

Opportunities and challenges of the transition towards healthy and sustainable food systems

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Towards healthy and sustainable food systems

- What can we and cannot we do ? Combined quantification of sustainability and health
- Where to start from? The benefit of targeted changes
- Where do we need to go? Absolute Sustainability - How good is good enough?





Global Burden of Disease (GBD): Leading Risk Factors in the World (2019) Healthy



Institute for Health Metrics and Evaluation (IHME). http://vizhub.healthdata.org/gbd-compare. (Accessed 08/12/2020)

80% of NH3 emissions

from agricultural PM_{2.5} (Goodkind, 2019)

46% of US land use for food production (USDA, 2012)



carbon footprint from agriculture (EPA, 2017)

Disparities: Climate change impacts of heat and cold on health



Global Burden of Disease (GBD): Leading Risk Factors in the World (2019) **Sustainable** Healthy



Institute for Health Metrics and Evaluation (IHME). http://vizhub.healthdata.org/gbd-compare. (Accessed 08/12/2020)

What can we can do: Combined Nutritional & Environmental LCA



Stylianou et al., 2016, Int J LCA 21:734–746

ENDPOINT CATEGORIES

Resources & ecosystem services

Ecosystem quality

Human Health impacts & benefits

DALYs

Nutritional assessment

Environmental

assessment

Foods & Diets

Common

From pioneering LCA ... to data rich datasets

Harmonisation of **Environmental LCA** for Agriculture 1993-1996

6 teams - one case study intensive / moderate / organic wheat



THE IMPACTS IN EACH COUNTRY

Compare and contrast the impacts of current consumption and different diets (flexitarian, pescatarian, vegetarian and vegan) in 147 countries, and of following National Dietary https://planetbaseddiets.panda.org/national-impacts

and consumers

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Reducing food's environmental impacts through producers

Science

From GBD risk ratios to Dietary risk factors (DRFs)

Marginal disease burden (+) or benefit (-) Impact per gram intake of risk component (\rightarrow DALY/g processed meat)





16 Cumulative DRFs, adjusted for age and gender

Weighted sum assuming independent & additive effect for marginal changes

Dietary Risk Factors (DRFs) [µDALY/g]



Mean]95% Confidence interval



Ischemic heard disease, YLL Ischemic heart disease, YLD Colon & rectum cancer, YLL Colon and rectum cancer, YLD

Diabetes, YLL Diabetes, YLD Other cardiovascular diseases, YLL Other cardiovascular diseases, YLD

Other diseases, YLL Other diseases, YLD Other neoplasms, YLL Other neoplasms, YLD

Example: HENI for a beef hot dog on bun (140g)





Health Nutrient Index HENI: Stylianou et al., 2021 Nature food

ARTICLES nature tood https://doi.org/10.1038/s43016-021-00343-4 Check for updates

Small targeted dietary changes can yield substantial gains for human and environmental health

Katerina S. Stylianou[®]¹[∞], Victor L. Fulgoni III² and Olivier Jolliet[®]¹[∞]

To identify environmentally sustainable foods that promote health, we combined nutritional health-based and 18 environmental indicators to evaluate, classify and prioritize individual foods. Specifically for nutrition, we developed the Health Nutritional Index to quantify marginal health effects in minutes of healthy life gained or lost of 5,853 foods in the US diet, ranging from 74 min lost to 80 min gained per serving. Environmental impacts showed large variations and were found to be correlated with global warming, except those related to water use. Our analysis also indicated that substituting only 10% of daily caloric intake from beef and processed meat for fruits, vegetables, nuts, legumes and selected seafood could offer substantial health improvements of 48 min gained per person per day and a 33% reduction in dietary carbon footprint.

Minutes of healthy life https://rdcu.be/cuVht Gained or lost for 5800+ foods



Eating a single hot dog could take 36 minutes off your life, a new study says



120,000 likes on CNN Instagram

High impact research >1000 news media with potential reach of 1.3 billion people



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 \heartsuit V 119,761 likes 7 DAYS AGO

Children understand the minutes of life lost!

Two Moms contacted me:

I mentioned your study to my kids, Andre (8) and Otto (5). They are now asking for additional servings of fruit by saying "Mom, can I have an extra 10 minutes of life, please?". They were quite excited also about your findings on peanut butter and jelly. But quite disappointed about hot dogs."



Huge variety of food choices

13

On a given day ~5,800 foods consumed in the US

(NHANES, 2016)



Marginal nutritional impacts and benefits of 5,853 foods in US Diet



Big data: NHANES (CDC) & National Death Index (NDI)



- 1988-2019 135,000 participants: diet, physiology, 400 chemicals
- NDI Mortality data is linked to NHANES until Dec. 2019
- 17,000 deaths in 2019
- Denmark has unique data availability, with the ability to link registries!

Health impacts of fatty acid and fibers consumption: hazard ratios





Carbon Footprint vs Nutritional Impacts per serving: 160 foods

Where to START from

The low hanging fruits!



-HENI (minutes of healthy life lost/serving)

Food substitution co-benefits



Where do we need to go? Mission towards what:

Sustainable



Healthy & tasty



Affordable

Profitable



and socially responsible food system



What is good enough ? Absolute sustainability

20



Absolute goal share of planetary boundary for protein=0.23 kg_{CO2e}/kg_{protein} Fava bean=3 kg_{CO2e}/kg_{protein},

 \rightarrow Not only change in diet, but also change in production (electrification, N₂O reductions, etc.)

Healthy: From average US diet to GBD ideal healthy diet



Females +15 minutes of healthy life per day compared to males

Asian +24 minutes of healthy life per day compared to white

US healthy diet + 50 minutes per day compare to current diet,

... *but still* -50 minutes under the ideal GBD diet with no detrimental

Combined intervention in Brazil (Eliseu Verly, Univ. Rio de Janeiro)

Health benefit 1000 = 14 min/pers/d



Environmental impact reduction



Healthy sustainable and affordable for all incomes



8

6

4

2

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Conclusion

- We can quantify dietary impact on both human health and the environment
- It provides flexibility for comparing a wide variety of foods in a consistent way.
- Multiple limitations and progress in front of us: how to differentiate apples from bananas. Children are not covered by GBD
- Big data offer very interesting perspectives, coupled with e...g Random Forest Algorithm. \bullet
- Small targeted changes can make a substantial difference (beef & processed meat substituted by a mix of healthy foods)
- What is good enough: we need to set much more ambitious target and study disruptive changes not to exceed planetary boundaries!
- \rightarrow have a START challenge-based conference, where we all contribute to design trajectories towards this goal

Quantitative screening of impacts in minutes per pers per day



An exciting era of Big Data, ... for the ART OF COMPARING!

3. Nutritional

5500+ food items

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