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The processed food revolution in African food systems and the double burden of malnutrition

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ABSTRACT

African consumers have purchased increasing amounts of processed food over the past 50 years. The opportunity cost of time of women and men has increased as more of them work outside the home, driving them to buy processed food and food prepared away from home to save arduous home-processing and preparation labor. In the past several decades, this trend has accelerated with a surge on the supply side of the processing sector and small and medium enterprises (SMEs) and large private companies making massive aggregate investments. Packaged, industrialized, ultra-processed foods and sugar-sweetened beverages (SSBs) are a growing proportion of the processed food consumed. Also, in the past several decades, overweight and obesity have joined the long-standing high levels of stunting and wasting among children and extreme thinness among women of childbearing age. Together these phenomena have formed a double burden of malnutrition (DBM). The DBM has emerged as an important health problem in sub-Saharan Africa. The rise of the DBM and the increase in ultra-processed food consumption are linked. Policy makers face a dilemma. On the one hand, purchases of processed food are driven by long-term factors, such as urbanization, increased income, and employment changes, and thus policy cannot change the pursuit of convenience and labor-saving food. Moreover, much processed food, like packaged milk, is a boon to nutrition, and the processed food system is a major source of jobs for women. On the other hand, the portion (some 10–30%) of processed food that is ultra-processed is a public health challenge, and policy must address its detrimental effects on disease burden. The global experience suggests that double duty actions are most important as are selected policies focused on healthy weaning foods for addressing stunting and taxes on SSBs, nutrition labeling, and other measures can steer consumers away from unhealthy ultra-processed foods to addressing obesity and possibly child nutrition and stunting. We recommend that African governments consider these policy options, but note that the current extreme fragmentation of the processing sector, consisting of vast numbers of informal SMEs in sub-Saharan Africa, and the limited administrative/implementation capacity of many African governments require pursuing this path only gradually.

1. Introduction

In sub-Saharan Africa (SSA), food systems and diets are rapidly transforming as is the epidemiology of the burden of malnutrition. There have been a significant body of literature examining the global nutrition transition and how food systems contribute to that transition but less on how this transformation is playing out on this diverse continent. Globally, the nutrition transition is shifting to a stage of high obesity driven by increased consumption of ultra-processed foods and beverages (hereafter termed 'ultra-processed foods') combined with significant

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reductions in physical activity. We define *ultra-processed foods* as multi-ingredient mixtures formulated by manufacturers (Monteiro et al., 2017). In SSA, "manufacturers" include not just large formal enterprises that produce packaged cookies for example, but also small and medium-scale enterprises (SMEs) that produce both packaged products and traditional products such as "mandazi" (oily sugared donuts) that are highly processed. . In addition, while not classed in our discuss below as ultra-processed (but rather as a separate category of processed food), much of the "meals away from home" (MAFH) are similar to ultra-processed foods in that they are often high in refined carbohydrates, sodium, unhealthy saturated fats, and sugar.

The most significant nutrition shift in developing regions globally is from undernutrition and stunting (short stature) to overweight and obesity (Popkin, 1994, 2017; Popkin et al., 2012, 2019). Stunting and overweight/obesity and the underlying sub-optimal diets affect nutrition-related noncommunicable diseases (NCDs). The double burden of malnutrition (DBM) is the coexistence of the two poles – undernutrition and overweight and obesity – of the nutrition transition among individuals and households and within populations.

The DBM has become more striking in SSA compared with other low- and middle-income regions (Popkin et al., 2019) due to the high initial levels of stunting, the comparable moderate decline of stunting from very high levels, and the moderate increase in the past two decades of overweight/obesity. We show that the nutrition transition and the DBM in SSA are linked to ultra-processed food consumption. This increase in ultra-processed food is clearly linked with the increase in overweight and obesity and possibly with the moderate decline in stunting from the two following angles.

First, overweight and obesity in SSA are increasing, particularly among adults in higher socioeconomic status households (Popkin et al., 2019). In SSA, overweight and obesity are rising faster in urban areas than in rural ones (NCD Risk Factor Collaboration 2019). A large and growing set of studies has linked excessive consumption of ultra-processed foods with increased risk of overweight/obesity. Ultra-processed food consumption is not the only obesity driver. Major reductions in activity levels in all phases of market and home work, transport, and leisure domains are another driver, and these are conditioned by underlying social and economic factors, from urbanization to the growth of men and women's off-farm employment to technological changes, including mechanization of many activities (Popkin, 2006; Reardon et al., 2007). However now ultra-processed food is the major direct cause of excessive weight gain in SSA. In the past three years many studies have shown the impact of ultra-processed food consumption on NCDs, including obesity, diabetes, and hypertension. In 2019, the US National Institutes of Health conducted a randomized controlled trial (RCT) with all individuals in a controlled food environment. It showed that adults fed ultra-processed foods increased in weight and biomarkers for diabetes and hypertension within two weeks (Hall et al., 2019). Many non-RCT cohort studies outside SSA link increased ultra-processed food consumption with NCDs, excessive weight gain, and increased risk of overweight/obesity (Cunha et al., 2018; Mendonça et al., 2016, 2017; Popkin, 2019; Rico-Campà et al., 2019; Rohatgi et al., 2017; Vandevijvere et al., 2019).

The diet and epidemiological data in SSA only weakly measures these links (Rousham et al., 2020). Likewise it is difficult to link data from the Food and Agriculture Organization of the United Nations (FAO) food balance sheets with external survey data on obesity (Steyn, Mchiza, 2014). Merely a few survey-based studies in SSA suggest that processed food intake, particularly in supermarket purchases, impact obesity (Demmler et al., 2018; Khonje, Qaim, 2019; Khonje et al., 2020; Wanyama et al., 2019). Hence, we must extrapolate the global RCT literature to SSA, as has been done for most studies on undernutrition and its causes on heart disease and cancer in SSA.

Second, undernutrition is still widespread in SSA. It appears that the limited decline in undernutrition in SSA may be just partially linked to the increasing consumption of ultra-processed foods and beverages among infants and young children (Feeley et al., 2016; Nordhagen et al., 2019; Pries et al., 2019a; Pries et al., 2019b). One study has associated ultra-processed foods with reduced length for age (the measure of stunting for children aged $\leq$ 2 years) (Pries et al., 2019). This literature is incomplete, and we can only speculate that in the future ultra-processed foods may be proved to impact undernutrition. Moreover, there are other major underlying causes of stunting in SSA such as poor sanitation, lack of diet diversity, gender-linked issues such as unequal distribution of food and poor education of females, poverty linked partially with unequal distribution of wealth and resources, regional political instability, loss of arable cropland, and drought (Black et al., 2013; Reinhardt, Fanzo, 2014; Smith, Haddad, 2015). The critical direct causes are poor maternal nutrition and poor complementary feeding and overall weak weaning foods in terms of nutrient density.

Most of the nutrition transition literature speaks broadly of the consumption of highly processed or ultra-processed foods across the globe (Baker, Friel, 2014; Baker et al.; Monteiro et al., 2017; Popkin et al., 2012). This literature tends to focus on the 2000s and 2010s, thus providing a relatively short-term lens on the topic. We think the longer view of five decades in this paper shows that the rise of consumption of processed food and the shift toward ultra-processed food was well underway in the 1980s in Africa and was part of a long trend toward purchases of processed food and food prepared away from home. Demand and supply forces have driven this phenomenon.

On the demand side, we show that factors that influence the opportunity cost of time impacting home processing and home preparation of food have driven the rise of processed food consumption over 50 years. Those factors include decades of increasing numbers of women working outside the home in both urban and rural areas and men increasingly commuting to urban jobs and to off-farm jobs in rural areas. This led at first to the shift from home processing, for example, hand-pounding grain, to purchasing low processed products like milled grain and oil, and highly processed products, like traditional fritters, and then packaged foods, like cookies and bread. The demand for processed food in SSA will continue to rise over the next decades with urbanization and the continued rise of rural nonfarm employment and their concomitant effects on women and men's opportunity cost of time and thus demand for food convenience.

On the supply side, we show that the development of the domestic supply of processed foods facilitated the increase of processed food consumption over 50 years in SSA. Rapid growth in the food processing, retail, and food service sectors selling packaged and prepared foods are meeting the demand for processed food in SSA. These sectors are mainly SMEs, although a modern sector of large processors, supermarkets, and fast-food chains is emerging.

To date, the literature on both the DBM and ultra-processed food consumption and supply in SSA has been fragmented, lacking an integrated overview, updated empirical trends, and evidence. This paper aims to address that gap in the debate with a combination of data synthesis and literature review. To highlight the links between the rise of the DBM in SSA and its correlates and drivers in the food system, we structure the article as follows. Section 2 presents definitions. Section 3 sets out the "health outcomes problem" of the DBM, using demographic and nutrition survey data across socioeconomic strata and SSA countries. The rest of the article then analyzes change in the food system which, as we note above, is a key driver of the DBM. We first, in section 4, briefly lay out the drivers of food system transformation in SSA, and thus the determinants of the evolution of demand and supply of processed food. Then in section 5 we trace the evolution over five decades of demand for processed food in SSA and the literature strands that have tracked that evolution. Section 6 then turns to the supply side of processed food, examining the evolution of processed food imports, manufactures (by small and large companies producing a range of processed foods), and the retail of processed foods via small shops and supermarkets, as well as via food service firms such as street vendors and fast food chains selling MAFH. We conclude in section 7 with policy

recommendations. In appendix 1 we provide detailed information on all data used and key measurements such as of the DBM.

We signal two caveats. First, SSA is heterogeneous over subregions, over countries, and over zones in countries. In general, the transformation of food systems (with the concomitant penetration of processed food) has occurred earlier and faster in the relatively better-off coastal countries and later and more slowly in the landlocked countries that are also, on average, poorer and less urban. The transformation has happened faster and earlier in urban areas than in rural ones and, within rural areas, earlier and faster in peri-urban and intermediate zones than in hinterland zones. The diffusion of purchased processed food mirrors those variations. We present this diversity in the cross-country DBM data sections. In the micro data sections on survey-based consumption studies and supply side studies of the processing and retail sectors, our treatment tilts toward the urban areas and the earlier and most transformed countries where the surveys have clustered. However, we also signal, for example, in our review of the penetration of processed food in rural areas, that even hinterland zones, such as in Tanzania (Keding et al., 2011, 2012; Sauer et al., 2019), have already experienced such penetration. We thus expect the areas where the transformation is presently at an earlier stage to continue along that path but more slowly, in the form of a moving average.

Second, we recognize that nutrition and health-related issues are a function of more than consumption of processed and ultra-processed foods, but also include other factors such as not consuming enough pulses, fruits, and vegetables. We are also aware that the food system transformations in SSA include other components, such as the safety and supplies of fresh fruits and vegetables, and influence other outcomes, such as farmer incomes and rural nonfarm employment (Reardon et al., 2007), in addition to an increased prevalence of the DBM. Yet our evidence requires a focus and a detailed review, so we leave other themes to future studies.

2. Definitions

2.1. Typology of purchased processed food

We focus on *purchased* processed food because, except for the raw fruits and vegetables consumed, nearly all food is processed, such as grain ground into meal. Table 1 shows the types of purchased processed foods. The rows show ascending levels of processing, and the explanation column gives the criteria in terms of the number of ingredients and processes.

The categories are broad and require several qualifications for application to SSA. First, in our review of the empirical literature we found the terms used differently in various studies. Some studies separate highly processed and ultra-processed, and others conflate them into one category, either highly processed or ultra-processed. Our interpretation is that SSA lacks detailed food consumption data sets that provide detailed ingredient information like types of sugar ingredients, for example, high-fructose corn syrup and other caloric sweeteners. And certainly, up-to-date detailed food composition tables that include packaged processed foods are missing.

Second, the levels of sugar, oil, and refined flour in many traditional snacks, such as East African sugar doughnuts (*mandazi*), make them nutritionally hard to distinguish from packaged industrial cookies. Packaging per se does not necessarily distinguish the level of processing or nutritional value. For example, *mandazi* are not usually packaged, and prepared foods sold at street vendors are not usually packaged but qualify as ultra-processed in terms of the number of ingredients. We loosen the definition of ultra-processed food for SSA as the transition of the supply side to pure control by major multinationals and large domestic manufacturers that produce packaged ultra-processed food in SSA is a decade or more off. Currently SMEs dominate the food supply in much of SSA. Moreover, as noted in the Appendix, our data sources are a combination of retail data that identify particular ultra-processed products, such as sugar-sweetened beverages (SSBs), and studies using household/individual survey data which employ a mix of terms with the ambiguities noted above.

Table 1
Processed food categories in sub-Saharan Africa.

Processing category	Degree of processing	Explanation	African examples
Unprocessed	None	Foods that have not been processed (such as raw fruit or dried beans)	Raw grain, live chicken, raw/dried fruit
Minimally processed	First stage	Single-ingredient foods and beverages with no or very slight modifications (e.g., cleaning, removal of inedible or unwanted parts, grinding, drying, fermentation, pasteurization, cooling, freezing)	Flour, edible oil, packaged milk, dried fish, butchered meat
Highly processed	Second stage	Multiple ingredient manufactured	Noodles, bread, cheese, foods preserved in salt or oil, multi-ingredient foods
Ultraprocessed	Second stage	Highly processed with products with added salt, sugar, oil, or other culinary ingredients to make processed foods and beverages more palatable or to extend preservation; these can be by SMEs or by large industrial firms that also add inputs like emulsifiers or high-fructose corn syrup	SSBs (bottled/canned sodas), packaged cookies, beer; traditional mandaazi
Ultraprocessed prepared FAFH	Third stage	Cooked dishes and snacks with many ingredients and high in added saturated fats, sugar, or salt bought away from home	Rice with sauce, chicken and potato fries, millet porridge and yogurt, cowpea fritters

Thus, our discussion takes a practical turn by employing four categories: unprocessed, minimally processed, highly processed and ultra-processed, and ultra-processed prepared foods. Where our data or the studies cited address specific products, such as SSBs or *mandazi*, or the data allow distinction between highly and ultra-processed, we use those terms.

2.2. Typology of forms and sources/suppliers of purchased processed foods

Processed food can be purchased in various forms: (a) loose, such as flour or beans sold in a plastic bag filled from a bin with a scoop; (b) packaged, such as flour, cookies, *fura* and *thiakry* (cooked millet) usually served with curdled milk or yogurt; (c) a meal or a snack on a plate at a restaurant or a street vendor or in a container for the recipient to take away, such as a prepared meal of roasted chicken and chips on a plate.

Consumers purchase processed foods from (a) traditional SME retailers, such as small shops, kiosks inside or outside wet markets, or SME mills providing traditional custom milling services; (b) modern large enterprises (LEs), such as retail chain convenience stores and supermarkets; (c) traditional SME food services, such as street vendors, kiosks, and small restaurants; and (d) modern food service enterprises, such as fast-food chains.

Retailers and food service firms purchase processed foods from: (a) wholesalers who import or buy from processors in the country; (b) SME food processors; and (c) LEs depending on either the domestic capital of

firms operating only in the country and multinational corporations (MNCs) based in the country or foreign direct investment (FDI) capital, such as foreign-headquartered MNCs.

3. The double burden of malnutrition in SSA in numbers

SSA and South Asia are the major regions with both extensive adult overweight/obesity and high levels of stunting among preschoolers (Popkin et al., 2019). When a country, region, household, or individual has this combination, we term this the DBM. We examined the changes in the DBM over the period 1990 to 2019 and then examined the dynamic shifts in undernutrition and overweight/obesity by country and for all SSA. Essentially the picture that emerged shows comparable trends in prevalence reduction in stunting per year and in prevalence increase in overweight/obesity per year. The biggest issue is the high starting point for the prevalence of stunting in the 1990s.

3.1. The DBM: prevalence and changes over time

SSA has seen important shifts in the number of countries with high levels of the DBM; these are the households with both a child with wasting, stunting, or overweight and a woman with thinness or overweight (Supplemental Table 3**).** Our analysis focuses on Demographic and Health Surveys (DHS) data but uses UNICEF, World Health Organization (WHO), World Bank, Measure, and NCD Risk Factor Collaboration estimates of the DBM based on a complete set of data for all SSA countries from small and large surveys. Fig. 1 maps the DBM countries with severe levels of undernutrition based on the UNICEF, WHO, and World Bank definition of severe levels of the DBM combined with three levels of total adult overweight/obesity in the population (UNICEF--WHO-World Bank, 2017) (Supplemental Table 4).

Fig. 1 shows that during 1990–2019 the number of countries in the region with severe levels of the DBM defined by the undernutrition measures noted above plus 20% overweight/obesity levels of adults stayed fairly constant, changing from 27 to 26. The main shift is that South Africa and Ghana—countries with higher incomes than most of the rest of SSA—no longer faced the DBM, while the poorer countries experienced increases.

We examined changes in levels of the DBM at different quartiles of countries' gross domestic products (GDPs) per capita based on purchasing power parity (PPP) in 1990 and in 2010 (Supplemental Table 4). Fig. 2 shows the number of countries in each quartile of GDP/capita (PPP) that eliminated or developed the DBM between the earliest and the most recent survey years at three levels of overweight/obesity prevalence (Supplemental Figure 1). The lower GDP quartiles have a higher prevalence of severe levels of DBMs in the most recent period. This is due to the increases in overweight/obesity among lower-income countries and reduced stunting among the higher-income ones. In the 1990s a severe DBM at any level of overweight/obesity appears in the upper quartiles. Most of the countries that reduced the DBM were in the higher GDP/capita (PPP) quartiles, while those that became DBM countries were mostly in the lower GDP/capita (PPP) quartiles.

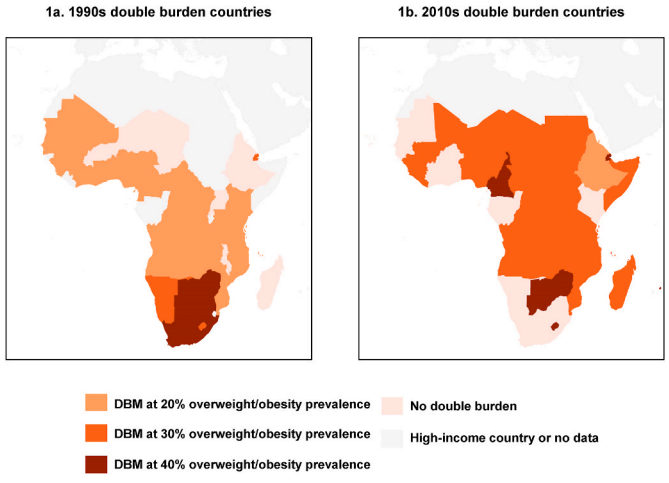

Fig. 1. The DBM* in low- and middle-income sub-Saharan African countries based on 1990s and 2010s weight and height data.

We see a bigger change in overweight/obesity prevalence when we relate the drop in the regional prevalence of child stunting from 54.4% to 44.3% with the increase in regional overweight/obesity in women ages 15–49 from 15.3% to 28.4% (Fig. 3). Considering the SSA country-level shifts in overweight/obesity prevalence, we see that increases in overweight/obesity are driving the increased number of countries with severe levels of the DBM. Declines in stunting have occurred too slowly to limit the spread of the DBM throughout the region.

Fig. 4 presents household-level data on changes in the prevalence of DBM households for all countries with data from the 1990s and the 2010s and a population ≥10 million in the latest survey year (Supplemental Table 3). The overall variability in reductions in stunting and household DBM over countries is important. We see a medium-sized annualized increase in DBM households in most countries. Some of the lowest levels of household DBM are in countries that are reducing stunting most quickly in annualized terms. In order of lowest to highest they are Ethiopia, Burkina Faso, Burundi, Ghana, Togo, the Republic of the Congo, Uganda, Malawi, Chad, and Kenya. Malawi shows the greatest reduction in DBM households.

3.2. Uneven reduction in undernutrition

Fig. 3 shows undernutrition for most SSA countries in the 1990s and the most recent survey year in the 2010s. We see in the 1990s very high levels of stunting (See Supplemental Tables 5 and 6 for corresponding data and Supplemental Figures 2–4.). Overall, SSA has seen a decline in undernutrition among children under five with an important annualized decline of −0.62% in stunting per year (Fig. 3). However, many countries have high levels of stunting. Most recent surveys estimate SSA's overall stunting prevalence for preschoolers at 43.5%.

Wasting, the other measure of child undernutrition, is used less frequently as it is a measure of acute undernutrition status. Changes in wasting prevalence from the early to the most recent survey years suggest slight reductions in acute undernutrition in SSA as a whole. However, as a number of SSA countries are experiencing social unrest, conflict, or drought and cannot be surveyed, this figure is most likely an underestimate. The regional weighted average in Fig. 3 shows a high prevalence of wasting but with a slight decline over time.

The overall trends in Fig. 3 show a 0.31% annualized decline in the prevalence of thinness among women of childbearing age. (Again, this does not account for the current situations in countries lacking more recent survey data.) The general trend masks variations over countries. Nigeria, Ethiopia, the Democratic Republic of the Congo, Sierra Leone, and Liberia had declines in thinness, while Senegal and the Republic of the Congo had large increases. In half of the countries with recent survey data more than 10% of women have BMIs below 18.5 (the measure of undernutrition for adult women) and five countries have prevalence levels exceeding 20% (Supplemental Figure 5).

3.3. Overweight and obesity by country

Among women of childbearing age, we see a marked increase in the overweight/obesity prevalence in nearly all SSA countries (Supplemental Table 6, Supplemental Figure 5). The weighted average prevalence for SSA is 29.2%. Over half of the surveyed countries have a prevalence over 30.0%, and in four countries over half of the women of childbearing age are overweight/obese. If current rates of increase continue, many more countries will share that high prevalence. From the few countries with adult male BMI data we know that male

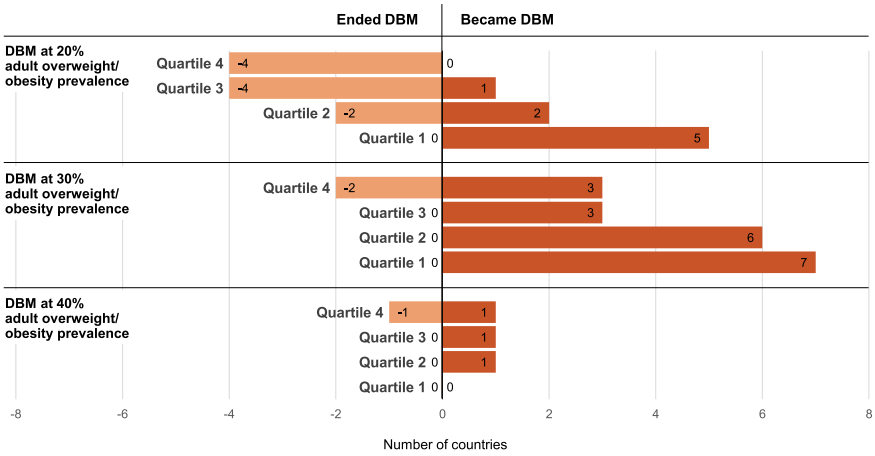

Fig. 2. Number of sub-Saharan African countries that changed DBM* status from 1990s to 2010s by GDP/capita (PPP) quartile.

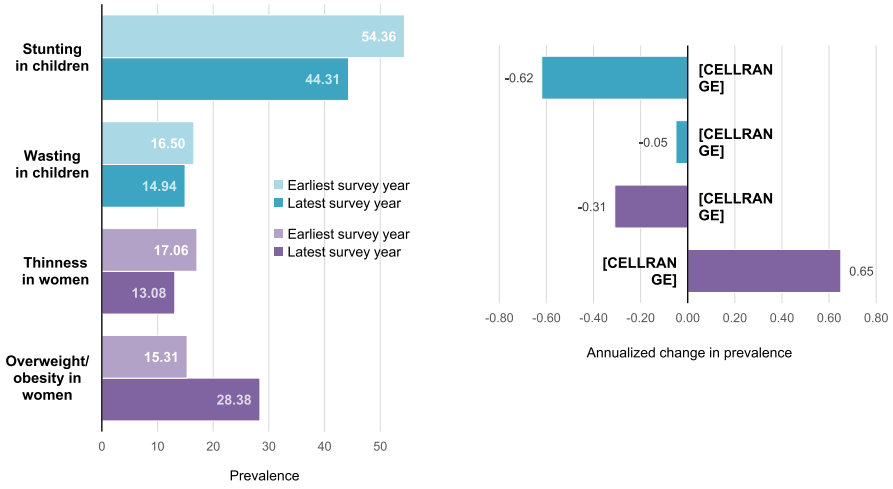

Fig. 3. Regional changes in prevalence of wasting and stunting among children (ages 0–4 years) and thinness and overweight/obesity among women (ages 15–49 years) in sub-Saharan Africa, 1990s to most recent survey year.

overweight/obesity prevalence is lower than that for women.

Fig. 5 maps changes in the region's overweight/obesity prevalence between surveys in the 1990s and those in the 2010s (Supplemental Tables 7–8). Most important is that more countries now have high levels of overweight/obesity. We do not present data on rural versus urban overweight/obesity, but two studies show increases in overweight and obesity across SSA with faster increases in urban areas (Jaacks et al., 2015; NCD Risk Factor Collaboration 2019).

3.4. *Overweight/obesity by income stratum*

Many studies in SSA show a greater prevalence of undernutrition among lower-income populations. Supplemental Table 9 and Supplemental Figures 6 and 7 provide the prevalence of overweight/obesity for women ages 15–49 in the lowest and highest household income quintiles in the earliest and latest surveys in the sample countries along with the annualized change. Overweight/obesity increases over time among the poor in all countries but Nigeria and Burkina Faso, but the annualized rate of increase is low. In contrast, the prevalence of overweight/obesity and annualized changes in prevalence are much larger for the highest-income quintile of women ages 15–49 than for those in the lowest-income quintile except in Senegal (Supplemental Figure 7, Supplemental Table 9).

Fig. 6 presents comparisons between the annualized changes in women's overweight/obesity prevalence for the lowest versus the highest household income quintiles in SSA countries (Supplemental Table 9). We subtracted the annualized rate of change for the lower-wealth quintiles from the higher-wealth quintiles. A negative annualized change indicates higher annualized growth in prevalence for the highest household income quintile compared with the lowest-income quintile. We see a large prevalence and lower long-term growth in the prevalence of overweight/obesity for the highest quintiles in all countries for which we have data except Senegal. These are long-term shifts, but we expect that it is increasing more rapidly among lower-income households while the rate of increase is slowing among higher-income ones.

4. Drivers of processed food demand and supply in SSA

The following interdependent factors have encouraged and facilitated changes in the demand and supply of processed ultra-processed foods in SSA.

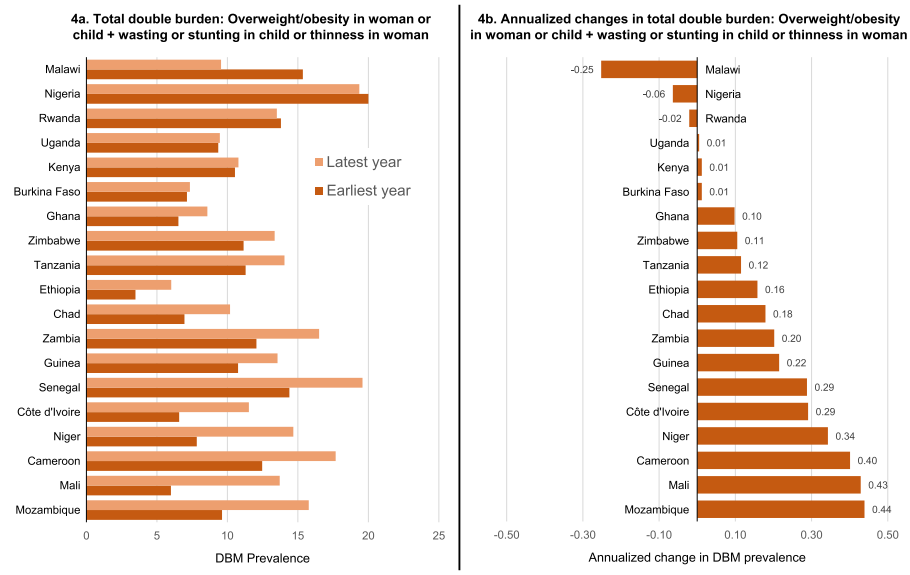

Fig. 4. Changes in nationally representative prevalence of household double burden from select sub-Saharan African countries' earliest to latest survey years* weighted by 2010 populations.

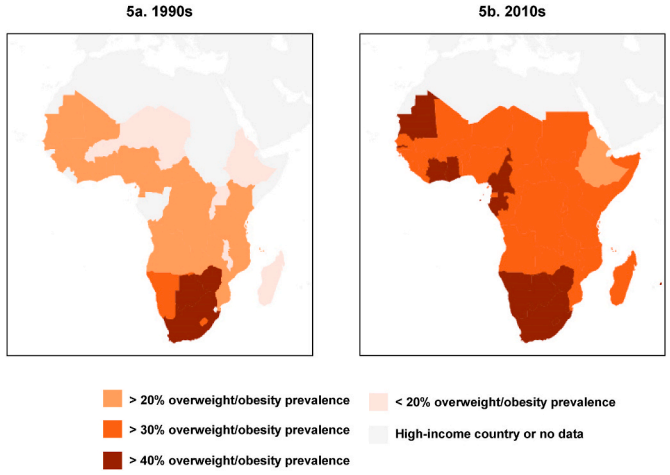

Fig. 5. Prevalence of overweight/obesity in low- and middle-income sub-Saharan African countries based on 1990s and 2010s weight and height data.

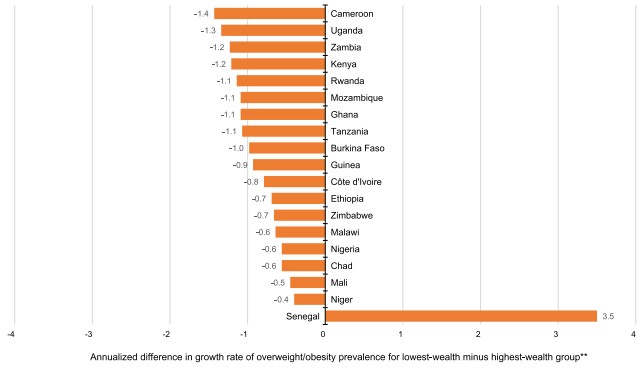

Fig. 6. The shifting burden of overweight/obesity from higher-to lower-wealth populations in a sample of sub-Saharan African countries*.

4.1. Urbanization

First, SSA has caught up with the average urban share in all developing countries, and the rate of urbanization in SSA is the world's fastest. The SSA urban population was 200 million in 1990, 31% of the total SSA population, and 548 million in 2018, 43% of the SSA total (United Nations Department of Economic and Social Affairs (Population Division), 2018).

The urban population shares underestimate the urban areas' share of total national food consumption. This is because urban incomes exceed rural incomes, for example, by a ratio of 2:1 in Tanzania (Sauer et al., 2019). In value terms, in developing Eastern and Southern Africa (ESA), urban residents consume 48% of national food consumption in value terms compared with an urban population share of only 25%. In Nigeria 50% of the population is in cities, but urban residents account for 70% of national food consumption (Reardon et al., 2019).

Second, migration studies, such as those for Tanzania, show that migrants from rural to urban areas change their diets to more processed food because of both the urban food environment and higher incomes (Cockx et al., 2019). Note however that far more urban population growth in SSA is from urban births exceeding deaths than from in-migration from rural areas (Jedwab et al., 2015).

Third, the "food environment" in urban areas encourages and facilitates consumers' buying processed foods compared to rural areas. Urban consumers have access to supermarkets while rural consumers do not. Moreover, they have twice the access to television, the internet, fuel, and electricity and thus to food advertisements compared with rural consumers (Blimpo, Cosgrove-Davies, 2019; Cockx et al., 2019; Ncube, Lufumpa, 2014).

4.2. Income growth and employment shift

First, income per capita has tripled in SSA in the past two decades. In current US dollars, it grew from USD 222 in 1970 to USD 712 in 1980, dropped from its 1980 spike down to 580 in 1985 then stagnated for 20 years at USD 661 in 1990 and USD 596 in 2000, then nearly tripled to USD 1574 by 2018 (The World Bank, 2020).

Second, women and men are increasingly working outside the home and off-farm. This spurs African households to find ways to save time with home processing, preparing, and shopping for food. The shift toward labor-saving modes is a function of perceived opportunity costs of

time (Mincer, 1963), which tend to be correlated with income and employment outside the home. Rural nonfarm income grew quickly in SSA in the 1990s and reached on average around 40% of the total rural income by the mid-2000s in a wide variety of countries, both coastal and inland (Reardon et al., 2007). In full-time equivalents, on average, 60% of the labor time of rural adults ages 15–64 in SSA is spent outside of their own farms. That time is spent mainly in rural nonfarm employment with small amounts in farm wage labor and seasonal migration. The labor force participation rate, calculated as individuals in the working age range of 15–64 involved in wage or self-employment, is 75% in SSA, compared to 58% in Asia and 68% in Latin America and the Caribbean; the rate for women is higher in rural areas, 72%, compared with urban areas, 58% (Dolislager et al., 2020).

4.3. Policies of liberalization and privatization of the agri-food sector

First, in the 1980s and 1990s many SSA governments privatized agri-food processing and distribution parastatals (Kherallah et al., 2002). This enabled the proliferation of SMEs and the emergence of large private firms, such as the Tanzania-based food processor Bakhresa.

Second, in the 1990s many SSA governments liberalized agri-food foreign direct investment (FDI) to varying degrees (UNCTAD, 1998). This led to FDI in food processing, such as Bakhresa's FDI in other East and Southern African (ESA) countries. FDI in ultra-processed foods, mainly in breweries and distilleries, sugar and confectionary products, and soft drinks, constitute 22% of agri-food FDI, twice as important as FDI in farms and plantations (Husmann, Kubik, 2019).

Third, structural adjustment programs in Africa in the 1980s and 1990s included import liberalization, which encouraged imports, mainly wheat grain, milled rice, edible oils, milk powder, and some ultra-processed food. Imports are further discussed below.

4.4. Public investment in infrastructure

Improvements in infrastructure played a role in spurring processed food consumption and supply. Electrification and generators were important. Road investments lowered transaction costs for processors and wholesalers to sell processed foods in rural areas, and in small and medium cities. Roads are far more important than railroads, ports, and airports in Africa as they account for 80% of the goods and 90% of the people transported. But Africa still lags in roads: 53% of the roads are unpaved, and the paved road kilometers per 1000 inhabitants is a third of the average in developing countries (African Development Bank, 2014). The 2000s and especially the 2010s saw substantial investment in roads and electrification in Ethiopia, Nigeria, and much of ESA, while other subregions, such as Central Africa, lag (IFPRI, 2019).

5. Demand side: 50-year evolution of consumption of processed and away-from-home food in SSA

5.1. Preview of long-term shifts in processed food consumption in SSA

Food system transformation takes place in three stages: (1) the traditional stage, when food supply chains (FSCs) are short, FSC actors are mainly micro and small enterprises and thus the FSC is fragmented, and the degree of food processing is low; (2) the transitional stage, when FSCs are long (stretching from rural to the rising urban areas), FSCs are still fragmented and dominated by SMEs, and purchases of processed food are rising; (3) the modern state, when FSC are long, consolidation is proceeding quickly with the emergence of supermarkets and large processing firms, and processed food purchases are common (Reardon et al., 2019). Over these stages of transformation, specific changes occurred in diets in general and the consumption of processed and prepared food away from home specifically.

The empirical literature on food consumption in SSA over the past 50 years has tracked these changes; we synthesize them in Table 2. The table shows the correlations between a given type of consumption behavior, the rows of the table, with the stages of transformation of the food system (the columns). Thus, for a given row, like purchase of meals away from home, the table shows it changing in intensity or nature as the food system transforms from traditional to traditional to modern. The changes in consumption behavior are similar to those that occurred in the United States (Barkema et al., 1991) and in Asia (for Sri Lanka (Senauer et al., 1986)). Note two qualifiers. First, these are the broad average trends, with location- and product-specific variations. Second, in most countries these changes are emerging or are in midcourse, and the different stages of food system transformation are happening simultaneously. Thus one can observe one consumption behavior (such as little purchase of meals away from home) in the traditional stage in the rural hinterlands, and another consumption behavior (such as frequent purchase of meals away from home from street vendors) in the transitional stage occurring already in medium towns and peri-urban areas, and yet another behavior (frequent purchase at fast food chains) in the modern stage of transformation already emerging in large

Table 2
Overview of 11 key shifts in the 50-year evolution of processed food consumption in SSA: Who, what, when, where, how.

	Traditional	Early transitional	Mid- to late transitional	Late transitional to early modern
Cereals consumed (not reflecting the form)	Home-produced millet, sorghum, and maize	Buy millet, sorghum, and maize; start buying rice and wheat	Buy more rice and wheat and less millet, sorghum, and maize	Continue shift to rice and wheat
Acquire minimally processed cereals	Pound grain at home	Custom mill flour or buy by scoop or large bag	Buy packaged branded maize flour and polished rice	Purchase highly and ultraprocessed rather than minimally processed
Acquire minimally processed roots and tubers	Pound roots and tubers at home	Buy cassava flour by scoop or bag	Buy packaged cassava and yam flours	Continue shift to packaged cassava and yam flours
Products' processing stages	No flour purchases	Buy flour (first-stage processed); start buying bread (second-stage processed)	Buy pasta and more bread (second-stage processed)	Buy highly and ultraprocessed foods
Acquire animal products	Hunt, fish, and raise animals to consume	Buy live or custom-killed animals at retailer and clean at home	Buy minimally processed, cleaned meat and fish	Continue buying minimally processed and start buying ultraprocessed
Acquire snacks and drinks	Cook and eat traditional snacks and treats at home	Buy traditional snacks and treats	Buy ultraprocessed packaged snacks and beverages	Increase purchases of ultraprocessed snacks and SSBs
When snacks are consumed	Traditional festivals	Diverse special occasions	Weekly or daily	Increase frequency
Meal preparation and acquisition	Cook and eat meals at home	Buy traditional meals at local street vendors	Buy nontraditional meals at restaurants and street vendors	Buy at fast-food chains
Who buys meals away from home	No purchased meals	Bachelors and students	Women and men working outside the home	Whole family
Purchases of highly processed foods	A few traditional snacks (fritters, *mandazi*)	A few types (bread, *mandazi*)	Many types	Increase diversity
Sources of processed foods	Home	Small local retailers and neighbors	SMEs, stalls, and retailers in towns	Small shops and supermarkets

cities.

These consumption changes can be summarized into five basic categories of change: (1) from home processing and meal preparation to buying processed and prepared foods; (2) from purchasing unpackaged to packaged foods; (3) from traditional to nontraditional categories of ingredients (such as from sorghum to wheat) and products or dishes (from millet gruel to ramen noodles with eggs); (4) from purchases only at local small retailers to purchases also at urban supermarkets; and (5) from narrow to broad in types and number of persons and occasions of snack/sweets consumption, such as from sweets as festival food to sweets as common food, and from sweets for children to sweets for the whole family. The first four changes share a main motivation: that of saving time in home processing, in home cooking, in shopping, and in returning to home to eat. Saving time is motivated by increasing opportunity costs of time, as discussed above.

The fifth category of change is linked to the "food environment," both in urban and rural areas. The food environment is the "interface where people interact with the wider food system to acquire and consume foods." It has external and personal dimensions. The external dimension includes food availability, prices, vendor and product properties, and marketing and regulation. The personal dimension includes accessibility (such as proximity), affordability (such as income), convenience (such as time needed to prepare), and desirability (tastes, knowledge, etc.) (Turner et al., 2020). In SSA, for processed food, specifics of that environment include: (a) easy access and reduced costs of processed foods; (b) a range of processed foods in the market; (c) influence of other households buying processed foods; (d) density of street vendors and stores; (e) influence of marketing on social media, television, radio, and billboards; and (f) colorful packaging appealing to children. This food environment is shaped by the development of the supply side of processed food discussed in sections 6.

5.2. *Four strands of literature on processed food consumption in SSA over 50 years*

The literature on purchased-processed food consumption in SSA tracking the above changes has come in four literature strands over the past 50 years. The emergence and development of the strands were roughly on a parallel track with the stages of food system transformation and changes in processed food consumption noted above. A key point is that the consumption of ultra-processed food is part of a long continuum and evolution.

The timeline that we note for the strands indicates the emergence of the strand. Note that the first three strands emerged together in the 1980s–1990s while the last strand emerged mainly in the 2000s. All the strands have continued to the present.

5.2.1. *First strand, emerging in the 1980s–1990s: literature on the rise of milled rice and wheat*

Consumption of milled rice and wheat and highly processed wheat (bread, noodles, and pastries) have grown rapidly in developing regions since the 1960s, changing African diets traditionally based on coarse grains (millet, sorghum, and maize) or tubers. The exception to the latter is in areas of traditional production and consumption of African indigenous rice (*Oryza glaberrima*) in the mangrove swamps along the coast of West Africa, and inland as far north as the savannah zone in the Sudan and south in parts of South Africa, in flood plain areas. Moreover, there was an introduction of *Oryza sativa* (the Asian rice species) probably by the Portuguese in the 16th century along the West African coast (Dania Ogbe and Williams, 1978). But in much of Africa, there has been a consumption shift to rice or wheat driven by convenience and fueled largely by imports of Asian rice as we discuss below (Reardon, 1993).

Studies in the 1990s showed that African households were sensitive to the costs of rice and wheat relative to coarse grains. They increasingly chose rice and wheat when they compared the cost of buying ready-to-cook rice and wheat flour with the cost of coarse grains plus the attributed time cost of hand processing them (Dibley et al., 1995). Consumption of wheat bread in Nairobi was driven by women's opportunity cost of time and household income (Kennedy, Reardon, 1994). In Ouagadougou, Burkina Faso, rice consumption was driven by women working outside the home and by men commuting to work. Macroeconomic studies showed that the trend in diets toward rice and wheat was not significantly affected by the ups and downs of domestic coarse grain prices and harvests (Reardon, 1993). These findings are still valid today. For example, in Nigeria, devaluation of the currency, reduction of subsidies, and tariffs on rice imports did not slow the rice import trend, and Nigeria is still the largest rice importer in the world after China (Olurounbi, 2018).

The early studies found that the adoption of consumption of rice and wheat was not limited to urban areas, but had started to extend into rural areas, such as in Senegal (Kelly et al., 1996). Studies also showed that the trend was not just among the middle class, but also among the poor. A study in the 1980s in Ouagadougou found, for example, that higher-income households consumed rice at home but poor households bought about the same amount of rice as the rich but bought it from street stalls to eat at or near their manual job sites so they would not need to spend time and money returning home for lunch (Reardon et al., 1989).

5.2.2. *Second strand, emerging in the 1980s–1990s: literature on the transition from hand pounding to purchasing processed coarse grains, roots, and tubers*

Millet, sorghum, fonio, and teff are African cereals and along with maize are called "coarse grains" (Kaur et al., 2014). Co arse grains, roots, and tubers are the main traditional staple foods of Africa along with indigenous rice in several areas. All have been consumed for millennia with the exceptions of maize and cassava, which became staples in the last century. Maize diffusion "took off" in Africa in the first half of the 1900s because of its productivity and thus relative cost (McCann, 2001). Our analysis of FAOSTAT data shows that from 1970 to 2013 the share of maize in total cereal output in SSA rose from 38% to 48%, while that of millet and sorghum fell from 43% to 29%.

The shift from hand pounding to purchase of milled coarse grains in the past 40 years. Until the 1980s and 1990s coarse grains were pounded by hand at home with wooden mortars and pestles. Four factors prompted the shift to mechanical milling. (1) In the 1980s and 1990s nongovernmental organizations introduced simple dehullers into many SSA villages, producing a technological change (Barrett, Browne, 1994; Eastman, 1980). (2) During that time hammer mills proliferated as parastatal markets liberalized and privatized, for example, in Zimbabwe (Rubey, 1995) and Mozambique (Rubey et al., 1997). (3) Custom hammer milling proliferated as women purchased custom milling to avoid hand pounding grain, which was time-consuming and exhausting. Prior to the abundance of hammer mills, Botswanan and Gambian women spent about 4 h a day pounding millet and sorghum. They valued the mills less as time-savers and more as energy savers, allowing them to be more productive in farm work and home chores (Barrett, Browne, 1994; Schmidt, 1988). (4) In the 1980s and 1990s women in urban areas turned to milled (but not packaged and branded) coarse grains, though custom milling still dominated in rural villages. Buying milled coarse grains was a function of women's opportunity cost of time increased by their working outside the home, for example, in Bamako, Mali (Boughton, Reardon, 1997).

Studies in the 2000s and 2010s found that custom milling has given way to packaged branded coarse grains especially for maize. Purchases of maize flour (rather than home pounding or custom milling) have become widespread even in the hinterland zones in rural areas, for example, in Tanzania (Sauer et al., 2019). Millet and sorghum processing and packaging have lagged maize except in West Africa, where packaged processed millet has recently spread (Hollinger, Staatz, 2015).

The rise of purchased-processed roots and tubers. In SSA the two main root and tuber staples are yams and cassava. White yams are indigenous

to Africa. West Africa, mainly Nigeria and Ghana, produces 90% of the world's yams. Portuguese traders brought cassava to West Africa from Brazil in the 1500s. It gradually spread over the humid zones of Africa through the 1700s and became a major crop in the 1800s and 1900s (Jones, 1957). Yams are losing ground to cassava which has higher yields and is cheaper (Nweke et al., 2013).

Traditional cassava processing steps include peeling, dewatering, fermenting, sieving, roasting, grinding or drying, and pounding. Home hand pounding is labor-intensive (Nweke, 2004). Factors similar to those for maize flour induced the spread of purchased-processed cassava as a substitute for home processing. (1) In the 1930s the French introduced a mechanized grater into Benin for the export market, and Nigerian artisans modified it. Mechanized graters slowly spread during the 1970s and 1980s (Nweke, 2004). (2) In the 1980s the urban street food market incorporated products based on *gari*, such as *attiéké*, for convenience and novelty (Bricas et al., 1985). (3) In the 1980s and 1990s SMEs made substantial investments in *gari* processing, and in the 2000s industrial *gari* processers and packagers invested in urban markets (Abas et al., 2011). In the 1980s Cadbury Nigeria developed and mass marketed an industrially processed yam called *poundo* yam (Hahn et al., 1987).

Today packaged *poundo* yam, *amala* made from yam, cassava flour, and *gari* from cassava are common purchases in West Africa and are exported to other African countries and to the African diaspora. Consumer surveys show that higher-income families consume *poundo* yam, the industrial product that is most convenient, while lower-income families consume *amala* and *gari* (Nweke et al., 2013).

5.2.3 Third strand, emerging in the 1970s–1990s: The rise of Food Away From Home (FAFH) in SSA.

Over the past 50 years consumption in the food service sector, which includes street vendors and stalls, fast-food chains, restaurants, cafés, and institutional food service providers, has increased in SSA.

FAFH in African cities in the 1980s–1990s. As cities grew and workers traveled from their homes to jobs across cities and students traveled to school, commuters began to buy breakfast and lunch at street stalls. The poor consumers were at least as likely as the well-off to buy meals. In the 1980s and 1990s street vendors prepared foods to serve individuals in transitions, such as the throngs of rural migrants newly arrived in cities, emerging commuters, and communities of migrants from other countries. Studies in Abidjan, Cotonou, Dakar, and Ouagadougou showed that prepared rice dishes, bread, and coffee made inroads in FAFH. Also an interesting combination of traditional plus innovative and fusion cuisines developed, such as street-food versions of traditional cassava dishes, such as *attiéké*; snacks crisscrossing countries and cuisines, such as cassava sweet doughnuts from Ghana that Ghanaian street vendors served in Dakar; traditional millet breakfast foods, such as *degue* (millet, milk, and sugar); and roasted meats and sandwiches like wheat bread sandwiches and *shawarma* (Bricas et al., 1985; Thuillier-Cerdan, Bricas, 1998).

Moreover, surveys in the 1990s showed the rising importance of carryout. In Cotonou, Benin, an important share of daily food was consumed on street vendors' premises, but a lot of meals were bought to take home; 91% of schoolchildren had a weekly snack budget and regularly bought snacks from street vendors near schools (Thuillier--Cerdan, Bricas, 1998). In Nairobi, Kenya, consumers' median share of daily energy intake from non-home-prepared foods ranged from 13% for schoolchildren in Korogocho to 36% for men in Dandora. The foods came from street vendors and kiosks (van't Riet et al., 2002).

Further development and expansion of FAFH in the 2000s–2010s. Research on African prepared-food street vendors in the 2010s echoes that of urban studies in the 1980s and 1990s. But recent studies show further development in urban areas and emergence in rural areas. First, industrial packaged ultra-processed foods, such as SSBs, have appeared. For example, Southern Africa has experienced rapid growth in take-out and take-home meals and snacks, including packaged foods high in saturated fats and trans fats, refined carbohydrates, simple sugars, salt, and animal products (Nnyepi et al., 2015). A 2019 study in Windhoek, Namibia, showed a mix of nontraditional and traditional street vendor foods but also industrial processed foods, such as SSBs, chips and crisps, and sweets and candies (Bricas et al., 1985; Nickanor et al., 2019).

Second, in the 2000s and 2010s the consumption of millet and sorghum purchased-prepared dishes, such as *thiakry or fura*, expanded in Senegal and Nigeria. Surveys in Dakar showed prepared millet dishes, such as *arraw*, *soungouf*, and *thiakry* spreading among SME processing enterprises and street vendors (Chase-Walsh, 2018; Gaye et al., 2003). Others found that processed (flour) and prepared (*enjera*) teff increased in Addis Ababa (Minten et al., 2016).

Third, nationally representative surveys from Nigeria and Tanzania showed that about a quarter of food consumption in urban areas and a tenth in rural areas is FAFH with an emergence in hinterland zones of rural areas (Dolislager et al., 2019; Minten et al., 2016a; Minten et al., 2016b; Sauer et al., 2019).

5.2.4. Fourth strand, emerging in the 2000s–2010s in SSA: literature on the consumption of ultra-processed food and links to obesity

Studies in the 2000s and 2010s showed the continued spread of processed and ultra-processed food in urban and rural areas. LSMS data analysis for Eastern and Southern Africa (Ethiopia (2004–2005), Uganda (2009–2010), Tanzania (2010–2011), Mozambique (2008–2009), and Malawi (2001–2011)) showed the following striking results (Tschirley et al., 2015). (1) In urban areas, in value terms, food purchases were 91% of the food consumed, and processed foods were 70% of all food purchases. Of processed food consumption, 40% was minimally processed, such as flour, and 60% was highly or ultra-processed. (2) In rural areas, in value terms, food purchases were 43% of the food consumed, and processed and ultra-processed foods were 70% of all food purchases, surprisingly identical to the share in urban areas. Of processed food consumption, 53% was minimally processed, and 47% was highly or ultra-processed, a lower share than in urban areas as expected, but not much lower. Moreover, LSMS data for Zambia show that the processed food share among total food purchases in rural areas increased from 25% in 1996 to 47% in 2015 and in urban areas from 44% in 1996 to 66% in 2015 (Chisanga, Zulu-Mbata, 2018; Harris et al., 2019).

A similar spread of processed food was occurring in West Africa. Hollinger and Staatz (2015) showed results from national consumption survey analyses for Burkina Faso (2009), Mali (2006), Niger (2005), Senegal (2002), Côte d'Ivoire (2008), and Ghana (2006) (Hollinger, Staatz, 2015). The share of processed cassava, millet, sorghum, and maize in the total consumption (purchases plus home-production) of these products was higher in urban than in rural areas and higher in emerging market countries, like Ghana, where 70% of maize and 60% of cassava expenditures in urban areas were processed, compared with poorer countries, like Niger. In Nigeria (Dolislager et al., 2019), LSMS data from 2011 to 2012 showed that in urban areas, in value terms, purchases of all processed and prepared foods constituted 76% of food consumption in primary cities and 70% in secondary cities. Minimally processed foods, like flour, were 56% of overall processed food consumption. Highly processed foods constituted 44% processed food consumption ultra-processed in cities. In rural areas minimally processed foods constituted 61% of processed food consumption, close to the urban share of 56%; 44% of processed foods were highly processed.

Studies of the retail sources of consumer purchases of processed foods emerged as an extension of the literature on the "supermarket revolution" in developing countries (Reardon et al., 2003). While some studies showed that the share of processed food purchases was sometimes a bit higher among supermarket shoppers, a number of studies showed that consumers buy most of their processed foods, even ultra-processed foods, from small shops and traditional retailers. For evidence from Kenya and Zambia see (Demmler et al., 2018; Kimenju et al., 2015; Kroll et al., 2019; Neven et al., 2006; Rischke et al., 2015).

In the introduction we noted that international experimental and empirical studies have confirmed links between consumption of ultra-

processed foods and obesity. Following on these studies, several recent survey-based studies have examined this link in Africa. A study of Tanzania, South Africa, and peri-urban and rural Uganda found high intakes of processed meats, refined grains, and sweets, and a correlation between these intakes and obesity in men and women (Holmes et al., 2018). Using several rounds of the Tanzania LSMS National Panel Survey, another study found a link between both ultra-processed and minimally processed food consumption and obesity in urban households but no link in rural households. Activity levels were negatively correlated with obesity in urban and rural areas, and the effect was twice as large in urban areas (Dhar, Tschirley, 2019).

6. Evolution of the supply side of processed foods

In this section we trace the development over decades of the supply of processed foods in SSA. That supply has come from imports of processed food as well as from domestic processing by large firms as well as SMEs. We also trace the rise of and sales of processed and prepared foods by supermarkets, fast food chains, and small vendors.

6.1. Imports of processed foods

Food imports have risen in SSA over the past four decades, as they have in other developing regions. This trend has provoked policy debates related to costs and competition and more recently about imports' relation to processed foods and thus rising overweight. Three strands of literature have treated imports via their role in changing diets directly by bringing in finished processed products and indirectly by bringing in ingredients such as wheat and sugar and edible oils for making processed foods locally.

6.1.1. First strand: rice and wheat imports

We used the Food and Agriculture Organization Statistical Database (FAOSTAT) tonnage data for 1970, 1990, and 2013 to show the trends of rice and wheat imports (Table 3). From 1970 to 2013 the share of the rice and wheat output in SSA cereals output only rose from 13% to 17%. The cereals share in total domestic food output barely changed, from 20% to 19%. But consumption of rice and wheat rose quickly, and imports of rice and wheat skyrocketed: rice imports rose eighteenfold in tons and from 10% to 18% of food imports, and wheat rose nine-fold in tons.

While rice is imported already milled, 90% of wheat is imported as grain. Local mills grind and sell flour that mainly goes into bread, pasta, and cookies. In the 1980s and 1990s bread was a luxury, for example in urban Burkina Faso and Kenya (Kennedy, Reardon, 1994). But today bread is usually not a luxury in coastal urban Africa. In Dakar cheap bread and bean sandwiches are commonly sold on the roadside to commuters. Likewise wheat noodles were a luxury in the 1980s, for example in Ouagadougou (Reardon et al., 1989), but have become a commonplace convenience food in coastal cities of Africa. Indomie, packaged wheat ramen noodles made from imported wheat in Nigeria by the Indonesia-based multinational corporation Indofood, have deeply penetrated food habits (Liverpool-Tasie et al., 2016). Wheat flour is used in many popular sweet snacks in Africa, from traditional snacks, such as *mandazi*, to packaged cookies now ubiquitous in rural and urban Tanzania.

Table 3
Cereals output and imports in SSA in 1970, 1990, and 2013 (millions of tons).

	1970	1990	2013
Rice output in milled equivalents in millions of tons	3.00	6.00	14.80
Wheat and wheat products output	2.80	3.80	7.40
Maize output	16.50	31.00	62.70
Millet output	8.00	10.60	14.10
Sorghum output	10.60	11.00	24.60
Other cereals output	2.50	2.80	8.30
Total cereals output	43.40	65.20	131.90
Total output of all foods	220.10	334.80	708.90
All cereals share of total food output	20%	20%	19%
	0.70	2.90	12.80
Rice total imports and in parentheses share of total food imports	(10%)	(16%)	(18%)
Wheat and wheat products total imports and in parentheses share in total food imports	1.80 (25%)	5.10 (29%)	16.80 (24%)
Millet imports in millions of tons	0.15	0.02	0.04
Total cereal imports in millions of tons	2.80	8.70	31.60
Total imports of all foods in millions of tons	7.30	17.90	69.20
All cereals as a share of total food imports	38%	48%	46%

Source: FAOSTAT data.

6.1.2. Second strand: imports of non-staple ingredients for domestic processing

In West Africa in the past two decades imports of milk powder, fruit concentrates, palm oil, refined sugar, and frozen fish and chicken have increased. Imports of sugar and oil have added to worries about diets and imports of milk, fish, and chicken to worries about the competitiveness of local products. During 2006–2010 rice and wheat made up 41% of food imports, vegetable oils, 13%, fish, 11%, dairy products, 9%, and sugar, 9%.

Vegetable oil imports have grown fastest, from 4% of food imports in 1986–1990 to 13% in 2006–2010. Cheap imports of palm oil from Asia into the Sahel countries anchored the climb, while domestic production of palm oil in particular and other vegetable oils grew in the coastal countries. Palm oil is a traditional food in West and Central Africa. This highlights the lack of competitiveness of many local food systems.

A similar trend has occurred in sugar and sweeteners used in tea, processed foods, and beverages, which rose rapidly over 1995–2014. Imports played a large role in the jump in access to sugar. West Africa imported 85% of its sugar intake in 2014, up from 70% in the 1980s (Hollinger, Staatz, 2015; Liverpool-Tasie et al., 2016).

As with wheat, large-scale processing firms are the main importers of milk powder and fruit concentrates for reconstituting into milk and fruit juice in domestic processing plants. Imports of fruit concentrates have been growing quickly (Hollinger, Staatz, 2015).

6.1.3. Third strand: imports of highly processed foods

Nationally representative consumption surveys in SSA lack details on brands and origins (imported or domestic) of processed foods. We thus used macro data from Comtrade (https://comtrade.un.org/) to analyze the share of imports in processed foods consumed. The Comtrade data in Table 4 show that most food imports into ESA (Malawi, Mozambique, Rwanda, Tanzania, Uganda, and Zambia) plus Nigeria are wheat (raw) grain, vegetable oil, and other processed cereals followed by sugar and fruit juices. Animal products, fruits, and vegetables make up only a very small share.

Table 4 shows the annual shares of imports in total food consumption (estimated from 2010 or later LSMS consumption data expanded to the national population per country) from 2008 to 2015. Contrary to popular perceptions, overall, imports are a small share of the total national food consumption, 6% over all countries and 10% if Nigeria is excluded.

Imports are highest among unprocessed nonperishable and highly processed nonperishable foods. Imports account for 62% and 76% of national consumption, respectively, in these categories when excluding Nigeria. Wheat grain accounts for 80–90% of unprocessed nonperishable food imports except in Rwanda at 56%, and Zambia, which grows all of its own wheat. Vegetable oils account for 49% of highly processed nonperishable imports (57% without Nigeria) (Table 5).

Table 6 shows food categories as columns and specific products as rows. Wheat grain and wheat products are 21% of total food imports in ESA plus Nigeria. Over 90% of this is imported as wheat grain and then milled in-country. Over several decades the trend has been from importing wheat flour to importing wheat as the domestic milling sector has grown quickly (see below). According to Comtrade data, ESA and

Table 4
Imports as shares of total food consumption (own production plus purchased) by value, annual averages over 2008–2015 (USD [2011] PPP).

	Own production perishable	Own production nonperishable	Unprocessed perishable	Unprocessed nonperishable	Minimally processed perishable	Minimally processed nonperishable	Highly processed perishable & FAFH	Highly processed nonperishable	Total
Malawi	0.000	0.000	0.010	0.779	0.018	0.037	0.234	0.262	0.083
Mozam.[a]	0.000	0.000	0.057	1.078	0.325	0.460	0.508	1.430	0.198
Nigeria	0.000	0.000	0.003	0.144	0.056	0.044	0.052	0.133	0.049
Rwanda	0.000	0.000	0.029	0.585	0.114	0.173	0.154	0.913	0.156
Tanzania	0.000	0.000	0.005	0.665	0.013	0.036	0.029	0.613	0.076
Uganda	0.000	0.000	0.009	0.669	0.002	0.057	0.078	1.109	0.103
Zambia	0.000	0.000	0.031	0.115	0.049	0.047	0.245	0.684	0.104
Total	0.000	0.000	0.005	0.203	0.054	0.051	0.058	0.233	0.060
Total without Nigeria	0.000	0.000	0.015	0.618	0.041	0.075	0.082	0.759	0.101

[a] Mozambique. Note: Authors' calculations from Comtrade import data.

Table 5
Imports as shares of all highly processed nonperishable food consumption: comparing vegetable oil and all others, annual average over 2008–2014.

	Highly processed nonperishable		
	Vegetable oil	All others	Total
Malawi	0.140	0.122	0.262
Mozambique	0.510	0.920	1.430
Nigeria	0.047	0.086	0.133
Rwanda	0.401	0.513	0.913
Tanzania	0.279	0.333	0.613
Uganda	0.703	0.406	1.109
Zambia	0.262	0.421	0.684

Note: Authors' calculations from Comtrade import data.

Nigeria do not import highly processed wheat, such as cookies.

Rice is only 7% of the imports into ESA and Nigeria, and in the country set in the table, it is mainly imported by Nigeria. Imports of other cereals are 12%, of which 42% are highly processed. Vegetable oil, 89% of the oil imports, and oilseeds, 9% of the oil imports, are 27% of total food imports. In contrast with wheat, vegetable oil is predominantly imported already processed as local milling capacity is deficient.

Animal products are still a minor share of food imports. Dairy, fish, poultry, other meat, and eggs together equal only 9% of food imports. Fruits and vegetables are only 6% of food imports, and only one-third of them arrive as fresh produce. The other two-thirds of imports arrive highly processed, such as fruit concentrates for domestic reconstitution as fruit juices.

While ultra-processed foods are only a very small share of overall food imports, they are increasing rapidly over time albeit from a tiny base. For instance, in the Southern Africa Development Community imports of soft drinks increased by 1200% and those of snack foods by 750% between 1995 and 2010. Trade liberalization abetted this phenomenon (Thow et al., 2015).

6.2. Processors

6.2.1. Overview of the evolution of food processing in SSA

Food processing in SSA has increased a great deal over the past 50 years as supply has followed the burgeoning demand. It is difficult to calculate this growth with precision without current or previous official statistics for either the informal (mainly SME) sector of food processing, which is the large majority of the volume, or the formal (mainly large enterprise, LE) sector. We infer growth from several factors: (1) consumption surveys in the 1980s showed lower shares of purchased processed foods than in the 2010s; (2) evidence of home processing waned greatly over the period; (3) surveys and case studies reviewed below showed significant investment by and proliferation of processing LEs and SMEs; and (4) imports of ingredients for processors soared. The evolution of processing mirrors the consumption trends discussed above: (1) from minimal processing, such as grain milling, to high and ultra-processing; (2) from custom milling to milling and marketing final products; (3) from selling unpackaged processed food to packaging and

Table 6
Shares of product categories in total food imports in a selected set of African countries.

Commodity groups	Unprocessed perishable	Unprocessed nonperishable	Minimally processed perishable	Minimally processed nonperishable	Highly processed perishable	Highly processed nonperishable	Total
Wheat		0.20		0.01	0.01	0.00	0.21
Rice				0.07			0.07
All other cereals		0.03		0.03	0.01	0.05	0.12
Pulses		0.01			0.00	0.00	0.01
Roots and tubers	0.00	0.00			0.00	0.00	0.00
Vegetable oil and oilseeds		0.01		0.00	0.01	0.24	0.27
Fruits	0.01	0.00		0.00	0.02	0.00	0.03
Vegetables	0.01			0.00	0.02		0.03
Poultry & eggs	0.01		0.00		0.01	0.00	0.02
Other meats			0.00		0.01	0.00	0.01
Dairy (excluding milk)					0.01	0.00	0.01
Milk					0.02		0.02
Fish	0.00		0.03		0.00	0.00	0.03
Sugars and sweets				0.00	0.02	0.09	0.11
Other foods		0.01		0.00	0.01	0.04	0.07
Total	0.02	0.26	0.04	0.11	0.15	0.42	1.00

Source: Authors' analysis of Comtrade data.

branding; and (4) from producing few to producing many types of processed foods.

The development of the food processing sector proceeded in three steps in the past 50 years in SSA: (1) the formation and then dissolution of parastatals processing staple grains; (2) the rapid proliferation of processing SMEs in the wake of parastatals and parallel with urbanization; (3) the emergence of large processing enterprises. We examine in turn the proliferation of SMEs and the rise of large processors.

6.2.2. The quiet revolution in processing in SSA: rapid proliferation of SMEs

Urbanization, diet change, elongating supply chains (because of urbanization), privatization of parastatals, and SMEs' own investments have driven a rapid proliferation of food processing SMEs in SSA. No official or systematic data exist for the spread of processing SMEs over time by country, product, and year. Official data mainly track the formal sector. Yet enough evidence of the proliferation of processing SMEs is emerging from case studies to suggest the spread.

In the 1980s the parastatals had a substantial share of the processed food market in African cities, mainly for grain flour. In the 1990s this share dropped as privatization occurred and SMEs proliferated, for example in Zimbabwe (Rubey, 1995). That proliferation continued into the 2010s, and Reardon (2015) termed it the "quiet revolution in the hidden middle." Reardon (2015) compared SSA and Asia and noted that the rapid proliferation of SMEs in the past two decades is similar to what happened in Asia in the past three decades. Southeast Asia experienced that proliferation a decade or so earlier than South Asia The latter transformed roughly at the same time or a bit earlier than the more economically advanced coastal areas of SSA. The interior countries of SSA are similar (in the proliferation of SMEs in processing) to where South Asia and coastal Africa were several decades ago and perhaps are impeded by small markets due to a relative lack of market integration over countries.

There have been a number of studies of the proliferation of SMEs in the 2000s, such as in Benin, Ethiopia, Ghana, Nigeria, Sierra Leone, South Africa, and Tanzania (Gough et al., 2003; Louw et al., 2013; Mather, 2005; Sanni et al., 2009). A new wave of survey-based analyses of processed food SMEs (and supporting firms such as in logistics) in the 2010s. We highlight several of these studies below to provide a sense of the rapidity of SME development all in situations of the absence of donor or government projects or support.

SME maize mills in Tanzania. Following the privatization of parastatal maize mills in the 1990s, and especially the 2000s and 2010s, many SMEs emerged to mill, package, and brand maize flour. A 2016 survey of SME mills in Arusha and Dar es Salaam found that 85% of the SMEs had started in the past 10 years. Only a third of the mills exclusively custom milled in the traditional fashion. Two-thirds of the mills branded and packaged their flour (Snyder et al., 2015). Even in small cities and rural towns maize flour SMEs were proliferating and shifting from custom milling to branding and packaging (Alphonce et al., 2019).

Teff enjera SMEs in Ethiopia. Rapid growth and transformation occurred in the teff value chain to and in Addis Ababa in the 2010s. Traditionally consumers bought teff grain, cleaned it, custom milled it, and prepared *enjera* at home; this is still the usual practice in rural areas. But those practices declined in Addis Ababa in the 2010s, and consumers increasingly bought teff flour or its pancake form, *enjera*. Teff mills, *enjera* enterprises, and *enjera* and teff retail outlets increased nearly 50% over just one decade (Minten et al., 2016).

Millet prepared by SMEs in Senegal and Nigeria. SME street food vendors have spread in West African cities. They sell traditional dishes, such as *gari* and *attiéké*; nontraditional convenience foods, such as wheat pasta, bread, and biscuits; and rice dishes. Fried and processed foods have also spread rapidly among food vendors in the large coastal cities, such as Accra and Lagos (Hollinger, Staatz, 2015). In Senegal and Nigeria women-run SMEs selling prepared millet dishes with fermented milk, such as *thiakry* in Senegal, have spread rapidly (Chase-Walsh, 2018).

6.2.3. The modern processing revolution in SSA

Large-scale food processors have developed in SSA, particularly over the past 30 years. They have been motors of economies of scale and modernization of equipment in milling. They have also been important in production of ultra-processed foods using imported oil, wheat, and sugar. However, no data exist to systematically calculate the share of these large processors in the processed food sector in SSA. Below we outline the main categories of these firms.

SSA food firms that emerged in the first half of the 1900s and invested throughout SSA in the 2000s–2010s. In countries that developed earlier, such as South Africa, firms arose to feed emerging middle classes and mining enclaves that required packaged foods. Among the ten leading fast-moving consumer goods (FMCG) firms that produced foods and beverages in Africa in 2016, the average firm's annual sales were 1.6 billion USD. Eight were South African: Tiger Brands, RCL Foods, Distell Group, Pioneer Foods Group, Tongaat Hulett, AVI, Astral Foods, and Novo Sugar. Two were Nigerian: Flour Mills of Nigeria and Nigerian Breweries (BusinessTech, 2017).

In SSA, South Africa and Nigeria account for 27% of the population and 55% of the GDP. These large domestic markets help the firms of those two countries lead in sales. South African FMCG firms tend to sell to their national market but also undertake substantial FDI in and exports to other SSA countries. Leading Nigerian FMCG firms sell mainly to their home market, which is 3.5 times larger than the South African market in population terms (Mbodiam, 2019).

Grain milling firms that bought privatized parastatals and moved into ultra-processed. A number of large processors got their start buying privatized parastatals. That allowed them to acquire all at once real estate next to a highway or a railway at a key location, water and electricity links, and mills and packing houses. These gave those firms immediate cost advantages over SMEs competing with them. Governments often incentivized privatization by providing investors with land discounts and import tax exemption.

In reviewing cases of companies in this category, we observed five common steps: (1) acquiring parastatals or other incumbent firms; (2) upgrading of the acquired companies' technology via replacing (usually old vintage) equipment; (3) expanding the plants' capacities and adding economies of scale; (4) adding lines to processing to differentiate products beyond flour into manufactured products like cookies (as most acquired companies were only milling flour before acquisition) thus adding economies of scope; and (5) integrating the acquired company into the regional or global wholesale and retail distribution networks of the parent company.

An archetype of this category is Bakhresa, founded in the 1980s. It is the largest food processor in East Africa. It is based in Tanzania but has FDI in seven other countries related to privatizations in the 2000s/2010s. It acquired privatized mills in Burundi, Kenya, Malawi, Mozambique, Rwanda, Uganda, and Seychelles (Bakhresa Group, 2019). The FDI presented a channel to introduce Bakhresa brands, such as ice cream to Kenya and Zambia. Thus, Bakhresa's FDI upgraded the privatized plants and provided a platform for diversification beyond milling into ultra-processed branded food products. In 2015 it bought Blue Ribbon Foods (BRF) in Zimbabwe, a wheat/maize flour and feed mill that had been in decline, with low capacity utilization. BRF had itself been a South African FDI into Zimbabwe. As with mills in the other countries, Bakhresa bought BRF and then invested in new equipment and silos, expanding its capacity and capacity utilization substantially (Nsehe, 2016).

Multinational Corporations from other regions. Asian food multinationals have been an important set of investors in SSA. As competition increased in Asian home markets and using the advantage of developed brands and technology, firms in Asian developing countries with earlier food system development, such as in Southeast Asia, invested in later-developing regions, such as SSA, where demand for processed foods

was rising but incumbent firms were relatively weak or undercapitalized (Awokuse, Reardon, 2018). An archetype of this category is the Indonesian multinational Indofoods, which has substantially invested in noodle processing in Nigeria and Ghana.

A second set of multinationals are global firms based in Europe (such as Nestle) and the US (such as Cargill and Coca Cola).

Marketing strategies of large processors. Large processing multinationals transferred technologies of packaging and processing and commercial practices of branding into SSA; as noted above, SMEs have adopted these practices. Moreover, large processors often use networks of dedicated distribution agents. These networks have historically provided an advantage to large processors over small processors in consistently placing their products among small retailers, often on credit (Reardon et al., 2012). These strategies are used in rural areas and small towns in Tanzania for the packaged foods of the leading processors Bakhresa and Metl Group (www.metl.net) which produces the "Mo's" brand of edible oils, flour, and sugar.

Some large processors direct retail. For example, Blue Ribbon Foods (now Bakhresa) in Zimbabwe has its own bakery chain with hundreds of outlets. This is a competitive strategy for brand promotion and creation of profit centers of modern retail and food service chains in SSA, where the modern retail and food service sectors are only emerging, as discussed next.

6.3. Retailers and the food service sector selling processed foods

6.3.1. Processed food is sold fin both supermarkets and small shops in SSA, based on micro survey data

First, traditional food stalls, as hybrids of take-away and dining *in situ*, have long sold highly processed traditional foods. Bean fritters cooked in peanut oil, palm wine, and cassava sweet cakes are sold at traditional stalls and shops in Cotonou, Benin (Thuillier-Cerdan, Bricas, 1998). An array of small traders, including street food stands, mobile vendors, small stores, and stalls in the open markets in Windhoek, sell a variety of sweetened and oily foods, such as cooked offal, cooked chicken and dishes like chicken stew, mashed cowpeas, and macaroni salad (Nickanor et al., 2019).

Second, ultra-processed foods are not sold just in supermarkets, as appears to be the popular assumption, but are also sold in small traditional shops. Small shops constitute about 90% of the food retail market, which suggests that by far, the majority of ultra-processed food is sold in small shops. This was demonstrated from the consumption side in our discussion of literature strand 4 in Section 5.

Moreover, retail surveys show the importance of ultra-processed food sales in both traditional shops and supermarkets. Recent studies show that both carry a range of types and brands of packaged processed foods, ranging from packaged grain flours, cookies, cakes, and noodles to sweetened juices, colas, and packaged milk. The supermarkets have more variety per category than small shops (so that a supermarket might carry 20 shop-keeping units of cookies but small shops only 5), but both sell the same categories of sugary, salty, and oily ultra-processed foods. The studies include Namibia (Nickanor et al., 2019), Ghana (Andam et al., 2018), Mali (Theriault et al., 2018), Nigeria (Liverpool-Tasie et al., 2016), South Africa (Emongor, Kirsten, 2009), and Tanzania (Alphonce et al., 2019; Snyder et al., 2015). In rural towns and small and medium cities in Tanzania, small shops have shifted away from a few types of packaged goods and loose flour to branded packaged flour and other processed foods such as cookies (Alphonce et al., 2019).

Furthermore, the popular image is that supermarkets sell large packages and small shops sell small units requiring less one-time outlay so lower-income consumers would necessarily prefer small shops. However, studies show that supermarkets sell not just large packages but also small packages that appeal to the poor, for example, in Kenya (Demmler et al., 2018; Rischke et al., 2015). Some studies even show that supermarkets' prices for processed foods are somewhat lower than those of traditional shops due to economies of scale in procurement (Minten, Reardon, 2008). In Nairobi supermarkets charged 5% less for tea and sugar, 4% less for maize flour, 3% less for oil and wheat flour, and 2% less for white bread compared with the nearest traditional retailer (Neven et al., 2006). In small towns in South Africa supermarkets charged 17% less than traditional shops for maize flour (D'Haese, Van Huylenbroeck, 2005). In Zambia packaged maize flour was 22% cheaper in supermarkets (Emongor, Kirsten, 2009). These lower prices are partly a function of procurement with economies of scale.

Because supermarkets sell a greater variety of processed food and at a lower price than traditional shops, one can infer that over time, as supermarkets (and fast-food chains) spread in SSA, sales of ultra-processed food in the overall food market will gradually rise, compared to a situation where retail developed only as small shops. Below we show that one should expect continued development of supermarkets and fast-food chains (and by extension, e-commerce) in the next decades as an extrapolation of the rapid emergence of these in the past two decades.

6.3.2. The spread of supermarkets in SSA

The retail transformation in SSA have been similar to but more recent than those in Asia and Latin America, which for the most part experienced the supermarket revolution in 1980–2000, and in the United States and Europe, which experienced it in 1920–1980. It involved a shift from the dominance of traditional retail (small shops and stalls in markets) to a transitional retail form (self-service non-chain small and medium-sized grocery stores) to modern retail (supermarkets and chains of convenience stores). A parallel shift occurred in food service from the traditional street food stall to independent restaurants to fast-food chains. For both retail and food service the most recent stage is e-commerce, emerging in developing regions, including in SSA. The supermarket and e-commerce transformations usually occurred earliest in processed foods (Lu, Reardon, 2018; Reardon et al., 2003).

As no official retail statistics show the shares of supermarkets versus traditional retail, we have to infer the current share of supermarkets from the few studies of supermarket shares of food consumption. The studies show that traditional and transitional retail are still dominant, with supermarkets holding only about 10–20% of total urban processed food retail. For example, in Nairobi in 2005, the share was 20% (Neven et al., 2006) and in Zambia in 2018, the share was 42% (Khonje, Qaim, 2019). The latter may be on the high end, so we conservatively estimate a share of 10–20% of processed food expenditures in supermarkets and 80–90% in traditional retailers. That exceeds the tiny or nonexistent share of supermarkets in urban areas in the 1990s, so supermarket sector development has begun in SSA.

However, data on supermarket sales exist, so we can infer their growth. Tables 7 and 8 show the rapid growth in the food sales of the leading chains in SSA from 2002 to 2018. We broke the data into three sets of countries corresponding to the waves of supermarket penetration (Reardon et al., 2003). While our data from Edge by Ascential provide information on most of the main foreign and domestic retailers per country, they do not include smaller and independent supermarket chains. It does include some convenience store chains. Thus, the data underestimate total supermarket penetration and sales in supermarkets funded by domestic capital.

Focusing on 2002–2012 so the data on supermarket food sales are comparable to prior studies in Latin America and Asia, we found that total food sales (in real 2018 USD) went from about USD 10 billion to USD 29 billion, an increase of 191%. Interestingly, this is close to the increase in supermarket food sales by the leading chains in Asia (Reardon et al., 2012) and Latin America (Popkin, Reardon, 2018) during that period. Asia and Latin America started from a higher baseline in the base year as the supermarket revolution had proceeded apace in the 1990s, but it is remarkable that the rates of increase are similar over the three regions in the 2000s. Also, as in Asia and Latin America, the growth is negatively correlated with the wave, so the later waves are catching up with the earlier waves (earlier in the sense that supermarket growth

Table 7
Edible grocery sales of leading modern retail chains by origin of retail company over selected African countries, 2002–2018, in real millions of US dollars (USD, 2018 constant prices).

Waves	Sales 2002	Sales 2018	Total growth 2002–2018 (%)	Average growth per year (%)
First Wave	8594.00	25,576	198	11
Botswana	718.00	937	30	5
Namibia	146.00	615	321	17
South Africa	7730.00	24,024	211	12
Second Wave	1124.00	1303	16	5
Kenya	209.00	1062	407	12
Madagascar	13.00	113	756	32
Malawi	901.00	128	−86	−5
Mozambique	0.03	208	608,312	15
Tanzania	31.00	18	−40	5
Zambia	0.11	354	323,935	15
Zimbabwe	217.00	960	343	11
Third Wave	42.00	664	1492	28
Angola	42.00	327	684	26
Ghana	–	43	–	19
Nigeria	–	294	–	35
Senegal	1.30	19	1380	22

Source: Authors' calculations from raw data from www.ascentialedge.com.

Table 8
Number of leading food retailer chains.

Waves	2002	2008	2012	2018
First wave				
Botswana	6	5	7	8
Namibia	5	7	7	7
South Africa	7	9	9	8
Second wave				
Kenya	4	4	8	10
Madagascar	3	2	2	2
Malawi	2	3	4	3
Mozambique	3	3	4	5
Tanzania	2	2	4	4
Zambia	2	2	5	7
Zimbabwe	5	6	5	5
Third wave				
Angola	2	3	5	4
Ghana	0	2	2	2
Nigeria	0	2	5	5
Senegal	1	1	1	2

The chains are all of those that Edge by Ascential followed per country that were specifically food retailers.
Source: Authors' analysis of raw data from www.ascentialedge.com.

occurred earlier in them than in the later waves).

6.3.3. *The spread of fast-food chains in SSA*

We used Edge by Ascential data to calculate Tables 9–11. Edge by Ascential recently started covering fast-food and coffee shop chain sales growth. Table 9 shows that the data are nearly exclusively on US chains

Table 9
List of food service retailers that Edge by Ascential followed.

Fast-food restaurants	Cafés
Burger King	Starbucks
Domino's	
Domino's Pizza	
Hungry Lion	
KFC	
McDonald's	
Pizza Hut	
Subway	

Table 10
US and South African MNC fast-food chain sales in SSA in real millions of US dollars (USD, 2018 constant prices).

Waves	Sales 2008	Sales 2018	Total sales growth 2008–2018 (%)	Average growth per year (%)
First Wave	812.1	1726.1	113	19
Botswana	6.4	23.0	255	28
Namibia	14.8	25.0	72	18
South Africa	790.9	1678.0	112	19
Second Wave	12.1	99.4	723	73
Kenya	–	39.0	–	70
Mozambique	–	13.0	–	20
Tanzania	4.4	6.0	46	35
Zambia	1.6	39.0	2336	36
Zimbabwe	6.1	2.0	−71	−39
Third Wave	0.5	55.0	9941	69
Angola	–	20.0	–	66
Ghana	0.5	2.0	223	−4
Nigeria	–	33.0	–	29

The chains are all of those that Edge by Ascential followed per country that were specifically food service.
Source: Authors' analysis of raw data from www.ascentialedge.com.

operating in Africa with the exception of the South African chain Hungry Lion (https://www.hungrylion.co.za). African domestic and regional chains are developing quickly, but at present they are not included in the Edge by Ascential data.

Table 10 shows that from a low base in 2008 the fast-food MNCs grew 2.4 times over only 10 years, from 0.55 billion to 1.8 billion in sales. The situation is far from maturity or saturation, so the waves, imposed on the country sets from the supermarket analysis, show little variation in the speed of food service development over the regions. Table 11 shows that individual companies have invested intensively and rapidly.

6.3.4. *The evolution of sales of ultra-processed foods by supermarkets and fast-food chains in SSA per Euromonitor data*

Euromonitor data on sales of SSBs and other ultra-processed foods in supermarkets and fast-food chains approximate national consumption per capita of these foods. While these chains still constitute only a small minority of food sales, the studies we reviewed (noted above) found that consumers also buy ultra-processed foods from small traditional shops with only a small difference from the amount purchased at supermarkets. This suggests we can use modern outlet sales of ultra-processed foods as a rough indicator of national trends.

Fig. 7 shows a rapid increase in South Africa in estimated per capita SSB sales and a much smaller increase in estimated sales of other ultra-processed foods. In Nigeria, we found a much smaller but significant increase in estimated SSB sales and no increase in other ultra-processed food sales. Fig. 8 shows large increases in sales of FAFH and nonalcoholic beverages between 1990 and 2017 in South Africa, Cameroon, and Côte d'Ivoire and more recently in Ethiopia.

7. Summary and conclusions

7.1. *Summary*

First, the DBM has developed rapidly in all countries in SSA, with stunting and overweight/obesity at severe levels. Stunting is declining at the same annualized year rate that overweight/obesity is increasing. However, the initial prevalence of stunting in the 1990s was very high in the region. This shift has been more obvious in urban areas and among higher-income households but is emerging in rural areas and among the poor. A key driver of obesity very likely is increasing consumption of ultra-processed foods while an array of economic, social, and environmental factors impacts stunting.

Second, we believe that much of the current debate views processed

Table 11
Evolution of total banner sales of fast-food and café retailers that Edge by Ascential followed in SSA, 2008–2018, in real millions of US dollars (USD, 2018 constant prices).

Retailers	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
KFC	413	693	1335	1284	1096	1022	1396	1040	586	871	1045
McDonald's	94	148	389	447	382	337	329	368	263	410	505
Hungry Lion	42	68	84	107	114	153	168	143	66	95	99
Pizza Hut							5	23	25	58	87
Domino's Pizza							7	40	30	50	70
Burger King						11	43	78	31	35	37
Domino's					3	4	32	31	17	12	16
Subway	3	4	11	13	13	14	16	15	8	11	14
Starbucks									1	5	7

Source: Calculated from Edge by Ascential data.

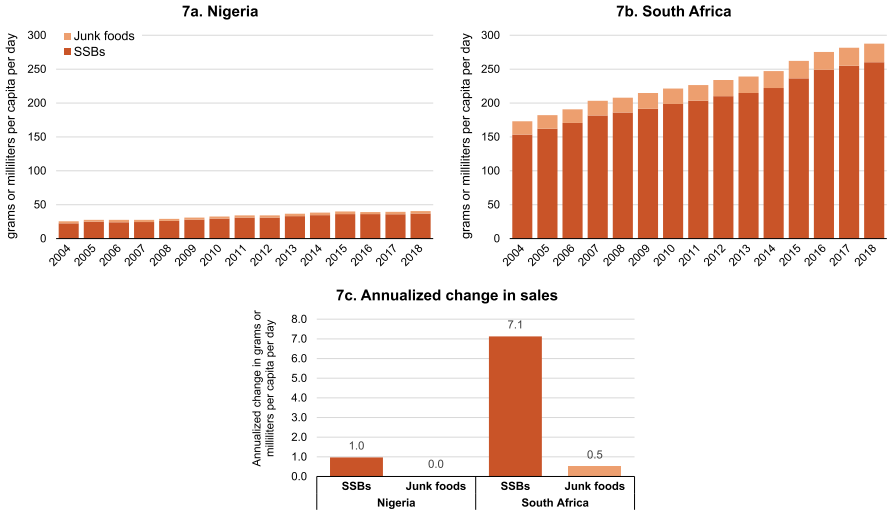

Fig. 7. Total estimated daily per capita components of ultraprocessed foods: SSB* and junk food** sales in Nigeria and South Africa and annualized change in sales, 2004–2018.

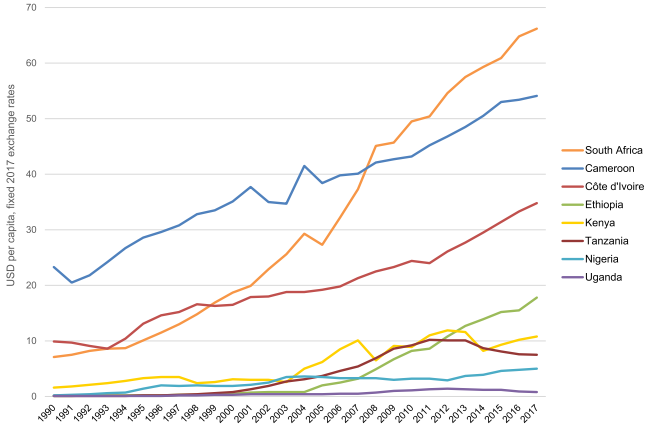

Fig. 8. Per capita consumer expenditures on away-from-home* food and nonalcoholic beverages, 1990–2017.

food as an emerging trend and only among some consumers, especially the urban middle class. By contrast, we found that for 50 years the trend has been African consumers increasingly purchasing processed foods. Recent times have only seen an uptick in a long trend. We found that today increased consumption of purchased processed food is not confined to the urban middle class but, rather, has spread over urban and rural areas and among the middle and poorer classes.

The trend has been driven by four factors: (1) rising opportunity costs of time for processing and cooking at home for women and men working away from home; (2) falling costs of processed foods due to a huge increase in domestic supply; (3) increasing purchasing power; and (4) changing food environments due to advertising. These four factors have created a strong, persistent, and we believe, long-term demand for processed foods both as ingredients, such as packaged flour, and as highly processed products, such as bread, so women can reduce time in home processing and preparation. Increased commuting to work has raised opportunity costs of time for both men and women, so breakfast and lunch are often bought at roadside stalls, restaurants, and market kiosks.

Hence a key message of this paper is that the demand for ultra-processed food and the larger trend toward minimally processed food, highly processed food, and FAFH is not a phenomenon set apart, which perhaps would be more easily addressed. Rather, the demand for ultra-processed food is rooted in the general rise in demand for processed food linked to deep and persistent economic and sociodemographic trends and forces that are not just attributable to a recently imported food culture.

Third, ultra-processed food is only a small share (about 10–30% over the studies) of all purchased processed food. Ultra-processed food consumption has risen along with all processed food consumption. Industrialized packaged ultra-processed food is not in itself a radical departure from traditional oily, sugary, or salty snacks and meals. The main difference is that the broad investments of both SMEs and LEs in production and packaging of ultra-processed food promises, via economies of scale, to make these foods cheaper over time. For reasons of cost and taste, these foods have taken a larger share of consumption over

time with concomitant health consequences.

Fourth, the supply of processed foods in SSA is mainly domestic and from SMEs. On the one hand, direct imports of processed foods are minor except for edible oil. Imports have an indirect role via imports of wheat, oil, and sugar as inputs into domestic processing. On the other hand, the supply of processed foods in SSA comes overwhelmingly (we estimate roughly 80%) from SMEs. We emphasize the rapid proliferation of SMEs both in milling and other minimal processing and in highly processed foods, such as breads and noodles. The LE sector, partly fueled by FDI like Tanzania's Bakhresa investing in Zimbabwe and Indonesia's Indofoods supplying Indomie ramen in Nigeria, is emerging in packaged snacks and other ultra-processed manufactured foods.

Fifth, supermarkets did not invent or even sustain the majority of ultra-processed food sales in SSA. Retail of processed food is dominated by SMEs, small shops that sell processed and ultra-processed foods. Supermarkets are emerging but still have a small share of the retail sector. The evidence shows that, after controlling for consumer income, supermarket shoppers are only slightly more apt to buy ultra-processed foods than shoppers at traditional stores, so the emerging supermarket revolution in Africa is not driving either processed food consumption or obesity.

Sixth, while ultra-processed food very likely contributes to obesity, as well as NCDs such as cardiovascular disease and cancer as a negative externality, it must be kept in mind that processed food in general is the source of major positive externalities. SME employment in the food system in processing, wholesale, transport, and retail is important to the employment of women and youth. In Africa 20% of rural employment and 25% of urban employment are in food system jobs, such as wholesale and processing (Dolislager et al., 2020). Moreover, as noted above, processed food "liberates" women by eliminating time spent home pounding grain so they can engage in home chores, leisure, and work outside the home.

7.2. Policy implications

We found that processed foods generate a mix of positive and negative externalities. On the positive side, access to convenient, processed foods generate more equity and women's progress in the workforce. On the negative side, some of these foods in their ultra-processed form have detrimental health consequences. Policy makers are thus faced with a challenge: encourage SME food processing and linked food system employment for equity reasons but manage the portion of ultra-processed foods that are unhealthy to improve public health.

(Bhutta et al., 2020; Hawkes et al., 2019)First, SSA policy makers must recognize and grapple with a new, complex context – that of the DBM. They have an incentive to reduce the supply of and demand for unhealthy, ultra-processed foods per se. It is beyond the scope of our paper to treat other objectives they have concerning reduction of malnutrition, such as insufficient consumption of micronutrients. Singular interventions to address undernutrition or overweight/obesity must ensure to do no harm in affecting the other aspect of the DBM. At the same time double duty interventions that can positively impact the DBM in its totality should be considered (Hawkes et al., 2017, 2019). At the same time there are many double duty actions that will impact both stunting and overweight/obesity (Hawkes et al., 2019). The latter laid out a number of measures that address prevention of stunting and overweight/obesity. Some key ones include redesigning an array of existing programs from cash and food transfers and subsidies to school feeding, growth monitoring, scaling up nutrition -sensitive agriculture programs, and redesigning complementary feeding programs.

Second, the rise of the demand and supply of processed food is part of a reality five decades in the making, driven by long-term employment trends of men and women and processed food supply trends. Current policies are not likely to reverse these trends in the immediate term. In fact, the policy incentives regarding food prices, employment, and food access are, rather, on the side of encouraging and facilitating growth of food supply chains, which the data shows, means more processed food and the means of distributing it more efficiently and cheaply.

Third, while it is realistic to assume that processed food consumption will continue to increase, it is important that the share of it that is unhealthy and ultra-processed be limited as much as possible by policy actions and incentives. Fiscal policies (like sugar taxes) and labeling of unhealthy foods have the potential to help SSA countries in this regard. This is exemplified by South Africa's Health Promotion Levy on SSBs (Stacey et al., 2019). Also, other countries in SSA, including Ethiopia, are considering adopting policy packages aiming to limit consumption of unhealthy, ultra-processed foods. Countries such as Chile have had some success in reducing sugar consumption through taxes on SSBs and in reducing purchases of unhealthy snacks and other packaged foods through required front-of-package warning labels and further advertising and marketing regulation of those foods. Mexico and South Africa are among the 44 countries with SSB tax laws today (Shekar, Popkin, 2020), and Ethiopia has passed a 25% tax on sugary beverages. Chile, Mexico, Peru, and Israel are among those with front-of-package warning labels (Corvalan et al., 2019).

However, most of the countries that have implemented SSB taxes have different conditions from those of most SSA countries. On the one hand, the SSB-taxing countries tend to have concentrated food sectors where large processors dominate. The opposite is the case in most of SSA, where, as we showed, the processing and retail sectors are fragmented and dominated by informal sector SMEs. This might mean the normal route of an excise tax on one or two major bottlers and distributors would be replaced by 5–10 taxes in SSA with more administrative complexity and difficult enforcement given the extremely fragmented nature of the food system. SSB taxation may be possible, but it is not clear if it would be feasible for ultra-processed foods. On the other hand, the sugar-taxing countries tend to have governments with strong administrative capacities that can implement the regulations. It may be challenging for many African countries to add and enforce such regulations.

Fourth, it is desirable for African governments to put in place nutrient profiling models and then front-of-package label regulations. They can build on the Chile and Mexico models with bans on unhealthy foods in schools, marketing controls, and if possible sugar or ultra-processed food taxes (Corvalan et al., 2019). But the actions need to be gradual and consider the special conditions relative to the African countries with higher GDP/capita taxing sugar and the multiple goals of African governments in the context of the DBM.

Fifth, African governments also need to continue to invest in public infrastructure to help food supply chains continue to grow and transform to feed cities and rural areas, keeping in mind that today in SSA, 80% of food consumption is purchased and thus depends on food supply chains. Roads, wholesale markets, and electrification stand out as urgent food system priorities. Food system growth will bring with it cheaper and more abundant food, will provide markets for farmers, and will supply the processed food that is not harmful but, rather, is needed, such as milk, fruits, vegetables, legumes, and fish. The other side of the coin is that more efficient supply chains will also bring ultra-processed food to consumers even more efficiently. Thus, the best option for SSA is to promote supply efficiency for food security but tax and label unhealthy foods.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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