Food choice and access to healthy diets: Evidence from food prices and diet costs worldwide

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Understanding food choice and dietary patterns in the U.S. can be informed by data on access to healthy diets worldwide

• **Many studies address revealed preferences and effective demand for each type of food**
  – People want healthy food, but may not know how each type of food will affect them and have other goals as well
  – Economists explain observed dietary patterns in terms of three factors:
    – Prices of available foods
    – Incomes available for food
    – Choice among affordable options, driven by preferences, food culture & health beliefs, meal preparation costs etc.
  – Preferences must be inferred from food choice among affordable options, at each set of prices and incomes
    – Price and income elasticities for observed consumption, revealed through *demand system estimation*
    – Willingness to pay for different items under different circumstances, revealed by *food choice experiments*

• **Poor diets could be caused by unaffordability, or by food choice among affordable options**
  – Since 2016, our *Food Prices for Nutrition* project has developed least-cost diets for monitoring access & affordability
  – Since 2020, these “Cost of Healthy Diets” metrics have been increasingly adopted to inform intervention
    – Data, results and software tools are downloadable from [Tufts University](#), the [FAO](#) and the [World Bank](#)
  – Monitoring affordability of least-cost healthy diets is designed to diagnose obstacles and guide new investments
    – Where prices for least-cost items are high, need better supply and distribution to *reduce costs*
    – Where incomes available to buy food is low, need better jobs or assistance to *raise affordability*
    – If people could buy a healthy diet but do not, need to address food preferences to *improve food choice*
Food costs for consumers are mostly post-harvest services

Share retail food costs by stage of production and distribution in the U.S., 1993-2021

When we buy food, we pay a lot for brands & services!

Note: Author’s calculations. Data shown are from the USDA Economic Research Service (2023), Food Dollar Series. Last updated Feb. 15, 2023, available at https://www.ers.usda.gov/data-products/food-dollar-series. Implied total spending on food advertising is roughly $60 billion per year, more than the NIH and CDC budgets combined. (Overall food spending is about $6,200 per person, about half our total health-care spending.) The FAO has piloted a global version of these data based on Yi et al. (2021) “Post-farmgate food value chains make up most of consumer food expenditures globally” in Nature Food, with downloadable data for a few countries available in FAOSTAT at https://www.fao.org/faostat/en/#data/GFDI.
Food prices are more variable for farmers than consumers

Consumer prices for groceries and restaurants vs. wholesale costs, Jan 1990 – June 2023

Restaurant prices rise with wages and rents
Grocery prices vary with overall inflation
Wholesale prices for raw commodities have brief spikes and long valleys

Note: Author’s calculations. Data shown are from the US Bureau of Labor Statistics, as the average for each category relative to the overall U.S. consumer price index for all goods and services. Data to June downloaded Aug 5th 2023, with the latest updated data available from https://fred.stlouisfed.org/graph/?g=12MMl.
Food price spikes cause brief but damaging food crises

Average rise in retail food prices relative to all other goods and services over previous 12 months in the U.S. and worldwide, Jan. 1998 - June 2023

Note: Author’s calculations. U.S. data are calculated from the Bureau of Labor Statistics (updates: https://fred.stlouisfed.org/graph/?g=12Myr). Global data are from the IMF, averaging up to 138 countries reporting monthly consumer price indexes (CPI) for food and for all goods and services, Jan. 2000 through Dec. 2022. Each observation is the average monthly rise over the previous 12 months, times 12 to obtain an annualized value. Number of countries rises from 51 in Jan 2000 to 95 in 2005 and then 138 from 2015 onwards. Raw data for all countries are at https://data.imf.org.

...but even when food prices are normal or low, many people cannot afford healthy diets
New global metrics are tracking the cost and affordability of healthy diets

The Food Prices for Nutrition project monitors access to healthy diets using the least expensive locally available foods as a kind of price index, measuring the cost of food as an input to health.

Our aim is to distinguish among barriers to healthy eating. We find a ladder of diet costs for nutrient and other food attributes.

- **Daily energy**
  Meets only calorie needs, for short-term survival and physical work
  \[ \text{Global average in 2017} = \$0.83/\text{day} \]

- **Nutrient adequacy**
  Avoids deficiency or excess of essential macro- and micronutrients
  \[ \text{Global average in 2017} = \$2.46/\text{day} \]

- **Healthy diets**
  Meets national dietary guidelines by food group
  \[ \text{Global average in 2017} = \$3.31/\text{day} \]

- **Caloric adequacy**
  Short-term subsistence
  \[ \text{Meets only calorie needs, for short-term survival and physical work} \]

For actual food choice among affordable options, observed consumption often displaces healthy items with other foods.

For SOFI 2022, the updated standard for the Cost of a Healthy Diet (CoHD) is a “Healthy Diet Basket” of the 11 least-cost items from 6 food groups.

For SOFI 2020, we used 10 countries’ guidelines for the Cost of Recommended Diets (CoRD).

Our AJAE 2018 article introduced a Cost of Diet Diversity (CoDD) metric and many other studies analyze the cost of nutrients.

Actual global food spending = \$5.46/day

Methods and options to monitor the cost and affordability of a healthy diet globally.

Background paper for The State of Food Security and Nutrition in the World 2022.

What foods are included in a least-cost healthy diet globally?

Foods selected are the least expensive items being sold at the time and place of measurement. Each set of 11 items reaches the same Healthy Diet Basket targets for balance across 6 food groups.

Senegal

- Sardines, small fish (dried) 16%
- Maize, rice (25% broken) 18%
- Groundnuts 5%
- Palm oil 8%
- Onions, carrots, eggplant 35%
- Dates, mangoes 18%

$2.19 per day

Pakistan

- Buffalo milk, live chicken (29% of cost)
- Wheat flour, maize (12% of cost)
- Red lentils (9% of cost)
- Vegetable oil (5% of cost)
- Onions, carrots, water spinach (18% of cost)
- Legumes, nuts & seeds (1 item, 300 kcal)
- Oils & fats (1 item, 300 kcal)
- Fruits (2 at 80 kcal each)
- Starchy staples (2 items, 580 kcal each)
- Vegetables (3 at 30 kcal each)

$3.41 per day

Areas show share of cost needed to meet HDB targets.

Note: Each item’s cost is for a sufficient weight or volume to meet the HDB targets, based on matching item descriptions to food composition data. In food groups requiring multiple items, the lowest-cost foods are listed first. Item descriptions are standardized across countries, with its availability and national average price reported by each country’s statistical agency to the International Comparison Program (ICP) for 2017. Cost levels are as published by FAO and the World Bank with methods detailed at Food Prices for Nutrition (2022). https://sites.tufts.edu/foodpricesfornutrition

Items selected reflect local availability and price, delivering the same balance across food groups in all settings.

All items shown are widely consumed in each country, but in very different quantities from these benchmark diets; in these countries actual diets are mostly starchy staples which results in undernutrition.

Benchmark costs shown here are for based on national average item availability and price reported for 2017, converted to US dollars at purchasing-power parity exchange rates.
What foods are included in a least-cost healthy diet globally?

Foods selected are the least expensive items being sold at the time and place of measurement. Each set of 11 items reaches the same Healthy Diet Basket targets for balance across 6 food groups.

**Italy**
- Boxed UHT milk, frozen chicken (25% of cost)
- Wheat flour, pasta (7% of cost)
- White beans, dried (9% of cost)
- Sunflower oil (2% of cost)
- Carrots, onions, cabbage (30% of cost)
- Bananas, apples (27% of cost)

Cost: $2.89 per day

**United States**
- Whole milk, semisoft cheese (16% of cost)
- Rice, spaghetti (20% of cost)
- White beans, dried (8% of cost)
- Carrots, cabbage, Iceberg lettuce (37% of cost)
- Bananas, apples (18% of cost)
- Sunflower oil (1% of cost)

Cost: $3.23 per day

Comparisons with higher-income, more industrialized countries are also revealing. The HDB target is designed for global monitoring, based on commonalities among national dietary guidelines. Resulting diets are close but may not exactly meet all DRI requirements for nutrients, or the U.S. DGAs.

Main difference is these animal source foods. Additional costs to meet DRIs or DGAs would be small, but actual spending in Italy or the U.S. is much greater due to other attributes of foods being purchased.

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What have we discovered about the cost and affordability of healthy diets?

Cost of the least expensive items for a healthy diet in 2017

Diet cost data are from FAO and the Food Prices for Nutrition project, using item prices reported by national statistical organizations through the International Comparison Program (ICP), downloaded from https://databank.worldbank.org/source/food-prices-for-nutrition, and national income (GNI) is from the World Development Indicators https://databank.worldbank.org/source/world-development-indicators. Guidelines are linear in the logarithm of income shown on the horizontal axis.

Least-cost healthy diets are unaffordable for the very poor, about 3 billion people

Based on overall food price inflation relative to incomes, real costs rose to $3.66 in 2021, up from $3.54 in 2020

Global average costs in 2017

- Cost of a healthy diet (CoHD) $3.31 (meets dietary guidelines for overall health)
- Cost of a nutrient adequate diet (CoNA) $2.46 (within upper & lower bounds for nutrients)
- Cost of an energy sufficient diet (CoCA) $0.83 (sufficient calories for work each day)

Food costs differ but are not lower in low-income countries when measured in real terms, compared to other goods & services

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How does actual spending on food compare to the cost of healthy diets?

Diet cost data are from FAO and the Food Prices for Nutrition project, using item prices reported by national statistical organizations through the International Comparison Program (ICP), downloaded from https://databank.worldbank.org/source/food-prices-for-nutrition. Food expenditures are derived from those data, and national income (GNI) is from the World Development Indicators https://databank.worldbank.org/source/world-development-indicators. Guidelines are linear in the logarithm of income shown on the horizontal axis.

Diet costs were derived to meet the following criteria:
- $5.64 per day (pursues many goals other than health)
- $3.31 per day (meets dietary guidelines for overall health)
- $2.46 per day (within upper & lower bounds for nutrients)
- $0.83 per day (sufficient calories for work each day)

Average food spending is much greater than least-cost healthy diets in middle- and high-income countries …but that is the national average, many households in these countries cannot afford healthy diets.

Actual food spending is less than healthy diet costs in low-income countries.

How does actual spending on food compare to the cost of healthy diets?
How does affordability of healthy diets relate to hunger and food insecurity?

Unaffordability of healthy diets and prevalence of food insecurity in 2017

Unaffordability of healthy diets drops with income from >95% to near zero. In contrast, “prevalence of food insecurity” drops from 50-80% to 5-15%.

Here, food insecurity is defined as a survey respondent’s answers to whether they went hungry, ate less or differently, skipped meals, etc. due to lack of resources to buy food.

Food insecurity refers to a person’s usual diet, which if often not healthy: in poor countries it is mostly starchy staples, in rich countries it is more expensive than a least-cost healthy diet due to other needs such as taste, convenience and aspirations.

Conclusion: Improving dietary patterns can be informed by least-cost healthy diets

• For about 3 billion people (40% of the global population), healthy diets remain unaffordable
  – Nutrient-rich foods are more costly to grow and distribute than starchy staples, vegetable oil & sugar
  – At times and places where prices are unusually high, supply improvements can lower cost
  – Most unaffordability is due to low incomes, so healthier diets will require higher earnings or safety nets

• For almost all Americans (and most people worldwide), healthy foods are “affordable” but not used
  – Many factors beyond health drive food choice, as people transition from inadequacy to excess
    • overshooting on animal-source foods, sweeteners and oils, even for home-cooked meals
    • switching to food away from home and packaged items, leading to excess salt, refined grains etc.
  – Frontiers for future work include time use and cost of meal preparation, role of nonfood factors

• Identifying least-cost items and diet costs helps guide intervention
  – Which items have the most potential to improve affordability of healthy diets
  – Which people would need higher incomes or safety nets to afford healthy diets
  – How and why unhealthy foods enter to displace the items in least-cost healthy diets
    • many different interventions are likely needed, as discussed by others in this workshop
Thank you!

We thank the many price collectors and contributors to the diverse databases used in this work and are grateful for funding to the Bill & Melinda Gates Foundation and UKAid, as well as complementary funding from FAO.
Other slides
Use national dietary guidelines, in terms of food groups
– Meet target quantities of each food group needed for a healthy diet
– Allow substitution within energy balance, by converting volume and weight to calories

Guidelines differ in details, but food group requirements are similar
– For CoRD (SOFI 2020), used median cost of 10 quantified guidelines from all UN regions
– Now in CoHD (SOFI 2022), a single Healthy Diet Basket from 31 guidelines with food guides
– Methods refined through many workshops with stakeholders in priority countries

How do we define healthy diets to measure their cost and affordability?

### Definition of the Healthy Diet Basket

<table>
<thead>
<tr>
<th>Food group</th>
<th>Number of items</th>
<th>Total energy (kcal)</th>
<th>Typical weight (grams)</th>
<th>Typical volume (plate share)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starchy staples</td>
<td>2</td>
<td>1,160</td>
<td>322g dry rice</td>
<td>25%</td>
</tr>
<tr>
<td>Vegetables</td>
<td>3</td>
<td>110</td>
<td>270-400g veg.</td>
<td>25%</td>
</tr>
<tr>
<td>Fruits</td>
<td>2</td>
<td>160</td>
<td>230-300g fruits</td>
<td>25%</td>
</tr>
<tr>
<td>Animal-source foods</td>
<td>2</td>
<td>300</td>
<td>210g egg</td>
<td></td>
</tr>
<tr>
<td>Legumes, nuts &amp; seeds</td>
<td>1</td>
<td>300</td>
<td>85g dry bean</td>
<td>25%</td>
</tr>
<tr>
<td>Oils and fats</td>
<td>1</td>
<td>300</td>
<td>34g oil</td>
<td></td>
</tr>
</tbody>
</table>

Total: 2,330
The foods required for a healthy diet are not yet available in the food supply; LAC is especially low in vegetables.