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Diet costs by level of food processing in 177 countries, 2011 and 2017

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Food processing and retail prices in 177 countries, 2011 and 2017

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Motivation

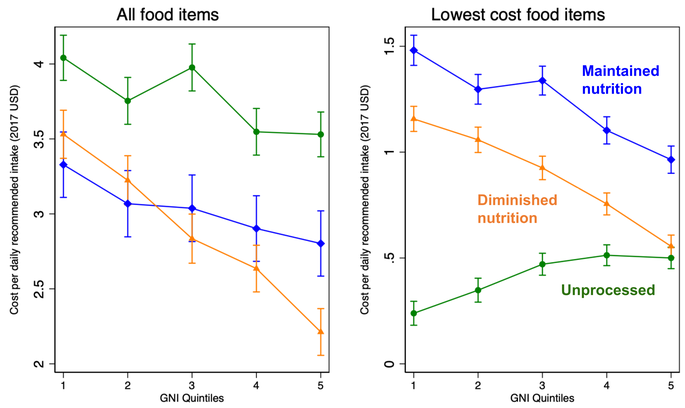
- **Retail prices** are increasingly used to measure food access and nutrition security, as the cost and affordability of healthy diets
  - Healthy diets are found to be about five times as costly as diets with sufficient energy from starchy staples alone
  - Nutrient-dense fruits, vegetables, and animal-source foods are particularly expensive per kilocalorie
- **Food processing** is an increasingly important factor in diet quality, affecting perishability, convenience, nutritional value, and price
  - Many unprocessed foods are perishable and costly to prepare
  - Processing can help *maintain or improve nutritional quality*, for example by freezing, drying, canning or fermentation
  - Some processed foods have *diminished nutritional quality* due to added sodium, sugar, and use of refined instead of whole grains
- **How retail prices vary with food processing** has been studied only in a few high-income countries, using NOVA classifications to identify ultra-processed foods
  - We use global data to compare prices *by level of national income*
  - We have prices for 803 distinct items, classified *by food group* and whether processing *maintained* or *diminished* nutritional value
  - We identify the *lowest-cost item* for each food group in each country, to address how processing affects affordability

Data

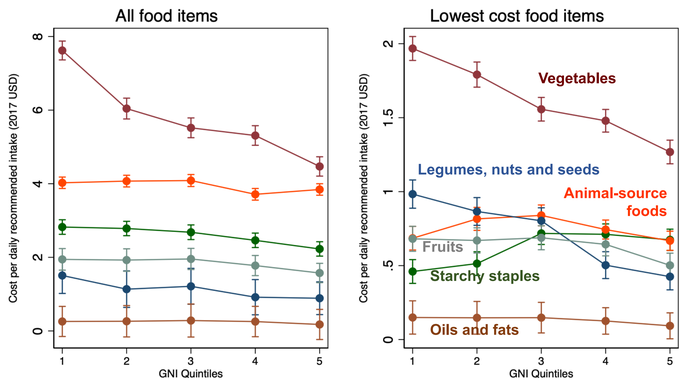
- *Food item availability and price:* Retail prices reported by national statistical agencies for 177 countries in 2011 and 2017 through the World Bank International Comparison Program (ICP)
  - Convert local market prices to standardized units, as US dollars per gram at purchasing power parity exchange rates
- *Nutritional composition and quantities*: Match items to their nutritional attributes, to compare cost per day for the quantity that would be required in an overall healthy diet
  - Classify items into 6 food groups of a Healthy Diet Basket, whose balance between groups meets most national dietary guidelines
  - Match items to food composition data, to determine edible portion of each item in quantities needed to meet daily needs
- *Processing effects on nutritional value*: Identify items by functional effects of processing on nutritional composition, based on:
  - Product description (e.g., canned, dried, frozen, fermented)
  - Ingredients (e.g., added salt, sugar, or refined vs. whole grains)

Results: Differences in retail food prices

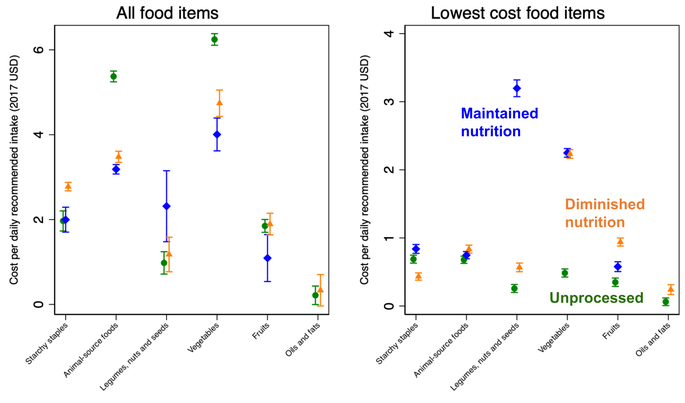
Panel 1. By processing type at each national income level
Foods are more expensive in poorer countries, except for the lowest-cost unprocessed items



Panel 2. By food group at each national income level
Foods are more or similarly expensive in poorer countries, except for starchy staples and animal-source foods



Panel 3. By processing type for each food group
Among least-cost items in each food group, unprocessed foods are lowest cost except for starchy staples



Note: Data shown are predictive margins with 95% confidence intervals by food group, processing type, and national income level estimates, from OLS regression.

Methods

Figures show means and confidence intervals for differences among foods in price per day, from OLS regression:

$$\begin{aligned} &Cost\ per\ recommended\ daily\ intake\ (2017\ USD) = \\ &\beta_0 + \beta_1 foodgroup + \beta_2 processing\ type + \beta_3 national\ income + \\ &\beta_4 foodgroup * processing\ type + \\ &\beta_5 foodgroup * national\ income + \\ &\beta_6 income * processing\ type + \\ &\beta_7 year + \beta_8 data\ available\ for\ 2011\ and\ 2017 + \mu \end{aligned}$$

All food items (left side): Results using all food items in each country (n=40,052 food items from 177 countries in 2011 and 2017)

Lowest cost food items (right side): Results using only the most affordable food items in each food group, processing type, and country (n=7,790 food items from 177 countries in 2011 and 2017)

Findings

Panel 1: By processing type at each national income level

- Foods in general are more expensive in lower income countries, except for the cheapest unprocessed items in each food group
- Unprocessed foods in general are more expensive than processed items, but cheapest item in each food group is usually unprocessed

Panel 2. By food group at each national income level

- Vegetables are the most expensive food group to meet daily recommendations, especially in lower-income countries
- Other food groups' prices have less variation with national income, except that the most affordable starchy staples are less expensive in lower-income countries, and animal-source foods are most expensive in middle-income countries

Panel 3. By processing type for each food group

- Processing reduces retail cost for the quantity needed each day only for vegetables and animal source foods; for other food groups, unprocessed items are among the least expensive
- Processed items with diminished nutritional value are the most affordable only for the least-cost starchy staple, due to refined grain

Conclusions

- In general, food is more expensive in poorer than in richer countries, and unprocessed foods are more expensive than processed alternatives
- Among the lowest-cost foods, unprocessed items are less expensive than processed alternatives, especially in lower-income countries
- These results could be affected by selection bias in which items and outlets are surveyed to reported item availability and price, as well as measurement error in prices per unit needed for a healthy diet

Food Prices for Nutrition
#FoodPricesForNutrition

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