



## Conference on ‘Multi-stakeholder nutrition actions in Africa: Translating evidence into policies, and programmes for impact’

### Urban food environments in Africa: implications for policy and research

Michelle Holdsworth<sup>1\*</sup> and Edwige Landais<sup>2</sup>

<sup>1</sup>Public Health Section, School of Health and Related Research-ScHARR, University of Sheffield, Sheffield, UK

<sup>2</sup>IRD (French National Research Institute for Sustainable Development), NUTRIPASS Unit, Université de Montpellier, IRD, Montpellier SupAgro, Montpellier, France

Africa is currently experiencing rapid urbanisation impacting on people’s food environments and dietary habits. Such changes are associated with higher prevalence of obesity coexisting with undernutrition. The present paper provides an overview of the healthiness of African urban food environments. We discuss the ways that food environments can be characterised and summarise the methods that can be used to investigate and intervene in the food environment. Data for Africa over a 50-year period (1961–2013) suggest an increasing availability of energy, animal products, fruit and vegetables, vegetable oils, sugar and sweeteners but a decrease in animal fats. There is a lack of evidence about how social, physical and macro-environments drive dietary habits in urban Africa, as most research has focused on the individual level. Examining how food consumption is embedded in everyday life, by investigating social environments is crucial to developing effective interventions. The informal food sector plays an important role in the retail food environment. Macro-level food price changes are an important factor influencing nutritional quality of African diets. The rapid expansion of food/beverages advertising in Africa threatens traditional food habits. Liberalisation of food trade is already impacting on the nutritional quality of food available. Improving African food environments represents a pressing public health concern and has the potential to prevent all forms of malnutrition. Hence, by conducting research into the role of urban social, physical and macro-environments, emerging interventions and policies are likely to positively impact on nutritional status, thereby enhancing social and economic development.

**Africa: Food environments: Social: Urban: Cities: Research: Policy: Interventions**

#### Evidence for changing food environments in Africa

Africa is currently experiencing rapid demographic change, partly driven by increasing migration of individuals to cities. As a consequence, people’s food environments and dietary habits are also changing, leading to nutrition transition, which results in a modification in food patterns from famine to affluent diets that are associated with increasing levels of obesity and nutrition-related non-communicable diseases coexisting with undernutrition<sup>(1,2)</sup>. This double burden of malnutrition represents a pressing public health concern and healthy food environments have the potential to prevent multiple

forms of malnutrition by targeting shared drivers<sup>(3)</sup>. The dietary changes arising from this transition are likely to be both qualitative and quantitative, encompassing shifts in the structure of the diet towards a higher intake of energy-dense foods (especially from fat and added sugars), a higher consumption of processed foods<sup>(4)</sup> animal source foods, sugar and saturated fats, and a lower intake of complex carbohydrates, dietary fibres, fruit and vegetables<sup>(5)</sup>. These changes are also expected to include shifts in meal patterns towards a higher number of meals eaten out-of-home. Besides urbanisation, these dietary changes are driven by economic development, increased access to food markets selling energy-dense

\*Corresponding author: Michelle Holdsworth, email [michelle.holdsworth@sheffield.ac.uk](mailto:michelle.holdsworth@sheffield.ac.uk)

processed foods at low prices and a decreased price of certain foods such as vegetable oils<sup>(6,7)</sup>.

In Africa, there is a lack of published longitudinal food consumption data to illustrate the dietary changes reported in other contexts. Repeated dietary consumption data are available for South Africa, from the Transition and Health during Urbanization in South Africa study<sup>(8)</sup> and from the Adult Prospective Urban and Rural Epidemiology cohort study<sup>(9)</sup>. In urban areas, during 1996–2005, energy from carbohydrates decreased whilst energy from fats increased<sup>(10)</sup>. Subsequently over the period 2005–2010 there was an overall increase in energy intake, as well as an increase in the percentage of energy from animal fats and added sugars<sup>(9,11)</sup>. In the Northern African region, Egypt conducted two National Food Consumption Surveys (1981 and 1998) reporting a substantial increase in meals eaten out-of-home (from 20.4 to 45.8 %)<sup>(12)</sup>.

The present paper explores how changing diets and nutrition transition are impacting on people's lived food environments in urban Africa. We discuss the different ways that food environments can be characterised from different disciplinary perspectives and summarise the methods that can be used to investigate different levels of the food environment. We summarise evidence for the healthiness of urban food environments in Africa, in which we include the social, physical and macro-environments. Finally, we discuss the implications of unhealthy food environments for interventions, policies and research in Africa.

### Characterising food environments

There are overlapping ways of framing the food environment, with some disciplines taking a socio-ecological approach, such as Swinburn *et al.*<sup>(13)</sup>, defining food environments as: Collective physical, economic, policy and sociocultural surroundings, opportunities and conditions that influence people's food and beverage choices. Agri-food disciplinary perspectives tend to focus more on the individual's relation with the physical food environment and broader food system, defining food environments as: The interface that mediates one's food acquisition and consumption with the wider food system. It encompasses multiple dimensions such as the availability, accessibility, affordability, desirability, convenience, marketing, and properties of food sources and products<sup>(14)</sup>. The models associated with a food system approach include most of the same factors that are found in the individual, physical and macro-levels of socio-ecological models, but they tend to minimise or exclude the role of the social food environment on people's dietary behaviours<sup>(14,15)</sup>.

A range of models and frameworks have been developed in order to understand why people eat what they do and the role of food environments in these varies. Understanding what factors drive food consumption is important because they influence the nutritional quality of the diets people purchase, cook and consume. Hence

a range of disciplinary perspectives are required, including agriculture, anthropology, behavioural science, economics, geography, nutrition, psychology, public health and sociology<sup>(16)</sup>.

Dietary behaviour frameworks that come from a public health perspective tend to use a socio-ecological approach, which has a long history in health promotion<sup>(16,17)</sup>. They encompass the importance of social inequalities in health and the need to acknowledge the crucial role of wider contextual socio-economic factors and sex<sup>(18,19)</sup>. They acknowledge the complexity of health behaviours and aim to disentangle the way people's lives are connected with their environments at multiple levels<sup>(17,18)</sup>. These frameworks draw on Dahlgren–Whitehead's 'rainbow model'<sup>(19)</sup>, which mapped the relationship between the individual, their environment and health, placing individuals at the centre, surrounded by levels of influence: lifestyle, social and community networks, living and working conditions, and general socio-economic, cultural and environmental conditions.

All socio-ecological dietary behaviour frameworks are based on a similar structure, usually including four levels. The example we detail here (Fig. 1) summarises the evidence of factors influencing dietary behaviours from the African context<sup>(20)</sup>. At the individual level, personal factors are included that can impact on food consumption through cognitive factors (motivation, self-efficacy and skills/competencies)<sup>(17)</sup>. Three environmental levels are then proposed to influence dietary behaviours at the social, physical and macro-level. The social environment encompasses social interactions with friends, families, neighbours and others. Story postulates that this influences dietary behaviours through role modelling, social norms and social support. The physical food environment captures the settings where people may produce/purchase/acquire food, cook and eat/drink, such as the local neighbourhood or home, or where people work. These physical settings influence the accessibility and availability of healthy and unhealthy foods. Macro-level environmental factors (such as marketing and advertising policy, food prices, trade) have an important influence on dietary behaviours, but there is less published evidence for them in Africa than the other levels<sup>(20)</sup>, probably because they are more distal, making them harder to investigate.

Socio-ecological approaches postulate that factors in these four levels all interact in different ways to then influence dietary behaviours. This is similar in many ways to a systems approach<sup>(21)</sup>, which has also been proposed in public health to summarise the inter-relation of different factors influencing dietary behaviours<sup>(22,23)</sup> and physical activity behaviours<sup>(24,25)</sup> because it acknowledges that factors within the levels are not static, but that there are connections between clusters within a dynamic system<sup>(26)</sup>. Systems approaches can be useful for improving public health because even though some shifts in behaviours only have a small impact on individuals, when combined they have the potential to stimulate population changes<sup>(27)</sup>. There is a lack of evidence about the causal pathways through which different factors influence dietary behaviours in Africa<sup>(20)</sup> and

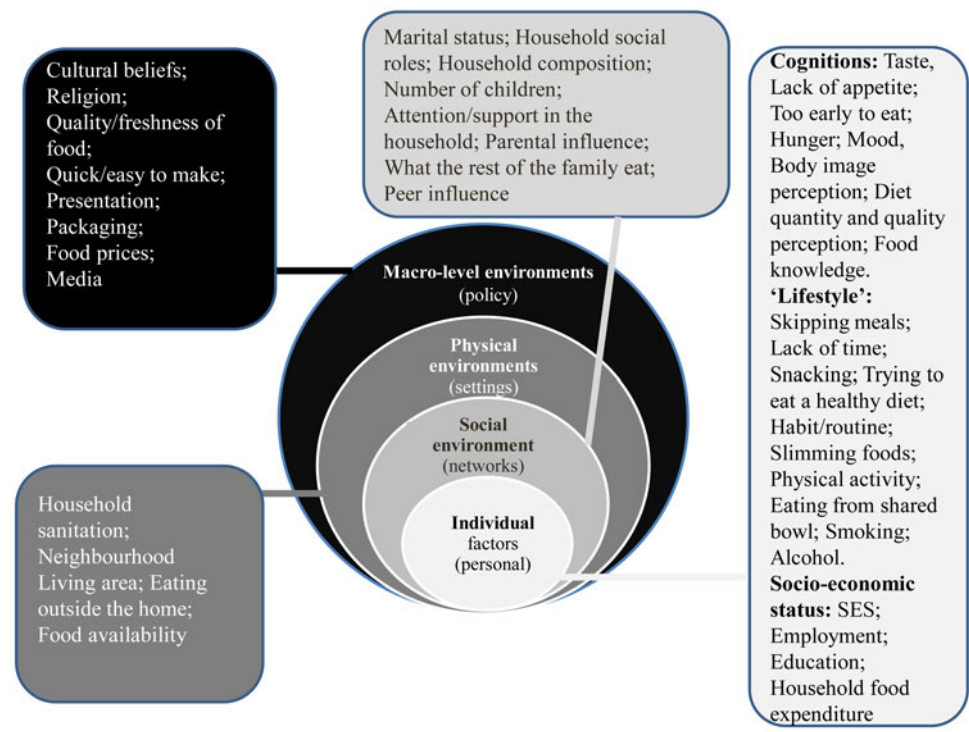


Fig. 1. (Colour online) Factors influencing dietary behaviours in Africa (evidence from urban studies of women; adapted from Gissing *et al.*)<sup>(20)</sup>.

globally<sup>(17)</sup>, which makes the production of a systems map challenging<sup>(22,24)</sup>. Data science may offer the opportunity to provide the much needed evidence for a systems approach by leveraging big data, which if combined with traditional data could shed light on the wider determinants of dietary behaviours across multiple levels<sup>(28)</sup>.

### Social food environments

Examining how food consumption is embedded in everyday life in Africa, by investigating what factors drive consumption in social environments is crucial to developing effective interventions that account for these. Dietary habits are structured and organised in social practices<sup>(29)</sup>, such as when/where food and beverages are eaten, how quickly and with whom, so they have an important influence on food decisions. Within the social food environment, we can include the role of family, friends, peers and role models on dietary behaviours, as well as the social support that individuals receive for their dietary choices and the social norms in their social networks that inform expectations.

There is a lack of evidence about how social environments drive dietary habits in African cities, as most research has focused on individual-level drivers<sup>(20)</sup>. Studies from outside Africa<sup>(30,31)</sup> suggest that mirroring dietary practices as a way of pleasing others or signalling identity and norms are important drivers of food choice. One study in South Africa found that ‘what the rest of my family will eat’ was an important influence on food

choice<sup>(32)</sup>. Other evidence from Africa found that marital status and women’s household social status influenced the nutritional quality of diets, fattening practices or snacking habits during food preparation<sup>(20)</sup>. Indeed, sex has been linked to food choice in many societies. The social environment seems to be particularly important for adolescents, including sharing food with family and mirroring of friends’ dietary behaviour.

Body size norms in Africa are a potentially important factor driving eating habits, particularly for women, with a preference for overweight observed in some African countries, associated with social status and economic success. One mixed methods study that encompassed urban Senegal (Dakar) conducted qualitative interviews and a quantitative survey of adults, and reported that overweight was socially valued and seen as a symbol of wealth and integration into the city for those that had migrated from rural Senegal<sup>(33)</sup>.

### Physical food environment

The physical environments that may influence dietary intake includes different settings where people eat or buy foods<sup>(17)</sup>. These settings include home, work, schools, retail food stores and eating out food outlets. In most studies, the physical environment is characterised using geographic measures (e.g. proximity, density, variety) using geospatial data (e.g. Geographical Information System, distance measurements).<sup>(34–39)</sup> Most such studies have been conducted in high-income countries<sup>(36,38,39)</sup>, with a

few in African cities (mainly in South Africa), where they have focused on the school, retail and eating out-of-home environments.

#### *School environment*

School environments have the potential to influence children's diets in a number of ways, from foods served in/near schools, food sold in tuckshops and the hidden curriculum of how foods and advertising can pervade classroom teaching. A study conducted in ninety South African primary schools located in poor settings reported that fruit was on the menu of only 28 % of schools and was served in only 4 % on the day of the survey<sup>(40)</sup>. The same study reported that most food vendors based within/outside schools sold unhealthy foods, such as chips, sweets or biscuits and that only 19 % of schools had a policy about foods sold in schools<sup>(40)</sup>. Other studies in urban South African primary schools<sup>(41,42)</sup> concluded that poor food purchasing practices may contribute to childhood overweight/obesity, as pupils who purchased food items from school tuckshops had a higher BMI compared with those who did not. Amongst adolescent South Africans living in Soweto, the majority (85 %) purchased food from school vendors and about two-thirds of these were unhealthy (sweets, sweetened beverages, crisps, fried chips and white bread)<sup>(43)</sup>.

#### *Retail food environment*

In Africa, the informal food sector plays an important role in the retail food environment. However, most studies have focused on the impact of supermarkets on dietary behaviours. In sub-Saharan Africa, the first supermarkets were established in Southern and Eastern Africa in the early 1990s<sup>(44)</sup>, particularly in South Africa and Kenya<sup>(45)</sup>. In the Southern African region, the growth in supermarket share of retail sales has increased rapidly from 10 to 50–60 % between the 1990s to mid-2000s<sup>(44)</sup>. In Western Africa, the development of supermarkets only began in the 2000s. In most sub-Saharan African countries, the supermarket share of retail is still relatively low, but it is increasing. When supermarkets are first established, the main foods sold tend to be dry, processed and packaged foods; but with time fresh products are sold (e.g. meat, fruit or vegetables)<sup>(45)</sup>.

In African cities, supermarkets establish first in high-income neighbourhoods followed by lower income areas, enabling access to supermarkets to poor urban households<sup>(46)</sup>. However, a survey conducted in Cape Town, South Africa, reported that supermarkets in low-income neighbourhoods sold less healthy foods, potentially impacting negatively on diets of the urban poor<sup>(47)</sup>. A study conducted in three Kenyan towns amongst adults reported that individuals purchasing foods in supermarkets had significantly higher BMI compared with those who did not<sup>(48)</sup>. The same study also reported that individuals who purchased foods in supermarkets consumed more energy, and had higher intakes of energy from processed meat, highly processed foods, dairy and vegetable oils<sup>(49–51)</sup>. Contrary to this, a study in North Africa (Tunis) reported that individuals doing

most of their food shopping at supermarkets had a significantly (albeit small) higher overall diet quality<sup>(52,53)</sup>. In West Africa, a study conducted in three poor neighbourhoods of Accra, Ghana inventoried three different sales points of foods using global positioning system<sup>(54)</sup>. The study reported that out-of-home cooked foods sales points (that mainly sell rice-based dishes and local staple foods) outnumbered other kind of sales points, i.e. convenience stores (that mainly sell processed and pre-packaged foods) or fruit and/or vegetables sales points, which were the least common.

#### *Eating out-of-home environment*

A study conducted in 2009–2010 amongst Moroccan women of childbearing age living in the urban area of Rabat-Salé reported that women who ate out-of-home more frequently ate significantly less vegetables<sup>(55)</sup>. However, no distinction was made for the venue or type of food outlet. In Benin, street food was an important source of energy, providing 39 % of total daily energy intake of adolescents in the capital city, where it was also associated with lower fruit and vegetable intake<sup>(56)</sup>. A study in three poor areas of Accra reported that each additional out-of-home cooked foods sales points was associated with a significant decrease in individuals' BMI<sup>(54)</sup>.

### **Macro-food environment**

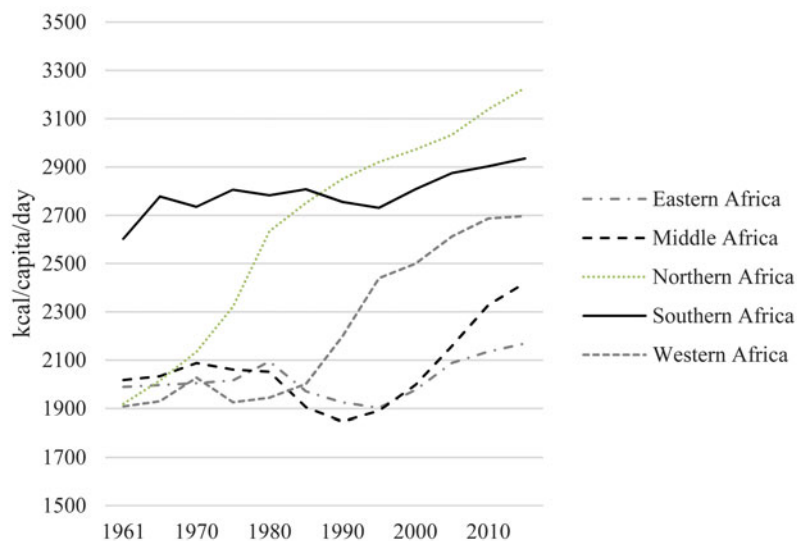
Macro-level environmental factors have an important influence on dietary behaviours. They include a wide range of factors (Fig. 1), some of which make up the 'food system' (food supply/production, food storage, transportation, food prices, food trade, food processing/transformation and food retailing) and the policies that shape them, including food and agriculture policies, economic and trade policy, political structures, food assistance, health and social support policy and marketing/advertising policy. Here we focus on evidence for some of these.

#### *Food supply*

Food supply data reflect the food available on a macro-environmental level. Food balance sheets from the FAO are a useful means to describe trends in food availability for human consumption as a gross proxy of food consumption. We divided Africa into the five FAO regions (Fig. 2). Food supply trends were analysed using food balance sheet data from 1961 to 2013 for energy supply and for foods that would be expected to shift over time, given evidence in other continents experiencing nutrition transition<sup>(57)</sup>. For the African region, data suggest an increasing availability of energy, animal products (but the picture is complex), fruit and vegetables, vegetable oils, sugar and sweeteners but a decrease in availability of animal fats. There were inconsistent changes in cereal/pulses and alcohol availability across Africa.

Energy (kJ (kcal)) availability increased in all five African regions (Fig. 2). The biggest increase was





**Eastern Africa:** Djibouti, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Uganda, United Republic of Tanzania, Zambia, Zimbabwe

**Middle Africa:** Angola, Cameroon, Central African Republic, Chad, Congo, Gabon, Sao Tome and Principe

**Northern Africa:** Algeria, Egypt, Morocco, Sudan, Tunisia

**Southern Africa:** Botswana, Lesotho, Namibia, South Africa, Eswatini (former Swaziland)

**Western Africa:** Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo

**Fig. 2.** Energy supply trends in African regions, 1961–2013, from FAO, 2017.

observed in Northern Africa, where it increased by almost 40 %, from 8033.3 (1920) to 13506 kJ (3228 kcal)/capita per d. For Western Africa, energy supply was quite stable until the mid-eighties but has since increased rapidly to 11284.2 kJ (2697 kcal)/capita per d. The same pattern was observed in Middle and Eastern Africa, but beginning later. Energy supply trends in Southern Africa were different as even though energy supply increased over time in this region, it was already high in 1961 (10891 kJ (2603 kcal)/capita per d) and has not increased subsequently as much as the other African regions.

As has been described in high-income countries, supply of animal products has increased across Africa (meat, eggs, milk and dairy products, fish and seafood) (Fig. 3). Meat supply increased in Southern, Northern and Middle Africa, whilst it remained stable in Western and Eastern Africa (Fig. 3a). In Southern Africa, the increase and level of supply was highest, i.e. in 2013, it was more than twice the level for Northern and Middle Africa and almost three times that of Eastern and Western Africa. Eggs availability increased over the same period in Southern, Northern and Western Africa, with the fastest increase observed in Southern and Northern Africa (Fig. 3b). Contrary to what is usually described with the nutrition transition, the availability of milk and dairy products decreased in Southern Africa (from 64 to 57 kg/capita per year). The opposite was reported for Northern Africa, where the increase was the fastest and greatest. In Western and Middle

Africa, milk and dairy products availability remained stable (Fig. 3c). Fish and seafood availability remained stable in Southern Africa, whilst it increased in other regions, particularly in Northern Africa (Fig. 3d).

Cereals availability rose in all African regions except Southern and Eastern Africa (where they remained stable) (Fig. 4a). Pulses availability was highest in Eastern Africa compared with the other regions and remained stable (Fig. 4b). In Southern Africa, pulses availability, which was the lowest compared with the other regions in 1961 continued to gradually decrease until 2013 (from 5 to 3 kg/capita per d). In Middle, Northern and Western Africa, pulses availability increased, particularly in Middle and Western Africa.

Vegetables availability was highest in Northern Africa and lowest in Eastern Africa. Contrary to what is usually described with the nutrition transition, vegetables availability did not decrease. Indeed, whilst it remained stable in Southern and Eastern Africa, it increased in the other regions. Once again, the greatest increase was in Northern Africa, where vegetables availability increased from 68 kg/capita per d in 1961 to 161 kg/capita per d in 2013 (Fig. 4c). Similarly, the expected trend for fruit consumption with the nutrition transition was not found for Africa, as fruit availability increased in all African regions at different rates and magnitude, with the greatest increase in Northern Africa (Fig. 4d).

Vegetable oils increased in every African region between 1961 and 2013, which is consistent with the trend that has been reported in other parts of the world

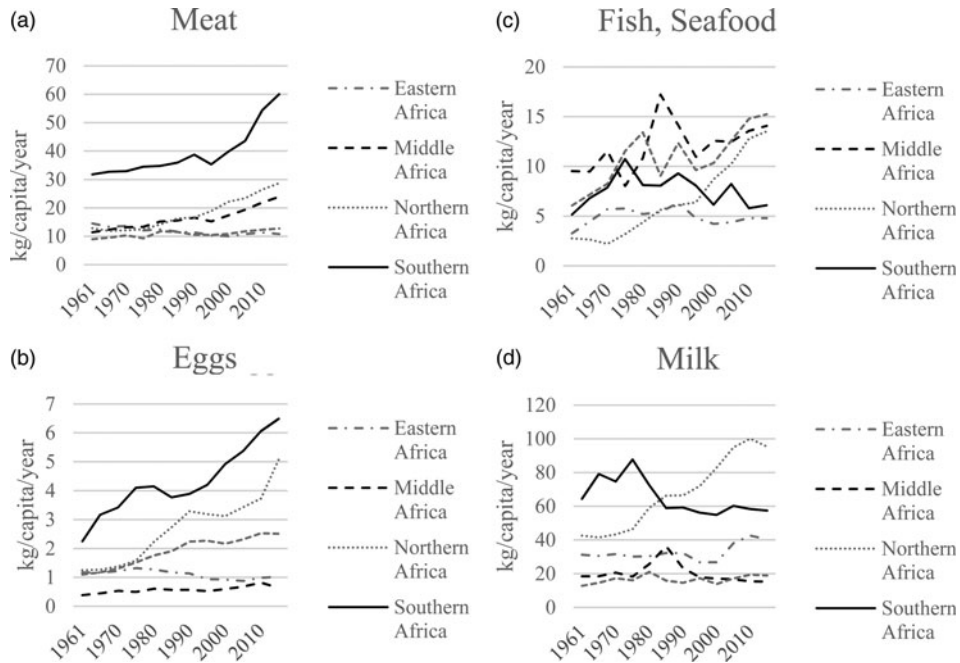


Fig. 3. Animal products supply trends in African regions, 1961–2013, from FAO, 2017.

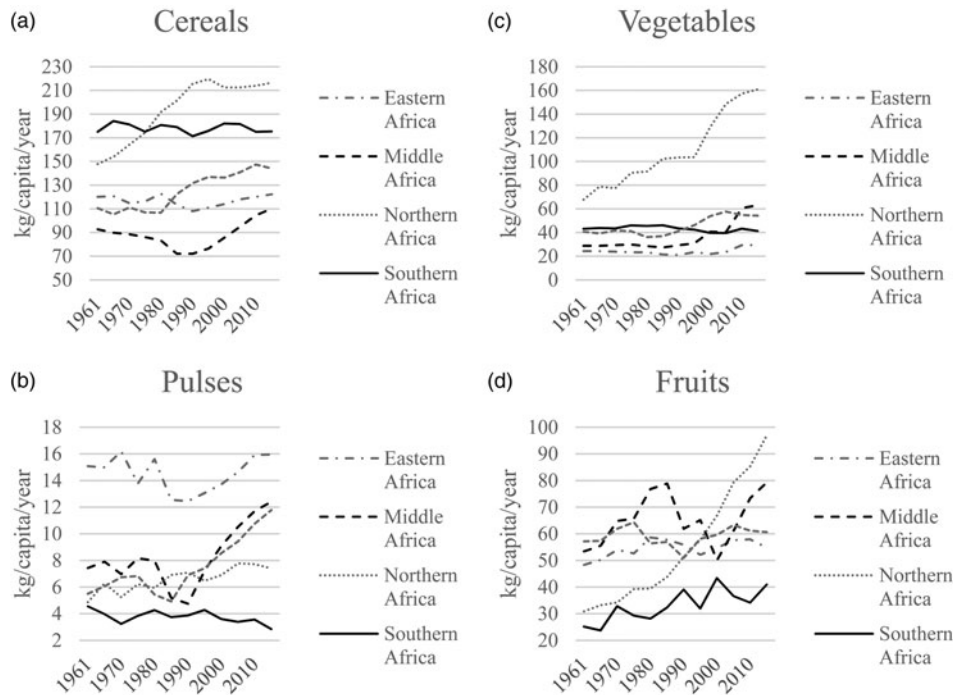
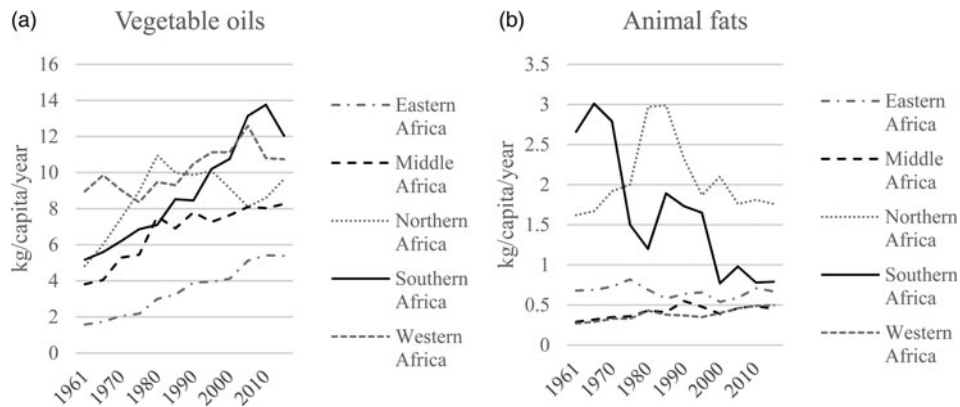


Fig. 4. Plant-based products supply trends in African regions, 1961–2013, from FAO, 2017.

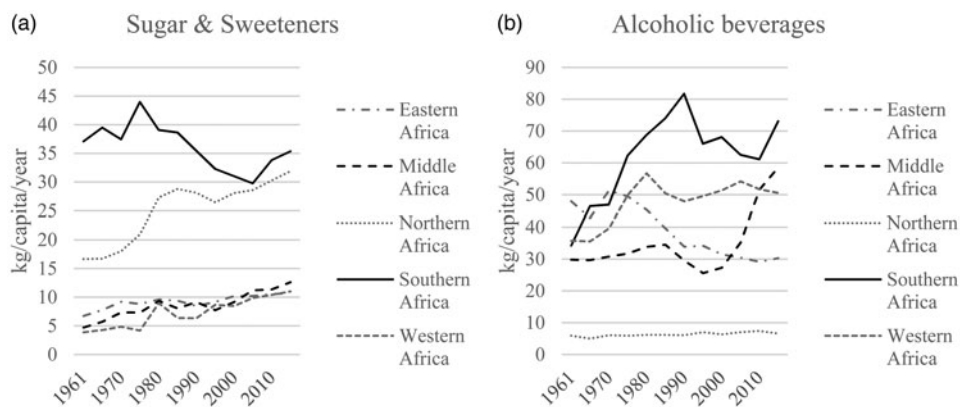
with the nutrition transition (Fig. 5a). Animal fats remained overall stable and low (<1 kg/capita per d) in Eastern, Middle and Western Africa, whilst they sharply decreased in Northern and Southern Africa (Fig. 5b), which is inconsistent with what we would expect with nutrition transition. At first glance, these changes in oils/fats seem to be encouraging as they could lead to

an improved profile of available fatty acids. However, food processing industries use a lot of hydrogenated vegetable oils in highly processed foods, which are often associated with salt and added sugar.

Between 1961 and 2013, sugar and sweeteners' availability increased across Africa except the Southern region, where it was already highest (Fig. 6a). In



**Fig. 5.** Vegetable oil and animal fats supply trends in African regions, 1961–2013, from FAO, 2017.



**Fig. 6.** Sugar and sweeteners, alcoholic beverages supply trends in African regions, 1961–2013, from FAO, 2017.

Eastern, Middle and Western Africa, availability was lowest but increased steadily. In Northern Africa, sugar and sweeteners availability was more than twice as high compared with Eastern, Middle and Western Africa in 2013. In Southern Africa, availability decreased until 2005 but then began to increase again. Whilst alcoholic beverages availability remained stable in Northern Africa, it increased in Middle, Southern and Western Africa, but decreased in Eastern Africa (Fig. 6b).

*Food prices*

Evidence of the impact of macro-level food prices on dietary behaviours in urban Africa comes from the 2008 food price crisis. One study<sup>(58)</sup> assessed food price rises in urban Burkina Faso (Ouagadougou) of over 3000 households, finding that both food security and dietary diversity deteriorated when food prices increased. Even though households increased their food expenditure, this was not enough to mitigate the impact of food price rises. A second study of over 2000 households in Ethiopia<sup>(59)</sup> also reported that the dramatic increase in food prices between 2005 and 2008 was accompanied by a decline of household food insecurity across urban (and rural) areas, concluding that wealth was the most

important factor for whether households could weather external shocks, especially in urban areas but less so in peri-urban or rural areas. This seems to confirm to some extent, that poor urban dwellers are especially vulnerable to price shocks because they spend a large proportion of their budget on food. Moving beyond the impact of food price rises on diet to health outcomes, longitudinal analysis of thirty-one low- and middle-income countries, including some African countries, suggested that rising food prices have an impact on obesity prevalence in adult women from high socio-economic status groups, but there was no evidence that they impact on low-income groups<sup>(60)</sup>.

*Food advertising and marketing*

Systematic reviews of the role of food/beverage advertising on dietary behaviours targeting children globally have provided convincing evidence that advertising promotes energy-dense nutrient-poor foods and has a negative nutritional impact<sup>(61,62)</sup>. A meta-analysis of seventeen studies indicated that exposing children to unhealthy food and beverage marketing increases dietary intake and preference (to a lesser extent) for energy-dense, nutrient-poor food and beverages<sup>(62)</sup>. The rapid

expansion of foods and beverages advertising in low- and middle-income countries is based on similar approaches to that of high-income countries, which threatens traditional food habits by introducing new food products<sup>(61)</sup>. The use of celebrities and sports personalities is common, e.g. in South Africa<sup>(63)</sup>. Some studies in Africa have investigated the food advertising environment on television. For example, one study from South Africa<sup>(63)</sup> found that 44 % of television adverts (15.00–21.00 hours) were related to food, of which 63 % were for food products, with unhealthy foods and sweetened drinks (and other hot drinks) most likely to be advertised. Particularly alarming was the finding that 21 % of adverts were for alcohol and two-thirds of these were within children/family viewing periods.

From a regulatory perspective, calls have been made for controls on marketing to children in Africa, as well as globally. However, food marketing continues to ‘target children as consumers in their own right, and as intermediaries who can influence other consumers especially their parents and peers’<sup>(61)</sup>. The WHO, endorsed by the World Health Assembly, has developed recommendations to facilitate the reduction in marketing to children of unhealthy foods/beverages (defined as high in free sugars, salt, saturated fats or *trans*-fatty acids)<sup>(64)</sup>. Introducing such controls on marketing policy will be a challenge in the African context, as they are globally.

#### *Food trade*

Liberalisation of food trade is a crucial element of food systems at different geographical scales, which has impacted on the nutritional quality and range of food available in people’s food environments, by opening up domestic markets towards international trade and investment, including provision and advertising from transnational food corporations<sup>(65)</sup>. Urban residents in Africa are most likely to be exposed to these food imports, although the urban poor can usually only access food and beverage products of a lower nutritional quality<sup>(66)</sup>, which may be energy dense and nutrient poor. Schram *et al.*<sup>(66)</sup> conducted an empirical modelling study in sub-Saharan Africa investigating the relationship between globalisation, economic growth and CVD outcomes (metabolic risk factors and deaths attributable to CVD), finding that trade and investment liberalisation impacted on CVD outcomes. A systematic review<sup>(67)</sup> yielding seventeen quantitative studies (including evidence from Africa) found consistent evidence that trade agreements were associated with increased consumption of sugar-sweetened beverages and processed foods.

#### **What are the implications for policy and interventions in Africa?**

Interventions that tackle the individual-level have limited success when they do not account for the wider contextual factors that drive food consumption in an individual’s social, physical and macro-environments<sup>(17,68)</sup>. Many decisions about food consumption are habitual

and understanding the social, physical and macro-environments that drive these routines is crucial to identifying effective interventions to promote healthier diets. Therefore, interventions to support healthier food environments need to be developed across all levels, which would enhance their reach because dietary behaviours will vary between individuals. Developing effective interventions will require engagement from a wide range of stakeholders (Table 1), emphasising the need for cross-sectoral interventions across different food environment levels.

Acknowledging the socially embedded nature of dietary behaviours is crucial. Interventions in the social environment appear to be particularly effective in shifting social norms in culturally homogenous contexts<sup>(31)</sup>. Interventions that involve existing social networks, such as community peer support groups (e.g. women’s groups) and community groups (e.g. churches or mosques) offer ideal opportunities to promote healthy eating and its nutritional advantages in the African context.

Interventions in the physical environment are likely to require policy and regulations. Evidence globally suggests that policy levers at the macro-level are likely to be most effective<sup>(69)</sup>. Interventions to address macro-level environments target policies by guiding choice through changing default policy, incentives and disincentives and by eliminating choice. Because personal freedom is potentially reduced if interventions involve removing choice (due to potential increasing conflict and intrusion), greater evidence may be needed to justify interventions and policies at the macro-level to convince policy makers to implement them<sup>(69)</sup>. Macro-level policies are notoriously difficult to implement, and they will require committed leadership in government and effective governance and infrastructure from African governments.

#### **What are the implications for research in Africa?**

##### *Research methods for investigating food environments*

Research across the different food environment levels will require a range of interdisciplinary studies using mixed or multiple methods involving qualitative and quantitative research (Fig. 7). Qualitative methods will be especially useful for shedding light on the social processes that drive behaviours in the social environment. Quantitative research methods will be especially useful for mapping the physical food environment. Research on the macro-environment is likely to use both quantitative and qualitative methods. Lytle and Sokol<sup>(37)</sup> conducted a systematic review of the methods used in food environment research, reporting that geographic analysis was most commonly used and all studies were quantitative. The review included studies on physical and macro-level food environments only, but the authors acknowledge the importance of social factors in mediating the choices individuals make when faced with physical and macro-food environments. Public health nutritionists will need to work with experts from a range of disciplines to undertake food environment research, including sociologists and anthropologists (social environment); health



**Table 1.** Interventions and stakeholders at different environmental levels and stakeholders needed

Environment level	Interventions (examples)	Stakeholders
Individual (personal)	Public education campaign on healthy diets	Individuals/household
Social environments (networks)	Interactive sessions such as healthy foods tasting or cooking sessions	Families
	Giveaways of healthy foods	Peers
	Restriction of competitive foods in schools	Caregivers
		Community leaders
Physical environment (settings)	Food pricing-subsidies on healthy food and taxation on unhealthy foods	Food vendors (market leaders)
	Increase availability of fruit and veg-voucher incentives	Religious leaders
	Regulations for food hygiene of food vendors	Youth leaders
	Nursery, school or workplace nutrition standards	Public health professionals
	Promotion of healthy foods through point of purchase materials (labels/posters)	School teachers
	Local farm to school/workplace programmes	Child care providers
	Ensure accessibility of healthy food, e.g. fruit and veg voucher incentives	Workplaces
	Limit the number of unhealthy foods that can be offered in food retail outlets	Informal and formal food vendors (market stall holders, shop owners)
		Local food suppliers
		Cafes/restaurant owners
Macro (policy)	Food procurement policies stipulate healthy food criteria in public sector	Health promotion officer
	Subsidise healthy food	Nutrition officer
	Tax unhealthy foods	Trade union officer
	Ban sugar-sweetened beverages	School teachers
		National government
		Local and regional government
		Large food retailers
		Food processing industry
		Farming industry
		Large catering companies
	Consumer groups	
	Media	
	Public health non-government organisation	
	Advertising industry	
	Food/drink authority officer	
	Health journalists	
	National nutrition advisory Committees	
	Pharmaceutical industry	
	Town and transport planners	

geographers, demographers and economists (physical environments); and political scientists and economists (macro-environment), amongst others.

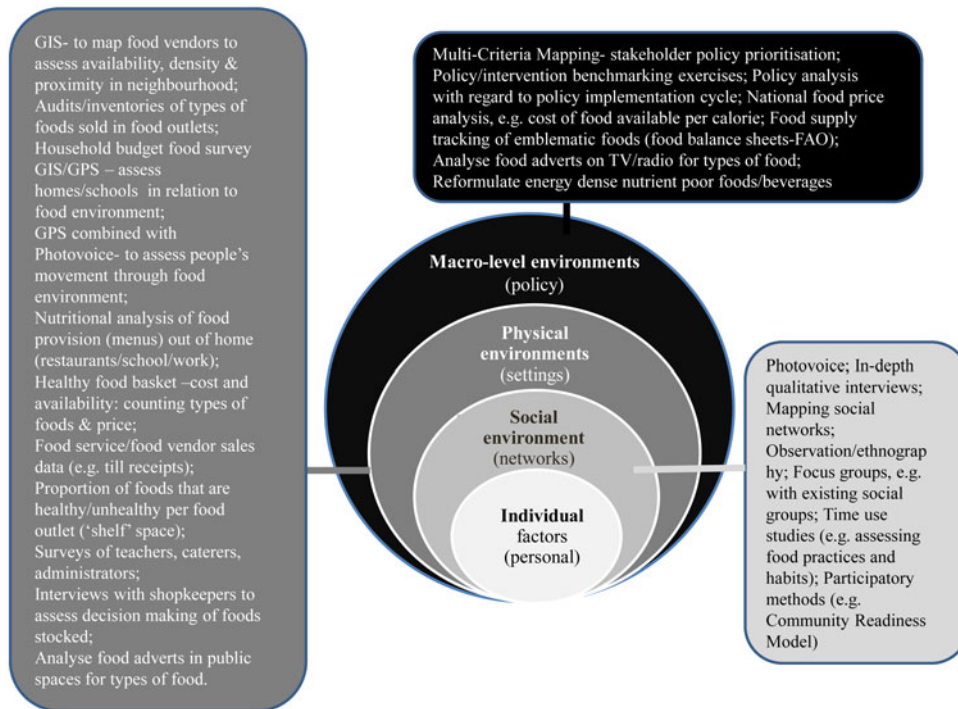
*Research priorities for healthy urban food environments*

An Africa-wide stakeholder consultation reported that African researchers prioritise the need for more research on community-level neighbourhoods that create an environment that prevents malnutrition (acknowledging the physical food environment, especially environmental sanitation) and the cultural and macro-environment suggesting the need for social protection programmes and safety nets, which would counter concern about food prices<sup>(70,71)</sup>. Shifting research away from individual-level drivers of food choice to food environments will need increased capacity development for competency in the range of research methods that can be used to explore food environments (Fig. 7).

Research on food environments needs to be sensitive to all forms of malnutrition, as a nutritionally adequate

diet in terms of macro- and micro-nutrients is the common goal to prevent all forms of malnutrition. Hence, research needs to focus on all forms of malnutrition, including the inter-relationships between them, acknowledging the social and physical environments that drive people’s dietary habits.

This review has highlighted a number of important research gaps that need addressing to shed light on the role of urban food environments in Africa, which will require a range of in-depth qualitative and longitudinal quantitative studies to answer the following: (1) How have diets changed over time and how does this differ across population groups, e.g. socio-economic groups, age and sex and different geographies (cities, towns and peri-urban contexts, countries and regions in Africa)? Africa is vast and diverse and there are a range of urban contexts within and between countries. (2) How do factors in the different environmental levels interact to shape dietary behaviours? Particularly how does the social environment and habitual social practices mediate dietary behaviours in urban Africa? (3) What are the



**Fig. 7.** (Colour online) Research methods for investigating the food environment at different levels. GIS, Geographical Information System; GPS, Global Positioning System.

common drivers of malnutrition (in all its forms) in urban African environments and which policies/interventions can be developed, supported and implemented by a range of stakeholders to best address these most cost-effectively without widening social inequalities?

### Conclusions

Improving African food environments represents a pressing public health concern and has the potential to prevent all forms of malnutrition. For the African region, data over a 50-year period suggest an increasing availability of energy, animal products (but is heterogeneous), fruit and vegetables, vegetable oils, sugar and sweeteners but a decrease in availability of animal fats. There have been inconsistent changes in cereal/pulses and alcohol availability across Africa in the same period. Contrary to what is usually described with the nutrition transition, vegetable and fruit availability has not decreased.

A range of models and frameworks have been developed in order to understand why people eat what they do and the role of food environments in these varies. Understanding what factors drive food consumption is important because they influence the nutritional quality of the diets people purchase, cook and consume. Dietary behaviour frameworks that come from a public health perspective tend to use a socio-ecological approach but systems approaches offer future potential.

Interventions that tackle the individual-level have limited success when they do not account for the wider contextual factors that drive food consumption in an individual's social, physical and macro-environments.

Many decisions about food consumption are habitual and understanding the social, physical and macro-environments that drive these routines is crucial to identifying effective interventions to promote healthier diets. Interventions in the physical environment are likely to require policy and regulations. Evidence globally suggests that policy levers at the macro-level are likely to be most effective. Interventions to address macro-level environments target policies by guiding choice through changing default policy, incentives and disincentives and by eliminating choice. However, introducing controls on marketing policy will be a challenge in the African context, as they are global. Research across the different food environment levels will require a range of interdisciplinary studies using mixed or multiple methods involving qualitative and quantitative research. Qualitative methods will be especially useful for shedding light on the social processes that drive behaviours in the social environment. Quantitative research methods will be especially useful for mapping the physical food environment. Research on the macro-environment is likely to use both quantitative and qualitative methods.

Hence, by conducting research into the role of urban social, physical and macro-environments, emerging interventions/policies and research are likely to positively impact on nutritional status, thereby enhancing social and economic development.

### Financial Support

None.



### Conflict of Interest

None.

### Authorship

The authors had joint responsibility for all aspects of preparation of this paper.

### References

1. NCD Risk Factor Collaboration (2017) Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *Lancet* **390**, 2627–2642.
2. Steyn NP & McHiza ZJ (2014) Obesity and the nutrition transition in Sub-Saharan Africa. *Ann N Y Acad Sci* **1311**, 88–101.
3. Pradeilles R, Baye K & Holdsworth M (2018) Addressing malnutrition in low- and middle-income countries with double-duty actions. *Proc Nutr Soc* **31**, 1–10.
4. Holmes M, Dalal S, Sewram V *et al.* (2018) Consumption of processed food dietary patterns in four African populations. *Public Health Nutr* **21**, 1529–1537.
5. Popkin BM, Adair LS & Ng SW (2012) Global nutrition transition and the pandemic of obesity in developing countries. *Nutr Rev* **70**, 3–21.
6. Popkin BM (2006) Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases. *Am J Clin Nutr* **84**, 289–298.
7. Mattei J, Malik V, Wedick NM *et al.* (2012) A symposium and workshop report from the Global Nutrition and Epidemiologic Transition Initiative: nutrition transition and the global burden of type 2 diabetes. *Br J Nutr* **108**, 1325–1335.
8. Vorster HH, Venter CS, Wissing MP *et al.* (2005) The nutrition and health transition in the North West Province of South Africa: a review of the THUSA (Transition and Health during Urbanisation of South Africans) study. *Public Health Nutr* **8**, 480–490.
9. Wentzel-Viljoen E, Laubscher R & Vorster HH (2018) Changes in food intake from 2005 to 2010 by a cohort of black rural and urban African men and women in the North West Province of South Africa: the PURE-NWP-SA study. *Public Health Nutr* **16**, 2941–2958.
10. Vorster HH, Kruger A & Margetts BM (2011) The nutrition transition in Africa: can it be steered into a more positive direction? *Nutrients* **3**, 429–441.
11. Vorster HH, Kruger A, Wentzel-Viljoen E *et al.* (2014) Added sugar intake in South Africa: findings from the Adult Prospective Urban and Rural Epidemiology cohort study. *Am J Clin Nutr* **99**, 1479–1486.
12. Galal OM (2002) The nutrition transition in Egypt: obesity, undernutrition and the food consumption context. *Public Health Nutr* **5**, 141–148.
13. Swinburn B, Vandevijvere S, Kraak V *et al.* (2013) Monitoring and benchmarking government policies and actions to improve the healthiness of food environments: a proposed Government Healthy Food Environment Policy Index. *Obes Rev* **14** Suppl 1, 24–37.
14. Turner C, Kadiyala S, Aggarwal A *et al.* (2017) *Concepts and Methods for Food Environment Research in Low and Middle Income Countries*. London, UK: Agriculture, Nutrition and Health Academy Food Environments Working Group (ANH-FEWG).
15. HLPE (2017) *Nutrition and Food Systems*. Rome, Italy: Committee on World Food Security.
16. Stok FM, Hoffmann S, Volkert D *et al.* (2017) The DONE framework: creation, evaluation, and updating of an interdisciplinary, dynamic framework 2.0 of determinants of nutrition and eating. *PLoS ONE* **12**, e0171077.
17. Story M, Kaphingst KM, Robinson-O'Brien R *et al.* (2008) Creating healthy food and eating environments: policy and environmental approaches. *Annu Rev Public Health* **29**, 253–272.
18. Richard L, Gauvin L & Raine K (2011) Ecological models revisited: their uses and evolution in health promotion over two decades. *Annu Rev Public Health* **32**, 307–326.
19. Dahlgren G & Whitehead M (1991) *Policies and Strategies to Promote Social Equity in Health*. Stockholm, Sweden: Institute for Futures Studies.
20. Gissing SC, Pradeilles R, Osei-Kwasi HA *et al.* (2017) Drivers of dietary behaviours in women living in urban Africa: a systematic mapping review. *Public Health Nutr* **20**, 2104–2113.
21. Carey G, Malbon E, Carey N *et al.* (2015) Systems science and systems thinking for public health: a systematic review of the field. *BMJ Open* **5**, e009002.
22. Holdsworth M, Nicolaou M, Langoien LJ *et al.* (2017) Developing a systems-based framework of the factors influencing dietary and physical activity behaviours in ethnic minority populations living in Europe – a DEDIPAC study. *Int J Behav Nutr Phys Act* **14**, 154.
23. Butland B, Jebb S, Kopelman P *et al.* (2007) *Foresight Tackling Obesity: Future Choices – Project Report*, 2nd ed. UK: Government Office for Science.
24. Chastin SF, De Craemer M, Lien N *et al.* (2016) The SOS-framework (Systems of Sedentary behaviours): an international transdisciplinary consensus framework for the study of determinants, research priorities and policy on sedentary behaviour across the life course: a DEDIPAC-study. *Int J Behav Nutr Phys Act* **13**, 83.
25. Condello G, Ling FC, Bianco A *et al.* (2016) Using concept mapping in the development of the EU-PAD framework (EUropean-Physical Activity Determinants across the life course): a DEDIPAC-study. *BMC Public Health* **16**, 1145.
26. Homer JB & Hirsch GB (2006) System dynamics modeling for public health: background and opportunities. *Am J Public Health* **96**, 452–458.
27. Rutter H, Savona N, Glonti K *et al.* (2017) The need for a complex systems model of evidence for public health. *Lancet* **390**, 2602–2604.
28. Morris MA, Wilkins E, Timmins KA *et al.* (2018) Can big data solve a big problem? Reporting the obesity data landscape in line with the Foresight obesity system map. *Int J Obes* **42**, 1963–1976.
29. Shove A, Pantzar M & Watson M (2012) *The Dynamics of Social Practice: Everyday Life and How It Changes*. London: Sage.
30. Robinson E, Blissett J & Higgs S (2013) Social influences on eating: implications for nutritional interventions. *Nutr Res Rev* **26**(2), 166–176.
31. Powell K, Wilcox J, Clonan A *et al.* (2015) The role of social networks in the development of overweight and obesity among adults: a scoping review. *BMC Public Health* **15**, 996.
32. Charlton KE, Brewitt P & Bourne LT (2004) Sources and credibility of nutrition information among black urban



- South African women, with a focus on messages related to obesity. *Public Health Nutr* **7**, 801–811.
33. Cohen E, Gradidge PJL, Ndao A *et al.* (2018) Biocultural determinants of overweight and obesity in the context of nutrition transition in Senegal: a holistic anthropological approach. *J Biosoc Sci* [Epublication ahead of print version].
  34. Herforth A & Ahmed S (2015) The food environment, its effects on dietary consumption, and potential for measurement within agriculture-nutrition interventions. *Food Secur* **7**, 505–520.
  35. McKinnon RA, Reedy J, Morrisette MA *et al.* (2009) Measures of the food environment: a compilation of the literature, 1990–2007. *Am J Prev Med* **36**, Suppl. 4, S124–S133.
  36. Caspi CE, Sorensen G, Subramanian SV *et al.* (2012) The local food environment and diet: a systematic review. *Health Place* **18**, 1172–1187.
  37. Lytle LA & Sokol RL (2017) Measures of the food environment: a systematic review of the field, 2007–2015. *Health Place* **44**, 18–34.
  38. Pitt E, Gallegos D, Comans T *et al.* (2017) Exploring the influence of local food environments on food behaviours: a systematic review of qualitative literature. *Public Health Nutr* **20**, 2393–2405.
  39. Townshend T & Lake A (2017) Obesogenic environments: current evidence of the built and food environments. *Perspect Public Health* **137**, 38–44.
  40. Faber M, Laurie S, Maduna ME *et al.* (2013) Is the school food environment conducive to healthy eating in poorly resourced South African schools? *Public Health Nutr* **17**, 1214–1223.
  41. Wiles N, Green J & Veldman F (2013) Tuck-shop purchasing practices of Grade 4 learners in Pietermaritzburg and childhood overweight and obesity. *South Afr J Clin Nutr* **26**, 37–42.
  42. Abrahams Z, de Villiers A, Steyn NP *et al.* (2011) What's in the lunchbox? Dietary behaviour of learners from disadvantaged schools in the Western Cape, South Africa. *Public Health Nutr* **14**, 1752–1758.
  43. Feeley A, Musenge E, Pettifor JM *et al.* (2012) Changes in dietary habits and eating practices in adolescents living in urban South Africa: the birth to twenty cohort. *Nutrition* **28**, 7–8, 1–6.
  44. Reardon T & Gulati A (2008) *The Supermarket revolution in Developing Countries: Policies for 'Competitiveness with Inclusiveness'*. Washington, DC: International Food Policy Research Institute.
  45. Reardon T, Timmer CP, Barrett CB *et al.* (2003) The rise of supermarkets in Africa, Asia, and Latin America. *Am J Agric Econ* **85**, 1140–1146.
  46. Battersby J & Crush J (2014) Africa's urban food deserts. *Urban Forum* **25**, 143–151.
  47. Battersby J & Peyton S (2014) The geography of supermarkets in Cape Town: supermarket expansion and food access. *Urban Forum* **25**, 153–164.
  48. Demmler KM, Klasen S, Nzuma JM *et al.* (2017) Supermarket purchase contributes to nutrition-related non-communicable diseases in urban Kenya. *PLoS ONE* **12**, e0185148.
  49. Demmler KM, Ecker O & Qaim M (2018) Supermarket shopping and nutritional outcomes: a panel data analysis for Urban Kenya. *World Dev.* **102**, 292–303.
  50. Rischke R, Kimenju SC, Klasen S *et al.* (2015) Supermarkets and food consumption patterns: the case of small towns in Kenya. *Food Policy* **52**, 9–21.
  51. Kimenju SC, Rischke R, Klasen S *et al.* (2015) Do supermarkets contribute to the obesity pandemic in developing countries? *Public Health Nutr* **18**, 3224–3233.
  52. Tessier S, Traissac P, Maire B *et al.* (2008) Regular users of supermarkets in greater tunis have a slightly improved diet quality. *J Nutr* **138**, 768–774.
  53. Kim S, Haines PS, Siega-Riz AM *et al.* (2003) The diet quality index-international (DQI-I) provides an effective tool for cross-national comparison of diet quality as illustrated by China and the United States. *J Nutr* **133**, 3476–3484.
  54. Dake FAA, Thompson AL, Ng SW *et al.* (2016) The local food environment and body mass index among the urban Ppor in Accra, Ghana. *J Urban Health* **93**, 438–455.
  55. Landais E, Bour A, Gartner A *et al.* (2015) Socio-economic and behavioural determinants of fruit and vegetable intake in Moroccan women. *Public Health Nutr* **18**, 809–816.
  56. Nago ES, Lachat CK, Huybregts L *et al.* (2010) Food, energy and macronutrient contribution of out-of-home foods in school-going adolescents in Cotonou, Benin. *Br J Nutr* **103**, 281–288.
  57. FAO (2017) Food Balance Sheets. <http://www.fao.org/faostat/en/#data/FBS> (accessed November 2018).
  58. Martin-Prevel Y, Becquey E, Tapsoba S *et al.* (2012) The 2008 food price crisis negatively affected household food security and dietary diversity in urban Burkina Faso. *J Nutr* **142**, 1748–1755.
  59. Hadley C, Linzerb DA, Belachewc T *et al.* (2011) Household capacities, vulnerabilities and food insecurity: shifts in food insecurity in urban and rural Ethiopia during the 2008 food crisis. *Soc Sci Med* **73**, 1534–1542.
  60. Conklin AI, Daoud A, Shimkhada R *et al.* (2018) The impact of rising food prices on obesity in women: a longitudinal analysis of 31 low-income and middle-income countries from 2000 to 2014. *Int J Obes* [Epublication ahead of print version].
  61. Cairns G, Angus K, Hastings G *et al.* (2013) Systematic reviews of the evidence on the nature, extent and effects of food marketing to children. A retrospective summary. *Appetite* **62**, 209–215.
  62. Sadeghirad B, Duhaney T, Motaghipisheh S *et al.* (2016) Influence of unhealthy food and beverage marketing on children's dietary intake and preference: a systematic review and meta-analysis of randomized trials. *Obes Rev* **17**, 945–959.
  63. Mchiza ZJ, Temple NJ, Steyn NP *et al.* (2013) Content analysis of television food advertisements aimed at adults and children in South Africa. *Public Health Nutr* **16**, 2213–2220.
  64. WHO (2010) Set of recommendations on the marketing of foods and non-alcoholic beverages to children. <http://www.who.int/dietphysicalactivity/publications/recsmarketing/en/>.
  65. Friel S, Hattersley L, Snowdon W *et al.* (2013) Monitoring the impacts of trade agreements on food environments. *Obes Rev* **14**, Suppl. 1, 120–134.
  66. Schram A, Labonté R & Sanders D (2013) Urbanization and international trade and investment policies as determinants of noncommunicable diseases in Sub-Saharan Africa. *Prog Cardiovasc Dis* **56**, 281–301.
  67. Barlow P, McKee M, Basu S *et al.* (2017) The health impact of trade and investment agreements: a quantitative systematic review and network co-citation analysis. *Global Health* **13**. doi: 10.1186/s12992-017-0240-x (Published online 8th March 2017).
  68. Mackenbach JD, Rutter H, Compernelle S *et al.* (2014) Obesogenic environments: a systematic review of the





- association between the physical environment and adult weight status, the SPOTLIGHT project. *BMC Public Health*. doi: 10.1186/1471-2458-14-233 (Published online: March 6th 2014).
69. Nuffield Council on Bioethics (2007) Policy process and practice. In *Public Health: Ethical Issues*, chapter 3, pp. 31–47. Cambridge, UK: Cambridge Publishers Ltd.
  70. Holdsworth M, Kruger A, Nago E *et al.* (2015) African stakeholders' views of research options to improve nutritional status in sub-Saharan Africa. *Health Policy Plan* **30**, 863–874.
  71. Lachat C, Nago E, Roberfroid D *et al.* (2014) Developing a sustainable nutrition research agenda in sub-Saharan Africa--findings from the SUNRAY project. *PLoS Med* **11**, e1001593.