

Understanding the demand for “protective foods” in East Africa: An economic analysis with policy recommendations

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Key messages

- Suboptimal diets are a major risk factor for avoidable death and disease in low- and middle-income countries.
- Evidence shows that some foods or food components (e.g., processed red meat, saturated fat, salt, sugar) significantly elevate the risk of noncommunicable diseases and mortality, while others protect health (e.g., vegetables, fruits, pulses, nuts/seeds, fish, whole grains—referred to in this document as “protective foods”)
- We used household surveys to compare dietary patterns in Ethiopia, Kenya, Tanzania, and Uganda to the EAT-Lancet healthy reference diet and to quantify and explain consumption gaps for nutritious foods.
- Compared to the EAT-Lancet healthy reference diet, consumption gaps for pulses and nuts/seeds, vegetables, and fruits are large for both poor and rich consumers in rural and urban areas in the four countries studied, while consumption gaps for meat, fish, and eggs and dairy foods are much larger for lower income groups.
- Food expenditures of most households in these four countries are far too low to allow consumption of the healthy reference diet; animal-source foods and vegetables are the largest cost components of food expenditures, although quantities consumed of both food groups are much lower than the EAT-Lancet healthy reference diet.
- Income elasticities of demand for pulses and nuts/seeds and vegetables are often low or moderate, suggesting weak consumer preference for these foods, while income elasticities for fruits and animal-source foods are relatively high.
- Income growth alone will not solve dietary problems in East Africa; in addition to supply-side interventions to improve affordability, special interventions are required to increase consumer demand for underappreciated protective (nutritious) foods such as pulses and nuts/seeds and vegetables.

The challenge of achieving healthier diets

Globally, suboptimal diets are one of the most important preventable risk factors for noncommunicable diseases (NCDs), accounting for 22% of all deaths and 15% of disability-adjusted life years among adults (Afshin et al., 2019). There is also mounting evidence that some foods or food components (processed red meat, saturated fat, salt, sugar) significantly elevate the risk of NCDs and mortality, while others (vegetables, fruits, pulses, nuts/seeds, whole grains, and fish) provide protective effects (and are referred to here as “protective foods”). The influential EAT-Lancet report shows that people in most regions of the world underconsume protective foods and that in middle- and high-income countries especially, large proportions of the population overconsume unhealthy foods. The report estimates that a transformation to healthy diets by 2050—which would also bring tremendous environmental benefits—would require reducing global consumption of unhealthy foods by half and more than doubling the consumption of nutritious foods (Willett et al., 2019).

Although the health and environmental benefits of moving to healthier diets are now better understood, the economic and behavioral challenges to achieving dietary change are not, especially among consumers in low- and middle-income countries (LMICs). Most LMICs now face multiple burdens of malnutrition—persistent problems of widespread maternal and child undernutrition and micronutrient deficiencies coexisting with rapid rises in overweight/obesity (Popkin et al., 2020). Dietary changes in LMICs are accelerating these trends and exacerbating the double burden of malnutrition. Traditional diets typically include some nutritious foods such as whole grains and pulses, but often lack adequate quantities of nutritious and protective foods. With nutrition transitions occurring in many LMICs, traditional diets are being replaced by diets that include more refined grains, animal-source foods, oil, and sugar—often from cheap, ultra-processed foods that are rich in calories, sodium, added sugars, and saturated fats but are poor in vitamins, minerals, and protein. Two recent global studies used International Comparison Program price data to illustrate the economic barriers to consuming a healthy diet for LMIC populations. The first shows how expensive different foods are in caloric terms relative to starchy staples: shifting from staples to nutrient-rich foods (with the exception of pulses and nuts/seeds) is typically very expensive, while shifting to foods rich in added sugars and fats and to highly processed foods is much more affordable in pure caloric terms (Headey and Alderman, 2019). The second is a costing study of the EAT-Lancet healthy reference diet that shows that 1.5 billion people could not afford this global reference diet even if they spent their entire income on food (Hirvonen et al., 2020). At the same time, the high cost of nutrient-rich foods in poor countries points to supply-side problems. Moreover, even as incomes rise in LMICs, convenience and taste factors may drive consumers to purchase unhealthy, highly processed foods instead of fresh vegetables and fruits and nutrient-rich animal-source foods. Demand-side barriers to healthy diets in LMICs are therefore more complex for middle-income consumers than for the poor because middle-class households have larger budgets and therefore more food and dietary choices.

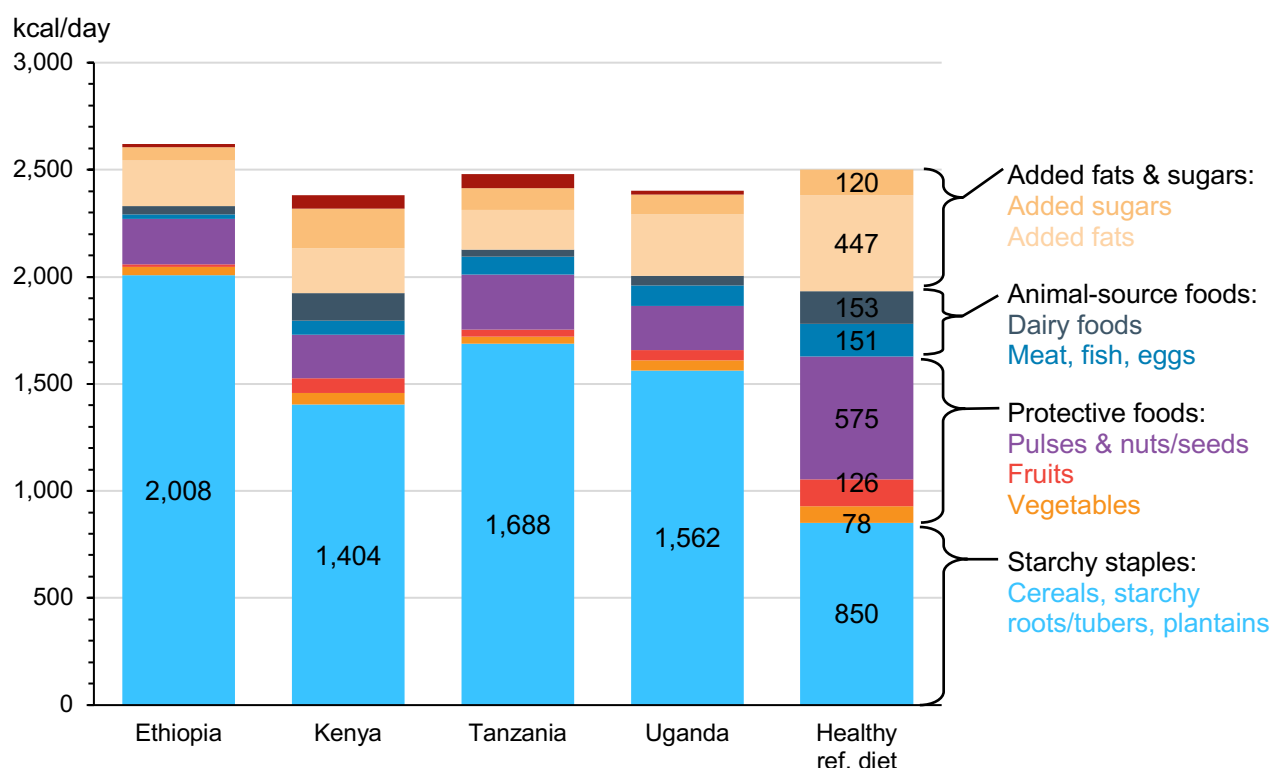
In this study, we sought to understand the drivers of consumer demand for protective foods in four East African countries (Ethiopia, Uganda, Kenya, and Tanzania) whose economies, food systems, and diets are rapidly transforming. We used recent nationally representative household survey data to document average dietary patterns relative to the composition of the healthy reference diet proposed by the EAT-Lancet Commission (Willett et al., 2019) to examine the factors that explain the divergence of actual diets from the healthy reference diet in rural and urban areas, and to identify potential interventions that could support a shift toward healthier diets.¹

Are average diets in East Africa meeting the intake levels of the EAT-Lancet healthy reference diet?

The EAT-Lancet healthy reference diet includes a balanced mix of vegetables, fruits, pulses, nuts/seeds, dairy foods, and (white or red) meat, fish, and eggs, and allows only a third of total calories to come from starchy staples and very limited quantities of added fats and sugars. Figure 1 reports average calorie consumption amounts and composition by main food groups for the populations in four East African countries and compares these averages to the midpoints of the possible calorie intake ranges of the healthy reference diet.² Note that the food groupings used here are driven by the datasets used, which combine into single groups pulses and nuts and meat, fish, and eggs, respectively.

The contrast between the actual diets of consumers in these four LMICs and the EAT-Lancet healthy reference diet is stark. Many people are consuming far too many calories from starchy staples, which account for 59%–77% of total calories consumed at home, on average. These nutrient-poor but calorie-dense diets may explain why all four countries still have high rates of preschooler stunting (>30%) and rapidly rising rates of adult overweight and obesity. The most recent Demographic Health Surveys suggest that overweight or obesity in the four countries affects 21%–43% of women in urban areas and 4%–26% of women in rural areas (ICF, 2015).

Figure 1. Calorie consumption per AE and composition by food group in four East African countries in comparison to the EAT-Lancet healthy reference diet



Source: Authors' estimates from nationally representative surveys in 2014–2017.

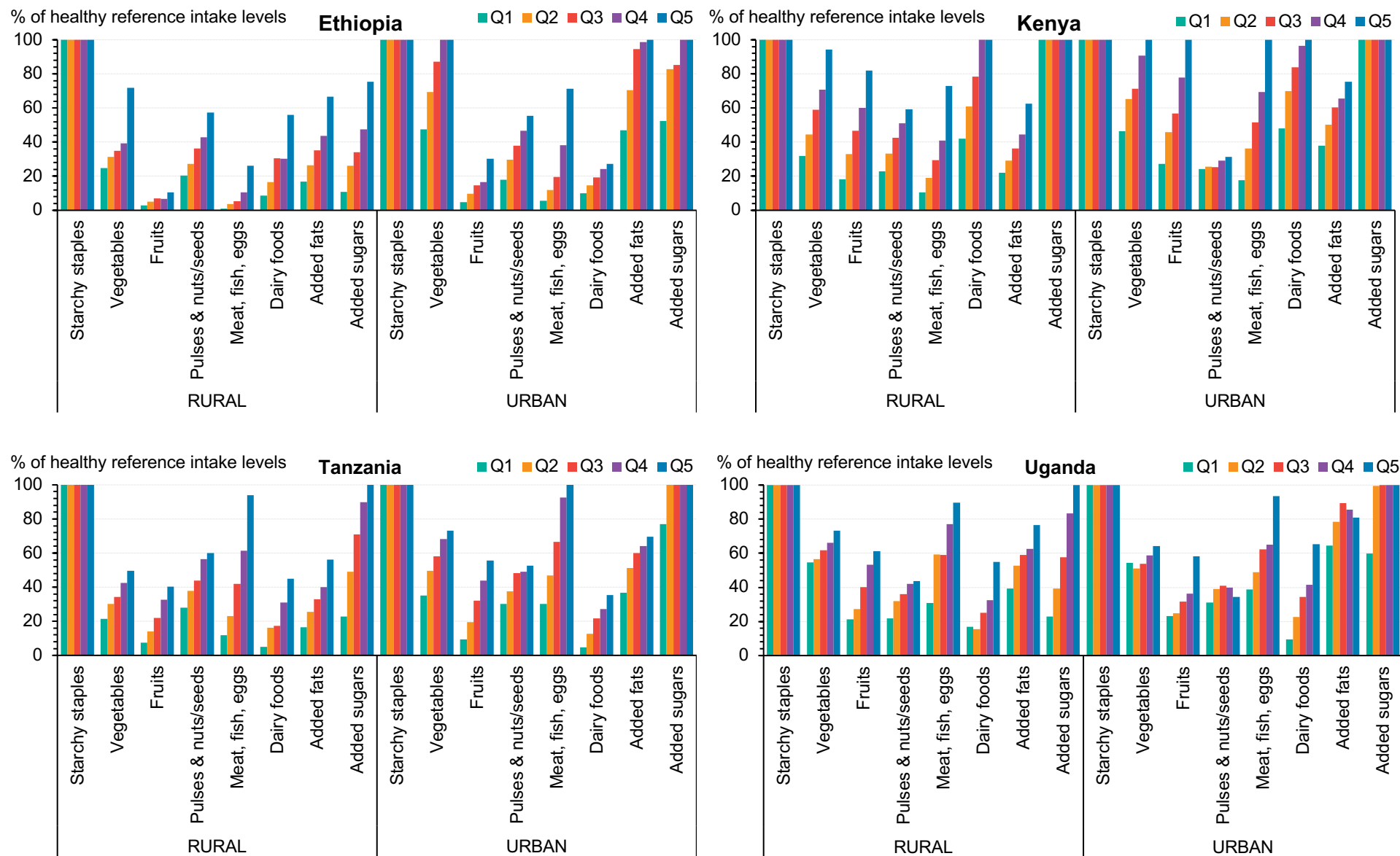
Note: One adult equivalent (AE) corresponds to an average adult with a calorie requirement of 2,500 kcal/day—the total calorie intake of the EAT-Lancet healthy reference diet. Calorie consumption estimates refer to food consumed at home only. The top (dark red) bar depicts calories from diverse, nonrequired foods such as snacks and beverages.

This dependence on starchy staples means that average consumption gaps for nutritious foods are consistently large in the four countries, but the size of these gaps generally varies between rural and urban areas and by income quintile within these areas, as shown in Figure 2. For some food group–country combinations, the gaps in consumption of nutritious foods are large for all income quintiles—especially in rural areas, where average household incomes are lower than in urban areas and average calorie consumption even in the higher income quintiles is far below the intake levels of the EAT-Lancet healthy reference diet. In urban areas, however, consumption gaps tend to diminish for some nutritious food groups, especially among richer consumers. In Kenya, the wealthiest of the four countries, for example, there are smaller gaps in the consumption of protective foods. The average calorie consumption amounts of vegetables, fruits, dairy foods, and meat, fish, and eggs of urban Kenyans in the highest income quintile are above the midpoints of the possible intake ranges of the healthy reference diet; and, on average, rural Kenyans with household incomes in the top two quintiles consume sufficient calories from dairy foods. These differences in dietary patterns by income group also shed some light on food preferences. Across all four countries, consumption of meat, fish, and eggs and of fruits, for example, rises sharply as real income increases, suggesting that these are preferred foods. In contrast, consumption of vegetables and of pulses and nuts/seeds tends to increase modestly with rises in real income, suggesting weak income preferences for these food groups. Another consistent pattern of concern is that many consumers in higher income quintiles, especially in urban areas (and across all income quintiles in rural and urban Kenya), overconsume added sugars and consume added fats amounting to at least 60% of the healthy reference intake levels even without the inclusion of snacks and beverages consumed at home and foods consumed away from home. In all four countries, more than half of households in the highest income quintile in urban areas and more than a quarter of households in the highest income quintile in rural areas spend at least \$2 (2011 PPP) per person a day on away-from-home food consumption, suggesting that consumption of unhealthy foods is likely high for better-off households in East Africa.

Are household food budgets too low for the EAT-Lancet healthy reference diet?

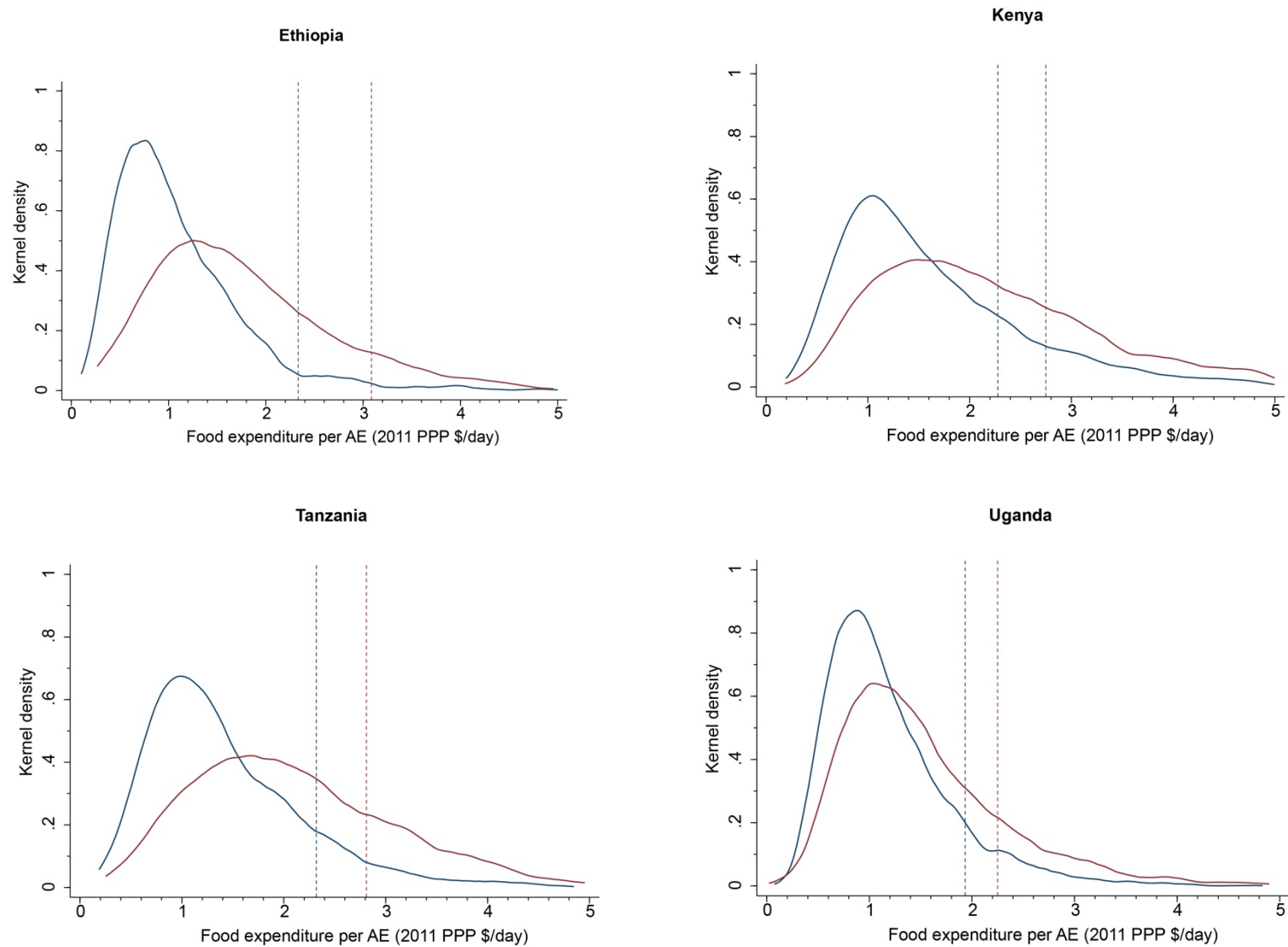
Many households in Ethiopia, Uganda, Kenya, and Tanzania are extremely poor and consequently have low food budgets. To examine if budget constraints can explain the consumption gaps between household diets and the EAT-Lancet healthy reference diet, we extended Hirvonen et al. (2020)'s cross-country analysis of retail food prices with a household-level analysis of how food expenditure compares to the minimum cost of the healthy reference diet in rural and urban areas of each country (Figure 3). Although we used local average food prices derived from unit values of food purchases reported in the household surveys rather than national-level retail price quotes, our cost estimates for the healthy reference diet are consistent with those of Hirvonen et al. Our estimates suggest that the costs of the healthy reference diet are considerably lower in rural than in urban areas, while the ranking of the four countries by our cost estimates is identical to that derived from Hirvonen et al.'s cost estimates. Moreover, Hirvonen et al. found that the minimum cost of the healthy reference diet varies between \$1.87 for Uganda and \$2.70 for Ethiopia; the national averages of our cost estimates fall within that range, varying between \$2.00 for Uganda and \$2.49 for Ethiopia (all in 2011 PPP). This result also means that most consumers in these LMICs tend to choose the least expensive foods within the main foods groups they consume (in calorie terms).

Figure 2. Calorie consumption vis-à-vis the EAT-Lancet healthy reference diet by food group and income quintile in rural and urban areas of four East African countries



Source: Authors' estimates from nationally representative surveys in 2014–2017.

Figure 3. Distributions of household food expenditure and costs of the EAT-Lancet reference diet in rural (blue) and urban (red) areas of four East African countries



Source: Authors' estimates from nationally representative surveys in 2014–2017.

Note: One adult equivalent (AE) corresponds to an average adult with a calorie requirement of 2,500 kcal/day—the total calorie intake of the EAT-Lancet healthy reference diet.

Consistent with Hirvonen et al.'s international analysis, we found that the percentage of the population unable to afford the EAT-Lancet healthy reference diet is extremely high in all countries, especially in rural areas: 96% of individuals in rural areas and 91% in urban areas live in households whose food expenditures are below the costs of the healthy reference diet. The rates of this form of nutritional poverty are 88% and 79% in rural and urban Kenya, respectively; 90% and 80% in rural and urban Tanzania; and 93% and 87% in rural and urban Uganda. Thus, insufficient household food budgets are a major barrier to the convergence of current diets with the healthy reference diet for most of the population in East Africa.

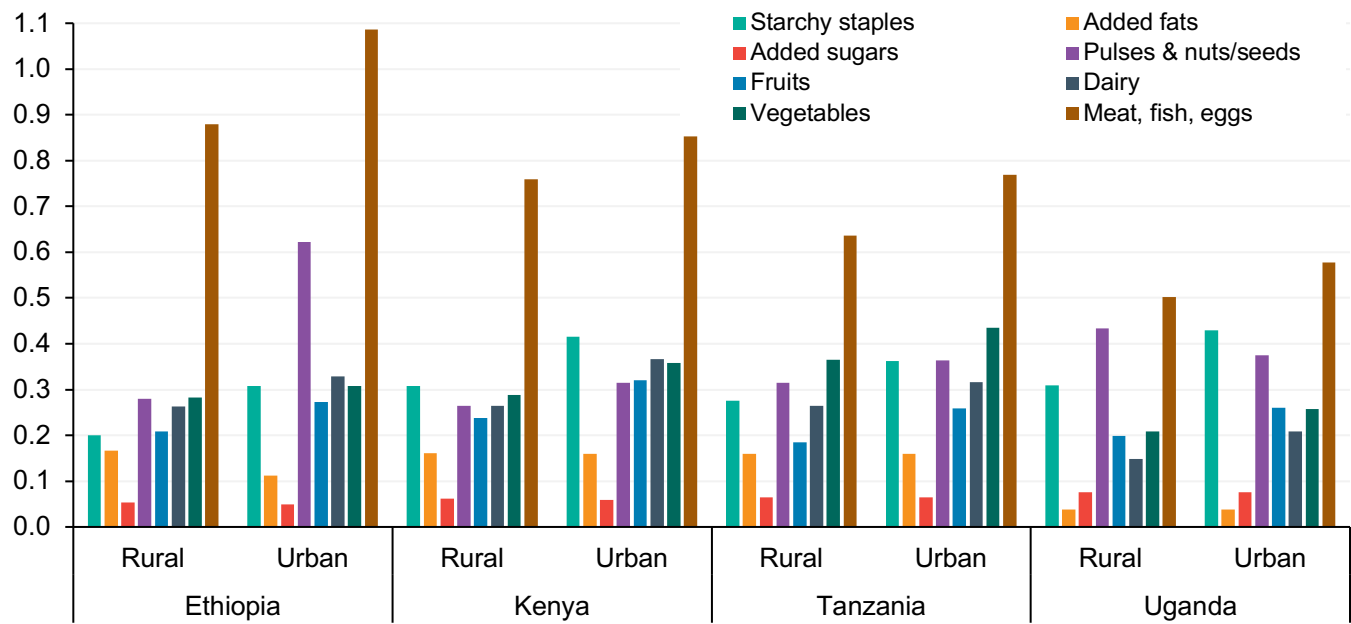
Are nutritious foods relatively too expensive?

A way to assess the relative affordability of nutritious foods is to compare unit costs. In Figure 4, we compare the median costs for the food groups of the EAT-Lancet healthy reference diet in terms of the daily reference calorie intake levels per adult equivalent (Panel A) and an equal intake of 100 kcal (Panel B).

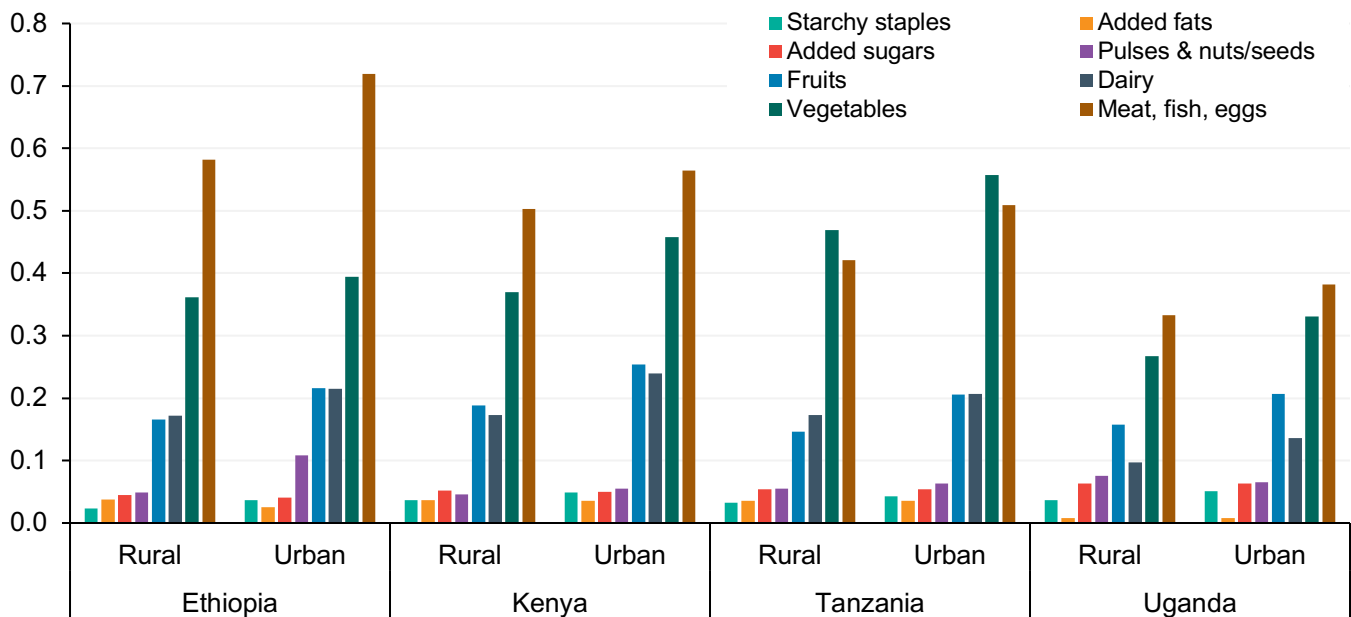
Panel A shows that the costs to consume the reference intakes of the healthy reference diet are highest for meat, fish, and eggs in both rural and urban areas of all four East African countries, ranging from \$0.50 to \$1.09 per day (2011 PPP \$). The costs for meat, fish, and eggs account for 26%–38% of the total costs of the EAT-Lancet healthy reference diet. Other nutrient-rich food groups and starchy staples contribute broadly similar costs of anywhere between \$0.15 and \$0.43 per day. Panel B shows that the costs per 100 kcal are also the highest for meat, fish, and eggs, ranging from \$0.33 and \$0.72. For both metrics, meat, fish, and egg consumption is consistently more expensive in urban than in rural areas, and, across the four countries, is most expensive in Ethiopia and least expensive in Uganda. Among the protein sources, meat, fish, and eggs are more than four times as expensive as pulses and nuts/seeds per 100 kcal, and more than twice as expensive as dairy foods. However, vegetables are also expensive in caloric terms, and indeed even more expensive than meat, fish, and eggs in Tanzania, but their main nutritional value is as a provider of micronutrients rather than dietary energy. Notably, staple foods and added fats and sugars are very inexpensive, making them attractive calorie sources for poorer consumers.

Figure 4. Food group costs of the EAT-Lancet healthy reference diet in rural and urban areas of four East African countries

Panel A. Median costs for the reference calorie intake levels per AE (2011 PPP \$)



Panel B: Median costs per 100 kcal (2011 PPP \$)



Source: Authors' estimates from nationally representative surveys in 2014–2017.

Note: One adult equivalent (AE) corresponds to an average adult with a calorie requirement of 2,500 kcal/day—the total calorie intake of the EAT-Lancet healthy reference diet.

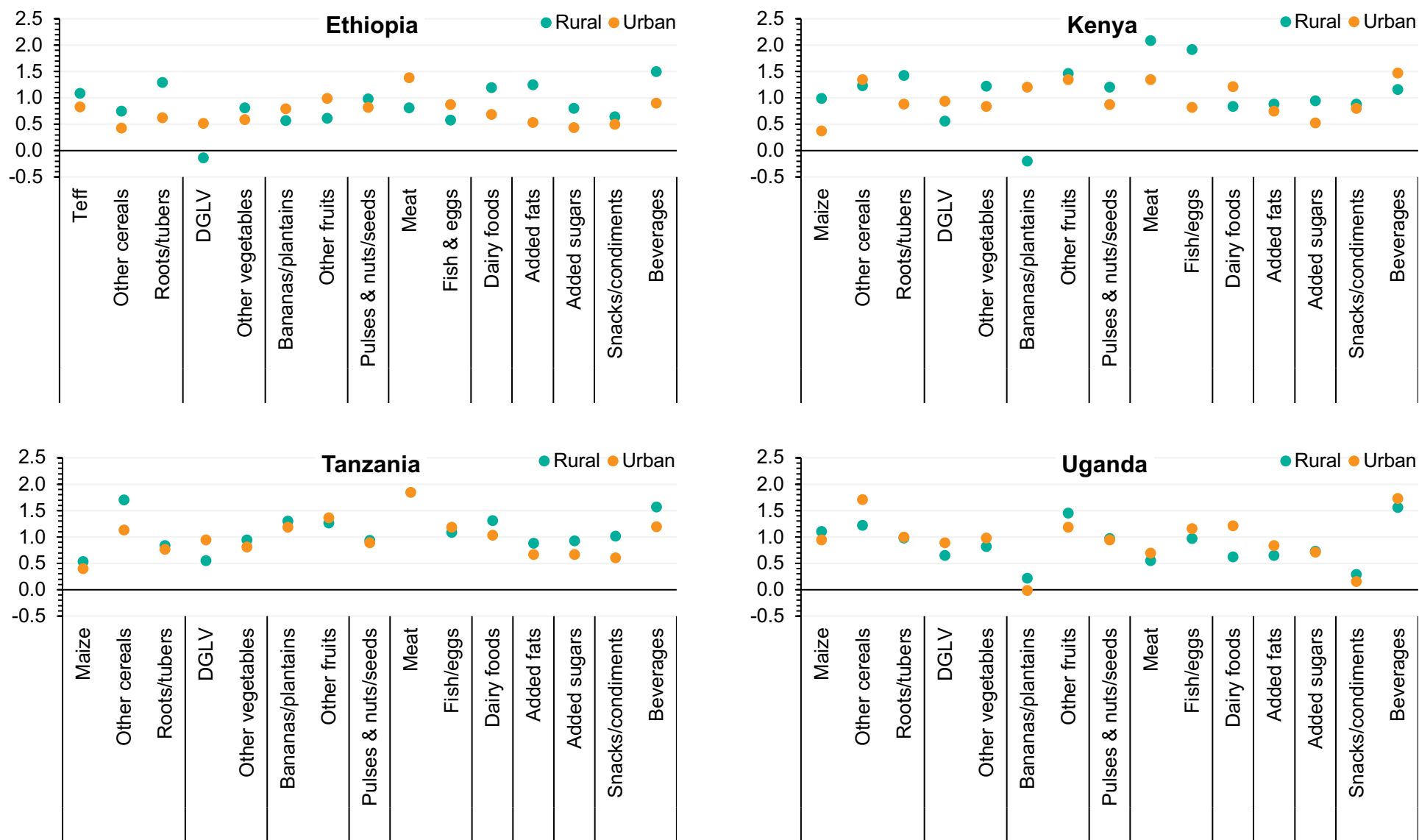
Are consumer preferences for nutritious foods weak?

Income elasticities of food demand measure how consumption of foods is expected to vary with changes in real income and constitute a useful metric for gauging latent preferences for different foods. Specifically, if consumers increase their consumption of a given food by, for example, just 3% in response to a 10% increase in household income (an elasticity of approximately 0.3), then it can be inferred that consumers' prevailing preference for that food is relatively weak and that income growth is unlikely to substantially narrow an existing consumption gap for that food. We think of income elasticities of below 0.5 as low, 0.5 to 1.0 as moderate, and above 1.0 as high.

Figure 5 reports estimated average income elasticities of the demand for 15 food groups that are a breakdown of the main food groups of the EAT-Lancet healthy reference diet. The elasticity estimates are derived from complete consumer demand system models that we estimated separately for rural and urban areas of each country and that account for consumption responses to food price changes (not reported).³ The results highlight diversity in food preferences across food groups, countries, and rural and urban areas. The income elasticities for starchy staples are often surprisingly high, especially in rural areas. This suggests that most consumers still have relatively strong preferences for staple foods, which can be explained by persistent food insecurity. The income elasticities for animal-source foods and especially meat, as well as fruits other than bananas, are generally high (except for meat in Uganda). Hence, increasing household income tends to disproportionately increase the consumption of these foods. Fish has high income elasticities in Tanzania and Uganda, where it is an important protein source in rural and urban diets. Income elasticities for vegetables are modest in both rural and urban areas of the four countries (except in rural Kenya, where it is high), suggesting that consumers increase vegetable consumption at lower margins than increases in household income. In rural areas, in particular, the income elasticities for dark green leafy vegetables are lower than those for other vegetables. The relatively low consumer preference for dark green leafy vegetables points to the challenge of substantially increasing the consumption of these nutritious foods to achieve healthier diets. Income elasticities for pulses and nuts/seeds are close to unity in rural and urban areas of the four countries, suggesting that income growth translates into relatively uniform increases in consumption of pulses and nuts/seeds across these countries and can essentially contribute to narrowing the consumption gaps for these rich plant-based protein sources.

Finally, income elasticities for potentially unhealthy food groups consumed at home vary but tend to be quite high for beverages (mainly tea, soft drinks, and alcohol). In addition, separate results (not reported) show that expenditures for food consumed away from home rise at least proportionately with household incomes (especially in urban areas), suggesting that consumer preferences for prepared, possibly unhealthy foods overall are likely quite strong.

Figure 5. Average income elasticities of food demand for rural (blue) and urban (red) areas of four East African countries



Source: Authors' estimates from complete consumer demand system models, using data from nationally representative surveys in 2014–2017.

Note: Hollow circles denote income elasticity estimates that are insignificantly different from zero and signify imprecise mean estimates. DGLV = dark green leafy vegetables

Potential policy and programmatic options to promote healthier diets in East African countries

Our analysis shows that household diets in Ethiopia, Kenya, Tanzania, and Uganda differ considerably from the EAT-Lancet healthy reference diet and are mostly too low in protective foods and too high in starchy staples and added sugars. Our analysis of the three possible explanations of this divergence—nutritional poverty, food prices, and food preferences—shows that nutritional poverty (defined as food expenditure below the cost of the EAT-Lancet healthy reference diet) is clearly the predominant problem in these four populations. It is therefore critically important for all four countries to foster inclusive and sustained income growth. High prices for nutritious foods are also problematic, however, and specific value chain studies should be used to assess whether there is scope to reduce the costs of key protective foods. At the same time, our demand analysis raises concern that even as African consumers are increasingly able to afford more nutritious foods, they may choose not to do so. This preference pattern raises the question of what can be done to improve diets through demand-side interventions, which would need to be combined with efforts to address the poverty and price problems. Below, we briefly review five broad categories of demand-side interventions and summarize the evidence and applicability of these approaches to the LMIC context, given that the preponderance of evidence currently comes from high-income countries (Table 1).

Behavior change communication (BCC) interventions

Personal or group-based BCC interventions have been widely used to improve maternal and child nutrition in LMICs, but the evidence is limited to these groups, and little information is available on their cost-effectiveness, scalability, and ease of adaptation either to other demographic groups or for shaping demand for nutritious foods. One notable initiative, the Alive and Thrive Program led by FHI360, successfully implemented holistic social BCC (SBCC) strategies—combining interpersonal communication, mass-media, and community mobilization approaches—in a range of LMICs (Kim et al., 2018; Kim et al., 2019; Kim et al., 2016; Menon et al., 2020; Nguyen et al., 2017a; Nguyen et al., 2017b; Rawat et al., 2015). The program improved maternal breastfeeding and complementary feeding practices; impacts were greater among mothers who were exposed to all three strategies, although this was also more costly (Menon et al., 2020). The SBCC strategies used in Alive and Thrive focused on maternal and child nutrition, but the approach could be expanded to promote healthy diets and lifestyles for other household members, including providing advice on improving dietary quality to reduce risks of overconsumption of harmful foods.

Experience with BCC using information and communication technology (ICT) in LMICs is still limited, but one intervention in Tanzania added roughly 120 nutrition-focused text messages to an existing SMS-based health communication campaign targeting pregnant women and mothers of young children. This program showed some success in increasing consumption of targeted fruits and vegetables (Gilligan et al., 2019). ICT-based interventions could potentially be highly cost-effective given the scale economies of text messaging, but more research is needed to assess both the internal and external validity of these interventions.

Other information-based interventions

In high-income countries, nutrition-focused interventions in supermarkets are common, including experimental work altering food positioning (An et al., 2013; Huitink et al., 2020; Hyseni et al., 2017) and food

labeling (Andreyyeva and Luedicke, 2013; Campos et al., 2011; Cecchini and Warin, 2016; Hyseni et al., 2017; Just and Gabrielyan, 2018), both of which show some evidence of impact. However, their applicability to lower-income consumers and rural populations in East Africa is questionable, except for targeting higher-income consumers. Poorer East Africans, even in urban areas, continue to purchase fresh foods primarily in wet markets and typically rely mostly on small fixed-place stores for nonperishable and processed foods (Headey et al., 2019). Future research could assess scope for information campaigns on healthy diets and promotion of healthy foods in wet markets.

Nutrition-sensitive agricultural programs

In enhanced homestead food production programs, agricultural extension aimed at increasing production of vegetables, fruits, poultry, or fish has been combined with SBCC to increase caregiver knowledge and promote greater consumption of nutrient-rich foods, especially among mothers and young children (Haselow et al., 2016; Ruel et al., 2018). These programs often show evidence of impact on consumption of nutritious foods and sometimes on nutrition outcomes (Haselow et al., 2016; Ruel et al., 2018), and suggest that the combination of supply- and demand-side interventions is an effective approach to achieve dietary changes in women and children in resource-constrained environments. Research from Ethiopia (Hirvonen and Headey, 2018) and other East African countries (Haile et al., 2021), however, shows that lack of water—from irrigation or rainfall—is a major constraint on vegetable production in Africa. An Africa-wide study also points to links between irrigation and rainfall deficits and lower vegetable and fruit consumption (Choudhury et al., 2019), and our study suggests low consumer preferences for dark green leafy vegetables, especially among rural households. The design of enhanced homestead food production interventions aimed at improving consumption must therefore take into account access to water and markets, as well as common food perceptions and women's time constraints.

Food and cash transfers

Food and cash transfers can directly stimulate food demand by expanding the total food budget while simultaneously influencing food consumption through BCC. Such transfers have been shown to increase consumption of nutritious foods but have also led to increases in overweight/obesity in some countries that were undergoing a rapid nutrition transition (Hawkes et al. 2020). This suggests that food and cash transfers should be accompanied by BCC interventions, also because there is some evidence suggesting complementarities of transfers and BCC on improving nutrition (Ahmed et al., 2019).

School feeding and take-home-ration programs have also shown evidence of benefits for child diets and for cognitive development and schooling outcomes (Aurino et al., 2020; Evans et al., 2012; Gelli et al., 2018; Jomaa et al., 2011; Webb, 2015) as well as potential spillovers for younger (pre-school) siblings' nutrition (Aurino et al., 2020). However, there is limited evidence of sustained impacts on diets, and few interventions so far have combined school feeding with nutrition education to achieve longer-term impacts (Nguyen et al., 2021). Nevertheless, given that LMICs have extremely young populations, that most countries have school feeding programs, and that food preferences are formed in childhood and adolescence, school-based interventions might be an important means of shifting preferences at a generational level.

Food taxes and subsidies

Populations in middle- and high-income countries have also been the subject of research on food pricing policies, particularly taxes on unhealthy foods like added sugars and fats and sugar-sweetened beverages (Bartlett et al., 2014; Black et al., 2012; Chakrabarti et al., 2018; Eyles et al., 2012; Hyseni et al., 2017; Jou and Techakehakij, 2012; McFadden et al., 2014; Ni Mhurchu et al., 2010; Powell et al., 2013; Sturm et al., 2013; Thow et al., 2014; Waterlander et al., 2012). *Ex ante* modeling components in this research suggest that taxes could significantly reduce consumption of unhealthy foods, and some empirical studies from countries like Mexico have demonstrated reduced consumption of sugar-sweetened beverages (Jou and Techakehakij, 2012; Powell et al., 2013; Thow et al., 2014). However, the effects of (modest) taxes on diets and nutrition outcomes are often relatively small. There is far less evidence on subsidies or vouchers to promote consumption of nutritious foods, and less practical experience on how such interventions would be implemented in LMICs, except in the context of modifications to large-scale food-distribution schemes (Chakrabarti et al., 2018). These caveats aside, from a policy perspective, higher taxation of unhealthy foods/ingredients in LMICs appears to be a low-hanging fruit, but likely to be only modestly effective.

Table 1. Overview and assessment of the evidence for demand-side interventions to improve diets in LMICs

Type of intervention	Scope of evidence on impacts	Limitations to evidence	Applicability to LMICs
BEHAVIOR CHANGE COMMUNICATION (BCC)			
Personal or group-based BCC	Some evidence of positive impacts on diets and child feeding practices, including sustained impacts after program cessation.	Interventions mostly pertain to mothers and young children. Limited evidence on household diets.	Applicable through health/nutrition service providers, but other platforms might be needed to influence household diets; costs uncertain.
Mass-media BCC	Some evidence of positive impacts on diets and child feeding practices, including sustained impacts after program cessation.	Difficult to rigorously identify impacts of mass media. Body of evidence is limited.	Applicable as television and social media gain traction in LMICs; high cost, but potentially cost-effective.
ICT-based BCC	Some evidence that SMS messages increase consumption of a targeted food. New studies on mobile apps to help consumers improve dietary quality are being designed.	Body of evidence is limited.	More evaluation research is needed; potentially cost-effective.
KNOWLEDGE/INFORMATION TRANSFER			
Food labeling	Some evidence that altering labeling in supermarkets and restaurants can improve health content of food purchases.	Limited to high-income countries	Relevant to supermarket and restaurant purchases, but these would mostly pertain to higher-income consumers
Interventions in supermarkets	Some evidence that altering food positioning can improve health content of food purchases, but impacts are variable and often quite small.	Limited to high-income countries	Relevant to supermarket purchases, but these would mostly pertain to higher-income consumers

Food promotion in wet markets	None thus far. USAID-funded SAFIRA program in Ethiopia plans to promote egg consumption in wet markets in Ethiopia.	No experimental evidence on effectiveness	In principle, market-based interventions could be cost-effective
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NUTRITION-SENSITIVE AGRICULTURE

Homestead food production + BCC	Some evidence of impacts on diets, micronutrient intake, and child nutrition outcomes.	Evidence mostly on diets; consumption diversity; consumption of targeted foods/food groups; some evidence on micronutrient intakes	Potentially more relevant to more remote rural populations in LMICs who have access to land/gardens
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NUTRITION-SENSITIVE SOCIAL PROTECTION

Cash/food transfers	Evidence that transfers can increase consumption of both nutritious and unhealthy foods.	Still limited evidence for Africa south of the Sahara.	Evidence strongly suggests that transfers should be accompanied by BCC for positive impacts on diets and nutrition
School feeding programs	Solid evidence of benefits for child diets, cognitive development, and school attendance, and some evidence of spillover effects on younger children; potential benefits to local agriculture.	Limited evidence on impacts on diets of other household members or of sustained impacts on children's preferences.	Applicable and widely used in developing countries. Feeding programs should be combined with school-based nutrition education programs.

FOOD PRICING

Food subsidies/taxes	Subsidies/vouchers do generally affect consumption; sufficiently large taxes also show impacts on consumption in most settings.	Significant internal and external validity concerns. Limited to high-income countries	Poor consumers tend to be more price-sensitive than wealthier consumers. Taxes on unhealthy foods should be progressive.
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Conclusions

There are many potential points of intervention for increasing consumption of protective foods, but there is a dearth of relevant evidence for LMICs, and even less information on the cost effectiveness of interventions to shape positive changes toward healthy diets. There are particularly large knowledge gaps on interventions that are likely to have higher potential in LMICs and in remote rural communities, in particular. Such interventions include ICT-based messaging, interventions in wet markets, school-based nutrition education, and nutrition education or SBCC programs designed to address dietary risks for all household members. Moreover, there is also an urgent need to design such programs as double-duty actions that address healthy diets holistically in order to both prevent undernutrition and curb the rapid rise of overweight and obesity in LMICs (Hawkes et al., 2020).

ENDNOTES

¹ All household surveys were collected within a period of three years. We used the Ethiopia Socioeconomic Survey—Wave 3, 2015–16; the Kenya Integrated Household Budget Survey, 2015–16; the Tanzania National Panel Survey—Wave 4, 2014–15; and the Uganda National Household Survey, 2016–17. After data cleaning, the samples included 3,253 households in rural areas and 1,109 households in urban areas of Ethiopia; 12,320 households in rural areas and 7,895 households in urban areas of Kenya; 1,861 households in rural areas and 1,239 households in urban areas of Tanzania; and 9,435 households in rural areas and 4,338 households in urban areas of Uganda.

² Food consumption quantities reported in the household surveys were converted into calorie consumption amounts using the USDA National Nutrient Database for Standard References—Release 28 (USDA, 2020) and the Tanzania Food Composition Tables (Lukmanji et al., 2008). The surveys' food consumption modules report the quantities of foods consumed at home for all household members combined. Estimates do not include food consumed away from home, which amounts to 5%–13% of total food expenditures, because of lack of information on the types of foods purchased. Food consumption data from most/all common household surveys do not provide information (or they provide insufficient detail) on the quantities of food consumed away from home. Calorie consumption amounts therefore cannot be derived for consumption entries due to missing quantitative information.

³ The demand system models include separate estimations of consumption decisions on two household budgeting stages. For the first stage, a Working-Leser model (Leser 1963; Working 1943) was estimated to derive the elasticities of demand for total food. For the second stage, a Quadratic Almost Ideal Demand System model (Banks et al., 1997) with censored demand equations (Shonkwiler and Yen, 1999) was used to estimate the within-food elasticities of demand for the 15 food groups. Both models account for household characteristics influencing consumption decisions. The total elasticities of food group demands were obtained by additive aggregation over the two budgeting stages (Edgerton, 1997). For more details on the methodology, we refer to the work of Ecker and Qaim (2011), which used a similar estimation approach for a three-stage budgeting process.

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