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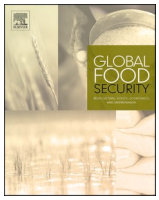

Diet cost and affordability metrics, their application today and in the future

Ensuring that all people can afford a healthy, i.e. nutritious, balanced, moderate and diverse, diet is a prerequisite for ending malnutrition. Diet cost and affordability metrics are useful in revealing the systemic barriers people face to consuming healthy diets and can also be very helpful to identify important geographical and lifecycle related vulnerabilities. This seven-article special issue brings together insights and analysis from the World Food Programme's Fill the Nutrient Gap, an analytical process that captures subnational and intra-household variation in the cost and affordability of diets (Bose et al., 2019). Findings shed light on the heightened vulnerabilities of groups such as adolescent girls, people living in fragile food environments, and those far from the threshold of being able to afford a nutritious diet (the affordability gap). Standardized data from Fill the Nutrient Gap analyses in 37 countries have also been gathered and made available as supplement to the Turowska et al., 2024 paper in this special issue.

Food security is defined as when all people, always, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and cultural food preferences for an active and healthy life. Different indicators of food security have been developed. At the population-level, many of these indicators focus on caloric adequacy of the food supply for populations over a specific period of time, such as the prevalence of undernourishment. At the household-level, indicators on the level of food insecurity experienced (FIES), diversity in food intake as recorded by the food consumption score (FCS), or coping strategies used to mitigate shortfalls of their food supply (CSI) are used. Further indicators are required to measure nutrition security/optimal nutrition. Diversity of food consumption by individuals, such as children aged 6–23 months and women of reproductive age, indicates adequacy of their food supply to meet not only energy needs, but also macro- and micronutrient needs. Nutritional status, as measured by anthropometric or biochemical indicators, is the result of the combination of intake and utilization, including tissue and nutrient losses due to illness.

However, to understand whether dietary inadequacy is due to inadequacies on the supply side and/or the demand side, additional indicators are required. On the supply side, quantity and quality, including diversity, are major issues. On the demand side, lack of access to markets, high food prices relative to what people can afford to spend on food and choices, habits and practices that do not prioritize nutritious foods for healthy diets are concerns. This is where diet cost and affordability metrics come in.

While poverty limits people's access to sufficient, good quality food, the food component of poverty line metrics is based on the cost of a basic food basket. Generally, these basic food baskets would not be sufficiently diverse to meet food-based dietary guidelines and provide for nutritional needs across the lifecycle. In addition, poverty lines, including their food component, are estimated at the national level, while food availability, prices and incomes vary sub-nationally, across seasons, and among different socio-economic and livelihood groups of a population, leading to substantial subnational variation in access to diets that meet health and nutrition needs. Globally, in 2021, 2.8 billion people could not afford what is referred to as a healthy diet (FAO, IFAD, UNICEF, WFP, WHO, 2024) - the lowest cost combination of foods that meets food-based dietary guidelines (Herforth et al., 2020). Acknowledging that being able to afford a healthy diet does not mean that people choose a healthy diet, affordability is a pre-requisite for being able to do so.

Balagamwala, Kuri et al. (2024) introduce the affordability gap, a metric that captures the extent to which people cannot afford a healthy or nutrient adequate diet, in addition to the proportion of people who cannot afford it. The affordability gap and the proportion who cannot afford a healthy or nutrient-adequate diet, are insightful metrics to gauge the risk of food and nutrition insecurity. The close association between affordability of diets and risk of inadequate diets is shown in Kuri et al., 2024 in this issue. These metrics also enable governments and partners to assess the potential of different interventions to reduce the affordability gap based on their modelled impact on lowering the cost of meeting food and nutrition needs or increasing food expenditure, including from households' sale of nutritious foods they produce. Effectively reducing the affordability gap requires nutrition-specific and -sensitive interventions across multiple sectors. The ability to quantify the potential contribution from interventions as diverse as homestead-level nutritious food production, improvement of egg value chains, staple food fortification, local production of appropriate fortified complementary foods, cash transfers, fresh food vouchers and multiple micronutrient supplements, has proven to be very helpful. As documented by the multi country evaluation of FNG analyses, the application of cost and affordability metrics; modelling to identify potential contributions from different sectors to improve economic access to nutritious diets; and country-led analytical processes, have successfully engaged multiple sectors around the why and how of nutrition integration (Knight et al., 2024). The design of government social protection programs (WFP, 2024), school meals, food processing including fortification, and food assistance provided by WFP and other actors, are some areas where the application of the diet cost and affordability metrics as part of the FNG analysis and stakeholder engagement process have been

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shown to be particularly useful.

As explained in the Klemm et al., 2025 and Turowska et al., 2024 papers, food prices used for WFP's FNG analyses were obtained from one of three sources a) CPI or market monitoring data from countries' Bureau of Statistics, Ministry of Agriculture or research department; b) household-reported food expenditure data from household consumption and expenditure surveys; or c) extensive food price data collection in markets, recording prices of most non- and minimally-processed foods. These food prices were used for the individual country FNG analyses. For this special issue they were also used for further analyses reported in the Klemm et al., 2024 and Shepperdley et al., 2024 papers. Klemm et al., 2024 found that children's dietary diversity as well as consumption of iron and vitamin A rich foods was lower in food environments with lower market assortment, higher minimum price and higher relative caloric price of nutrient-dense foods, and that these could vary as much within as between countries. Identifying sub-national drivers of availability, assortment and relative price is important to drive towards change. Shepperdley et al., 2024 introduce a novel market score that captures food assortment and prices, and examine for Mali, Burkina Faso and Mauritania how that relates to nutritious diet cost and affordability, and to rainfall, infrastructure and conflict as structural drivers of food insecurity. This provides granular insights into sub-national drivers of food and nutrition insecurity, which are important both for anticipatory as well as for mitigating actions.

The theme of the 2020 State of Food Security and Nutrition in the World, or SOFI, report was diet cost and affordability (FAO, IFAD, UNICEF, WFP, WHO, 2020). It introduced it as an indicator of food and nutrition security and reported on the cost and affordability of energy-only, nutrient-adequate and healthy diets globally. It included a national-level data point for 183 countries, based on the 2017 ICP (International Comparison Programme) price data submitted by countries and income data from the World Bank's PovCal database. Subsequent SOFI reports have updated the healthy diet cost and affordability metrics, with the 2024 report using the new, 2021, ICP data and a more precise method for estimating affordability (FAO, IFAD, UNICEF, WFP, WHO, 2024). The Klemm et al., 2025 paper describes how sub-national and lifecycle-specific estimates of diet costs as applied in FNG analyses support the formulation of country-specific nutrition-sensitive policies and programmes.

Countries are also increasingly monitoring cost and affordability of diets, with support from WFP and/or the Food Prices for Nutrition team (Wallingford et al., 2024; Chui and Donelly, 2024), to understand and respond to shifts in vulnerability and unpack drivers of food and nutrition insecurity. In West Africa the cost and affordability of nutritious diet metric has been adopted as a 'contributing factor' indicator for food security within Cadre Harmonisé (CH), reflecting the dimensions related to economic access and utilization (Cadre Harmonisé, 2023). The Permanent Interstate Committee for Drought Control in the Sahel (CILSS) have together with WFP initiated monitoring of cost and affordability to inform CH in Benin, Burkina Faso, Mali, Niger, Senegal and Togo in 2024, with plans to gradually scale up to all 17 countries in the region. Similar diet cost and affordability monitoring initiatives are taking place in Sri Lanka, Nigeria, Pakistan and Ethiopia. This attests to the interest in the metrics and their diverse application to inform shorter and longer-term programming and strategies to improve food security and access to nutritious foods, to ensure healthy diets.

With the increasing availability of data on food prices, as well as food composition and nutritional requirements (Allen et al., 2019) and advancement of analytical tools, the options for estimating diet cost and affordability metrics and their modeling are expanding. Around 20 years ago, Save the Children UK (SC-UK) developed an excel-based tool that applied linear programming to select the lowest cost combinations of foods in a defined geographic area that could meet energy and/or nutrient needs. This analysis used a list of user-collected food prices, and restrictions could be added in terms of minimum and maximum amounts of foods included, to align with dietary choices of the specific population. SC-UK eventually transferred the tool, called 'Cost of the Diet', to a more user-friendly software (Deptford et al., 2017), which, since 2015, the WFP have used to conduct the FNG analyses reported on in this special issue. As WFP and partners' demand for cost and affordability metrics grew, including for the FNG analysis, often needing larger data sets, covering over 50 different urban and rural locations within a country with data for more than 100 food items at multiple points in time (seasonal or trends over multiple years), we identified the need for a more advanced analytical platform. In 2020, WFP together with the Zero Hunger lab of Tilburg University in the Netherlands, Capgemini Netherlands and Johns Hopkins University, embarked on the development of a new platform for conducting diet optimization analyses, named *Enhance* WFP. Enhance platform. https://enhancedietsanalytics.wfp.org.

Enhance allows users to upload their own food price data, link them to foods from the embedded food composition tables, and model and obtain costs for food baskets ('diets') of their choice for different target groups (Koenen, 2024, WFP. 2024. Enhance platform. https://enhancedietsanalytics.wfp.org). Enhance includes a wide range of food basket options - baskets that meet energy needs, nutrient needs, are healthy (meeting nutrient and diversity needs), baskets that meet the nutrient needs of children suffering from moderate acute malnutrition, as well as baskets that provide the best possible nutritional value without exceeding a certain cost, and baskets that remain within or close to current dietary patterns (based on user-input data) while meeting food-based dietary guidelines. Users have the option to share their data and/or their results with other users via the platform.

Furthermore, the Enhance database also has environmental indicators, including greenhouse gas emissions, land use and fresh water use. Using these indicators allows users to estimate the environmental requirements and impacts of selected baskets, and to conduct optimization to identify food combinations that most optimally meet dietary needs, budget constraints, impact of climate change (e.g. fresh water availability) and/or national targets for greenhouse gas emissions from food production and consumption. Results of the multi-objective optimization of Enhance provide valuable insights for setting trajectories of change for food systems in order to better provide for affordable, healthy (nutritious, balanced, moderate and diverse) diets that are produced within current and predicted local constraints and in ways that stay within planetary boundaries.

In summary, the estimation and use of diet cost, affordability and affordability gap metrics has expanded rapidly over the past 15 years, with applications from multiple actors in this field, ranging from assessments and monitoring of diet cost to assessing current and projected food security and nutrition situations. This information is used to inform the design of humanitarian food and nutrition assistance, of nutrition-sensitive social protection programmes, to guide multisectoral national nutrition strategies, and advocate for more investment in contextualised solutions to reduce the affordability gap, examples of which are showcased in this special issue. The Turowska et al., 2024 paper in this special issue also describes the FNG dataset for the first 37 countries that is downloadable as a supplement to that paper. Meanwhile, the availability of tools to estimate the metrics is also increasing, with Enhance being the latest and very comprehensive addition that also includes multi-objective optimization to identify food combinations that can provide for healthy (nutritious, balanced, moderate and diverse), affordable, climate change adapted and sustainably produced diets.

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