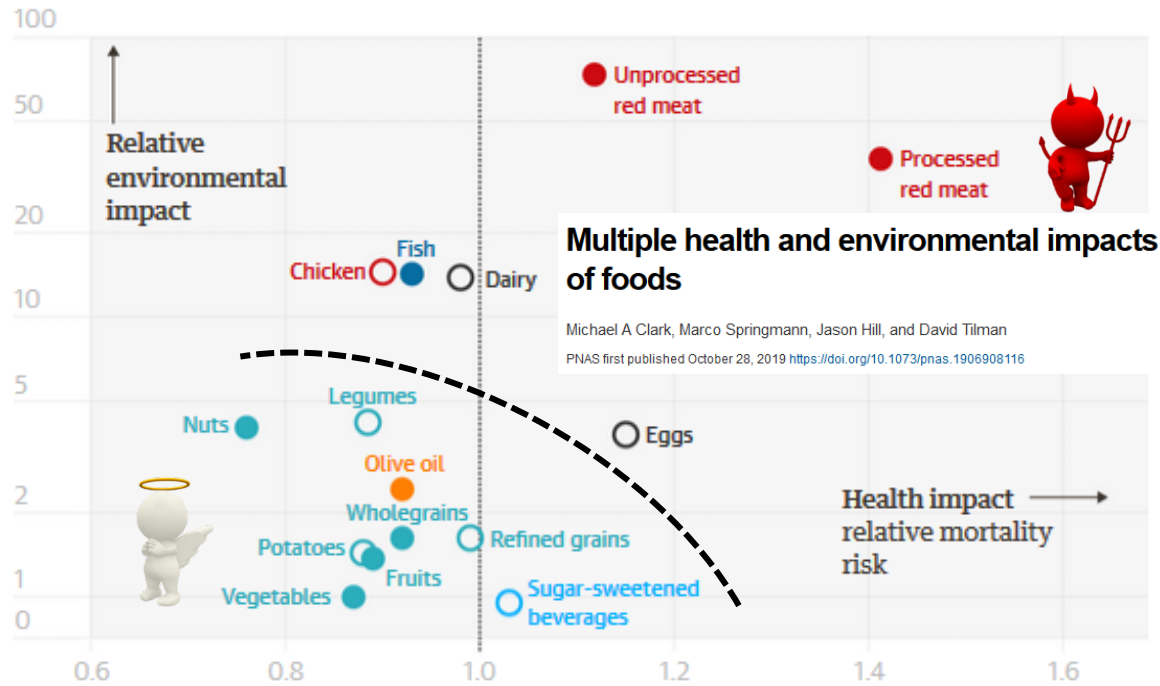
Professor of Food and Nutrition Politics and Policy  
University of Melbourne

The narrative is one of “**protein transition**”, whereby the ultra-processed constitution of the imitation is hidden behind a smokescreen of virtuousness, ignoring the intrinsic value of the original food matrix and undermining other more valuable ways of knowing and engaging with food

# When scientific reporting transpires ideology and conflict of interest

- Reductionist metrics (CO<sub>2</sub>-eq, 'land', 'water', etc.)
- No broader view on sustainability (C-seq, ecosystem, livelihoods ...)
- Top-down: global/category averages rather than local specificities
- Focus on animal-plant binary (ignoring harm on the plant side)
- **Disregard for true nutritional value** (protein quality, micronutrients)
- **Unsubstantiated claims from nutritional epidemiology**

## Foods that are good for health are also good for the environment



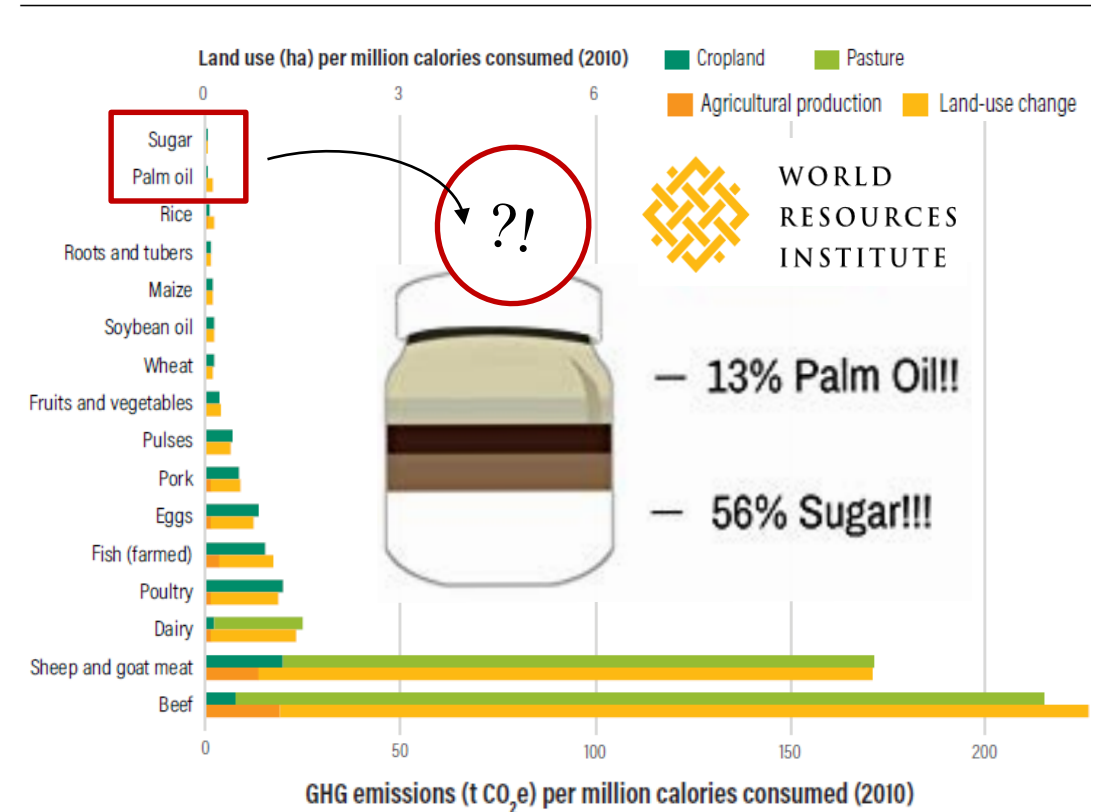
Guardian graphic. Source: Clark et al, PNAS, 2019. Note: Foods linked to a statistically significant change in mortality risk are denoted by solid circles. Those not linked are denoted by open circles

Healthy diet means a healthy planet, study shows

theguardian

Damian Carrington  
 Environment editor  
 @dpcarrington  
 Mon 28 Oct 2019 19:00 GMT

Figure 6-6a | Foods differ vastly in land-use and greenhouse gas impacts

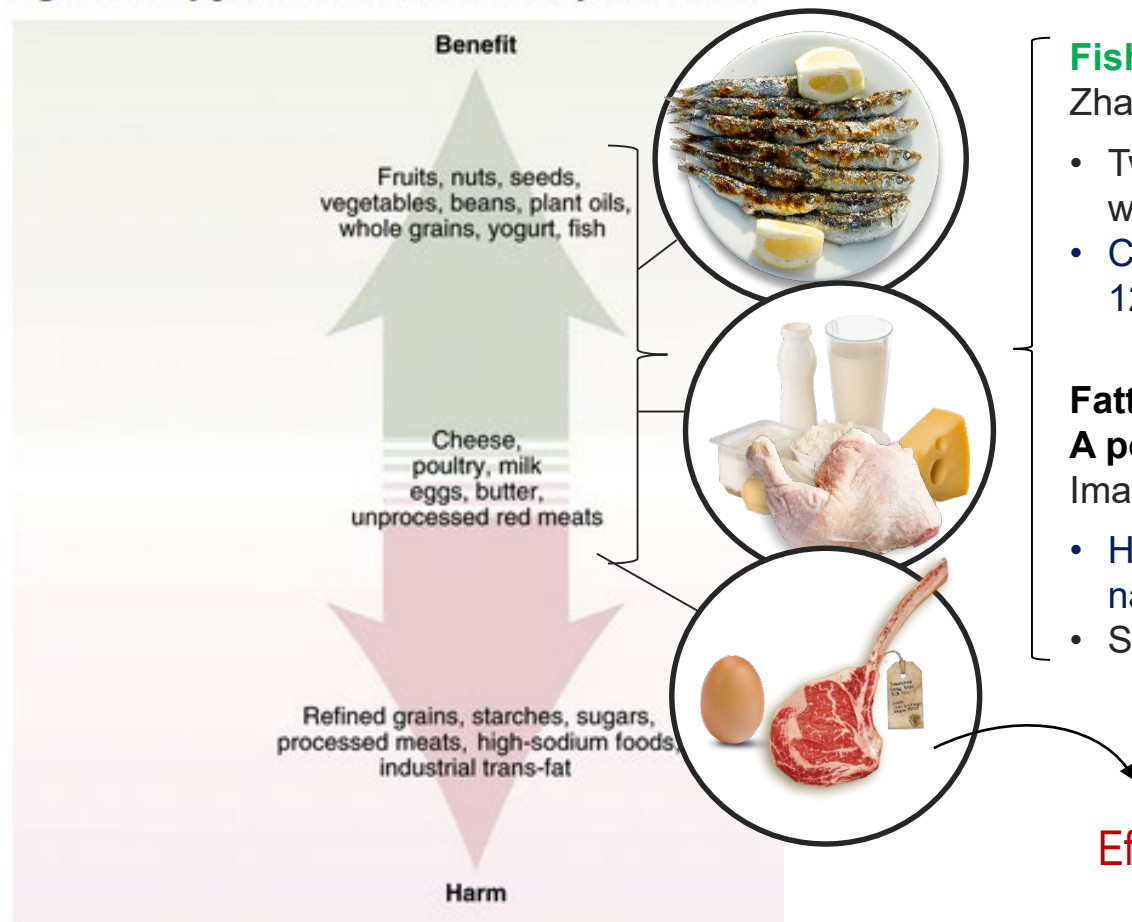


# If anything, animal foods display mostly neutral to protective associations

## Dietary and policy priorities to reduce the global crises of obesity and diabetes

Mozaffarian 2020 Nature Food

Fig. 3: Dietary priorities to reduce obesity and T2DM.



Evidence, mostly based on observational studies, does not suggest that 'animal foods' should be reduced as a group

### Fish consumption and all-cause mortality: a meta-analysis of cohort studies

Zhao et al. 2016 Eur J Clin Nutr

- Twelve prospective cohort studies with 672 389 participants and 57 641 deaths were included in this meta-analysis
- Compared with never consumers, 60 g of fish per day was associated with a 12% reduction in risk of total death

### Fatty acid biomarkers of dairy fat consumption and incidence of type 2 diabetes: A pooled analysis of prospective cohort studies

Imamura 2018 PLOS Med

- Higher circulating and tissue concentrations of odd-chain saturated fats and a natural ruminant *trans*-fat are associated with lower risk of T2D
- Strongest evidence to date for relationships of these fatty acid biomarkers with T2D

Effects of red meat, butter, eggs usually small or close to neutral



Gastroenterology, Critical Care, and Lifestyle Medicine (SA McClave, Section Editor)

Published: 07 August 2018

## Saturated Fat: Part of a Healthy Diet

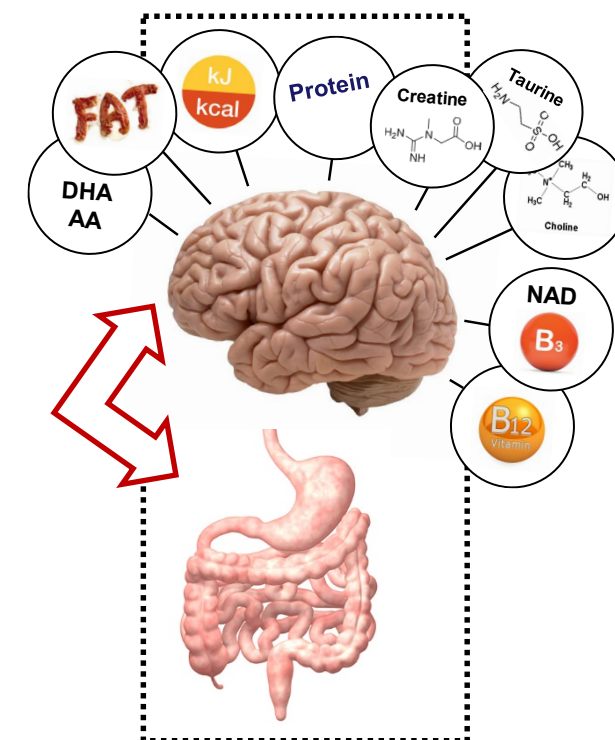
[Victoria M. Gershuni](#) 

[Current Nutrition Reports](#) 7, 85–96(2018) | [Cite this article](#)

> [PLoS One](#). 2011;6(12):e28689. doi: 10.1371/journal.pone.0028689. Epub 2011 Dec 9.

## Man the Fat Hunter: The Demise of Homo Erectus and the Emergence of a New Hominin Lineage in the Middle Pleistocene (Ca. 400 Kyr) Levant

Miki Ben-Dor <sup>1</sup>, Avi Gopher, Israel Hershkovitz, Ran Barkai





## Yearly per capita red meat intake

### Ignored reality

#### Hunter gatherers

80-500 kg



**80-220 kg**

!Kung, Nukak, Onge, Anbarra, etc.

**350-500 kg**

African Hadza, Australian Arnhem, American Hiwi and Aché, etc.



**300-500 kg** (+150-300 kg blubber)  
Inuit (Greenland)

#### Chimpanzees

4-15 kg



4-15 kg per individual on average,  
**>30 kg for males** (not evenly distributed)

### Reality



**The West**

50 kg

**50 kg** (+ 24-50 kg poultry)



**World**

21 kg

**21 kg** (+ 14 kg poultry)

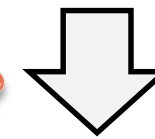
#### Developing countries



**13 kg** (+ 8 kg poultry)

13 kg

### Virtual reality



**World Cancer Research Fund International**

<26 kg

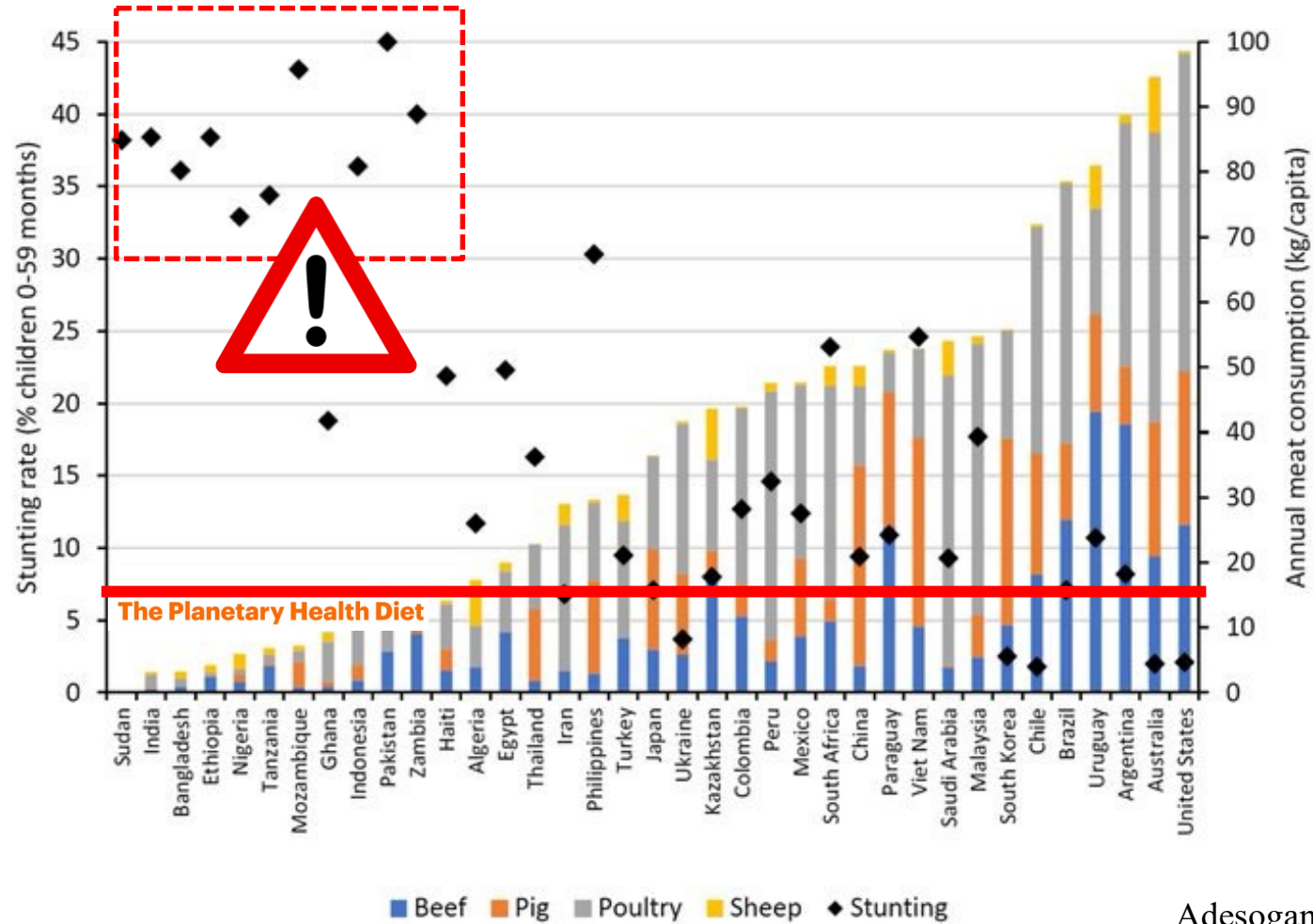


0-5 kg

**0-5 kg red meat**  
(+ 0-11 kg poultry)

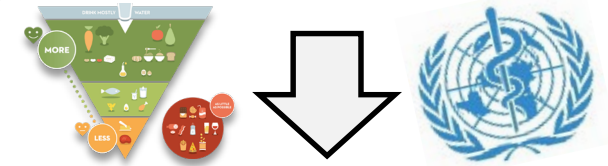
India (1 + 2), Indonesia (3 + 8)  
Ethiopia (3 + 0), Nigeria (4 + 1)


# Advice to reduce intake to levels that parallel malnutrition globally



Adesogan et al 2019


## Virtual reality





**World Cancer Research Fund International**

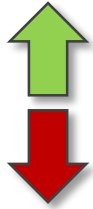
<26 kg

**0-5 kg red meat**  
(+ 0-11 kg poultry)

0-5 kg

## Macrobiotic diet

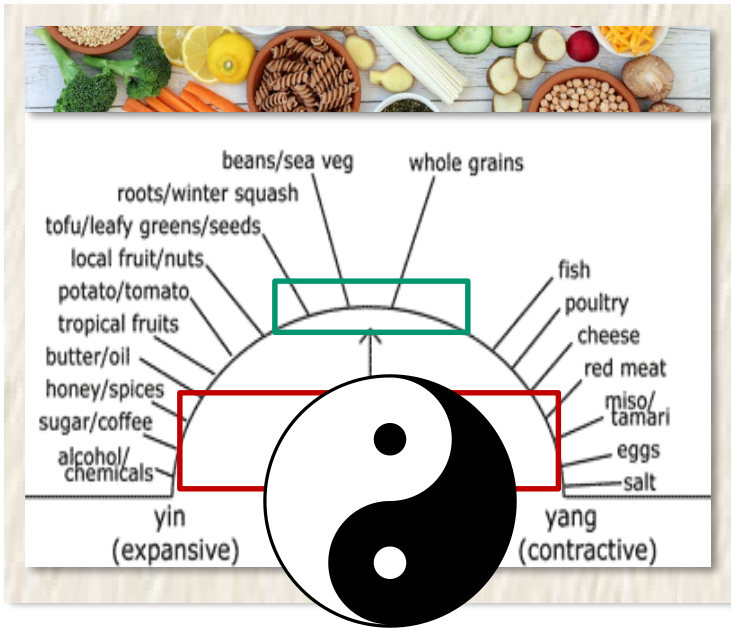


Mostly whole grains, legumes, vegetables, ...  
 No or low levels of dairy, fish, poultry, potato  
 Restrict or avoid red meat and eggs



14/3/2018: Mario Pianese (Ma-Pi) 🇮🇹

Italian police crack macrobiotic diet sect that left followers emaciated

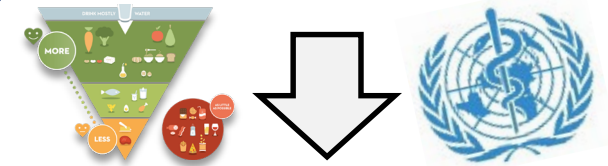


## Deficiencies and impaired development

- Macrobiotic Dutch infants (4-18 m)
- **Ubiquitous deficiencies** (energy, protein, Ca, Fe, vitamins B2, B12, D)
- Retarded growth, fat and muscle wasting, slower psychomotor development, rickets
- Breast milk: less vitamin B12, Ca, Mg

Van Dusseldorp et al., Am J Clin Nutr 1999  
 Schneede et al., Pediatr Res 1994  
 Dagnelie & van Staveren, Am J Clin Nutr 1994  
 Dagnelie et al., Am J Clin Nutr 1989, 1990

## Virtual reality



World Cancer Research Fund International

<26 kg



0-5 kg

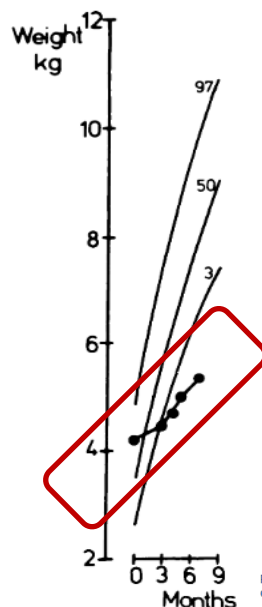
0-5 kg red meat (+ 0-11 kg poultry)

*J Nutr Sci* 2017; 6: e58.  
Published online 2017 Nov 23. doi: [10.1017/ins.2017.62](https://doi.org/10.1017/ins.2017.62)

PMCID: PMC5705809  
PMID: [29209497](https://pubmed.ncbi.nlm.nih.gov/29209497/)

Long-chain n-3 PUFA in vegetarian women: a metabolic perspective  
[Graham C. Burdge](#),<sup>1,\*</sup> [Sze-Yen Tan](#),<sup>2</sup> and [Christiani Jeyakumar Henry](#)<sup>2</sup>

Infants born to vegan mothers have lower EPA and DHA status than those born to omnivore mothers.



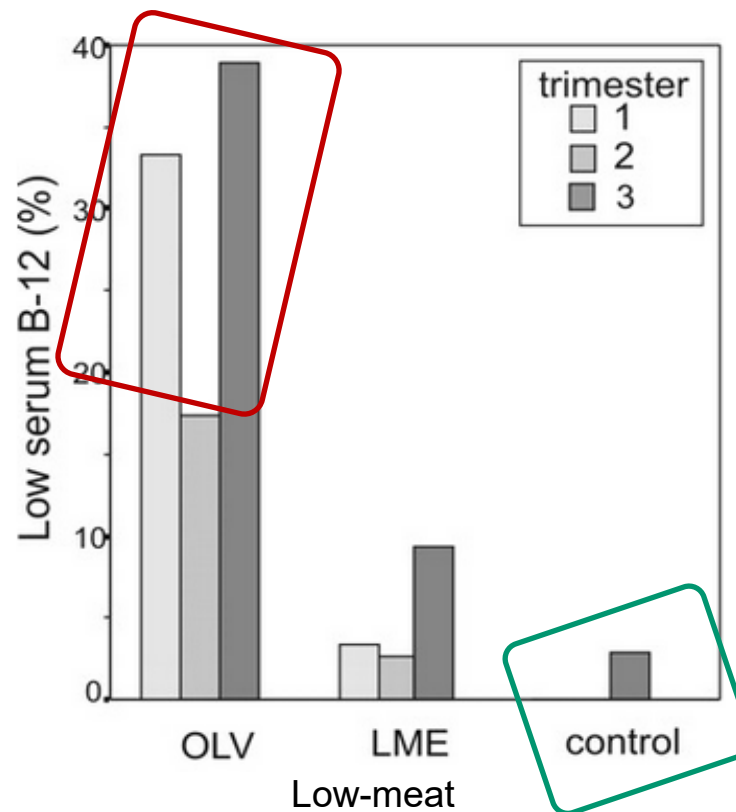
**WARNING**

Totally Vegetarian Diets and Infant Nutrition  
Eric D. Shinwell, Rafael Gorodischer

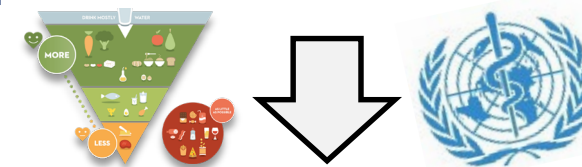
## Long-Term Ovo-Lacto Vegetarian Diet Impairs Vitamin B-12 Status in Pregnant Women

Corinna Koebnick , Ingrid Hoffmann, Pieter C. Dagnelie, Ulrike A. Heins, Sunitha N. Wickramasinghe, Indrika D. Ratnayaka, Sindy Gruendel, Jan Lindemans, Claus Leitzmann

*The Journal of Nutrition*, Volume 134, Issue 12, 1 December 2004, Pages 3319-3326,



## Virtual reality



**World Cancer Research Fund International**

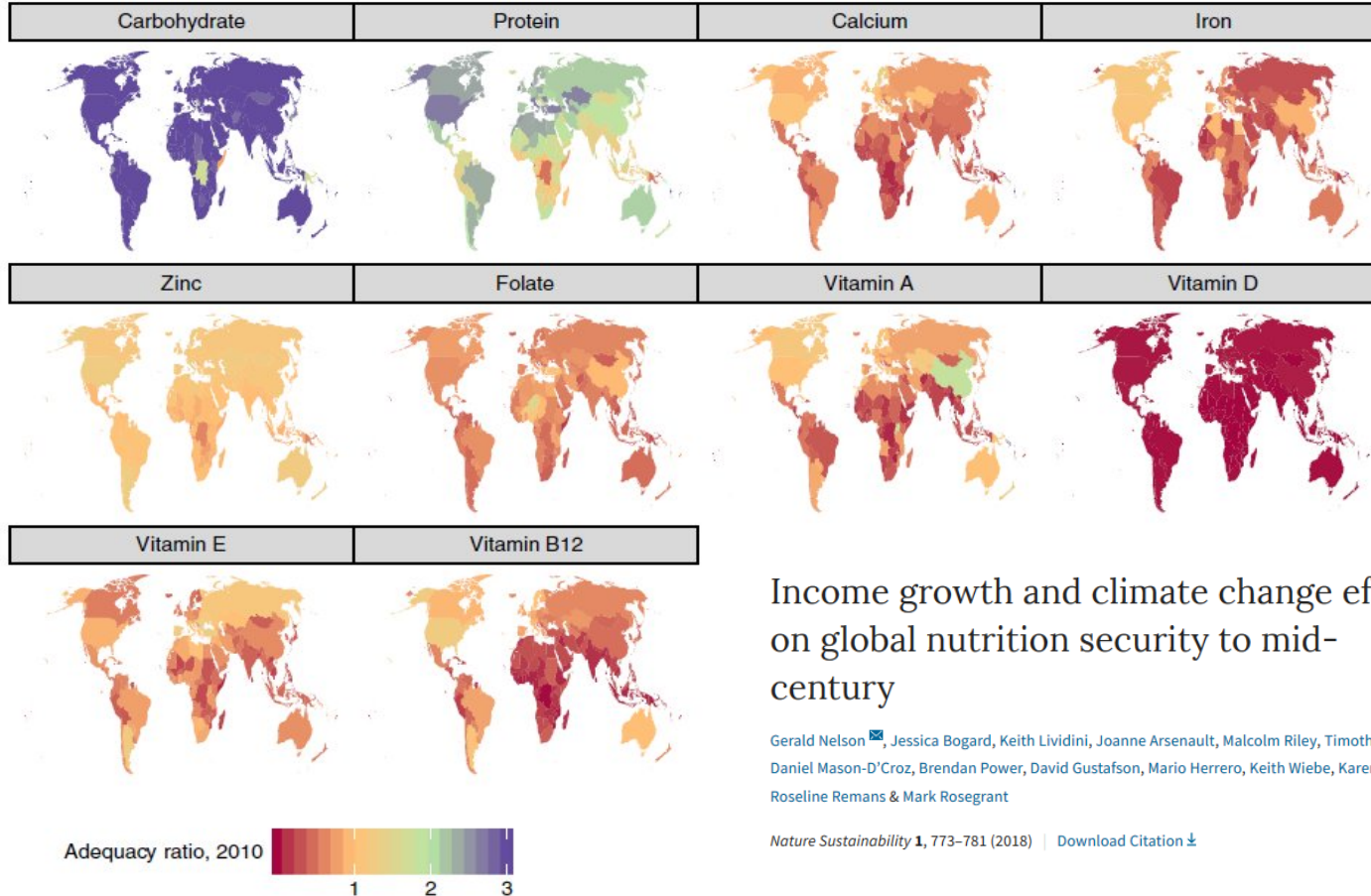
<26 kg

0-5 kg

**0-5 kg red meat**  
(+ 0-11 kg poultry)



# Sacrificing our hopes on adequate essential nutrition?



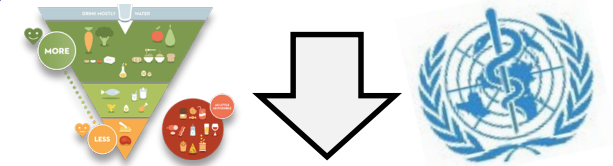
Income growth and climate change effects on global nutrition security to mid-century

Gerald Nelson, Jessica Bogard, Keith Lividini, Joanne Arseneault, Malcolm Riley, Timothy B. Sulser, Daniel Mason-D'Croz, Brendan Power, David Gustafson, Mario Herrero, Keith Wiebe, Karen Cooper, Roseline Remans & Mark Rosegrant

*Nature Sustainability* 1, 773-781 (2018) | [Download Citation](#)

**Fig. 3 |** Country-specific adequacy ratios for selected nutrients, 2010. Values outside the range of the legend have the same colour as the legend extremes.

## Virtual reality



World Cancer Research Fund International

<26 kg



0-5 kg

0-5 kg red meat (+ 0-11 kg poultry)

# Not all protein is created equal

**Table 2 Impact of using either the protein digestibility corrected amino acid score or digestible indispensable amino acid score for determining protein content claims for nonanimal foods identified as protein foods or meat alternatives within US national dietary standards**

Protein food categories (NDB) <sup>a</sup>	RACC (g) <sup>b</sup>	Application of PDCAAS method			Application of DIAAS method		
		PDCAAS	Corrected protein content in RACC (g) <sup>c</sup> (%DRV) <sup>d</sup>	Permitted protein claim <sup>e</sup>	DIAAS <sup>f</sup>	Crude protein content in RACC (g) <sup>g</sup> (%DRV) <sup>d</sup>	Permitted protein claim <sup>h</sup>
<b>Nuts and seeds</b>							
Almonds (12 061)	30 g	39	2.5 (5.0)	No claim	40	6.3 (12.7)	No claim
Sunflower seeds (12 036)	30 g	66	4.1 (8.2)	No claim	67	6.2 (12.5)	No claim
Peanut butter (16 167)	32 g	45	3.2 (6.3)	No claim	46	7.0 (14.0)	No claim
<b>Legumes/pulses<sup>i</sup></b>							
Navy beans	35 g dry	67	5.7 (11.5)	Good source	51	8.6 (17.2)	No claim
Whole green lentils	35 g dry	63	5.8 (11.6)	Good source	65	9.2 (18.4)	No claim
Split red lentils	35 g dry	54	5.6 (11.2)	Good source	50	10.3 (20.7)	No claim
Split yellow peas	35 g dry	64	5.7 (11.4)	Good source	73	8.8 (17.7)	No claim
Chickpeas (16 057)	35 g dry	74	5.9 (11.8)	Good source	83	7.7 (15.3)	Good source
<b>Soy products</b>							
Tofu (16 426)	85 g	56	8.22 (16.4)	Good source	52	14.7 (29.4)	No claim

Abbreviations: DIAAS, digestible indispensable amino acid score; DRV, daily reference value; NDB, USDA nutrient database; PDCAAS, protein digestibility-corrected amino acid score; RACC, reference amount customarily consumed.

<sup>a</sup>NDB is the Nutrient Database Number from the USDA Nutrient Database USDA National Nutrient Data Release 28. <http://www.ars.usda.gov/Services/docs.htm?docid=8964>. Accessed August 12, 2016.

<sup>b</sup>RACC from FDA: 21CFR101.12.<sup>2</sup>

<sup>c</sup>Corrected protein content = crude protein content in RACC × PDCAAS.

<sup>d</sup>Values in parentheses reflect % DRV, where the DRV for protein = 50 g<sup>2</sup>

<sup>e</sup>5–9.9 g = good source; ≥ 10 g = excellent source.<sup>2</sup>

<sup>f</sup>DIAAS calculated using available digestibility coefficients (ileal or fecal) or using estimates of 0.85.

<sup>g</sup>Crude protein content per RACC, based on proposed approach in Food and Agriculture Organization report.<sup>6</sup>

<sup>h</sup>Claim based on both quantity (if crude protein, 5–9.9 g = good source if the DIAAS is >75; ≥ 10 g = excellent source only if the DIAAS is ≥ 100.<sup>6</sup>

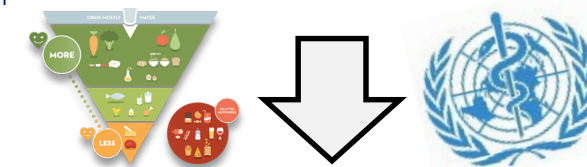
<sup>i</sup>Data from pulses, unless noted, are derived from the author's (J.D.H.) laboratory (unpublished data).


Burd et al. 2019 Sports Medicine



Soy: 0.8-0.9  
Legumes: 0.6  
Cereals: 0.3-0.5  
Animal: ≥1


## Virtual reality





**World Cancer Research Fund International**

<26 kg



0-5 kg

**0-5 kg red meat (+ 0-11 kg poultry)**

Am J Clin Nutr. 2005 Aug;82(2):327-34.

Long-chain n-3 polyunsaturated fatty acids in plasma in British meat-eating, vegetarian, and vegan men.

Rosell MS<sup>1</sup>, Lloyd-Wright Z, Appleby PN, Sanders TA, Allen NE, Key TJ.

## EPA levels:

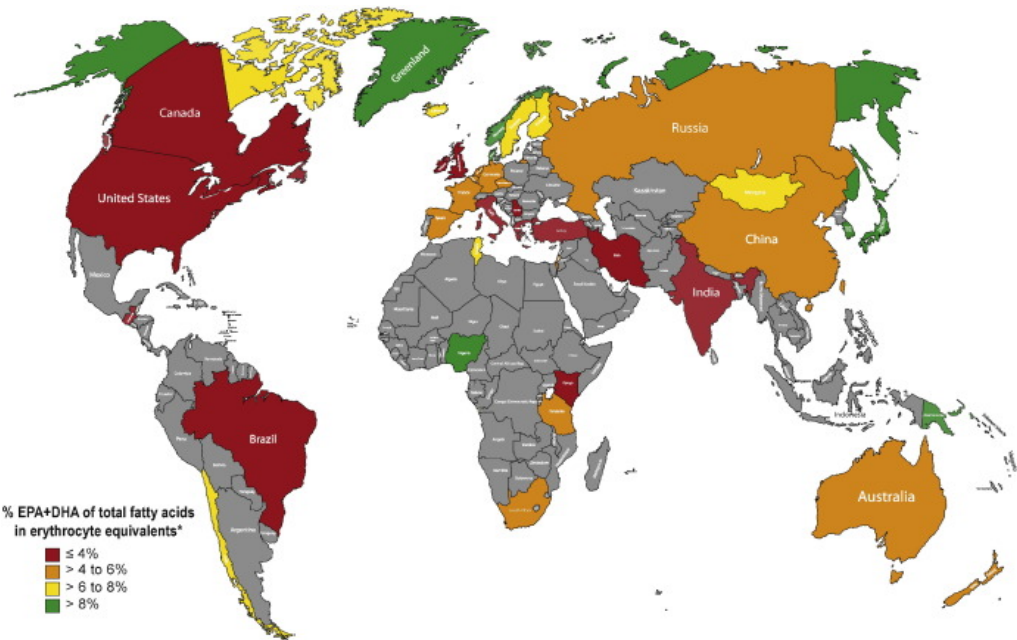
**28%** lower in vegetarians

**53%** lower in vegans

## DHA levels:

**31%** lower in vegetarians

**59%** lower in vegans

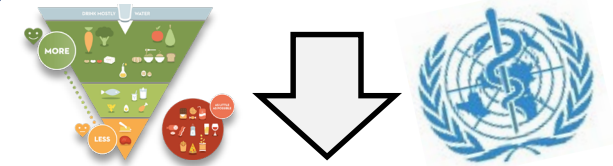


Global survey of the omega-3 fatty acids, docosahexaenoic acid and eicosapentaenoic acid in the blood stream of healthy adults - Stark et al. 2016 Progress in Lipid Research

## Global EPA + DHA blood levels

- **High** in Japan, Alaska, Greenland, Scandinavia
- **Very low** in North-America, India, Middle East, parts of Europe (potential bias due to sampling in urban centres?)

## Virtual reality



World Cancer Research Fund International

**<26 kg**



**0-5 kg**

**0-5 kg red meat**  
(+ 0-11 kg poultry)



# Many beneficial nutrients are still underappreciated

[Amino Acids](#). 2020; 52(3): 329–360.

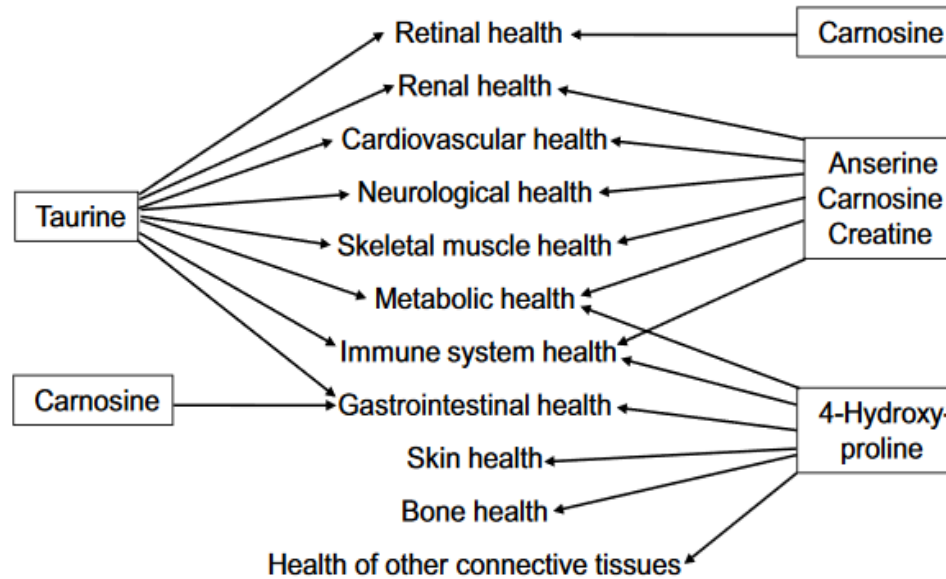
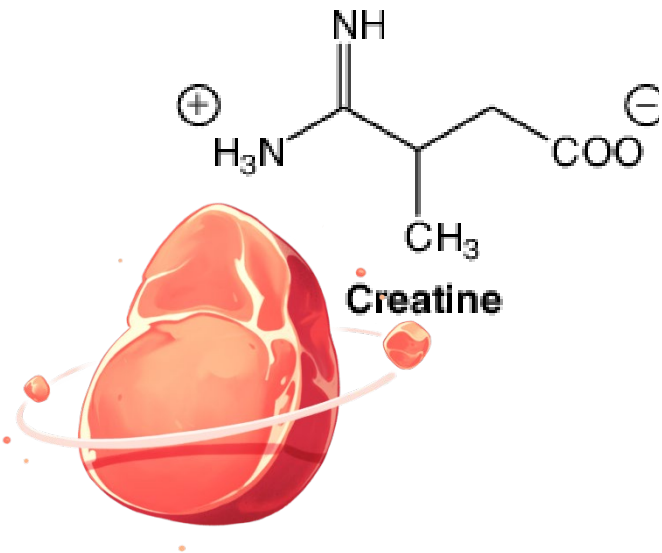
Published online 2020 Feb 18. doi: [10.1007/s00726-020-02823-6](https://doi.org/10.1007/s00726-020-02823-6)

PMCID: PMC7088015

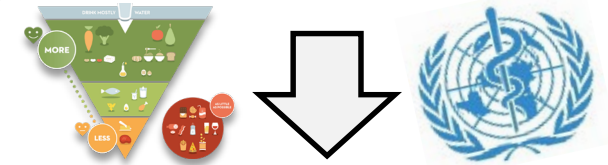
PMID: [32072297](https://pubmed.ncbi.nlm.nih.gov/32072297/)

## Important roles of dietary taurine, creatine, carnosine, anserine and 4-hydroxyproline in human nutrition and health

[Guoyao Wu](#)



## Virtual reality



**World Cancer Research Fund International**

**<26 kg**

**0-5 kg**

**0-5 kg red meat (+ 0-11 kg poultry)**

CRITICAL REVIEWS IN FOOD SCIENCE AND NUTRITION  
<https://doi.org/10.1080/10408398.2019.1657063>

REVIEW

## Should dietary guidelines recommend low red meat intake?

Frédéric Leroy<sup>a</sup> and Nathan Cofnas<sup>b</sup>

<sup>a</sup>Research Group of Industrial Microbiology and Food Biotechnology (IMDO), Faculty of Sciences and Bioengineering Sciences, Vrije Universiteit Brussel, Pleinlaan 2, Brussels, B-1050, Belgium; <sup>b</sup>Balliol College, University of Oxford, Oxford, OX1 3BJ, UK



ELSEVIER

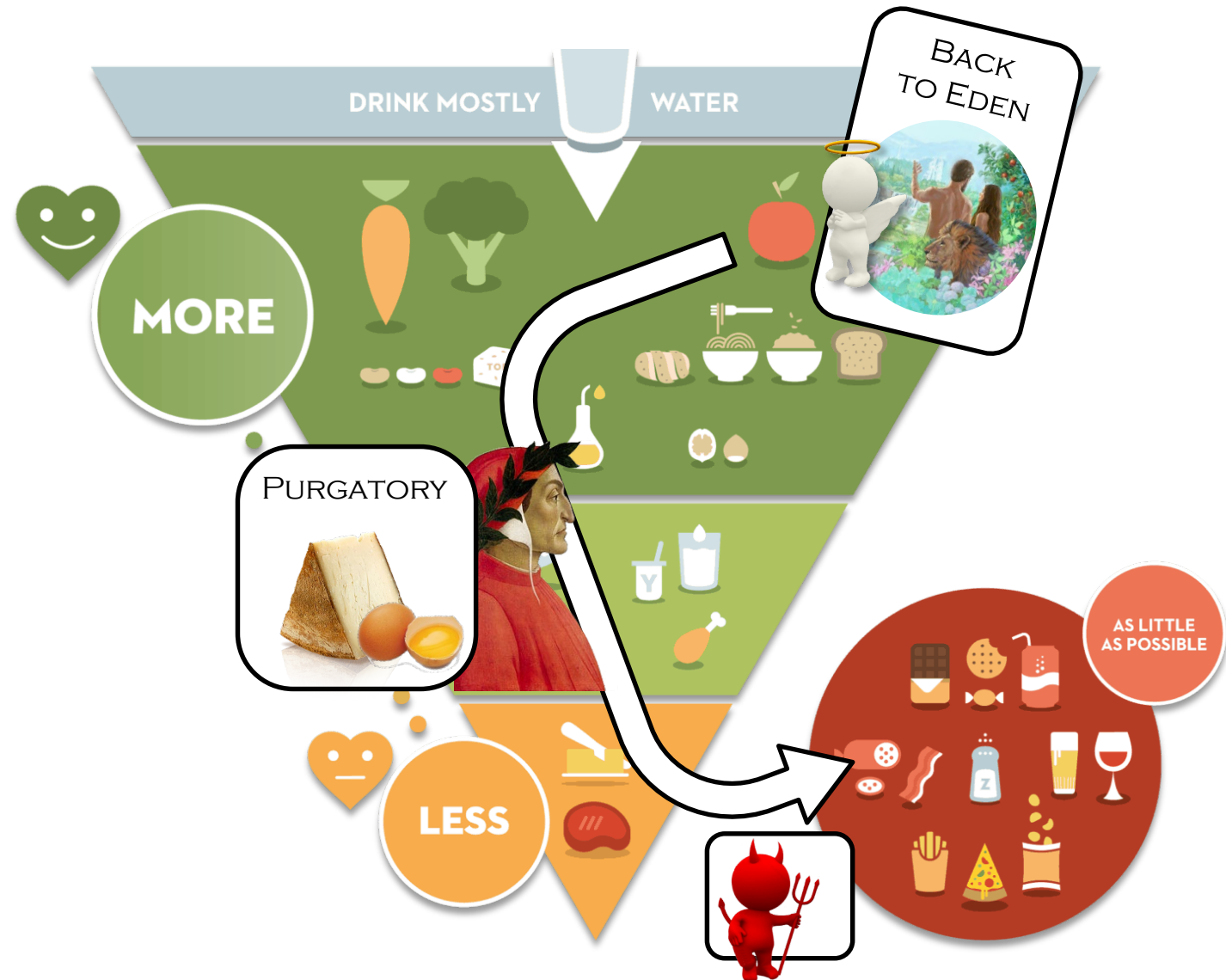
International Journal of Food  
Microbiology

Volume 274, 2 June 2018, Pages 67-70



### Fermented meats (and the symptomatic case of the Flemish food pyramid): Are we heading towards the vilification of a valuable food group?

Frédéric Leroy <sup>a</sup> ✉, Teresa Aymerich <sup>b</sup>, Marie-Christine Champomier-Vergès <sup>c</sup>, Luca Cocolin <sup>d</sup>, Luc De Vuyst <sup>a</sup>, Mónica Flores <sup>e</sup>, Françoise Leroi <sup>f</sup>, Sabine Leroy <sup>g</sup>, Régine Talon <sup>g</sup>, Rudi F. Vogel <sup>h</sup>, Monique Zagorec <sup>i</sup>



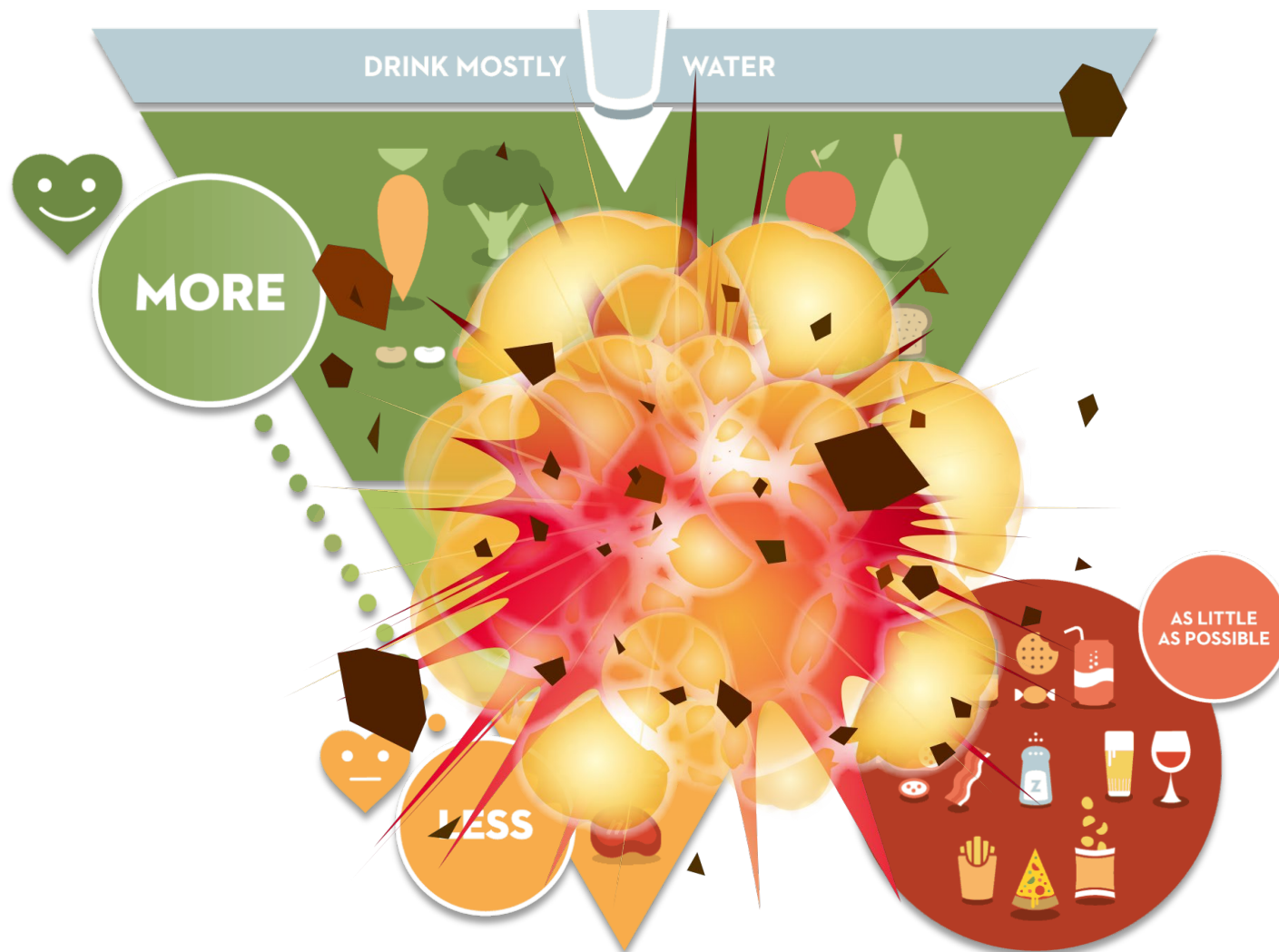
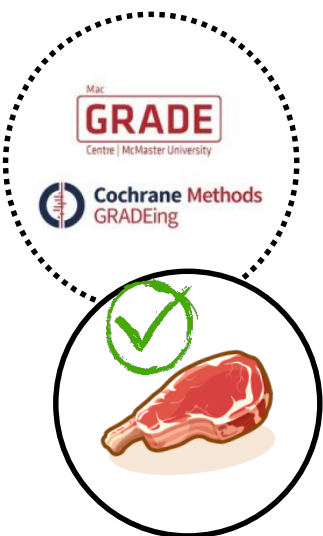
# Dietary advice: what are the scientific standards of evidence?

Annals of Internal Medicine® CLINICAL GUIDELINES | 19 NOVEMBER 2019

## Unprocessed Red Meat and Processed Meat Consumption: Dietary Guideline Recommendations From the Nutritional Recommendations (NutriRECS) Consortium <sup>FREE</sup>

Bradley C. Johnston, PhD; Dena Zeraatkar, MSc; Mi Ah Han, PhD; Robin W.M. Vernooij, PhD; Claudia Valli, MSc; Regina El Dib, PhD; Catherine Marshall; Patrick J. Stover, PhD; Susan Fairweather-Taitt, PhD; Grzegorz Wójcik, PhD; Faiz Bhatia, PEng; Russell de Souza, ScD; Carlos Brotons, MD, PhD; Joerg J. Meerpohl, MD; Chirag J. Patel, PhD; Benjamin Djulbegovic, MD, PhD; Pablo Alonso-Coello, MD, PhD; Malgorzata M. Bala, MD, PhD; Gordon H. Guyatt, MD

**Recommendation to continue rather than reduce** consumption of unprocessed red meat or processed meat



# Dietary advice: what are the scientific standards of evidence?

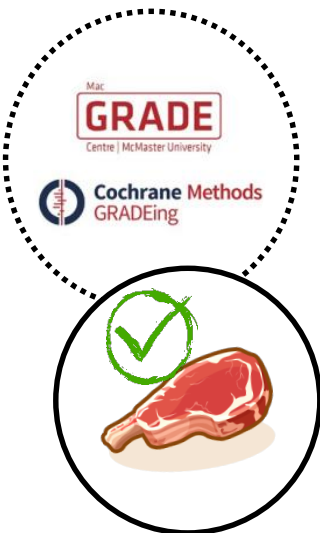
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### 1 Trivial absolute risk reduction

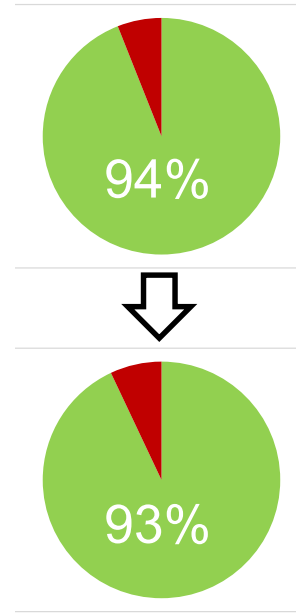
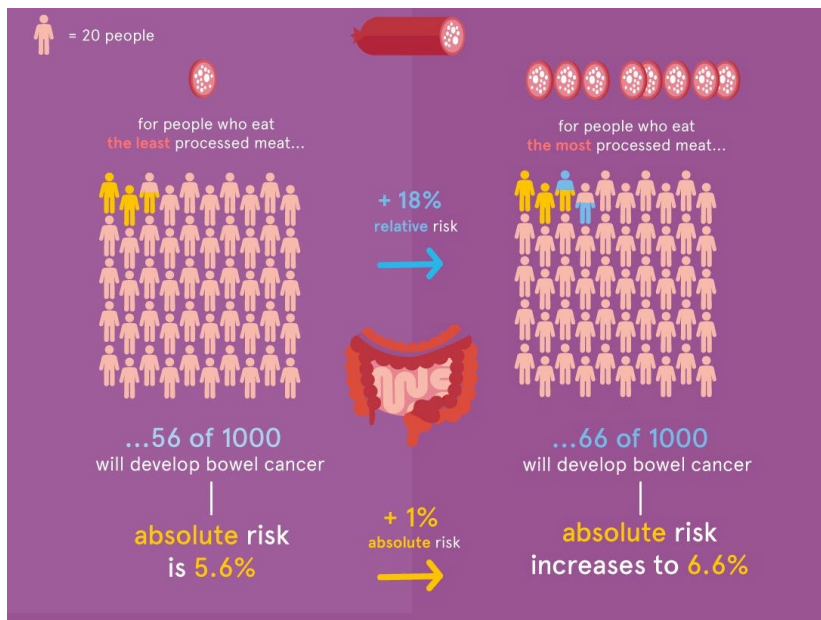


According to the World Health Organization...  
Eating **50g** of processed meat a day - less than two slices of bacon - increased the <sup>^</sup> chance of developing colorectal cancer by ~~18%~~ **1%** **absolute**



Source: IARC/WHO  
© Global News

Put differently: the risk that one will not develop colorectal cancer in a lifetime would decrease from 94 to 93% when eating high amounts of processed meats



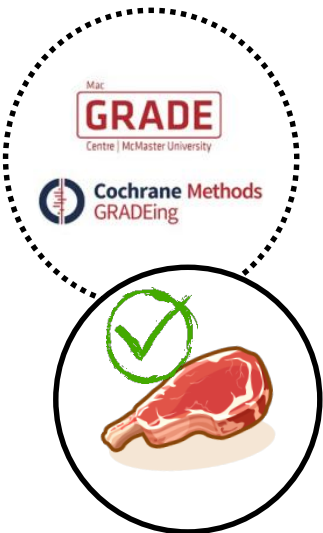
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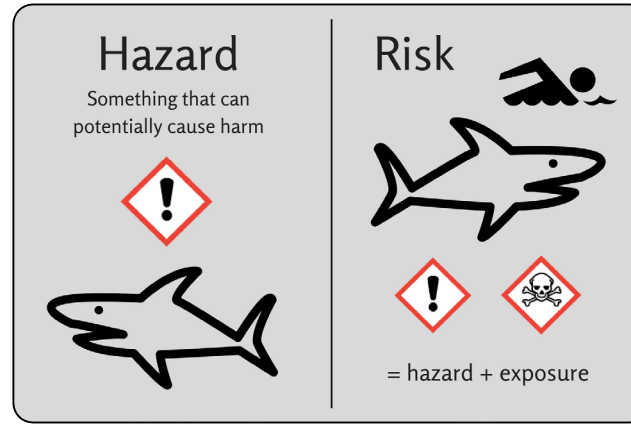
### 1 Trivial absolute risk reduction

Likelihood causes cancer High to Low

1 Causes cancer: Processed meats including		
2a Sausages and hotdogs	Bacon	Salami
2b Probably causes cancer: Red meats including		
3 Pork	Beef	Lamb
4		

Source: Cancer Research UK, WHO International Agency for Research on Cancer BBC

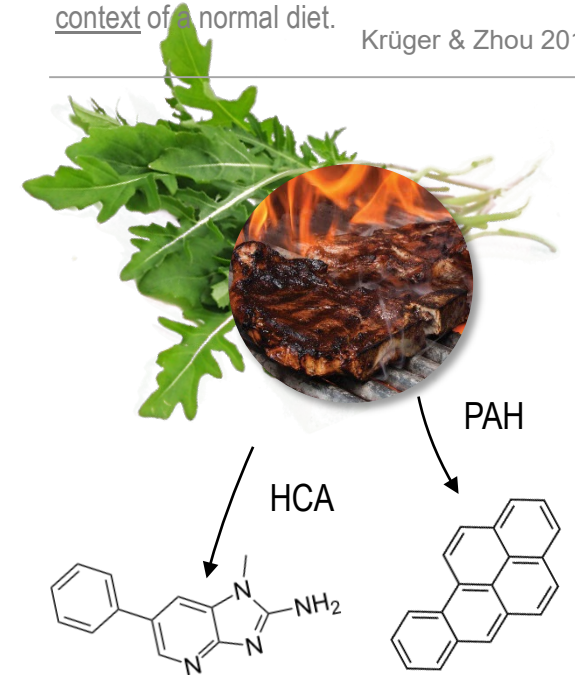
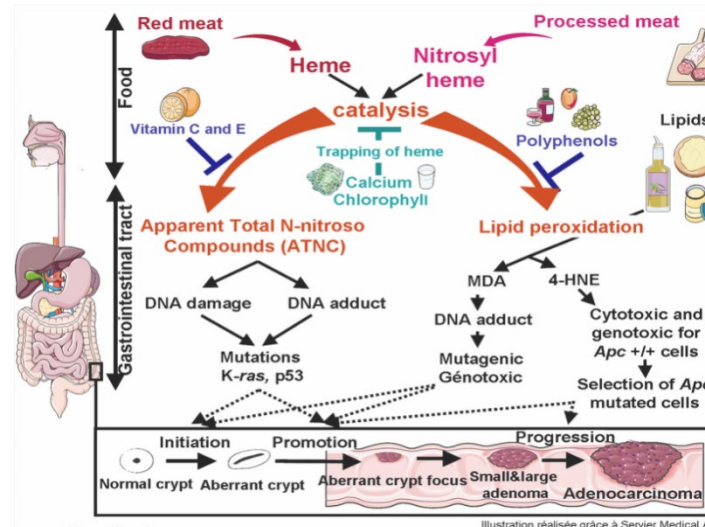
## Requires 'risk assessment'



Red meat and colon cancer: A review of mechanistic evidence for heme in the context of risk assessment methodology

Current studies of heme **have not** provided sufficient documentation that the mechanisms studied would contribute to an increased risk of promotion of preneoplasia or colon cancer at usual dietary intakes of red meat in the context of a normal diet.

Krüger & Zhou 2018



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2b	Pork 	Beef 	Lamb 
3			
4			

Source: Cancer Research UK, WHO <sup>1</sup>International Agency for Research on Cancer



## Context is everything



2A: Working as barber or hairdresser



1: Sunlight



Regul Toxicol Pharmacol. 2016 Dec;82:158-166. doi: 10.1016/j.yrtph.2016.10.014. Epub 2016 Oct 22.

**Classification schemes for carcinogenicity based on hazard-identification have become outmoded and serve neither science nor society.**

Boobis AR<sup>1</sup>, Cohen SM<sup>2</sup>, Dellarco VL<sup>3</sup>, Doe JE<sup>4</sup>, Fenner-Crisp PA<sup>5</sup>, Moretto A<sup>6</sup>, Pastoor TP<sup>7</sup>, Schoeny RS<sup>8</sup>, Seed JG<sup>9</sup>, Wolf DC<sup>10</sup>.

[...] Because a risk-based decision framework fully considers hazard in the context of dose, potency, and exposure the unintended downsides of a hazard only approach are avoided, e.g., health scares, unnecessary economic costs, loss of beneficial products, adoption of strategies with greater health costs, and the diversion of public funds into unnecessary research.

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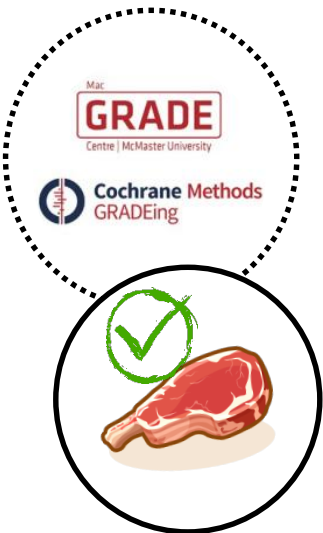
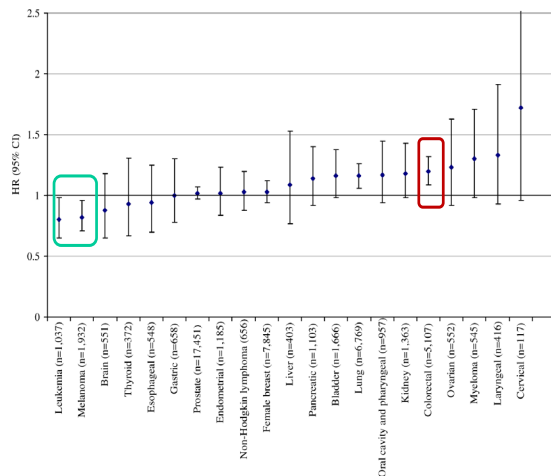
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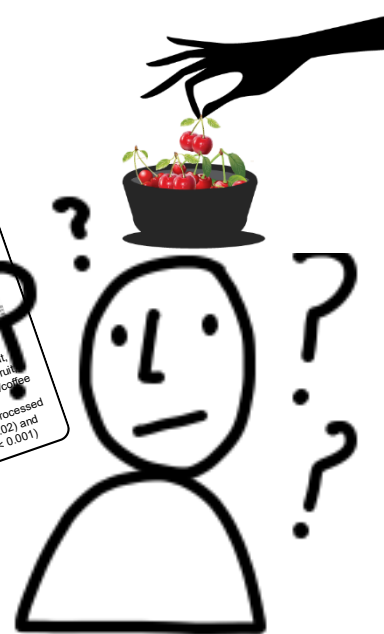
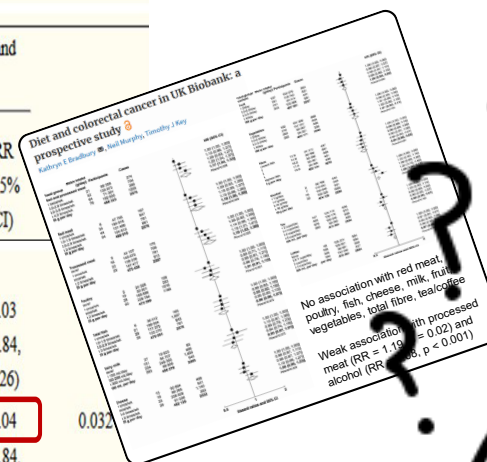


## Inconvenient facts

- Red and processed meat intake is associated with colorectal cancer but inversely associated with melanoma (Cross et al. 2007; Yen et al. 2018)
- With respect to colorectal cancer most studies were from 1990s, more up to date info from the UK showed no significant association with red meat and only a weak one with processed meats (Bradbury et al. 2020)
- (British) vegetarians are not better off than meat eaters: higher incidence of colorectal cancer (Key et al. 2014); mortality from circulatory diseases and all causes is not significantly different (Key et al. 2009)

Incident malignant cancers and RRs (95% CIs) by diet group among 32,491 meat eaters, 8612 fish eaters, and 20,544 vegetarians and vegans

Cancer site (ICD-10 codes) and model	Meat eaters		Fish eaters		Vegetarians and vegans	
	No. of cancers	RR	No. of cancers	RR (95% CI)	No. of cancers	RR (95% CI)
Colorectum (C18-20)						
Basic	382	1.00	43	0.66 (0.48, 0.92)	154	1.03 (0.84, 1.26)
+BMI		1.00		0.67 (0.48, 0.92)		1.04 (0.84, 1.28)



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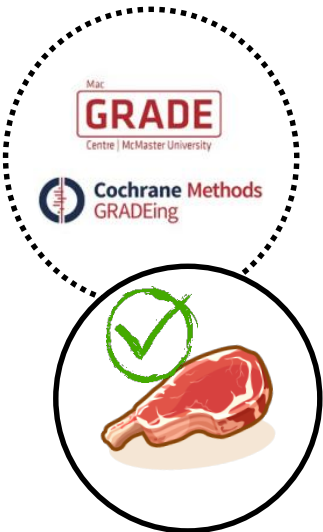
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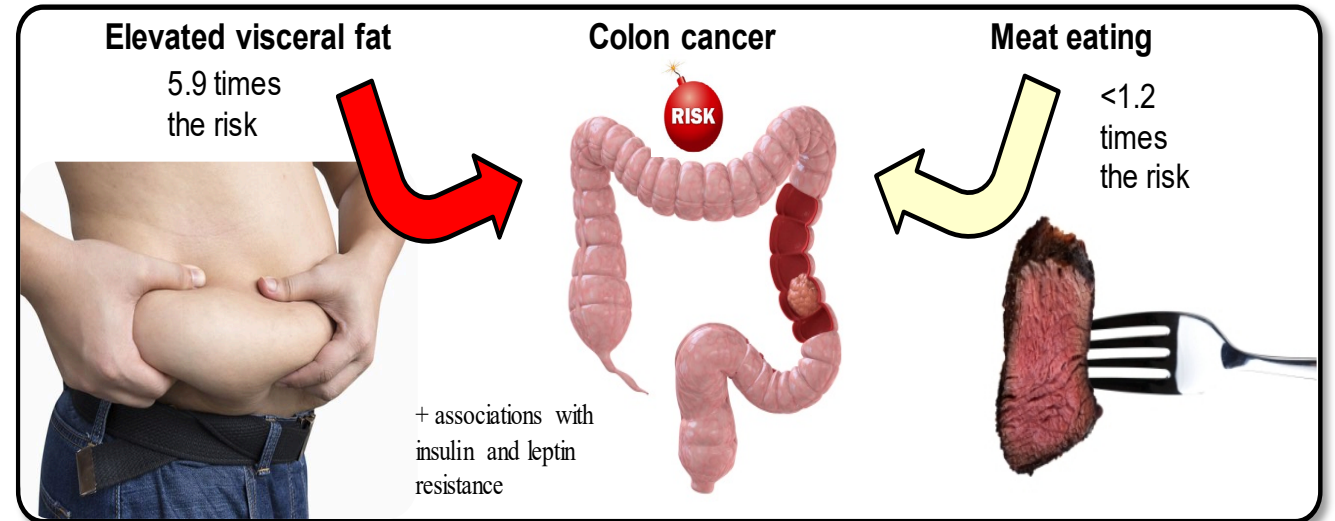


## Very low relative risk preclude causal conclusions

Epidemiologists have only primitive tools, which for small relative risks are too crude to enable us to distinguish between bias, confounding and causation; when estimates are much below 2.0, we are simply **out of business**

Shapiro 2004, *Pharmacoepidemiology & Drug Safety*

e.g., 18% RR < 0.2 << 2.0





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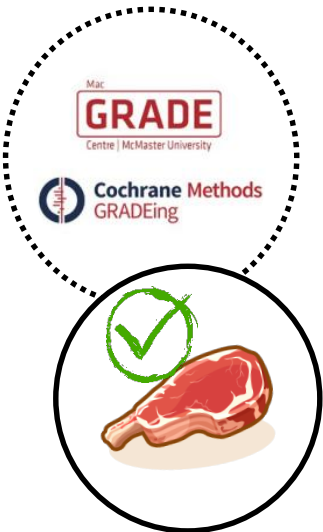
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## Only limited evidence due to potential confounding

Br J Nutr. 2014 Sep 14;112(5):762-75. doi: 10.1017/S000711451400124X. Epub 2014 Jun 16.

### Association between total, processed, red and white meat consumption and all-cause, CVD and IHD mortality: a meta-analysis of cohort studies.

Abete I<sup>1</sup>, Romaguera D<sup>1</sup>, Vieira AR<sup>1</sup>, Lopez de Munain A<sup>2</sup>, Norat T<sup>1</sup>.

“The results of the present meta-analysis indicate that processed meat consumption could increase the risk of mortality from any cause and CVD, while red meat consumption is positively but weakly associated with CVD mortality. These results should be interpreted with caution due to the high heterogeneity observed in most of the analyses as well the possibility of residual confounding.”

## What does really say?

World Health Organization Health Topics Countries News Emergencies

### 12. How many cancer cases every year can be attributed to consumption of processed meat and red meat?

According to the most recent estimates by the Global Burden of Disease Project, an independent academic research organization, about 34 000 cancer deaths per year worldwide are attributable to diets high in processed meat.

**Eating red meat has not yet been established as a cause of cancer.** However, if the reported associations were proven to be causal, the Global Burden of Disease Project has estimated that diets high in red meat could be responsible for 50 000 cancer deaths per year worldwide.

“Eating meat has not yet been established as a cause of cancer”

### Limited evidence

”means that a positive association has been observed between exposure to the agent and cancer but that other explanations for the observations (technically termed chance, bias, or confounding) could not be ruled out.”

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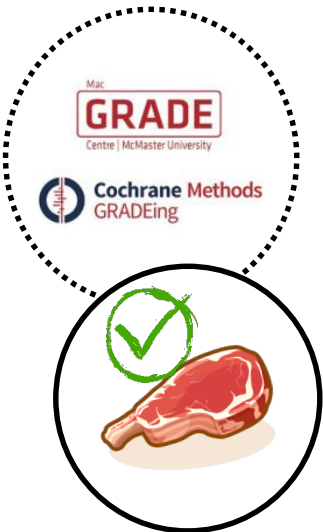
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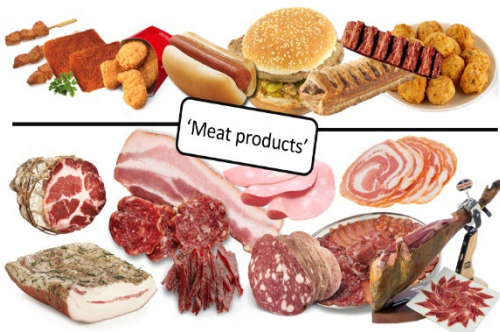
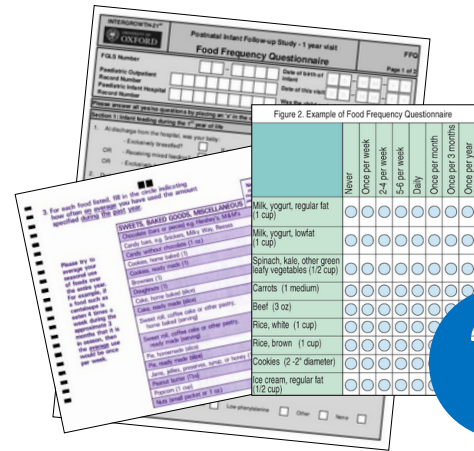
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## Input data (FFQs)



J Clin Epidemiol 2018, pii: S0895-4356(17)31375-6

### Controversy and debate: memory based methods paper 1: the fatal flaws of food frequency questionnaires and other memory-based dietary assessment methods

Archer E, Marlow ML, Lavie CJ

*Our position is that FFQs and other M-BMs are invalid and inadmissible for scientific research and cannot be employed in evidence-based policy making. [The data is] both fatally flawed and pseudo-scientific.*

Am J Clin Nutr 2003;78(suppl):626S-32S

### What do vegetarians in the United States eat?<sup>1-4</sup>

Ella H Haddad and Jay S Tanzman

*Of self-defined vegetarians, most (64%, 214/334) ate a significant quantity of meat on at least 1/2 days for which their dietary intake was surveyed*

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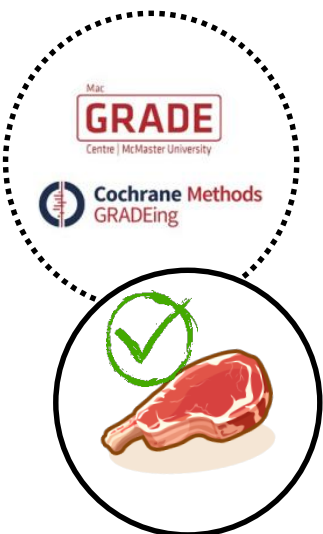
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## Healthy user bias (eating *right*)

Meat and Muscle Biology™

### The Place of Meat in Dietary Policy: An Exploration the Animal/Plant Divide

Frédéric Leroy<sup>1\*</sup> and Adele H. Hite<sup>2</sup>

<sup>1</sup>Research Group of Industrial Microbiology and Food Biotechnology (IMDO), Faculty of Sciences and Bioengineering Sciences, Vrije Universiteit Brussel, Pleinlaan 2, B-1050 Brussels, Belgium

<sup>2</sup>Research scholar, Ronin Institute for Independent Scholarship, Montclair, NJ, USA

\*Corresponding author. Email: [frederic.leroy@vub.be](mailto:frederic.leroy@vub.be) (Frédéric Leroy)

**Abstract:** The virtues of “plant-based” eating are commonly extolled in public and academic discourse, in particular in postindustrial countries and exceedingly so on a global level. Animal source foods, on the other hand, are regularly stigmatized for their alleged link with disease, environmental deterioration, and animal abuse. Although there is a reasonable case for the improvement of animal agriculture, this discourse leads to a binary and counterproductive view of food systems: plants are largely seen as beneficial and animal source foods as intrinsically harmful. We argue that this animal/plant binary and the promotion of civic responsibility to accept it as such are cultural constructs that emerged in the Anglosphere during the 19th century. The divide has been continuously evolving since and is currently deepening due to a global sense of urgency, underpinned by various societal anxieties and normative responses. A symptomatic example is provided by the recent call for a Planetary Health Diet and a Great Food Transformation by the EAT-Lancet Commission and its wider network.

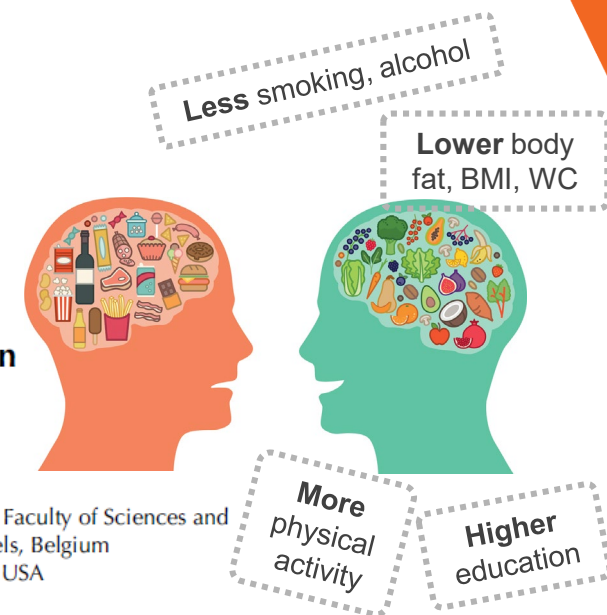
**Key words:** meat, veganism, vegetarianism, health, sustainability, animal agriculture

*Meat and Muscle Biology* 4(2): 2, 1–11 (2020)

doi:10.22175/mmb.9456

Submitted 17 December 2019

Accepted 20 February 2020



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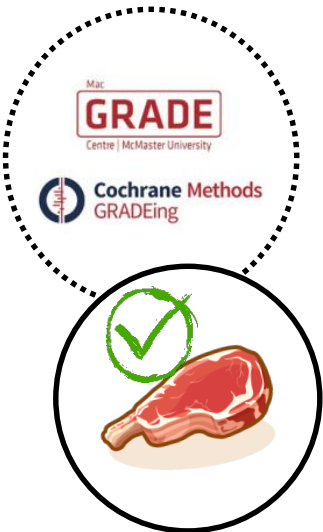
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## Western artefact

Associations vanish or invert (!) when taken out of a US context or when study design improves (cohort vs. case-control studies)

Processed meat intake and chronic disease morbidity and mortality: An overview of systematic reviews and meta-analyses

Mina Nicole Händel, Isabel Cardoso, Katrine Marie Rasmussen, Jeanett Friis Rohde, Ramune Jacobsen, Sabrina Mai Nielsen, Robin Christensen, Bert Lilienthal Heitmann  
Published: October 17, 2019 • <https://doi.org/10.1371/journal.pone.0223883>

Controversy on the correlation of red and processed meat consumption with colorectal cancer risk: an Asian perspective

Sun Jin Hur, Cheorun Jo, Yohan Yoon, Jong Youn Jeong & Keun Taik Lee  
Received 23 Mar 2018, Accepted 28 Jun 2018, Accepted author version posted online: 12 Jul 2018, Published online: 10 Sep 2018

"our results show that dairy products and meat are **beneficial** for heart health and longevity. This differs from current dietary advice"



Guidelines | .

All Types ▾

Clinical Topics Latest In Cardiology Education and Meetings Tools and

## PURE: Healthy Diet Including Dairy and Meats May Be Good For Hearts Worldwide

Aug 28, 2018

### PURE STUDY

- >218,000 participants
- 50 countries, five continents



Salim Yusuf, senior author



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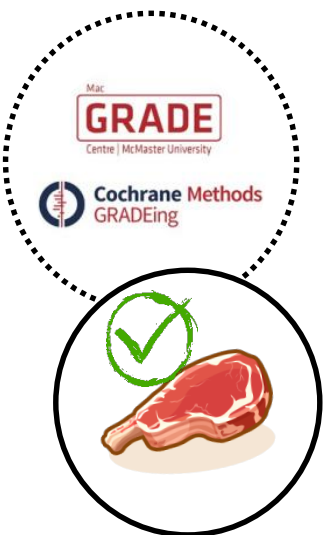
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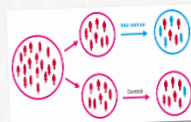
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## Lack of support from controlled trials

### Human intervention trials: no harm



- Cardiovascular risk factors  
O'Connor et al. (2017)
- Inflammation/oxidative stress  
Hodgson et al (2007)
- Insulin sensitivity  
Turner et al. (2015)



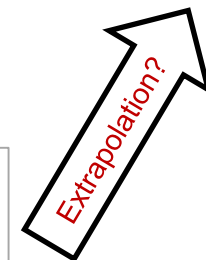
There is **inadequate** evidence in experimental animals for the carcinogenicity of consumption of red meat and of processed meat  
IARC Monograph, Lancet Oncol.

*Exp Biol Med (Maywood)*. 2017 Apr; 242(8): 813–839.  
Published online 2017 Feb 16. doi: [10.1177/1535370217693117](https://doi.org/10.1177/1535370217693117)

## Association between red meat consumption and colon cancer: A systematic review of experimental results

Nancy D Turner<sup>1,2</sup> and Shannon K Lloyd<sup>1</sup>

Forty studies using animal models or cell cultures met specified inclusion criteria, most of which were designed to examine the role of heme iron or heterocyclic amines in relation to colon carcinogenesis. Most studies used levels of meat or meat components well in excess of those found in human diets. Although many of the experiments used semi-purified diets designed to mimic the nutrient loads in current westernized diets, most did not include potential biologically active protective compounds present in whole foods. Because of these limitations in the existing literature, there is currently **insufficient evidence** to confirm a mechanistic link between the intake of red meat as part of a healthy dietary pattern and colorectal cancer risk.



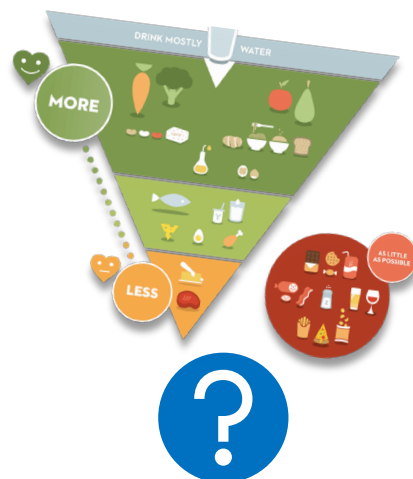
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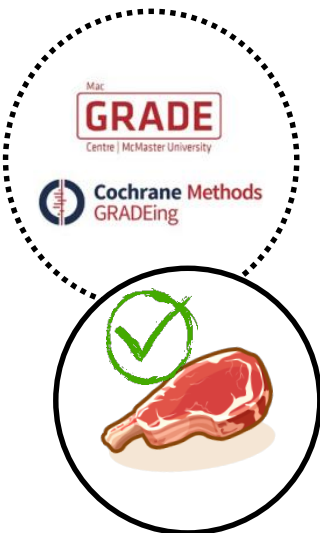
## Unprocessed Red Meat and Processed Meat Consumption: Dietary Guideline Recommendations From the Nutritional Recommendations (NutriRECS) Consortium FREE

Bradley C. Johnston, PhD; Dena Zeraatkar, MSc; Mi Ah Han, PhD; Robin W.M. Vernooij, PhD; Claudia Valli, MSc; Regina El Dib, PhD; Catherine Marshall; Patrick J. Stover, PhD; Susan Fairweather-Taitt, PhD; Grzegorz Wójcik, PhD; Faiz Bhatia, PEng; Russell de Souza, ScD; Carlos Brotons, MD, PhD; Joerg J. Meerpohl, MD; Chirag J. Patel, PhD; Benjamin Djulbegovic, MD, PhD; Pablo Alonso-Coello, MD, PhD; Malgorzata M. Bala, MD, PhD; Gordon H. Guyatt, MD

**Recommendation to continue rather than reduce consumption of unprocessed red meat or processed meat**



- 1 Trivial absolute risk reduction
- 2 (Very) low certainty
- 3 Peoples' attachment to meat-based diets

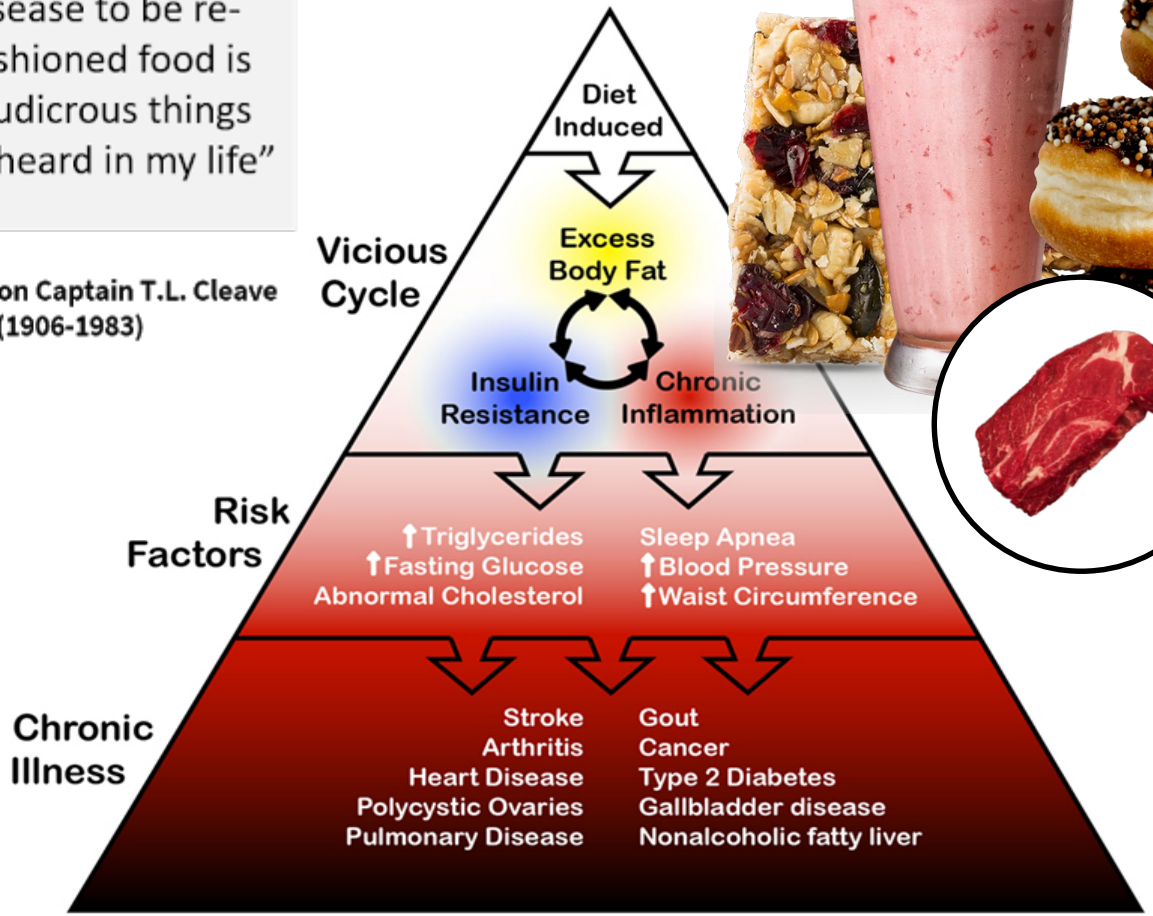


# Distracting us from the root cause

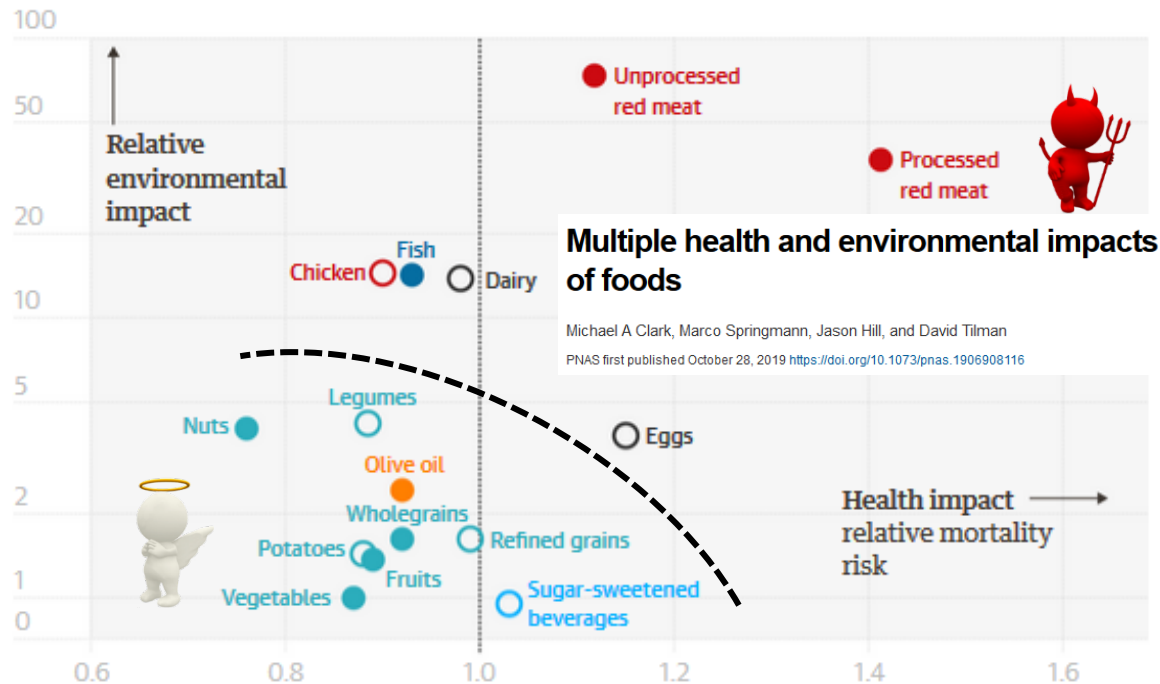
“For a modern disease to be related to an old-fashioned food is one of the most ludicrous things I ever heard in my life”



Surgeon Captain T.L. Cleave  
FRCP (1906-1983)



## Foods that are good for health are also good for the environment



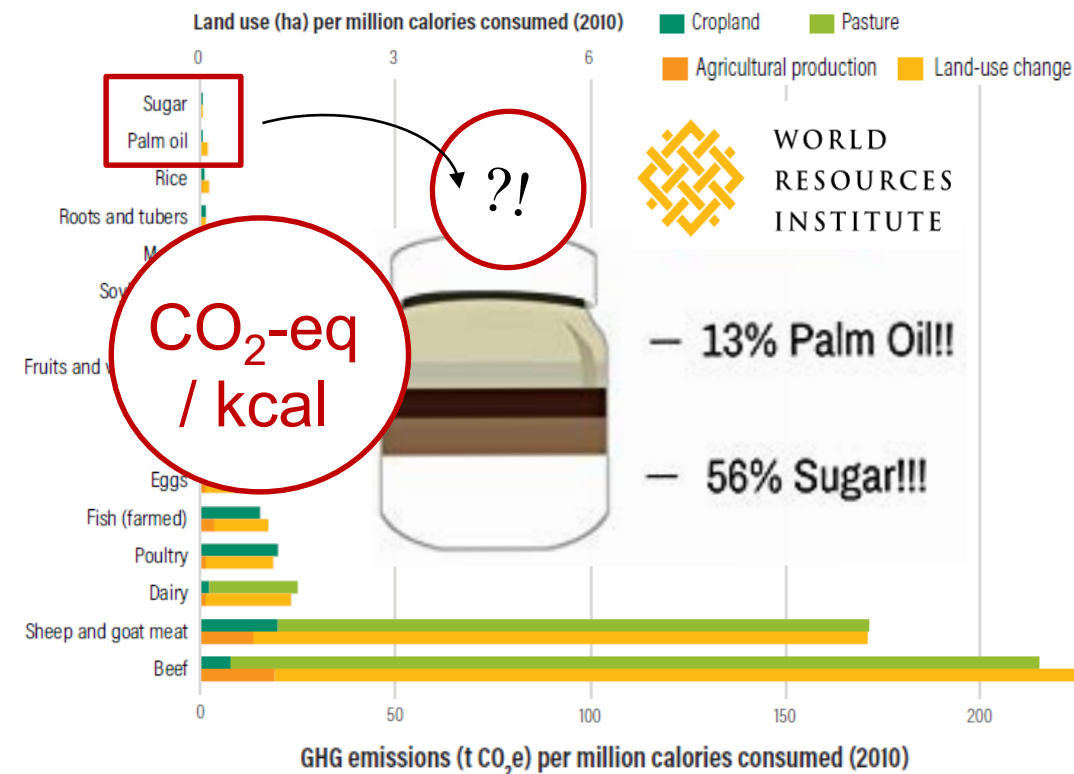
Guardian graphic. Source: Clark et al, PNAS, 2019. Note: Foods linked to a statistically significant change in mortality risk are denoted by solid circles. Those not linked are denoted by open circles

Healthy diet means a healthy planet, study shows

the guardian

Damian Carrington  
 Environment editor  
 @dpcarrington  
 Mon 28 Oct 2019 19:00 GMT

Figure 6-6a | Foods differ vastly in land-use and greenhouse gas impacts





hope



Coronavirus: Kiwis more positive about farming after Covid-19...  
New Zealanders are beginning to see food producers in a new light.  
[stuff.co.nz](http://stuff.co.nz)



Frederic.leroy@vub.be

Research reflecting the special dynamics of grassland should be supported. The same goes for communicating the findings to practitioners working with grazing animals and grassland.

Better use has to be made of the particular potential of grasslands for the promotion of soil fertility, flood protection, balanced watersheds, climate mitigation and the enhancement of biodiversity

Pasture grazing must be supported – even with coupled payments.

Sustainable pasture grazing is active grassland and climate protection.



VRIJE  
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SRP, IRP, IOF projects

**IRP11 - Interdisciplinary Research Program** - Tradition and naturalness of animal products within a societal context of change.

Food biotechnology research within IMDO

Research Group of Industrial Microbiology and Food Biotechnology  
Prof. Dr. ir. Luc De Vuyst  
Prof. Dr. ir. Frédéric Leroy  
Prof. Dr. Stefan Weckx

