Alternative Proteine

Technische Möglichkeiten und Ressourcenanforderungen

Wie alternativlos sind “alternative Proteine” ?

..... alternativ zu WAS ?

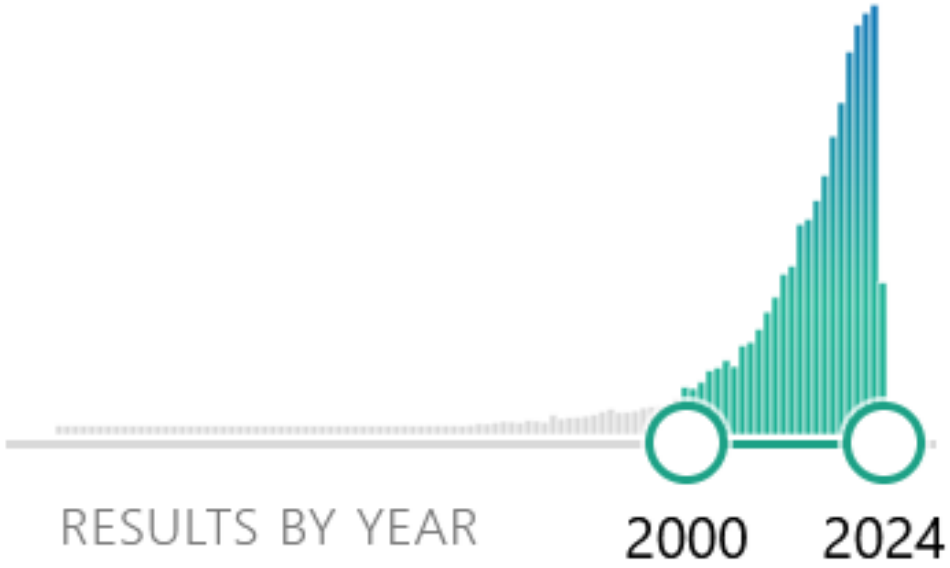
… alternativ zu Soja, um Importe und Abhängigkeiten zu reduzieren?!

… alternativ zu Fleisch und anderen tierischen Produkten (für Substitute) und besserer Umweltbilanz?!

… alternativ (eigentlich zusätzlich) zu konventionellen Quellen für wachsende Weltbevölkerung?!

….alternativ zu den bestehenden Quellen um Resilienz/Diversität/Sortenvielfalt zu erhalten?!

……



National Library of Medicine
National Center for Biotechnology Information

PubMed®

alternative proteins food

Search

15,869 results

1 Cite Share

Alternative proteins for meat and dairy replacers: **Food** safety and future trends.

Banach JL, van der Berg JP, Kleter G, van Bokhorst-van de Veen H, Bastiaan-Net S, Pouvreau L, van Asselt ED.

Crit Rev Food Sci Nutr. 2023;63(32):11063-11080. doi: 10.1080/10408398.2022.2089625. Epub 2022 Jun 27.

PMID: 35757863 Review.

Assessing how **alternative proteins** are processed and their impact on **food** safety helps realize market opportunities while ensuring **food** safety. ...Understanding the effects of processing and safety **alternative proteins** is paramount to ens ...

2 Cite

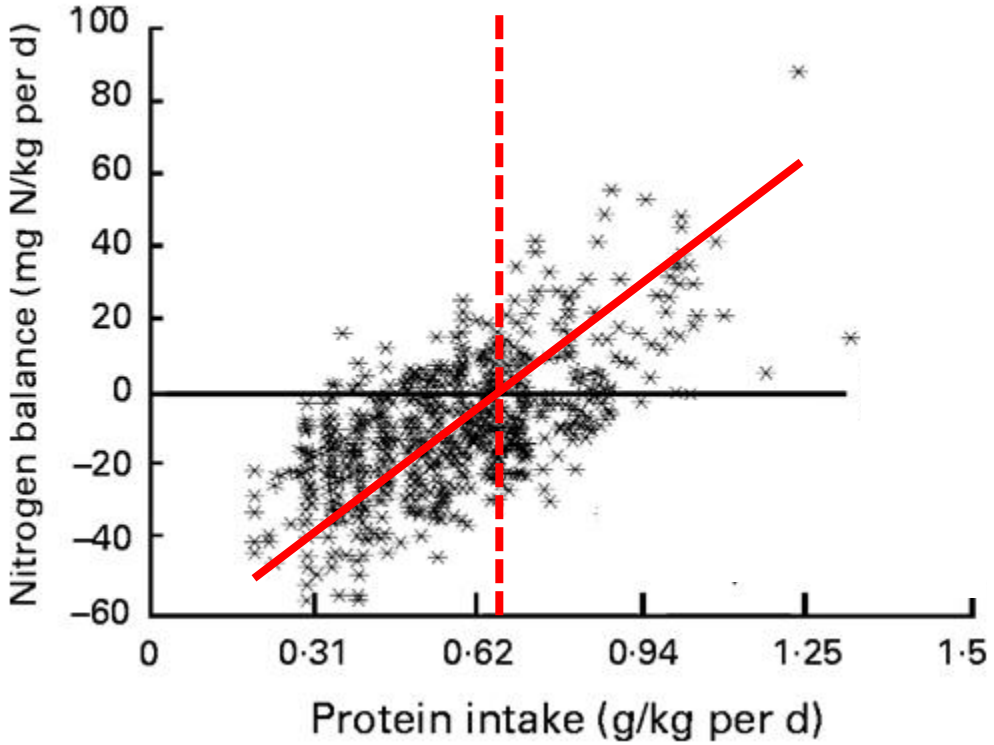
Replacement of animal **proteins** in **food**: How to take advantage of nutritional and gelling properties of **alternative protein** sources.

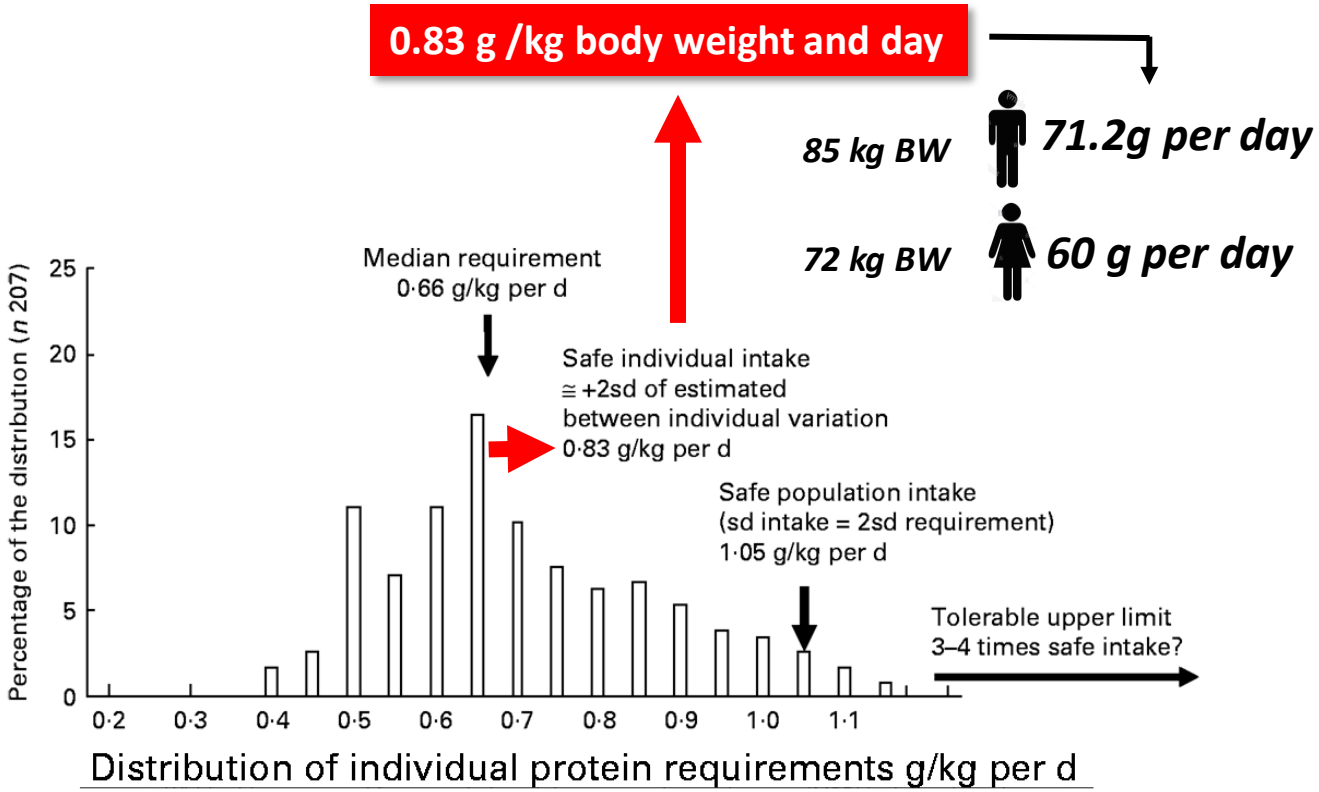
Floret C, Monnet AF, Micard V, Walrand S, Michon C.

Crit Rev Food Sci Nutr. 2023;63(7):920-946. doi: 10.1080/10408398.2021.1956426. Epub 2021 Jul 26.

Protein in der Kost: zwischen Bedarf und Bedenken

Bedarf & Zufuhr an Nahrungsprotein





Identifying recommended dietary allowances for protein and amino acids: a critique of the 2007 WHO/FAO/UNU report. British Journal of Nutrition , 108 , S2 , August 2012 , pp. S3 - S21

H DANIEL

Bedarf und Zufuhr an Nahrungsprotein

ONLY ADULTS assumed statista

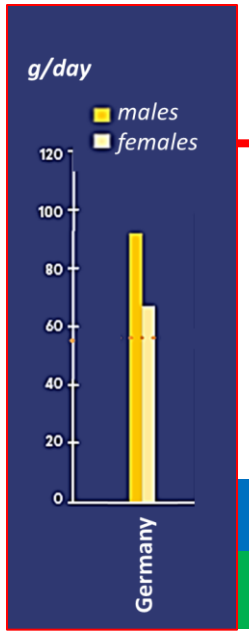
71,2g x 365 days = 26kg x 41.500.000 males = 1.050.000 tons per year

60,0g x 365 days = 22 kg x 42.800.000 females = 916.000 tons per year

children not included

Recommended quantity

around 1.900.000 tons of protein



consumed quantity

[European Journal of Clinical Nutrition](#) **volume 63**, pagesS16–S36 (2009)

around 3.131.000 tons of protein

surplus consumption of protein = around 1.230.00 tons per year

around 200.000 tons of NITROGEN extra per year by this surplus of protein intake

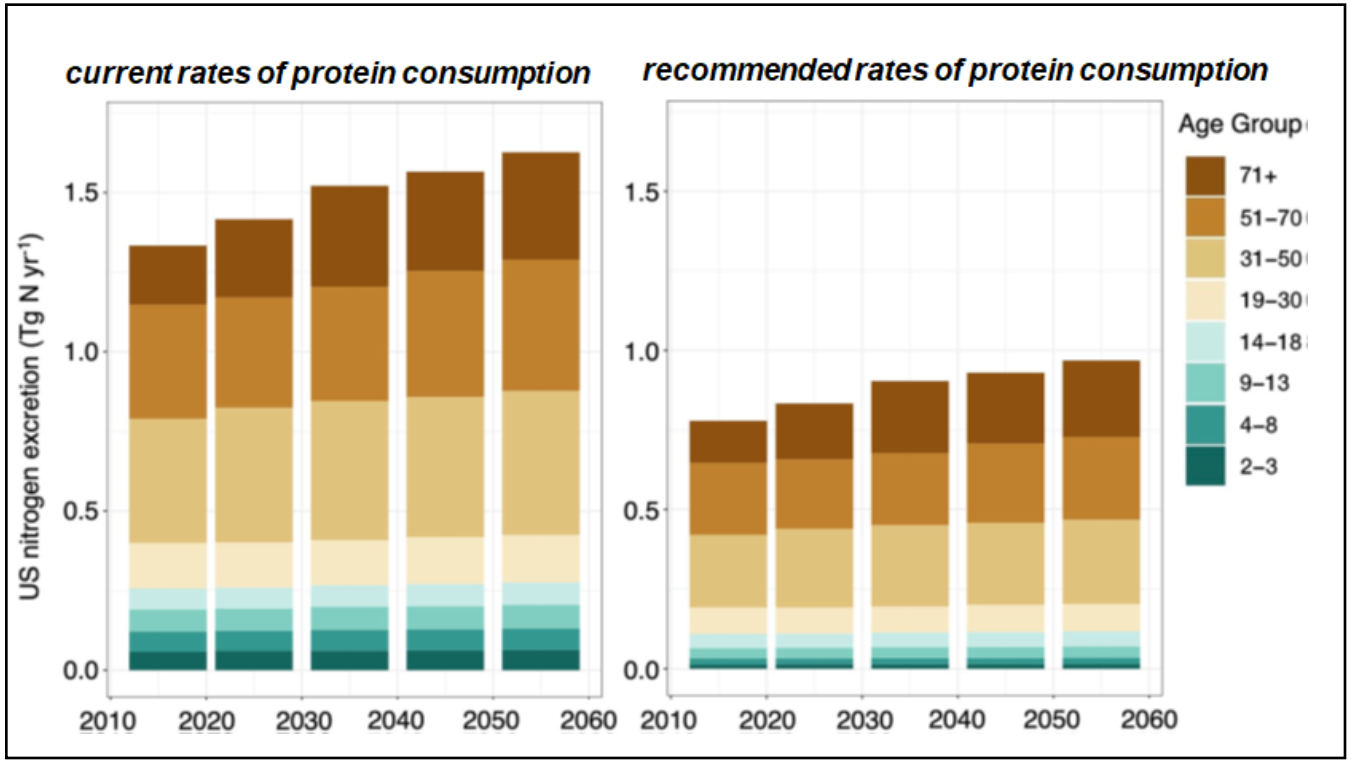
around 600.000 tons from farm animals per year

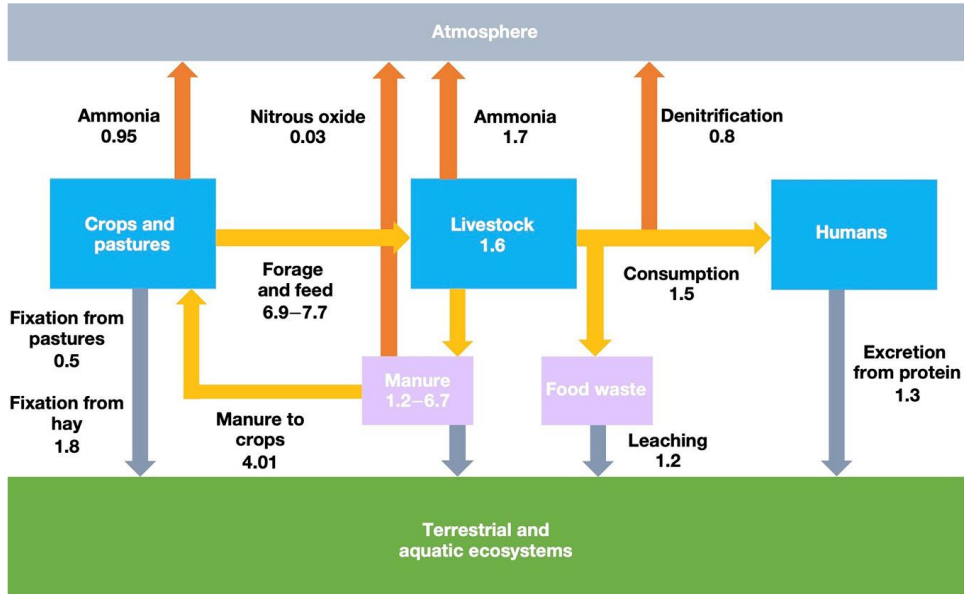
EU Science Center

Bedarf und Zufuhr an Nahrungsprotein

The impact of excessive protein consumption on human wastewater nitrogen loading of US waters

Maya Almaraz, Caitlin D Kuempel, Andrew M Salter, and Benjamin S Halpern





N fluxes (expressed in teragrams N per year [Tg N yr$_{-1}$]) related to livestock production and consumption in the US.

Were US citizens to consume protein at recommended rates, projected N excretion rates in 2055 would be 27% less than they are today, despite population growth. ***Optimizing US protein consumption to levels that meet human health standards has environmental benefits while also generating impactful economic benefits.***

Front Ecol Environ **2022**; 20(8): 452–458, doi:10.1002/fee.2531

BUND
FRIENDS OF THE EARTH GERMANY

Wie wir mit Fleischverzicht das Klima retten können

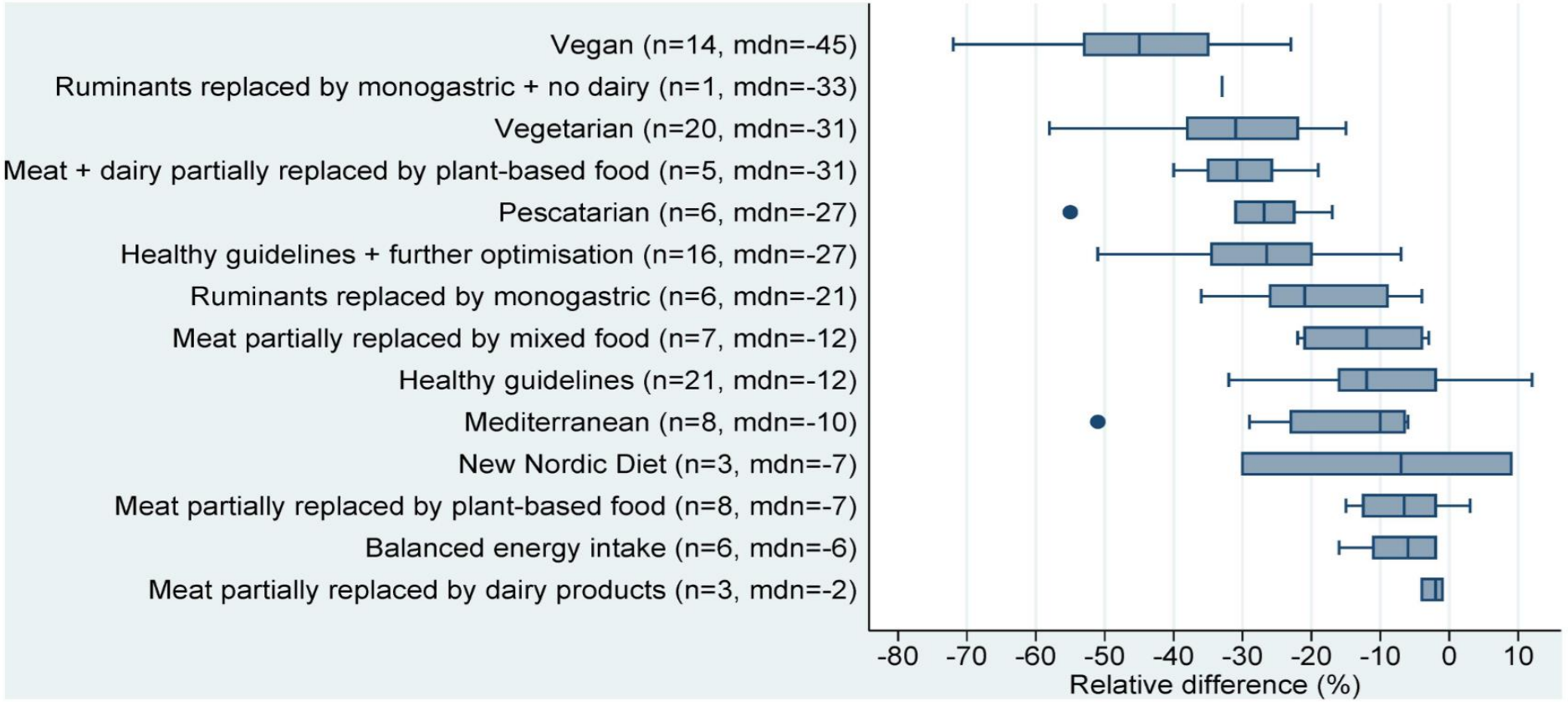
Landwirtschaft, Nachhaltigkeit, Suffizienz, Massentierhaltung

Wir könnten schon jetzt den Hunger in der Welt erfolgreich bekämpfen und dabei noch etwas für das Klima tun – wenn wir auf übermäßigen Fleischkonsum verzichten.

Tierische versus pflanzliche Proteine & klimawirksame Emissionen

Ernährungsverhalten & klima-wirksame Emissionen

The Impacts of Dietary Change on Greenhouse Gas Emissions, Land Use, Water Use, & Health: A Systematic Review



Relative differences in GHG emissions (kg CO_2eq/capita/year) between current average diets and sustainable dietary patterns.
n = number of studies, mdn = median.

Article Source: **The Impacts of Dietary Change on Greenhouse Gas Emissions, Land Use, Water Use, and Health: A Systematic Review**
Aleksandrowicz L, Green R, Joy EJM, Smith P, Haines A (2016) The Impacts of Dietary Change on Greenhouse Gas Emissions, Land Use, Water Use, and Health: A Systematic Review. PLOS ONE 11(11): e0165797.

Ernährungsverhalten & klima-wirksame Emissionen

The neglected potential of red and processed meat replacement with alternative protein sources: simulation modelling and systematic review

Andrew N. Reynolds,[a,b,c,*] Cliona Ni Mhurchu,[d,e] Zi-Yi Kok,[a,c] and Christine Cleghorn[f]

SCENARIOS	total greenhouse gas emission ($kgCO_2$ equivalents)	Percentage change from current diet
Current diet	*5.00*	*-*
Following Heart Foundation red and processed meat recommendations	*4.05*	*-19%*
Following EAT-Lancet red and processed meat recommendations	*3.77*	*-25%*
Replacing red & processed meats with minimally processed plant-based alternatives	*3.28*	*-34%*
Replacing red & processed meats with ultra-processed plant-based alternatives	*3.43*	*-31%*
Replacement with cellular meat	*4.01*	*-20%*

Interpretation All meat replacement scenarios considered indicated appreciable health gains and GHGe reductions. Replacement with minimally-processed plant-based foods appeared consistently superior than other scenarios. Evidence of real-world population strategies to achieve these benefits however is currently lacking.

www.thelancet.com Vol 56 February, 2023

Ernährungsverhalten & klima-wirksame Emissionen

Climate-friendly, health-promoting, and culturally acceptable diets for German adult omnivores, pescatarians, vegetarians, and vegans - a linear programming approach

Abstract

Objectives: A frequently suggested approach to reduce greenhouse gas emissions (GHGEs) caused by food production is to reduce the intake of animal products, which can create nutritional deficiencies. This study aimed to identify culturally acceptable nutritional solutions for German adults that are both climate friendly and health promoting.

Methods: Linear programming was applied to optimize the food supply for omnivores, pescatarians, vegetarians, and vegans considering nutritional adequacy, health promotion, GHGEs, affordability, and

The findings report that a shift to vegan diets (n = 14) would result in the highest reduction of associated GHGEs (45%), followed by vegetarian diets (n = 20) by 31% and pescatarian diets (n = 6) by 27%. This synthesized evidence supports the feasibility of optimized diets.

men. The intake of vegetables, cereals, pulses, mushrooms, and fish increased by between 63% and 260% for the omnivores, compared with baseline. Besides the vegan dietary pattern, all optimized diets cost less than the baseline diet.

Conclusions: A linear programming approach for optimizing the German habitual diet to be healthy, affordable, and meet the IPCC GHGE threshold was possible for several dietary patterns and appears to be a feasible way forward toward including climate goals into food-based dietary guidelines.

Masino T, Colombo PE, Reis K, Tetens I, Parlesak A. Climate-friendly, health-promoting, and culturally acceptable diets for German adult omnivores, pescatarians, vegetarians, and vegans - a linear programming approach. Nutrition. 2023 May;109:111977. doi: 10.1016/j.nut.2023.111977. Epub 2023 Jan 21. PMID: 36801703.

QUO VADIS - FLEISCH

Frankfurter Allgemeine

Fleisch oder Klimaschutz?

Von Anne Kokenbrink 15.04.2024, 09:44 Lesezeit: 3 Min. KONSUMVERHALTEN DER BÜRGER

Ernährungstipps oder Informationskampagnen führen laut einer neuen Erhebung nicht dazu, dass Verbraucher weniger Fleisch essen. Sie äußern nicht einmal die Absicht dazu. Derweil geht die Debatte um eine Fleischsteuer weiter.

Hartmut Kiewert
Friends V (2024)
Öl auf Leinwand 190x150 cm

Wie viele Kühe können wir noch halten, wenn sie nur vom Grasland ernährt werden?

DAS POTENZIAL EINER GRÜNLANDBASIERTEN MILCHPRODUKTION IN DEUTSCHLAND

FiBL *im Auftrag von* GREENPEACE

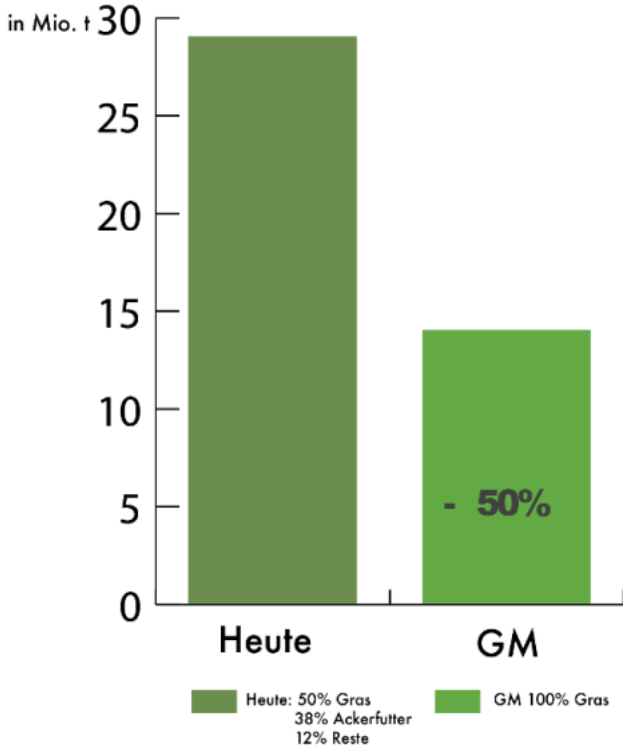
H DANIEL

Wie viele Kühe können wir noch halten, wenn die wirklich nur Gras fressen

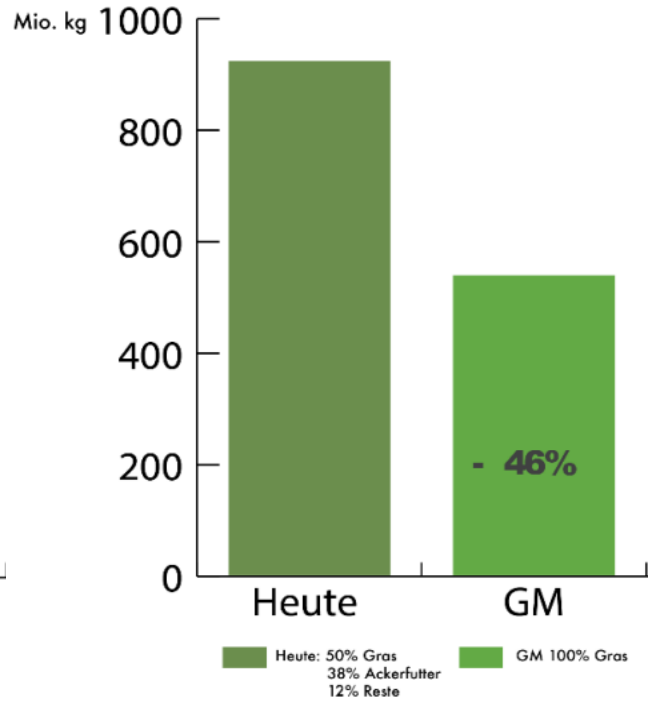
DAS POTENZIAL EINER GRÜNLANDBASIERTEN MILCHPRODUKTION IN DEUTSCHLAND

FiBL GREENPEACE

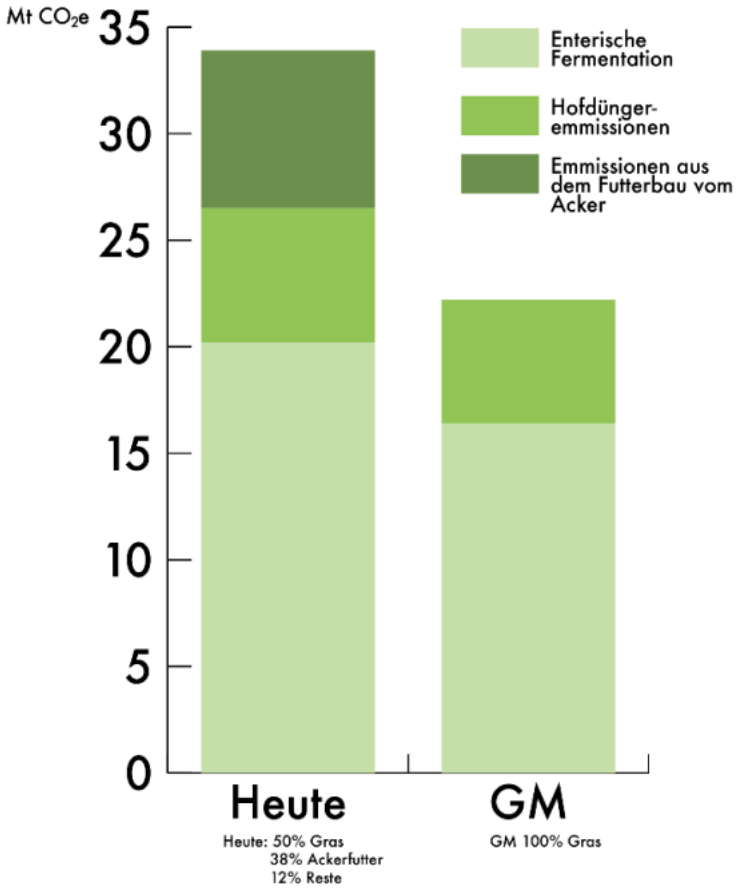
Rückgang der Milcherzeugung



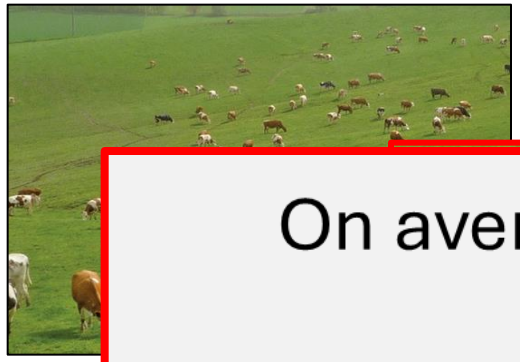
Rückgang der Fleischerzeugung



Treibhausgasemissionen der Rinderhaltung



Wie viele Kühe können wir noch halten, wenn die wirklich nur Gras fressen



On average, an EU citizen consumed

16 kg per year of plant-based proteins

&

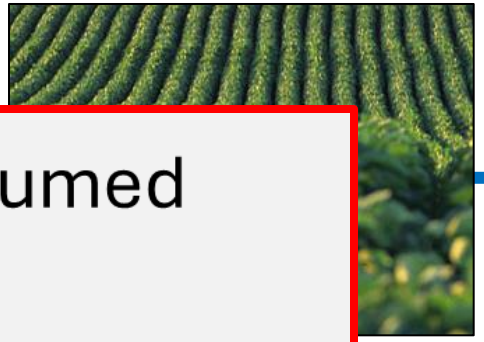
22 kg per year of animal-based proteins

when replaced

(FAOSTAT, 2018)

1.800.000 tons per annum in Germany*

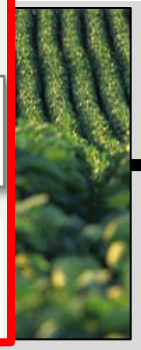
Halkjær, J., Olsen, A., Bjerregaard, L. *et al.* Intake of total, animal and plant proteins, and their food sources in 10 countries in the European Prospective Investigation into Cancer and Nutrition. *Eur J Clin Nutr* 63 (Suppl 4), S16–S36 (2009). https://doi.org/10.1038/ejcn.2009.73



6,2 Millionen t Sojabohnen

1,86 Millionen t PROTEIN

1,10 Millionen t PROTEIN



0,75 Millionen t PROTEIN

1,85 Millionen t PROTEIN

23.750.000 t $CO_{2\ Äqui.}$ pro Jahr

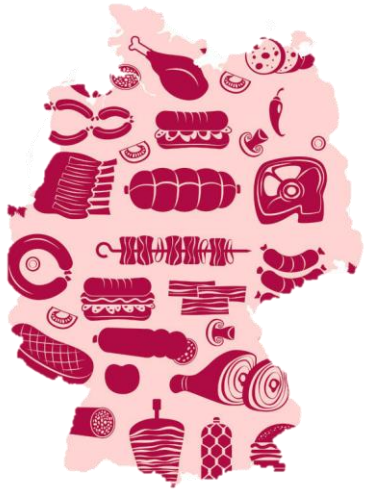
mit ca. 25 t CO_2 pro ha und Jahr

ADVANCED SUSTAINABLE SYSTEMS

The Power of Nature-Based Solutions: How Peatlands Can Help Us to Achieve Key EU Sustainability Objectives

Franziska Tanneberger, Lea Appulo, Stefan Ewert, Sebastian Lakner, Niall Ó Brolcháin, Jan Peters, Wendelin Wichtmann

First published: 09 October 2020 | Volume 5, Issue 1 January 2021



28 kg pro Jahr
(3,45 kg CO_2 pro kg Fleisch)

13 kg pro Jahr
(3,5 kg CO_2 pro kg Fleisch)

9 kg pro Jahr
(14,34 kg CO_2 pro kg Fleisch)

1,5 kg pro Jahr

52 kg pro Jahr

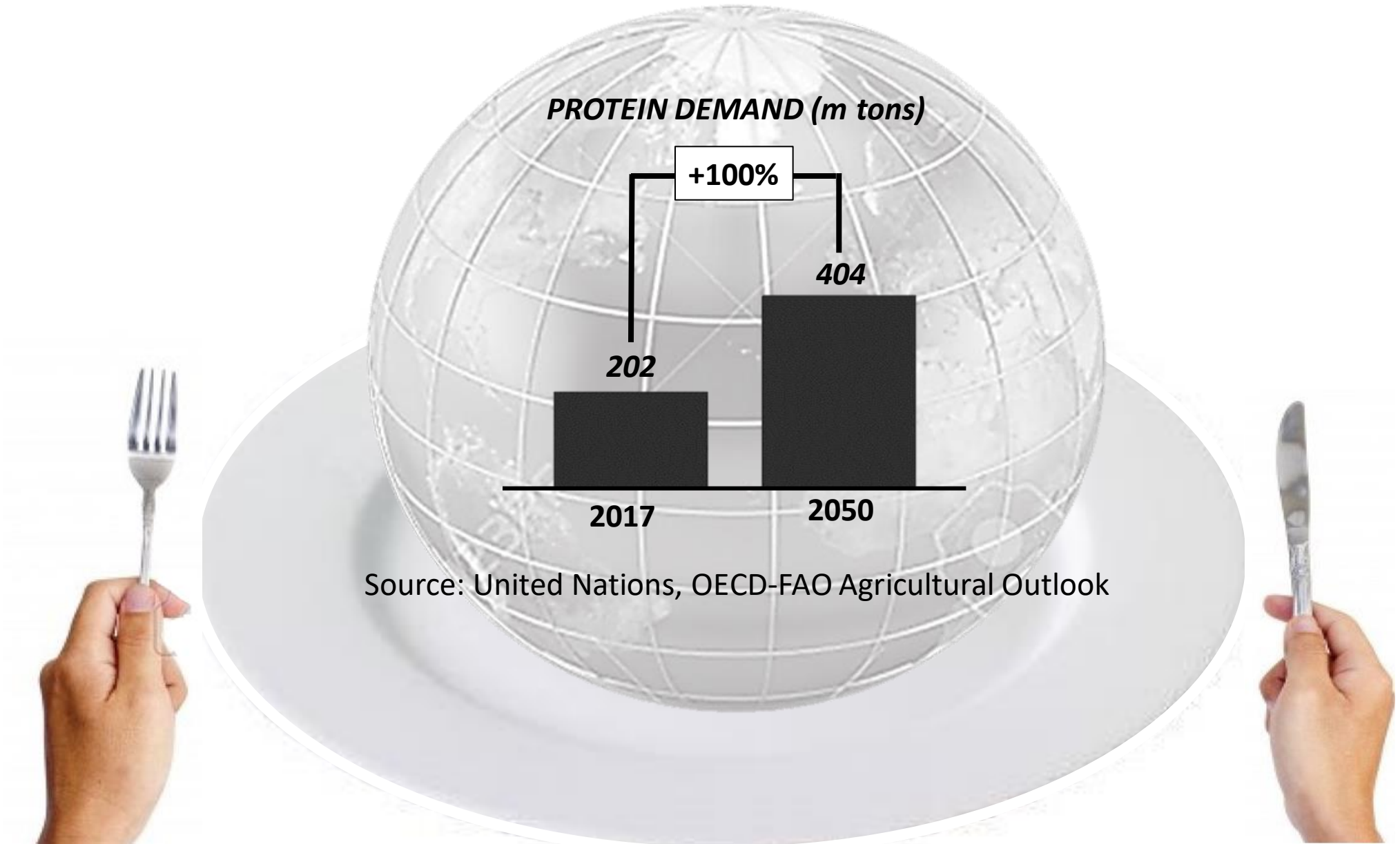
(∅ 5,49 kg CO_2 pro kg Fleisch)

23.410.000 t $CO_{2\ Äqui.}$ pro Jahr

QUELLE: Umweltbundesamt und STATISTA

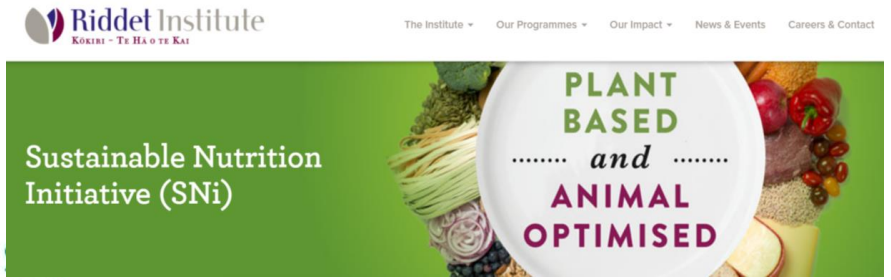
Die WELT von MORGEN: Quantität & Qualität der Proteinversorgung

Die WELT von MORGEN: Quantität & Qualität der Proteinversorgung



Source: United Nations, OECD-FAO Agricultural Outlook

Die WELT von MORGEN: Quantität & Qualität der Proteinversorgung

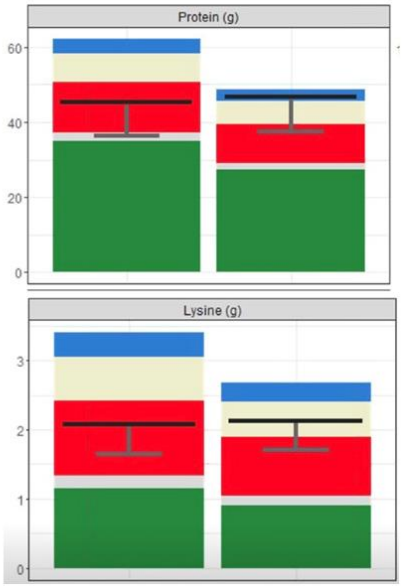


SNi SUSTAINABLE NUTRITION INITIATIVE®
Hosted by the Riddet Institute

Protein is not the problem

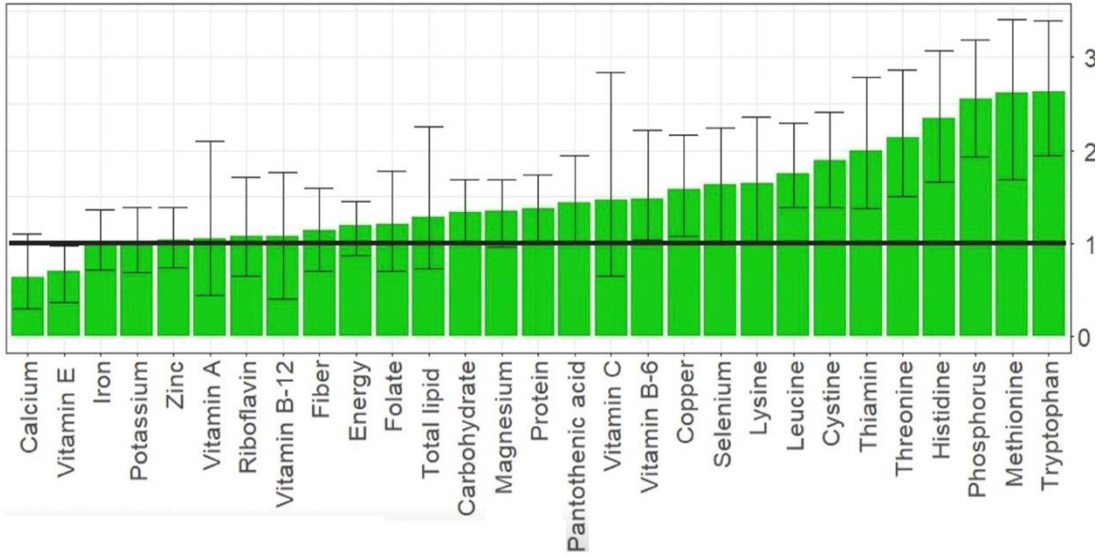
Distributed evenly the world already produces enough protein for nutritional needs of the expected 2050 population

	Scenario 1	Scenario 2
	2018 Baseline	2050 Baseline
Year	2018	2050
Population (M)	7629.799	9733.613
Reference Diet	Base	Base



SNi

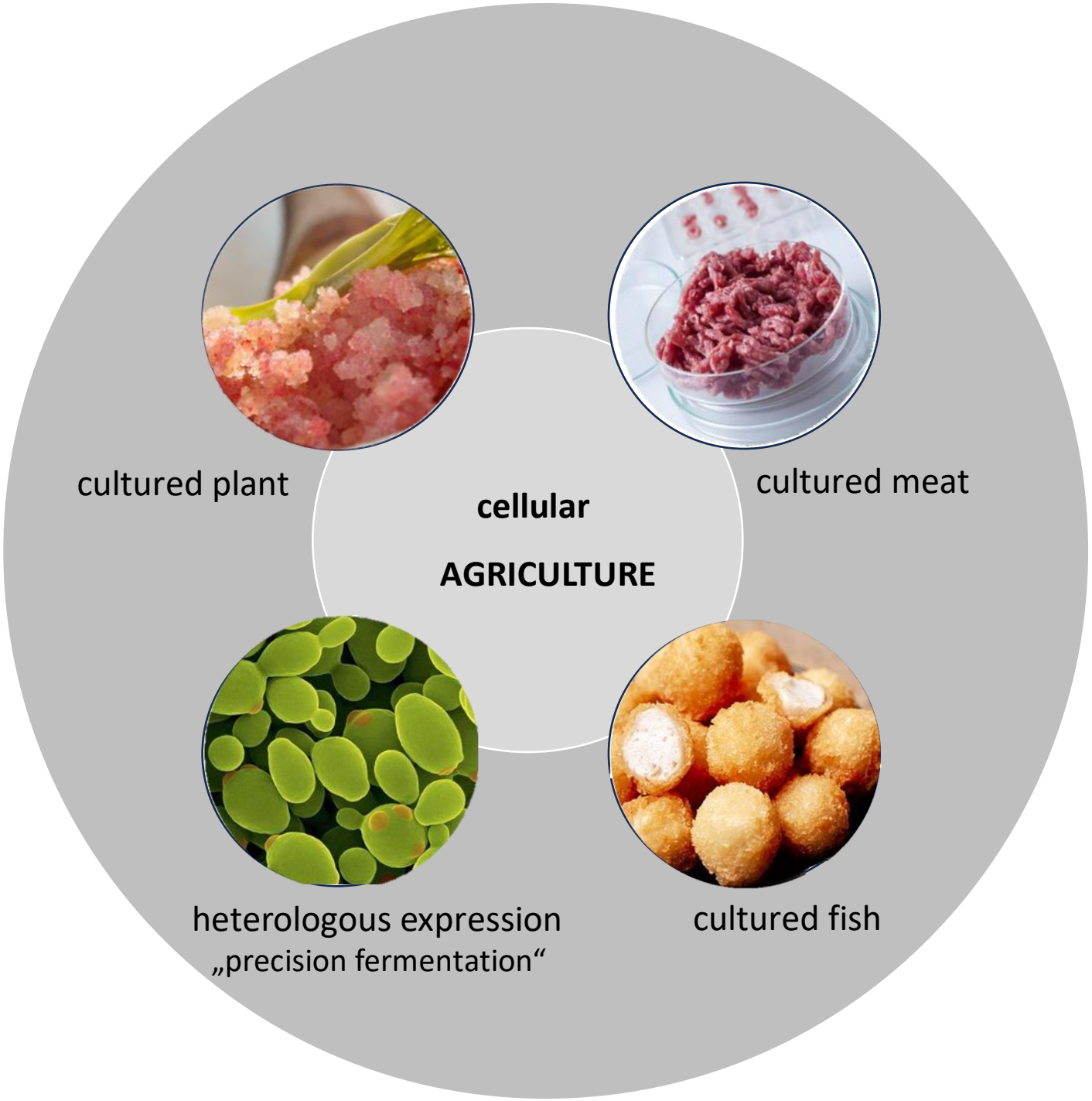
Distribution of nutrition



"This means that the global challenge of nutrient inadequacy is less a problem of insufficient production, and more an issue of distribution, access to food, and excess consumption"

Smith NW, Feltcher AJ, Dave L. et al. Use of the DELTA Model to Understand the Food System and Global Nutrition. J Nutr 2021 Oct 1;151(10):3253-3261.

Neue Proteinquellen


cultured plant
cultured meat
cellular
AGRICULTURE
heterologous expression
„precision fermentation“
cultured fish

	Zahl der Unternehmen	Gesamtes Investment
pfl. Substitute 	?	4.1 Milliarden $
Fermentation 	158	8.5 Milliarden $
in vitro-Ansätze 	174	3.1 Milliarden $

Quelle: Reports des GFI 2024


Europa:
BLUU SEAFOOD
Upstream foods
FISHWAY
Asien:
UMAMI BIOWORKS
CellX
avant
forsea
MERMADE
PREMIUM CELL-BASED SEAFOOD
Nordamerika:
WILDTYPE
BlueNalu
CELL AG TECH
BLUEFIN FOODS
FINLESS FOODS
Kultiviertes Fleisch*:
BioBQ
Vow
Meatable
ivyfarm technologies
MEAT OUR FUTURE
ClearMeat
TISSUE By NET
SPACE iFi
Biofood Systems
GOURMEY PARIS
SuperMeat
HOXTON FARMS
DFC
MISSION BARNS
MASC VALLEY
LABFARM FOODS
ARTEMYS
CellMEAT
IntegriCulture
INNOCENT MEAT
FUTURE MEAT
NEW AGE MEATS
MeaTech
Mosa Meat
Bio.Tech. Foods.
Greenfoods
bruno-cell
MOGALE
MZANSI MEAT CO
GOOD
Bene Meat Technologies
CUBIQ FOODS
FORK&GOODE
JOES FUTURE FOOD
ALEPH FARMS
MEAT GROWERS
Cellular Agriculture
CELL FARM
UPSIDE Foods
Hs Higher Steaks
BLUE RIDGE BANTAM
Orbillion
CellX
MIRAI FOODS

Haben die Produkte der zell. Produktion geringere klimawirksame Emissionen?

Haben die Produkte der zell. Produktion geringere klimawirksame Emissionen?

Good Food Institute

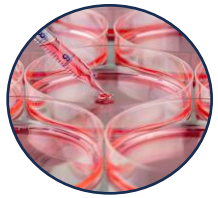
zero emissions

By 2030, cultivated meat can be cost-competitive and massively reduce the climate impact of meat production.

WASHINGTON — New studies released today by independent research firm CE Delft show that — compared with conventional beef — meat cultivated directly from cells may cause up to **92% less global warming** and **93% less air pollution** and use up to **95% less land** and **78% less water**.

The studies model a future large-scale cultivated meat production facility and show that by 2030, the production cost of meat grown from cells, or "cultivated meat," when manufactured at scale could be as low as **$5.66 per kg ($2.57 per pound)**. (Note that this figure strictly reflects the cost of goods sold and does not include markup by the manufacturer or retailer, so this is the production cost rather than the price that consumers would see.) This production cost would enable cultivated meat to compete with multiple forms of conventional meat or serve as a high-quality ingredient in plant-based meat products.

Haben die Produkte der zell. Produktion geringere klimawirksame Emissionen?

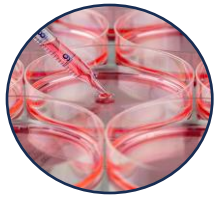
	FEED CONVERSION RATIO (kg input for 1kg of living mass)	
PIG 	**2.6 – 3.6**	*(depending on breed and condition)* *Animal Genetic Resources 53:169-184, 2013*
SALMON 	**1.1 - 2.1**	*(depending on condition)* *Environmental Research Letters, 13(2), 2018*
CULTURED MEAT 	**1 – 4.0**	*(1.0 theoretically)** *Front Nutr. 2023 Apr 6;10:1151801*

Protein conversion efficiency


17%

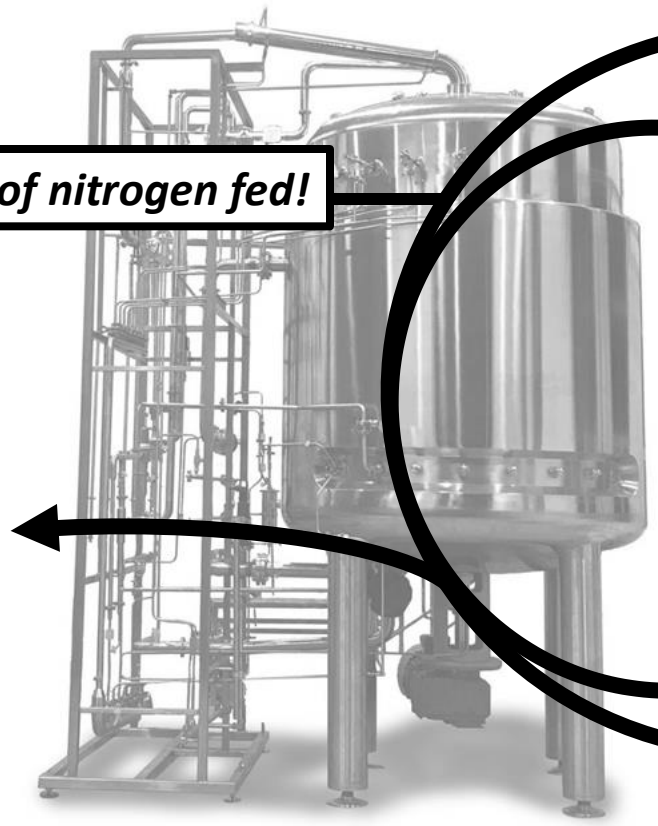

5%


24%


25%

Myers GM, Jaros KA, Andersen DS, Raman DR. Nutrient recovery in cultured meat systems: Impacts on cost and sustainability metrics. Front Nutr. 2023 Apr 6;10:1151801.

Haben die Produkte der zell. Produktion geringere klimawirksame Emissionen?



140.000 L culture medium**

every 2nd. day

74% of nitrogen fed!

+Gluc+AA

80.000 L culture medium**

every 3nd. day

NH_4^+

LACTATE

80-140.000 L waste water***

1.000 kg cultured meat**

approx. 850 €/t CM

*Hubalek S, **Post M** Moutsatsou P. Towards resource-efficient and cost-efficient cultured meat. Current Opinion Food Science. Volume 47, October 2022, 100885

**Specht. L. An analysis of culture medium costs and production volumes for cultivated meat, 2020, The Good Food Institute

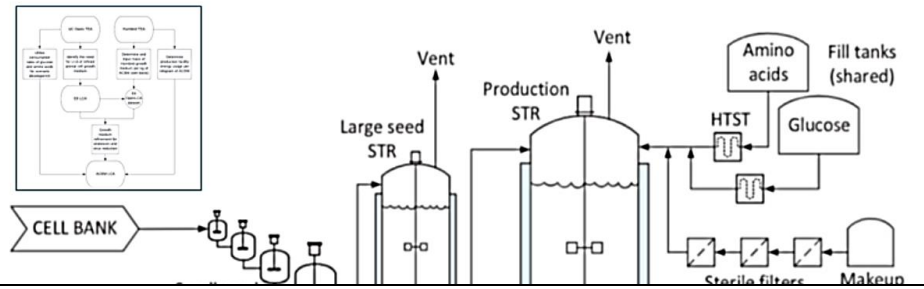
***Myers GM et al. Nutrient recovery in cultured meat systems: Impacts on cost and sustainability metrics. Front Nutr. 2023 Apr 6;10:1151801. doi: 10.3389/fnut.2023.1151801.

Haben die Produkte der zell. Produktion geringere klimawirksame Emissionen?

Environmental impacts of cultured meat: A cradle-to-gate life cycle assessment

Derrick Risner[1], Yoonbin Kim[1], Cuong Nguyen[2], Justin B. Siegel[3,4,5,6], Edward S. Spang[1,6]

[1]Department of Food Science and Technology, University of California, Davis, CA 95616, USA



How much will large-scale production of cell-cultured meat cost?

Greg L. Garrison, Jon T. Biermacher *, B. Wade Brorsen

Journal of Agriculture and Food Research 10 (2022) 100358

Expected Operating and Fixed Costs Associated with a Cell-Based Meat Production Plant with a Production Capacity of 548,400 kg yr^{-1}

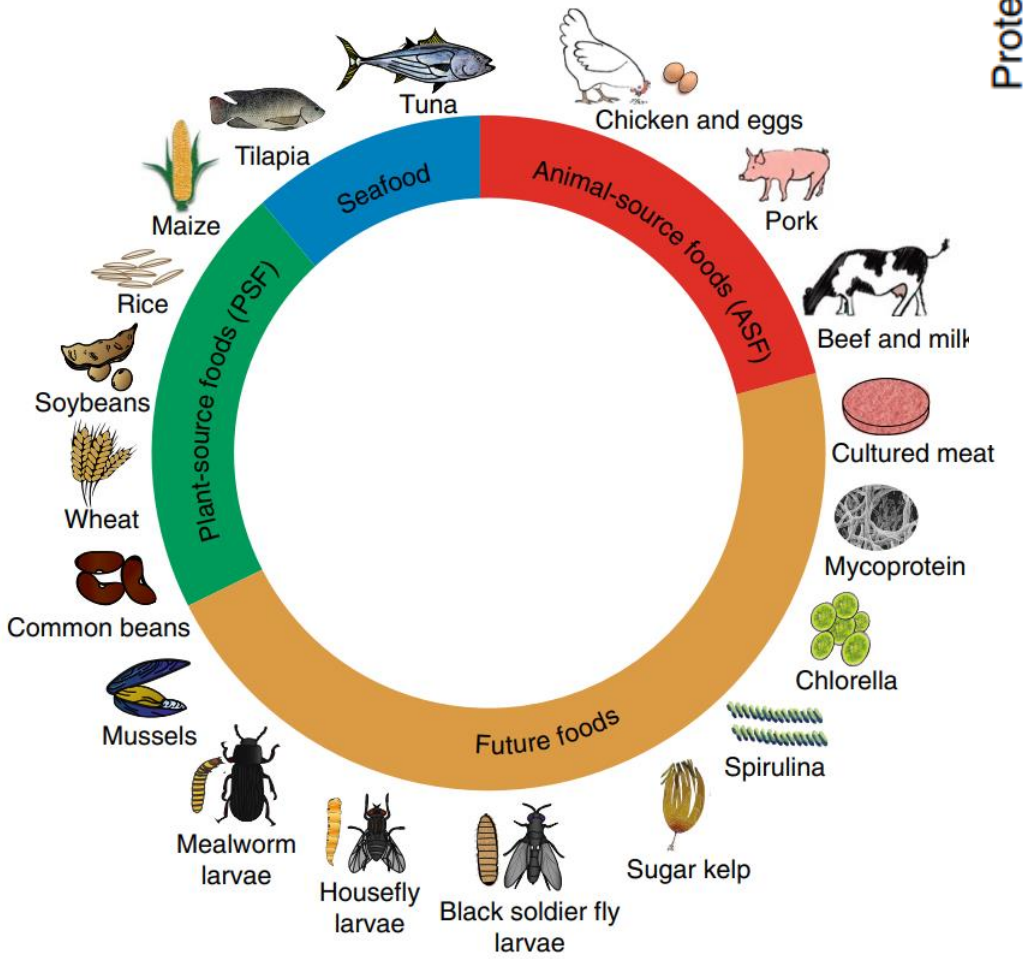
Input description	Units	Quantity (unit/year)	Price ($/unit)	Cost ($/year)	Cost ($/day)	Cost ($/kg)
Operating:	–	–	–	–	–	–
Growth medium[a]	kl	2880.00	3743.00	10,779,840.00	29,533.81	19.66
Labor and benefits[b]	employees	94.00	102,997.00	9,681,718.00	26,525.25	17.65
Repairs and general maintenance	% of total investment	–	5.00	3,000,000.00	8219.18	5.47
Water[a]	kl	11,780.00	2.46	28,978.80	79.39	0.05
Electricity	kwh	323,772.00	0.16	53,292.87	146.01	0.10
Transportation	km	11,584.80	2.49	28,800.00	78.90	0.05
Packaging	kg	548,400.45	0.33	181,383.45	496.94	0.33
Total operating costs minus interest	$	–	–	23,754,013.12	65,079.49	43.32
Interest on operating capital	total $ at risk	23,754,013.12	0.06	712,620.39	1952.38	1.30
Total operating costs	$	–	–	24,466,633.51	67,031.87	44.61

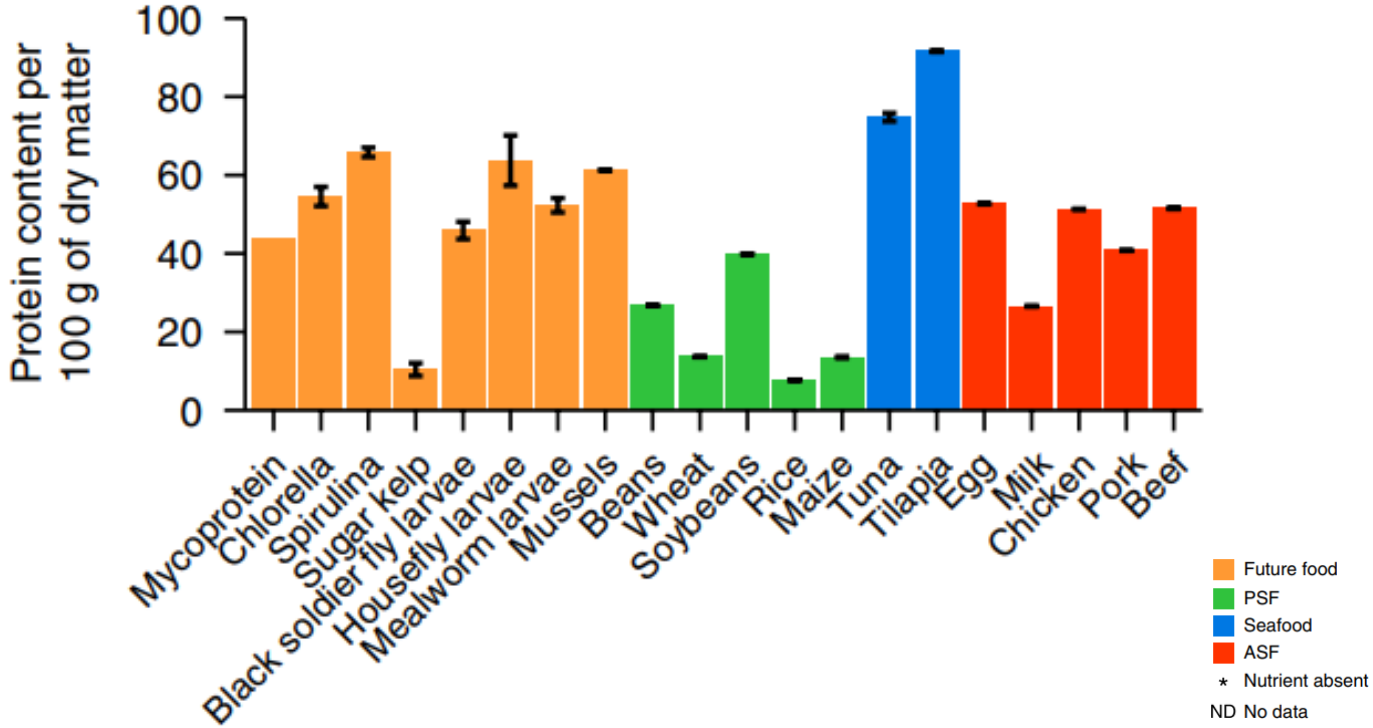
When using gloabl average energy mixes, cellular meat has a lower footprint than beef, but higher than pork and chicken“ (CEDelft in Ex-ante LCA)

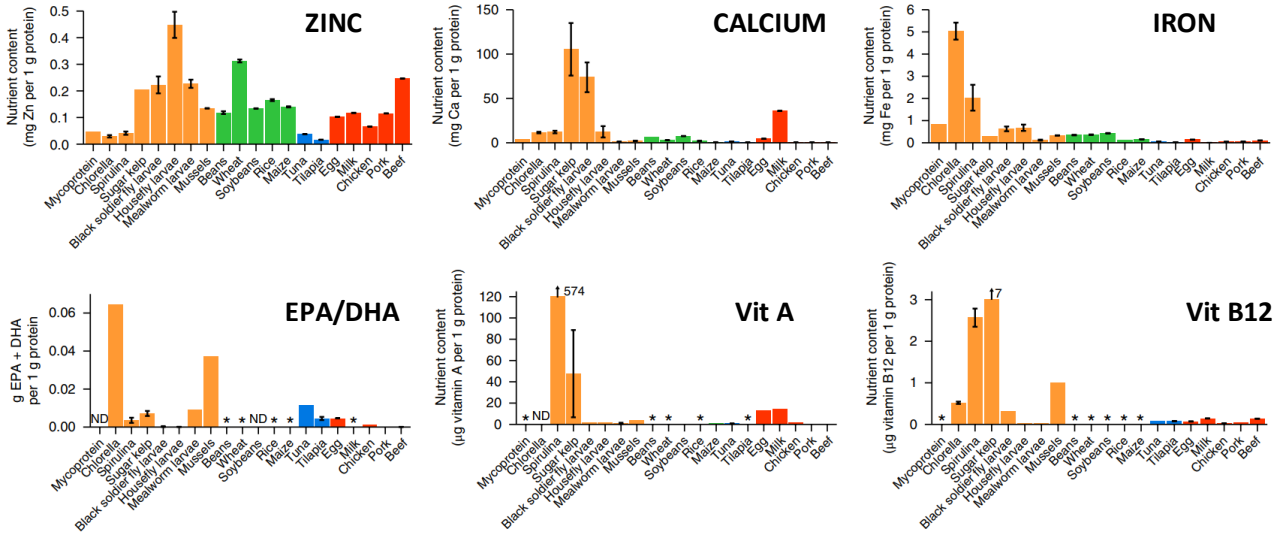
The results indicate that the environmental impact of near-term animal cell-based meat production is likely to be orders of magnitude higher than median beef production if a highly refined growth medium is utilized for production.

… our economic analysis suggests that cell-cultured meat produced in a large-scale plant can be produced at a cost $63/kg with a kilogram of cell-cultured hamburger meat would cost well over $100/kg at the supermarket and restaurants.

Neue Quellen

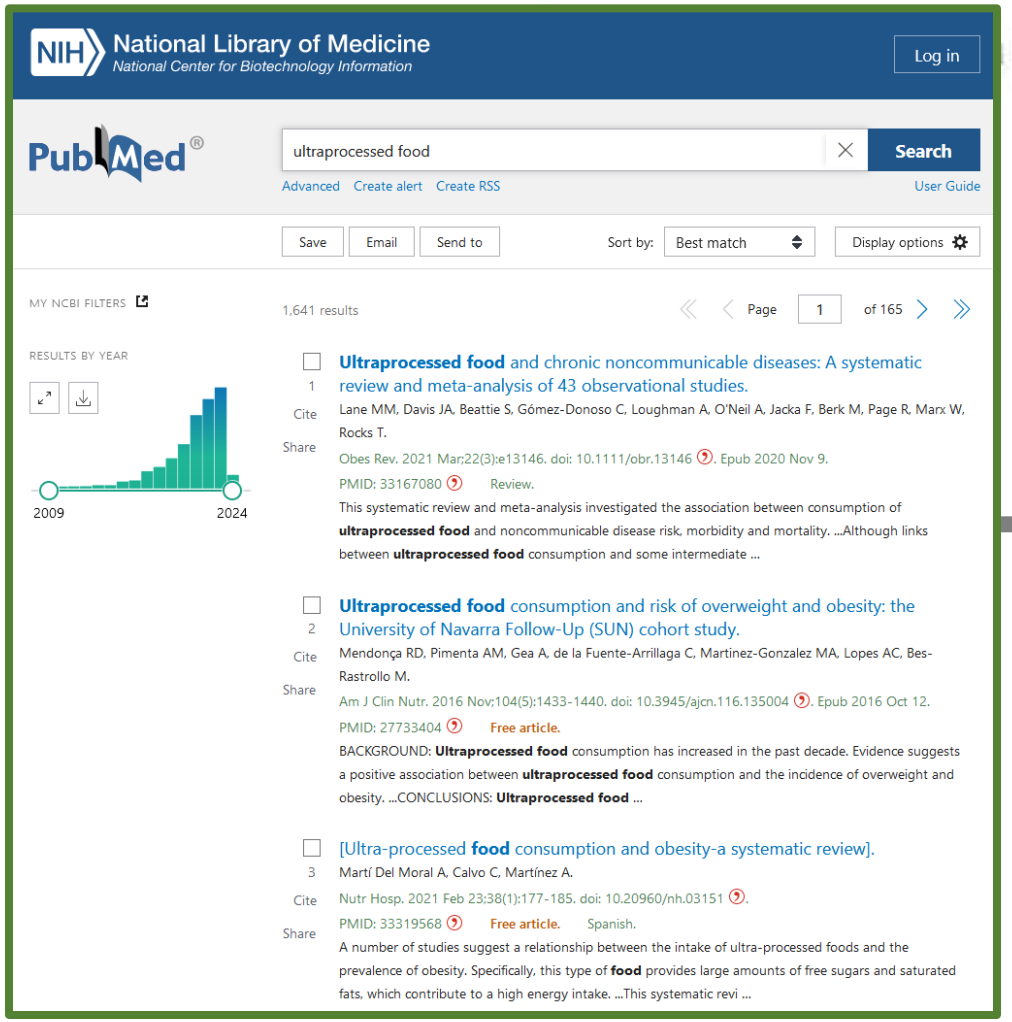






Nature Sustainability volume 1, pages782–789(2018) Parodi, A, et al. The potential of future foods for sustainable and healthy diets

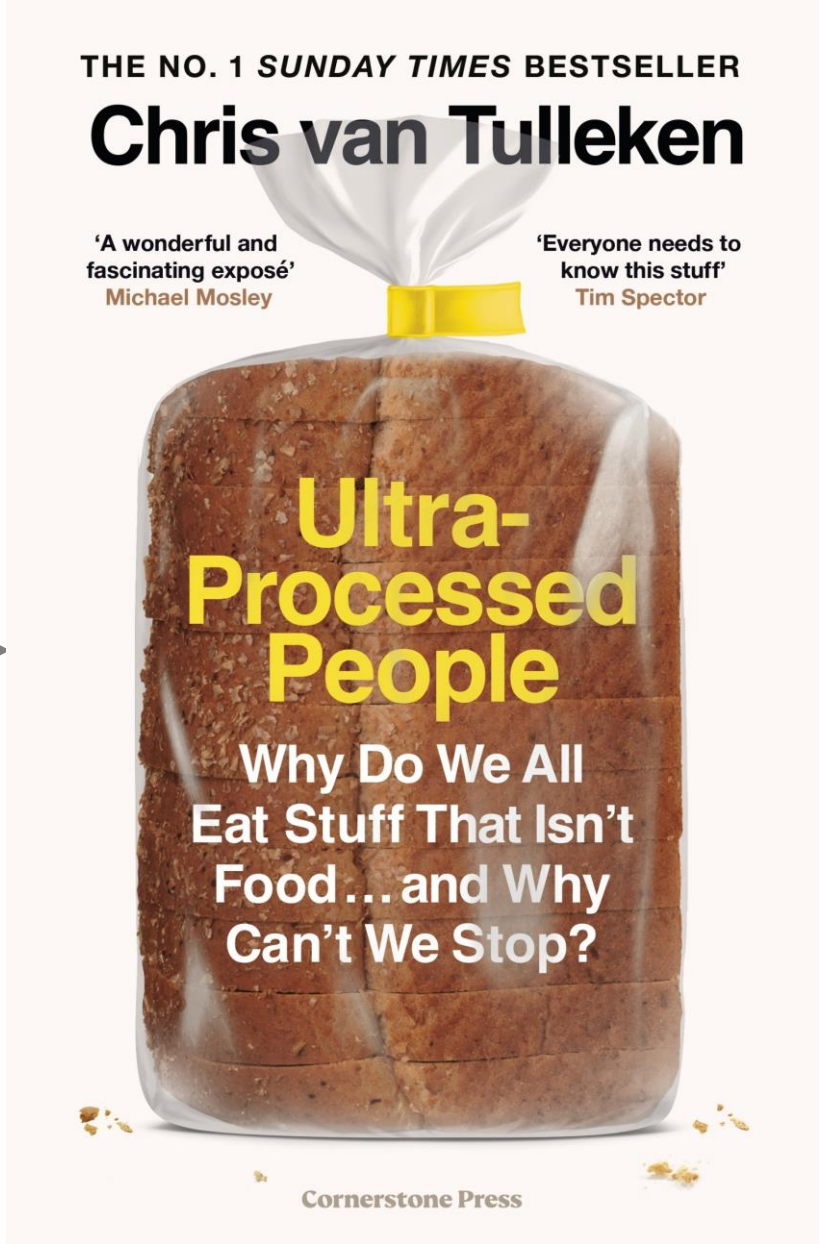
Neue Produkte - ULTRAPROZESSIERT

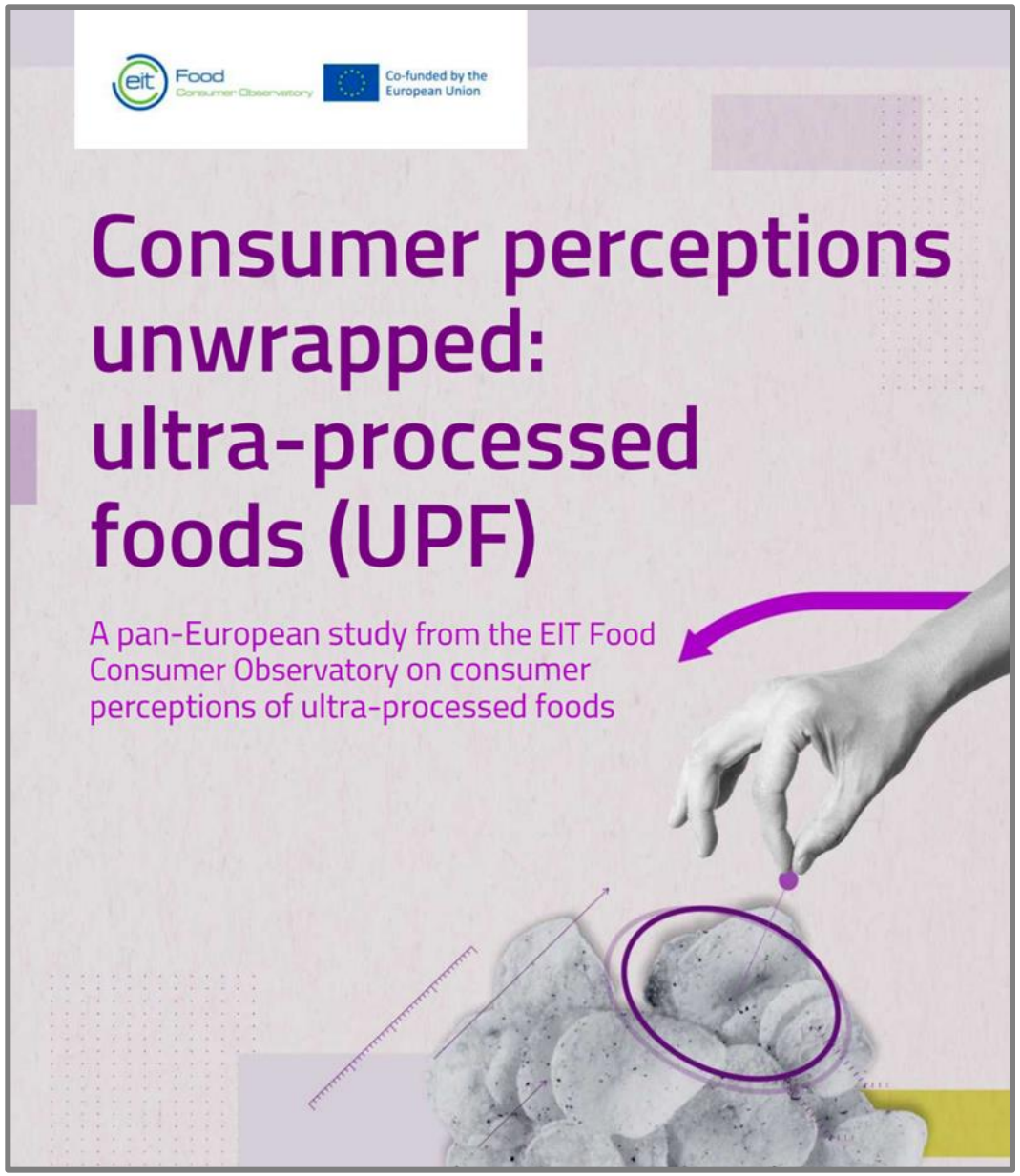


Zusätze

Methylcellulose
Aromen
Fasern
Hefeextrakt
Gewürze

Eisen
Zink
Calcium
Kalium
Magnesium
Vitamin E
Vitamin B1
Vitamin B6
Vitamin B12





Europeans consider UPF hazardous for their long-term health

Most Europeans believe that UPF contribute to obesity, diabetes and other lifestyle-related health issues (67%) and that they will cause health issues later in life (65%).

NEUE PROTEINQUELLEN und die Preis-Parität

Hackfleisch (regional)

9,96 Euro per kg

pfl. Alternative

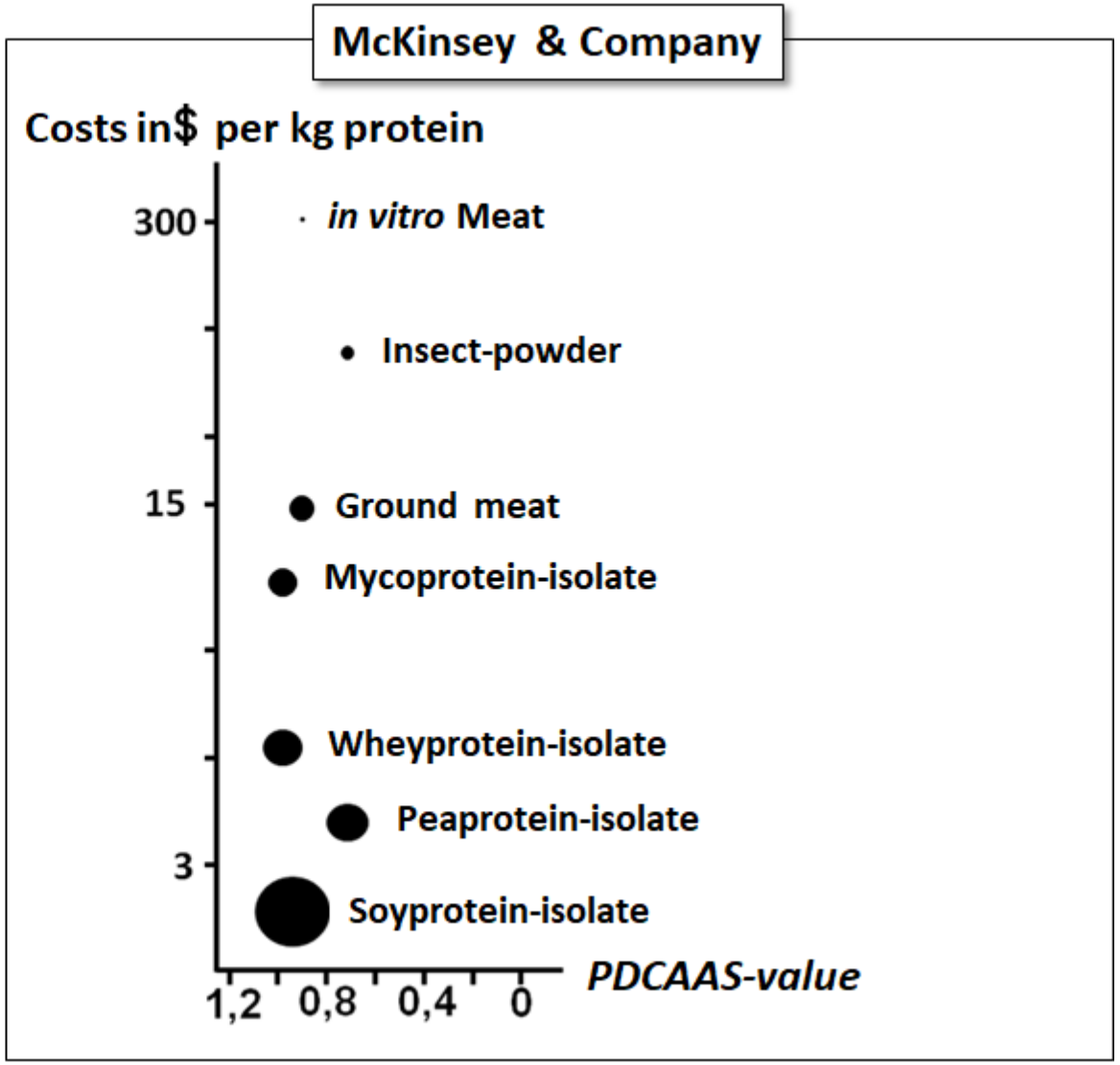
19,95 Euro per kg

in vitro Fleisch-Alternative

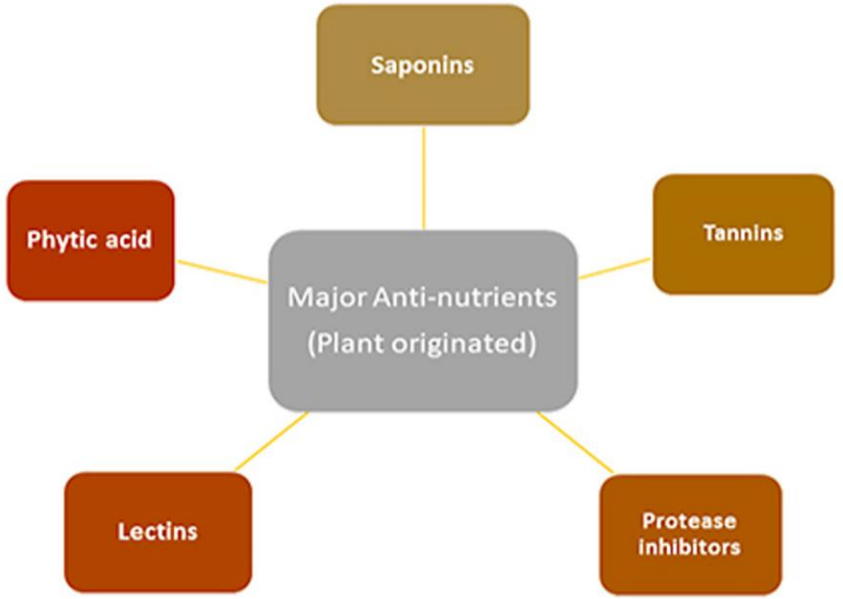
geschätzt: 100 Euro per kg

Neue Quellen und ihre Marktchancen

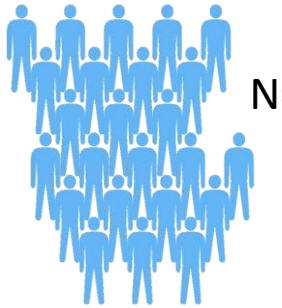
Preis (€/kg)	
Ackerbohnenmehl	1,30
Ackerbohnen-Isolat	2,95
Weizengluten (vital)	2,10
Hafer-Protein	3,90
Erbsenprotein-Isolat (85%)	2,95
Soja-Isolat (Europa)	2,65
Soja-Konzentrat (Europa)	2,45



..... ernährungsphysiologische Aspekte ....



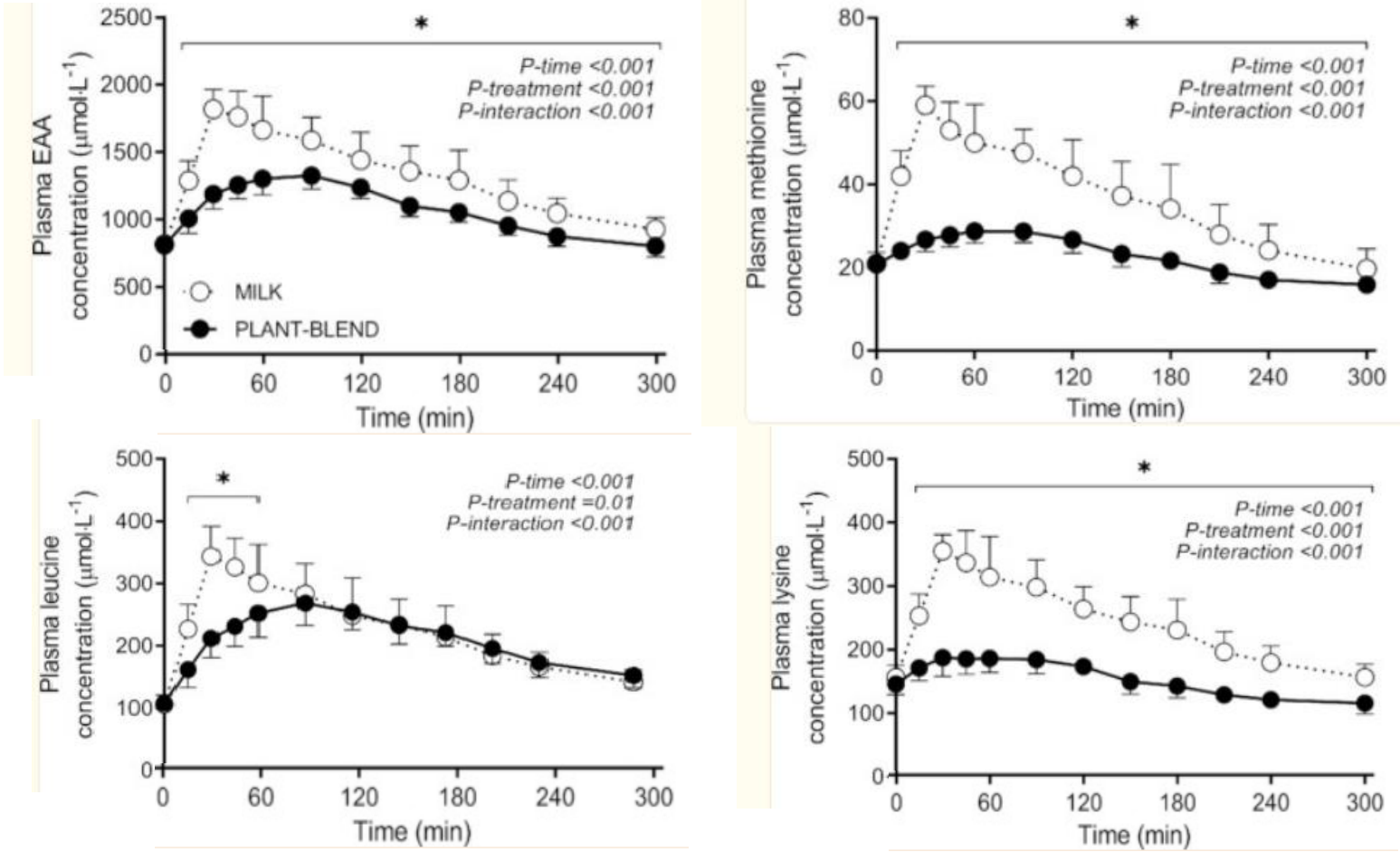
The Muscle Protein Synthetic Response to the Ingestion of a Plant-Derived Protein Blend Does Not Differ from an Equivalent Amount of Milk Protein in Healthy Young Males



N=24

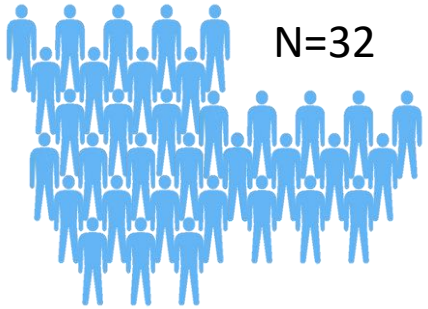
aged 24 ± 4 y

They ingested 30 g milk protein (MILK) or a 30 g plant-derived protein blend combining 15 g wheat, 7.5 g corn, and 7.5 g pea protein (PLANT-BLEND).



Pinckaers, P.J.M. et. Al. (2023). The Muscle Protein Synthetic Response to the Ingestion of a Plant-Derived Protein Blend Does Not Differ from an Equivalent Amount of Milk Protein in Healthy Young Males. *J Nutr.* 152(12):2734-2743. doi: 10.1093/jn/nxac222.

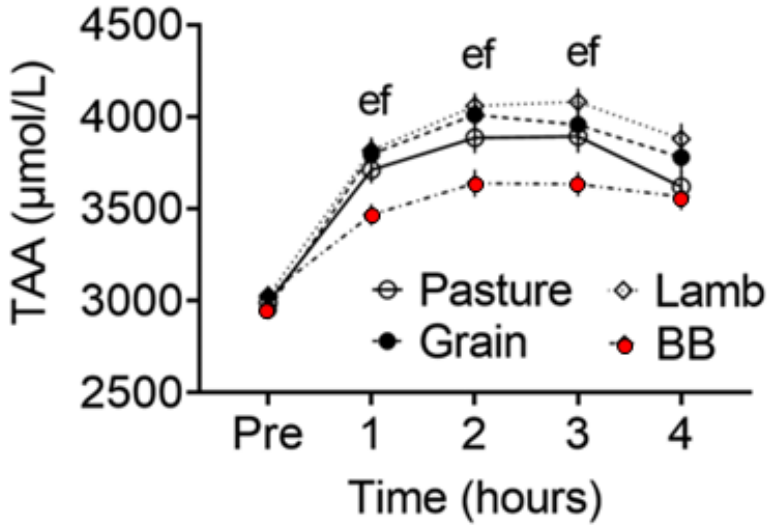
Plasma Amino Acid Appearance and Status of Appetite Following a Single Meal of Red Meat or a Plant-Based Meat Analog: A Randomized Crossover Clinical Trial

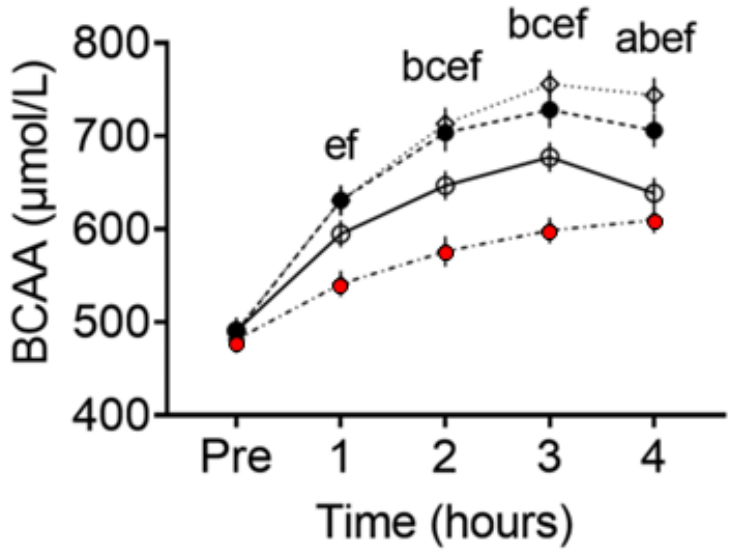


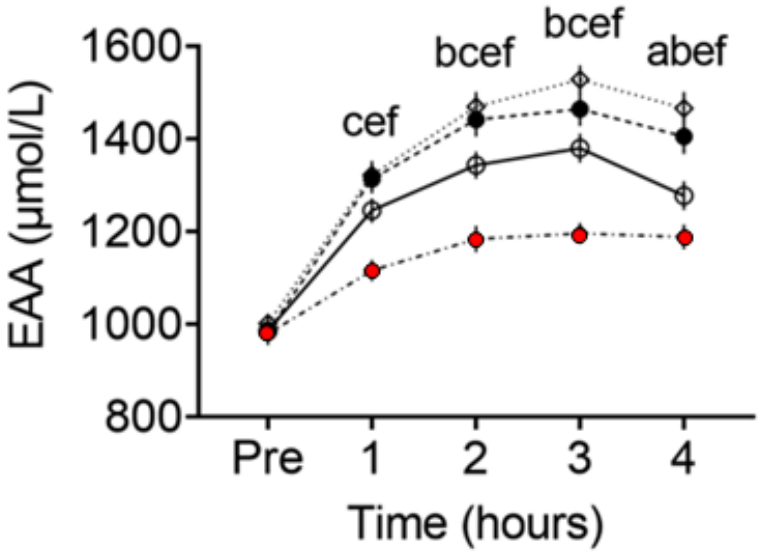
Nutrient composition of the raw meats in their minced forms, the PBMA as commercially packaged, and the cooked meals (units per 100 g, 470 g per meal)[1]

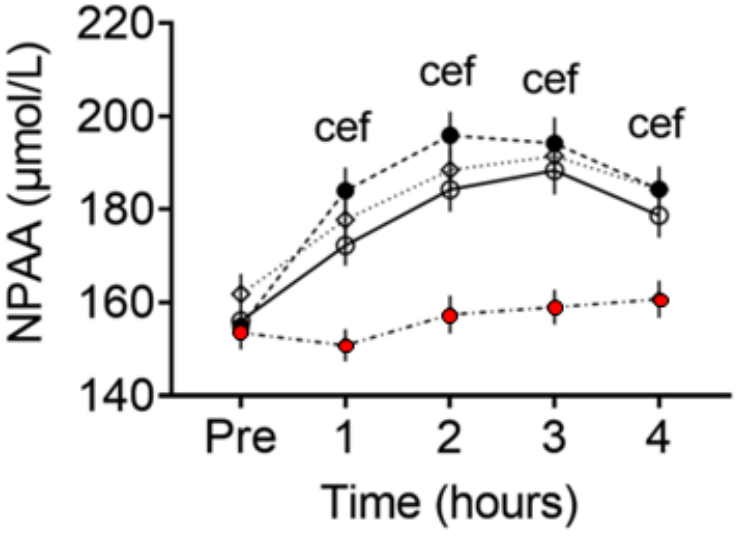
Nutrient	Pasture	Grain	Lamb	BB
Raw meats and PBMA, g				
Crude protein	18.7	18.4	21.4	18.7
Fat	17.7	9.1	2.4	17.8
Cooked meal				
Crude protein, g	10.3	11.2	12.4	10.7
Fat, g	11.1	6.7	4.3	10.1
Carbohydrates, g	18.1	18.4	19.1	18.3
Total dietary fiber, g	1.6	1.1	1.7	1.9
Sugars, g	3.5	4.0	4.0	3.8
Sodium, g	0.3	0.3	0.3	0.4
Iron, mg	<2.0	<2.0	<2.0	1.9
Zinc, mg	1.2	1.4	1.2	1.1
Cholesterol, mg	27.9	26.0	27.4	<0.5

[1]The test meal groups contained either pasture-raised beef (Pasture), grain-finished beef (Grain), pasture-raised lamb (Lamb), or BB. BB, Beyond Burger (Beyond Meat); PBMA, plant-based meat analog.









Curr Dev Nutr 2022;6:nzac082.

Peripheral Amino Acid Appearance Is Lower Following Plant Protein Fibre Products, Compared to Whey Protein and Fibre Ingestion, in Healthy Older Adults despite Optimised Amino Acid Profile

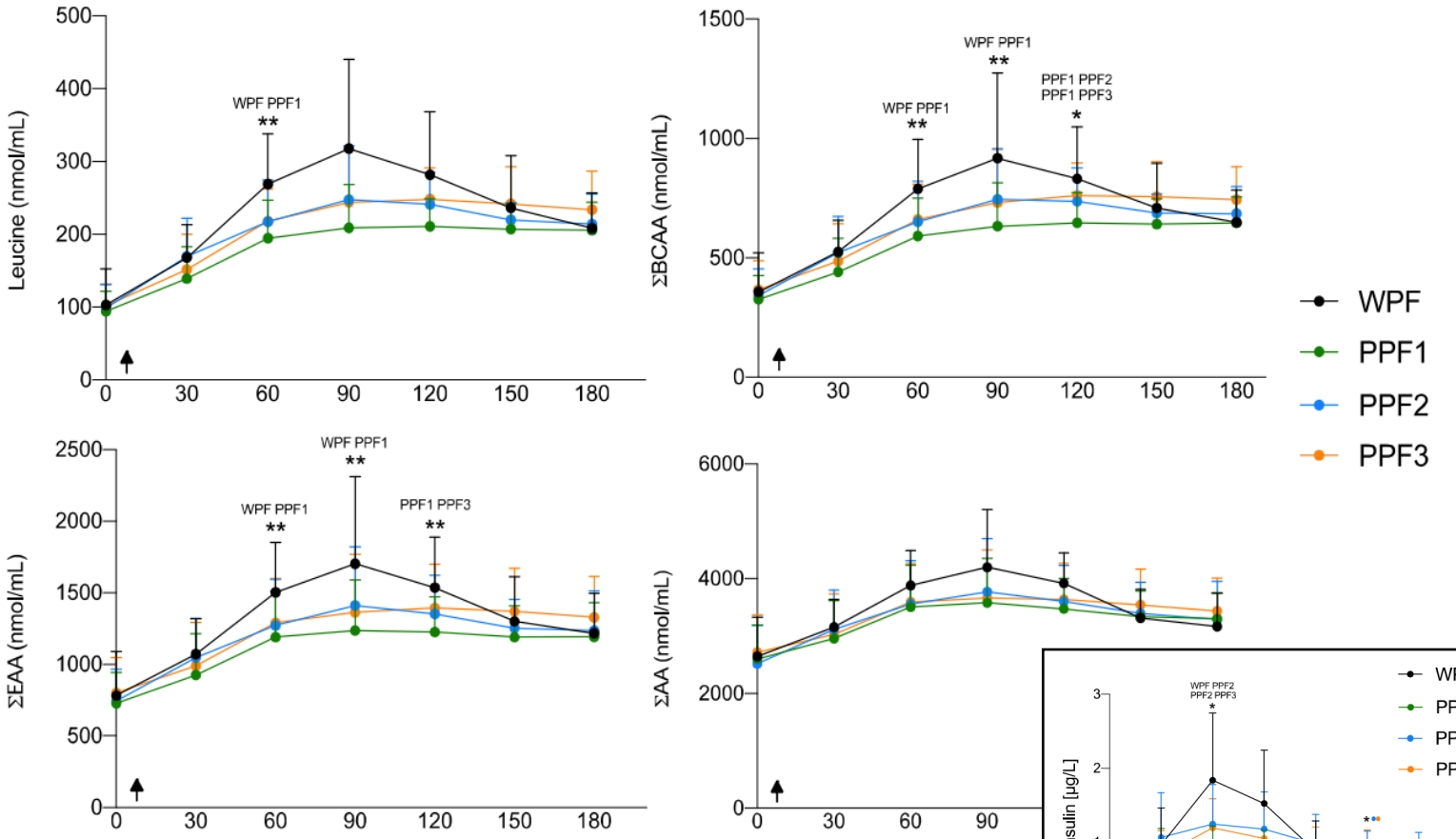
N=12

aged > 65 ± 4 y

Meal Composition	WPF	PPF1	PPF2	PPF3
Lipids, g	30.0	30.0	30.0	30.0
CHO, g	15.2	15.2	15.2	15.2
Protein, g	30.9	41.3	41.8	41.1
Salt + ash, g	0.8	1.4	1.5	1.1
Energy, kcal	454.2	495.7	497.8	495.2

[1] Macronutrients and energy theoretical values (calculated from the manufacturer's food nutrition label). CHO, carbohydrate; PPF, plant protein fibre; WPF, whey protein fibre.

A. Protein sources	protein content (g/ 100 g dry matter basis)	PPF1	PPF2	PPF3
Rice protein isolate	91	0%	0%	18%
Pea protein isolate	88	54%	54%	36%
Pumpkin protein concentrate	62	26%	0%	0%
Soy protein isolate	92	0%	0%	26%
Oat protein concentrate	55	0%	17%	0%
Almond protein concentrate	59	0%	9%	0%
Pea fibre	11	20%	20%	20%



In vitro protein digestibility of plant protein (PP) and plant protein fibre (PPF) products [1].

	In Vitro Digestibility (%)	
	PP	PPF *
PP 1: Pea (67%), Pumpkin (33%)	114 ± 5	110 ± 0
PP 2: Pea (68%), Oat (21%), Almond (11%)	108 ± 3	103 ± 3
PP 3: Pea (45%), Soy (33%), Rice (22%)	109 ± 1	105 ± 0

de Marco Castro E, Valli G, Buffière C, Guillet C, Mullen B, Pratt J, Horner K, Naumann-Gola S, Bader-Mittermaier S, Paganini M, De Vito G, Roche HM, Dardevet D; APPETITE Consortium. Peripheral Amino Acid Appearance Is Lower Following Plant Protein Fibre Products, Compared to Whey Protein and Fibre Ingestion, in Healthy Older Adults despite Optimised Amino Acid Profile. Nutrients. 2022 Dec 21;15(1):35. doi: 10.3390/nu15010035. PMID: 36615694; PMCID: PMC9824653.

Estimated micronutrient shortfalls of the EAT–Lancet planetary health diet

Ty Beal, Flaminia Ortenzi, Jessica Fanzo

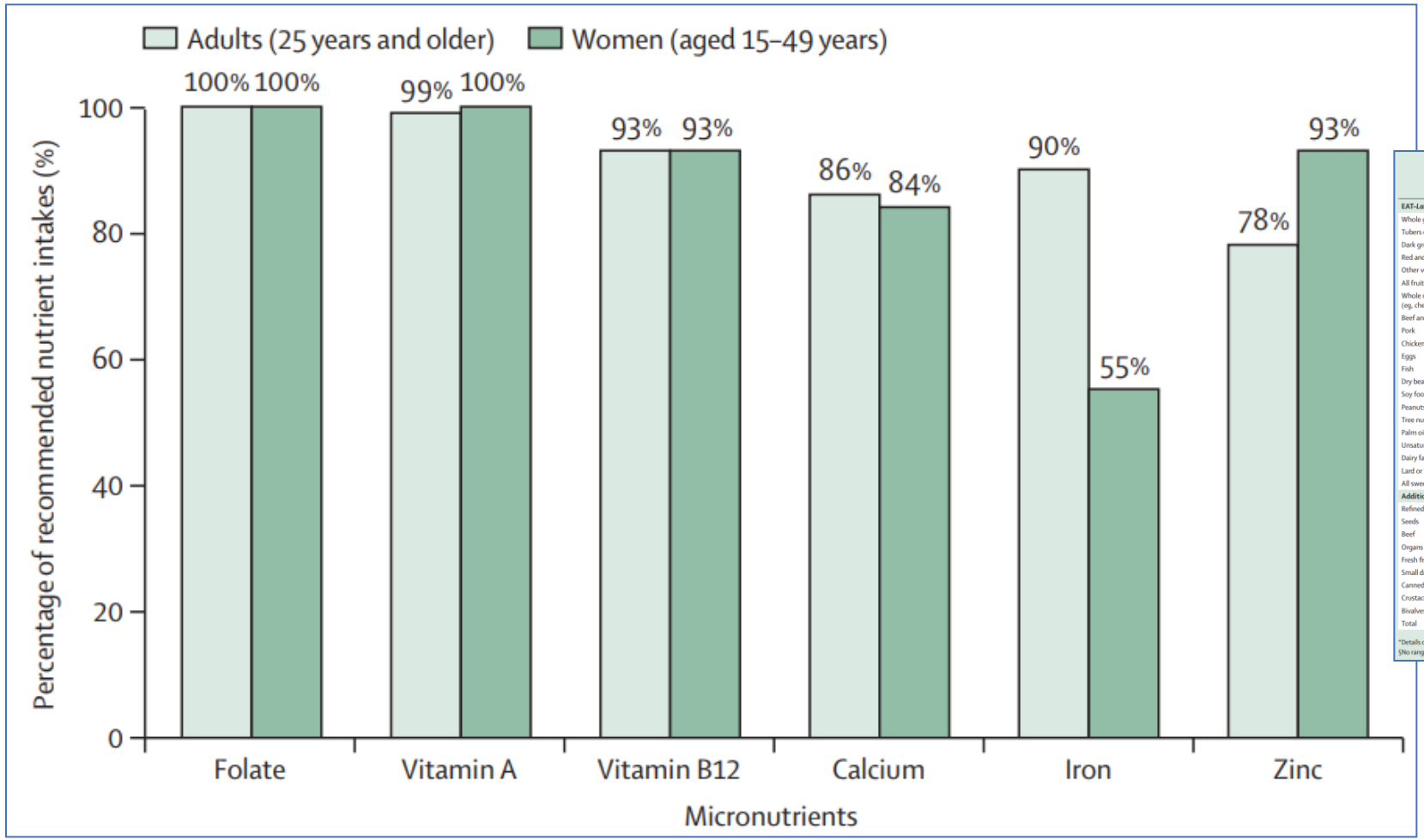
oa OPEN ACCESS

Lancet Planet Health 2023; 7: e233-37

Global Alliance for Improved Nutrition, Washington, DC, USA (T Beal PhD); Global Alliance for Improved Nutrition, Geneva, Switzerland (F Ortenzi MS); Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD, USA (Prof J Fanzo PhD)

Percentage of recommended nutrient intakes for six micronutrients in the EAT–Lancet healthy reference diet

Estimates are based on target values (within a possible range) that were adjusted for the energy requirements of a moderately active individual

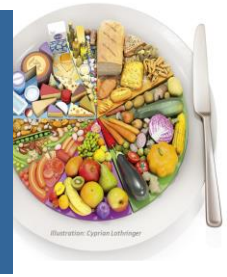


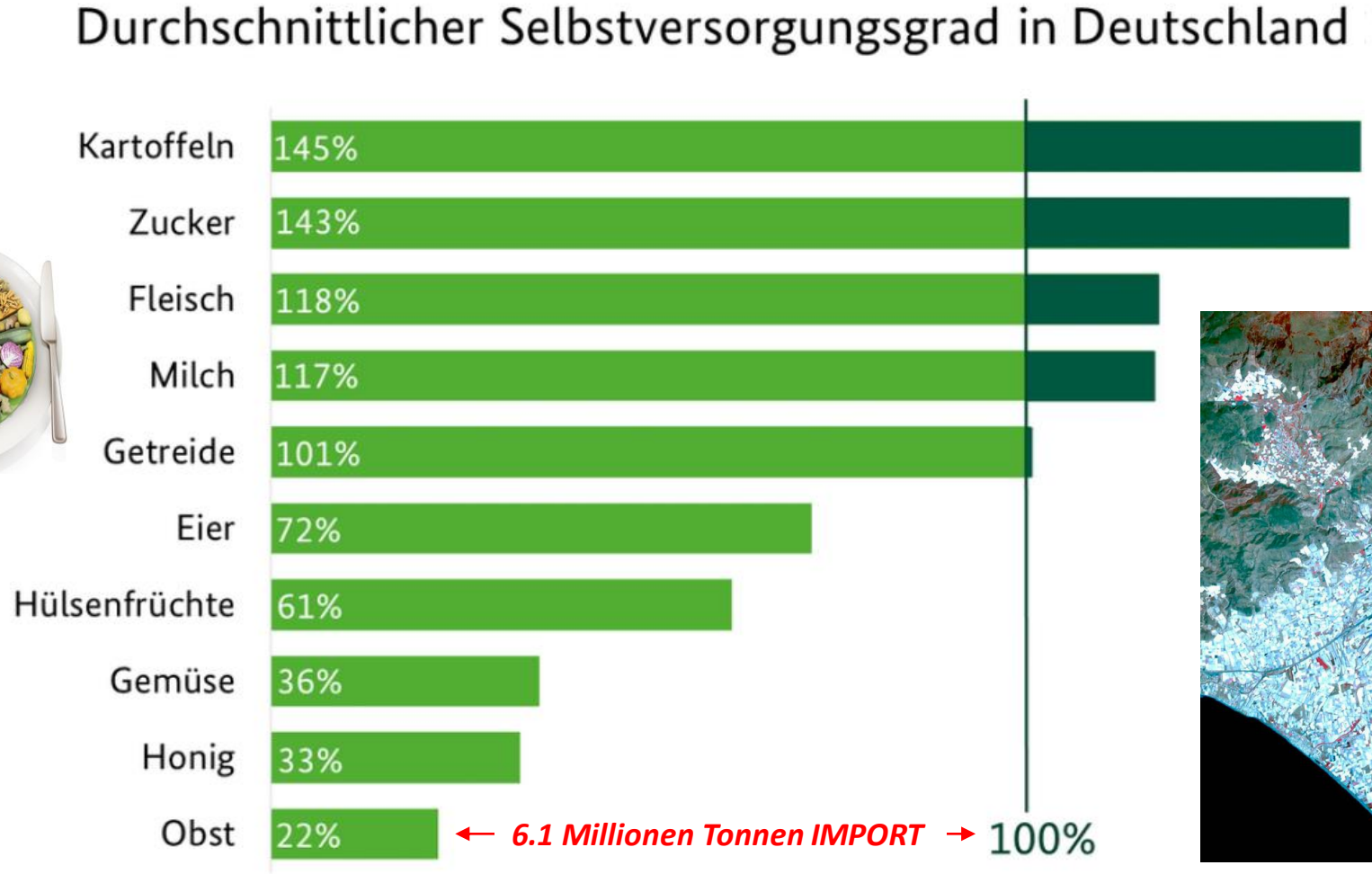
	EAT-Lancet healthy reference diet*		Adequate diet for adults (25 years and older)†		
	Macronutrient intake (possible range), g per day	Caloric intake, kcal per day	Macronutrient intake, g per day	Caloric intake, kcal per day	Difference, kcal per day (g per day)
EAT-Lancet planetary health diet food groups					
Whole grains	232 (0-60%‡)	811	171	300	−511 (−291)
Tubers or starchy vegetables	50 (0-100)	39	181	200	+161 (+146)
Dark green leafy vegetables	100§	23	77	23	..
Red and orange vegetables	100§	30	89	30	..
Other vegetables	100§	25	85	25	..
All fruit	200 (100–300)	126	222	126	..
Whole milk or derivative equivalents (eg, cheese)	250 (0–500)	153	239	153	..
Beef and lamb	7 (0-14)	15	7	15	..
Pork	7 (0-14)	15	12	30	+15 (+6)
Chicken and other poultry	29 (0-58)	62	40	92	+30 (+13)
Eggs	13 (0-25)	19	50	79	+60 (+38)
Fish	28 (0-100)	40	39	40	..
Dry beans, lentils, and peas	50 (0-100)	172	27	36	−136 (−102)
Soy foods	25 (0-50)	112	61	100	−12 (−7)
Peanuts	25 (0-75)	142	4	25	−117 (−19)
Tree nuts	25§	149	4	25	−124 (−20)
Palm oil	7 (0-7)	60	7	60	..
Unsaturated oils	40 (20-80)	354	40	354	..
Dairy fats (included in milk)	0	0	0	0	..
Lard or tallow	5 (0-5)	36	4	36	..
All sweeteners	31 (0-31)	120	30	120	..
Additional food groups					
Refined grains	..	..	68	100	+100 (+68)
Seeds	..	..	17	100	+100 (+17)
Beef	..	..	19	45	+45 (+19)
Organs (eg, liver, spleen, kidney, and heart)	..	..	6	8	+8 (+6)
Fresh fish	..	..	16	20	+20 (+16)
Small dried fish	..	..	3	10	+10 (+3)
Canned fish with bones	..	..	15	30	+30 (+15)
Crustaceans	..	..	34	30	+30 (+34)
Bivalves	..	..	17	15	+15 (+17)
Total	..	2503	..	2227	−276

*Details on the food composition data are available in the appendix (p 2). †Details on the food composition data are available in the appendix (p 3). ‡Of total dietary energy. §No range recommended in the EAT–Lancet planetary health diet.

… eine unversöhnliche„Ernährungswelt“

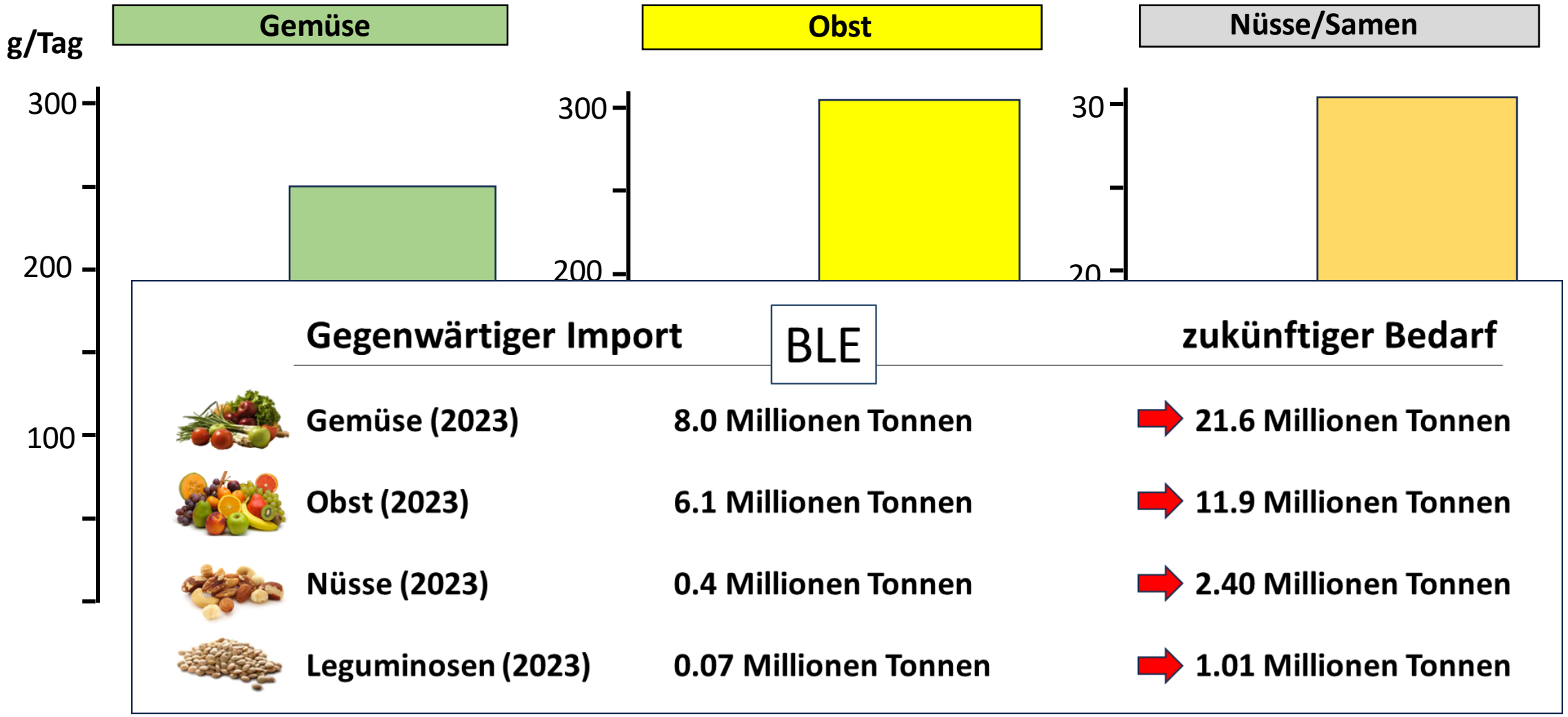
Wie geht dies?





Anmerkung: Angaben zum Selbstversorgungsgrad Obst Wirtschaftsjahr 2018/19
Quelle: Statistisches Jahrbuch über Ernährung, Landwirtschaft und Forsten.

Verzehr und Empfehlungen zum Verzehr an Gemüse/Obst/Nüsse&Samen bei einer Ernährung nach den neuen Empfehlungen der DGE



BLE

	Gegenwärtiger Import	zukünftiger Bedarf
Gemüse (2023)	8.0 Millionen Tonnen	21.6 Millionen Tonnen
Obst (2023)	6.1 Millionen Tonnen	11.9 Millionen Tonnen
Nüsse (2023)	0.4 Millionen Tonnen	2.40 Millionen Tonnen
Leguminosen (2023)	0.07 Millionen Tonnen	1.01 Millionen Tonnen

…… von „alternativen“ Proteinen

- *In entwickelten Ländern ist die Proteinzufuhr schon signifikant höher als von Fachgesellschaften empfohlen. Noch höhere Zufuhr ist schon aus Umweltgründen **nicht sinnvoll**.*
- *Pflanzliche Substitute können gegenüber tierischen Produkten einen Umweltnutzen generieren – dieser wird aber häufig in seiner Effektgröße **überzogen ausgelobt.***
- *Eine bestehende Protein-Hype setzt enorme Forschungsanstrengungen in Gang – vielfach begründet mit nachhaltigerer Erzeugung – **was aber bisher kaum belegt werden kann.***
- *Viele der neuartigen Produkte müssen umfangreiche Zulassungsprozesse in der EU durchlaufen und werden auch kaum eine Preis-Parität erreichen. Sie sind eher als **Nischen-Produkte** zu sehen.*
- *Der wachsende Bedarf an Lebensmitteln für die anwachsende Welt-Population erfordert u.a. neue Technologien zur Lebensmittelproduktion (und nicht nur Protein) – **aber VOR ORT !!***

ChatGPT >

CO

You

Was ist Komplexitätskomplexität?

ChatGPT

Komplexitätskomplexität bezieht sich auf die Tendenz, komplexe Lösungen für Probleme zu entwickeln, die eigentlich einfacher gelöst werden könnten. Es ist eine Art Meta-Komplexität, bei der die Lösungen selbst unnötig komplex sind.

DANKE

..... problems .....

Safety Assessment: Main Considerations

Characterisation & Specifications

Alfalfa protein concentrate

- 45 - 60 % protein
- L-canavanine
- Phytoestrogens (coumestrol and isoflavones)
- Saponins
- Phytate

Rapeseed powder & protein isolate

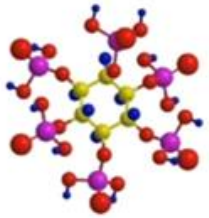
- Powder 33–43 % protein, isolate ≥ 90 % protein
- Glucosinolates
- Phytate
- Erucic acid

Chia seeds

- seeds 15-26 % proteins, powder ≥ 40 % protein
- Phenolic acid derivatives and flavonoids
- Process contaminants

Safety Assessment: Main Considerations

Nutritional Information



- Protein digestibility
- Aminoacid profile
- Antinutrients

Safety Assessment: Main Considerations

Characterisation & Specifications

- Contaminants & undesirable substances

(e.g. primary & secondary metabolites, process enzymes and heavy metals, residues of cultivation conditions)

- Microbiological aspects

(e.g. pH, water activity, microbial counts & toxins)

- Processing contaminants

(e.g. thermal processing: lysinoalanine, Maillard reaction products, acrylamide)

- Stability markers

(e.g. lipid oxidation markers, organoleptic attributes)

- Macro- and micro- nutrients
- Antinutritional factors
- Toxicants/allergens

Safety Assessment: Main Considerations

Allergenicity

- Scarce evidence in the existing literature
- *de novo* sensitization
- Cross reactivity (e.g. rapeseed with mustard)
- Potential impact of the production process
- Mixture of various proteins

nature sustainability

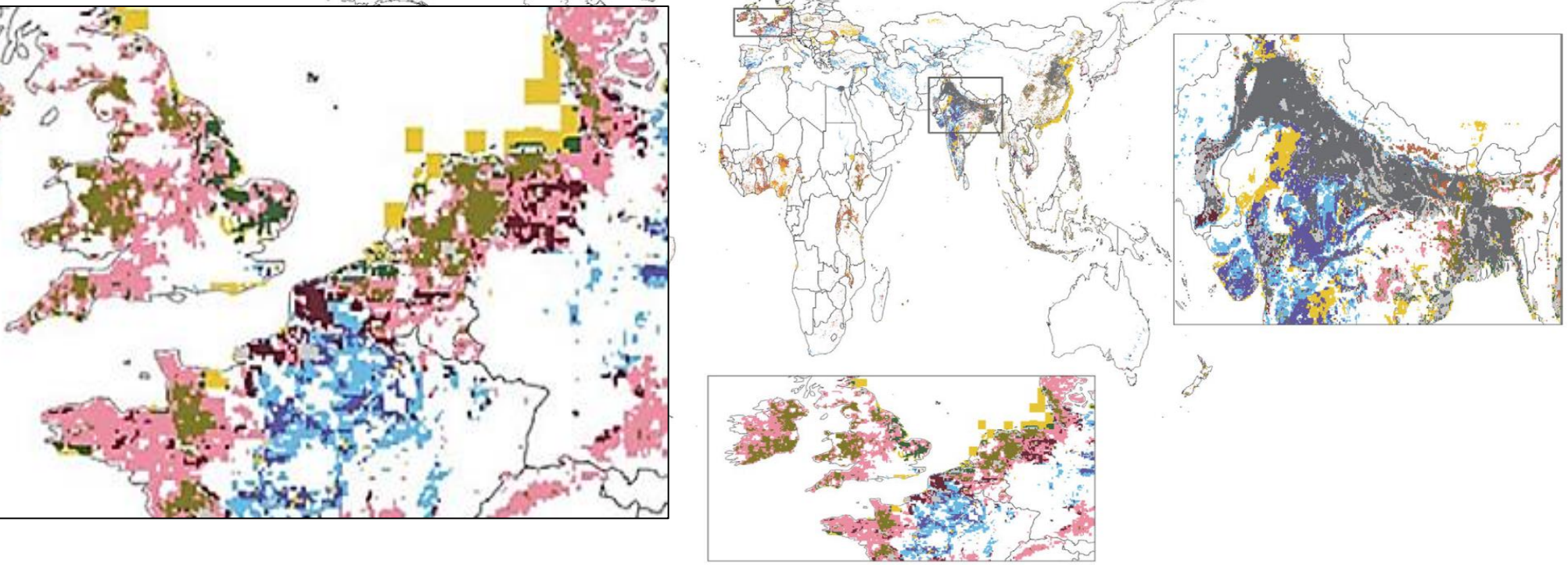
Accepted: 2 September 2022

The environmental footprint of global food production

Nature Sustainability | Volume 5 | December 2022 | 1027–1039

Benjamin S. Halpern et al.

Spatial overlap of the top 1% greatest pressure values for each of the four dominant pressures from food production.



nature food

Partial substitutions of animal with plant protein foods in Canadian diets have synergies and trade-offs among nutrition, health and climate outcomes

Olivia Auclair[1], Patricia Eustachio Colombo[2,3], James Milner[3,4] & Sergio A. Burgos[1,5,6]

Dietary guidelines emphasize the consumption of plant protein foods, but the implications of replacing animal with plant sources on a combination of diet sustainability dimensions are unknown. Using a combination of data from a national nutrition survey, greenhouse gas emissions from dataFIELD and relative risks from the Global Burden of Disease Study 2017, we assess the impact of partially substituting red and processed meat or dairy with plant protein foods in Canadian self-selected diets on nutrition, health and climate outcomes. The substitutions induced minor changes to the percentage of the population below requirements for nutrients of concern, but increased calcium inadequacy by up to 14% when dairy was replaced. Replacing red and processed meat or dairy increased life expectancy by up to 8.7 months or 7.6 months, respectively. Diet-related greenhouse gas emissions decreased by up to 25% for red and processed meat and by up to 5% for dairy replacements. Co-benefits of partially substituting red and processed meat with plant protein foods among nutrition, health and climate outcomes are relevant for reshaping consumer food choices in

Diet-related GHGE and percentage exceeding the per capita planetary boundary for observed and modelled dietary substitutions

	kgCO_2eq per person per day	*P* values[a]	*P* values[b]	% > per capita planetary boundary
Observed diets	**3.99 (3.88, 4.11)**			**214**
Male	4.72 (4.53, 4.91)		<0.0001	257
Female	3.27 (3.17, 3.37)			171
Red and processed meat (25%)	**3.56 (3.47, 3.65)**	**<0.0001**		**191**
Male	4.16 (4.01, 4.31)		<0.0001	226
Female	2.95 (2.87, 3.03)			155
Red and processed meat (50%)	**3.12 (3.05, 3.19)**	**<0.0001**		**167**
Male	3.60 (3.49, 3.72)		<0.0001	195
Female	2.63 (2.57, 2.69)			138
Dairy (25%)	**3.89 (3.78, 4.01)**	**<0.0001**		**208**
Male	4.61 (4.42, 4.79)		<0.0001	251
Female	3.18 (3.08, 3.27)			166
Dairy (50%)	**3.79 (3.67, 3.90)**	**<0.0001**		**203**
Male	4.50 (4.31, 4.68)		<0.0001	244
Female	3.08 (2.98, 3.18)			161

Combined effects of
50% less red meat/products
50% dairy products

around 27%

Food Quality and Preference 103 (2023) 104705

Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

The heritability of pescetarianism and vegetarianism

Laura W. Wesseldijk [a,*], Joshua M. Tybur [a,b], Dorret I. Boomsma [c,d], Gonneke Willemsen [c,d], Jacqueline M. Vink [e]

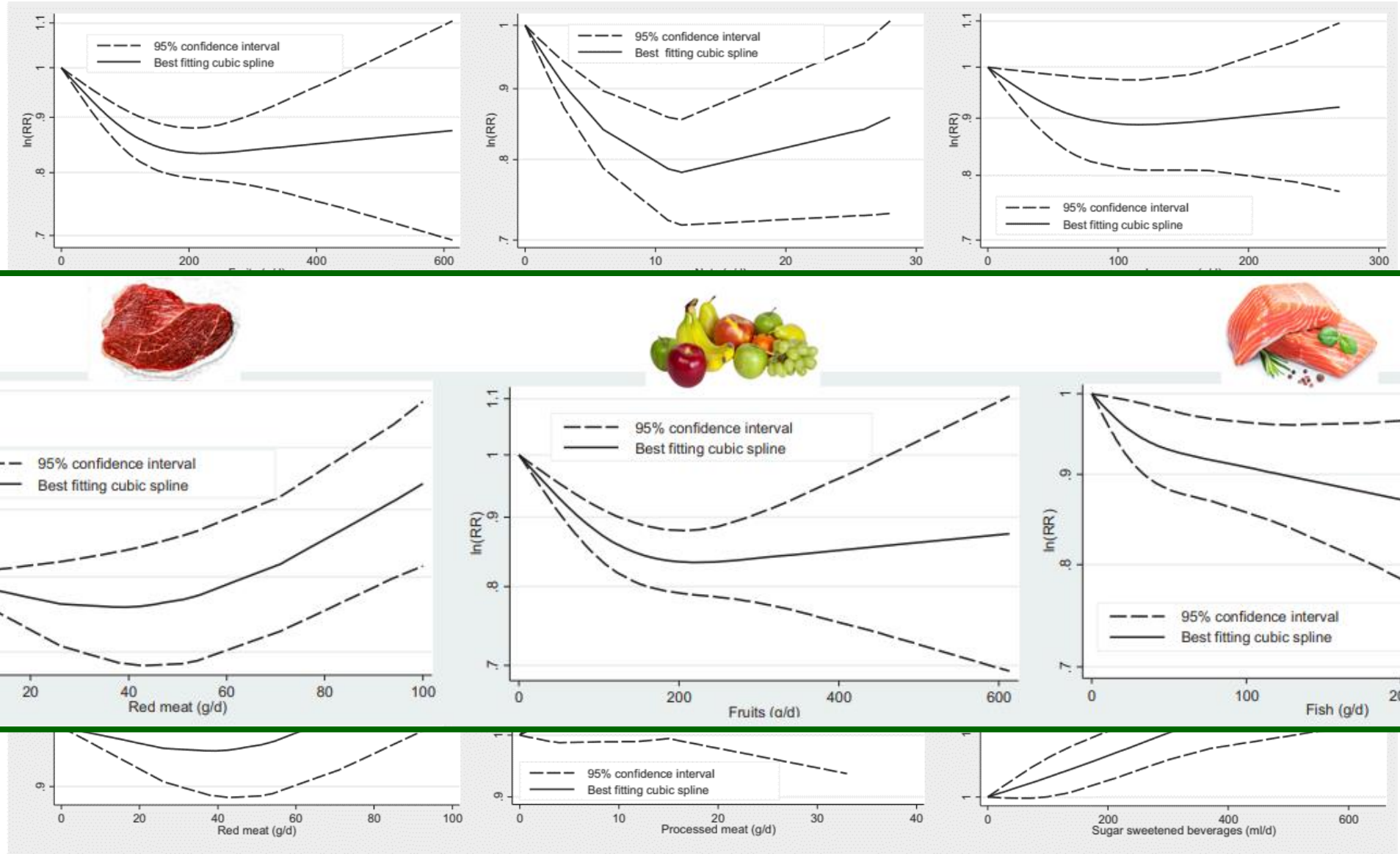
ABSTRACT

Genetic factors have a substantial influence on individuals' food
looked at the influence genetics may have on pescetarianism (n
= 8196). We also examined genetic and environmental influen
individuals gave for not eating these types of meat and fish (e.g
5.3% for beef to 46% for shellfish, and 3.7% did not eat meat
than men. Genetic factors accounted for 74% and 77% of varia
non-shared environmental influences. Heritability for abstinen
mostly due to health concerns, abstention from poultry, fish an
Most pescatarians and vegetarians reported beliefs as one of th
role in pescetarianism, vegetarianism and abstinence from eat

Highlights

- Pescetarianism is 74% heritable and vegetarianism 77%.
- Genetic influences account for 70–80% of individual differences in abstinence from eating beef, pork, poultry, fish and shellfish.
- Individuals did not eat pork mostly because of health reasons, poultry, fish and shellfish because of dislike, and beef because of beliefs.
- Regardless of the different reasons for abstinence, heritability estimates were of a similar large magnitude.

Food groups and risk of coronary heart disease, stroke and heart failure: A systematic review and dose-response meta-analysis of prospective studies



Bechthold A, Boeing H et al. Critical Reviews in Food Science and Nutrition, 59:7, 2019: 1071-1090

Zelluläres Fleisch und Gesundheit: die Pro´s und Con´s

Agriculture **2022**, *12*(3), 355; https://doi.org/10.3390/agriculture12030355

Environmental Impacts of Egg Production from a Life Cycle Perspective

by Aurore Guillaume [1,2,*], Anna Hubatová-Vacková [1] and Vladimír Kočí [1]

Table 6. Climate change potential in kg CO_2 eq. and feed conversion ratio for one kilogram of eggs; a comparison with other LCA studies.

Study	Country		Battery	Barn	Free Range	Organic
Pelletier et al.	Canada	FCR	2.2	2.1	2.2	2.0
		Kg CO_2 eq	2.31	2.4	2.4	1.37
Rocío et al.	Spain	FCR	2.8	-	-	-
		Kg CO_2 eq	3.4	-	-	-
Constantini et al.	Italy	FCR				2.49
		Kg CO_2 eq	-	-	-	1.46
Leinonen et al.	United Kingdom	FCR	2.15	2.4	2.55	2.69
		Kg CO_2 eq	2.92	3.45	3.38	3.42
Dekker et al.	Netherlands	FCR	1.99	2.28	2.33	2.59
		Kg CO_2 eq	2.24	2.67	2.74	2.55
Our study	Czech Republic	FCR	2.08	2.26	1.97	4.51
		Kg CO_2 eq	2.46	3.45	3.41	3.46

PLOS ONE

Feed Conversion, Survival and Development, and Composition of Four Insect Species on Diets Composed of Food By-Products

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SPECIES	***feed conversion ratio***
Argentinean cockroach	1.7 ± 0.24
Black soldier fly	1.8 ± 0.71
Yellow mealworm	4.8 ± 0.14
House cricket	2.3 ± 0.57

Zelluläres Fleisch & Gesundheit: die Pro´s & Con´s

nature medicine

ARTICLES

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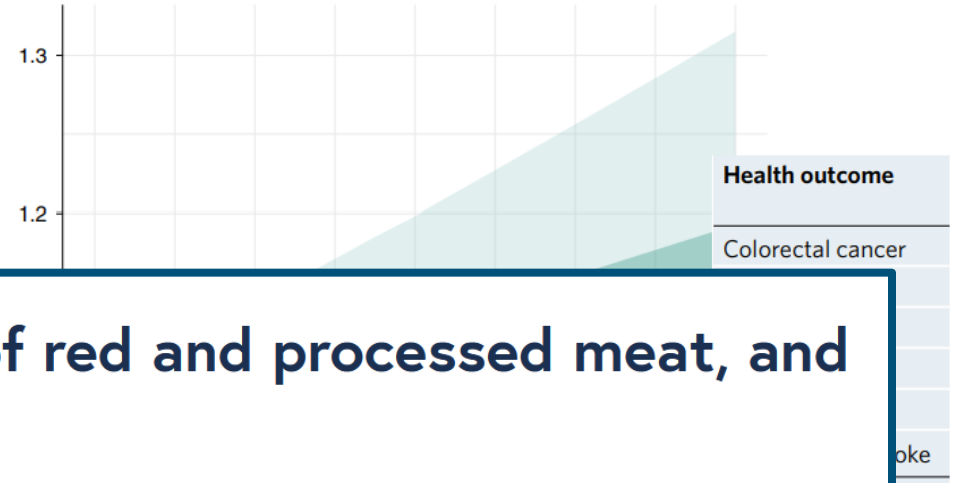
OPEN

Health effects associated with consumption of unprocessed red meat: a Burden of Proof study

NATURE MEDICINE



BMC Medicine

Association between consumption of red and processed meat, and poultry and all-cause mortality in EPIC.

From: Meat consumption and mortality - results from the European Prospective Investigation into Cancer and Nutrition

	Observed	Calibrated
	HR[a] (95% CI)	HR[a] (95% CI)
Red meat (per 100 g)	1.02 (0.98 to 1.06)	1.02 (0.98 to 1.06)
Processed meat (per 50 g)	1.09 (1.06 to 1.12)	1.18 (1.11 to 1.25)
Poultry (per 50 g)	0.96 (0.92 to 0.99)	0.95 (0.87 to 1.04)

[a]stratified by age (one-year age groups), sex, study center, adjusted for education (five categories), body weight (continuous), body height (continuous), total energy intake (continuous), alcohol consumption (continuous), physical activity (four categories), smoking status (seven categories), smoking duration (six categories); CI, confidence interval; HR, hazard rate.

Absolute risk numbers are needed to understand relative risks!

www.eufic.org

Example: processed meat and bowel cancer
What does a 18% increased risk of bowel cancer really mean?

estimated lifetime risk
of developing bowel cancer

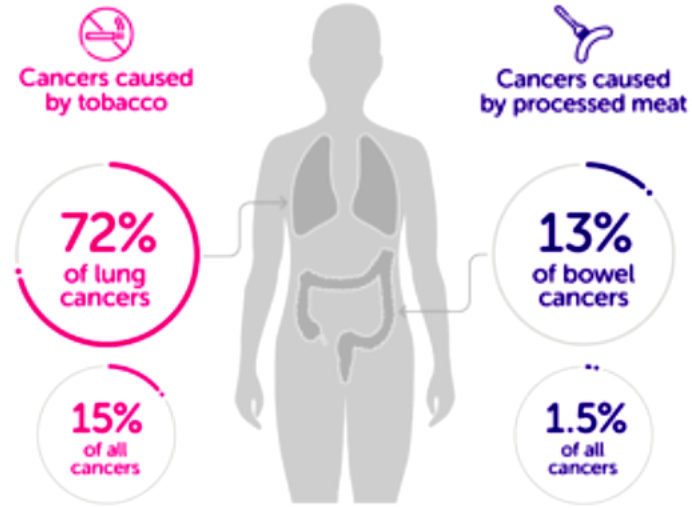
estimated lifetime risk
of developing bowel cancer if you
eat 50 g/day of processed meat

relative risk
increases
by 18%

absolute risk is 5.6% + 1% absolute risk = absolute risk is 6.6%

Tobacco vs meat – what's the risk?

The evidence that processed meat causes cancer is as strong as the evidence for tobacco, but the risk from tobacco is much higher...

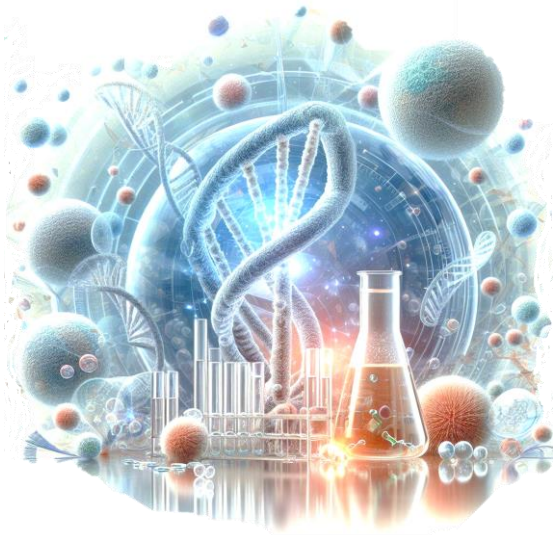


The number of cases per year in the UK that could be prevented by...

Together we will beat cancer

CANCER RESEARCH UK

..... products .....



... upscaling ....

2.041.800.000 kg Cheese in Germany per annum