Chapter 10

FOOD SECURITY

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Introduction

Ethiopia has made remarkable progress in reducing poverty and malnutrition in the presence of overall economic growth since the turn of the century (Stifel and Woldehanna 2016). Furthermore, effective safety nets and targeted food and nutrition interventions have provided important sources of social insurance (Gilligan, Hoddinott, and Taffesse 2009; Coll-Black et al. 2011; Berhane et al. 2012). Nonetheless, food security remains an important concern in the country as the quantity and quality of diets, and related nutritional outcomes, are at risk (Ethiopia, CSA and WFP 2016). Despite the enormous economic progress in the country, it is still unclear to what extent food security has improved and what changes we are seeing in diet diversity and nutritional improvements.

To understand where the country currently stands, this chapter provides an assessment of food security and diet quality in Ethiopia using data from the most recent Ethiopian Household Consumption Expenditures Survey (HCES) dataset (2015/2016)—data that have only been recently released. The HCES are repeated nationally representative cross-sectional surveys collected by the Central Statistical Agency (CSA) of Ethiopia and serve as the official source for poverty statistics in the country. An extensive consumption-expenditure module allows us to estimate household food consumption patterns to assess food security in 2015/2016 and to compare these patterns to those observed in the 2010/2011 HCES. A word of caution must be noted, however. Temporal comparisons over this time period may not indicate long-term trends in food security since much of the country experienced an extended drought in 2015/2016 (Hirvonen, Sohnesen, and Bundervoet 2018) but not in 2010/2011. This drought, which especially affected the eastern part of the country during the main cropping season, appears not to have affected child undernutrition (Hirvonen, Sohnesen, and Bundervoet 2018). Furthermore, drought predictors from 2015 fail to show an impact on household consumption (Sohnesen 2018), and rainfall shocks in our regression analysis do not have an effect on household energy consumption and diet quality. Nonetheless, we remain cautious in our interpretation of long-term food security trends based on comparisons of the 2010/2011 and 2015/2016 HCES data.

Ethiopia continues to face high levels of food insecurity. Daily energy consumption is low (3,055 kilocalories per adult on average), and diet quality is poor (starchy staples account for 71.6 percent of calories) and monotonous (6.1 food groups are consumed per week out of a possible 12). Between 2011 and 2016 the diets of the poorest half of the population improved slightly (less reliance on starchy staples and greater dietary diversity), although this was mostly in rural areas. For the rest of the population, the changes were mixed (less reliance on starchy staples but less diverse diets). Ethiopian diets are also affected by seasonality. Energy consumption tends to be highest in both urban and rural areas during postharvest periods and lowest during lean periods; reliance on cereals, roots, and tubers (starchy staples) tends to vary little seasonally in urban areas but accounts for most of the decline in energy consumption during lean periods in rural areas; dietary diversity varies little seasonally in urban areas but is generally lower during lean periods in rural areas; and the poorest households in urban areas experience more seasonal variation in starchy staple consumption and dietary diversity than less poor households, whereas richest households in rural areas experience more seasonal variation than less poor households in terms of energy consumption, reliance on starchy staples, and dietary diversity.

In both rural and urban areas, smaller, more educated households with higher overall expenditure levels are generally more food secure. Those who have members working as legislators, professionals, technicians, and clerks are also more food secure. Agricultural households in urban areas are among the least food secure. In rural areas, although average energy intake is reasonably high for agricultural households, the quality of their diets is low. In rural areas male-headed households consume fewer calories per adult than female-headed households but have slightly higher-quality diets. In urban areas there is virtually no distinction between male- and female-headed households in terms of food security. We find little evidence of diets being affected by rainfall shocks. This is particularly salient since Ethiopia had just experienced its worst drought in decades.

At first glance the results of this chapter appear to be inconsistent with the evidence presented in Chapter 1 that stunting rates for children under five years of age fell from 44 percent to 38 percent from 2011 to 2016 (see Figure 1.2). This apparent disconnect, however, may follow from the different units of analysis, where food security in this chapter is measured at the household level, while stunting is measured at the individual child level. Since child nutrition outcomes depend on how resources are allocated within households (Thomas 1990; Sahn and Stifel 2002), as well as on other factors such as general feeding practices, mother's health and education, and household-level sanitation (Danaei et al. 2016), the link between average household-level consumption/diet quality and individual-level child nutrition is not automatic. Where this link may be observed, however, is among the poorest half of the population, where improved diet quality may have contributed to less growth faltering in these households. In addition, improved healthcare and access to improved water sources may have played an important role in improving child nutrition outcomes (Headey et al. 2019) despite the persistence of household food security.[1] Finally, it is worth noting that despite the improvements over time, the high level of child stunting in 2016, especially in rural areas (40 percent; Ethiopia, CSA and ICF 2016), is nonetheless consistent with the high levels of food insecurity described in this chapter.

The structure of the chapter is as follows: we begin with a description of the data and methods for measuring food security. After presenting a temporal comparison of the state of food security in 2010/2011 and 2015/2016, we turn to 2015/2016 by analyzing the seasonal nature of food security and providing a profile of the food insecure. We end with concluding remarks.

Methodology and Data

Methodology

> Food security . . . [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.
>
> (FAO 1996)

In the spirit of Amartya Sen's notion of entitlements (Sen 1981), the statement from the 1996 World Food Summit makes clear that food security depends on peoples' abilities to acquire nutritious food. This in turn depends on food

1 For example, according to the 2011 and 2016 Demographic and Health Surveys (Ethiopia, CSA and ICF 2012; Ethiopia, CSA and ICF 2016) the percentage of children born in health facilities rose (10 percent to 26 percent), as did the share of deliveries assisted by skilled providers (11 percent to 28 percent). In addition, the percentage of children with four or more antenatal care visits rose from 19 percent to 32 percent, while antenatal care received from a nurse or midwife rose from 28 percent to 42 percent. Finally, households with access to improved water sources increased from 54 percent to 65 percent from 2011 to 2016.

being sufficiently available, and people being able to regularly acquire adequate quantities of it, and to store and prepare it in a manner that results in a positive nutritional impact (FAO 1996). As such, food-secure households are those that have diets that are sufficiently high in quantity and in quality. Using this framework as a guide for measuring food security in the context of a household consumption and expenditure survey, we employ two sets of indicators that are measured at the household level: diet quantity and diet quality.

The two diet-quantity indicators that we use are meant to capture the quantity of food that people consume. The first, food energy consumption, is a measure of the total daily number of calories per adult equivalent acquired by the household (see Table 10A.1 for the equivalence scales that we used). It is calculated by adding the energy contents of the edible portions of all foods (purchased, produced, or gifted) acquired by the household over the seven-day recall period in the survey and dividing this sum by seven and by the number of adult equivalents in the household. We computed energy content using the energy conversion factors reported in the Ethiopian food composition table (EHNRI 1997). This measure represents food acquired by the household, not necessarily the food consumed by the household. Nonetheless, the mean of this measure over a random sample of households provides a good estimate of mean food energy consumed by a population (Smith and Subandoro 2007). As such, and for ease of exposition, we refer to food energy acquisition in this report as food energy consumption.

The second diet-quantity measure, food energy deficiency, is an indicator of whether members of a household consume sufficient dietary energy. The idea is that members of a household are food energy deficient if the total household acquisition of dietary energy is not sufficient to meet the dietary energy requirements of all of the household members. These requirements are for basal metabolic function (state of rest) and light activity, and depend on the sex and age of each household member (Smith and Subandoro 2007). In practice, because we divide total household food energy consumption by the number of adult equivalents in the household, it is sufficient to compare the total daily calories per adult equivalent to the energy requirements for an adult male. As such, we record household members as being food energy deficient if their household's daily caloric consumption is less than 2,200 kilocalories per adult equivalent, the minimum caloric requirement that is used to estimate the national poverty line (Ethiopia, MoFED 2013).

We use three diet-quality measures in this analysis in recognition that living "active and healthy lives" requires more than just meeting energy requirements. Macronutrients such as proteins, and micronutrients such as iron, vitamin A, and iodine, are also essential for nutrition and health outcomes (FAO 1996; Welch 2004). In addition, there is a growing literature showing that insufficient energy consumption is becoming less of a binding constraint than inadequate diet quality (Ruel 2003; Graham, Welch, and Bouis 2001; Smith and Subandoro 2007) and that diet-quality measures are a better gauge of the impacts of shocks (Headey and Ecker 2013).

The first diet-quality measure is the percentage of food energy from starchy staples, which is measured as the percentage of total household dietary energy consumption (availability) derived from food staples (for example, maize, teff, wheat, sorghum, barley, roots, and tubers). Because energy-dense starchy staples have limited amounts of proteins and micronutrients, households that consume more of these staples compared to other foods are more vulnerable to protein and micronutrient deficiencies (Smith and Subandoro 2007). As such, a larger percentage of food energy from starchy staples represents a lower-quality diet.

Our second diet-quality measure is related to the first. We indicate that when households have a high proportion of calories from starchy staples, that is, when 75 percent or more of total household food energy consumption derives from energy-dense starchy staples, they have low-quality diets. We report percentages of individuals living in households that acquire a high proportion of their calories from starchy staples.

Our third diet-quality measure is a Household Dietary Diversity Score (HDDS), the number of food groups consumed by household members during the seven-day recall period. Dietary diversity indicators tend to be highly correlated with more complex measures of food and nutrient intake (Ruel, Harris, and Cunningham 2013). As Headey and Ecker (2013) note, there are two basic reasons that these indicators are effective measures of food and nutrition security. First, a diverse diet is one that is more likely to capture the consumption of both macro- and micronutrients (Ruel 2003). Second, there is evidence that individuals will only diversify into higher-value micronutrient-rich foods (such as meats, fish, eggs, dairy products) when they have satisfied their basic caloric needs. Thus, as their incomes grow, poor households substitute out of monotonous energy-dense diets into more diversified nutrient-rich diets (Jensen and Miller 2010). For our HDDS we follow Swindale and Bilinsky (2006) and categorize the 377 food items in the survey into twelve food groups: (1) cereals; (2) roots and tubers; (3) vegetables; (4) fruits; (5) meat, poultry, and offal; (6) eggs; (7) fish and seafood; (8) pulses, legumes, and nuts; (9) milk and milk products; (10) oils and fats; (11) sugar and honey; and (12) miscellaneous food items. Thus the HDDS ranges from

1 (all food consumption derives from one food group) to 12 (household consumed items from all 12 food groups), with higher values representing higher-quality diets.

For each of these quantity and quality measures, we calculate weighted averages of the household indicators to attain sample population means. To do this, we use as weights the household sampling weights multiplied by the household size. This approach results in diet-quantity estimates that are qualitatively similar but slightly different from those reported by the CSA (Ethiopia, CSA 2018). This follows for food energy consumption, for example, because the CSA divides their estimate of all calories consumed in the relevant strata by the estimate of the total number of adults in the strata to get an estimate of calorie consumption per adult equivalent in the strata. Our approach instead results in an estimate of the mean calorie consumption per adult equivalent in the strata.

Data

The primary data sources used for the analysis are the Household Consumption and Expenditures Surveys (HCES) for 2010/2011 (hereafter 2011) and 2015/2016 (hereafter 2016). The HCES data are collected by the CSA and are used to construct household consumption aggregates to calculate the official poverty statistics in Ethiopia. Both surveys were conducted over the course of a year for a similar time period (for example, July 8, 2010–July 7, 2011 and July 8, 2015–July 7, 2016). A total of 27,835 households were interviewed in the 12-month period in the 2011 survey, while 30,229 were interviewed in the 2016 survey. To minimize recall error on consumption, each survey household was visited twice within a single week. The survey covered all 11 regions of the country and included 864 rural and 1,104 urban enumeration areas in 2011, and 864 rural and 1,242 urban enumeration areas in 2016. The HCES did not cover the pastoralist communities in Afar (three zones) and Somali (six zones). The sampling began by stratifying the country into rural and urban areas. After that, the enumeration areas were selected using the probability-proportional-to-size approach, where more populated units have a higher probability of being selected into the sample. The final household sample was formed of households that were randomly selected from these enumeration areas. We use sampling weights, which are based on selection probabilities and provided by the CSA, to compute representative estimates for rural and urban areas of the country.

Table 10.1 shows the sources of calories for households in Ethiopia as measured by the 2011 and 2016 HCES data. Cereals in general are consumed

TABLE 10.1 Shares of calories and shares of households consuming food items in Ethiopia, 2011 and 2016 (%)

	Calorie shares		Share of households consuming	
Food item	2011	2016	2011	2016
All Cereals	63.3	61.1	99.0	99.0
Teff	11.0	12.1	67.5	68.5
Wheat	10.4	11.7	78.7	77.2
Barley	4.1	3.7	19.5	23.4
Maize	20.2	20.5	51.9	53.6
Sorghum	12.4	9.9	25.2	21.0
Other cereals	3.2	3.2	20.7	27.0
Processed cereals	0.2	0.1	4.2	2.1
Roots and tubers	3.6	3.7	5.1	56.9
Pulses	7.3	7.1	90.5	89.5
Oil seeds	0.2	0.1	7.0	3.4
Animal-sourced foods	1.8	2.4	59.0	61.7
Oil and fat	4.3	7.7	82.7	89.2
Vegetables and fruits	2.1	2.8	88.2	90.9
Pepper	1.7	1.0	5.5	73.0
Enset/kocho	8.8	6.8	11.1	10.6
Coffee/tea/chat	1.9	1.5	87.0	92.9
Sugar and salt	2.0	2.6	95.3	91.0
Other foods	3.0	3.2	58.2	59.9
Total	**100.0**	**100.0**	**100.0**	**100.0**

Source: Authors' calculations from Ethiopia, CSA 2011 and 2016.

by nearly all households and are the most important calorie source, making up just more than 61 percent of total calories for the average household. Among cereals, maize is the largest source (20.5 percent) and is consumed by slightly more than half of all households (53.6 percent). Although wheat is the most ubiquitous (77.2 percent of households consume it), it accounts for a smaller percentage of total calories (11.7 percent). Teff is also consumed by a large percentage of households (68.5 percent) and accounts for an average of 12.1 percent of calories. Other important sources of calories consumed by nearly 90 percent of households are oils and fats (7.7 percent) and pulses (7.1 percent). Although animal-sourced foods (ASF) account for only 2.4 percent of calories, nearly 62 percent of households consume them. This low share of calories attributable to ASF is not surprising given the high prices of these food items, as described in Chapter 8.

Changes in the dietary composition over time were not large (Table 10.1). While still making up the bulk of diets for nearly all Ethiopians, cereals accounted for a smaller share (2.1 percentage points) of calorie consumption in 2016 than in 2011. This was offset by more households consuming more oils and fats (82.7 percent in 2011 and 89.2 percent in 2016), and deriving a larger share of calories from them (4.3 percent to 7.7 percent, respectively). While teff and wheat consumption as a share of total calories increased by 1 percentage point between 2011 and 2016, sorghum consumption fell by over 2 percentage points. Finally, although 2.7 percentage points more households consumed ASF in 2016 compared with 2011, the share of calories derived from ASF increased by only 0.6 percentage point. This may be due to the rapid rise in ASF prices discussed in Chapter 8.

Table 10.2 illustrates how households acquire their calories. Interestingly, the majority of calories are acquired through market purchases (52.2 percent), while 44.3 percent come from consumption of own production, and the remainder (3.6 percent) from other sources such as gifts and in-kind transfers from NGOs and the government. Even though own production provides the largest source of calories from staples (49.9 percent), market purchases are important (45.7 percent), especially for teff (63.8 percent). It is noteworthy that 13.2 percent of calories from wheat are acquired from other sources. This is not surprising given that food aid is provided in the form a wheat. For non-cereals, households rely on own production for root crops (59.7 percent) and enset (76.4 percent). Conversely, 90.3 percent of calories from oils and fats and 80.3 percent of calories from fruits and vegetables are acquired through market purchases.

Food Security, 2011–2016

Ethiopia continues to face high levels of food insecurity. As illustrated in Table 10.3, the quantity of food consumed is low. The average daily energy consumption per adult in 2016 was 3,055 kilocalories.[2] Using a threshold of 2,200 kilocalories, we find that 25.6 percent of Ethiopians are food energy deficient. Furthermore, the quality of diets is poor as indicated by (1) starchy

2 This is larger than the Central Statistical Agency's (Ethiopia, CSA 2018) estimate of 2,468 kilocalories per person per day because the estimates reported here are kilocalories per adult instead of per person.

TABLE 10.2 **Shares of calories by sources of acquisition in Ethiopia (%)**

Food item	Own production	Purchased	Other†
All cereals	49.9	45.7	4.4
Teff	30.7	63.8	5.4
Wheat	40.5	46.3	13.2
Barley	78.8	20.2	1.0
Maize	55.6	42.6	1.8
Sorghum	62.1	37.1	0.8
Other cereals	50.5	48.2	1.3
Processed cereals	13.1	75.8	11.1
Root crops	59.7	40.0	0.4
Pulses	30.5	66.2	3.3
Oil seeds	45.7	54.0	0.4
Animal-sourced foods	45.5	50.8	3.7
Oil and fat	6.8	90.3	2.8
Vegetables and fruits	18.8	80.3	0.9
Pepper	7.1	92.3	0.6
Enset/kocho	76.4	23.6	0.0
Coffee/tea/chat	29.3	68.9	1.8
Sugar and salt	1.4	97.7	0.9
Other foods	26.6	63.8	9.6
All food	**44.3**	**52.2**	**3.6**

Source: Authors' calculations from Ethiopia, CSA 2016.
Note: † Includes gifts and in-kind transfers from NGOs and government.

staples accounting for an average of 71.6 percent of total household energy consumption, (2) 46.3 percent of the population living in households in which starchy staples account for more than 75 percent of energy consumption, and (3) individuals consuming an average of only 6.1 food groups per week out of a possible 12 food groups (Table 10.4).

Despite the high levels of food insecurity, there is evidence of some uneven improvements between 2011 and 2016. Average daily energy consumption rose by 1.0 percent, from 3,024 kilocalories per adult equivalent to 3,055 kilocalories per adult equivalent, while the percentage of the population that is energy deficient fell by 2.1 percentage points, from 27.7 percent to 25.6 percent (Table 10.3). This change in average levels, however, masks a rather mixed picture throughout the distribution of energy consumption

TABLE 10.3 Diet quantity in Ethiopia by region, 2011 and 2016

	Energy consumption†				Energy deficiency††			
Region	2011	2016	% difference		2011	2016	difference	
National	3,024	3,055	1.0	***	27.7	25.6	–2.1	***
Rural/urban								
Rural	3,091	3,144	1.7	***	26.9	24.6	–2.3	***
Urban	2,688	2,678	–0.4		31.8	29.8	–2.0	***
Region								
Tigray	2,870	2,759	–3.8	***	32.4	28.2	–4.2	***
Afar	2,834	2,870	1.3		31.9	35.0	3.2	*
Amhara	2,669	2,462	–7.8	***	36.6	44.7	8.1	***
Oromia	3,085	3,260	5.7	***	26.6	20.5	–6.1	***
Somali	2,879	2,875	–0.1		29.7	23.0	–6.7	***
Benishangul-Gumuz	3,210	2,826	–12.0	***	21.3	23.9	2.6	
SNNP	3,455	3,660	5.9	***	17.1	10.9	–6.1	***
Gambella	3,225	3,340	3.6	**	26.6	14.7	–11.9	***
Harari	3,054	2,814	–7.8	***	24.2	31.2	7.0	***
Addis Ababa	2,509	2,338	–6.8	***	35.6	33.9	–1.7	
Dire Dawa	2,799	2,648	–5.4	**	28.2	37.4	9.2	***
Rural								
Tigray	2,878	2,770	–3.8	**	33.7	28.7	–5.0	***
Afar	2,853	3,011	5.6	**	33.1	29.4	–3.7	
Amhara	2,667	2,389	–10.4	***	37.4	49.0	11.6	***
Oromia	3,147	3,346	6.3	***	25.6	18.9	–6.7	***
Somali	2,924	2,915	–0.3		29.3	21.7	–7.6	***
Benishangul-Gumuz	3,234	2,802	–13.4	***	21.1	24.3	3.2	
SNNP	3,517	3,811	8.3	***	16.1	7.5	–8.6	***
Gambella	3,466	3,570	3.0		20.4	8.6	–11.8	***
Harari	3,503	3,416	–2.5		13.6	15.9	2.3	
Dire Dawa	3,330	3,237	–2.8		11.9	13.5	1.5	
Urban								
Tigray	2,836	2,727	–3.8	**	27.4	26.8	–0.6	
Afar	2,789	2,255	–19.2	***	28.9	59.7	30.7	***
Amhara	2,686	2,853	6.2	***	31.3	21.8	–9.5	***
Oromia	2,673	2,742	2.6	***	33.2	30.0	–3.1	***
Somali	2,688	2,648	–1.5		31.0	29.9	–1.0	
Benishangul-Gumuz	3,063	2,924	–4.6	*	22.8	22.2	–0.6	

	Energy consumption†				Energy deficiency††			
Region	2011	2016	% difference		2011	2016	difference	
Urban (continued)								
Gambella	2,713	2,892	6.6	***	39.7	26.5	−13.1	***
Harari	2,554	2,310	−9.5	***	36.0	44.1	8.1	**
Addis Ababa	2,509	2,338	−6.8	***	35.6	33.9	−1.7	
Dire Dawa	2,547	2,327	−8.6	***	35.9	50.4	14.5	***

Source: Authors' calculations from Ethiopia, CSA 2011 and 2016.

Note: SNNP = Southern Nations, Nationalities, and Peoples. † Average kilocalories per adult equivalent per day. †† Percentage of population in households consuming less than 2,200 kilocalories per adult per day. *, ** and *** indicate significance levels of 10 percent, 5 percent, and 1 percent, respectively.

(Figure 10A.1). Indeed, there was virtually no change in the level of energy consumption for the lowest 30 percent of the population (distributions overlap), while there was a slight improvement for those in the 30th to 50th percentile and a slight deterioration for those in the 50th to 80th percentile. Changes in diet quality at the national level were also mixed. Although average energy consumption from starchy staples fell by 4.1 percentage points (and throughout the distribution; Figure 10A.2), and although the share of people deriving a high proportion of their energy from starchy staples fell by 11.5 percentage points, dietary diversity worsened slightly from 6.3 food groups to 6.1 food groups on average (Table 10.4). Here too the average masks different experiences throughout the distribution. Although Ethiopian diets became slightly more monotonous on average, those at the lower end of the distribution consumed more food groups in 2016 than in 2011 (Figure 10A.3).

Consistent with Berhane et al. (2012), the Central Statistical Agency (Ethiopia, CSA 2018), and Hirvonen, Tafesse, and Worku Hassen (2016), urban-rural comparisons indicate that energy consumption in rural areas (3,144 kilocalories per adult) is 17 percent higher than in urban areas (2,678 kilocalories per adult), and 34 percent higher than in Addis Ababa (2,338 kilocalories per adult). Similarly, the share of the rural population that is energy deficient (24.6 percent) is 17 percent lower than in urban areas in general (29.8 percent deficient) and 27 percent lower than in Addis Ababa (33.9 percent deficient). These differences, however, more likely represent differences in caloric energy needs than differences in levels of food security (Deaton and Drèze 2009; Headey and Ecker 2013). This follows from the need to expend less energy in urban areas due to less physically demanding labor, increased use of motorized transportation, and reduced energy losses through improved health.

While urban residents consume fewer calories than their rural counterparts, the quality of their diets is higher. The average urban resident in 2016 acquired 60.2 percent of her or his daily calories from starchy staples, which was 19 percent lower than for the average rural resident (74.3 percent). Moreover, the proportion of urban residents relying heavily on starchy staples (15.6 percent) was 70 percent lower than in rural areas (53.5 percent). This was even lower in Addis Ababa, where only 5.1 percent acquired more than 75 percent of their calories from starchy staples. As they shift out of staples, urban residents shift into more diverse diets. This is illustrated by urban residents consuming food from an average of 6.9 different food groups over the course of a week, compared with 5.9 food groups in rural areas.[3]

Diet quantity generally improved in both urban and rural areas between 2011 and 2016. For example, energy deficiency fell in each by roughly 2 percentage points. Interestingly, while average daily energy consumption increased by 1.7 percent in rural areas, from 3,091 kilocalories per adult to 3,144 kilocalories per adult, the level in urban areas in 2011 was not statistically different from the 2,678 kilocalories per adult observed in 2016. As was observed at the national level, changes in the quality of diets in urban and rural areas were mixed. The reliance of households on low-quality starchy staples fell considerably. The average share of starchy staples in urban and rural diets dropped by 6.6 percentage points and 3.2 percentage points, respectively. Similarly, the share of households consuming 75 percent or more of their calories from starchy staples fell by 11.4 percentage points in urban areas and by 10.3 percentage points in rural areas. This decline in the share of staples in total food consumption accompanying the increases in total calories, however, appears to represent shifts away from staples to other food groups that were already being consumed, rather than to new food groups. In fact, dietary diversity appears to deteriorate somewhat, from 6.0 to 5.9 food groups in rural areas and from 7.4 to 6.9 food groups in urban areas.

A regional analysis of rural areas reveals a mixed picture for 2016 with (a) energy consumption highest in SNNP and Gambella, (b) reliance on staples lowest in Somali, Benishangul-Gumuz and Amhara, (c) and dietary diversity highest in Harari and Oromia. Conversely, we find that (a) energy consumption was lowest in Amhara, (b) reliance on staples is highest in Dire Dawa and Harari, and (c) dietary diversity is lowest in Amhara.

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3 Relatively large differences in dietary quality between urban and rural areas have also been observed in several other studies, including for Ghana (Ecker and Fang 2016), Malawi (Jones, Shrinivas, and Bezner-Kerr 2014), Mozambique (Smart, Tschirley, and Smart 2018), South Africa and Kenya (Steyn et al. 2012), and all of Africa south of the Sahara (Hirvonen 2016).

Compared to the average daily energy consumption in all rural areas in 2016 (3,144 kilocalories per adult), SNNP (3,811 kilocalories per adult), Gambella (3,570 kilocalories per adult), Harari (3,416 kilocalories per adult), and Oromia (3,346 kilocalories per adult) fared well. This translates into fewer than 10 percent of the rural population in SNNP and Gambella suffering from energy deficiency, and less than 20 percent being energy deficient in Harari and Oromia. At the other extreme, however, the low level of daily energy consumption in Amhara (2,389 kilocalories per adult) means that nearly half of the rural population there consumes fewer than 2,200 kilocalories per day on average. This is considerably higher than the all-rural average of 24.6 percent. Although rural food energy consumption fell between 2011 and 2016 in Benishangul-Gumuz (13.4 percent) and Tigray (3.8 percent), the 10.4 percent decrease in Amhara left an already low food-quantity region with even lower consumption. In fact, Amhara was the only province to observe an increase in rural dietary deficiency over this time period.

The low average quality of diets in rural areas masks considerable regional variation. The average share of total calories derived from starchy staples, for example, ranges from 66.1 percent in Somali to 83.7 percent in neighboring Dire Dawa. It is not surprising that rural residents in Somali are less reliant on staples (only 29 percent consume more than 75 percent of total calories from starchy staples) than elsewhere in the country (53 percent of all rural individuals consume a high proportion of staples) given the predominance of pastoralism and the higher consumption of animal-sourced foods consumed there. Interestingly, although residents in Amhara have the lowest levels of daily energy consumption among rural populations, they are less reliant on staples (70 percent of total calories) than those in all other regions except for Somali and Benishangul-Gumuz. Although most regions experienced declines, residents in rural Afar became more dependent on starchy staples as a share of total calories (3.6 percentage point increase to 77.6 percent).

Dietary diversity further adds to the mixed picture. While two regions with higher than average levels of rural daily energy consumption (Harari and Oromia) are also those with the highest levels of dietary diversity (6.4 and 6.3 food groups, respectively), another region with highest energy consumption (SNNP) has the lowest level of dietary diversity (5.8 food groups). So while rural households in SNNP appear to be satisfying their basic caloric needs with energy-dense diets, they are less likely to be acquiring essential macronutrients and micronutrients that accompany more diversified diets. In Amhara, though, low dietary diversity (5.5 food groups) is consistent with low daily caloric intake (2,389 kilocalories).

A regional analysis of urban areas reveals an equally mixed picture for 2016 with (a) energy consumption highest in Benishangul-Gumuz, Gambella, and Amhara, (b) reliance on staples lowest in Afar, and (c) dietary diversity highest in Dire Dawa and Harari. Conversely, we find that (a) energy consumption was lowest in Afar and Harari, (b) reliance on staples is highest in Tigray, Gambella, and SNNP, and (c) dietary diversity is lowest in Amhara and Afar.

In terms of quantity measures of food security, whereas urban residents in Benishangul-Gumuz had the highest levels of daily energy consumption in 2016 (2,924 kilocalories per adult) despite experiencing a 4.6 percent decrease between 2011 and 2016, urban residents in Amhara (2,853 kilocalories per day) and Gambella (2,892 kilocalories per day) consumed more than the urban average (2,678 kilocalories per day) due to growth over this period. Not surprisingly, these three regions also experienced the lowest levels of urban energy deficiency in 2016 (22.2 percent, 21.8 percent, and 26.5 percent, respectively).

An indication that calorie consumption may not be a good indicator of food security in urban areas is that the four regions in which urban food energy consumption is lowest and in which food energy deficiency is highest (Afar, Harari, Dire Dawa, and Addis Ababa) are also regions characterized by high-quality diets. For example, the proportion of urban residents in these regions whose diets include a high proportion of starchy staples are well below the urban average of 15.6 percent (for example, 4.0 percent, 6.1 percent, 5.1 percent, and 2.9 percent, respectively). In addition, although dietary diversity in urban Afar is among the lowest in the all urban areas (6.6 food groups), it is highest in Dire Dawa (7.5), Harari (7.3), and Addis Ababa (7.1).

Seasonality

Levels of food security in Ethiopia vary seasonally due to weather patterns, crop cycles and religious observances. General patterns observed over the 12 months from July 2015 through June 2016 during which data were collected for the HCES include the following: (1) energy consumption was highest in both urban and rural areas during postharvest periods and lowest during lean periods; (2) reliance on cereals, roots, and tubers (starchy staples) varied little in urban areas but appears to account for most of the decline in energy consumption during lean periods in rural areas; (3) dietary diversity varied little in urban areas but was generally lower during lean periods in rural areas; and (4) the poorest households in urban areas experienced more seasonal variation in starchy staple consumption and dietary diversity than less poor households, whereas the richest households in rural areas experienced more seasonal variation than less poor households in terms of energy consumption, reliance on starchy staples, and dietary diversity.

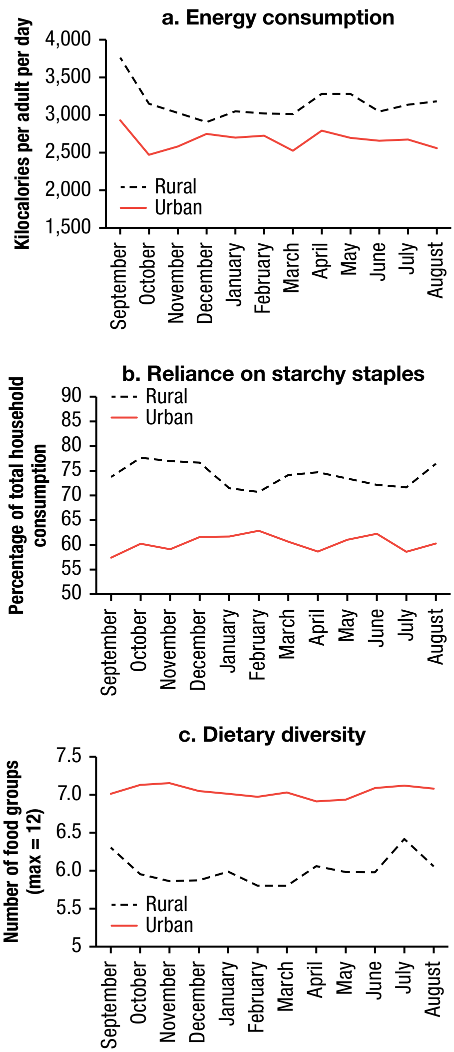
As illustrated in Figure 10.1a, while energy consumption in rural areas is higher and slightly more variable than in urban areas, the seasonal patterns are generally similar. Average calorie intake per adult equivalent was highest at the beginning of the *meher* harvest in September (rural: 3,763 kilocalories; urban: 2,929 kilocalories) and the *belg* harvest in April (rural: 3,281 kilocalories; urban: 2,791 kilocalories), and was low in the lean months just prior to these harvests (rural: 3,121 kilocalories for June–August and 3,027 kilocalories for January–March; urban: 2,558 kilocalories in August and 2,524 kilocalories in March).

Figure 10.1b and 10.1c show that although energy consumption varied over the course of the year in urban areas, the quality of diets there remained stable. Throughout the course of the year, urban diets consisted of roughly seven food groups, with starchy staples accounting for about 60 percent of calories consumed. In rural areas, however, the quality did change over time. For example, during the lean season months, the decline in rural energy intake appears to follow from the lower consumption of starchy staples. This is illustrated by the percentage of calories from starchy staples falling from more than 75 percent to 70 percent just prior to the *belg* harvest, and from 75 percent to 71 percent just prior to the *meher* harvest.

Turning to household dietary diversity, we find that rural diet quality is lowest in the *belg* lean period months of February and March (5.8 food groups on average) and highest in September (6.3 food groups) and July (6.4 food groups). The high dietary diversity score in July is puzzling since this is in the midst of the *meher* lean period, when energy consumption is low. Furthermore, this is nearly 0.5 food groups higher than in June and August. Interestingly, Hirvonen, Tafesse, and Worku Hassen (2016) find a similar result using the 2011 HCES. One partial explanation may be that this follows from an increase in vegetable consumption since harvests from homestead garden crops reach their peak in July in Ethiopia (Hirvonen and Headey 2018). This is consistent with our finding that the percentage of people consuming fruits and vegetables rose from 86 percent in June to 96 percent in July (Figure 10.2).

To get a better understanding the seasonal composition of diets in Ethiopia, we illustrate in Figure 10.3 the monthly shares of daily energy intake from noncereal sources. Consistent with the stability of the quality of urban diets observed in Figure 10.1, we find that the composition of urban diets generally did not change substantively over the course of the survey

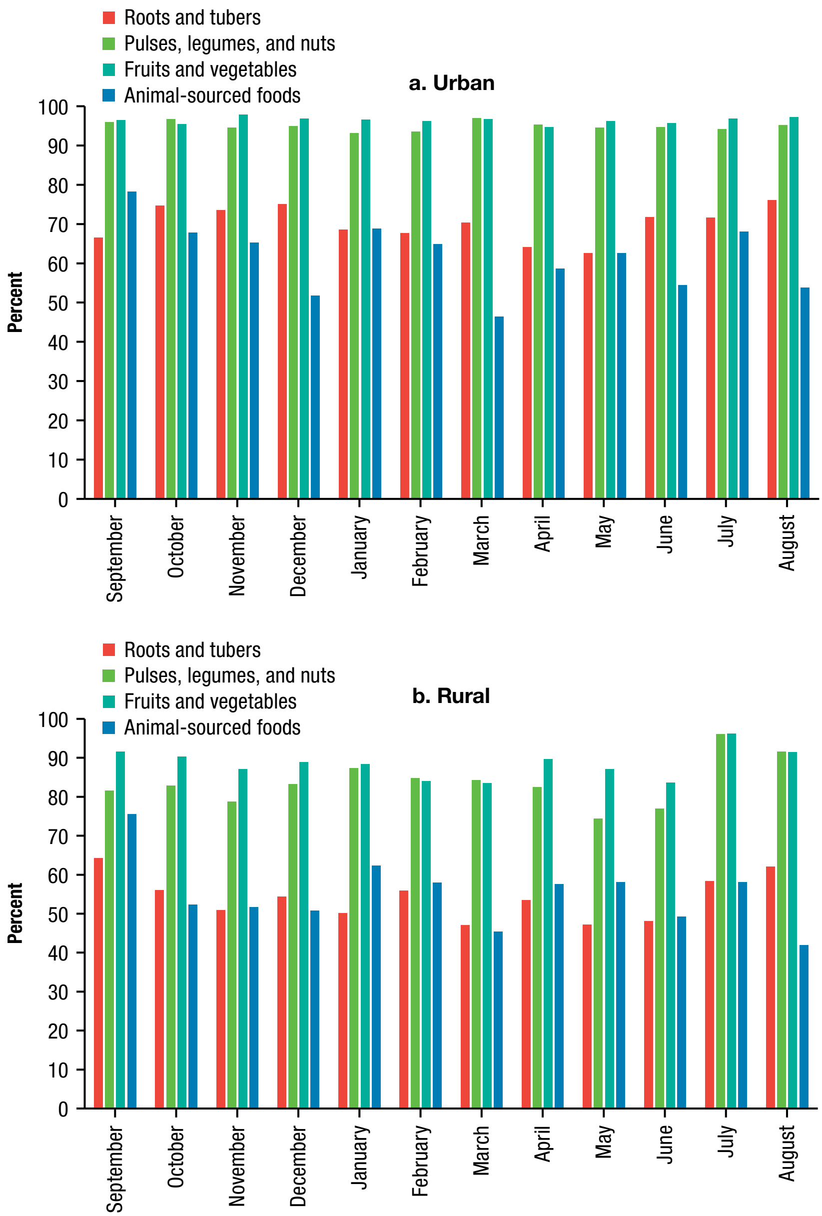
FIGURE 10.1 Seasonality and food security in Ethiopia



Source: Authors' calculations from Ethiopia, CSA 2016.

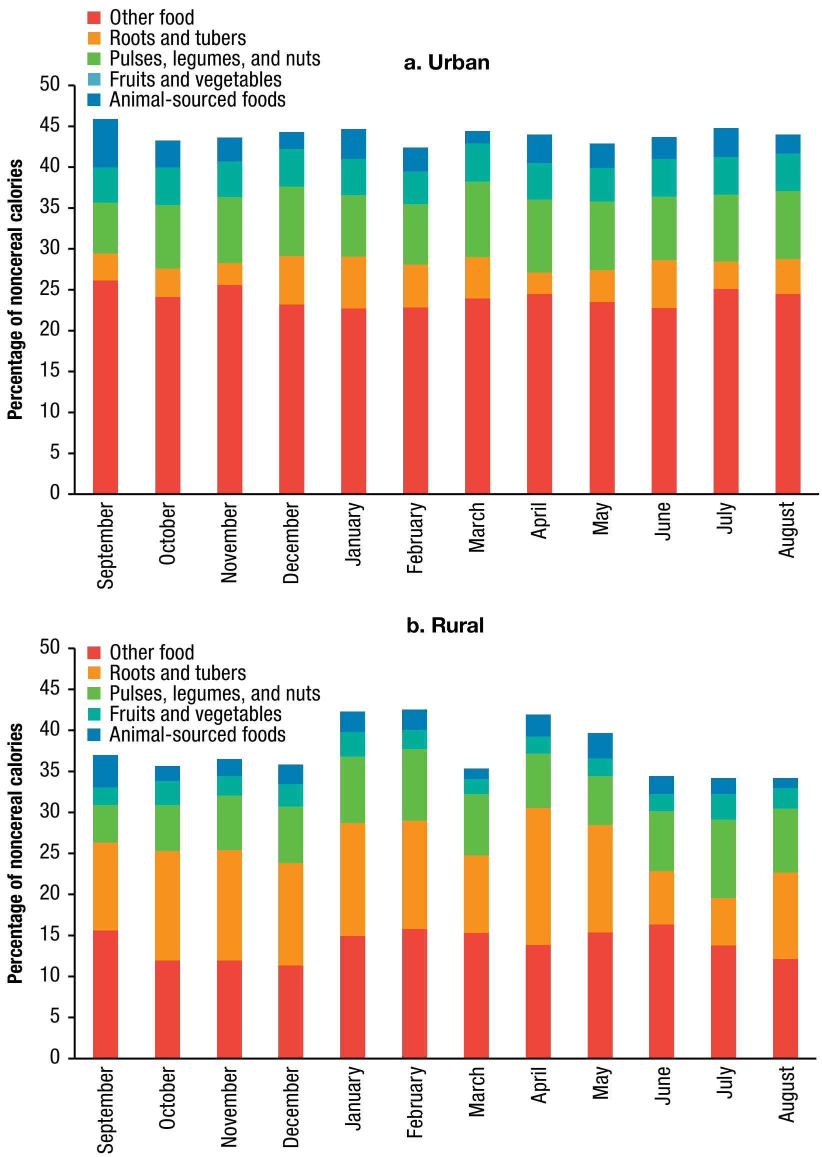
year (Figure 10.3a). The main source of calories was cereals, which constituted 56 percent of energy intake throughout the year. Other foods (oils, fats, sugars, and so on) were the next most important source of energy, making up a stable quarter of urban diets. Pulses, legumes, and nuts made up about 7 percent of urban energy consumption, while fruits and vegetables and roots

FIGURE 10.2 Percentage of households consuming items from noncereal sources in Ethiopia, by month



Source: Authors' calculations from Ethiopia, CSA 2016.

FIGURE 10.3 Percentage of daily energy intake from noncereal sources in Ethiopia, by month



Source: Authors' calculations from Ethiopia, CSA 2016.

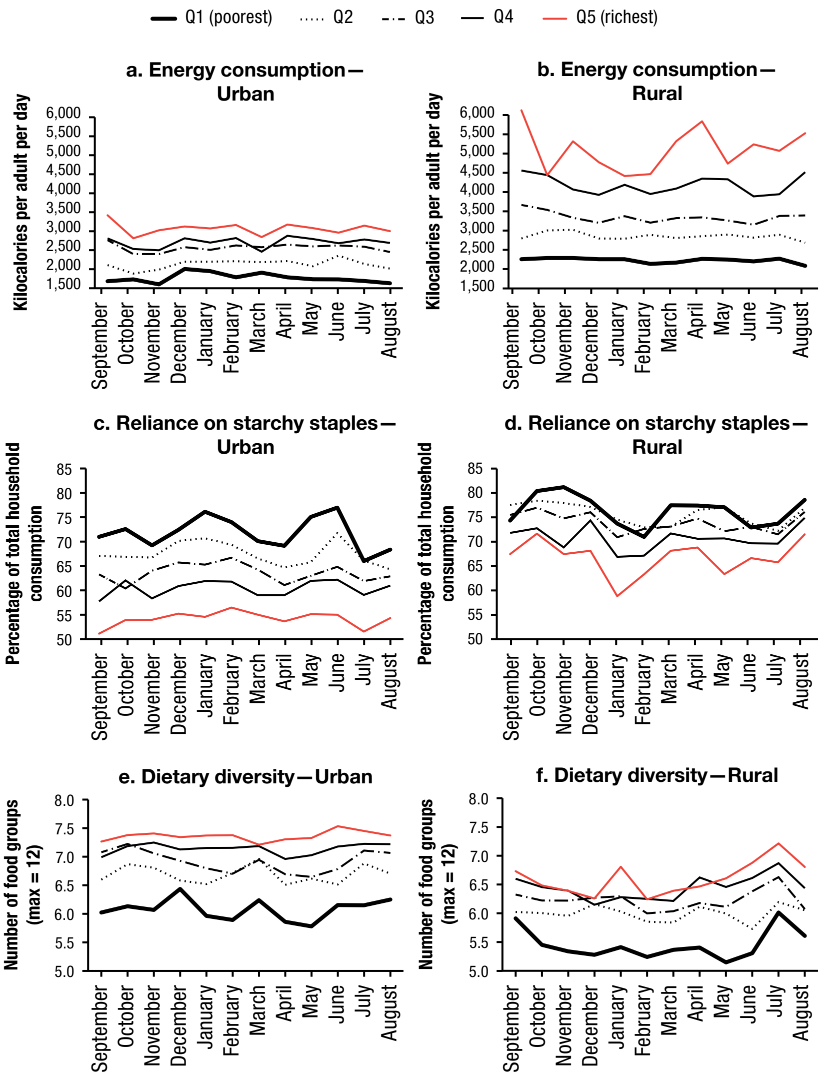
and tubers each accounted for 4 percent. Finally, animal-sourced foods (meat, poultry, fish, and dairy products) account for only 3 percent of calorie intake, but this does vary from a high of 6 percent in September to a low of 2 percent during the fasting months of December and March.

Rural diets (Figure 10.3b) are more heavily weighted toward cereals (63 percent) than urban diets (56 percent) and experience greater fluctuations over the course of the year. The largest sources of seasonal variation in rural diets come from cereals and roots and tubers. For example, cereals fell from 64 percent of rural diets in December to 57 percent in February. This was offset by a 2 percentage point rise of roots and tubers from 12 percent to 14 percent, as well as a 5 percentage point rise in other foods, to the extent that calorie intake over this period did not change (Figure 10.1a). In a similar manner the 6 percentage point decline in the share of roots and tubers between May and June was entirely offset by a 6 percentage-point increase in the share of cereals.

Figure 10.4 illustrates how the seasonal variation in our diet-quantity and -quality measure differs by total household expenditure quintile for urban and for rural areas. Note that the quintiles are calculated over the full sample.[4] So rural households in the second quintile, for example, have a similar range of expenditure levels as urban households in the second quintile. Several patterns emerge from these figures. First, the poorest households in both urban and rural areas have the lowest energy consumption, the highest reliance on starchy staples, and the most monotonous diets. Second, the fact that the richest urban households consume fewer calories on average than rural households in the middle quintile provides further evidence that we should not put too much emphasis on this measure of food security when making urban-rural comparisons. Third, aside from energy consumption, where seasonal variability was modest across all expenditure quintiles, poorer households in urban areas experienced more seasonal variation in their diets than households in higher quintiles. Conversely, in rural areas, richer households experienced more seasonal variation in their diets compared to poorer households. This is especially the case for energy consumption where daily energy consumption for households in the richest quintile ranges from 6,125 to 4,416 kilocalories per adult, compared to a range from 2,288 to 2,086 kilocalories per adult for those in the poorest quintile.

4 Using total household expenditure quintiles calculated separately within urban and rural areas does reduce some of the noisiness of the highest rural quintile and of the lowest urban quintile. But it does not qualitatively change the messages of Figure 10.4.

FIGURE 10.4 Seasonality and food security in Ethiopia, by expenditure quintile



Source: Authors' calculations from Ethiopia, CSA 2016.

Correlates of Food Security

To better understand the mechanisms that affect household food security in Ethiopia in 2016, we present household-level correlates of food security in rural (Table 10.4) and urban (Table 10.5) areas. The major takeaways are that in both rural and urban areas, smaller, more educated households with higher overall expenditure levels are generally more food secure (Figures 10.A4 and 10.A5). Those who have members working as legislators, professionals, technicians, and clerks are also more food secure. Agricultural households in urban areas are among the least food secure. In rural areas, although average energy intake is reasonably high for agricultural households, the quality of their diets is low. In rural areas male-headed households consume fewer calories per adult than female-headed households but have slightly higher-quality diets. In urban areas there is virtually no distinction between male- and female-headed households in terms of food security.

Smaller households have higher energy consumption per adult equivalent than larger ones. For example, in rural areas one-person households consume an average of 4,568 kilocalories per day, compared with 2,829 kilocalories per day for households with six or more members. The gap is not as large in urban areas but remains significant nonetheless, with one-person households consuming 3,443 kilocalories, compared with 2,326 kilocalories for households with six or more members. While energy deficiency levels are higher in urban areas, as noted previously, the gap between small and large households is larger in urban areas (23.8 percentage points) than in rural areas (21.9 percentage points) as well. In terms of the quality of diets, households with fewer members generally rely less on staples and have more diverse diets. While the share of total calories from staples increases monotonically with household size (65.2 percent to 75.7 percent in rural areas, and 52.3 percent to 64.0 percent in urban areas), the number of food groups plateaus after four members. In rural areas one-person households consume an average of just under five food groups in a week, while households with four or more members consume about six food groups. In urban areas one-person households consume 1.5 fewer food groups (5.6) than those with four or more members (7.1).

Better educated households are generally more food secure. Using the education level of the household head as our measure of household education, we find that more educated households in both rural and urban areas tend to have higher energy intake and better quality diets. The exception is households whose head has adult or informal education (that is, literate but with no formal education). In urban areas the food security status of these

TABLE 10.4 Food security and household characteristics in Ethiopia, rural areas (2016)

Characteristic	Diet quantity: Energy consumed[a]	Diet quantity: Energy deficiency[b]	Diet quality: Share from staples[c]	Diet quality: High portion staples[d]	Diet quality: Dietary diversity[e]
Sex of household head					
Female	3,451	19.2	75.1	57.5	5.8
Male	3,082	25.7	74.1	52.7	6.0
Household size					
1	4,568	8.7	65.2	27.7	4.9
2	4,202	9.8	69.8	41.4	5.7
3	3,898	13.3	71.8	43.1	5.8
4	3,522	16.5	72.8	46.4	6.0
5	3,180	21.5	73.6	51.2	5.9
6+	2,829	30.6	75.7	58.7	6.1
Education (household head)					
None	3,069	26.1	74.9	55.3	5.8
Grades 1–4	3,216	21.3	75.0	56.4	6.2
Grades 5–8	3,510	15.8	74.2	53.1	6.4
Grades 9–12	3,614	10.3	72.8	48.8	6.6
Postsecondary	4,112	6.1	67.3	29.3	7.0
Adult/Informal	2,557	45.2	70.4	41.3	5.8

households is not substantively different from households with no or little education. In rural areas these households are substantially worse off than all others in terms of energy intake. The following discussion thus focuses on the 93 percent of households who either have no education or have at least some formal education.

In rural areas diet quantity increases monotonically with each level of education. For example, households with no education consume an average of 3,069 kilocalories per adult per week, while those with postsecondary education consume 4,112 kilocalories per adult per week. Similarly, energy deficiency declines monotonically and dramatically with schooling. The share of individuals who consume fewer than 2,200 kilocalories per adult per day is 26.1 percent for those in households with no education, compared to 6.1 percent for those in households with postsecondary education. Diet quality for rural households tends to increase for households with five or more years of formal schooling. For example, while the share of calories derived from starchy staples is about 75 percent for households without any education

	Diet quantity		Diet quality		
Characteristic	Energy consumed[a]	Energy deficiency[b]	Share from staples[c]	High portion staples[d]	Dietary diversity[e]
Expenditure quintiles					
Q1 (poorest)	2,230	55.8	76.7	61.1	5.4
Q2	2,863	17.0	75.8	58.4	6.0
Q3	3,347	12.7	74.0	52.9	6.2
Q4	4,207	5.6	70.6	41.2	6.4
Q5 (richest)	5,126	1.7	66.7	31.1	6.6
Profession					
Agriculture	3,298	24.8	75.2	57.3	5.6
Legislator	3,375	18.0	65.5	12.9	6.6
Professional	4,059	6.0	65.3	20.5	7.2
Technician	3,673	8.9	65.0	33.4	7.0
Clerk	3,226	13.8	60.6	16.4	6.6
Service	3,100	28.3	72.6	49.5	6.0
Skilled	3,128	24.5	74.5	54.1	6.0
Craft	3,089	28.1	72.4	47.0	6.0
Plant/machine operator	2,922	24.9	68.4	20.1	6.2

Source: Authors calculations from HCES 2015/2016 (Ethiopia, CSA 2016).

Note: a. Average kilocalories per adult per day.

b. Percentage of population in households consuming less than 2,200 kilocalories per adult per day.

c. Average share of total calories from starchy staples.

d. Percentage of population in households consuming more than 75 percent of total calories from starchy staples.

e. Average number of food groups (max = 12) consumed by household during previous week.

and for those with one to four years of schooling, the reliance on staples falls for households that acquired more than four years of education (for example, 74.2 percent for those with five to eight years, 72.8 percent for those with nine to twelve years, and 67.3 percent for those with more than twelve years). This translates to a similar decline in the percentage of those living in households with a high proportion (75 percent) of their calories from starchy staples. For example, 56 percent of those in households with less than five years of schooling consume a high proportion from starchy staples, compared with 29.3 percent of those in households with postsecondary education. Dietary diversity also increases with education, rising from an average of 5.8 food groups for households with no education to 7.0 food groups for those with postsecondary education.

In urban areas diet quantity improves with education for those with more than eight years of schooling. For example, individuals in urban households

TABLE 10.5 Food security and household characteristics in Ethiopia, urban areas (2016)

Characteristic	Diet quantity		Diet quality		
	Energy consumed[a]	Energy deficiency[b]	Share from staples[c]	High portion staples[d]	Dietary diversity[e]
Sex of household head					
Female	2,712	30.7	60.0	15.4	7.0
Male	2,661	29.4	60.3	15.8	7.1
Household size					
1	3,443	16.4	52.3	8.5	5.6
2	3,163	20.9	54.7	9.5	6.7
3	2,933	22.5	56.9	12.0	7.0
4	2,792	24.9	59.8	13.8	7.1
5	2,575	28.6	61.1	14.7	7.2
6+	2,326	40.2	64.0	21.2	7.2
Education (household head)					
None	2,597	34.1	63.6	21.3	6.7
Grades 1–4	2,579	33.9	63.4	24.3	6.9
Grades 5–8	2,568	34.7	60.0	15.6	7.0
Grades 9–12	2,699	27.7	58.1	11.5	7.2
Postsecondary	2,915	20.2	56.7	8.3	7.5
Adult/informal	2,621	30.0	63.4	19.8	6.7

with eight years of schooling or less consume approximately 2,600 kilocalories per adult on average, while those with nine to twelve years consume 2,699 kilocalories per adult, and those with postsecondary education consume 2,915 kilocalories per adult. This pattern is reflected in energy deficiency levels, which fall from about 34 percent for those with eight years of schooling or less, to 27.7 percent for those with nine to twelve years, and further to 20.2 percent for those with postsecondary education. Diet quality similarly improves with education but starts with five to eight years of schooling, rather than nine to twelve years. For example, the average share of starchy staples in the diets of urban households falls monotonically from 63.4 percent for those with one to four years of schooling, to 56.7 percent for those with postsecondary education. Similarly, the share of those with a high proportion of starchy staples in their diets falls monotonically from 24.3 percent for households with one to four years of schooling to 8.3 percent for those with postsecondary education. Finally, dietary diversity in urban areas increases monotonically

Characteristic	Diet quantity		Diet quality		
	Energy consumed[a]	Energy deficiency[b]	Share from staples[c]	High portion staples[d]	Dietary diversity[e]
Expenditure quintiles					
Poorest	1,768	72.2	71.3	44.4	6.1
Q2	2,132	53.9	67.3	30.9	6.7
Q3	2,562	28.8	63.5	19.8	6.9
Q4	2,711	25.2	60.4	13.1	7.1
Richest	3,094	15.2	53.9	3.9	7.4
Profession					
Agriculture	2,570	33.3	60.8	15.7	7.0
Legislator	2,743	23.5	56.9	10.0	7.6
Professional	2,918	19.4	57.0	8.4	7.5
Technician	2,940	18.9	57.6	9.2	7.3
Clerk	2,789	24.1	56.7	8.3	7.3
Service	2,577	33.9	59.3	14.4	7.0
Skilled	2,850	26.9	68.7	33.5	6.7
Craft	2,655	31.0	62.8	18.9	6.8
Plant/machine operator	2,609	29.2	56.8	11.6	7.4

Source: Authors' calculations from HCES 2015/2016 (Ethiopia, CSA 2018).

Note: a. Average kilocalories per adult per day.

b. Percentage of households consuming less than 2,200 kilocalories per adult per day.

c. Average share of total calories from starchy staples.

d. Percentage of households consuming more than 75 percent of total calories from starchy staples.

e. Average number of food groups (max = 12) consumed by household during previous week.

throughout the formal education distribution, rising from 6.7 food groups for those without any education to 7.5 food groups for those with postsecondary education.

To explore the avenues through which education may affect household food security, we regress our energy consumption, share of starchy staples, and dietary diversity variables on household education and progressively add such variables as expenditure quintiles, household demographics, rainfall shocks, and profession of the household head. Comparisons of the estimated coefficients on education across the models yields insights into the possible mechanisms linking household education and food security.[5]

5 This approach, referred to as mediation or suppression effects, is common in the public health literature (MacKinnon, Krull, and Lockwood 2000).

TABLE 10.6 **Regressions of household energy consumption in Ethiopia per adult equivalent**

	Rural			
Variables	Model 1	Model 2	Model 3	Model 4
Education of household head (base = none)				
Grades 1–4	147.1** (45.57)	97.31* (38.09)	118.8** (37.74)	5.216 (36.11)
Grades 5–8	440.4*** (57.93)	202.5*** (48.47)	216.2*** (47.61)	98.38* (45.88)
Grades 9–12	544.3*** (108.20)	107.7 (85.10)	124.7 (88.29)	–34.62 (87.76)
Postsecondary	1042.7*** (152.60)	–67.26 (153.30)	–91.22 (158.50)	80.44 (222.90)
Adult/informal	–512.5*** (45.54)	–442.8*** (38.36)	–350.4*** (38.85)	–46.21 (38.68)
Expenditure quintile (base = poorest)				
Q2		610.6*** (24.15)	577.4*** (24.12)	415.0*** (23.92)
Q3		1078.3*** (39.05)	1034.8*** (37.87)	924.1*** (36.64)
Q4		1946.3*** (51.12)	1893.6*** (53.15)	1736.3*** (51.31)
Richest		2862.1*** (82.63)	2764.9*** (85.45)	2584.2*** (81.47)
Household head is male (dummy)			–53.01 (38.00)	–52.28 (37.10)
Age of household head			–5.322*** (1.03)	–6.208*** (1.02)
Household size			–97.80*** (7.67)	–122.6*** (7.80)
Share of dependents in household			1010.4*** (68.07)	979.3*** (63.45)
Meher rain deviation from average				0.992 (1.95)
Additional controls	No	No	No	Yes
R2	0.034	0.348	0.383	0.475
Number of observations	10,366	10,366	10,366	10,366

Source: Authors' calculations from HCES 2015/2016 (Ethiopia, CSA 2016).

Note: Additional controls include occupation, region, and agroecological zone dummies. Robust standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

	Urban			
Variables	Model 1	Model 2	Model 3	Model 4
Education of household head (base = none)				
Grades 1–4	–18.16 (38.71)	–77.67* (34.37)	–76.32* (32.55)	–65.94* (31.72)
Grades 5–8	–29.78 (30.97)	–194.4*** (27.77)	–187.1*** (27.85)	–112.5*** (26.81)
Grades 9–12	101.4*** (30.79)	–208.0*** (28.49)	–196.0*** (28.95)	–95.29*** (28.10)
Postsecondary	318.0*** (30.62)	–111.1*** (30.06)	–104.1*** (30.66)	–95.56** (32.60)
Adult/informal	23.89 (46.25)	–79.3 (41.42)	–10.07 (38.63)	–39.78 (37.83)
Expenditure quintile (base = poorest)				
Q2		383.1*** (34.08)	377.6*** (32.88)	431.9*** (32.08)
Q3		816.4*** (33.92)	789.6*** (33.19)	848.9*** (32.91)
Q4		978.2*** (31.28)	943.6*** (31.23)	1047.5*** (31.61)
Richest		1374.6*** (30.38)	1325.9*** (32.57)	1471.3*** (33.12)
Household head is male (dummy)			39.46* (18.58)	–63.04*** (19.15)
Age of household head			–3.276*** (0.64)	–0.321 (0.66)
Household size			–99.04*** (5.70)	–97.58*** (5.64)
Share of dependents in household			844.4*** (39.80)	726.0*** (37.51)
Meher rain deviation from average				0.537 (0.47)
Additional controls	No	No	No	Yes
R2	0.016	0.175	0.242	0.316
Number of observations	19,856	19,856	19,856	19,856

These models suggest that in rural areas the effects of education on energy consumption and the share of starchy staples are almost entirely mediated by households' abilities to acquire goods (that is, household expenditure quintile). Household expenditures, profession of the household head, and other controls account for roughly half of the effect of education on dietary diversity, suggesting that education still has a direct effect on the diversity of diets in rural areas. To see this, we note first that Model 1 for both rural (column 1) and urban (column 5) areas in Tables 10.6, 10.7, and 10.8 show the differences in energy intake, share of starchy staples, and dietary diversity by household education levels that are illustrated in Tables 10.4 and 10.5. When we add expenditure quintiles to the model (Model 2), the magnitudes of the education coefficients for energy consumption (Table 10.6) and share of starchy staples (Table 10.7) fall substantially and in most cases become insignificant.

Given the positive association between education and household expenditures (rural households with postsecondary education have expenditure levels that are 60 percent higher than those with no education in this sample), and the positive and monotonic relationship between household expenditure quintiles and all of our food security indicators (Table 10.4), the fall in the magnitude of the coefficients on education suggests that the positive relationship between education and energy consumption and share of starchy staples is due to the effect of education on household expenditure. While the magnitudes of the education coefficients also fall for the rural dietary diversity models (Table 10.8), they remain statistically and economically significant once household expenditure quintiles are added to the model. They fall further once household demographics, rainfall shocks, and profession of the household head are added but remain statistically and economically significant. Thus, although expenditures and profession mediate part of the effect of education on dietary diversity, education appears to have an independent effect as well.

For urban areas these models suggest that although household expenditure and profession mediate some of the effect, education continues to have an independent effect on diet quality (coefficients in urban Model 4 in Table 10.8 are positive and statistically significant). Interestingly, the mediated effect of education on energy consumption through household expenditures appears to be so large that education becomes negatively associated with energy consumption when we control for expenditures. The decline in magnitude of the education coefficients when we further add occupation suggest that the negative relationship between education and energy consumption may be due to less demanding work-energy requirements for those with more education. Nonetheless, even when the full controls are included in the model, the education coefficients in the energy requirement models remain statistically significant.

Finally, controlling for agroecological zones in Model 4, we find no evidence that rainfall shocks had an impact on food security in rural areas. We do find evidence of an impact on diet quality in urban areas, but the magnitudes are small. For example, one additional millimeter of rain during the *meher* season above the 30-year *meher* season average is associated with a modest increase of 0.002 food groups. This result is particularly salient since Ethiopia experienced in 2015 one of the worst droughts in decades (Sohnesen 2018). This lack of an impact is consistent with the findings of Hirvonen, Sohnesen, and Bundervoet (2018) that the drought did not lead to widespread undernutrition. Hirvonen, Sohnesen, and Bundervoet (2018) credit this resilience to the role of the improved road infrastructure and to the effective targeting of aid and social safety nets. We are unable to conduct inference on these possible sources of resilience. Nonetheless, the absence of a negative effect of rainfall shocks in the models, as well as the fact that we did not observe a widespread deterioration of food security between 2011 and 2016, suggests that the transformation and integration of food markets (Chapters 7 and 9) may have had a dampening effect on shocks and that responses to the drought by the Ethiopian government and the international community were successful.

Conclusion

This chapter provides an updated assessment of food security in Ethiopia using data from the most recent Ethiopian Household Consumption and Expenditure Survey dataset (2015/2016). The HCES are repeated nationally representative cross-sectional surveys collected by the Central Statistical Agency and serve as the official source for poverty statistics in Ethiopia. An extensive consumption–expenditure module allows us to estimate household food consumption patterns to assess food security in 2016 and to compare these patterns to those observed in the 2011 HCES.

Ethiopia continues to face high levels of food insecurity. Daily energy consumption is low (3,055 kilocalories per adult on average) and diet quality is poor (starchy staples account for 71.6 percent of calories) and monotonous (6.1 food groups are consumed per week out of a possible 12). Moreover, energy consumption is especially low for the poorest total household expenditure quintile (2,200 kilocalories per adult), compared with the richest quintile (3,916 kilocalories per adult). Between 2011 and 2016 the diets of the poorest

TABLE 10.7 Regressions of share of starchy staples in household diets in Ethiopia

	Rural			
Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Education of household head (base = none)				
Grades 1–4	0.0944 (0.44)	0.225 (0.43)	0.755 (0.45)	−0.618 (0.44)
Grades 5–8	−0.652 (0.48)	0.113 (0.47)	0.876 (0.49)	−0.256 (0.46)
Grades 9–12	−2.020* (0.92)	−0.534 (0.88)	0.654 (0.88)	−0.706 (0.84)
Postsecondary	−7.532*** (1.28)	−3.539** (1.20)	−2.061 (1.17)	−0.38 (1.53)
Adult/informal	−4.424*** (0.62)	−4.620*** (0.60)	−4.501*** (0.60)	−1.774** (0.56)
Expenditure quintile (base = poorest)				
Q2		−1.066* (0.44)	−0.824 (0.44)	−2.529*** (0.42)
Q3		−2.931*** (0.47)	−2.729*** (0.47)	−4.129*** (0.47)
Q4		−6.207*** (0.50)	−5.614*** (0.53)	−7.263*** (0.54)
Richest		−9.899*** (0.64)	−8.786*** (0.68)	−11.14*** (0.68)
Household head is male (dummy)			−2.164*** (0.42)	−1.810*** (0.41)
Age of household head			0.0695*** (0.01)	0.0431*** (0.01)
Household size			0.480*** (0.09)	0.308*** (0.09)
Share of dependents in household			1.365 (0.79)	0.593 (0.77)
Meher rain deviation from average				−0.0275 (0.02)
Additional controls	No	No	No	Yes
R^2	0.013	0.057	0.071	0.193
Number of observations	10,366	10,366	10,366	10,366

Source: Authors' calculations from HCES 2015/2016 (Ethiopia, CSA 2016).

Note: Additional controls include occupation, region, and agroecological zone dummies. Robust standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

	Urban			
Variables	Model 1	Model 2	Model 3	Model 4
Education of household head (base = none)				
Grades 1–4	–0.169 (0.61)	0.566 (0.56)	0.774 (0.56)	–0.38 (0.54)
Grades 5–8	–3.636*** (0.45)	–1.548*** (0.42)	–1.085* (0.45)	–1.307** (0.44)
Grades 9–12	–5.509*** (0.46)	–1.494*** (0.44)	–0.811 (0.47)	–0.879 (0.47)
Postsecondary	–6.893*** (0.42)	–1.236** (0.42)	–0.722 (0.45)	–1.615** (0.53)
Adult/informal	–0.156 (0.68)	1.133 (0.64)	0.406 (0.65)	–1.16 (0.62)
Expenditure quintile (base = poorest)				
Q2		–3.840*** (0.70)	–3.622*** (0.70)	–2.894*** (0.66)
Q3		–7.594*** (0.68)	–7.148*** (0.69)	–5.956*** (0.67)
Q4		–10.59*** (0.62)	–9.888*** (0.63)	–8.238*** (0.60)
Richest		–16.75*** (0.60)	–15.45*** (0.63)	–13.22*** (0.62)
Household head is male (dummy)			0.385 (0.29)	–0.303 (0.30)
Age of household head			0.0675*** (0.01)	0.0599*** (0.01)
Household size			0.399*** (0.08)	0.618*** (0.08)
Share of dependents in household			2.186*** (0.61)	0.976 (0.58)
Meher rain deviation from average				–0.0195** (0.01)
Additional controls	No	No	No	Yes
R^2	0.032	0.149	0.161	0.244
Number of observations	19,856	19,856	19,856	19,856

TABLE 10.8 Regressions of dietary diversity in household diets in Ethiopia (number of food groups out of 12)

	Rural			
Variables	Model 1	Model 2	Model 3	Model 4
Education of household head (base = none)				
Grades 1–4	0.418*** (0.04)	0.384*** (0.04)	0.276*** (0.04)	0.219*** (0.04)
Grades 5–8	0.587*** (0.04)	0.473*** (0.04)	0.366*** (0.04)	0.325*** (0.04)
Grades 9–12	0.800*** (0.08)	0.626*** (0.07)	0.540*** (0.07)	0.463*** (0.07)
Postsecondary	1.176*** (0.10)	0.806*** (0.09)	0.720*** (0.09)	0.398*** (0.12)
Adult education	0.0457 (0.06)	0.0926 (0.05)	0.0783 (0.05)	0.127* (0.05)
Expenditure quintile (base = poorest)				
Q2		0.538*** (0.04)	0.620*** (0.04)	0.594*** (0.04)
Q3		0.746*** (0.04)	0.826*** (0.04)	0.771*** (0.04)
Q4		0.966*** (0.04)	1.188*** (0.04)	1.136*** (0.05)
Richest		1.058*** (0.06)	1.414*** (0.06)	1.324*** (0.06)
Household head is male (dummy)			0.0287 (0.04)	−0.00677 (0.04)
Age of household head			−0.00376*** (0.00)	−0.00350*** (0.00)
household Size			0.118*** (0.01)	0.112*** (0.01)
Share of dependents in household			0.104 (0.07)	0.116 (0.07)
Meher rain deviation from average				−0.00058 (0.00)
Additional controls	No	No	No	Yes
R^2	0.05	0.138	0.18	0.226
Number of observations	10,366	10,366	10,366	10,366

Source: Authors' calculations from HCES 2015/2016 (Ethiopia, CSA 2016).

Note: Additional controls include occupation, region, and agroecological zone dummies. Robust standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001.

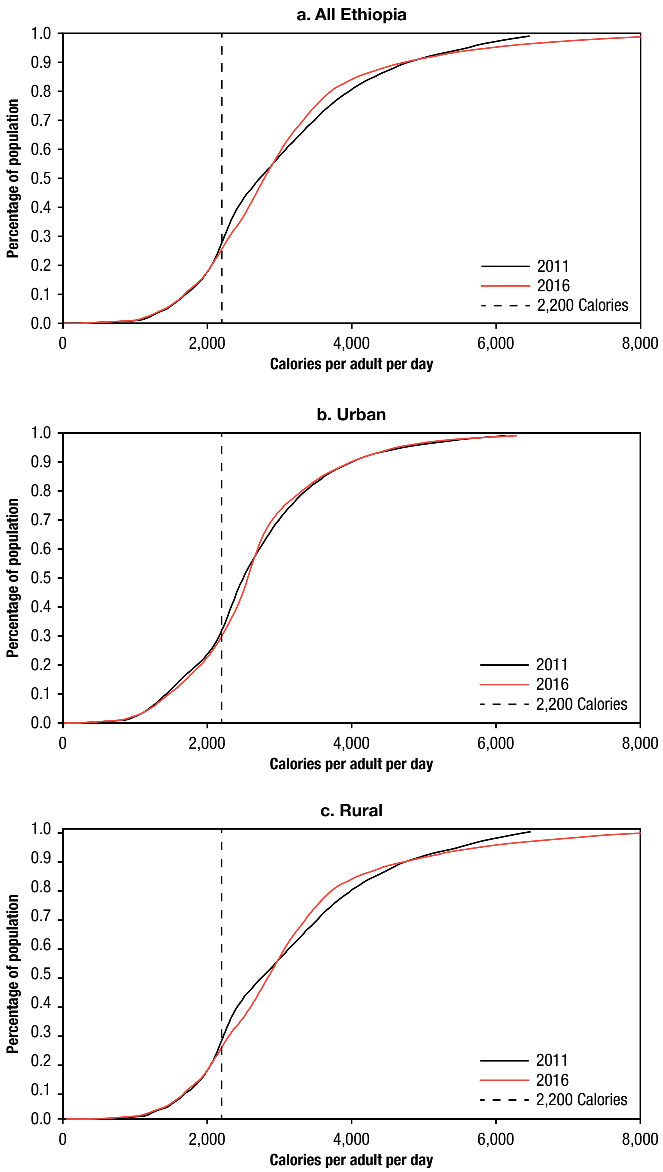
	Urban			
Variables	Model 1	Model 2	Model 3	Model 4
Education of household head (base = none)				
Grades 1–4	0.201*** (0.04)	0.152*** (0.04)	0.157*** (0.04)	0.127** (0.04)
Grades 5–8	0.355*** (0.04)	0.236*** (0.03)	0.264*** (0.04)	0.187*** (0.04)
Grades 9–12	0.489*** (0.04)	0.272*** (0.04)	0.322*** (0.04)	0.236*** (0.04)
Postsecondary	0.779*** (0.03)	0.492*** (0.03)	0.534*** (0.04)	0.441*** (0.04)
Adult education	0.012 (0.06)	−0.0664 (0.06)	−0.0981 (0.05)	0.0116 (0.05)
Expenditure quintile (base = poorest)				
Q2		0.553*** (0.06)	0.631*** (0.05)	0.641*** (0.05)
Q3		0.800*** (0.06)	0.942*** (0.06)	0.942*** (0.05)
Q4		0.951*** (0.05)	1.165*** (0.05)	1.162*** (0.05)
Richest		1.092*** (0.05)	1.477*** (0.05)	1.461*** (0.05)
Household head is male (dummy)			−0.136*** (0.02)	−0.151*** (0.02)
Age of household head			−0.00068 (0.00)	−0.00107 (0.00)
Household size			0.141*** (0.01)	0.133*** (0.01)
Share of dependents in household			0.596*** (0.05)	0.608*** (0.05)
Meher rain deviation from average				0.00153** (0.00)
Additional controls	No	No	No	Yes
R^2	0.051	0.112	0.201	0.236
Number of observations	19,856	19,856	19,856	19,856

half of the population improved slightly (less reliance on starchy staples and greater dietary diversity), although this was mostly in rural areas. For the rest of the population the changes were mixed (less reliance on starchy staples but less diverse diets). Ethiopian diets are also affected by seasonality. Energy consumption tends to be highest in both urban and rural areas during postharvest periods and lowest during lean periods; reliance on cereals, roots, and tubers (starchy staples) tends to vary little in urban areas but accounts for most of the decline in energy consumption during lean periods in rural areas; dietary diversity varies little in urban areas but is generally lower during lean periods in rural areas; and the poorest households in urban areas experience more seasonal variation in starchy staple consumption and dietary diversity than less poor households, whereas richest households experience more seasonal variation than less poor households in terms of energy consumption, reliance on starchy staples, and dietary diversity.

In both rural and urban areas, smaller, more educated households with higher overall expenditure levels are generally more food secure. Those who have members working as legislators, professionals, technicians, and clerks are also more food secure. Agricultural households in urban areas are among the least food secure. In rural areas, although average energy intake is reasonably high for agricultural households, the quality of their diets is low. In rural areas male-headed households consume fewer calories per adult than female-headed households but have slightly higher quality diets. In urban areas there is virtually no distinction between male- and female-headed households in terms of food security. We find little evidence of diets being affected by rainfall shocks. This is particularly salient since Ethiopia had just experienced its worst drought in decades.

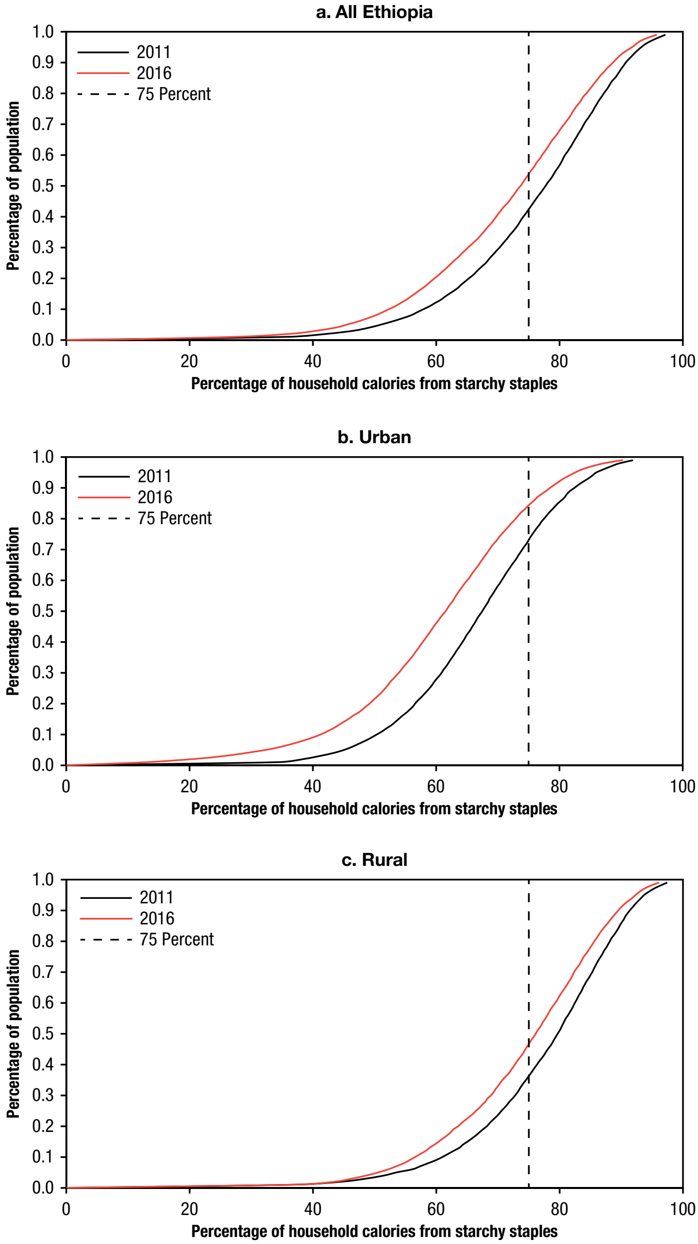
Appendix 10A: Diet Consumption Distributions over Time and Expenditure Quintiles

FIGURE 10A.1 Distributions of energy consumption in Ethiopia, 2011–2016



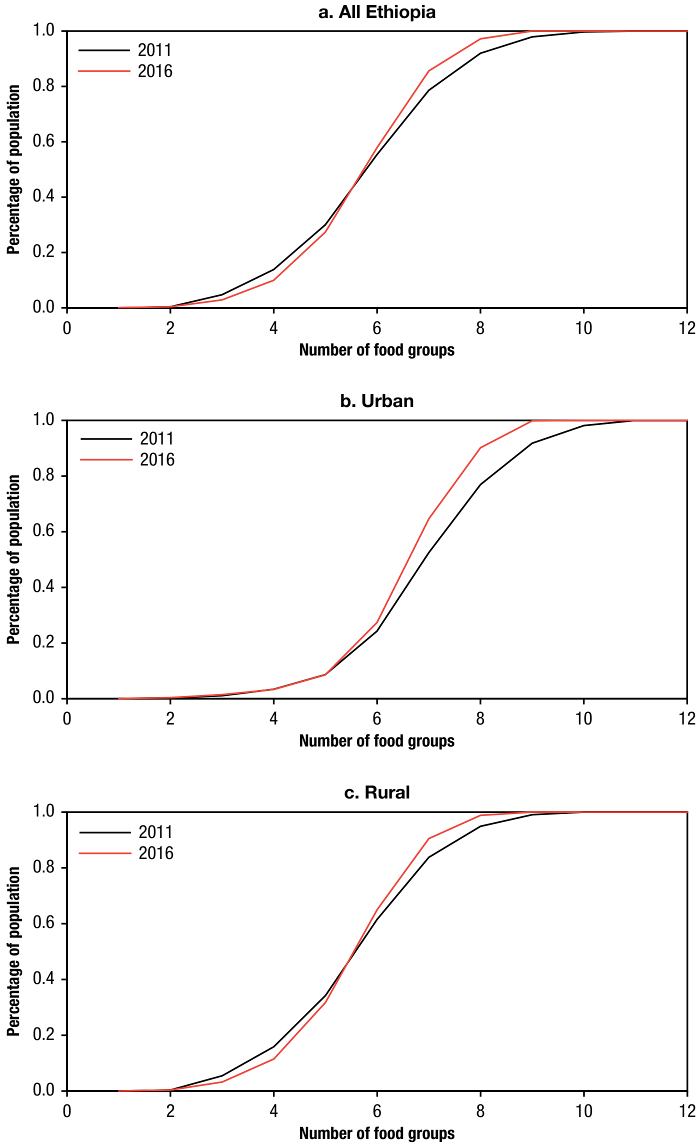
Source: Authors' calculations from HCES 2010/2011 and 2015/2016 (Ethiopia, CSA 2011 and 2016).

FIGURE 10A.2 Distributions of starchy staple consumption in Ethiopia, 2011–2016



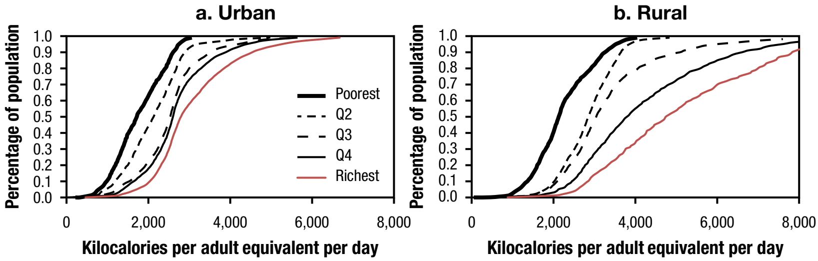
Source: Authors' calculations from HCES 2010/2011 and 2015/2016 (Ethiopia, CSA 2011 and 2016).

FIGURE 10A.3 Distributions of number of food groups consumed in Ethiopia, 2011–2016



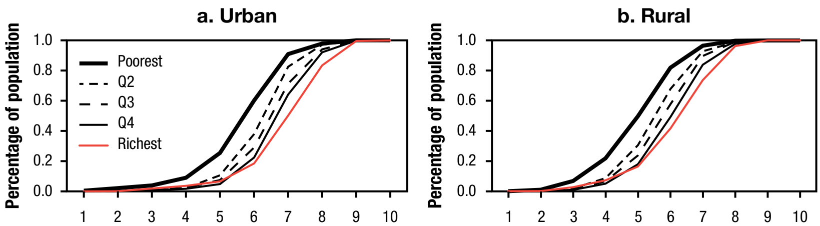
Source: Authors' calculations from HCES 2015/2016 (Ethiopia, CSA 2018)

FIGURE 10A.4 Distributions of energy intake in Ethiopia, by expenditure quintile (2016)



Source: Authors' calculations from HCES 2010/2011 and 2015/2016 (Ethiopia, CSA 2011 and 2016).

FIGURE 10A.5 Distributions of number of food groups consumed in Ethiopia, by expenditure quintile (2016)



Source: Authors' calculations from HCES 2010/2011 and 2015/2016 (Ethiopia, CSA 2011 and 2016).

TABLE 10A.1 Adult Equivalence Scales

Age group (years)	Male	Female
< 1	0.30	0.30
1–2	0.46	0.46
2–3	0.54	0.54
3–5	0.62	0.62
5–7	0.74	0.70
7–10	0.84	0.72
10–12	0.88	0.78
12–14	0.96	0.84
14–16	1.06	0.86
16–18	1.14	0.86
18–30	1.04	0.80
30–60	1.00	0.82
> 60	0.84	0.74

Source: Ethiopia, CSA (2018).

Note: The numbers in the table are the ratios of food requirements of men and women of various ages to the food requirements of an average adult male between the ages of 30 and 60 years.

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