D4N 2025

Delivering for Nutrition in South Asia

Towards Impact at Scale

Enhancing Micronutrient Content of Animal Source Foods through Feed: Opportunities, Risks, and the Road Ahead

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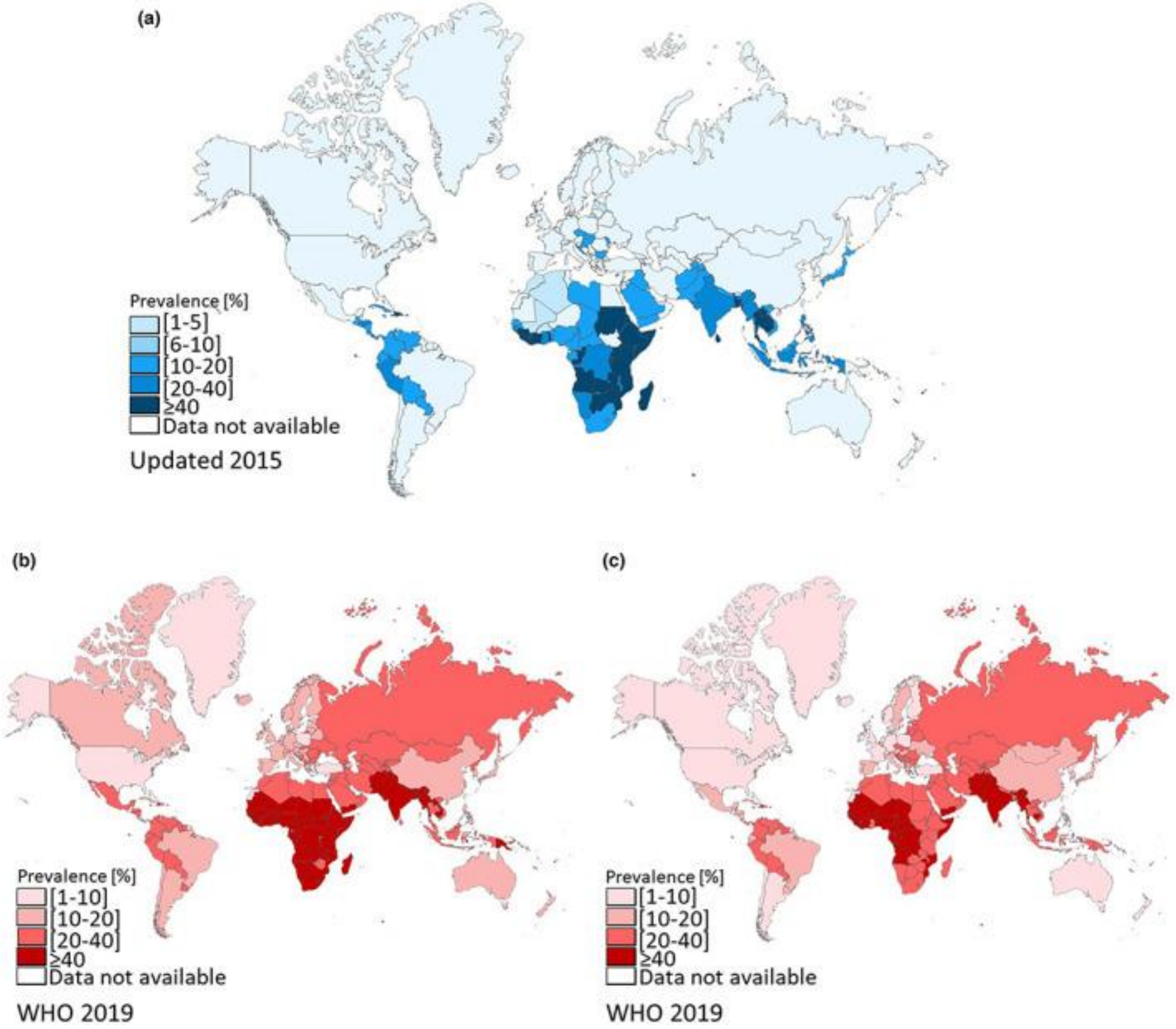
WorldFish



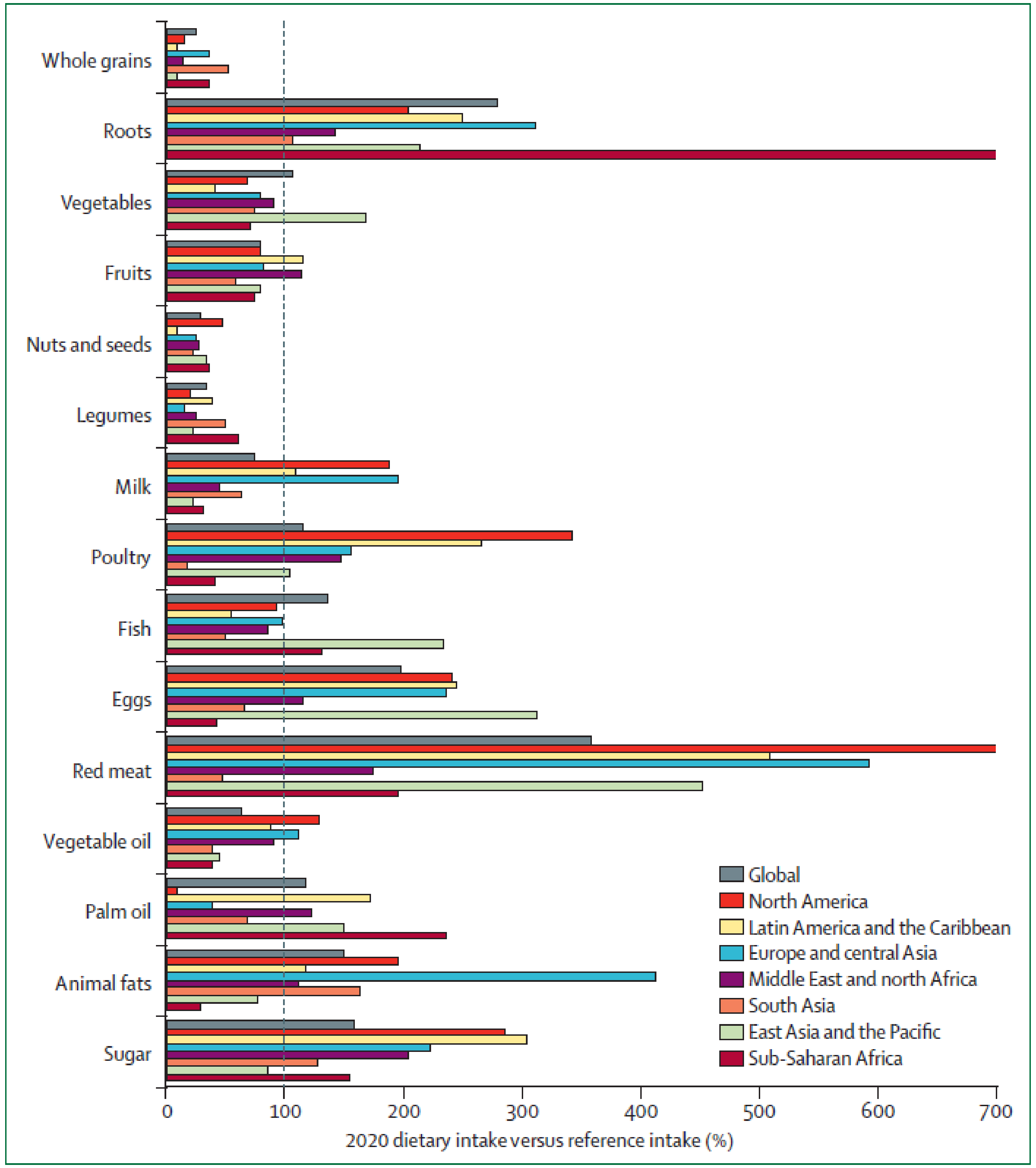
World map showing the prevalence of iron and zinc deficiencies as the percentage of population with intakes below physiological requirements for each country. (a) Prevalence of zinc deficiency. Map generated from Wessells and Brown (2012) and updated according to Joy et al. (2013) and Kumssa et al. (2015). (b) Prevalence of anaemia associated mainly to iron deficiency among preschool-age children (6–59 months). (c) Prevalence of anaemia among women of reproductive age (15–49 years). Map generated from WHO data (2019); accessed September 2021.; *Huertas et al; 2022*


Diets matter!

Ways to improve diets through agriculture

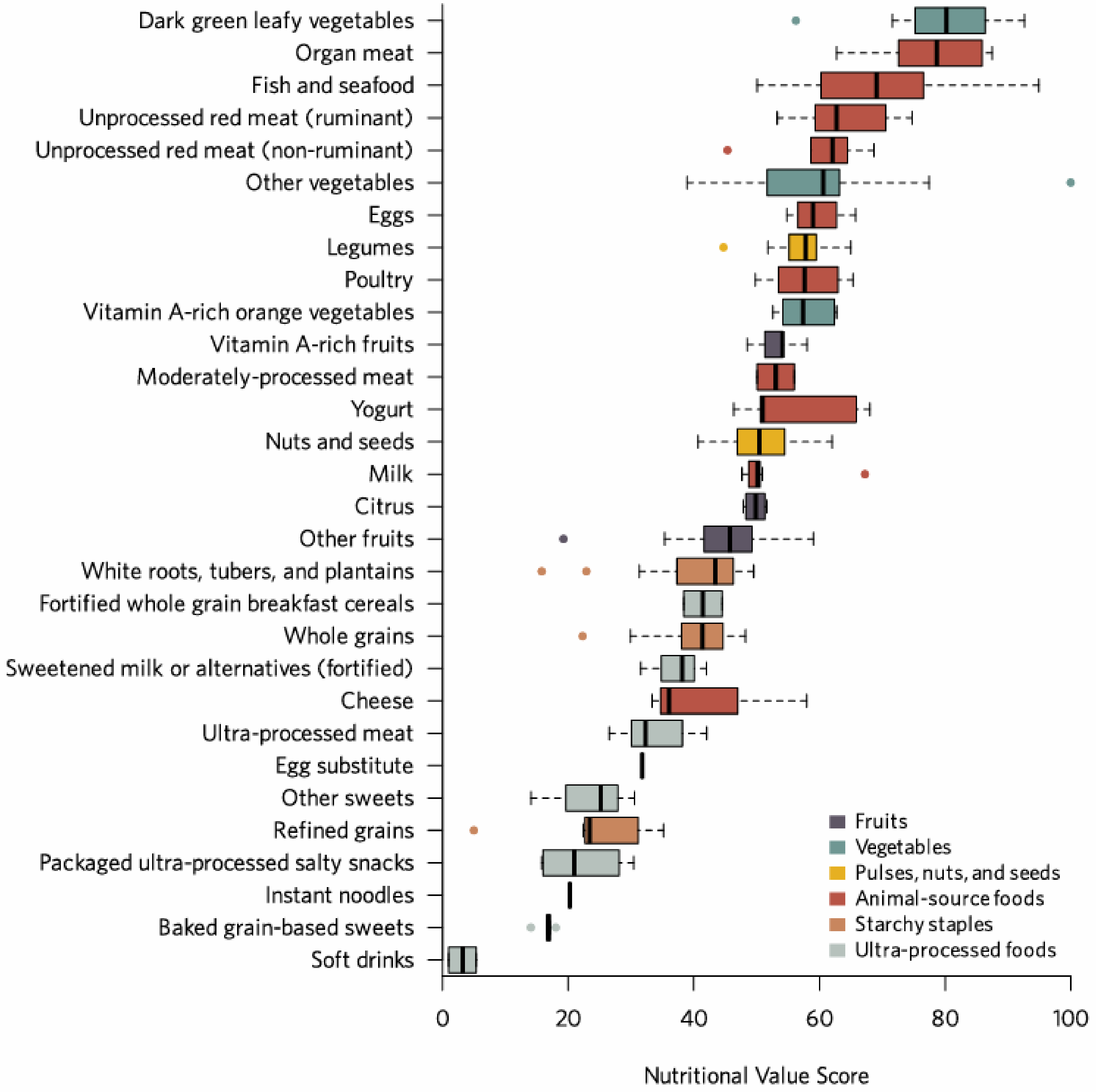
Source: USAID SPRING Project, www.spring.nutrition.org

What is the challenge?



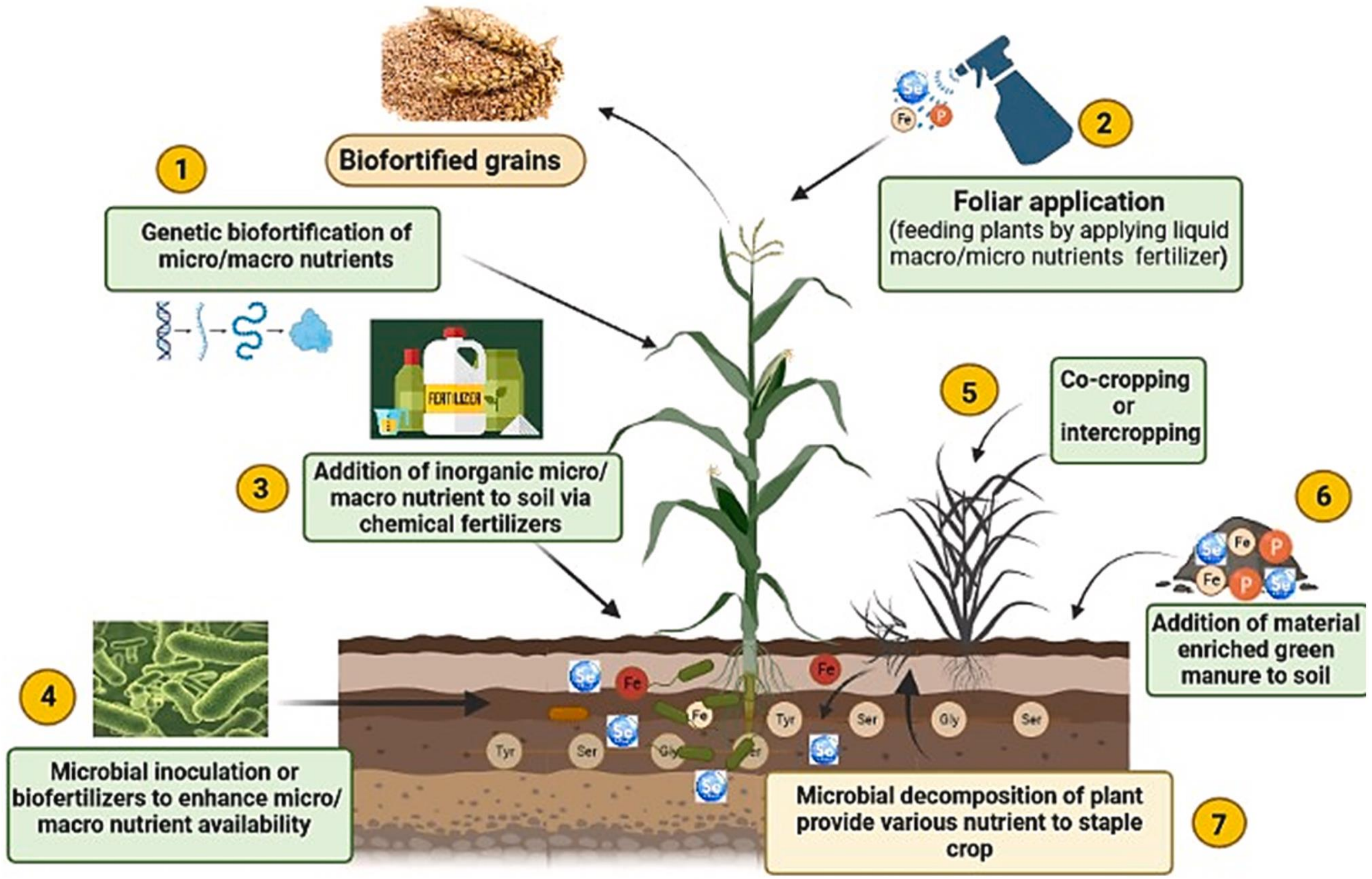
Differences between adult diets in 2020 and the planetary health diet globally and by region. The dashed line represents the reference values of the flexitarian version of the. Source: *EAT Lancet commission 2025*

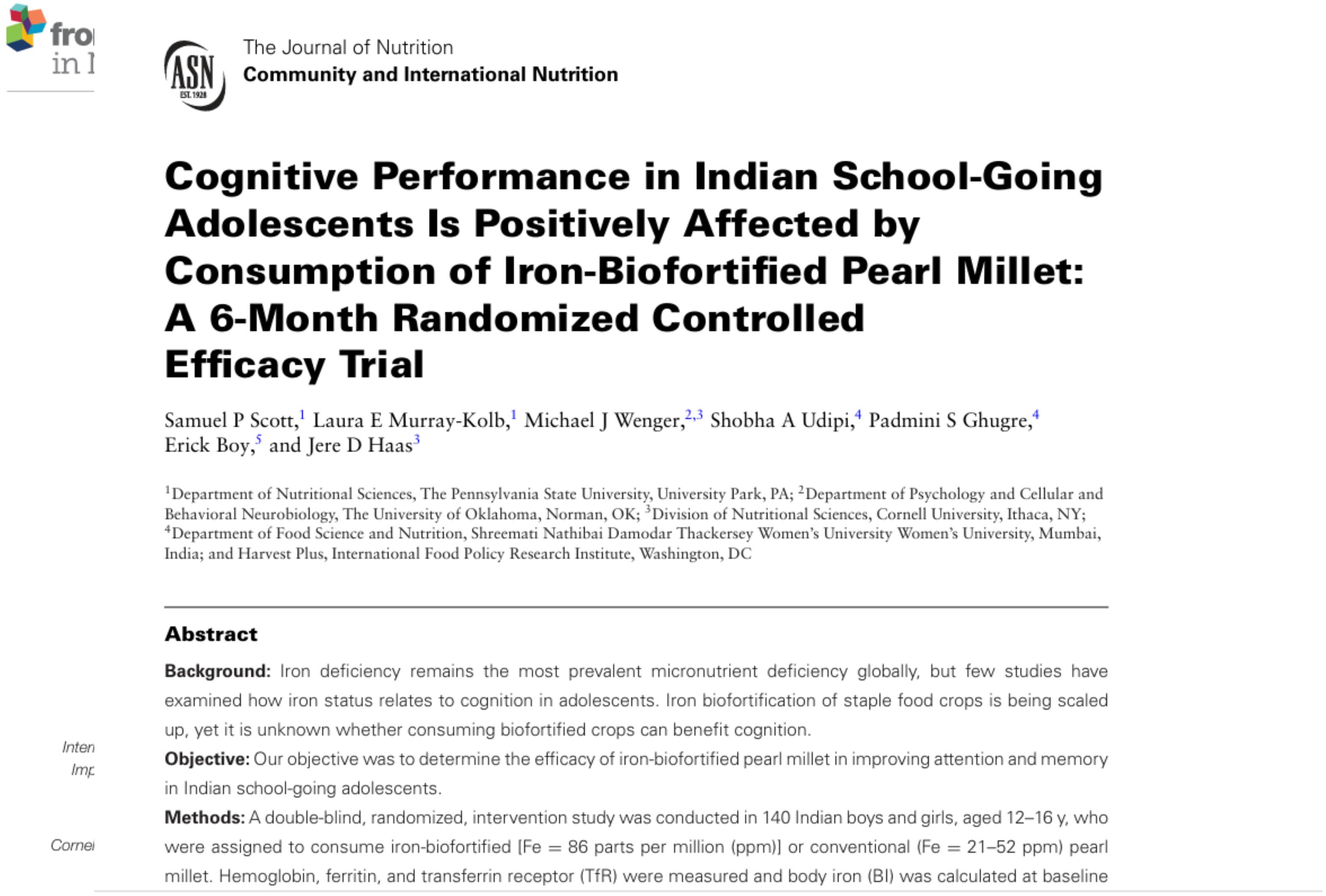
What is the challenge?



Nutritional Value Scores for 289 unique foods in Indonesia, 207 Bangladesh, Kenya, Nigeria, and the United States categorized into common 208 209 210 211 212 food groups, *Beal & Ortenzi, 2025*, https://doi.org/10.21203/rs.3.rs-3443927/v2

Can enhancing nutrient content of animal source foods be a credible pathway to improving diets?





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Cognitive Performance in Indian School-Going Adolescents Is Positively Affected by Consumption of Iron-Biofortified Pearl Millet: A 6-Month Randomized Controlled Efficacy Trial

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Abstract

Background: Iron deficiency remains the most prevalent micronutrient deficiency globally, but few studies have examined how iron status relates to cognition in adolescents. Iron biofortification of staple food crops is being scaled up, yet it is unknown whether consuming biofortified crops can benefit cognition.

Objective: Our objective was to determine the efficacy of iron-biofortified pearl millet in improving attention and memory in Indian school-going adolescents.

Methods: A double-blind, randomized, intervention study was conducted in 140 Indian boys and girls, aged 12–16 y, who were assigned to consume iron-biofortified [Fe = 86 parts per million (ppm)] or conventional (Fe = 21–52 ppm) pearl millet. Hemoglobin, ferritin, and transferrin receptor (TfR) were measured and body iron (BI) was calculated at baseline

Systematic Review

Map existing biofortification efforts in animal source foods to identify nutrient targets, species used, intervention methods, and research gaps. Focus on fish to show no progress has been made on this end

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Species and Nutrient Prioritization

Select commonly consumed, farmed species and target key micronutrients (iron, zinc, selenium, omega-3s) based on public health need and biological feasibility.

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Experimental Trials

Test biofortification strategies such as nutrient-enriched feeds or pond fertilization to enhance nutrient content in fish.

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Nutrient Partitioning and Bioavailability

Analyze where nutrients accumulate in the fish (e.g., muscle, bones, liver) and assess how much is retained and absorbed after cooking and digestion.

↓

Human Efficacy Trials

Conduct trials to evaluate whether consuming biofortified fish improves nutrition status(e.g., iron status, selenium, zinc, DHA levels) in target populations.

There is preliminary work in increasing omega 3 in eggs, and perhaps can be extended to other animal source food products such as milk and meat

Challenges to consider on the approach ?

1. Why increase micronutrient content of animal source foods and they are already nutrient dense?

- Targets nutrients that are still insufficient in ASF for vulnerable populations (e.g., PUFA in aquatic foods, iron in eggs, vitamin A in milk).
- Targets impact for populations at risk of multiple micronutrient deficiencies, especially where ASF intake is low.

2. What about acceptability?

- Biofortified ASF are designed with appearance, taste, and cook properties that would similar to conventional ASF, minimizing cultural or sensory barriers.
- Involvement of consumers in the design and implementation of such approaches is crucial for trust and adoption.

3. What about the cost benefits of this? Would the costs increase that ASF would become even more expensive and more out of reach for low income populations?

4. Would this not affect the drive to also address systems challenges? should complement, not replace, broader food system interventions such as improving supply chain challenges, affordability and accessibility

This work was made possible through the support of the Sustainable Animal and Aquatic Foods Science Program of the CGIAR

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