Impacts of Diet Quality on Cardiometabolic Disease: the Global Dietary Index (GDI)

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Background

Diet quality strongly impacts global cardiometabolic health, and benefits or harms from individual diet components are affected by concomitant exposure to other dietary factors.

Objective

This study introduces a novel Global Dietary Index (GDI) to measure the impact of diet quality from key healthful and unhealthful dietary factors on cardiometabolic health in 2010 by age and sex across 186 countries.

Methods

Data Sources

- Country-, age- and sex-specific dietary intake data for 2010 were obtained from the Global Dietary Database.
- Country-, age-, sex-, and cause-specific disability-adjusted life years (DALYs) were obtained from the Global Burden of Diseases, Risk Factors, and Injuries 2010 database.
- Age-specific etiologic effects of individual dietary factors on cardiometabolic outcomes were obtained from on previously published data based on meta-analyses of observational studies.

Statistical Analysis

- The GDI quantifies the overall impact of commonly-consumed healthful and unhealthful dietary factors on cardiometabolic health by calculating the dietary risk-weighted sum of cardiometabolic DALYs for each dietary factor for the country-, age-, and sex-specific population of interest using the equation below.

$$GDI_p = \sum_{j=1}^{n}\sum_{k=1}^{m} RR_{jk} Intake_{jp} Disease\ Burden_{kp},$$

  - RR_{jk} is the log per-unit relative risk of the effects of dietary factor *j* on disease *k*. To improve interpretability of the index, the sign of the log-transformed RR is inverted.
  - $Intake_{jp}$ is the average intake of dietary factor *j* in population *p*, where *p* represents a country-age-sex stratum;
  - Disease $Burden_{kp}$ is the proportion of DALYs from disease *k* in population *p*;.
- GDI values are computed as log points of risk for loss of cardiometabolic DALYs due to diet and are computed separately for protective vs. harmful dietary factors.
- $GDI_{protective}$ measures risk reduction from 6 beneficial factors (fruits, vegetables, nuts, whole grains, PUFAs substituting carbohydrates, and PUFAs substituting saturated fat).
- $GDI_{harmful}$ measures risk increase from 3 harmful factors (processed meat, red meat, and saturated fat).
- Cardiometabolic outcomes included are: ischemic heart disease, ischemic stroke, hemorrhagic stroke, and diabetes.
- Linear regression was used to analyze the relationships between GDI and country income level controlling for age and region.

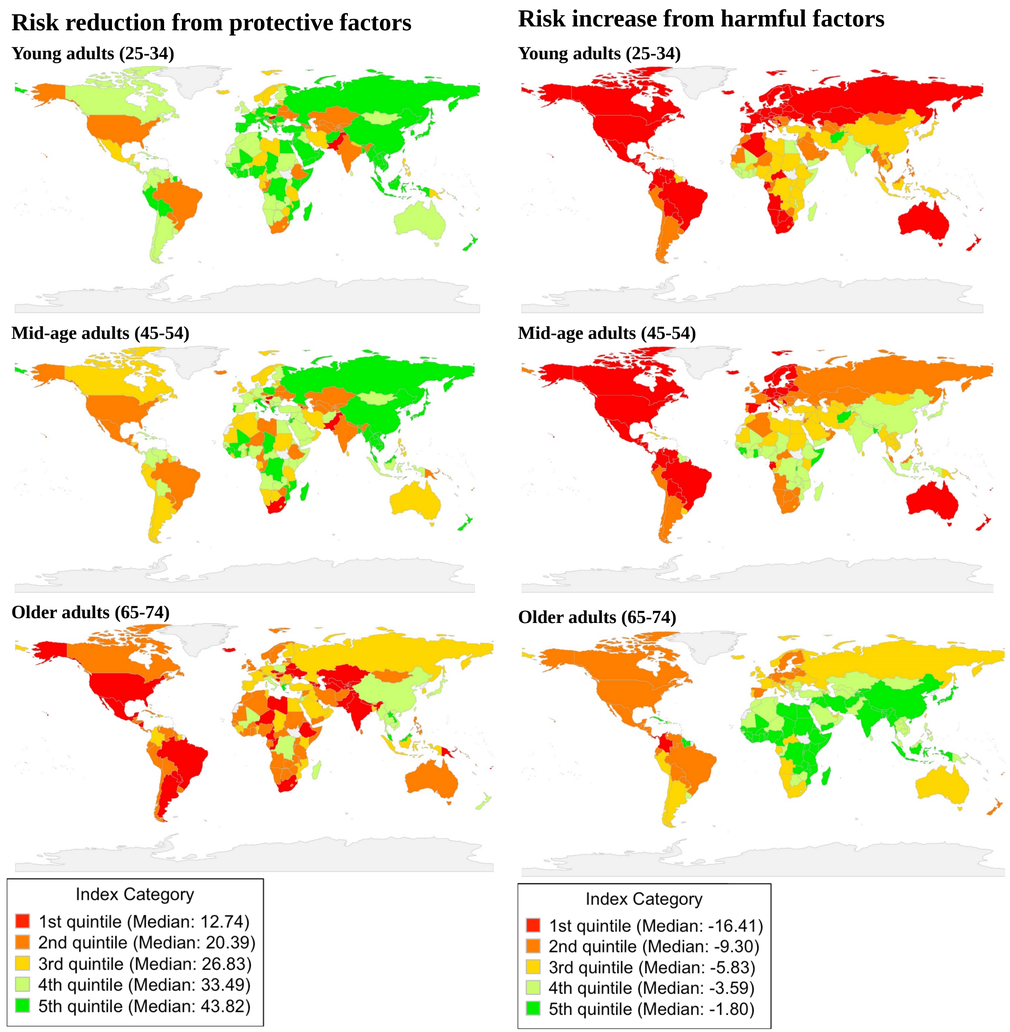

Figure 1: Quintiles of $GDI_{protective}$ and $GDI_{harmful}$ by country and age group, indicating the overall cardiometabolic impacts of commonly consumed protective vs. harmful dietary factors.

Results

- $GDI_{protective}$ varied from 102.35 for middle-aged women in Laos to 3.56 for men aged 75+ in Pakistan.
- The $GDI_{harmful}$ ranged from -0.47 for women aged 75+ in Bangladesh to -34.78 for younger men in Panama.
- The region encompassing East and Southeast Asia attained greatest protection from beneficial foods (mean $GDI_{protective}$ = 33.97±17.19) while South Asia experienced least risk from harmful foods (mean $GDI_{harmful}$ = -2.70±1.50).
- The Canada/U.S. region attained least protection from healthful dietary factors and also experienced the greatest harms from unhealthful dietary factors ($GDI_{protective}$ = 20.56±7.44, $GDI_{harmful}$ = -13.48±6.54).

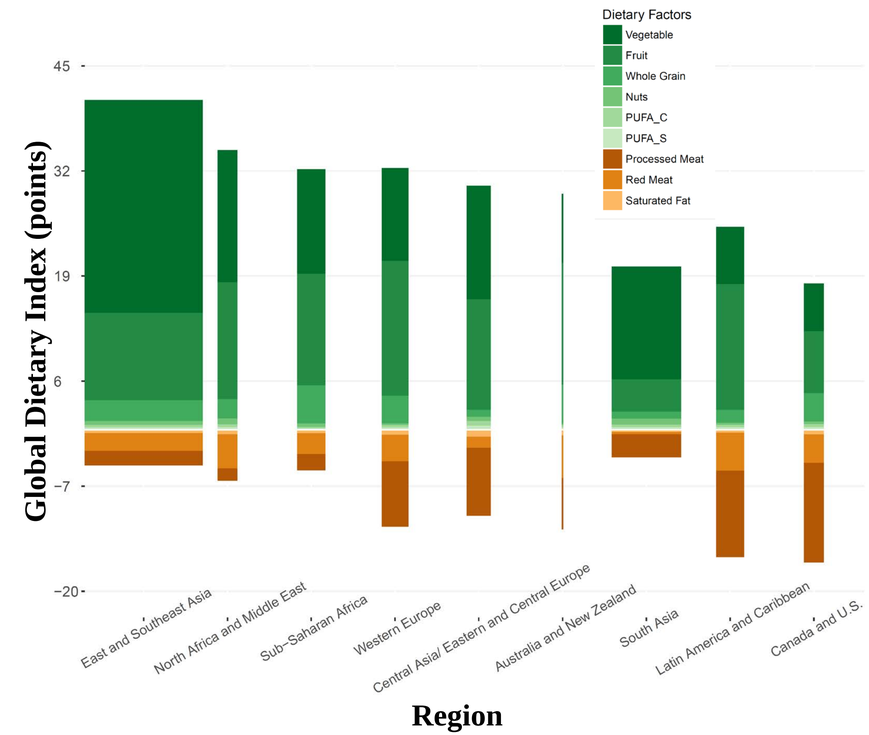

Figure 2: Region-specific population-weighted GDI, indicating the overall impacts of diet on cardiometabolic health, and the contribution of each dietary factor to the overall index. The width of each bar is proportional to the size of the population in a region.

Results

- Higher national income was significantly associated with less cardiometabolic risk abatement from healthful foods and greater cardiometabolic risk from harmful foods ($GDI_{protective}$: F= 3.48, p= 0.015; $GDI_{harmful}$: F= 75.65, p< 0.001).
- Higher age is significantly associated with a smaller magnitude of both harmful and protective indices (p<0.001) in both males and females).

Conclusions

- The Global Dietary Index provides a novel and comparable means of assessing the overall dietary impact of key frequently consumed foods and nutrients on cardiometabolic health by age, sex, and country.
- The GDI provides a valuable tool to policy makers and public health professionals to tailor interventions to populations that are at greatest cardiometabolic risk due to poor diet, and provides insights into population needs for reducing intakes of harmful factors while increasing consumption of healthful foods and nutrients.

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