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The Health Value of Modelled Healthy Eating Patterns Is Largely Constrained by the Current Reference Values for Bioavailable Iron and Zinc

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Objectives: We aimed to study if, and to what extent, the current nutrient reference values for bioavailable iron and zinc limit the identification of healthier dietary patterns.

Methods: Using observed diets from a representative French survey (INCA3) and multi-criteria optimization, we identified diets that comply with all nutrient reference values and maximize a health criteria based on food-based dietary guidelines while minimally departing from the observed diet. Nutrient reference values included absorbed iron and zinc. This non-linear diet optimization problem was solved in men and women with higher (Fe⁻) and lower (Fe⁺) iron requirements separately, either strictly (Non Flexible model, NF) or by allowing

some tolerance on absorbed iron and zinc using goal programming to minimize their decreases below reference values (Flexible Model, F). Using a comparative risk assessment framework and a probabilistic approach, we estimated changes in risks of cardiovascular diseases, diabetes and colorectal cancer, and changes in estimates of the prevalence of iron-deficiency anemia for the diets optimized using each model.

Results: With the NF model, the reference values for absorbed iron and zinc were the most binding constraints (over 34 constraints). Compared to the observed diets, the NF-optimized diets showed large redistributions within cereals and meats, with total meat consumption remaining similar in men and Fe⁻ women and doubling in Fe⁺ women. In contrast, the F-optimized diets had higher value for the health criteria objective, being systematically lower in meat, especially red meat, and higher in whole grain products. We estimated that the reduction in mortality risk would be 17.7% with the NF-optimized diets and 21.5% with the F-optimized diets. However, the later diets would increase the prevalence of iron-deficiency anemia from 2.1% currently to 5.6%.

Conclusions: We evidenced that the reference values for iron and zinc with regard to their bioavailability are critical factors when modelling healthy eating patterns. Considering lower references for iron and zinc leads to identify diets with an apparent higher benefit for the population health with regards long-term health.

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