



Photo: A Herforth, Ghana, 2016

Indicators and Tools for the Cost of Nutritious Diets

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<http://sites.tufts.edu/candasa>

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Evolution of new metrics for the cost of nutritious diets

IANDA: Indicators of Affordability of Nutritious Diets in Africa (2015-17)

- Developed several new metrics: Cost of Recommended Diet (CoRD), Cost of Nutrient Adequacy (CoNA), and others.
- Conducted a landscape analysis of food price data collection at national and global levels, interviewing stakeholders in national and global institutions to understand their role in collecting and disseminating food price information, and how it is used in decision-making.
- Engaged with stakeholders in two countries, Ghana and Tanzania, building metrics using their existing data and exploring integration of metrics into their food price monitoring systems.

CANDASA: Changing Access to Nutritious Diets in Africa and South Asia (2018-2020)

- Refining and publishing CoNA and CoRD methodologies.
- Researching the cost of nutrient adequacy and recommended diets in India, Malawi, Ethiopia, Tanzania, Ghana, Myanmar; also exploring application in other countries such as Nigeria and Nepal.
- Researching how access to nutritious diets changes based on shifts over time and space in food prices, wages, and upstream determinants such as infrastructure and GDP.
- Researching how food prices are associated with diet and nutritional status, where data are available.
- Continued contact with Ghana government stakeholders, and establishing a group led by the University of Ghana Institute for Statistical, Social & Economic Research (ISSER) to support integrating the new metrics into Ghana food price monitoring.

Publications, uptake, and future work

- Articles include Masters et al. (2018), "[Measuring the Affordability of Nutritious Diets in Africa](#)" in *Am. J. of Agric. Econ.* 100(5):1285-1301.
- New indicators have been used by the World Bank, e.g. Dizon and Herforth (2018) "[The Cost of Nutritious Food in South Asia](#)" World Bank Policy Research Working Paper.
- We envision providing increased support to governments and global institutions to use cost of nutritious diet metrics in routine food price monitoring, to shift dialogue and focus toward incentivizing availability and access to nutritious diets.

Rationale for this work:

Existing indicators used to measure change over time in the cost of food do not consider its nutritional quality. Global metrics such as the FAO's Food Price Index reflect quantities traded on world markets, while each country's Consumer Price Index reflects quantities currently consumed by its population. Neither reflects the healthy diets promoted by many policies and programs.

New indicators are needed to track differences in access to nutritious foods at each location, and thereby guide systemic change and other interventions to bring healthy diets more closely within reach for people at risk of malnutrition. Market price indexes allow us to identify what interventions most effectively improve affordability of healthy diets, and to measure their impact on nutrition outcomes.

Changing Access to Nutritious Diets in Africa and South Asia (CANDASA) is an \$800,000 investment over 2.5 years (December 2017 – June 2020), jointly funded by the UK Department for International Development and the Bill & Melinda Gates Foundation (BMGF), implemented by the Friedman School of Nutrition at Tufts University with the International Food Policy Research Institute (IFPRI) and other research partners in India, Bangladesh, Ethiopia, Ghana, Malawi and Tanzania. CANDASA builds directly on a prior project, Indicators of Affordability of Nutritious Diets in Africa (IANDA) funded by the UK Department for International Development through an IMMANA grant (2015-2017), and Advancing Research in Agriculture-Nutrition Actions (ARENA) at IFPRI funded by BMGF (2014-2020).

The project's objective is to answer the following questions:

- 1) How do prices and availability of nutritious foods and diets vary over time and space, relative to wages and other earnings?
- 2) When and where does investment in rural infrastructure and farming systems improve and stabilize access to healthy diets?
- 3) Does the variation we see in price and availability of nutrient-rich foods have significant associations with nutrition outcomes?

Results will inform policies and programs in our target countries, and provide generalizable results to guide nutrition-smart investments elsewhere.

Key Metrics

Cost of Nutrient Adequacy (CoNA)

Purpose: CoNA measures the minimum cost of using locally-available foods to obtain enough of all essential nutrients needed for an active and healthy life. The measure can be used for advocacy, design and evaluation of interventions, as well as research about the causes and consequences of changing food prices.

Methods: CoNA is calculated with linear programming using data on (1) the price of each locally-available food, (2) its nutrient composition, and (3) nutrient requirements in terms of both lower and upper limits. Results become valuable only when accurate prices and nutrient composition data are available for the full range of foods actually used to meet nutrient needs. Calculating least-cost diets with a lower diversity of foods than are actually available or incorrect composition data will result in unrealistic costs using an infeasible combination of foods. Unrealistic nutrient requirements can also lead to unrealistic results.

Outputs: CoNA shows the minimum cost of achieving minimum nutrient adequacy for a target population (e.g. adult females, not pregnant or lactating), with no other dietary constraints. It also shows which nutrients are the most constraining, and which foods contribute most to meeting each nutrient requirement.

Cost of Recommended Diet (CoRD)

Purpose: CoRD measures the minimum cost of using locally-available foods to meet dietary recommendations. Any set of dietary recommendations can be used, provided they specify quantitative serving recommendations. For policy relevance, we often use food-based dietary guidelines (such as those pictured, right). These specify the quantity of each food group needed for both nutrient adequacy and prevention of diet-related non-communicable disease within a culturally acceptable diet.

Methods: CoRD is calculated by selecting the lowest-cost foods within each group, in sufficient quantities to meet each recommendation, using data on (1) the price of each locally-available food, (2) its edible portion and water content, and (3) the target quantity needed to meet recommendations.

Outputs: CoRD measures diet costs for the set of recommendations used. National food-based dietary guidelines (FBDG) are usually applicable to the general population. Where FBDG exist for specific sub-populations (e.g. women, men, young children), these sub-population guidelines can be applied to the analysis.



Comparison to other metrics

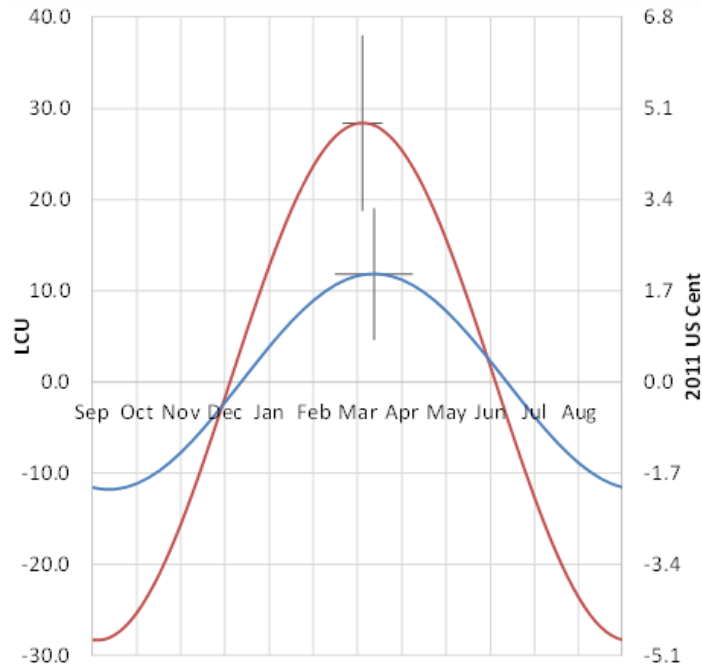
CoNA and CoRD are market-level price indexes designed to monitor the food environment at each place and time. They build on efforts to identify the most affordable healthy diet for target populations, such as Optifood (which is used to determine the extent to which nutrient requirements for specific target groups can be met using local foods within existing dietary patterns) and the Cost of the Diet (CoTD) approach developed by Save the Children and used in the World Food Programme's Fill the Nutrient Gap analysis (described in further detail on the next page). CoNA and CoRD also build on previous studies of food prices that focus on cost per calorie or for specific food groups, adding factors affecting overall diet costs such as normative guidelines and macronutrient distribution ranges. All of these cost metrics can be compared to household income and expenditure data, to calculate affordability as a percentage of average income or the proportion of households that can afford a nutritious diet in each target population.

Summary of metrics of the cost of nutritious diets

Indicator	Population	Data required and nutritional standard to be met	Results available	Recommended uses
Cost of Recommended Diet (CoRD) <i>(IANDA-CANDASA metric)</i>	General population; a target population may be specified if food-based dietary guidelines exist for that population	<ul style="list-style-type: none"> Price per gram of each food Dietary recommendations (e.g. national food-based dietary guidelines) Quantity of each food category recommended (e.g. 400 grams of fruits and vegetables per day) 	<ul style="list-style-type: none"> Cost per day of meeting dietary recommendations (such as national food-based dietary guidelines) Cost per day of each food group in the recommended diet Cost per serving of each food group in the recommended diet 	<p>Monitoring the food environment at each marketplace, and regionally and nationally</p> <p>Useful to understand whether diets that follow dietary guidelines are affordable to most people, and which food groups are the most expensive</p> <p>Identifies the lowest-cost foods in each food group at any given time and place</p>
Cost of Nutrient Adequacy (CoNA) <i>(IANDA-CANDASA metric)</i>	Any target population of interest for which nutrient requirements are available (e.g. adult women, pregnant women, young children)	<ul style="list-style-type: none"> Price per gram of each food Nutrient composition of each food, in terms of energy, protein, fat, nine vitamins and seven minerals (Fe, Zn, Ca, Mg, Cu, P, Se), and potentially also phytate as an antinutrient Nutrient requirements of the target population, such as estimated average requirements (EARs), upper limits (ULs) and macronutrient ranges 	<ul style="list-style-type: none"> Cost per day of achieving nutrient adequacy Quantity and cost per day of each food and of each nutrient in the lowest-cost adequate diet Cost per unit of each limiting nutrient, to show the most costly nutrients 	<p>Monitoring the food environment at each marketplace, and regionally and nationally</p> <p>Useful to understand whether diets that provide adequate nutrients are affordable to most people, and which nutrients are most expensive.</p> <p>Identifies the lowest-cost foods to provide nutrients at any given time and place</p>
Cost of the Diet (CotD) and Fill the Nutrient Gap (FNG) <i>(Save the Children and WFP metric)</i> <i>Acknowledgements: inputs on this section provided by Saskia de Pee, Janosch Klemm, Giulia Baldi, and Amy Deptford</i>	Household of a certain composition; or any target population of interest for which nutrient requirements are available (e.g. adult women, pregnant women, young children)	<ul style="list-style-type: none"> Price per gram of each food Nutrient composition of each food for energy, protein, fat, nine vitamins and four minerals (Fe, Zn, Ca, Mg), using embedded food composition table (within the CotD software) or custom data EARs for energy, percentage energy from fat and recommended nutrient intakes (RNIs) Portion sizes for all foods found on the market using embedded portion size database or custom data Optional: Typical food habits of the household or target individuals Typical, average, or 'model' household size and composition of the target area 	<ul style="list-style-type: none"> Daily, monthly and/or annual cost of achieving nutrient adequacy, aligned with usual dietary patterns, by season (optional) for the model household and individuals within the household Quantity and cost per day, week, or year of each food selected by the model The amount and percentage of energy and nutrients provided by each edible portion of food selected by the model, summarized by day, week or year The percentage of target intakes met for each nutrient by day, week, season or year Cost attributed to each food group per week 	<p>Fill the Nutrient Gap is a process designed to engage stakeholders in a single or periodic assessment of the cost of the diet, and relevant policy options</p> <p>Useful to model the lowest cost of meeting nutrient needs within a reasonably realistic dietary pattern, and then show what such a diet would resemble for individuals and the household.</p> <p>Useful to identify impact of fortification or lowering cost of local nutritious foods on cost of meeting nutrient requirements.</p> <p>A software package is available for the modeling, with embedded data on food composition, nutrient requirements, and portion sizes. Training is required to use the software.</p>

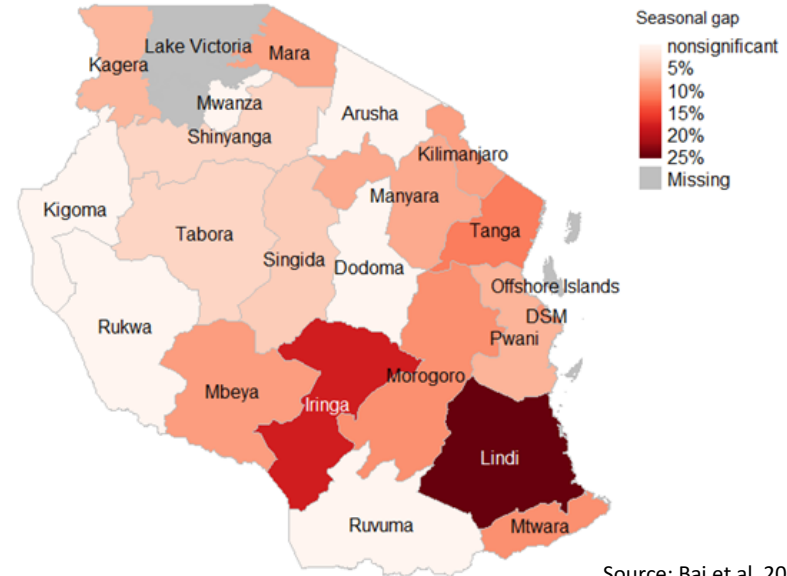
Sample Results: Cost of Nutrient Adequacy (CoNA)

Seasonal variation is significantly greater for nutrients (red line) than for daily energy (blue line) in Tanzania



Source: Bai et al. 2019

Seasonal rises in the cost of nutrient adequacy are greatest in the southern regions in Tanzania



Source: Bai et al. 2019

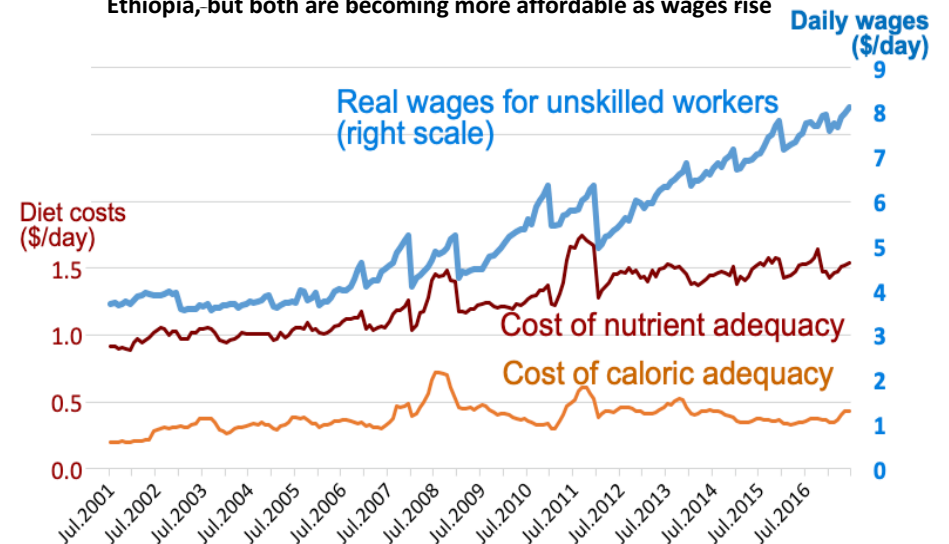
This CoNA analysis uses food price data over time and across regions in Tanzania to show that the cost of nutrient adequacy is much more variable across seasons than the cost of energy (upper left), and that seasonal rises in price are greatest in the south (upper right). Further analysis revealed that the price difference is mainly due to seasonality in fruits and vegetables.

Ongoing analysis in Ethiopia shows that while wages increased in Ethiopia from 2001-2016, the cost of nutrient adequacy remained significantly higher than the cost of caloric adequacy.

Sources:

- Bai Y et al. (2019), and Bachewe F et al. (2019)
- Presented at IFPRI, [Policy Seminar](#) on May 29 2019.

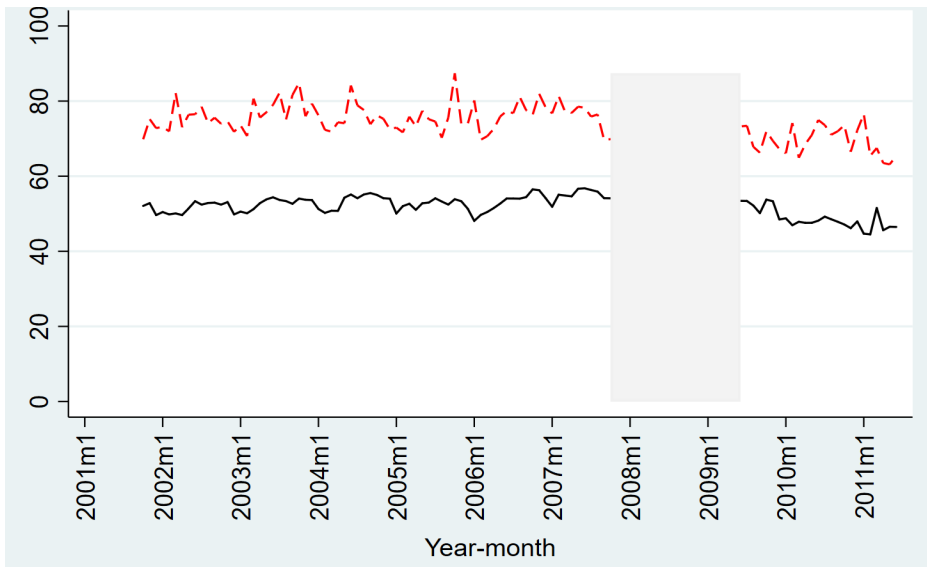
Cost of nutrient adequacy is significantly higher than the cost of caloric adequacy in Ethiopia, but both are becoming more affordable as wages rise



Source: Bachewe et al. 2019

Sample Results: Cost of Recommended Diet (CoRD)

Trends in the cost of the recommended diet as a percent of wages for rural unskilled labor in India

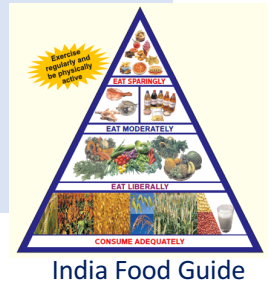


The CoRD analysis in India uses national food-based dietary guidelines that specify a range of servings for each recommended food group separately for women and men, and activity level.

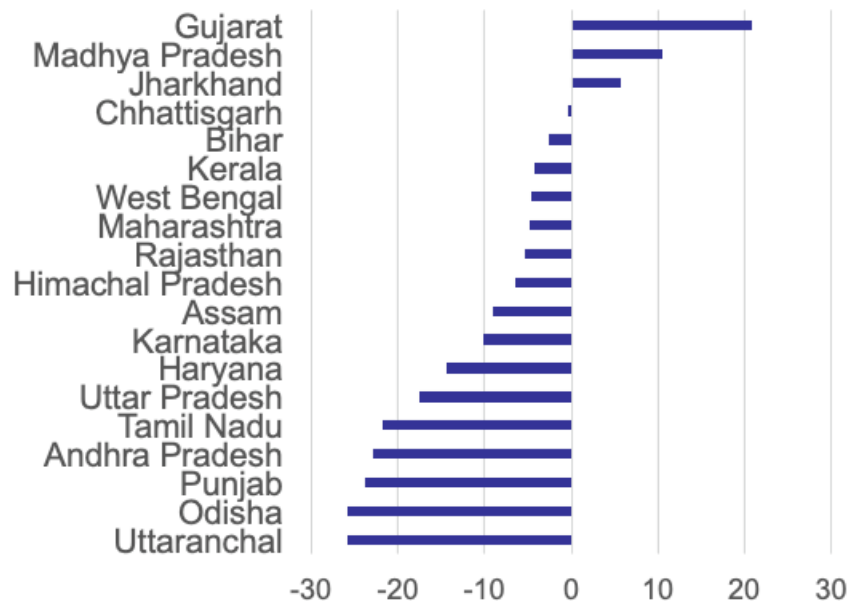
These results show that in India for the period covered, recommended diets are highly unaffordable, and using gender-specific recommendations, costs are a larger fraction of unskilled wages for women than for men: 70-80% of women's wages, and 50-60% of men's wages.

The change over time in cost of recommended diets relative to wages has varied by state. Seasonality in prices is highest for fruits and vegetables.

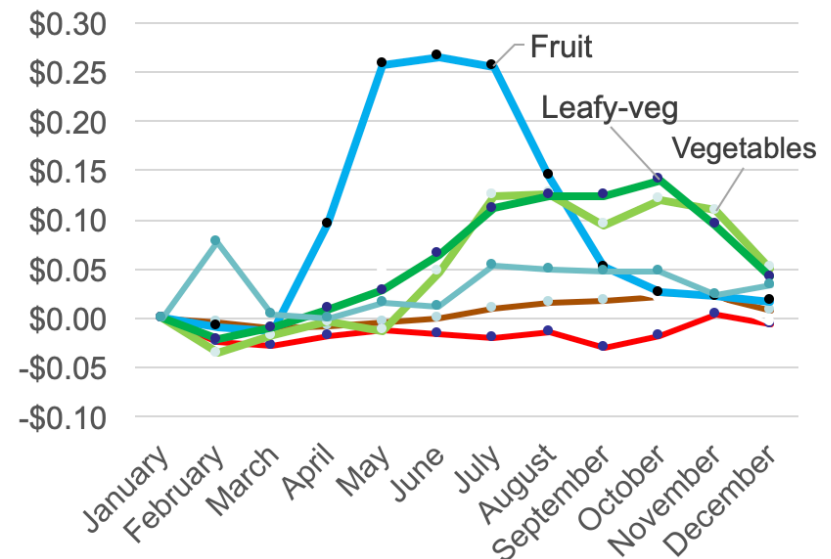
Source: Raghunathan K, Herforth A, & Headey D. 2019. Affordability of nutritious diets in India. Presented at IFPRI, [Policy Seminar](#) on May 29 2019.



Change in recommended diet affordability across states in India, 2001-2011



Seasonality in food group prices



Policy Engagement

Since 2016 IANDA/CANDASA has worked with Ghanaian authorities (GSS, MoFA) to help officials use the new price indexes within their routine food price monitoring.

2016: IANDA held the first meeting with Ghana Ministry of Food and Agriculture (MoFA) and Ghana Statistical Service (GSS). We worked with these national agencies to understand the process of how food price info is gathered, and reviewed the food lists they use for food price monitoring. Together we determined that MoFA's list could be updated to include more nutritious foods that are commonly consumed, such as nkontomire, a nutritious dark green leafy vegetable (pictured below).



Photo: A Herforth, Ghana, 2016

2017: MoFA piloted the new expanded food list and decided to update the food list used for food price monitoring nationwide. We held a workshop to discuss interest in monitoring the metrics as national statistics. An analysis by WFP showed that the expanded food list gave more realistic results in the CotD and *Fill the Nutrient Gap* analysis. John Nortey from MoFA attended three global meetings (FAO and CFS) to present MoFA's efforts at nutrition-sensitive metrics.



John Nortey (MoFA) presented Ghana's leadership in nutrition-sensitive metrics to the World Committee on Food Security (CFS) at FAO headquarters (2017)

2018: Held a meeting at ANH Academy Week, where GSS and MoFA stated intent to track the Cost of Recommended Diets and a nutritious food price index as national statistics.



2019: To help introduce new metrics, an informal "Nutritious Food Prices Analysis Support Group" will be hosted at the University of Ghana's Institute for Statistical, Social & Economic Research (ISSER), with the support of CANDASA. This is to allow government statistical officers to meet regularly with local economists and other stakeholders, before and after release of new data, to discuss the significance and interpretation of each indicator. Meetings will begin mid-2019.