



From Ampesie to French fries: systematising the characteristics, drivers and impacts of diet change in rapidly urbanising Accra

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Abstract

Sub-Saharan Africa (SSA) is urbanising rapidly. One of the most visible outcomes of this urbanisation process is the change in the diets of urban residents. However, diet change in the context of rapid urbanisation is a complex and multi-dimensional phenomenon that encompasses multiple intersecting historical, environmental, socioeconomic, and political aspects. This study aims to unravel and systematise the characteristics, drivers and impacts of diet changes in Accra, through the interviews of multiple stakeholders and Causal Loop Diagrams. Diet change is characterised by the increased consumption of certain foodstuff such as rice, chicken, fish, vegetable oil, sugar, and ultra-processed food (UPF), and the decreased consumption of traditional foodstuff such as roots, tubers, and some cereals such as millet. These changes are driven by multiple factors, including among others, changes in income, sociocultural practices, energy access, and policy and trade regimes, as well as the proliferation of supermarkets and food vendors. Collectively, these diet changes have a series of environmental, socio-economic, and health/nutrition-related impacts. Our results highlight the need to understand in a comprehensive manner the complex processes shaping diet change in the context of urbanisation, as a means of identifying effective interventions to promote healthy and sustainable urban diets in SSA. The development of such intervention should embrace a multi-stakeholder perspective, considering that the relevant urban actors have radically different perspectives and interests at this interface of urbanisation and diet change.

Keywords Diet change · Urbanisation · Food systems · Sustainability impact · Stakeholders · Ghana

Introduction

Many developing countries have experienced unprecedented demographic changes over the past few decades (UN-Habitat 2016; United Nations 2019). Between 1950 and 2018, the population of developing countries grew from 1.72 to 6.37 billion, and it is expected to reach 8.47 billion people by 2050 (United Nations 2019). Much of this growth has occurred (and will occur) in urban areas, with an estimated 5.56 billion people expected to live in the urban areas of developing countries by 2050 (United Nations 2019). For example, the urban population in Africa increased from 27 million in 1950 (13% of total population) to 567 million in 2015 (50% of total population) (OECD/SWAC 2020). With the continent's population projected to double by 2050, over two-thirds of this growth will occur in urban areas (OECD/SWAC 2020). In other words, an additional 950 million people are expected to live in urban areas (59% of total population) (OECD/SWAC 2020).

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One of the outcomes of this rapid urbanisation has been the radical changes in the diets of urban residents in large parts of sub-Saharan Africa (SSA) (Haggblade et al. 2016; Holdsworth et al. 2020; Cockx et al. 2018). Some of the more common manifestations of this diet change include the shift away from traditional/staple diets predominately characterised by cereals, roots and tubers, to diets characterised by the high consumption of meat, ultra-processed foods (UPFs),¹ and “meals away from home” (MAFH) (Popkin et al. 2020; Reardon et al. 2021; Vorster et al. 2011).

However, urban diets have changed in very diverse ways and through very different mechanisms across the region. One of the most commonly identified drivers of diet change in urban contexts has been the rising incomes and living standards (Bai et al. 2020; Bosu 2015; Colen et al. 2018; Cockx et al. 2018; May 2018). Furthermore, the changing pace of life in increasingly larger and more hectic cities has altered foodscapes in SSA cities, further catalysing diet change. For example, there is a very obvious proliferation of informal food vendors in many SSA cities, which reflects both the changes in current food production systems (e.g., shifts from subsistence agriculture-based livelihoods to paid employment that is increasingly concentrated in cities) and their ability to meet certain urban food needs both in terms of food preferences and convenience (Blekking et al. 2017; Battersby and Watson 2018; Giroux et al. 2020). Arguably such vendors represent a convenient solution for urban residents, but in the process shape urban diets in unprecedented ways, especially for the urban poor (Ambikapathi et al. 2021; Holdsworth et al. 2020). Furthermore, globalised trade and the emerging middle class have also caused the proliferation of supermarkets that enable access to food options (whether processed or unprocessed) that were previously uncommon, having both positive and negative effects for nutrition/health outcomes and broader food systems (Kimenju et al. 2015; Demmler et al. 2017, 2018; Andam et al. 2018; Rischke et al. 2015).

At the same time, diet changes have been linked with many sustainability impacts related to (a) health and nutrition impacts, (b) environment and (c) socioeconomic change (Aldaya et al. 2021). For example, related to (a) health and nutrition impacts, many studies in SSA have drawn links between changing urban diets with the rising prevalence of obesity and non-communicable diseases such as diabetes, which have reached epidemic status in some areas (Steyn and Mchiza 2014; Ofori-Asenso et al. 2016; Frank et al.

2014; Steyn et al. 2012). Related to (b), the negative environmental impacts of diet change are usually linked to the growing volume of solid waste from food packaging and food waste (Chakori et al. 2021), which can add a substantial burden to the already struggling waste management systems in many countries and cities in the region (Magezi 2015; Shi et al. 2021). Similarly, economic impacts can manifest at different levels. Related to (c), on one hand, food vendors and supermarkets offer employment and income options to many urban residents and farmers (von Holy and Makhoane 2006; Alonso et al. 2018; Giroux et al. 2020; Ogotu et al. 2020), while on the other hand the import of cheap food (e.g., frozen chicken, UPFs) found in such establishments can transform national food systems, affect the competitiveness of national food producers and, as an extension, affect rural livelihoods (Sumberg et al. 2016; Andam et al. 2018; Auma et al. 2019; Stevano et al. 2020; Bruin et al. 2021).

The above clearly illustrate that diet change in the context of urbanisation is a complex and multi-dimensional phenomenon in SSA that encompasses multiple intersecting historical, environmental, socioeconomic, and political aspects. Scholars have generally pointed to the need for a holistic understanding and evidence-based interventions at the interface of urbanisation, urban diet change, food system transformation, and sustainability that are aligned to the needs of relevant social groups and urban actors (Vorster et al. 2011; May 2018; de Bruins et al. 2021). This is because the relevant points of intervention and related groups are very diverse, and intersect with food systems and diet change dynamics in very different ways (Blekking et al. 2017; Haggblade et al. 2016; Laar et al. 2020).

However, there is a general lack of studies that synthesize in a comprehensive manner the insights of multiple stakeholders about critical aspects of diet change in SSA, especially in the context of urbanisation (Blekking et al. 2017; Vorster et al. 2011). Whereas it is acknowledged that this interface can be complex and context-specific, most current studies on urban diet change in SSA tend to be fragmented and focus on single drivers or impacts, mainly through quantitative analyses at the individual or household level. In this sense, there is a general lack of studies that seek to provide a systematic overview of the main phenomena and processes at the interface of urbanisation and diet change.

One of the most common challenges when exploring urban phenomena and/or food systems is the complexity posed by multiple interacting processes. Systemic approaches such as System Dynamics Modelling tools have gradually become popular for studying urban systems due to their capacity to combine soft and hard methodologies for data collection and analysis (Richardson 2013; Adamides et al. 2017; Eker et al. 2018). Such tools have also been used to study food systems, including among others to (a) identify mechanisms associated with food supply vulnerability and

¹ For the purposes of this paper the term UPF denotes food containing multi-ingredient mixtures (i.e., added salt, sugar, oil) developed by manufacturers, whether large companies or small and medium-scale enterprises, to make food more palatable and extend preservation (Reardon et al. 2021).

resilience (Stave and Kopainsky 2015), (b) understand the interactions between food supply and distribution (Vanessa et al. 2015), and (c) identify the opportunities of organic farming in reducing food systems' vulnerability (Brzezina et al. 2016). Studies employing system dynamics tools in the broad interface of urbanisation and food systems have focused on specific health impacts such as child obesity (Nelson et al. 2015), metabolic risk factors (Sharma et al. 2017), inequities in healthy eating (Friel et al. 2017), and non-communicable diseases in general (Waqar et al. 2017). For example, participatory methodologies have been used to create causal loop diagrams (CLDs) to identify health dynamics in Latin-American cities, and multiple connections between sociocultural practices and the consumption of UPFs (Langellier et al. 2019). A recent literature review used CLDs to identify the connections between food packaging in various countries with supermarket expansion, UPF overconsumption, and waste generation increase (Chakori et al. 2021). However, although such studies have demonstrated the explanatory power of system dynamic tools at the interface of urbanisation and food systems, to the best of our knowledge, no study has attempted to capture the drivers and impacts of the multiple dimensions associated with diet changes in rapidly urbanising cities of the developing world.

Ghana and its capital Accra offer an ideal case to explore the intersection of urbanisation and diet change. Ghana is one of the fastest-growing countries in SSA both in terms of population (from 769,000 people in 1950 to 35.5 million people by 2050) (Cobbinah et al. 2015). The fraction of its urban population is projected to increase from 15.5% in 1950 to 72.3% in 2050 (Cobbinah et al. 2015) (currently it stands at 51.2%) (Ghana Statistical Service 2013). Accra is central in these rapid demographic and socioeconomic transitions (see “Study area”), and there is strong evidence that urbanisation has affected the lifestyles and incomes of its residents significantly, influencing diet change (Chaudhary et al. 2018; Eker et al. 2019).

This study aims to identify and systematise the multiple aspects of diet change in the context of urbanisation in SSA, using Accra as a case study. In a nutshell, our study (a) elicits insights about the characteristics, drivers, impacts and other relevant aspects of diet change in Accra through expert interviews, and (b) uses Causal Loop Diagrams (CLDs) to systematise this evidence by mapping their interactions. First we introduce the policy context of food production and nutrition in Ghana, within which urban diet changes unfold. Subsequently, we introduce the research approach and data collection and analysis methods. Then we outline the main characteristics, drivers and impacts of diet change in Accra, and systematises them through CLDs. Finally we critically discuss some of the main aspects of diet change in Accra, and identify priority areas for future research and interventions at the interface of urbanisation and diet change.

Food production and nutrition policy landscape in Ghana

The national policies related to food in Ghana fall primarily within the broad thematic areas of food production, processing, trade, marketing, nutrition and utilisation (Thow et al. 2020). Food production aspects are usually within the remit of the Ministry of Food and Agriculture (MoFA) and the Ministry of Fisheries and Aquaculture Development (MoFAD). Aspects related to food processing, trade, and marketing are within the remit of the Ministry of Trade and Industry (MoTI) and the Ministry of Local Government and Rural Development (MLGRD). Finally, aspects related to food utilisation, food safety and nutrition are usually within the remit of the Ministry of Health (MoH).

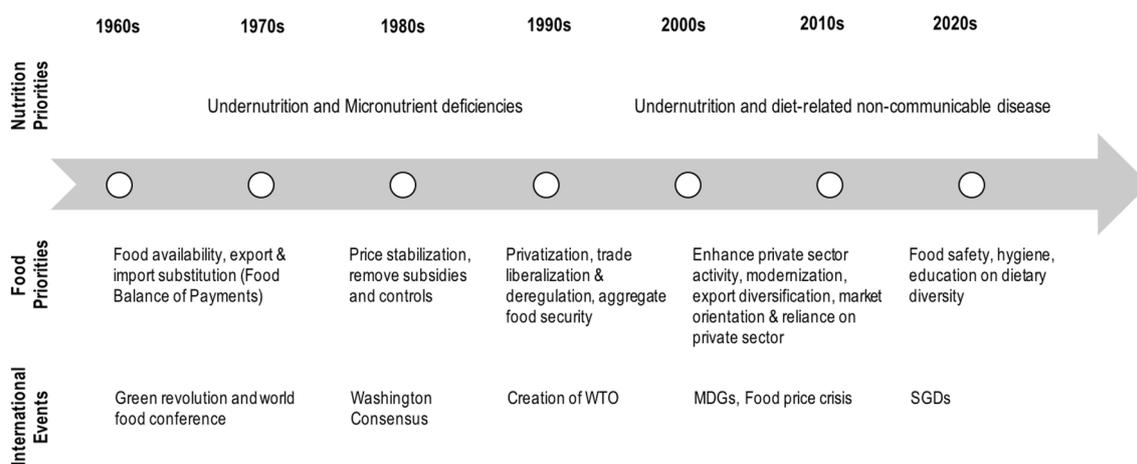
Below we provide a brief summary of the evolution of the food-related policy landscape in Ghana to understand the policy context within which diet changes have unfolded. We mainly focus on the evolution of the policy landscape related to food production and nutrition, as these dimensions are essential for appreciating diet changes in the country. The evolution of the nutrition policy landscape is outlined across the seven eras suggested by Ghartey (2010). It is worth noting that although food and nutrition in urban areas has grown in importance in tandem with the growth of Ghanaian cities (see “Introduction”), this urban dimension was rarely explicitly delineated in the individual policies, at least prior to the 2010s.

The first major Ghanaian health and nutrition policy was formulated in the period 1951–1957 during the transition to independence (Ghartey 2010) (Table 1). In 1961, the National Food and Nutrition Board was established to oversee nutrition education, following the findings of a national nutrition survey that demonstrated the high prevalence of malnutrition and the lack of education on healthy diet (Ghartey 2010). The activities of the National Food and Nutrition Board included food demonstration events in schools and hospitals.

On the food production and supply side the early policies of the post-independence government in the 1960s reflected a highly interventionist approach (Yaro et al. 2018). The focus was to address undernutrition (see above) and deficits in food balance sheets for agricultural commodities such as maize, yam, rice, fruits, and meat (Fig. 1), mainly through price control and subsidies to ensure the availability of food (Seini 2002). Furthermore, there was a massive government involvement in the production, distribution and marketing of the food commodities outlined above through the establishment of state-owned enterprises such as the Ghana Agro-Food Company (GAFCO), the Bolgatanga Meat Factory, the Nsawam Cannery, Ghana Distilleries, the Pwalugu Tomato Factory, and the Tema Food Complex (Frimpong Boamah and Sumberg 2019). International circumstances, and the

Table 1 Evolution of nutrition-related policy priorities in Ghana. Source: Adopted from Ghartey (2010), Republic of Ghana (2016), Linderhof et al. (2019)

Period	Focus
1957–1966	Food demonstration and nutrition education
1966–1974	Identification of attitudes and behavioural change
1974–1987	Promotion of weaning and supplementary foods. Treating malnourishment
1987–1990	Addressing of micronutrient requirements
1990–2000	Planning and mobilization for action. Addressing of micronutrient deficiencies and exclusive breastfeeding
2000–2010	Consolidation of strategies for addressing micronutrient deficiencies (exclusive of breastfeeding). Promotion of community-based growth monitoring
2010–2020	Promotion of healthy eating and lifestyle

**Fig. 1** Chronology of food production and nutrition policy priorities over time. Source: Adapted from Thow et al. (2020)

Green Revolution in particular, influenced ‘Operation Feed Yourself’, which emphasized self-sufficiency as a means of addressing food shortage and undernutrition (Girdner et al. 1980; Yaro et al. 2018).

Following the military take-over of the government in 1966 through a coup d’état, policies changed substantially both on the nutrition and food production side. On the nutrition side, the National Food and Nutrition Board was converted into the Nutrition Division of the Ministry of Health (MoH). However, at that time, nutrition received a rather low priority due to the lack of understanding of nutrition-related issues among members of the Division (Ghartey 2010). At the same time, the national nutrition survey revealed that attitudes and behavioural issues were critical in shaping the transition towards healthy diets (Davey 1962). To address this human resource deficit, the Department of Nutrition and Food Science was established at the University of Ghana in 1966 to train nutrition specialists (Republic of Ghana 2016). The Department of Nutrition and Food Science and the Nutrition Division jointly started initiatives geared towards attitudinal and behavioural change on nutrition

(1966–1974) (Table 1). In 1974, as part of the World Food Conference, Ghana held a Food Conference organized by the MoH, whose outcomes indicated that a large proportion of children 6–9 months old were not receiving appropriate complementary foods to breastmilk (United Nations 1975). This led to a drastic change in nutrition focus towards weaning food for malnourished children (1974–1987) (Table 1). As a result, the free distribution of wheat, oil and non-fat powdered milk to children became common, often through the support of international donor agencies such as USAID (Liebersohn et al. 1997).

On the production side, the policy focus during the 1970s shifted towards the promotion of non-edible commodity crops such as cocoa, oil palm and sugarcane (Yaro et al. 2018; Thow et al. 2020). Despite the large domestic market for oil palm, cocoa and sugarcane, these crops were mainly exported for foreign exchange generation, with their production controlled by the military government (Yaro et al. 2018). This period also saw the establishment of major state-owned enterprises including the Ghana Oil Palm Development Company (GOPDC), the Ghana Cocoa Processing Company

and the Komenda Sugar Factory (Frimpong Boamah and Sumberg 2019). At the same time import restrictions sought to protect such state-owned enterprises (Thow et al. 2020). However, as the commodity crop sector overshadowed food crop production the policies outlined above largely failed to address the critical factors associated with undernutrition (Thow et al. 2020), arguably creating a large divide between production-related and nutrition-related policies.

However in the 1980s the aforementioned restrictions on the production and import of agricultural commodities eased, with a clear move toward the liberalisation of the agricultural sector (and the national economy more broadly) (Thow et al. 2020; Yaro et al. 2018). With price stability and undernutrition becoming key policy priorities (Fig. 1), the national government liberalised the economy by allowing food imports and foreign direct investments (FDIs) (Thow et al. 2020). The Economic Recovery Program (ERP) through the Structural Adjustment Program (SAP) led to massive state withdrawal from the agricultural sector, precipitating the increased involvement of the private sector, which continues to this day (Yaro et al. 2018; Arthur 2006). This push towards liberalisation accelerated in the 1990s, and by the start of the decade the private sector became a central player in the Ghanaian food system, as the country witnessed the mass privatisation of inefficient state-owned enterprises (Adams 2011). In 1994, the adoption of the Agricultural Sector Development Policy demonstrates this desire to make the private sector the growth engine in efforts to increase agricultural productivity. At the same time the concept of food security across the four pillars of food access, availability, affordability, and utilisation, started framing the efforts to address undernutrition (Nkegbe et al. 2017; Ecker 2018).

After many years of relative stagnation, the late 1980s and early 1990s saw major shifts in the focus of nutrition-related policies (Table 1). Many of these changes related to the growing realisation that many Ghanaians experience micronutrient deficiencies (Messer 1992). For example, a study conducted by the Department of Nutrition and Food Science illustrated that iodine deficiency was a major public health and nutrition challenge (Ministry of Health/University of Ghana 1994), which led to a change in policy direction between 1987 and 1990 towards addressing micronutrient requirements (Table 1). At that time, the government started undertaking iodine capsules and salt iodization campaigns (Asibey-Berko and Orraca-Tetteh 1995). The early 1990s saw the proportion of undernourished Ghanaians declining from 64% in 1981 to 35% in 1990 (Aggrey-Fynn et al. 2003). However, government still lacked central control mechanisms for coordinated planning, implementation, resource allocation and monitoring (Ghartey 2010). This influenced a shift in the national government's focus towards planning and mobilizing for action to further address micronutrient

deficiencies and exclusive breastfeeding, with a series of relevant policy measures adopted between 1992 and 2000 (Tables 1, 2). The implementation of these policies combined with other national and international circumstances further decreased the proportion of undernourished Ghanaians to 12% of the national population by 2000 (Aggrey-Fynn et al. 2003).

However, by the early 2000s, urbanisation started precipitating major changes for food production (and the food, agriculture and nutrition sectors more broadly), as approximately 43.9% of the national population lived in urban areas (Cobbinah et al. 2015). One of the main avenues to address food and nutrition security, especially in urban contexts, was through the gradual shift towards the industrialisation and modernisation of the agricultural sector (Nyantakyi-Frimpong and Kerr 2015). The 2002 Food and Agriculture Sector Development Policy further boosted both the role of the private sector in the food system, as well as the import of agricultural commodities (Table 2). Simultaneously, the adoption of the Millennium Development Goals (MDGs) further “pushed” the national government to address food security and hunger (Pedercini and Barney 2010).

After 2000, several other nutrition-related policies and programmes were implemented, especially linked to the consolidation of strategies for addressing micronutrient deficiencies (Tables 1, 2). Furthermore, the long-standing challenge of stunting, combined with the recently emerging issues of overweight and obesity (Laar et al. 2020), added up to the myriad of nutrition-related challenges in the country. Indeed, an increasing number of studies have pointed to the double burden of malnutrition (DBM) facing urban populations, characterised by the presence of stunting, overweight and other diet-related non-communicable diseases (Doku and Neupane 2015; Kushitor et al. 2020). Finally some of the most relevant contemporary policy measures at the urban level have sought to promote nutrition-sensitive interventions in cities, as a means of addressing the double burden of malnutrition and curbing the constraints for urban agriculture (Laar et al. 2020) (Tables 1, 2).

Methodology

Research approach

This study draws from sustainability science and systems dynamics to identify and delineate the processes underpinning urban diet changes in Accra. In more detail, our analysis adopts some of the key tenets of sustainability science such as a problem-oriented approach, linkage of social and ecological systems, and transdisciplinarity (Kates et al. 2001; Kates 2011). Such a lens is necessary considering that diet change in rapidly urbanising SSA contexts is a

Table 2 Major policies related to food production and nutrition in Ghana since the early 1990s. Source: (WHO GINA 2022; Republic of Ghana 2016; Linderhof et al. 2019)

Policy	Type	Priority	Start Year	End Year
Food and Drugs Act, 1992	Legislation relevant to nutrition	Promote healthy diets and prevention of diet-related Non-Communicable Diseases (NCDs)	1992	–
National Plan of Action on Food and Nutrition	Comprehensive national nutrition policy, strategy or plan	Improve maternal, infant and young child nutrition. Promote International Code of Marketing of Breast-milk Substitutes	1995	2000
Food and Drug Law and Amendments: Universal Salt Iodisation	Legislation relevant to nutrition	Improve vitamin and mineral nutrition	1995	–
Breastfeeding Promotion Regulations	Legislation relevant to nutrition	Improve maternal, infant and young child nutrition	1995	–
Vitamin A Policy	Nutrition-related policy, strategy or plan focusing on specific nutrition areas	Improve vitamin and mineral nutrition	1998	–
Breastfeeding Promotion Regulations 2000, L11667	Legislation relevant to nutrition	Promote breastfeeding	2000	–
Food and Agriculture Sector Development Policy (FASDEP I)	Food security or agriculture sector national policy, strategy or plan, with nutrition-related components	Facilitate the production, processing and distribution of food commodities to enhance food security	2002	2007
Labour Act, 651	Legislation relevant to nutrition	Empower women to combine their reproductive and productive roles successfully and to prevent unequal treatment in employment due reproduction	2003	–
National Reproductive Health Service Policy and Standards	Health sector policy, strategy or plan with nutrition-related components	Address of low birth weight and underweight in women	2003	–
Integrated Anaemia Control Strategy	Nutrition-related policy, strategy or plan focusing on specific nutrition areas	Promote food fortification and micronutrients supplements	2003	–
Imagine Ghana Free of Malnutrition	Comprehensive national nutrition policy, strategy or plan	Reduce undernutrition In children and mothers	2005	–
Ghana Trade Policy	Comprehensive policy for food trade	Strengthen agro-processing, domestic market-led industrialization, and related exports	2005	–
Ghana School Feeding Programme	Nutrition-related policy, strategy or plan	Reduce hunger and malnutrition in school children, and increase school enrolment, attendance and retention	2005	–
Growth and Poverty Reduction Strategy (GPRS II)	Multisectoral development plan with nutrition-related components	Promote nutrition-sensitive actions to address food security	2006	2009
Food and Agriculture Sector Development Policy (FASDEP II)	Food security or agriculture sector national policy, strategy or plan with nutrition-related components	Facilitate the production, processing and distribution of food commodities to enhance food security	2007	2011
Regenerative Health and Nutrition Strategic Plan	Nutrition-related policy, strategy or plan focusing on specific nutrition areas	Increase the consumption of fruits, vegetables, and water. Reduce the intake of salt and saturated fats and oils	2007	2011
Under Five's Child Health Policy	Health sector policy, strategy or plan with nutrition-related components	Improve prenatal and neonatal nutrition including iron and foliate supplementation	2007	2015
Child Health Policy	Health sector policy, strategy or plan with nutrition-related components	Improve infant and young child feeding	2007	–

Table 2 (continued)

Policy	Type	Priority	Start Year	End Year
National Health Policy	Health sector policy, strategy or plan with nutrition-related components	Enable equitable access to good quality and affordable health, population and nutrition services	2007	–
Infant and Young Child Feeding Strategy for Ghana	Nutrition-related policy, strategy or plan focusing on specific nutrition areas	Promote counselling on healthy diets and nutrition during pregnancy	2007	2013
Medium-Term Development Policy Framework, Ghana Shared Growth and Development Agenda (GSGDA)	Multisectoral development plan with nutrition-related components	Improve food production and distribution for food security	2010	2013
Health Sector Medium Term Plan	Health sector policy, strategy or plan with nutrition-related components	Intensify the prevention and control of non-communicable and other communicable diseases	2010	2013
National Urban Policy	Local economic development policy, strategy or plan	Improve urban agriculture and infrastructure	2012	–
Strategy for the Management, Prevention and Control of Chronic Non-Communicable Diseases	Health sector policy, strategy or plan with nutrition-related components	Reduce avoidable morbidity and premature mortality	2012	2017
Health Sector Medium Term Development Plan	Health sector policy, strategy or plan with nutrition-related components	Intensify the prevention and control of non-communicable and other communicable diseases	2014	2017
National Nutrition Policy	Comprehensive national nutrition policy, strategy or plan	Ensure optimal nutrition across the entire population, promote child survival, and enhance economic growth and development	2016	–
Food Safety Policy	Comprehensive national nutrition policy, strategy or plan	Implement nutrition-sensitive interventions to address the double burden of malnutrition	2015	–
National Policy for the Management of the Marine Fisheries Sector	Food security or agriculture sector national policy, strategy or plan with nutrition-related components	Achieve the sustainable use of fish stock, improve protein intake from fish and reduce post-harvest losses	2015	–
Global Food Security Strategy	Comprehensive national nutrition policy, strategy or plan	Reduce hunger, malnutrition, and poverty	2018	–
Investing for Food and Jobs (IFJ): An Agenda for Transforming Ghana's Agriculture	Food production agenda	Implement nutrition-sensitive agriculture with food fortification, and improve education on dietary diversity and the consumption of biofortified crops	2018	–

multi-dimensional problem with major expected ramifications for the decades to come (see “[Introduction](#)”). Furthermore, as urban diet changes are the outcomes of diverse historical, environmental, socioeconomic, and political processes where different institutions intersect, there is a clear need to engage non-academic stakeholders through transdisciplinary processes to both understand better how these phenomena unfold and identify priority areas for intervention (see “[Introduction](#)”). For these reasons the main information presented in this analysis is elicited through 20 expert interviews with stakeholders representing some of the main organisations relevant to the different aspects of diet change in Accra (see “[Data collection and analysis](#)”).

To systematise the knowledge generated through the expert interviews we use CLDs, a tool commonly used in system dynamics modelling studies (see “[Introduction](#)”). CLDs are essentially mental models that represent the underlying behaviours within a system. They formalise the relationship between different phenomena underpinning the behaviour of the system by connecting through causal links variables that represent these phenomena. These links can depict positive or negative relations between the variables/underlying phenomena. If a dependent variable increases its own value following an increase of an independent variable (all other things being equal), then their relation (polarity) is considered positive; conversely, the polarity is considered negative (Sterman 2000) when the relationship between two or more variables creates a closed cycle, this is called a “feedback loop”. A loop is considered “reinforcing” if the polarities of all the variables in the loop create an effect in the same direction at every cycle. Conversely, a loop is “balancing” if the positive and negative effects “cancel” each other, alternating between increasing and decreasing effects at each cycle (Sterman 2000; Meadows 2008). Feedback loops can provide a deeper understanding of a system’s behaviour, as well as help identify potential points for intervention (Malard et al. 2015; Eker et al. 2018).

Study area

Accra is the capital, and main population and economic hub of Ghana. It has grown rapidly in recent decades, and after engulfing many neighbouring areas it has received the name of Greater Accra Metropolitan Area or Accra Metropolitan Region (Akubia and Bruns 2019). Its population increased from 1.6 million inhabitants in 2010 to more than 2.0 million inhabitants in 2019, with a growth rate of 4.2% per annum (World Bank 2017; National Population Council 2017). Its land area has increased to 139.7 km², through the conversion of agricultural land and natural vegetation in the urban and peri-urban area for buildings, industrial areas and infrastructure (Addae and Oppelt 2019; Akubia and Bruns 2019; Akubia et al. 2020). For

example, the built-up area increased from 96 km² in 2008 to 114 km² in 2017 (Akubia and Bruns 2019) through the transformation of agricultural land (10 km²) and natural vegetation (6 km²) (Akubia et al. 2020).

During this process of urbanisation, livelihoods have shifted from the primary sector (e.g., agriculture) to the secondary (e.g., manufacturing) and subsequently the tertiary sector (e.g., services), especially in Accra’s periphery (Ghana Statistical Service 2014; Accra Metropolitan Assembly 2019). Accra’s Gross Domestic Product (GDP) reached USD 6.95 billion in 2019 (Accra Metropolitan Assembly 2020), accounting for 10.3% of the national GDP (World Bank 2021). As a result, in 2019 average income in Accra stood at 4358 USD/cap/year compared to the national average of 2166 USD/cap/year (Ghana Statistical Service 2019). Similarly, the fraction of people > 15 years old that have attended school is much higher in Accra than the national average education (Ghana Statistical Service 2019).

By virtue of becoming the country’s economic powerhouse, Accra evolved into a trade and communication hub, not only for Ghana but also for Western Africa. It is one of the main “points” of entry of foreign capital, investment and innovations (Accra Metropolitan Assembly 2020), ranking in 2016 as the 13th highest in Africa in terms of attracting FDIs (UN-Habitat and IHS-Erasmus University Rotterdam 2018).

These demographic and socioeconomic changes coupled with policy shifts in the last decades (see previous section) seem to have had major effects on the food preferences of urban residents. For example, national statistics show increasingly large imports of poultry, milk, sugar, and dairy production since the early 1990s (Goody and Goody 1995; Stevano et al. 2020) with the imports of fruits and vegetable oil exceeding domestic production since the 2000s (FAOSTAT 2021). Also, there is an observed pattern of increased imports of rice and frozen food, especially since the early 2000s (Amanor 2015; Sumberg et al. 2016). Most of these imported food are consumed in urban areas, and especially Accra, where subsistence food production is rather low. Furthermore, there has been a proliferation of supermarkets and street food vendors (Andam et al. 2018; Hiamey and Hiamey 2018), while the changes in working habits have been linked to increased eating outside of the home and meals away from home. Concomitant with these trends, studies have shown the growing prevalence of overnutrition (particularly in women) leading to increasing levels of overweight, obesity and non-communicable diseases (Doku and Neupane 2015; Ofori-Asenso et al. 2016). Interestingly, there seem to be increases in both the consumption of healthy foods on one side (from urban rich) and unhealthy food (from urban poor) (Imamura et al. 2015; Stevano et al. 2020; Holdsworth et al. 2020).

Table 3 Organisations and affiliations of the interviewed experts

Category	Organisation	Affiliation	Abbreviation
Government	Ministry of Health (MoH)	Directorate, Dept of Nutrition	GOV1
	Ghana Health Service (GHS)	Nutrition Unit	GOV2
	Ministry of Food and Agriculture (MoFA)	Directorate, Women In Agriculture and Nutrition	GOV3
		Crop Service Directorate	GOV4
	Ministry of Trade and Industry (MoTI)	Industrial Development	GOV5
	Ministry of Fisheries and Aquaculture Development (MoFAD)	Inspection Directorate	GOV6
	Food and Drugs Authority (FDA)	Certification Division	GOV7
	National Development Planning Commission (NDCP)	Planning and Policy Division	GOV8
	Food Research Institute	Food Safety Division	GOV9
	Environmental Protection Agency (EPA)	Food Safety Unit	GOV10
Private sector	KFC	Finance and Accounts	COM1
	Accra Mall	Operations	COM2
	West Hill Mall	Operations	COM3
	Ghana Association of Livestock Traders	–	COM4
	Ghana Association of Poultry Farmers	–	COM5
Civil Society	Partnership for Food Solutions	–	CSO1
	Peasant Farmers' Association	–	CSO2
	National Diabetes Association Ghana	–	CSO3
	Plan International- Ghana	Programs Directorate	CSO4
	Oxfam Ghana	Programs Directorate	CSO5

Data collection and analysis

Primary data were collected through expert interviews with stakeholders representing the main types of organisations involved in food and nutrition in Ghana, and especially Accra. In particular, following the policy analysis (see “[Food production and nutrition policy landscape in Ghana](#)”), review of current knowledge for Accra (see “[Introduction](#)”) and snowballing (see below) we identified 19 relevant organisations, which span government agencies, civil society, and the private sector (Table 3). It should be noted that the stakeholders consulted in this study have extensive practical experience in different aspects of the food system associated with urban diet change in Ghana (and Accra more specifically). Thus, their answers reflect not only a theoretical understanding of the issue but a well-rooted experience through in person observation and practice.

All interviews were conducted between May 2019 and October 2020. First, the ten interviews with government agencies were conducted in May 2019. This was followed with the expert interviews with civil society and the private sector organisations in October 2020. The expert interviews were semi-structured and open-ended to allow the respondents to elaborate freely based on their experience. The expert interviews were structured in four parts: (a) characteristics of diet changes in Accra in terms of food type and quantity; (b) drivers of diet change and the

prioritisation of most important factors; (c) sustainability impacts of diet changes; (d) possible policies, practices and interventions for addressing the negative impacts of diet change. Each interview lasted for about 60–85 min and was audio recorded. Before starting each interview, the respondents were asked to consent to the interview, audio-recording and note-taking. All interviews were conducted in English.

Interviews were transcribed, coded across the different aspects outlined above (i.e., characteristics, drivers, impacts), and analysed using the “Atlas ti” software. The major analytical categories for the drivers and impacts of diet change in Accra were identified through a comprehensive literature review (see Introduction). For drivers, the main analytical categories include (a) income and food expenditure (Bosu 2015; Cockx et al. 2018; Annan et al. 2018; Harris et al. 2019), (b) sociocultural practices (Boatema et al. 2018; Annan et al. 2018; Chakona and Shackleton 2019), (c) agricultural and trade policies, and standards (Thow et al. 2014; Annan et al. 2018), (d) increasing prevalence of food vendors and supermarkets (Demmler et al. 2017, 2018; Khonje and Qaim 2019; Reardon et al. 2021), and (e) changes in energy access (Makungwa et al. 2013; Sola et al. 2016). For impacts, the very diverse set of impacts falls under the three major categories of (a) health and nutrition, (b) environment and (c) socioeconomic change (e.g., Aldaya et al. 2021).

The final analytical categories for drivers and impacts were formalized following the content analysis of the interviews. This was to allow for the identification of specific and possibly unique phenomena and mechanisms related to the drivers and impacts of diet change in Accra. In this sense, we did not populate a pre-determined conceptual framework of drivers and impacts, but instead we used the literature as a guiding light to develop a framework that reflects the actual situation in Accra. This means that some of the pre-identified analytical categories were expanded reflecting the actual content of the interviews, with the final analytical categories essentially becoming formalized following the coding.

The above is particularly obvious in the grouping of the drivers of diet change across two tiers as shown in Table 4. Tier I contains all of the drivers of diet change identified by each respondent, and Tier II the most relevant overarching category. This two-tier system reflects the need to develop coherent analytical categories that convey in a straightforward manner the very different drivers of diet change as evoked by the respondents. Upon closer examination the rich set of drivers included in Tier I was shorted into the five overarching categories of drivers identified above (Tier II). Hence this process distilled the Tier I drivers into fewer coherent themes (that are consistent with the literature) to enable readers to appreciate the major drivers of diet change. A similar approach was also followed for the impacts.

To establish the connections between the different aspects of diet change in Accra we develop a CLD using the Vensim PLE Plus software. This was conducted through the detailed inspection of the interviews transcripts, to identify the variables, linkages and polarities described by each expert. For instance, we identify three variables through the analysis of the following transcript section: “The emergence of fast food chains is driven mainly by the increase of disposable income, because if you do not have money, you will not eat out” (GOV10). In this case, the three variables are: (a) household leisure budget allocation, (b) eating out of home, and (c) UPF consumption from food vendors. Similarly, two linkages can be identified, one from “a” to “b”, and another from “b” to “c”, both of them with positive polarities (i.e., an increase in the first variable causes an increase in the second variable).

Visualisation can be particularly challenging in complex CLDs that depict many variables and linkages due to their “overlapping”. In these cases, the Vensim PLE Plus software used in this study provides the “shadow variables” functionality (depicted in grey color in the diagrams in the “Results” section), which allows the repetition of the same variable in different parts of the diagram (Roubík et al. 2019) to facilitate visualization. Such an example is the variable “urbanization” that appears originally in the lower right side of the full system diagram (see “Systems diagram” sub-section) but is linked to the variable “living costs”, which is in the upper

left part of the diagram. To facilitate the representation of the linkage between the two variables, “urbanization” was added in the upper left side of the diagram as a “shadow variable”, to depict that both “urbanization” variables are the same. Other visualization tools that were used in our CLDs relate to the loop labels “R” for reinforcing loops and “B” for balancing loops, followed by consecutive numbers.

Finally, following the construction of the first drafts of the CLDs by the second author, the entire research team undertook several rounds of group revisions to identify any necessary adjustments and assure that the CLDs reflected the experts’ responses with the utmost accuracy. In this sense, we verified linkages and polarities in the CLDs through an iterative expert process (rather than a stakeholder workshop) whose outcomes were compared with published literature from other SSA contexts (see Discussion).

Table S1 in the Supplementary Material contains all variables identified in the interview transcripts, together with an indication of the stakeholder that identified each of them. Considering the large number of variables and loops, the “Causal loop diagrams” section outlines only the most important ones.

Results

Characteristics of diet change in Accra

The expert interviews reveal that the most visible diet changes in Accra are linked to (a) increases in the consumption of rice, maize, chicken, raw fish, vegetable oil, sugar, and UPFs, (b) decreases in the consumption of roots, tubers and some cereals such as millet, and (c) an almost stable consumption of other cereals (with the exception of maize which increased, as discussed above) (see Quotes 1–2, Table S2, Supplementary Material).

In terms of animal protein, poultry consumption, and specifically chicken (broiler meat), has increased rapidly in Accra due to its high availability and convenience (see Quote 3, Table S2, Supplementary Material). Similarly there are increases in the consumption of fish and seafood that have gradually become one of the most preferred sources of protein for Accra’s residents (see Quote 4, Table S2, Supplementary Material). The annual per capita fish consumption in Ghana is about 26 kg, which is much higher compared to the ECOWAS average (14 kg/cap/year) (Personal communication GOV6).

However, by far the most obvious manifestation of diet change is the increased consumption of UPFs (e.g., bottled/canned food, packaged processed foods, cookies) and vegetable oil (see Quote 5, Table S2, Supplementary Material). The source of these UPFs is very diverse and includes street vendors, restaurants, and supermarkets, and is linked to

Table 4 Drivers of diet change in Accra

Category	Organisation	Tier I drivers	Tier II drivers	
Government	GOV1	High income Low food prices Taste preference	Income and food expenditure	
	GOV2	Low income Taste preference Family size	Income and food expenditure	
	GOV3	Family size	Income and food expenditure	
	GOV4	High income Prevalence of supermarkets and restaurants		
	GOV5	Trade liberalisation Subsidies Urban agriculture	Policies and trade	
		GOV6	Trade liberalisation Subsidies	Policies and trade
		GOV7	Family size High income Low food prices Prevalence of supermarkets	Income and food expenditure
	GOV8	Taste preference Social prestige Cooking time	Sociocultural practices	
	GOV9	High income Low food prices Taste preference Urban agriculture	Income and food expenditure	
	GOV10	Taste preference Social prestige Energy type and access	Sociocultural practices	
Private sector	COM1	Energy type and access Cooking time Cooking safety	Energy access	
	COM2	Taste preference Social prestige	Sociocultural practices	
	COM3	Prevalence of supermarkets and food vendors Low food prices Aggressive marketing and media campaigns	Food retail sector	
	COM4	Prevalence of supermarket and food vendors Low food prices Aggressive marketing and media campaigns	Food retail sector	
	COM5	Working and life style Cooking time Cheap imported food	Energy access	
Civil Society	CSO1	Trade liberalisation Subsidies 1 Low food prices	Policies and trade	
	CSO2	Working and life style Cooking time Energy type and access	Energy access	
	CSO3	Trade liberalisation Subsidies Low food prices	Policies and trade	
	CSO4	Taste preference Social prestige Prevalence of meals away from home (MAFH)	Sociocultural practices	
	CSO5	Taste preference Social prestige	Sociocultural practices	
		Prevalence of supermarket and food vendors Cheap imported food Urban agriculture products Aggressive marketing and media campaigns	Food retail sector	

multiple drivers as discussed in section “[Centrality of ultra-processed foods in urban diet changes](#)”. At the same time there is a marked increase in the consumption of sugar, especially during Ramadan and among the urban working class, who consume it daily especially for breakfast (see Quote 6, Table S2, Supplementary Material).

Drivers of diet change in Accra

According to the expert interviews various factors combine to give rise to the diet changes outlined in the previous section. Table 4 contains all drivers outlined by each respondent (Tier I), as well as the related aggregate categories (Tier II) (see “[Data collection and analysis](#)”). In no particular order, the most commonly mentioned Tier II drivers include changes in: (a) income and food expenditure, (b) sociocultural practices, (c) policies and trade, (d) food retail sector, and (e) energy access.

In terms of income and food expenditure, several stakeholders (and especially those affiliated with government agencies) suggest that income change is the most important driver of diet change in Accra (via changes in food expenditure) (Table 4). However, changes in income and food expenditure do not have a uniform effect, with their effects being rather different between richer and poorer households. On one hand, some stakeholders, especially from the Ministry of Health, suggest that increasing income for the emerging working and middle classes increases budgetary allocation for food. As a result, these gradually more affluent households and individuals can afford any type of food at any time, often preferring UPFs (see Quote 7, Table S2, Supplementary Material). Conversely, some respondents approached the relationship between income, food expenditure and diet change through the lens of poverty. Low incomes compel many of the poor urban households in Accra to also reduce food expenditure, influencing access to unhealthy (but cheap) food from street vendors or even selling the output from urban farms to richer households (see Quote 8, Table S2, Supplementary Material).

Many respondents (and especially CSOs) have mentioned that changes in sociocultural practices are one of the most important drivers of diet change in Accra. Most such respondents view diet change as a function of food taste preferences (especially UPFs) and a desire to acquire social prestige, which combine with lifestyle and eating habits (i.e., eat late at night) to give rise to many negative health impacts (section “[Centrality of ultra-processed foods in urban diet changes](#)”) (see Quotes 9–10, Table S2, Supplementary Material).

Trade policies and imports of cheap food have been also identified as drivers of diet change. This includes trade liberalisation through the promotion of south-south cooperation, import subsidies, and incentives for foreign direct

investments (FDIs) that have jointly increased the availability of cheap food such as rice, chicken, sugar and different types of UPFs (see Quotes 11–13, Table S2, Supplementary Material).

The burgeoning retail sector is also perceived as a significant driver of diet change in Accra. Interviews indicated that before 2005 there were only three big supermarkets in the city, with ten more added between 2005 and 2010 through FDIs from South Africa and Asia, and many more established since 2010 (Personal Communication, GOV5). Respondents have linked supermarkets and diet change via the aggressive marketing and media strategies that influence lifestyle and social prestige, enabling access to certain types of food such as UPFs, and increasing convenience as one-stop purchase places (see Quote 14, Table S2, Supplementary Material). Similarly the number of food vendors, and especially fast-food joints, has also increased to accommodate food demand, especially linked to lifestyle changes.

Finally, a significant and largely unexpected driver of diet change is access to energy (Personal Communication, GOV10, CSO1). According to CSO1, lifestyle and work shapes diet choices, and the type of energy source (and access to it) is an important factor. For example, due to the heavy traffic many workers are often compelled to make certain diet choices, such as heating fast food or food already stored in the fridge, as they get home after 8:00 PM and as a result cooking meals at that time might not be an option. In this sense access to electricity for food storage and quick heating (compared to slow fuelwood and charcoal stoves), can shape certain dietary choices (see Quote 15, Table S2, Supplementary Material). For example families that do not have secure access to electricity might choose not to change their diet towards frozen food or fast food that require quick reheating.

Sustainability impacts of diet change in Accra

The respondents mentioned a series of sustainability impacts, particularly (a) negative health and nutrition impacts, (b) negative environmental impacts, and (c) positive socioeconomic benefits (see “[Data collection and Analysis](#)”). Of these, health and nutrition impacts are the most commonly articulated among the different respondents (Table 5).

In terms of health and nutrition impacts, many interviewees suggested that diet change is linked to the observed rise of non-communicable diseases such as diabetes, and overweight and obesity in both children and adults. For example, type 2 diabetes is linked to the high current consumption of sweets and UPFs. NDAG the prevalence of overweight and obesity seem to be more common in females than males (for both adults and children), with the trend also prevalent among high-income households (see Quote 16, Table S2,

Table 5 Major sustainability impacts of diet change in Accra

Category	Organisation	Tier I impacts	Tier II impacts
Government	GOV1	Non-communicable diseases	Health and nutrition
	GOV2	Non-communicable diseases Food waste	Health and nutrition Environment
	GOV3	Non-communicable diseases	Health and nutrition
	GOV4	Non-communicable diseases	Health and nutrition
	GOV5	Employment and livelihoods	Socioeconomic
	GOV6	Employment and livelihoods	Socioeconomic
	GOV7	Food waste and safety	Environment
	GOV8	Food waste	Environment
	GOV9	Food waste	Environment
	GOV10	Non-communicable diseases Food waste	Health and nutrition Environment
Private sector	COM1	Non-communicable diseases Food waste	Health and nutrition Environment
	COM2	Employment and livelihoods	Socioeconomic
	COM3	Employment and livelihoods	Socioeconomic
	COM4	Non-communicable diseases	Health and nutrition
	COM5	Non-communicable diseases	Health and nutrition
Civil Society	CSO1	Food waste	Environment
	CSO2	Employment and livelihoods	Socioeconomic
	CSO3	Non-communicable diseases	Health and nutrition
	CSO4	Non-communicable diseases	Health and nutrition
	CSO5	Employment and livelihoods	Socioeconomic

Supplementary Material). Closely related to health were some environmental concerns in terms of food waste, packaging waste and food safety. Most interviewees were concerned that the diet changes linked to the retail and food vendors had implications for food waste and safety (Personal Communication GOV7) (see Quote 17, Table S2, Supplementary Material).

Diet change also has some ramifications for the broader food system. For example, diet change has boosted the production of certain agricultural commodities such as rice, at the expense of traditional crop varieties such as millet. Domestic rice production has been increasing since the 1980s, assisted by trade liberalisation and subsidies for FDIs in the irrigation sector through south-south cooperation with China and Brazil. As a result, while domestic rice production reached 450,000 t in 2018, less than 20% was consumed in cities, with urban residents preferring usually imported rice that was perceived of higher quality (see Quote 18, Table S2, Supplementary Material).

Finally, it is worth noting that diet changes can have some positive socioeconomic impacts. Firstly, interviews with private sector organisations revealed that the current pattern of supermarkets' proliferation has created employment opportunities for several young people, and especially women (COM1). Some interviewees also believe that the diet change has increased male involvement in urban agriculture to address the demand gap for fresh

vegetables (CSO2) (see Quote 19, Table S2, Supplementary Material).

Causal loop diagrams

System diagram

Figure 2 is a causal loop diagram (CLD) that systematises the mechanisms and processes that mediate diet change in Accra, as elicited through the interviews. Figure 2 contains the characteristics, drivers, impacts, and other relevant processes with the identified variables. We colourcode the different parts of Fig. 2 following the major categories of drivers and impacts identified in the Methodology and the previous sections of the Results. The highlighted categories of drivers are (a) income and food expenditure, (b) sociocultural practices, (c) agricultural and trade policies, (d) food retail sector, and (e) energy access. The highlighted categories of impacts are: (a) health and nutrition, (b) environment and (c) socioeconomic change.

The CLD contains all relevant variables identified by respondents (Table S1, Supplementary Electronic Material), and also shows the most important loops, which are explained in more in detail in Table 6. To appreciate better the main processes at the interface of urbanisation and diet change in Accra, we divide the CLD into two of its major subsystems, and discuss it in greater detail below,

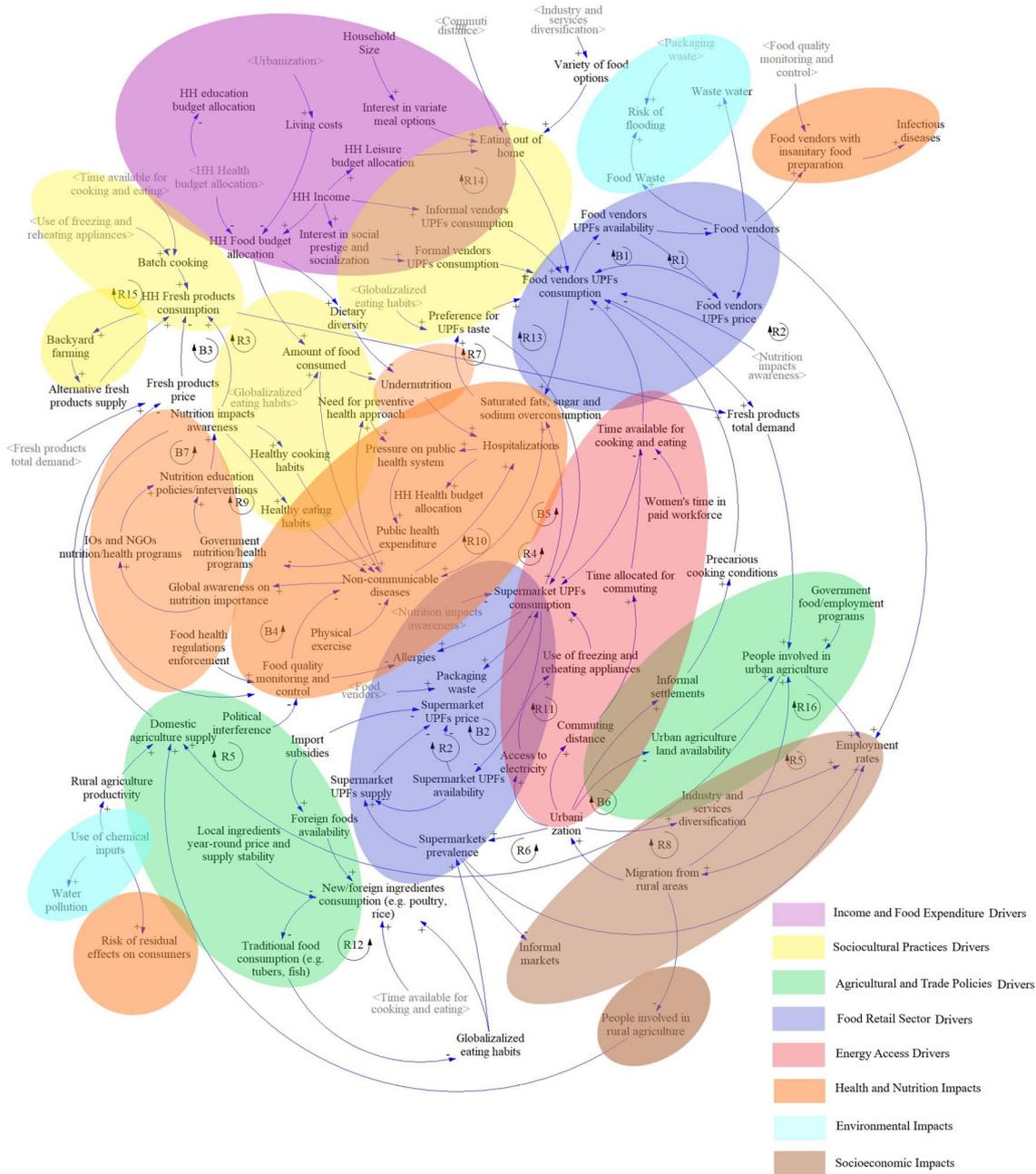


Fig. 2 Causal Loop Diagram of urban diet change in Accra

namely the food supply sub-system (Fig. 3) and the food consumption sub-system (Fig. 4) presented in the following sub-sections.

Supply subsystem

Figure 3 shows the main variables, linkages and feedback loops that characterize the mechanisms influencing the supply of different types of food, mainly (a) UPFs from food vendors (e.g., prepared food from food chains and informal

food vendors); (b) UPFs from supermarkets and other retailers (e.g., canned and frozen food); and (c) fresh food products from urban agriculture.

Loops B1, B2, R1 and R2 represent the supply/demand dynamics for UPFs from food vendors and supermarkets. In each case, the balancing loops B1 and B2 suggest that when UPF supply from these sources increases, their price decreases, leading to increases in their demand, which has a balancing effect to their supply. At the same time, the reinforcing loops R2 and R1 showcase the reinforcing

Table 6 Main feedback loops identified in the Causal Loop Diagram

Mechanism	Variables	Loop
Pattern in the creation of UPFs taste preferences	Supermarket UPFs consumption (+) Saturated fats, sugar, and sodium overconsumption (+) Preference for UPFs taste (+)	R7
	Food vendors UPFs consumption (+) Saturated fats, sugar, and sodium overconsumption (+) Preference for UPFs taste (+)	R13
Effect of price changes on UPFs demand	Food vendors UPFs consumption (-) Food vendors UPFs availability (-) Food vendors UPFs price (-)	B1
	Supermarket UPFs consumption (-) Supermarket UPFs availability (-) Supermarket UPFs price (-)	B2
Effects of the increase in UPFs supply	Food vendors UPFs consumption (-) Food vendors UPFs availability (-) Food vendors UPFs price (-)	R1
	Supermarket UPFs consumption (-) Supermarket UPFs availability (-) Supermarket's UPFs supply (-) Supermarket UPFs price (-)	R2
Effect of urban agriculture on fresh products consumption	People involved in urban agriculture (+) Domestic agriculture supply (-) Fresh products price (-) HH Fresh products consumption (+) Fresh products total demand	R3
Effect of the shift from rural to urban agriculture	People involved in urban agriculture (+) Employment rates (+) Migration from rural areas (-) People involved in rural agriculture (+) Domestic agriculture supply (-) Fresh products price (-) HH Fresh products consumption (+) Fresh products total demand (+)	B3
Migration to urban areas based on prospective employment	People involved in urban agriculture (+) Employment rates (+) Migration from rural areas (+)	R5
Pattern in the globalization of eating habits	Globalized eating habits (+) New/foreign ingredients consumption (e.g. poultry, rice) (+) Traditional food consumption (e.g. tubers, fish) (+)	R12
Land availability constraints to urban agriculture expansion	People involved in urban agriculture (+) Employment rates (+) Migration from rural areas (+) Urbanization (-) Urban agriculture land availability (+)	B6
Interaction between urbanization and fresh products demand	People involved in urban agriculture (+) Employment rates (+) Migration from rural areas (+) Urbanization (+) Commuting distance (+) Time allocated for commuting (-) Time available for cooking and eating (-) Batch cooking (+) HH Fresh products consumption (+) Fresh products total demand (+)	R15
Interaction between food variety and UPFs consumption	Food vendors UPFs consumption (-) Food vendors UPFs availability (-) Food vendors (+) Employment rates (+) Migration from rural areas (+) Urbanization (+) Industry and services diversification (+) Variety of food options (+) Eating out of home (+)	R14
Effects of the increase of non-communicable diseases on UPFs consumption	Food vendors UPFs consumption (+) Saturated fats, sugar, and sodium overconsumption (+) Non-communicable diseases (+) Global awareness on nutrition importance (+) IOs and NGOs nutrition/health programs (+) Nutrition education policies/interventions (+) Nutrition impacts awareness (-)	B5
	Supermarket UPFs consumption (+) Saturated fats, sugar and sodium overconsumption (+) Non-communicable diseases (+) Global awareness on nutrition importance (+) IOs and NGOs nutrition/health programs (+) Nutrition education policies/interventions (+) Nutrition impacts awareness (-)	B7
Interaction between funds for nutrition programs and public cost of non-communicable diseases	Supermarket UPFs consumption (+) Saturated fats, sugar and sodium overconsumption (+) Non-communicable diseases (+) Hospitalizations (+) Pressure on public health system (+) Public health expenditure (-) Government nutrition/health programs (+) Nutrition education policies/interventions (+) Nutrition impacts awareness (-)	R9
	Food vendors UPFs consumption (+) Saturated fats, sugar and sodium overconsumption (+) Non-communicable diseases (+) Hospitalizations (+) Pressure on public health system (+) Public health expenditure (-) Government nutrition/health programs (+) Nutrition education policies/interventions (+) Nutrition impacts awareness (-)	R10

Table 6 (continued)

Mechanism	Variables	Loop
Effect of non-communicable diseases on food monitoring and control	Nutrition impacts awareness (+) Food quality monitoring and control (-) Non-communicable diseases (+) Global awareness on nutrition importance (+) IOs and NGOs nutrition/health programs (+) Nutrition education policies/interventions	B4
Effects of urbanization and supermarkets expansion on traditional food consumption	Globalized eating habits (+) Supermarkets prevalence (+) Employment rates (+) Migration from rural areas (+) Urbanization (+) Commuting distance (+) Time allocated for commuting (-) Time available for cooking and eating (-) New/foreign ingredients consumption (e.g., poultry, rice) (-) Traditional food consumption (e.g., tubers, fish) (-)	R6
Interaction between UPFs consumption and access to energy	Supermarket UPFs consumption (+) Saturated fats, sugar and sodium overconsumption(+)Preference for UPFs taste(+)Food vendors UPFs consumption(-)Food vendors UPFs availability(-)Food vendors(+)-Employment rates(+)-Migration from rural areas(+)-Urbanization(+)-Access to electricity(+)-Use of freezing and reheating appliances(+)	R11
Interaction between supermarkets expansion and UPFs consumption	Supermarket UPFs consumption (+) Saturated fats, sugar and sodium overconsumption (+) Preference for UPFs taste (+) Food vendors UPFs consumption (-) Food vendors UPFs availability (-) Food vendors (+) Employment rates (+) Migration from rural areas (+) Urbanization (+) Supermarkets prevalence (+) Supermarket's UPFs supply (-) Supermarket UPFs price (-)	R4
Interaction between UPFs consumption and urban growth	Supermarket UPFs consumption (+) Saturated fats, sugar and sodium overconsumption (+) Preference for UPFs taste (+) Food vendors UPFs consumption (-) Food vendors UPFs availability (-) Food vendors (+) Employment rates (+) Migration from rural areas (+) Urbanization (+) Commuting distance (+) Time allocated for commuting (-) Time available for cooking and eating (-)	R8
Interaction between urban agriculture and UPFs	Food vendors UPFs consumption (+) Fresh products total demand (+) People involved in urban agriculture (+) Employment rates (+) Migration from rural areas (+) Urbanization (+) Industry and services diversification (+) Interest in variate meal options (+) Eating out of home(+)	R16

effect that this has on a progressive increase over time in the UPF supply from supermarkets and food vendors, respectively.

When it comes to urban agriculture and fresh products, the loop R3 shows the potential progressive increase in the production of fresh products due to the effect of urban agriculture on food prices, while loop B3 shows the balancing effects that a decrease in fresh products supply from rural areas could have due to a shift to urban agriculture. Loop R5 depicts the progressive migration from rural to urban areas, which in many cases is based on prospective employment in urban agriculture. In this regard, while there is an increasing number of people who are interested in engaging in urban agriculture, land availability is a major constraint for the expansion of this sector (Loop B6).

Loops R4, R6, R8 and R16 display multiple shared connections between the supply and consumption subsystems. These loops reflect the reinforcing effect of urbanization processes on the decrease of traditional food

consumption, and the increase in the number of supermarkets and UPFs consumption. On the one hand, urbanization has increased commuting distances for a large number of urban residents, which has in turn reduced time for cooking and increased the need for food that can be prepared easily (e.g., rice), causing a decline in the consumption of traditional food types (e.g., tubers) (Loop R6). At the same time, urbanization has led to the expansion of the retail sector, which has introduced a large variety of UPFs with high contents in saturated fats, sugar, and sodium. This has led to an increased demand of these types of food served by food vendors and supermarkets, which contributes to the profitability and vibrancy of these sectors, which reinforces urbanization as they are a major driver of employment provision (Loops R4 and R8).

This subsystem also shows the impacts of food supply, which mainly relates to the use of chemical inputs to enhance productivity, which could cause water pollution and have effects on consumers through food safety. On

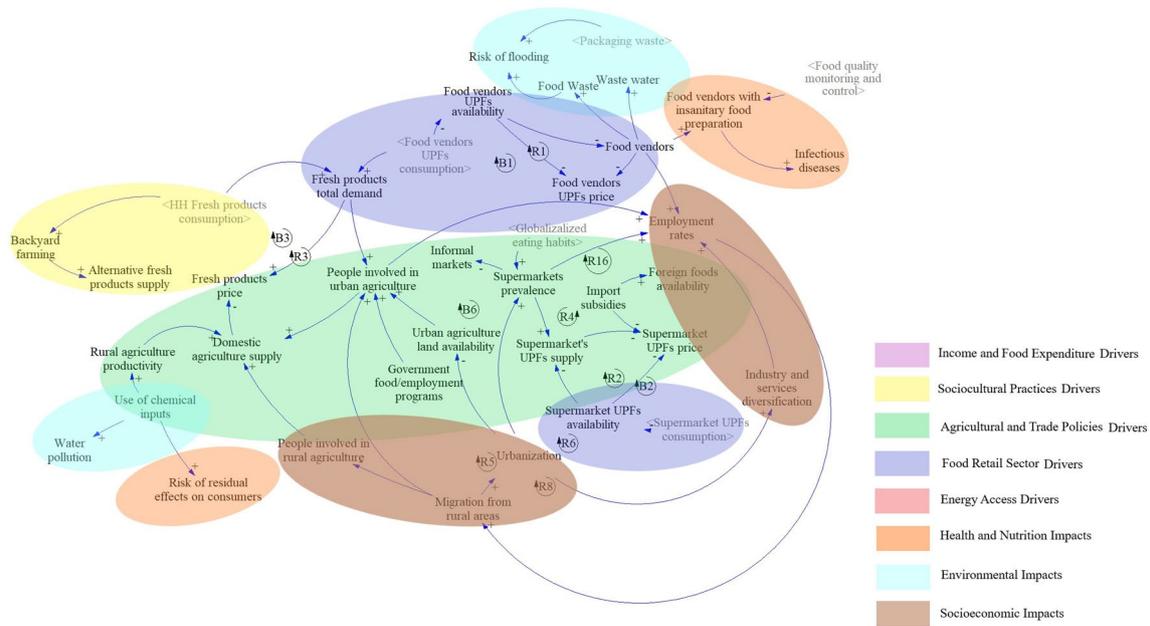


Fig. 3 Causal loop diagram for the food supply subsystem

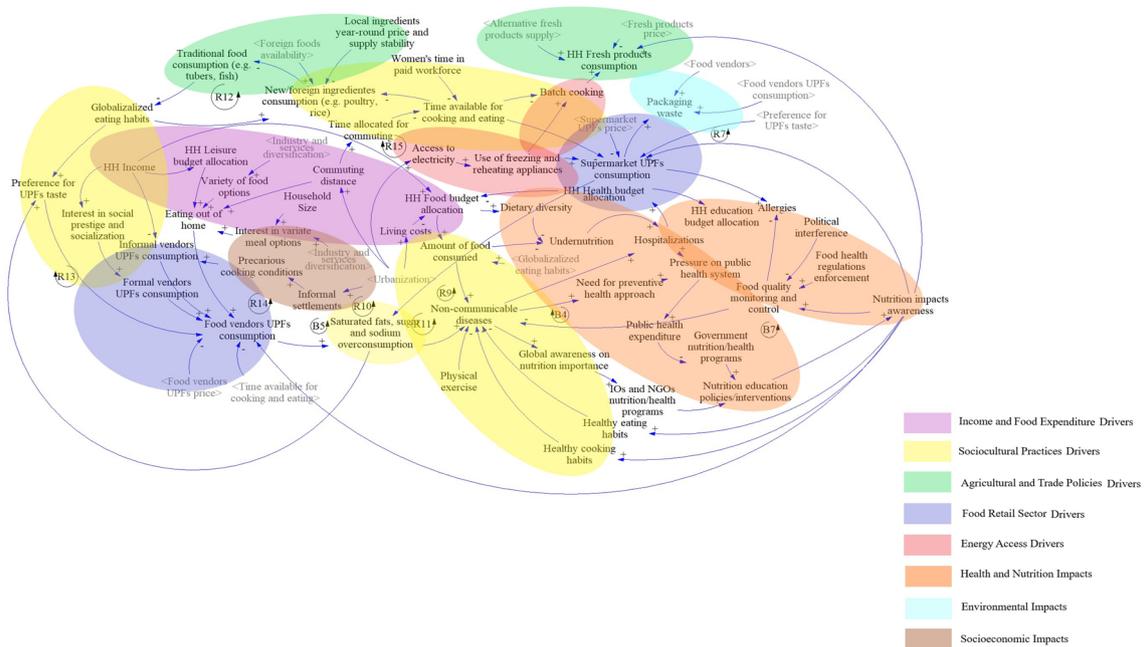


Fig. 4 Causal loop diagram for the food consumption subsystem

the other side, impacts linked to the supply of UPFs from vendors and supermarkets related to increases in food and packaging waste, which could also lead to increased risks in urban flooding from clogging waterways, and increases in infectious diseases due to unsanitary food preparation practices.

Consumption subsystem

The consumption subsystem depicts the variables, relations and feedback loops related to the mechanisms influencing the dietary choices across the food types outlined in the previous sub-section, namely (a) UPFs from food vendors; (b)

UPFs from supermarkets; and (c) fresh food products from urban agriculture.

Loops B5 and B7 show the balancing effects that the increases in the prevalence of non-communicable diseases could have, through increases in awareness, leading to the implementation of more programs and policies focused on nutrition and health education. Similarly, loop B4 displays a similar effect on the implementation of more food monitoring activities, as a response to increases in the prevalence of non-communicable diseases. On the other side, loops R9 and R10 depict the potential negative reinforcing effect of the increase in the prevalence of non-communicable diseases on public health expenditure. Such increases in public health expenditure could compete for budget allocation with prevention programs (e.g., increasing nutrition awareness), leading to the proliferation of non-communicable diseases.

Urbanization can have a reinforcing effect on UPFs consumption, through the expansion in the number of food vendors (Loop R14), and increased access to electricity for cooking and food storage (Loop R11). However, there is a similar effect linked to the increase of fresh food demand through batch cooking due to the limited time that could be allocated for cooking (Loop R15).

Discussion

Synthesis of main findings

The results outlined in the Results show that diet change in Accra is a multi-dimensional phenomenon that is mediated by very diverse processes. In terms of its characteristics, diet change is characterised by the increased consumption of some foodstuff such as rice, chicken, fish, vegetable oil, sugar, and UPFs, and the decreased consumption of traditional foodstuff such as roots, tubers, and some cereals such as millet (Sect. 4.1). Several other studies in other urban contexts of SSA have identified this type of diet change away from traditional foodstuff, towards diets higher in protein and processed food (Baker et al., 2020; Khonje and Qaim 2019; Smart et al. 2020; Cockx et al. 2018; Holdsworth et al. 2020; Rousham et al. 2020; Auma et al. 2019).

When it comes to the drivers of diet change our results confirm findings from other SSA urban contexts. In particular we see that practically all of the Tier II drivers outlined in Table 4 have been observed or theorised to different extents in other parts of SSA: (a) income and food expenditure (Bai et al. 2020; Bosu 2015; Cockx et al. 2018; Annan et al. 2018; Harris et al. 2019), (b) sociocultural practices (Boatema et al. 2018; Annan et al. 2018; Chakona and Shackleton 2019), (c) agricultural and trade policies, and standards (Thow et al. 2014; Annan et al.

2018), (d) prevalence of food vendors and supermarkets (Demmler et al. 2017, 2018; Khonje and Qaim 2019; Reardon et al. 2021), and (e) energy access (Makungwa et al. 2013; Sola et al. 2016).

Our results confirm that the main impacts of diet change fall under the three broad dimensions of (a) health and nutrition impacts, (b) environmental impacts, and (c) socioeconomic impacts. These dimensions reflect well the impact dimensions of diet change as identified in the broader literature (e.g., Aldaya et al. 2021). For example, some of the specific socioeconomic impacts of diet change in Accra (Table 5) have been also identified in other parts of SSA such as income from engagement in food vending and retailing (though not always high) (Kazembe and Crush 2019; Hill et al. 2019; Tawodzera 2019), and income from engagement in urban agriculture (Lee-Smith 2010; Hamilton et al. 2014; Frayne et al. 2016). Some of the individual environmental and health/nutrition impacts identified in Accra that have been observed in other parts of SSA include waste generation from packaging (Chakori et al. 2021), and obesity and health problems through non-communicable diseases especially via increased consumption of UPFs (Holmes et al. 2018; Popkin et al. 2020; Baker et al. 2020; Reardon et al. 2021; Ofori-Asenso et al. 2016).

The references above suggest an already growing literature at the interface of urbanisation and diet changes in SSA in terms of its characteristics, drivers, and impacts. However, our study has moved beyond this literature to create a comprehensive landscape of how these dimensions of diet change intersect (Fig. 2). Rather than discuss the connections of all individual drivers and impacts we unpack in the following sub-sections only some of the most critical intersections for diet change in Accra as alluded to by the respondents.

Centrality of ultra-processed foods in urban diet changes

Urbanization processes in Accra have catalyzed various linkages and reinforcing feedback mechanisms that progressively lead to increasing UPFs availability (in supermarkets, restaurants and food vendors) and consumption (inside and outside the home) (see feedback loops R4, R8 and R14 in Table 6; Figs. 3, 4). This has major impacts on health and livelihoods (see feedback loops R9 and R10 in Table 6; Fig. 3).

On one hand, the feedback loop R8 suggests that urban expansion causes larger commuting distances for many urban residents, reducing the available time for cooking and eating, and causing a growing preference for easy home-cooking or on-the-go meals. This essentially creates the pre-conditions for increased UPF consumption inside and outside of home, and unhealthy eating and cooking habits

(e.g., eating late at night), which may lead eventually to an increased risk of non-communicable diseases. This linkage between urban form, lifestyle, and diet change has been identified in some urban contexts of SSA and elsewhere (Tiuganji et al. 2020; Bren d'Amour et al. 2020; Khonje and Qaim 2019).

On the other hand, the feedback loop R4 suggests that the continuous migration to Accra from other parts of Ghana has resulted in a large number of people finding employment in the informal food sector, as a means of sustaining their livelihoods. It is rather common for rural migrants to find employment in the informal food sector considering the low required skillset, lack of employment and the often established networks between rural migrants and food vendors (Frayne et al. 2016; Resnick et al. 2019). As this informal food sector increasingly relies on UPFs (see R13) rather than healthier food options (see below), and with more opportunities for employment due to the ongoing diet change, there might be a reinforcing effect on urbanization.

Another mechanism relates to food consumption but moves beyond the convenience aspect. In particular, some of the observed connections in the consumption subsystem (Fig. 3) suggest that the observed income increases for some social groups, which translates into increases in family budget allocation for leisure and socialization. This, combined with the higher available variety of food options due to a vibrant city life, has resulted in the increased consumption of certain food types, including UPFs (loop R14). This link between higher disposable income, leisure and diet change has been identified in other studies in SSA cities (Smart et al. 2020; Boafo et al. 2021).

In this context, the accelerated urbanisation through employment in cities (incl. in urban food systems) has played a vital role in the shift from farm employment and the emergence of a middle-income class in many SSA cities, which has had a subsequent effect on dietary preferences and change (Eledi and Kuusaana 2014; Cockx et al. 2018; Battersby and Watson 2018; May 2018).

Emergence of supermarkets as key nodes in urban foodscapes

The urbanization process in Accra has intersected strongly with the expansion of the food retail sector, and especially supermarkets. Supermarkets have emerged as central nodes of Accra's foodscape, becoming major sources for the supply for foodstuff associated with the observed diet change, including a great variety of UPFs. As the demand for this type of food increases, supermarkets have the capacity to increase their supply at convenient prices, aided also by subsidies and other trade liberalization policies (see Fig. 3; loops R2 and R4 in Table 6). Although supermarkets can also cater for healthier food options (e.g., fresh fruits and

vegetables), the interviewees suggested that this is generally much less prevalent compared to the provision of unhealthy food options such as UPFs.

This reflects various empirical studies and reviews that have shown how supermarkets can be linked to diet change in SSA cities and different health outcomes (Kimenju et al. 2015; Andam et al. 2018; Reardon et al. 2021). For example supermarkets have been linked to the increased consumption of unhealthy food (Rischke et al. 2015; Khonje and Qaim 2019), and have increased food choices, with a subsequent correlation between food purchases from supermarkets and body mass index (Dubowitz et al. 2015; Demmler et al. 2017, 2018). Similarly studies have shown how the supermarket sector has benefited from policies conducive for FDI which has led to the flooding of the domestic market with cheap food such as frozen chicken and UPFs (Andam et al. 2018).

Balancing role of urban agriculture

Urban agriculture seems to play a balancing role for urban diet changes in Accra. While the consumption of fresh products from urban farms would seem to be threatened by urbanization, which favors UPFs consumption as discussed in Sect. 5.2, there is evidence that certain urban lifestyles also increase the demand for fresh produce from the urban agriculture sector.

On one side, according to loop R16 (Table 6; Fig. 3) many of the food vendors preparing UPFs also tend to use and sell fresh vegetables to some extent, increasing the demand for urban agriculture products. This reflects studies showing that such urban food production systems can have ripple effects as a commercial activity in SSA cities, supplying local restaurants and food vendors (Giroux et al. 2020; Ambikapathi et al. 2020).

On the other side, according to loop R15 (Table 6; Fig. 3) the reduced available time for cooking and eating due to the hectic city lifestyle also influences many families to engage in batch cooking during weekends, using to some extent fresh products, instead of consuming UPFs. Furthermore, some high-income households tend to prefer fresh produce from urban farms, as they have the means to acquire them (Table S2, Supplementary Material). The above reflects multiple studies across SSA pointing to the critical role of urban agriculture for changing urban diets and enhancing urban food security (Smart et al. 2020; Lee-Smith 2010; Hamilton et al. 2014; Frayne et al. 2016).

However, according to some respondents an important constraint preventing urban agriculture to facilitate positive diet changes on a large scale is the declining availability of urban and peri-urban land for agriculture. As shown in loop B6, this land scarcity can act as a balancing

effect in this process (Table 6). Such points have been made for many other SSA cities, including in Ghana (Eledi and Kuusaana 2014; Davies et al. 2020).

Underappreciated role of energy access

Urbanization in Accra improved energy access for many households, which in turn allowed the use of appliances for food storage (e.g., fridges) and fast cooking and reheating (e.g., electric stoves and microwaves over traditional fuel-wood/charcoal stoves). This, combined with the time constraints for cooking and eating considering the hectic life of some households as discussed above, can affect diet change in various ways. On one hand, it can favor the consumption of UPFs such as canned/frozen food and ready-made meals, which is seen as an easy option for quick meals at home after work (see loop R11 in Table 6 and Fig. 3). On the other hand, as mentioned in the previous section, it provides the option to engage in batch cooking to avoid these types of UPFs and consume more fresh products (See Fig. 4). It is interesting to point out here that changes in energy access can have two very different outcomes, one favouring unhealthy diet change (i.e., increased consumption of UPFs) and the other a healthy diet change (i.e., increased consumption of fresh products). While both are currently visible in Accra, several of the respondents alluded that the former is currently more prevalent.

Such possible links between shifts in cooking fuel and diet change have been theorised in other urban contexts of SSA (Makungwa et al. 2013; Sola et al. 2016). However, a systematic review linking diet preferences/change and cooking fuel in SSA found limited empirical data to support this, although the underlying hypothesis has existed since the 1980s (Sola et al. 2016).

Implications and recommendations for policy and practice

The reinforcing and balancing loops at the interface of diet change and urbanisation in Accra (see Figs. 2, 3, 4, Table 6) are particularly relevant for policy and practice, as they can indicate priority areas for preventing/reducing negative diet changes (and associated impacts) or promoting positive ones. As discussed below some of the more promising loops for the former include R1, R2, R11 and B6; and for the latter R3, B4, and R15.

Firstly, the increased consumption of UPFs and the associated health impacts (see “[Centrality of ultra-processed foods in urban diet changes](#)”) suggest that the government and other stakeholders in the food sector should create comprehensive policies to increase both the awareness/education for healthy diets (Loop B4), as well as their availability and affordability (Loop R1) (Holdsworth et al. 2020). At the

same time informal food vendors should be regulated better to ensure proper hygiene, as well as provide incentives that can boost the consumption of healthier food items (e.g., refrigeration to include healthier food items in menus).

Secondly, with the proliferation of supermarkets (see “[Emergence of supermarkets as key nodes in urban foodscapes](#)”), there should be efforts to monitor better these outlets to ensure the consumption of safe and healthy food (Loop R2). This can include increasing taxes on (and regulating the importation of) unhealthy food items (Laar et al. 2020). Similarly, economic incentives could be offered to increase the stocks of domestically produced food items, including from urban agriculture (Loop R3) (see below).

Thirdly, as our results suggest, urban agriculture could shape more sustainable diet changes (see “[Balancing role of urban agriculture](#)”). However, currently there are limited comprehensive policies for urban agriculture, with urban farmers often facing land eviction (Puppim de Oliveira and Ahmed 2021). The results point to the need for nationally coordinated efforts to improve land use governance and planning, including appropriate zoning and protection of land for urban and peri-urban agriculture (Loop B6). Furthermore, as land is primarily owned customarily in Ghana, appropriate economic incentives to landowners can improve the perception of urban agriculture as an attractive and financially rewarding option (Loop R15) (Puppim de Oliveira and Ahmed 2021).

Finally, the increasingly strong relationship between energy access and dietary choices (see “[Underappreciated role of energy access](#)”) suggests that national policies should increasingly seek to have an integrated planning approach to energy and food systems. Integrating such policies at the planning stage can help improve synergies and reduce trade-offs at the household level (Loop R11) (Sola et al. 2016). Integrative frameworks such as the “[food-energy-water-health nexus](#)” can be mobilised to frame the design of such policies.

Limitations and future research

Despite its comprehensive focus our study has some limitations. First, the selection of the participants might have affected the information offered and thus introduce bias in the CLD, as has been discussed in other similar studies in urban contexts (Friel et al. 2017; Langellier et al. 2019). To avoid such biases we sought to include stakeholders from very different types of organisations, and triangulated to the extent possible the findings with multiple studies at the interface of diet change and urbanisation in other SSA contexts, including Ghana and Accra in particular.

Second, it was not possible to involve actual consumers in this study due to (a) their very diverse characteristics that makes the development of representative focus groups

problematic, and (b) health-related concerns as this research was mostly conducted during the early stages of the COVID-19 pandemic. To compensate for this we selected stakeholders that have extensive knowledge of consumer-related issues. For the same reason, it was not possible to undertake a CLD validation workshop (Setianto et al. 2014; Smetschka and Gaube 2020). Instead we verified the linkages through the very comprehensive mapping and iterative revision of the variables and their linkages (see “Data collection and analysis”) and the comparison of the main findings with the literature (see previous sections of “Discussion”).

Third, although we believe that the phenomena and linkages have been captured in a robust manner, we cannot assess their relative importance (Lane 2008; Featherston and Doolan 2012; Friel et al. 2017). For example, certain feedback loops might have a stronger effect on diet change than others. In this sense while we can identify some priority areas for interventions as discussed above, we cannot conclude which is the most promising, and what should be the appropriate interventions to achieve this. In this sense our study is exploratory in nature, as it has sought to capture through a wide lens all relevant dimensions of diet change in the context of urbanisation in Accra. Future studies should aim to populate the developed model with primary and secondary information, and explore different scenarios for possible interventions. This process could be facilitated through transdisciplinary approaches to both design the scenarios, as well as identify the most desirable ones to prevent/reduce negative diet changes (and associated impacts) or promote positive ones (Schwaninger et al. 2008; Smetschka and Gaube 2020; Sun et al. 2021).

Conclusion

This study offers a multi-dimensional understanding of the different dimensions at the interface of diet change and urbanisation in SSA cities. By eliciting the perspectives of multiple stakeholders, we developed CLDs to systematise the information about the characteristics, drivers and impacts of diet changes in Accra, and the mechanisms and processes underpinning them. Some of the more important intersections we identified are (a) the centrality of UPFs in the observed urban diet changes, (b) the emergence of supermarkets as central nodes in Accra’s foodscape, (c) the balancing role of urban agriculture, and (d) the underappreciated role of changes in energy access.

The CLDs provide a comprehensive, yet qualitative, landscape of the main processes related to urban diet change that can enrich our understanding and help identify appropriate priority areas for interventions that could enable healthy and sustainable urban diet transitions. They also aptly reveal the

need for understanding the very diverse social, economic, environmental and political processes shaping urban diet change (as well as the impact pathways) to identify effective interventions.

The development of such interventions will most certainly require multi-stakeholder consultations. Toward this end, future studies should seek to populate models similar to the one developed in this study with primary and secondary data to obtain a quantitative understanding of the most important mechanisms and promising areas for interventions. Such transdisciplinary exercises could explore different intervention scenarios that could enable healthy and sustainable urban diet changes.

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