Food and Agriculture Organization
of the United Nations

IMPROVING DIETS IN RURAL GHANA

Food system analysis to identify opportunities for nutrition-sensitive small and medium enterprises

INTERNATIONAL
FOOD POLICY
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PREFACE

It is widely acknowledged that small and medium enterprises (SMEs) play a pivotal, direct role in poverty and hunger reduction, industry growth and job creation. Nevertheless, the development of an enabling policy environment for small food enterprises is often overlooked, falling between the crevices of policies on agriculture and agro-industries, food safety, nutrition and trade.

Improving nutrition by making nutritious food available, affordable and desirable to all requires actions from all stakeholders involved in food systems, including producers, processors, retailers, consumers and private and public institutions. SMEs have a great potential to play a particular role in enhancing nutrition in food systems.

The Food and Agriculture Organization of the United Nations (FAO) is committed to supporting SMEs through the creation of an enabling environment that encourages the prioritization of nutrition as a business opportunity and incites policymakers to collaborate with multiple stakeholders, including the private sector, development agencies, civil society, non-governmental organizations and academia.

This report is based on analysis undertaken as part of the FAO project "Strengthening capacities for nutrition-sensitive food systems through a multi-stakeholder approach". The project is funded by the Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF) and coordinated by FAO's Food and Nutrition Division (ESN), in collaboration with the Ghana office of the International Food Policy Research Institute (IFPRI). It presents a detailed analysis of Ghana's food system, with a focus on rural resource-constrained communities.

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ABBREVIATIONS AND ACRONYMS

AGI	Association of Ghana Industries
CGIAR	Consortium of International Agricultural Research Centers
FAO	Food and Agriculture Organization of the United Nations
FCT	Food Composition Table
GEPC	Ghana Export Promotion Council
GNCCI	Ghana National Chamber of Commerce and Industry
IDI	In-depth interview
IFPRI	International Food Policy Research Institute
MOTI	Ministry of Trade and Industry (Ghana)
NBSSI	National Board for Small Scale Industries (Ghana)
NCD	Non-communicable diseases
PEF	Private Enterprises Foundation (Ghana)
PFJ	Planting for Food and Jobs (Ghana)
PNF	Preferred nutritious foods
SME	Small and medium enterprise
SUN	Scaling Up Nutrition
USAID	United States Agency for International Development
VCN	Value chains for nutrition
WHO	World Health Organization

1. INTRODUCTION

1. INTRODUCTION

Almost 22 percent of deaths worldwide can be attributed to unhealthy diets, according to the Global Burden of Disease study, making unhealthy diets the world's biggest killer (GDB 2017 Diet Collaborators, 2019). While the prevalence of stunting is decreasing worldwide, that of overweight and obesity and associated health problems is increasing (IFPRI, 2018). Furthermore, while the percentage of stunted children has decreased in Africa, the absolute number has increased (IFPRI, 2018). Given the considerable dietary challenges facing the world, and the growing understanding of their complexity, the emphasis is increasingly on systemic approaches to addressing poor diets.

Food system approaches are critical to improving diet quality, as they facilitate the simultaneous consideration of multiple issues and help address them from a systemic perspective. Food systems encompass all actors involved in the many processes and activities along food value chains, including production, storage, transportation, trade and retailing (Global Panel on Agriculture and Food Systems for Nutrition, 2016). A food systems perspective is particularly powerful as it considers multiple nutrition-related problems simultaneously and leverages synergies throughout the system. In addition, a food systems perspective may help avoid unintended negative consequences of the functioning of a food system.

The actions of players in the private sector are critical to the formation and functioning of food systems. This raises the question of how the private sector can contribute to efforts to make diverse and nutritious food available, accessible and desirable to all segments of the population. In the context of a transforming agriculture sector, particular questions are raised regarding the potential role of small and medium enterprises (SMEs) in improving the accessibility and availability of nutritious food.

The analysis of food systems requires a tool that allows for the systematic consideration of the diverse and interrelated actors and activities of the system (Global Panel on Agriculture and Food Systems for Nutrition, 2016; Maestre and Poole, 2018). Such a tool must identify which activities and roles of private actors can be strengthened. Gelli *et al.* (2015) presents a diagnostic framework to fill this need. The Value Chains for Nutrition (VCN) diagnostic tool allows for the simultaneous examination of multiple food value chains through a nutrition lens, from production to consumption (FAO, 2017). Specifically, the VCN approach focuses on three interlinked factors that shape food environments and impact upon diets:

- the demand for nutritious foods;
- the supply of nutritious foods; and
- nutritious value addition (or retention) along a set of food value chains.

In Ghana, problems related to nutrition are diverse and geographically varied. A food systems approach to assessing these problems helps capture and leverage this complexity. It considers the varied drivers of and barriers to improving diets, and can identify market-based opportunities for improving the diets of low-income consumers. Furthermore, a food systems approach helps identify the roles of actors in different sectors and develop a common language for coordinated action. Improving links within food systems requires interventions to address the circumstances and needs of actors engaged in the production, processing and marketing of food, as well as the preferences and tastes of consumers.

This report presents a detailed analysis of Ghana's food system, with a focus on rural resource-constrained communities. The report identifies a set of nutritious foods that merit priority, formulates value chain interventions that can boost the consumption of these foods, and distinguishes opportunities for SMEs throughout value chains.

2. COUNTRY CONTEXT

2. COUNTRY CONTEXT

Over the past decade, economic growth in Ghana has coincided with significant decreases in undernutrition and poverty, though they still constitute a significant problem in some parts of the country. Welfare disparities between rural and urban populations and northern and southern regions are evident in terms of poverty, food insecurity and undernutrition. In addition, the emerging problem of overweight and obesity and their associated diseases is a cause for concern. While overweight and obesity are currently concentrated in Ghana's urban populations, rising incomes, mechanization and increased access to processed foods may begin to shift the burden to rural populations (Bixby *et al.*, 2019).

Chronic childhood malnutrition (among children under five years of age) as measured by stunting (low height-for-age) in Ghana fell from 28.1 percent in 2008 to 18.8 percent in 2014 (University of Ghana *et al.*, 2017). Child undernutrition has declined much more slowly in rural areas than in urban areas, and tends to be concentrated in the northern regions. Meanwhile, overweight and obesity increased from 2008 to 2014. In 2014, one out of four Ghanaian women (age 15 to 49) was overweight (with a body mass index of 25 to 30), and more than 15 percent were obese (with a body mass index of 30 or above). The prevalence of obesity was 2.5 times higher among urban woman than among rural women (Ghana, Statistical Service, Ghana, Health Service and ICF International, 2015b). In addition, anemia (Shenton, Jones and Wilson, 2020) and Vitamin A deficiency (Wegmüller, Bentil, Wirth, Petry, Tanumihardjo, Allen, Williams *et al.*, 2020) need to be addressed. This emerging situation can be described as a nutrition transition, whereby dietary energy consumption and activity levels shift from undernutrition to overnutrition, coinciding with economic and demographic changes. Ecker and Fang (2015) analyse nationally representative data on food purchases to gauge the extent and trajectory of the nutrition transition in Ghana. They find that Ghana has only recently started showing signs of a nutrition transition, which is most advanced in the urban south and least advanced in the rural north. Analysis suggests that animal-sourced food consumption will continue to rise with incomes, as will the consumption of pulses, a healthier source of protein. This is significant as protein from animal sources and legumes are an important part of a healthy diet and are often consumed in inadequate amounts in vulnerable populations. However, the increased consumption of meat beyond recommended levels is also associated with a higher risk of obesity and non-communicable diseases.

Ghana's rural populations are predominantly engaged in semi-subsistence agriculture on small plots, with most farming on less than two hectares of land (Ghana, Ministry of Food and Agriculture, 2015). Evidence shows that as far as household access to diverse foods is concerned, many rural households rely mainly on their own production (Ecker, 2018; Signorelli, Haile and Kotu, 2017). Traditional farming methods, characterized by low input use, little mechanization and low productivity, are still widely used (Ghana, Ministry of Food and Agriculture, 2015). These farming practices are largely reliant on rainfall and family labour.

Resource-poor smallholder farmers have been largely unable to tap into the growing market opportunities for food products created by the rise of the urban middle class. Urban diets are increasingly dependent on imported food products due to changing food preferences as well as the inability of local producers to meet quality preferences, limited productivity and high costs of production (Andam *et al.*, 2018; Andam *et al.*, 2019; Zhou and Staatz, 2016).

Policymaking for the agriculture sector currently emphasizes supporting the production of staple

crops through the implementation of the Planting for Food and Jobs (PFJ) programme, a flagship agricultural programme providing subsidized seeds and fertilizers. While it includes other crops, the bulk of investment under the programme is focused on boosting the local production of maize and rice to support food self-sufficiency and decrease food imports, especially for rice. Other policies and programmes (for example the Ghana Trade Policy and the Food and Agriculture Sector Development Policy II) support agricultural transformation away from subsistence farming towards an agro-industrial economy. However, these initiatives have yet to reduce food imports or significantly increase downstream processing of domestic agricultural commodities. Andam et al. (2018) find that imported food products are dominant among packaged foods in retail food outlets, especially in small cities. They surmise that unstable supply is the main barrier to increasing the local processing of foods and displacing imports. Small and medium-sized enterprises (SMEs) are the backbone of the Ghanaian economy. They are estimated to account for about 85 percent of all businesses in the country, and contribute about 70 percent of Ghana's gross domestic product (GDP) (ITC, 2016). This suggests that SMEs, including those operating in the agro-processing sector, may be leveraged to enhance nutrition in the Ghanaian food system.

A number of institutions, both public and private, have been established to facilitate the growth of SMEs. These institutions include the National Board for Small Scale Industries (NBSSI), an agency under the Ministry of Trade and Industry (MoTI), the Association of Ghana Industries (AGI), the Empretec-Ghana Foundation, the Ghana Export Promotion Council (GEPC), the Private Enterprises Foundation (PEF), the Ghana National Chamber of Commerce and Industry (GNCCI) and local and international nongovernmental organizations. They provide assistance to SMEs by offering opportunities for training, promoting the organization of SMEs, providing industry-related information and linking SMEs to financing institutions for credit, thus promoting entrepreneurship and export readiness.


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3. Analytical approach

3. ANALYTICAL APPROACH

The analytical framework applied here builds on the VCN diagnostic tool presented in Gelli et al. (2015) to identify food system interventions that can contribute to more nutritious diets in rural Ghana, with a particular focus on the role of markets. Based on a series of in-depth interviews (IDIs) with both women and men in sampled communities, food preferences and sources were analysed, with a focus on nutrient-rich foods. The diagnostic process entailed the selection of a set of promising nutrient-rich foods for further analysis, based on the IDIs. These foods, referred to as preferred nutritious foods (PNF), were selected according to the following criteria:

- rich in nutrients (especially those consumed in inadequate amounts, as evidenced by the analysis of household data);
- locally available in preferred forms; and
- acceptable to consumers in the locality.

Structured interviews with food outlets and vendors patronized by the sampled communities provided an understanding of the market characteristics of preferred foods, again with an emphasis on nutrient-rich foods. Interviews with value chain actors explored constraints faced by market sellers, supply and demand patterns, the role of women in the marketing of nutritious foods, and activities such as processing, packaging and distribution.

The dual streams of analysis — across communities and across value chains — were amalgamated to identify the supply and demand characteristics of the selected preferred nutritious foods, as well as the drivers of increased consumption. The results of this analysis allow for the identification of challenges and opportunities for improving diets in the value chain, which are then translated into context-specific policy and programme alternatives throughout the food system.

Data were collected on eight study sites across four regions to reflect the diversity of nutrition-related problems and cover the country's main agroecological zones and ethnic groups (Figure 1). Eight community case studies were undertaken, based on IDIs with rural (primarily agricultural) household heads and structured interviews with food sellers operating within the communities and market vendors in nearby market centers. In total, 48 IDIs were conducted: 28 with women and 20 with men. Based on interviews with household members, PNFs and commonly patronized food outlets/sellers were identified for each community. The food outlets that were identified included community kiosks and sellers and one main reference market for each community. In total, 17 local food sellers and 92 market vendors were interviewed. Data were collected from July to September 2018.

Estimates of the nationally available food provide insights into the food supply system and the amount and diversity of food in a country (FAO, 2018). Food availability estimates utilize food balance sheet data, combining national agricultural output estimates with data on other sources or losses of food, such as food trade (imports and exports) or the transformation of food into animal feed.

FIGURE 1 SAMPLED COMMUNITIES AND MARKETS

Note: Communities typically use more than one market; the primary market is the most frequently visited, while secondary markets are visited only occasionally.

Source: Adapted from Map No. 4186 Rev.3 UNITED NATIONS, February 2005. Department of Peacekeeping Operations, Cartographic section.

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4. Food and nutrient availability

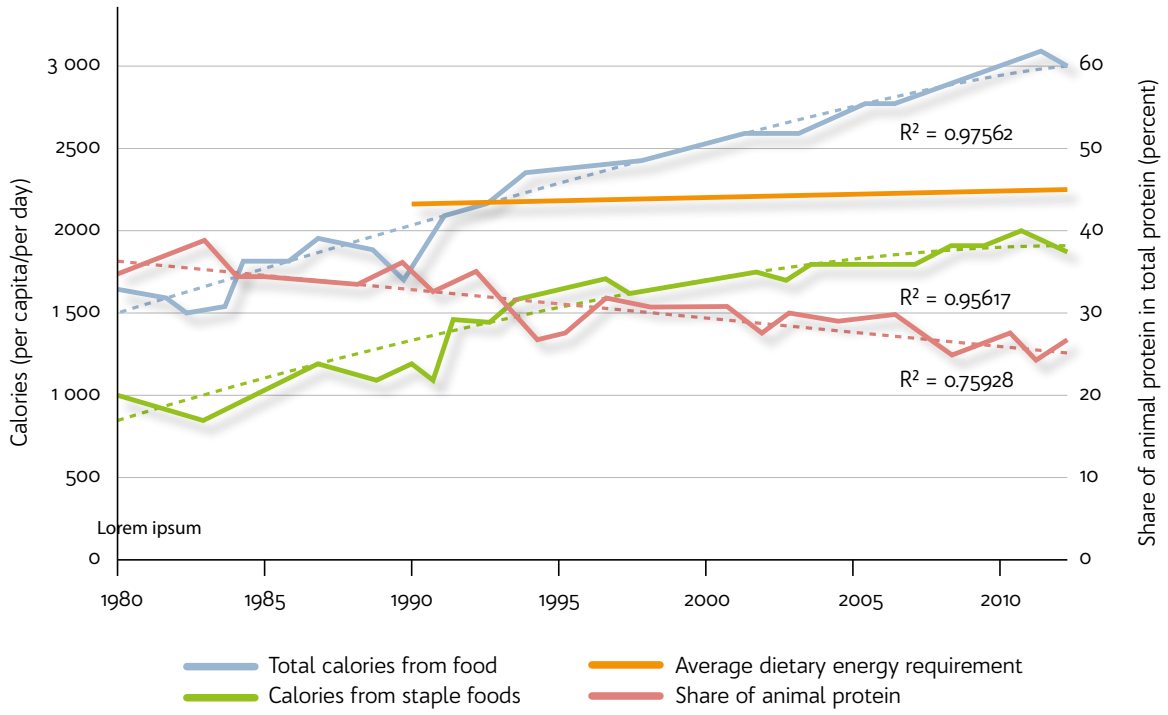
4. FOOD AND NUTRIENT AVAILABILITY

This section describes the historical trends in food availability, household food and nutrient consumption patterns, and diet preferences in Ghana, triangulating data from different sources to provide a fuller picture of the situation.

4.1. TRENDS IN FOOD AVAILABILITY

According to national estimates, the availability of food at the national level in Ghana has been increasing steadily for decades (Figure 2). Increased availability of total calories (per capita per day) is largely driven by increases in the availability of staple foods. This reflects the heavy emphasis in Ghanaian diets on starchy staples and the related underconsumption of nutrient-rich foods such as fruits, vegetables and high-quality protein. However, it is important to consider that national food availability figures are likely to overestimate human consumption as they include industrial and animal feed uses. In addition, they may mask inequalities as they do not consider disparities in food consumption levels across the population.

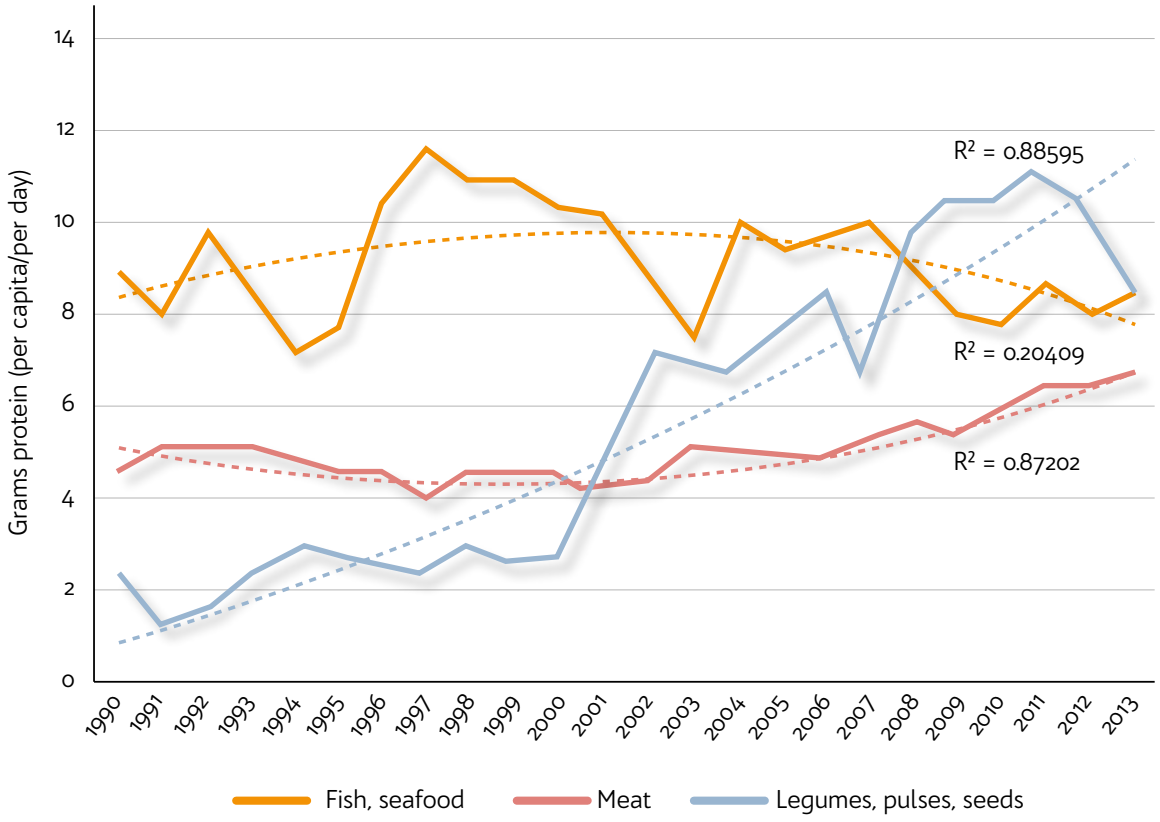
FIGURE 2 FOOD AND NUTRIENT AVAILABILITY TRENDS (1980-2013)



Source: author's calculations based on food balance sheet data from FAO (FAO, 2018).

Figure 3 shows the availability of high-quality protein, per capita per day, broken down by source. Historically, fish and seafood were the most important source of protein available. However, the amount of protein coming from legumes and seeds has been increasing slowly, and surpassed that of fish and seafood in 2008. Meanwhile, the amount of protein from meat has been increasing in recent years. Over the period from 2003 to 2013, the availability of meat increased at an average rate of 4 percent per year.

FIGURE 3 AVAILABILITY OF PROTEIN (1990–2013)



Source: author's calculations based on food balance sheet data from FAO (FAO, 2018).

4.2. HOUSEHOLD FOOD CONSUMPTION PATTERNS AND NUTRIENT GAPS

Household consumption data collected from a nationally representative sample of primarily rural households in 2016 offer a better understanding of the food that is actually accessed by households.[1]

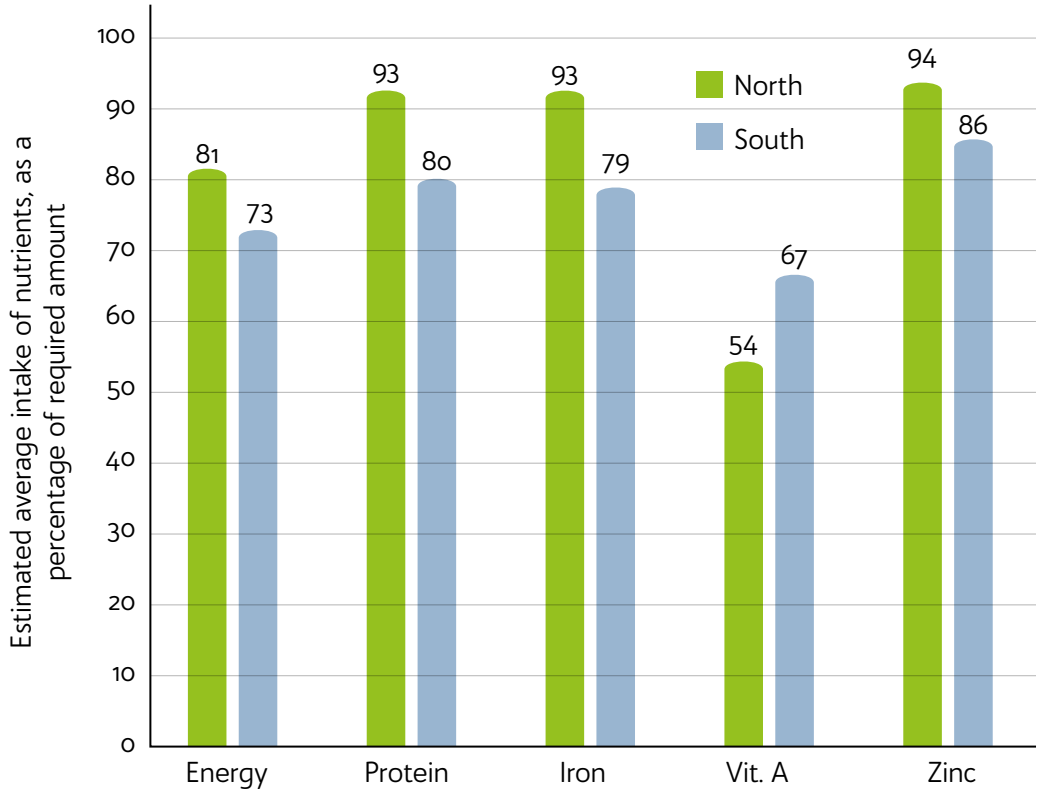
Figure 4 presents the per capita availability of key micronutrients in relation to estimated average requirements, based on data from a seven-day recall of household consumption and expenditure. The figure illustrates how much of the required amounts of energy, protein, iron, zinc and vitamin A is actually consumed; however, the numbers are not adjusted by bioavailability and are therefore likely to be overestimates. Figure 4 demonstrates that poor rural households face important deficits in micro- and macronutrient intake.

Their calorie consumption is less than adequate at 81 percent of the daily requirement in the north and 73 percent in the south. Protein, zinc and iron consumption are close to adequate (93 to 94 percent) in the north, while the level of vitamin A consumption is about half of what is required. In the south, protein, iron and zinc consumption levels are lower (80 percent, 79 percent and 86 percent of the required levels), while vitamin A consumption is higher, but still inadequate (67 percent).

Consumption deficiencies can be better understood by looking at the data for various food groups and their nutrient contributions.
Table 1 presents data on food consumption by households in the lowest expenditure quintile in Ghana by food group. The table illustrates the contribution of each food group to the overall intake of micro- and macronutrients (calories, protein, iron, vitamin A and zinc) in northern and southern Ghana.

[1] *Nationally representative data were collected by IFPRI and the Institute of Statistical, Social and Economic Research (ISSER) at the University of Ghana ISSER; the figures were republished with permission from Aberman* et al. *(2020). The nutritional content of individual foods was estimated by using the West African Food Composition Table (FCT) (FAO, 2012).*

FIGURE 4 ESTIMATED AMOUNT OF NUTRIENTS AVAILABLE TO HOUSEHOLDS IN NORTHERN AND SOUTHERN GHANA, AS A PERCENTAGE OF REQUIRED AMOUNTS



Source: Aberman et al., 2020.

TABLE 1 NUTRIENTS CONSUMED BY HOUSEHOLDS IN NORTHERN AND SOUTHERN GHANA BY FOOD GROUP, AS A SHARE OF TOTAL NUTRIENT CONSUMPTION

NORTH

Food groups	Quantity (kg)	Calories	Protein	Iron	Vit. A	Zinc
Staple foods	73%	77%	64%	70%	36%	71%
Legumes & seeds	8%	13%	21%	16%	0%	20%
Vegetables	11%	3%	4%	9%	57%	6%
Fruits	3%	0%	0%	0%	2%	0%
Animal-based foods (e.g. dairy)	3%	2%	10%	4%	3%	2%
Oil, sweets, condiment	2%	4%	1%	0%	0%	0%

SOUTH

Food groups	Quantity (kg)	Calories	Protein	Iron	Vit. A	Zinc
Staple foods	66%	64%	53%	51%	15%	61%
Legumes & seeds	2%	4%	8%	7%	0%	7%
Vegetables	17%	6%	11%	24%	57%	16%
Fruits	7%	10%	6%	8%	18%	4%
Animal-based foods (e.g. dairy)	3%	4%	14%	6%	6%	6%
Oil, sweets, condiment	4%	10%	3%	2%	1%	2%

Source: adapted from Aberman et al., 2020. Quantity is based on weight, and nutrient shares are estimated based on the West African Food Composition Table (FCT) (FAO, 2012).

Staple foods are the overwhelmingly dominant source of nutrients for households in both northern and southern Ghana; they account for 77 of calories consumed in the north and 64 percent in the south. Furthermore, in the north, where maize dominates diets, the supply of nutrients is likely much lower than Table 2 suggests, due to low the bioavailability of that staple food.

The shares of food groups other than staple foods (including fruits, vegetables and animal-based foods) in overall food intake are very low in the north. However, in spite of their limited intake, vegetables provide 57 percent of total vitamin A intake, most of which comes from the consumption of chilli peppers. Animal-based foods, including dairy products, account for just 10 percent of protein and 4 percent of iron intake. Legumes, although consumed in small amounts, provide more of these nutrients: 21 of protein and 16 percent of iron.

The intake of fruits and vegetables is higher in the south than in the north. Fruits account for a higher share of total vitamin A intake in the south (18 percent) than in the north (2 percent). The intake of oil and animal-based foods is higher in the south as well

4.3. EXAMINING FOOD PREFERENCES AND DIET CHOICES

Food preferences and dietary aspirations may differ from actual food consumption, as factors such as availability, affordability and time may constrain consumption. Furthermore, it is important to reflect on the social and cultural dimensions of diet choices. The in-depth interviews with farm household members show that the specific foods that are consumed vary from region to region. However, overall diet patterns and preferences are similar throughout the country. Ghanaians enjoy variety, consuming various starchy staples and different accompanying soups and stews. Staple foods include maize, plantains, cassava, yams, cocoyams and rice. In the north, millet and sorghum are also common. Soups and stews typically start with a base of dried fish, onions, chilli peppers and tomatoes, and include small amounts of ground groundnuts or seeds (most commonly egusi, the seed of a melon-like gourd), vegetables and – when possible – chicken or other meat. In addition to onions, chilli peppers and tomatoes, commonly preferred vegetables include okra, garden egg (a variety of eggplant), abedru (turkey berry) and different leafy greens. Households throughout Ghana were found to seek out different types of fruits and recognize their health benefits.

When describing the foods they liked, people started by naming the base staple. When prompted, they also specified which type of soup or stew they liked to eat with it. There are some typical combinations – for instance, one eats light soups with fufu (dumplings made from cassava and yam or plantains), okra soup with banku (fermented maize patties) and stew with rice – and common formulations of recipes, but there are many different variations.

A few processed and packaged food were ubiquitous across the communities interviewed. These included flavoured stock cubes (such as those of the brands Maggi or Onga), tinned tomatoes and imported rice. Other packaged foods mentioned include bread, tinned or powdered milk, beverages like tea or Milo (a sweet powdered cocoa drink), sunflower oil (as a substitute for locally processed palm oil) and tinned fish or meat. Consumers said that they rarely differentiate between foreign or Ghanaian brands. The factors they mentioned as having an influence on decisions as to what to purchase included flavour, past use and expiration dates. In communities in or near a major urban centre, processed foods were more commonly mentioned. In some of the most remote communities, households often rely on tinned foods and flavour cubes when other ingredients are not available, as illustrated by the following fragments from IDIs:

Q: "In case you don't get fish, what do you add to the soup?"
R (female respondent, North East Region): "In that case we use Maggi cubes."
R (male respondent, Oti Region): "Sometimes the fish for the stew, I mean the dry fish, is not available so if we don't get dry fish then we buy Tinappa tinned sardines."

All communities interviewed aspired to consume more rice. Many said they would like to consume more beans (some households limit their

consumption of beans during the production and harvest seasons because of the time required to cook them) and yams. Milo, bread, evaporated or powdered milk and fruit were also occasionally mentioned as foods that households would like to consume more frequently. And, while people lamented having to consume the same foods day after day due to seasonal scarcity, they also aspire to eat more of their preferred dishes. While people often referred to their ethnic identity to explain why certain foods were eaten in a community, it was also common for people to not eat those foods based on personal tastes and preferences.

Respondents' conceptions of the nutritiousness of foods related to traditional concepts like "blood building" or "giving strength", except in the few instances where the respondent had some formal training in healthcare (for instance, one respondent was a pharmacist). Respondents listed a number of foods they considered nutritious, such as leafy greens, abedru and various fruits. Fish was commonly described as nutritious, beef was sometimes described as harmful to one's health, and a number of people mentioned skin reactions and other illnesses from eating pork.

Most commonly, foods were said to be nutritious because they give strength and energy, "build the body" or "build blood". These effects were described in terms of one's ability to work hard on the farm, make one's body strong, or withstand or avoid illnesses. Abedru – and sometimes kontomire (cocoyam leaves) – was described as a "blood tonic". There were also many references to the dangers of foods that produce phlegm in the body, and debates about which ones were worse in this respect – cassava, yams or cocoyams. Respondents discussed phlegm as something that can weaken the body, for instance by worsening the effects of a malaria infection. A health benefit commonly ascribed to fruits was relief of constipation.

5. Sourcing nutritious foods

5. SOURCING NUTRITIOUS FOODS

5.1. FOOD OUTLETS USED

The food outlets patronized by the households interviewed include community-based food hawkers and kiosks, small rural markets and large district markets grouping butchers, cold stores, millers and other specialty sellers. Many people rely on community-based kiosks as a convenient source of food or to fill the gap before for the next trip to their usual market. Products are consistently more expensive in these kiosks but their convenience encourages people to patronize them. Kiosks predominantly stock less perishable foods such as tinned foods (e.g. tomatoes, mackerel, corned beef), flavour cubes, powdered milk, Milo, oil, salt and dried fish. However, some kiosks also sell locally produced fresh foods, such as fresh tomatoes and abedru. Some remote communities purchase foods such as fresh fish or bread from mobile venders who pass through periodically.

Communities have access to multiple markets and weigh various factors when deciding which market to patronize. While large district markets offer better prices and more options, the financial and time costs of travelling to those markets can be a barrier. Only a couple of very remote communities consider the costs of travelling to the market as a bigger constraint to purchasing preferred foods than not having the money to purchase the foods.

All households reported that they purchase foods to supplement what they grow themselves. When foods produced at home run out, consumers purchase these foods, or buy certain packaged and processed foods. These results are consistent with the food consumption data reported in Table 1.

5.2. SEASONALITY AND OTHER AVAILABILITY BARRIERS

All communities face seasonal barriers to the consumption of preferred foods. Households tending towards subsistence farming stop consuming fresh fruits and vegetables when they are unavailable on the farm. Others noted that the market availability of fresh fruits and vegetables is limited during certain months of the year. Consumers only reluctantly substitute dried forms of vegetables for fresh vegetables (leafy greens and okra), except in the north, where the taste of dried vegetables is more acceptable. Tomatoes, a key ingredient in most recipes (especially in southern Ghana), become scarce and expensive during the dry season, and people switch seamlessly to processed tomatoes in a tin or sachet. This allows people, even in remote rural communities, to continue eating tomatoes throughout the year. Fruits like mangoes, bananas, oranges and avocados are enjoyed while in season, but people forgo them when they are not available from their own production; these foods are rarely purchased.

Contrary to fruits and vegetables, staple foods are available more consistently. While people sometimes have to go without their most preferred staple food at certain times of the year, the variety of staple foods with different harvest times allows most households to switch between them, rather than experiencing a prolonged period without staple foods. A male respondent in Ashanti stated the following: "Normally I grow a variety of crops; I grow corn, I grow rice and cassava, among others, so that when one is out of season I can fall back on the other." Many households aspire to consume more rice (see Section 4.3.); it is a food that helps households cope with seasonal shortages because it can be

easily purchased and quickly prepared in small amounts when other staples run out. A male respondent in the Central Region stated the following: "When there are seasonal challenges, I buy bags of rice to sustain us. Rice is always available, so I just buy it."

While most foods are consumed with relatively little processing or value addition, there are some exceptions. Groundnuts are commonly processed into paste, cassava is processed into gari (dried cassava flakes), fruits are cut for convenience or peeled for esthetics, and fish vendors often smoke, dry and/or grind fish themselves. Like tomatoes, chilli peppers are ubiquitous in Ghanaian cuisine; there are few recipes that would be considered appetizing without them. Chilli peppers are dried and ground for year-round availability. Most of this processing is undertaken by households or market sellers.

Substitution was often expressed as an effort to prepare flavourful food when preferred ingredients are unavailable. For instance, in the Central and Ashanti Regions, groundnuts, palm nuts or egusi are used when kontomire and other fresh vegetables are not available, depending on the preferred recipe. Palm nut soup was cited as the most common recipe when more preferred foods are scarce. A female respondent in the Ashanti Region said the following: "If there is no money, we make palm nut soup, but if there is money we use abedru, kontomire and groundnuts."

In the North East Region, dried vegetables are the most common substitute for fresh vegetables. When the main staple dish, tizet (a corn mush), cannot be prepared, a bean-based porridge is eaten. Unlike in the south, tomatoes are considered optional in northern cooking. A male respondent in the North East Region said the following: "We don't have it [okra and tomatoes] all through the year; there are times we hardly even get some from the market to buy. [Instead], we can use dry powdered okra or dried powdered baobab leaves (tukara) for soup. For tomatoes, even if we don't have them, we can still prepare the soup."

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6. Food market environment

6. FOOD MARKET ENVIRONMENT

6.1. CONSTRAINTS FOR MARKET SELLERS

The costs of transportation associated with purchasing goods or bringing them to the market to sell are identified by traders in all markets as their main business expense (see Table 2). Transport costs include payments made to porters who load and offload goods onto vehicles, payments made at police or customs checkpoints, and unplanned expenses incurred during delays caused by bad roads or accidents.

Traders who undertake minimal processing (e.g. smoking fish or freezing foods) identified energy costs (i.e. the cost of buying electricity or fuelwood) as their largest business expense. Many traders selling smoked fish tend to buy frozen fish (called ice fish) from cold stores, and then smoke them. Cold stores require a consistent supply of electricity, while traditional fish sellers use a lot of fuelwood to smoke the fish.

Perishability and the lack of storage facilities constitute the main business challenges faced by traders of fresh produce (see Table 3). Insufficient or poor-quality facilities limit the sale of unprocessed seasonal products. Traders have to sell fresh produce as quickly as possible to avoid waste, and may therefore drastically lower their prices towards the end of the day. For instance, sellers of fresh greens in Nalerigu reported that while they sell a bundle of greens for GHC 1 during most of the day, they offer two bundles for the same price towards the end of the day because the leaves cannot be stored until the next market day, which is three days away[2].

TABLE 2 MAIN BUSINESS EXPENSES AS REPORTED BY TRADERS (NUMBER OF MENTIONS)

	Transportation costs	Market tolls	Stall fees	Energy (fuelwood)
Ashanti	15	3	2	7
Oti	20	0	1	9
Central	32	1	1	4
North East	21	3	0	9

Note: fuelwood is mainly used to smoke fish or cook food (by street food vendors).
Source: developed by the author.

[2] One Ghanaian cedi equalled approximately USD 0.21 in July–September 2018.

TABLE 3 MAIN BUSINESS CHALLENGES AS REPORTED BY TRADERS (NUMBER OF MENTIONS)

	Perishability/storage difficulties	Access to credit	Transport	Other
Ashanti	14	3	4	5
Oti	17	5	1	7
Central	24	5	4	5
North East	22	2	3	6

Note: "other challenges" include low margins, inability to reinvest profits, slow business growth, domestic issues, etc
Source: developed by the author.

In the off-season, many traders change their sources of supply from nearby farmers to other markets or to farmers in parts of the country where the crop is still in supply. This leads to increased transport costs, which traders say are also a major challenge. Aside from the cost of transport, poor travel conditions (roads and vehicles) were also identified as key business challenges. Indeed, the roads linking some of the sampled communities to their major markets are of very poor quality. Meanwhile, many traders tend to trade in more than one market and thus have to move their wares between markets throughout the week. This causes damage to goods, impairs the health of the traders themselves and increases expenses. Transport challenges also limit the traders' ability to restock goods. For instance, sellers of anchovies or "Keta school boys" in Jimbale and Poase Cement must travel by bus to restock their product; missing a bus may leave them without products to sell for an entire week.

A lack of access to credit was mentioned by certain traders who expressed a desire to expand or diversify their business. This constraint was mentioned by processed food sellers with permanent stores or stalls and by sellers of fresh tomatoes and peppers and dried fish, who source their goods from distant markets.

6.2. WOMEN IN THE FOOD MARKET ENVIRONMENT

It is well documented that agricultural market trading is traditionally considered a women's domain in Ghana. Nevertheless, women's economic empowerment lags behind that of men. For instance, using asset ownership as a proxy for economic empowerment, national statistics indicate that

81 percent of women aged 15 to 49 do not own a house, and 78 percent do not own any land (Ghana, Statistical Service *et al.*, 2015). Women's wages in both self-employment and wage employment lag behind those of men (Baah-Boateng, 2012). In addition, 14 percent of women are engaged in unpaid work (Ghana, Statistical Service, Ghana, Health Service and ICF International, 2015b). Enhancing women's engagement in food markets may have a positive impact on women's economic empowerment and wellbeing, and may have direct and indirect effects on the nutrition and food security of households.

Recent research conducted by IFPRI in two communities in Ghana found that gendered social norms as to appropriate livelihood activities for men and women – rather than access to credit or training – determine women's economic occupation (Kramer and Lambrecht, 2019). Men are considered more suited for agricultural work, while women are considered more suited for off-farm activities.

The analysis of the IDIs and market interviews supports these conclusions. To analyse community food environments, interviews were conducted with all local food vendors in the eight sampled communities. In communities near larger and more developed markets, local sellers were less common or non-existent. In Nalerigu, in the North East Region, vendors of prepared food were common.

Table 4 presents the sampled food sellers by regions, type and gender. Out of a total of 18 local food sellers, 14 were female. In the southern regions of Ashanti and Central, all were women, while in the north one was male. In the Oti Region, considered part of the south, three of the four local food vendors were male.

Households participating in IDIs described non-farming activities of women in the household, which consisted almost entirely in the processing of, or other value adding to, agricultural products. More specifically, these activities include grinding cassava into gari (cassava flour), preparing kenkey (fermented maize dumplings), making palm fruit oil, drying fish and selling vegetables (as a hawker or in a kiosk) or pito (a homemade alcoholic drink consumed in the north).

TABLE 4 LOCAL FOOD SELLER TYPES, BY REGION AND GENDER

		Seller of prepared food	Home shop	Kiosk	Shop	Total
Ashanti	Female	1	2	3		6
	Male					0
Oti	Female		2			2
	Male					0
Central	Female				1	1
	Male			2	1	3
North East	Female	4			1	5
	Male				1	1

Source: developed by the author.

Respondents identified a number of business challenges facing local food sellers and household off-farm businesses. The household interviews demonstrated that changes in household structure (e.g. the birth of a baby or an older child going away to school) may prompt women to stop their business. One woman noted that she switched from selling fresh produce to selling shoes to avoid losses from food wastage. Local sellers identified transport costs, the lack of money to reinvest in their business, food wastage and low or inconsistent sales as their main challenges. Some women noted that they consume the food in their shops when they run out of food at home. One woman stated that when the household's crops do badly, she must contribute to costs such as school fees, making it hard reinvest in the business. One man in the north noted that women engaging in business have to be careful travelling alone or staying away overnight because it may damage their reputation. Most local sellers started their businesses by using revenues from the sale of farm products. A few borrowed money from relatives or managed to access microcredit.

7. Supply and demand patterns across markets and foods

7. SUPPLY AND DEMAND PATTERNS ACROSS MARKETS AND FOODS

Market supply and demand patterns vary depending on the market and the food crop being considered. Archetypal rural markets – those serving primarily rural communities where agriculture is the main livelihood source – have demand patterns that are closely connected to farm production patterns and farmers' decisions about whether to keep or sell farm products. Meanwhile, more urban markets – those located in large towns where a higher proportion of the population derives its income from activities other than primary agricultural production – have demand patterns that are somewhat delinked from the agricultural seasons.

In all markets, the traders interviewed felt that consumers are sensitive to changes in prices. Traders therefore keep their prices stable, but change the quantity offered at a given price. During the off-season, for example, traders charge the same price as during the supply season, but give less produce in exchange. Although the reduction of quantities leads to a de facto increase in prices, consumers do not perceive it as such.

For example, a trader reported that 15 or more leaves of kontomire (cocoyam leaves) can be had at the market in Agona Swedru for GHC 2 in August, while the same amount buys only five to seven leaves in December and January[3].

Although rainfall patterns in Ghana have become more variable, the main agricultural production season coincides with a period of heavy rainfall between April and July in the southern regions (including Ashanti, Central and Oti) and from June to September in the northern regions (North East). Grains and legumes are harvested in August–September in the south and October–November in the north. Much of the south has a second rainy season in September–October, which is shorter and comes with less rainfall than the main rainy season. The second rainy season does not typically allow a second production cycle for cereals and legumes, but farmers may continue to produce vegetables (like tomatoes, okra and

TABLE 5 RURAL AND URBAN MARKETS IN GHANA

	Region	Rural	Urban
South	Ashanti	Ofoase	Obuasi
	Central	Gomoa Kokofu and Gomoa Obuasi	Agona Swedru
	Oti	Dodo Amanfrom	Kete Krachi
North	North East	Jimbale	Nalerigu

Source: developed by the author.

[3] *Two Ghanaian cedi equalled approximately USD 0.42 in August 2018.*

leafy greens) and plantains (a key staple food) throughout this wet season. The sampled areas of the Oti Region can be considered a transitional zone, where rainy seasons tend to blend into each other, creating one long rainy season. Rainfall is lowest in the coastal savanna (Central Region). The dry season starts in December and lasts until March in the south and until May in the north.

Rural market vendors and village sellers in rural communities reported high sales during the rainy or production season. During this time, farm households often run out of stocks from the last harvest, so they must buy both food and seed for replanting. However, sales reduce dramatically when harvesting starts, as most households then eat primarily from their own food stocks. Sales are also low during the dry season, when households have little cash on hand for food purchases. Traders in rural markets tend to switch from selling fresh foods to (minimally) processed (dried, ground, milled etc.) foods during the harvest period.

Urban markets serve both farming and non-farming households. Overall sales volumes on those markets are highest during harvest time, when higher supplies lead to a reduction in prices; sales volumes are lowest during the off-season. The demand and supply patterns for individual types of food on rural and urban markets exhibit more nuanced differences. For example, the supply of grains and legumes such as maize, millet, cowpeas and groundnuts increases at harvest time, when farmers sell their produce in the market. Traders in the northern rural market of Jimbale reported that sales of grains and legumes are low during this period because most consumers meet their demand for these crops through own production. By the beginning of the next rainy season, farm households tend to run out of their own food stocks, and market traders are able to sell more. Sales peak just before the next harvest, around August. By contrast, traders in urban markets say that sales volumes of cereals and pulses peak just after the harvest, when the high quantities supplied lead to lower prices.

Early on in the rainy season, vegetables, including leafy greens, are supplied to urban markets by a small number of producers that use irrigation or depend on early rainfall. The small quantity supplied is easily sold. As the rainy season progresses, early producers of rainfed crops also begin to supply the market, taking advantage of unmet demand. Later, markets are inundated with produce from local producers while some consumers produce their own vegetables; as a result, prices drop. Even consumers who are not farmers often cultivate their own vegetables in their small gardens.

In the north, vegetable traders report low sales volumes from the harvest season through to the dry season, whilst in the south an increase in sales is reported. This is attributed to the fact that it is common in the north to dry and store vegetables for use after the rainy/production season.

The harvest seasons for most types of fruit roughly coincide, though the precise timing varies according to fruit type and variety. In rural markets, traders report low sales volumes of fruit during the off-season as they are considered too expensive. In these markets, sales increase when the fruits are just coming into season, but quickly decline as fruits become available for most people either from their own fields or from the wild. In more urban markets, sales volumes increase when supply is high and prices are low. A fruit seller in the market at Nalerigu reported that she typically sells fruits only when they are in season, but switches to selling other food items in the off-season because of the steep decline in demand.

TABLE 6 DEMAND AND SUPPLY CONDITIONS OF VARIOUS FOOD GROUPS, PER TYPE OF MARKET

	Demand and supply conditions	
	Rural markets	Urban markets
Leafy greens	Sales are highest during the early part of the rainy season (March–May) because households are not yet producing their own food. Local growers typically sell leafy greens in April–May before the market becomes inundated and prices drop. Sales are low from June to September, when most consumers grow and stock their own food. After the rains end, supply decreases, prices rise and sales remain low. Households in the north more commonly store dried vegetables and leaves for consumption during the off-season (November–March/April), minimizing their purchases during these months.	Sales begin to increase during the last quarter of the year and peak in April–May, when most people cannot rely on their own stocks and supply comes mainly from irrigated plots. Demand stabilizes and supply from producers in neighbouring villages increases over the rainy season, resulting in lower prices during the midseason (June–August).
Other vegetables	The demand pattern is similar to that for leafy greens. Sales are high at the beginning of the rainy season as households are not yet producing their own food; they slow down as consumers start consuming their own produce. Because vegetables are highly perishable, producers sell excess produce in the market, which further depresses prices.	Sales volumes grow over the last quarter of the year (September–December); there is no oversupply. The only supply during this time comes from irrigated fields. Towards the beginning of the rainy season, early planters start supplying the market. Urban residents often have backyard gardens where they grow their own vegetables, so markets are oversupplied during the rainy season.
Cereals and pulses	Sales increase from March onwards as rural households purchase both seed and food. Sales peak in July–August when households have exhausted their own stocks and the new crop is not yet harvested. Sales drop sharply in the last quarter of the year as consumers/farmers eat from their own stocks. The sale of excess production by farming households further depresses prices.	Sales volumes peak after the harvest (October–December), when a high supply leads to lower prices. Goods may be brought into the southern regions from the north, which is now producing large quantities, and even from other neighbouring countries.
Fruits	Sales are low throughout the year, as most rural households consume fruits from their own fields or from the wild. For most of the year, little fruit is offered on rural markets. Sales are highest early in the season (May–June), when some fruit is available but households' own produce may not yet be ready. Sales are also high in December–January due to the end-of-year festivities.	Sales volumes increase during the rainy season when supply is high and prices are low (June–August). Sales are also high in December/January due to the end-of-year festivities.
Animal-based foods	Sales increase during the last quarter of the year as staple crops are harvested in the north and cocoa is harvested in forest areas. Sales peak in December–January due to the end-of-year festivities. Sales are low for the rest of the year, except at the time of local festivals and funerals.	Sales volumes increase during the last quarter and peak in December–January due to the end-of-year festivities.
Processed foods	Sales are stable during the first quarter of the year, then fall drastically during the harvest season of fresh vegetables and leafy greens (July–August). Sales peak during the harvest period for staple crops and cash crops, such as cocoa (September–December). During this period, households typically have more purchasing power due to the sale of crops.	Sales are generally stable throughout the year but do increase sharply during the end-of-year festivities (December–January). Sales drop slightly mid-year due to the increased supply of fresh vegetables such as tomatoes, garden eggs, etc.

Source: developed by the author.

Throughout all markets, sellers reported that few customers purchase high-value animal-based foods such as meat and chicken, except for directly after the main harvest season and during festivities. In the Central, Ashanti and (to some extent) Volta Regions, higher sales coincide with the cocoa harvest, as cocoa is the predominant cash crop in these areas. Meanwhile, in the north, often described as Ghana's maize basket, increased sales are tied to the harvest of major food crops like sorghum, maize, groundnuts, yams and rice.

Sales of processed foods such as tinned or powdered milk, tinned fish, tinned tomatoes, spices and flavour cubes are generally stable; they do experience a slight increase during festivals and funerals, when schools are in session, and at the beginning of the harvest season. Village sellers in all markets see their sales volumes decrease when fresh foods such as fresh tomatoes, garden eggs and leafy greens (for which processed foods often serve as substitutes) become highly available. However, sellers report keeping the price constant, regardless of the drop in sales.

Local festivals and funerals can produce localized increases in sales, especially in rural areas. Traders in the Central and Oti Regions observed that funeral rites were performed either at the end of every month or every other month (according to local rules). During these funeral rites, as well as during local festivals, which are celebrated in almost all traditional areas, many urban dwellers travel to their villages for a week or two; both these travellers and locals tend to purchase more food during these times. Traders in Gomoa Obuasi noted that the demand for both processed and fresh foods, which travellers buy to take back home, increases during these periods. In addition to periods of local festivals, the end-of-year festive season (December to January) was reported to be a period when the demand for food, including from travellers, is generally high (particularly for animal-based foods). The public school calendar also tends to affect the demand for animal-based and processed foods as children must purchase food while at school. Increased demand during school sessions was reported in both rural and urban markets in all communities.

Traders overwhelmingly attributed changes in the supply of foods to the seasonality of production (see Table 7), especially for fresh foods sourced from farmers in neighbouring villages. Transport delays and poor-quality roads are another major cause of supply cuts, primarily for fish, poultry products and processed foods, most of which are bought from wholesalers in larger markets and transported. Wholesalers may fail to supply at times, due to transport problems or for unknown reasons. In the off-season, fresh tomatoes and chillis are imported from Burkina Faso.
Fresh meat sellers (butcher shops) in the north reported that the supply of animals for slaughter increases when harvests are poor and households need to sell livestock to be able to buy food; availability is reduced when livestock diseases break out in the villages that supply animals. Traders in the market of Jimbale also expressed worries over ethnic tensions and conflicts, which often curtail supplies from producers in neighbouring villages.

TABLE 7 TRADERS' PERCEPTION OF THE MAIN REASONS FOR CHANGES IN SUPPLY (NUMBER OF MENTIONS)

	Main causes of changes in supply			
Region	**Seasonality of production**	**Transport difficulties**	**Wholesaler difficulties**	**Other***
Ashanti	17	7	3	0
Central	23	7	6	2
Oti	21	3	5	1
North East	17	8	5	3

Note: "Other" includes conflicts (ethnic violence), poor harvests and diseases/epidemics.
Source: developed by the author.

Most sellers in both rural and urban markets report that they source fresh produce primarily from their own production and from farmers in nearby communities. When local supplies dwindle, they may source produce from neighbouring communities or from more distant parts of Ghana and even across West Africa. Vegetables were frequently reported to be sourced from own production or from surrounding areas during the rainy season. During the off-season, tomatoes are primarily sourced from itinerant traders who travel to buy in the north, as well as in Burkina Faso. Cereals, grains and pulses are typically sourced from major markets in the Northern and Ashanti Regions, and sometimes from neighbouring countries. Frozen fish, chicken and eggs are typically sourced from wholesalers in larger urban markets. Anchovies (or "Keta school boys") were reported to be sourced from wholesalers in Ashanti. Fresh meat (cows, goats and sheep) is often sourced from the Northern Region. Fruits are most often sourced from own fields and within traders' own communities. Processed foods were commonly reported to come from wholesalers or distributors in urban markets.

8. Nutritious food value chains: bringing together supply and demand characteristics

8. NUTRITIOUS FOOD VALUE CHAINS: BRINGING TOGETHER SUPPLY AND DEMAND CHARACTERISTICS

This section examines the supply-side, demand-side or value chain constraints that hamper the consumption of nutritious foods in Ghana. First, a set of commonly preferred nutritious foods is identified. Second, the supply-side, demand-side and value chain constraints to the adequate consumption of these foods are analysed.

Table 8 lists commonly preferred nutritious foods (PNFs) and their key nutrients, by sampled region. The orange bars indicate how many times respondents mentioned a food as preferred. The key nutrients provided by that food are listed in the last column. Foods that are both locally preferred and available are considered to offer a good potential to fill existing nutrient gaps.
Foods are categorized by region and food group: fruits, leafy greens, other vegetables, legumes and seeds, and animal-based foods (eggs, meat and fish). While many foods are preferred across regions (e.g. groundnuts, cowpeas, tomatoes, chilli peppers and fish), others are preferred regionally (e.g. leafy greens and fruits). For most PNFs, a boost in consumption would improve diets. An exception is meat, as excessive meat consumption may have detrimental health effects.

TABLE 8 PREFERRED NUTRITIOUS FOODS, BY REGION (NUMBER OF MENTIONS DURING IDLS)

		South			North	
	Food | Region	Ashanti	Oti	Central	North East	Key nutrients
Fruits	Papaya	6	4	5	1	Vit A, vit C
	Mango	5	5	3	9	Vit A, vit C
	Orange	4	5	7	3	Vit A, vit C
	Avocado	6	1	3	0	Vit A, vit C
	Shea fruit	0	2	0	12	Vit A, vit C
	Dawadawa fruit	0	2	0	10	Iron, zinc, vit A, vit C
	Pineapple	3	3	5	0	Vit A, vit C
	Baobab fruit	0	2	0	0	Iron, vit A, vit C, calcium
Vegetables	Tomato	8	12	11	12	Vit A, vit C
	Cocoyam leaves (kontomire)	6	9	8	0	Iron, vit A, vit C
	Amaranth (alefu)	1	1	0	3	Iron, vit A, vit C, calcium
	Roselle leaves (guant/bra)	0	0	0	12	Iron, zinc, vit A, vit C, calcium
	Okra leaves	0	0	0	1	Vit A, calcium
	Jute/bush okra (ayoyo)	4	10	0	7	Iron, vit A, vit C, calcium
	Baobab leaves	1	1	0	4	Iron, vit A, vit C, calcium, zinc
	Cowpea leaves	0	0	0	4	Iron, vit A, vit C, calcium
	Bitter leaf	1	3	0	0	Iron, vit A, vit C, calcium
	Garden egg	5	10	9	2	Vit C
	Abedru	7	4	3	0	Iron, zinc, calcium, protein
	Chili pepper	10	13	10	9	Vit A, vit C
	Okra	6	13	5	11	Vit A, vit C

continued

		South			North	
	Food | Region	Ashanti	Oti	Central	North East	Key nutrients
Seeds and legumes	Melon seed (egusi)	0	4	4	4	Iron, zinc, protein
	Groundnut	10	12	7	12	Iron, zinc, protein
	Cowpea	5	10	7	11	Iron, calcium, protein
	Bambara beans	0	0	1	8	Iron, zinc, protein
	Soybeans	0	1	0	6	Iron, zinc, calcium, protein
Animal-based foods	Eggs	3	3	8	6	Protein, zinc
	Chicken	7	3	5	7	Iron, zinc, protein
	Goat	1	3	3	2	Iron, zinc, protein
	Beef	3	2	4	5	Iron, zinc, protein
	Fish	10	13	11	12	Protein
	Snails	2	1	3	0	n/a

Notes: nutrient contents are calculated by the authors based on figures of the West Africa Food Composition Table (FAO, 2012) (values for abedru are taken from Ogah, 2015). A food is considered rich in nutrients if 100 g contains 10 percent or more of the recommended nutrient intake for the average adult.

Source: developed by the author.

Table 9 summarizes the factors that hamper the consumption of selected PNFs on the supply side, demand side and throughout the value chain, and identifies potential solutions and areas for investment and innovation.

TABLE 9 SUPPLY-SIDE, DEMAND-SIDE AND VALUE CHAIN CHALLENGES OF PREFERRED NUTRITIOUS FOODS

	Supply and demand issues	Value chain characteristics and issues	Consumer preferences and issues	Areas for innovation/solutions
Fruits	There is a seasonal undersupply of most fruits. Consumers are not willing to pay high prices for fruits that are out of season.	Fruits are highly perishable, and the infrastructure to avoid wastage is inadequate. Fruits are commonly sold cut or peeled, increasing food contamination risks.	Fruits are considered healthy. Most fruits are eaten only when in season. Fruits are often described as "wild" food: they grow on the field for people to eat but are too expensive to purchase.	- Seasonal gaps in supply: extend the period of availability and increase the income-earning potential of fruit production through processing. - Food wastage during transport and storage: explore innovations in packaging and transportation to reduce wastage. - Contamination risks: help processors adopt appropriate hygiene practices.
Leafy greens and okra	There is a seasonal undersupply of leafy greens and okra. Consumer demand is lower than optimal in terms of nutrient requirements.	Leafy greens and okra are highly perishable, and the infrastructure to avoid wastage is inadequate. To preserve them, they are sometimes dried and ground.	Leafy greens and okra are both commonly used. Consumers prefer their own produce due to concerns about agrochemical contamination. The dried or ground variants are not preferred by consumers (except in the north).	- Seasonal gaps in supply: extend the period of availability through the use of irrigation and other techniques to produce during the dry season. Explore low-cost innovations to keep greens fresh for longer (during transport and at the market). Explore ways to process greens that maintain their taste. - Boost demand: promote recipes that use more of these vegetables yet still meet taste preferences. Review and standardize dietary guidelines used by district government staff to educate consumers about the importance of consuming higher quantities of these and other nutrient-rich foods. - Misuse of agrochemicals: promote the appropriate and safe use of agrochemicals; use certification to promote safe produce. - Microbial and other contamination: educate vendors and consumers about safe and unsafe food handling practices. - Food wastage during transport and storage: explore innovations to reduce wastage.

continued	Supply and demand issues	Value chain characteristics and issues	Consumer preferences and issues	Areas for innovation/solutions
Other vegetables (tomato and pepper)	Fresh peppers and fresh tomatoes face seasonal undersupply (the undersupply of tomatoes is, to some extent, filled by imports). Processed variants are used as substitutes.	The processing of peppers (drying and grinding) is done by households (using their own produce) or by market vendors. Tomatoes are highly perishable, and the infrastructure to avoid food waste is inadequate.	Tomatoes and peppers are indispensable ingredients in most recipes. When chilli peppers are scarce during the dry season, consumers switch to dried chillis. Consumers switch to tinned tomatoes when fresh tomatoes are unavailable or too expensive. Consumers are concerned about pesticide contamination; they prefer to eat their own produce rather than purchase at the market.	- Gaps in supply: consider production and supply-chain innovations to boost the domestic production of tomatoes. - Misuse of agrochemicals: promote the appropriate and safe use of agrochemicals; use certification to promote safe produce. - Microbial and other contamination: educate vendors and consumers about safe and unsafe food handling practices. - Food wastage during transport and storage: explore innovations to reduce wastage.
Legumes and seeds	Cowpeas are an inferior good but offer some preferred consumer characteristics. Bambara beans are a more expensive and more preferred substitute. Egusi and groundnuts are used in soups, as a substitute for fresh vegetables.	There are concerns about the contamination of groundnuts with aflatoxins, due largely to issues related to processing and storage.	People enjoy eating cowpeas and bambara beans, but they are consumed only occasionally. Groundnuts and egusi and other seeds are commonly used ingredients. Groundnuts are also eaten as a snack, especially by school children.	- Boost demand: review and standardize dietary guidelines used by district government staff to educate consumers about the importance of consuming higher quantities of these and other nutrient-rich foods. - Aflatoxin contamination of groundnuts: explore new technologies or techniques to prevent contamination and educate operators about the dangers of contamination.
Animal-based foods	Fresh meat, poultry and fish are luxury goods. The demand for them is very income-responsive. Dried fish is a cheaper substitute for other animal-based foods. Consumer demand is too low to meet nutrient requirements.	There are concerns related to the contamination of frozen fish and chicken meat that are thawed and resold. Dried fish may contain unsafe chemicals.	Dried and smoked fish are among the most common foods, but they are consumed in very small amounts. Poultry and livestock are commonly viewed as a store of value rather than a food source; they may be consumed when other foods are unavailable. Eggs are largely reserved for children.	- Demand: boost consumer demand for affordable animal-based foods by, for example, reviewing and standardizing dietary guidelines used by district government staff to educate consumers about the importance of consuming higher quantities of dried fish. - Food safety: promote safe processing and handling practices amongst consumers and vendors.

Source: developed by the author.

The seasonal undersupply of fresh fruits and vegetables negatively affects diet quality during a part of the year. Fruits are seen as a healthy "wild" food and consumed as a snack by the whole family when they are readily available. Fruits are highly perishable and levels of wastage are high. The only value addition reported was the cutting and pealing of fruits for sale, which carries a risk of contamination.
Vegetables are an important ingredient in most recipes, but their overall consumption is low as the amounts used in recipes are small, and supply is characterized by seasonal gaps. Most vegetables are dried for use during the dry season. Dried leafy greens and okra are commonly used in the north, but they are not preferred in other areas. Dried chilli peppers are common, whereas tomatoes are often consumed in tinned/packaged form when the availability of fresh tomatoes is limited. People are concerned about the use of agrochemicals on vegetables, and hence prefer to consume vegetables from their own gardens.

Seasonal patterns in supply and demand (which is met by produce grown at home, when in season) limit the marketability of these foods, especially in rural markets. However, there are more opportunities to sell fresh produce to consumers in urban areas, who are less likely to grow their own fruits and vegetables.

Most legumes and seeds are readily available throughout the year. Cowpeas, groundnuts and egusi (and similar seeds used in the north) are particularly common ingredients. Many consumers report using groundnuts or egusi as a substitute for fresh vegetables when they are out of season. While cowpeas are a preferred food, consumer behaviour indicates that is it an inferior good, a cheap, filling food consumed when there is no other food available or no time to cook. National food availability data suggest that the consumption of legumes is increasing; interventions could build on this trend to further increase consumption even when other foods are available. Groundnuts are consumed both as an ingredient in recipes and as a snack. Value addition such as roasting, grinding and bagging are commonly done by producers, as well as vendors. Aflatoxin contamination of groundnuts is known to be a challenge and must be addressed before this food can be promoted.

All animal-based foods are eaten in very small amounts. Fresh and frozen meat and fish are available and preferred, but their high cost makes them a luxury food, consumed only by wealthier consumers or during times of celebration. In times of hardship, however, households may slaughter an animal if they cannot access any other food, especially in the north. Dried fish of all sorts is a cheaper substitute for meat; it is ubiquitous in recipes throughout the country. Dried and frozen fish are both known to present risks of contamination due to handling practices; however, these risks do not lead consumers to shun these foods.

Seasonal gaps in the supply of fresh fruits and vegetables can be addressed by increasing – when feasible – production during the dry season. Innovations in storage and transportation may extend the shelf life and limit wastage of fruits and vegetables. Market-oriented interventions may be effective in areas with easy access to urban markets. In other contexts, it may be necessary to support producers and/or distribute these foods for free.
Innovative approaches to preserving fruits and vegetables safely should be explored. Processed packaged foods are consumed throughout Ghana, so their acceptability is not a challenge. In fact, industrially processed tomatoes and peppers processed by smaller producers ensure the year-round availability of these foods.

Processed spices and flavour cubes are consumed across regions, especially when fresh foods or dried fish are not available. Dawadawa is an example of a locally produced alternative to these products, without preservatives, additives or unhealthy fats. Dawadawa is made from the fermented seeds of the African locust bean tree (or sometimes with fermented soya) and consumed primarily in northern Ghana.

A better understanding of dietary requirements may help boost the consumption of PRFs. Food-based dietary guidelines for the country can be utilized by district-level health workers to educate consumers about the importance of consuming higher quantities of nutrient-rich foods.

Food safety is a major consumer concern and appears to encourage consumers to limit their intake of many nutrient-rich vegetables to home-grown produce. People are concerned about the effect on their health of the inappropriate use of agrochemicals (pesticides and fertilizers) on vegetables. While legitimate, concerns about the safe handling of fish and the contamination with aflatoxins of groundnuts are not widely raised by consumers. The understanding of food safety risks among consumers and vendors must be improved. Safe food production and handling programmes may be rolled out in major district markets. Awareness raising on the risks of aflatoxin contamination must be combined with the promotion of appropriate technologies and practices for aflatoxin risk mitigation.

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9. Conclusions and recommendations

9. CONCLUSIONS AND RECOMMENDATIONS

9.1. CONCLUSIONS

The analysis of consumption patterns shows estimated consumption gaps for micronutrients measured: zinc, iron and vitamin A. These gaps may be filled by a number of highly nutritious and preferred foods that are produced locally but are currently consumed in amounts that are too small to meet nutrient requirements.

Urban markets offer diverse food options every day, in contrast to rural markets, which often set up only once or twice weekly. In communities close to an urban market, local food vendors are an important source of food, as they offer a large selection and interesting prices. In more remote communities, where reaching a reference market may carry significant financial and time costs, local village vendors can play an important role in filling food gaps. They often sell food on credit, thus easing buyers' cash constraints during the dry season. Nevertheless, households in remote communities often prefer to wait to purchase food until they have products to sell.

Even in the most remote communities, a few processed foods are ubiquitous: processed tomatoes, cooking oil and flavour cubes. These are foods that enhance the flavour of recipes and are particularly important when traditional fresh or animal-based ingredients are unavailable or unaffordable. Processed tomatoes fill important seasonal gaps in the supply of fresh tomatoes. Although some nutrients are lost during processing, processed tomatoes can still fill important nutrient gaps during the dry season. Flavour cubes are used as a substitute for vegetables or dried fish. While some brands of flavour cubes are fortified with micronutrients, this ultra-processed food is high in salt and hydrogenated oil. Oil consumption should be therefore be limited to appropriate amounts.

Consumers prefer diverse diets and flavours. Households consume different staple foods with different harvest periods, thus protecting themselves from periods of severe hunger. However, a number of factors hamper the consumption of nutrient-rich foods: they are often used in small amounts in traditional recipes, seasonal availability limits access to fresh fruits and vegetables, and financial constraints limit the consumption of animal-based foods. People report that beans are a highly preferred food but household survey data show that they are only consumed in small amounts. Among animal-based foods, dried fish is frequently consumed by all communities, but usually in small amounts. Chicken and frozen fish are also preferred; however, they are not consumed very often as they are expensive. Eggs are a common food, especially for children. The consumption of all animal-based foods is constrained by their high price.

Selling opportunities for producers supplying rural markets are limited, as consumers' food demands are largely met by home production. Households all harvest and sell the same crops at around the same time, at low prices. Fresh fruits and vegetables constitute a particular challenge in this respect; as they cannot be stored for later sale, producers all sell at the same time, earning little income. Producers supplying urban markets have more selling opportunities than their rural counterparts, especially for grains and legumes and for vegetables (particularly in the south).

9.2. RECOMMENDATIONS

Promoting the supply and demand of nutritious foods

The household interviews suggest that consumers value certain nutrient-rich foods but have insufficient knowledge of the required amounts or frequencies of consumption. It is recommended to improve and intensify awareness raising on healthy diets nationwide (e.g. by improving the school curriculum on nutrition).

Addressing seasonal constraints to the production and sale of fresh fruits and vegetables may be the most effective and rapid way to increase the consumption of nutritious foods in rural communities. Meanwhile, market-oriented approaches may be effective in urban communities. Efforts to address seasonal supply constraints are crucial, as are interventions aimed at smoothing out incomes throughout the year. Boosting the production fruits and vegetables during the dry season may improve the diets of producers (by generating off-season revenues) and non-producers (by meeting currently unfulfilled demand).

Public incentives may boost the production of perishable nutritious foods. For instance, large-scale food distribution programmes (e.g. home-grown school feeding programmes) in Ghana could systematically incorporate these foods; they would thus not only improve diets but also incentivize year-round production. Food distribution programmes must be designed in such a way as to overcome potential implementation challenges such as highly variable market prices (Gelli *et al.*, 2019).
Addressing post-harvest losses of fresh vegetables and fruits during storage and transportation may increase producers' incomes from sales (especially for those near urban markets). More broadly speaking, improvements in storage and transportation may strengthen producers' links to rural and urban food markets, thus advancing the supply of locally produced nutritious foods to rural and urban residents.

Strategic support to the production, packaging, processing and transport of locally preferred nutritious foods near urban markets could have positive impacts on diets and livelihoods of both rural and urban households; such efforts would benefit from the demand from non-agricultural consumers.

Processed foods are used throughout Ghana to enhance flavour and fill seasonal gaps. While the excessive consumption of some ultra-processed foods may have detrimental health effects, consumers' taste for processed foods presents an opportunity to develop nutrient-rich alternatives (e.g. for flavour cubes), produced locally from local produce. This analysis has found that Ghanaians prioritize flavour and variety in their diet; processed products should therefore emphasize flavour and affordability. Boosting the supply of nutrient-rich, flavourful and affordable processed foods may help achieve healthy diets for both rural communities and the growing urban population.

The University of Ghana, together with a number of international partners, is currently conducting research on the development of nutritious condiments; these efforts could be enhanced by adopting value chain approaches. Various initiatives (e.g. cooking competitions for small caterers) may stimulate the development of tasty and locally-acceptable recipes that use more nutrient-rich ingredients.

Maestre *et al.* (2017) note that a key challenge of the marketing of nutrient-dense foods is their

KEY RECOMMENDATIONS

- Increase consumer demand for nutrient-rich foods by exploring ways to improve nutrition education in community health clinics and schools.
- Address seasonal restrictions to the supply of fresh nutrient-rich foods by enabling production during the dry season, thus improving diets and strengthening livelihoods.
- Encourage SMEs to explore innovative solutions to the storing, packaging, processing and transporting of nutrient-rich foods to extend shelf life and decrease wastage.
- Help women use more or new technologies for processing or other value addition to nutrient-rich foods, to improve their economic empowerment and promote healthy diets.
- Address consumers' food safety concerns by training producers and traders on food quality and safety standards.

credence characteristic – that is, their nutrient values are not observable by consumers. The demand for these foods therefore depends upon distinctive quality labelling and marketing. Governments must monitor, evaluate and regulate to ensure that nutrition claims are accurate and reliable.

Opportunities for small and medium enterprises

The actions of private actors are critical to the formation and functioning of a food system. SMEs in particular have a great potential to play a particular role in enhancing nutrition in food systems, while at the same time creating new livelihood opportunities (Maestre, Poole and Henson, 2017). The literature suggests that the approach to leveraging SMEs for nutrition must be chosen carefully, depending on the context and the product (Aberman, 2018). If direct support is provided to SMEs, the food product in question must be carefully examined for its availability, its affordability to low-income consumers, its acceptability to local tastes and its ability to maintain nutrient levels from processing to purchase. This report provides a strong basis for promoting the consumption of a selection of commonly preferred nutritious foods; it also provides guidance on the supply-side, demand-side and value chain challenges that require attention.

Agro-processing in Ghana is currently dominated by SMEs and, even more so, microenterprises (Afful-Koomson *et al.*, 2014). Supporting these enterprises may contribute to healthy diets. For example, cost-effective innovations in the processing and preserving of fresh fruits and vegetables may help avoid seasonal supply gaps. Locally preferred fruits, for instance, may be processed and packaged for sale as snacks for schoolchildren. Produce perishability and a lack of storage facilities constitute the main business challenges identified by traders of fresh produce in both rural and urban markets. Affordable, small-scale technologies for extending the shelf life of fruits and vegetables may open up business opportunities for SMEs. For instance, solar-generated cold storage may extend the period during which locally preferred fresh vegetables are available, especially for urban consumers who do not grow their own produce. Local processors may explore ways to dry vegetables that maintain taste.

Women have the potential to play an important role in the promotion of healthy diets through SMEs. Gendered social norms generally consider

off-farm enterprises in food processing and preparation as a women's domain (although regional differences in these norms should be further explored, as gender norms appear to be more restrictive in the north and in Oti). Supporting women to expand their businesses or adopt new technologies to add value to nutrient-rich foods (e.g. by processing) may contribute to their economic empowerment and at the same time promote healthy diets.

Consumers' food safety concerns may be addressed by training producers and traders on quality and safety standards. Certification and awareness raising among consumers may help ensure that safe products are trusted and demanded. Small food service providers such as caterers and food vendors play an important role in diets; improving their knowledge on nutritious and safe food may therefore be crucial to improving diets (Aberman, 2018).

Mechanisms and focal points

While the Ministry of Food and Agriculture and the Ministry of Health of Ghana may appear as the natural focal points for many of the interventions discussed in this report, the multi-sectoral nature of this topic may necessitate the use of different focal points (Aberman, 2018). Suggested entry points for nutrition-focused food system initiatives include the National Development Planning Commission, which convenes the Scaling Up Nutrition (SUN) platform in Ghana. An additional entry point are universities, where interventions may aim at strengthening training capacities on nutrition-sensitive food systems. Other interventions may aim at promoting the adoption of nutrition-sensitive approaches and practices by SMEs in their business models. FAO and its partners in Ghana, including universities, local SMEs and government agencies, are currently working to link all relevant stakeholders to identify knowledge and capacity gaps; the aim of these efforts is to promote partnership and build capacity among academia and SMEs. Additional interventions may aim at improving the understanding of nutrition of business associations, which have the capacity to reach a great number of SMEs. In addition, the management of district-level markets may raise awareness on healthy diets and act as promotors and enforcers of safe food handling practices and practices aimed at avoiding nutrient losses. Public awareness campaigns aimed at consumers buying food at markets may incite them to demand that vendors adopt such practices, and build trust. The feasibility of using various media outlets to disseminate messages on nutrition may also be explored.

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