Affordability of healthy and sustainable diets: The cost of EAT-Lancet recommendations and other healthy diets vs household income around the world

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What is the EAT-Lancet diet?

Executive Summary

Food systems have the potential to nurture human health and support environmental sustainability, however our current trajectories threaten both. The EAT–Lancet Commission addresses the need to feed a growing global population a healthy diet while also defining sustainable food systems that will minimise damage to our planet.

The Commission quantitatively describes a universal healthy reference diet, based on an increase in consumption of healthy foods (such as vegetables, fruits, whole grains, legumes, and nuts), and a decrease in consumption of unhealthy foods (such as red meat, sugar, and refined grains) that would provide major health benefits, and also increase the likelihood of attainment of the Sustainable Development Goals. This is set against the backdrop of defined scientific boundaries that would ensure a safe operating space within six Earth systems, towards sustaining a healthy planet.

Table 1. Healthy reference diet, with possible ranges, for an intake of 2500 kcal/day

<table>
<thead>
<tr>
<th></th>
<th>Macronutrient Intake (possible range), g/day</th>
<th>Caloric Intake, kcal/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole grains*</td>
<td>232 (total grains 0–45% of energy)</td>
<td>811</td>
</tr>
<tr>
<td>Tubers or starchy vegetables</td>
<td>50 (0–100)</td>
<td>39</td>
</tr>
<tr>
<td>Vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All vegetables</td>
<td>300 (200–500)</td>
<td>--</td>
</tr>
<tr>
<td>Dark green vegetables</td>
<td>100</td>
<td>23</td>
</tr>
<tr>
<td>Red and orange vegetables</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>Other vegetables</td>
<td>100</td>
<td>25</td>
</tr>
<tr>
<td>Fruits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All fruit</td>
<td>200 (100–300)</td>
<td>126</td>
</tr>
<tr>
<td>Dairy foods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whole milk or derivative equivalents (eg. cheese)</td>
<td>250 (250–500)</td>
<td>153</td>
</tr>
<tr>
<td>Protein sources*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef and lamb</td>
<td>7 (0–14)</td>
<td>15</td>
</tr>
<tr>
<td>Pork</td>
<td>7 (0–14)</td>
<td>15</td>
</tr>
<tr>
<td>Chicken and other poultry</td>
<td>29 (0–58)</td>
<td>62</td>
</tr>
<tr>
<td>Eggs</td>
<td>13 (0–25)</td>
<td>19</td>
</tr>
<tr>
<td>Fish</td>
<td>28 (0–100)</td>
<td>40</td>
</tr>
<tr>
<td>Legumes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry beans, lentils, and peas*</td>
<td>50 (0–100)</td>
<td>1/2</td>
</tr>
<tr>
<td>Soy foods</td>
<td>35 (0–50)</td>
<td>112</td>
</tr>
<tr>
<td>Peanuts</td>
<td>25 (0–25)</td>
<td>142</td>
</tr>
<tr>
<td>Tree nuts</td>
<td>25</td>
<td>149</td>
</tr>
<tr>
<td>Added fats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palm oil</td>
<td>6 (0–18)</td>
<td>60</td>
</tr>
<tr>
<td>Unsaturated oils*</td>
<td>40 (0–80)</td>
<td>354</td>
</tr>
<tr>
<td>Dairy fats (included in milk)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lard or tallow*</td>
<td>5 (0–3)</td>
<td>26</td>
</tr>
<tr>
<td>Added sugars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All sweeteners</td>
<td>11 (0–31)</td>
<td>120</td>
</tr>
</tbody>
</table>

For an individual, an optimal energy intake to maintain a healthy weight will depend on body size and level of physical activity. Processing of foods such as partial hydrogenation of oils, refining of grains, and addition of salt and preservatives can substantially affect health but is not addressed in this table.

Why this webinar?

**THE LANCET Global Health**
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Affordability of the EAT–Lancet reference diet: a global analysis

Kalle Hirvonen, Yan Bai, Derek Headey, William A Masters

Summary

**Background** The EAT–Lancet Commission drew on all available nutritional and environmental evidence to construct the first global benchmark diet capable of sustaining health and protecting the planet, but it did not assess dietary affordability. We used food price and household income data to estimate affordability of EAT–Lancet benchmark diets, as a first step to guiding interventions to improve diets around the world.

**Methods** We obtained retail prices from 2011 for 744 foods in 159 countries, collected under the International Comparison Program. We used these data to identify the most affordable foods to meet EAT–Lancet targets. We compared total diet cost per day to each country’s mean per capita household income, calculated the proportion of people for whom the most affordable EAT–Lancet diet exceeds total income, and also measured affordability relative to a least-cost diet that meets essential nutrient requirements.

**Findings** The most affordable EAT–Lancet diets cost a global median of US$ 84 per day (IQR 2.41–3.16) in 2011, of which the largest share was the cost of fruits and vegetables (31–2%), followed by legumes and nuts (18–7%), meat, eggs, and fish (15–2%), and dairy (13–2%). This diet costs a small fraction of average incomes in high-income countries but is not affordable for the world’s poor. We estimated that the cost of an EAT–Lancet diet exceeded household per capita income for at least 1.58 billion people. The EAT–Lancet diet is also more expensive than the minimum cost of nutrient adequacy, on average, by a mean factor of 1.60 (IQR 1.41–1.78).

**Interpretation** Current diets differ greatly from EAT–Lancet targets. Improving diets is affordable in many countries but for many people would require some combination of higher income, nutritional assistance, and lower prices. Data and analysis for the cost of healthier foods are needed to inform both local interventions and systemic changes.

**Funding** Bill & Melinda Gates Foundation.
Why this webinar?

1. **What systemic policy** changes might help better diets become more affordable for the poor?

2. **What program interventions** can we use to fill gaps, to reach the poor and ensure they get access to healthy diets?

3. **What research** is needed to guide the required change in policies and programs?
Reference diets can be far from actual intake

The EAT-Lancet report has clear policy message

Globally, should cut meats, eggs and starches, and increase F&V, nuts, whole grains

Reference diets can be far from actual intake

The EAT-Lancet report has clear policy message

In US, should also cut poultry & dairy

Reference diets can be far from actual intake

The EAT-Lancet report has clear policy message

In Africa, need to increase all nutrient-dense food groups (except red meat)

Why focus on cost & affordability?

For rural farm families in low-income countries such as Ethiopia, purchased foods fill seasonal gaps, especially for key food groups.

Data: Nationally representative household consumption survey (monthly recall data collected July 2010-June 2011, n=10,322)

To measure affordability, we need to find the least-cost set of foods that meet dietary goals

The oldest approach is based on nutrient adequacy
– First proposed by Stigler (1945), still widely used (e.g. week 4 of NUTR 238)
– Least-cost combination of foods to meet all nutrient requirements, updated in recent years for macronutrient balance and risk of toxicity
– Results depend on food composition data and bioavailability assumptions, as well as nutrient requirements that vary by age, sex, reproductive status etc.

Dietary guidelines are typically based on food groups
– Aim for nutrient adequacy plus other functional attributes of each group
– Often tailored to specific populations, based on local needs
– Results depend on definitions and quantities of food in each group

– Specifies quantities from each of 15 food groups, totaling 2500 kcal/day
– Aims for lifelong health and also environmental sustainability, based on evidence reviews by W. Willett et al. (health) and by J. Rockstrom et al. (environment)
– Deliberately omitted consideration of market prices or diet costs
For prices, we use data collected for other purposes

National statistical agencies collect retail food prices to monitor inflation and measure national income
– Choice of items aims to represent all good & services consumed
– Indexes weight each price by the item’s share of total spending
– Underlying data are typically confidential

International Comparison Program (ICP) at the World Bank uses prices to compare across countries
– Standardized items sold in multiple countries
– Indexes underlie measurement of global growth and poverty
– Global and regional items include 799 foods & beverages

Novelty is use of prices to track retail food systems
– Other food price indexes focus on wholesale or farmgate prices
– Other price indexes focus on cost of current purchases, not policy goals and affordability of reference diets
– Other uses of least-cost diets are to recommend specific foods
Are EAT-Lancet diets within reach for poor people?

Using retail prices for 799 food items across 159 countries in 2011, assembled for the International Comparison Program at the World Bank.

Using retail prices for 799 food items across 159 countries in 2011, assembled for the International Comparison Program at the World Bank.

Cost of EAT-Lancet diets around the world, by level of national income per capita

- **World Bank**
  - $3.20/day poverty line
  - About 26% of world population, or 1.8 b. people
  - Cost is lower in low-income countries due to having more basic items available within some food groups

- **World Bank**
  - $1.90/day poverty line
  - About 10% of world population, or 700 m. people

Mean cost in low-income countries
- Sweeteners, $0.10
- Oils & fats, $0.28
- Meat, fish, eggs, $0.42
- Dairy, $0.38
- Fruits & veg, $0.65
- Pulses/nuts, $0.35
- Starchy staples, $0.25

EAT-Lancet diets are more costly than the least expensive sources of essential nutrients

Cost of EAT-Lancet versus nutrient adequate diets, by income level and geographic region

People can get adequate nutrients at lower cost than EAT-Lancet food groups, especially in S. Asia, but still unaffordable in Africa

Source: CANDASA and ARENA project results, calculated from Hirvonen et al. (2019) and Alemu et al. (2019)
EAT-Lancet diets are much more costly than the least expensive source of day-to-day subsistence.

Cost of EAT-Lancet and nutrient adequate diets vs. caloric adequacy, by income level and region.

In South Asia and Africa, low-cost staples imply a big premium for nutrients.

Source: CANDASA and ARENA project results, calculated from Hirvonen et al. (2019) and Alemu et al. (2019)
EAT-Lancet diets would cost a large fraction of total spending on all goods and services

We find that at least 1.58 billion people have total incomes below the cost of an EAT-Lancet diet in their country

Cost of EAT-Lancet diets as percent of total household income or expenditure on all goods and services

One-third of total spending (=introduced in U.S. in 1963)

In most countries of Sub-Saharan Africa, an EAT-Lancet diet would cost >75% of total spending on all goods & services

Affordability of EAT-Lancet diets has clear spatial patterns, is most unaffordable in Africa

Cost of EAT-Lancet diets as percent of total household income or expenditure on all goods and services

In dark red countries, cost of EAT-Lancet reference diet is >71% of total expenditure per person

Nutrient adequacy costs less than EAT-Lancet, but still above 33% of all spending in many countries.

Cost of nutrient adequate diets as percent of total household income or expenditure on all goods and services

In dark brown countries, cost of nutrient adequate diet is >36% of total expenditure per person.

The cost of nutrient adequacy over daily energy reveals the food system’s premium for nutrients

Cost of nutrient adequate diets as multiple of subsistence cost of daily energy from starchy staples

In India, the least-cost nutrient adequate diet is 5.25 times the cost of dietary energy

Source: CANDASA and ARENA project results, from R. Alemu et al. (2019)
Looking within one country (Malawi), we see wide variation over space and time, and by life stage

Range of cost/day for a nutrient adequate diet in Malawi over 25 market locations and 120 months (2007-16), by age, sex and reproductive status

Cost per day
(US$ at 2011 PPP prices)

Expense is highest in pregnancy and lactation;
Well above global and local poverty lines

$1.90
$1.50

Life stage (age range, in years)

Cost per 1,000 kcal
(US$ at 2011 PPP prices)

A more expensive mix of foods is needed for children, adolescent girls & women than for men

Life stage (age range, in years)

Malawi’s national poverty line is about $1.50/day, lower than the World Bank’s global level of $1.90

Source: CANDASA project results, from Y. Bai et al. (2019)
Price variation over time and space reveals opportunities for improvement

Seasonality of retail prices in Malawi across 25 market locations, 2007-16

Timing and magnitude of price rise by food group

- Starchy staples
- Pulses
- Animal foods
- Fruits and veg.
- Oils & Fats
- Sweets

Spatial variation in seasonality of overall diet cost

- Seasonality
  - 40%
  - 20%

- Peak Time Estimate
  - nonsignificant
  - significant

Width shows period of higher prices
Dark dots show significant peaks
Colors show magnitude of rise

Peaks are generally aligned
Little or no seasonality
Peak timing varies by crop
No seasonality

Source: CANDASA project results, from Y. Bai et al. (2019)
Price trends & fluctuations over time reveal need for investment in nutrient-dense food groups

Average prices by food group for 92 items at 120 markets in Ethiopia, monthly from 2001 to 2017

- Starchy staples
- Legumes and nuts
- Dairy products
- Eggs
- Dark green leafy vegetables
- VitA rich vegetables & fruits
- Other fruits and vegetables
- Vegetable oils and fats

Falling prices for green revolution crops
Rising prices for nutrient-rich foods
Different investments are needed to lower and stabilize prices for each food group

Prices in 2011 US$ at PPP prices

Source: CANDASA project results, from F. Bachewe et al. (2019)
Conclusion:
Measuring overall diet cost and affordability provides a new view of food system change

• A healthy diet remains beyond reach for the world’s poorest
  – Eliminating undernutrition would require higher income & safety nets, as well as food system change to lower prices
  – The EAT-Lancet diet costs more than nutrient adequacy, because it includes more of the expensive animal-sourced foods

• Least-cost diets are a powerful tool for research and policy
  – Retail prices collected for other reasons are confidential, but can be accessed through national governments, or the International Comparison Program at the World Bank
  – For example, the CANDASA project is working through the University of Ghana to help the Ghana Statistical Service and Ministry of Food & Ag. to launch new price indexes in 2020
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