AFFORDABILITY OF NUTRITIOUS FOODS FOR COMPLEMENTARY FEEDING IN **INDIA**

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KEY MESSAGES

- Several foods commonly available to households in India are rich in nutrients lacking in the diets of young children. Yet resource-constrained households (the lowest spending 10–30%, based on food expenditures adjusted for household composition) struggle to afford enough of these nutritious foods to meet even 50% of the dietary requirements for zinc, calcium, and iron for their children under age two.
- While dietary gaps in vitamin A and vitamin B_{12} persist, it is unlikely that they are due to unaffordability: even households that spend very little on food can afford dark leafy green vegetables, liver, orange-fleshed vegetables, or fish in large enough quantities to meet half of the nutrient needs of young children.
- Protein and folate requirements could also be affordably met by most households but may present affordability barriers to the lowest-spending 10–25% of households.
- The most affordable nutritious foods to fill nutrient gaps are dark leafy green vegetables (folate, calcium, vitamin A, iron, as well as all six micronutrients considered here combined); pulses (zinc, folate, iron); fish (protein, vitamin B_{12}); liver (vitamins A and B_{12}, folate [chicken liver], all six micronutrients); milk (protein, vitamin B_{12}, vitamin A, all six micronutrients), eggs (protein, all six micronutrients); and okra (folate).
- A combination of several strategies—including price reductions, promotion of homestead production of certain foods, demand creation for certain foods, cash transfers in the short term, and increased incomes in the long term—will be essential to improving the diets of young children among resource-constrained households in India.

WHY DOES AFFORDABILITY OF COMPLEMENTARY FOODS MATTER IN INDIA?

India is a lower-middle-income country with a per capita gross national income (GNI) of $2,020 and a population of around 1.4 billion people, making it the second most populous country in the world.[1-3] The third-largest economy globally, India maintained strong economic growth rates—above 5%—from 2013 to 2018, making it the fastest-growing major economy in the world.[2] Agriculture accounts for almost half of India's workforce (70% of rural households in India still depend primarily on agriculture for their livelihoods) but only 15% of its GDP.[4,5] India accounts for a quarter of the world's hungry people, and poverty rates hover around 22%.[2,5] Among children under age five, 35% are stunted, 17% are wasted, and 41% are anaemic, and only 21% of children 6–23 months old consume an adequately diverse diet.[6]

Many children in the complementary feeding period—the period when infants and young children are 6–23 months old and breast milk is no longer sufficient to meet their nutritional needs—do not consume enough iron, vitamin A, calcium, zinc, folate, vitamin B_{12}, and animal-source protein, and these shortfalls hinder their growth and development.[7,8] Unaffordability is an important barrier, among others, to the consumption of foods rich in these important nutrients. However, the extent to which unaffordability is a barrier for specific nutrients and which foods are the most affordable sources of these nutrients are unclear. This brief summarizes the affordability of nutritious foods that could fill important nutrient gaps during the complementary feeding period and discusses implications for policy and programmes.

METHODS

Using household expenditure data and price data estimated from India's 2011 National Sample Survey on Household Consumer Expenditure (round 68),[9] we benchmarked the cost of foods that could meet nutrient requirements against current household food expenditures to assess affordability, using a previously developed method.[10] Because nutrients are generally obtained from a combination of foods, we analysed whether households could afford to meet half of the daily requirements for protein, iron, vitamin A, calcium, zinc, folate, and vitamin B_{12} for their children under age two through specific foods. These foods were chosen because of their nutrient content and availability in India. For protein, only animal-source foods were used since plant-based sources of protein are generally not complete in essential amino acids critical for child growth and development.[11] We calculated the cost of realistic portion sizes required to meet 50% of nutrient needs from complementary foods (since nutrient requirements are met through a combination of foods), adjusting for refuse, cooking yield, and bioavailability where applicable.[10] To assess the relative affordability of nutrients and foods, these costs were compared with current food spending per adult equivalent (a method of adjusting for household size and composition) for each household with children under age two surveyed. To

assess absolute affordability, we established a threshold of 10% of household food spending per adult equivalent, based on previous analysis.[10] We also assessed foods in terms of their affordability for meeting needs for several micronutrients in combination. In this joint micronutrient analysis of six key micronutrients commonly lacking in the diets of infants and young children, we calculated which foods are most affordable at providing an average of one-third of a young child's daily nutrient requirements from complementary foods. Finally, we compared the relative costs of energy among those foods that provide at least 100 kilocalories of energy in a 100-gram (g) portion (a threshold of 50 g was used for milk). It is important to note that this research contains several limitations, which are described in Ryckman et al. (2021).[10]

HOUSEHOLD FOOD EXPENDITURE AND CONSUMPTION PATTERNS

On average, households with children under age two in India devoted 57% of expenditures to food (that is, the total value of food consumption from purchases, home production, and in-kind sources), with an average of 21% of food expenditures allocated to cereal products and 15% allocated to dairy products. Other food groups accounted for less than 10% of total food expenditures. Virtually all households (99–100%) consumed cereal products, pulses, and vegetables; 95% consumed roots and tubers; and 90% consumed dairy. Fruit was consumed by 74% of households, and meat, fish, and/or eggs were consumed by 54% of households.

Of the specific foods chosen for this analysis as possibilities to meet one or more likely nutrient gaps, the most commonly consumed was pulses, followed by fresh milk (87%) and dark green leafy vegetables (59%) (Figure 1). Pulses, milk, and dark green leafy vegetables were the only analysed foods for which more than 2% of households consumed their own production, at rates of 10%, 23%, and 9% of households, respectively. Okra, pumpkin, and eggs were consumed by 30–36% of households, while the remaining foods were consumed by fewer than one in four households. All foods were less commonly consumed than cereal products.

AFFORDABILITY BY NUTRIENT

Animal-source protein: Fresh fish was the lowest-cost animal source of protein, followed by eggs and fresh milk (Figure 2). All three foods fell below the 10% affordability threshold for the average household with children under age two. Fish was affordable for 93% of households (based on the 10% threshold), while milk and eggs were affordable for 71–78% of households (Figure 3). Chicken and yogurt fell slightly above this threshold, costing an average of 14% and 16% of weekly adjusted household food expenditures per adult equivalent, while goat/mutton cost 21% of food expenditures. However, these three foods were unaffordable for the majority of households.

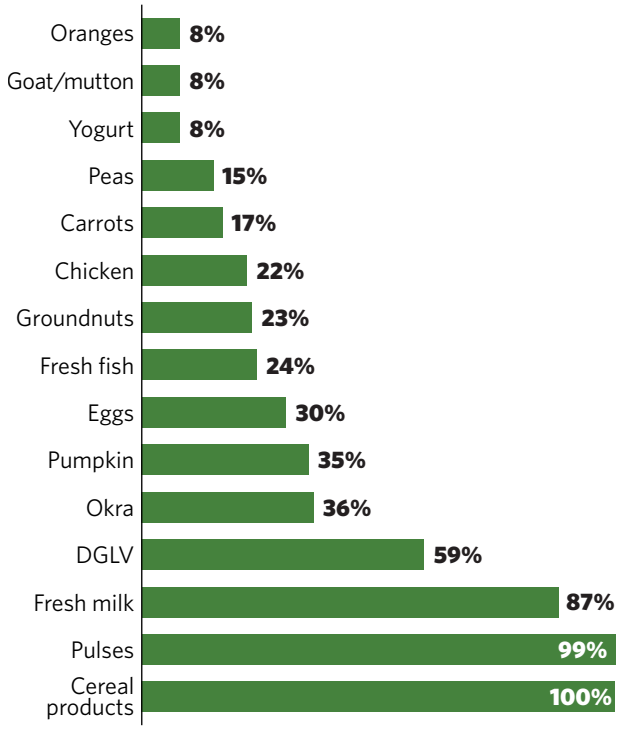

FIGURE 1. Percentage of surveyed households that had consumed selected foods in the past week. Data are from 10,868 households in the 2011 National Sample Survey.[9] DGLV = dark green leafy vegetables.

Calcium: Dark green leafy vegetables were the most affordable source of calcium, costing 7% of adjusted food expenditure on average. However, 19% of households may face affordability barriers in accessing adequate quantities of dark leafy greens. The next most affordable source of calcium was fresh milk, averaging 13% of adjusted household food expenditure but exceeding 10% for more than half of households.

Folate: Portion sizes of dark green leafy vegetables, pulses, okra, and chicken liver that meet 50% of folate needs all cost less than 10% of adjusted food expenditure, on average. These foods also cost less than 10% of adjusted food expenditure for 61–93% of households. Peas and groundnuts (11% and 15% of adjusted food expenditure, respectively) could also be affordable options to meet folate needs for some households.

Iron: Dark green leafy vegetables and pulses could meet 50% of children's iron requirements from complementary feeding for 9% and 11% of adjusted food expenditure,

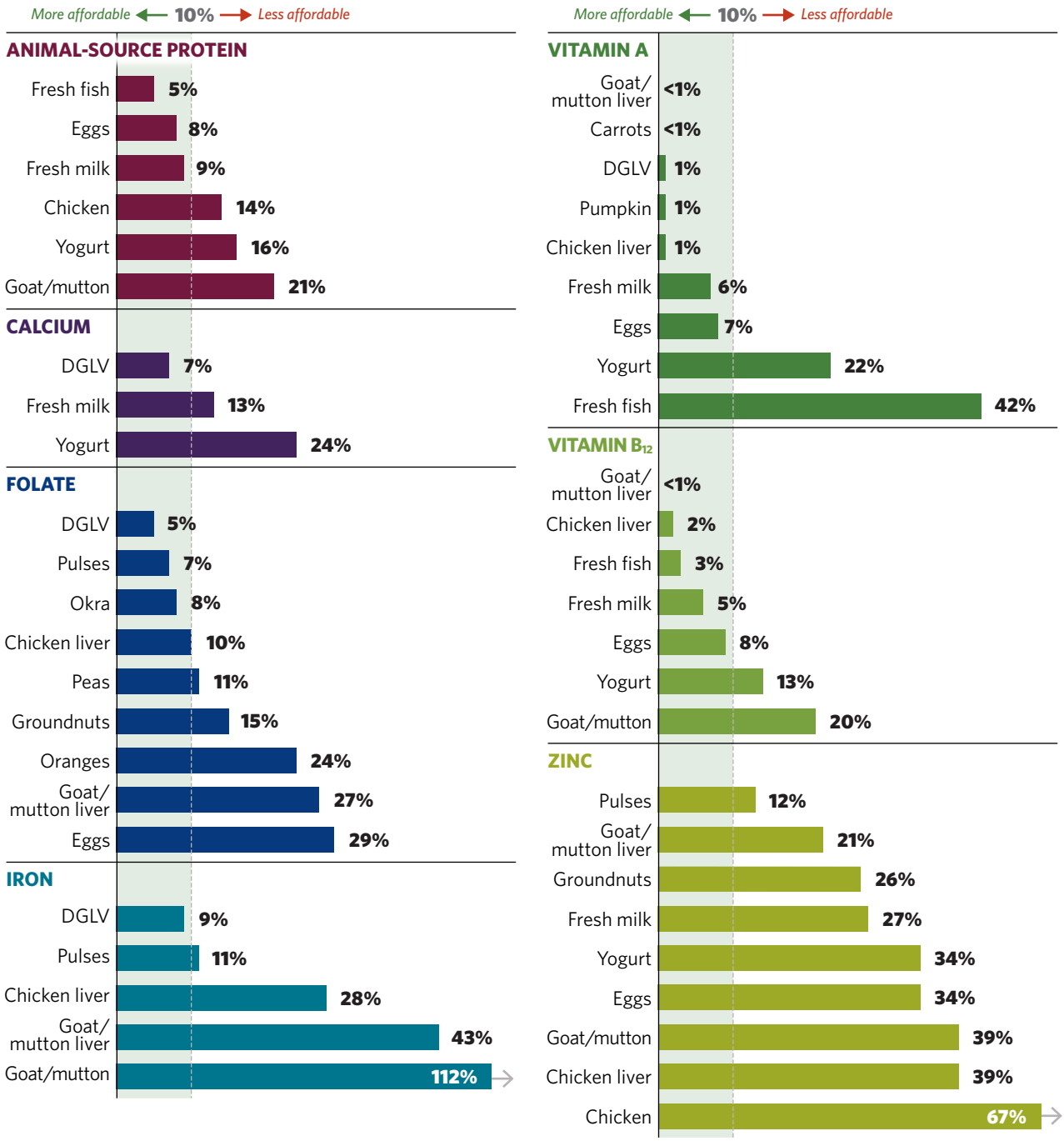

FIGURE 2. Share of food expenditures per adult equivalent needed to meet half of nutrient requirements from complementary foods. The dashed line represents the affordability threshold of 10%. Bars below the dashed line are considered affordable. Household expenditure data are from 10,868 households in the 2011 National Sample Survey.[9] Nutrient densities are mostly from the United States Department of Agriculture food composition database as well as regional food composition tables and published studies.[12-15] Nutrient requirements from complementary foods are from Ryckman et al. (2021).[10] DGLV = dark green leafy vegetables.

respectively (on average). However, at a 10% affordability threshold, dark green leafy vegetables would be unaffordable for 31% of households and legumes would be unaffordable for 50% of households. Other sources of iron vastly exceeded the 10% threshold and would be unaffordable for most households.

Vitamin A: Multiple foods could be used to affordably fill likely gaps in vitamin A consumption, including goat/mutton liver, carrots, dark green leafy vegetables, pumpkin, and chicken liver, all of which cost less than 2% of adjusted food expenditure for the average household and cost less than 10% of adjusted food expenditure for 100% of households. Fresh

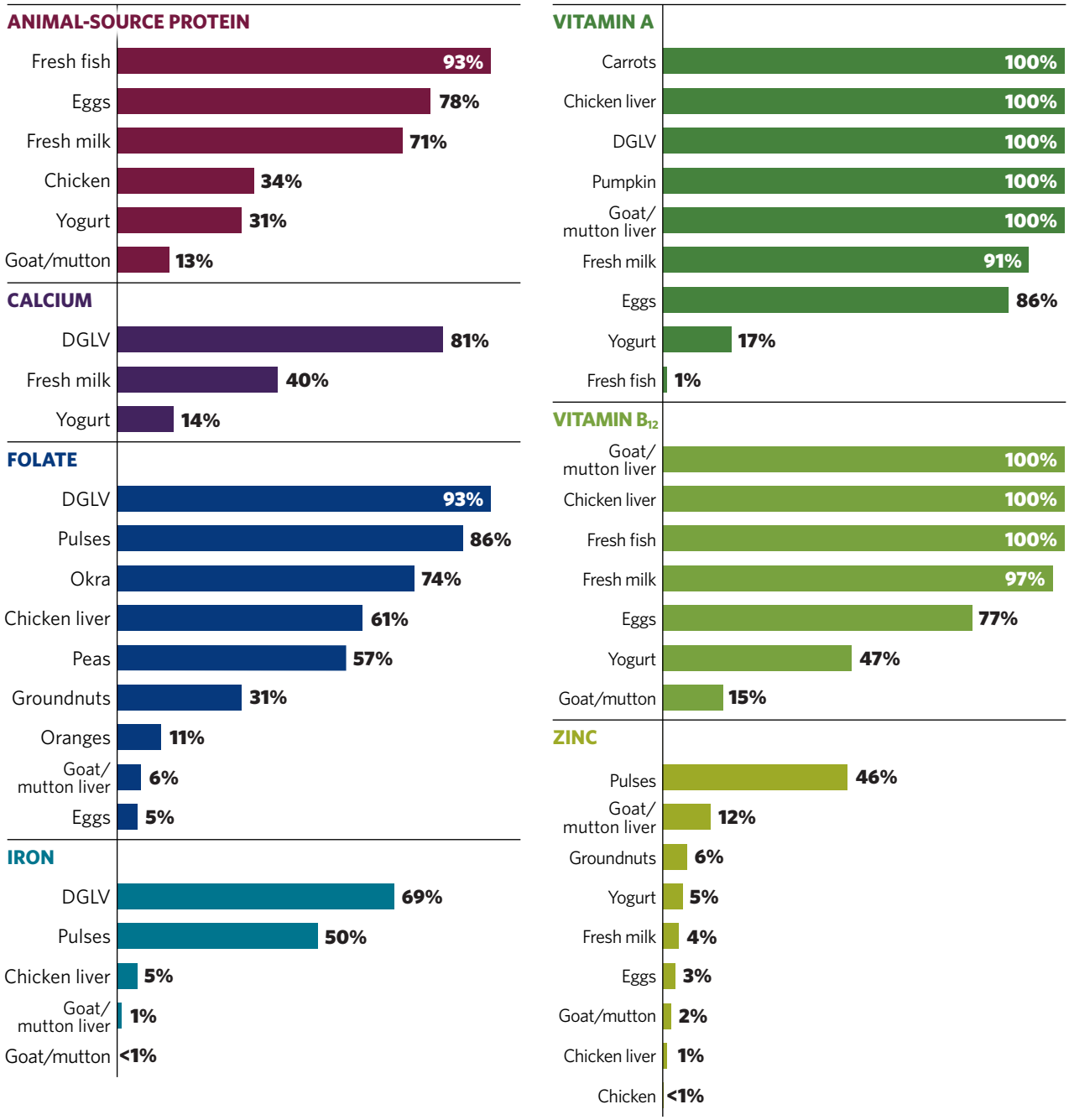

FIGURE 3. Percentage of households able to afford portion sizes meeting half of nutrient requirements from complementary foods. Foods were considered affordable if their required share of food expenditures per person was below the affordability threshold of 10%. Household expenditure data are from 10,868 households in the 2011 National Sample Survey.[9] Nutrient densities are mostly from the United States Department of Agriculture food composition database as well as regional food composition tables and published studies.[12-15] Nutrient requirements from complementary foods are from Ryckman et al. (2021).[10] DGLV = dark green leafy vegetables.

milk and eggs could also meet half of vitamin A requirements for less than 10% of adjusted food expenditure.

Vitamin B_{12}: Goat/mutton liver, chicken liver, and fresh fish could all meet half of vitamin B_{12} requirements for 3% or less of adjusted food expenditure, on average, and would be affordable at a 10% threshold for 100% of households. Milk costs 5% of adjusted food expenditure on average and is affordable for 97% of households. Eggs could also be an affordable option for more than three-quarters of households.

Zinc: None of the analysed foods could meet 50% of zinc requirements from complementary feeding while

costing less than 10% of adjusted food expenditure for the average household. Pulses (12%) were the only food that cost less than 20% on average, but they would exceed 10% for more than half of households. The next most affordable sources of zinc were goat/mutton liver, groundnuts, and fresh milk, but at a 10% threshold they would be out of reach for 88% or more of households.

AFFORDABILITY ACROSS MULTIPLE MICRONUTRIENTS

Goat/mutton liver, chicken liver, dark green leafy vegetables, fresh milk, and eggs, which were affordable options to fill one or more single micronutrient gaps, are also considered affordable sources of multiple micronutrients in combination (Figure 4). Notably, dark green leafy vegetables and groundnuts were the only plant-source foods that could achieve one-third micronutrient requirements with daily portion sizes of 100 g or less. Groundnuts were also at the threshold of affordability as a source of multiple micronutrients. Fresh fish, goat/mutton, and chicken, which were generally not affordable sources of single micronutrients (with the exception of fresh fish as a source of vitamin B_{12}), were also less affordable options to fulfil multiple micronutrient requirements simultaneously.

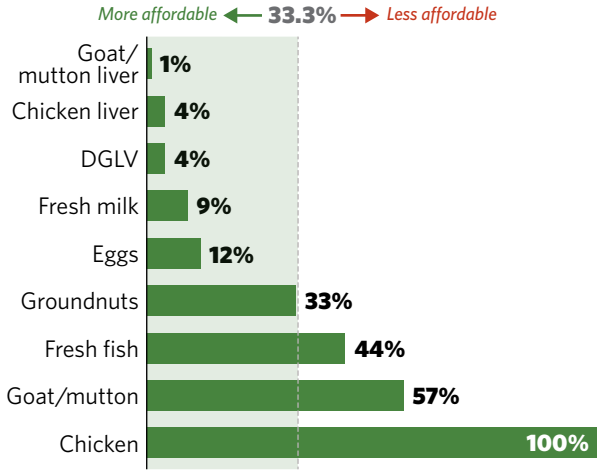

FIGURE 4. Share of food expenditures per person needed to provide an average of one-third of a young child's requirements for iron, vitamin A, zinc, folate, vitamin B_{12}, and calcium. The affordability threshold (dashed line) was set at one-third (33.3%) of food expenditures because this analysis is based on meeting an average of one-third of requirements for six micronutrients from complementary foods. The share of daily requirements of each nutrient provided by the specified quantity of food was capped at 100%. Household expenditure data are from 10,868 households in the 2011 National Sample Survey.[9] Nutrient densities are mostly from the United States Department of Agriculture food composition database as well as regional food composition tables and published studies.[12–15] Nutrient requirements from complementary foods are from Ryckman et al. (2021).[10] DGLV = dark green leafy vegetables.

DIETARY ENERGY AFFORDABILITY

While animal-source foods tend to be more nutrient dense than plant-source foods, as seen in Figure 4, they are much higher cost in terms of their energy composition (Figure 5). The lowest-cost nutritious foods to fulfil daily energy requirements were pulses and groundnuts. However, even these foods cost three to four times as much as the lowest-cost (but nutrient-poor) staple, unfortified wheat flour. Of the animal-source foods, milk and eggs were the lowest-cost, while chicken and goat/mutton cost the most.

CONCLUSIONS

In summary, vitamin A, vitamin B_{12}, and folate are three relatively affordable nutrients for which there is evidence of consumption gaps among children of complementary feeding age. Nearly all households (93–100%) could obtain adequate quantities of these nutrients through dark green leafy vegetables (folate and vitamin A), chicken liver (both vitamins; it is also a relatively affordable source of folate), goat/mutton liver (both vitamins), fresh milk (vitamin B_{12}; it is also a relatively affordable source of vitamin A), fresh fish (vitamin B_{12}), and orange- and yellow-fleshed vegetables such as carrots and pumpkin (vitamin A). Some low-resource households (10–25%) may still face challenges in obtaining adequate quantities of folate, since the only affordable option for these households is dark green leafy vegetables, for which availability and prices may vary seasonally.[10]

Protein is the next most affordable nutrient, and many households could obtain animal-source protein from fresh fish, eggs, and/or milk. However, 10–25% of

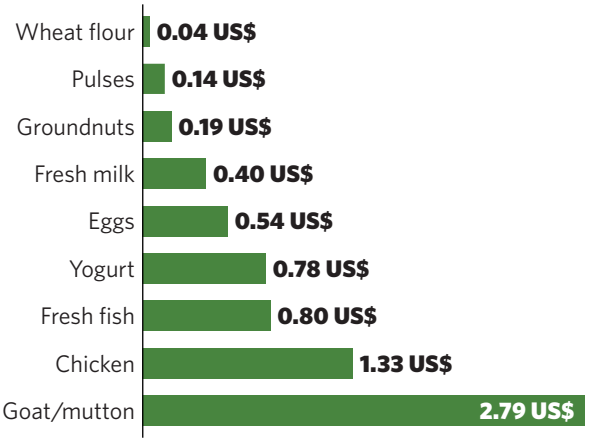

FIGURE 5. Cost of daily dietary energy requirements from complementary foods (450 kilocalories). Price data are estimated from the 2011 National Sample Survey.[9] Dietary energy densities are mostly from the United States Department of Agriculture food composition database as well as regional food composition tables.[12,13] The cost of 450 kilocalories is shown because this is the average daily dietary energy requirement for a child aged 6–23 months.

households will likely face affordability barriers to purchasing adequate quantities of these foods. Additionally, many households in India do not consume flesh foods for cultural or religious reasons, limiting some households' options for meeting children's animal-source protein needs to dairy.

Dark green leafy vegetables are the only food that could meet half of calcium and iron requirements for less than 10% of adjusted food expenditure for the average household. For 20–30% of households, even this most affordable option would likely present cost challenges. Less than half of households could afford to supply children of complementary feeding age with adequate quantities of zinc. Pulses were the lowest-cost option to fill likely zinc gaps and were also the second lowest cost option to meet iron and folate needs.

Some foods can supply several of the six micronutrients gaps simultaneously. The most affordable of these foods are liver, dark green leafy vegetables, milk, and eggs, and for some households, groundnuts.

Possible interventions to help reduce likely nutrient gaps among children of complementary feeding age in India therefore include the following:

- Reduce the prices of several foods that are affordable for many households but infeasible for 10–30% of the lowest-resource households. These foods include dark green leafy vegetables, pulses, fish, eggs, and milk.
- Support households in producing their own dark green leafy vegetables, milk, and legumes, which could fill several nutrient gaps. Given that 9-20% of households already consume their own production of these foods, they are feasible options for expansion.
- Provide iron supplementation and iron and/or zinc fortification or biofortification. These two nutrients are the least affordable and may require interventions beyond those aimed at improving food affordability.
- Expand social protection schemes and other efforts to boost the incomes of low-resource households, some of which may continue to be constrained by unaffordability even if they are able to access these foods at lower prices.
- Adopt social behaviour change interventions to increase demand for and consumption of foods that were found to be affordable sources of one or more nutrients (dark leafy green vegetables, liver, milk, fish, orange-fleshed vegetables) but that may not be widely consumed.

Future research priorities include exploring these various options and gaining a better understanding of the dietary choices of young children. It will also be valuable to gather more information on the acceptability of liver, both in general and specifically for young children; consumption data were scarce, but liver was found to be an affordable source of several nutrients, both individually and jointly.

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