Development of evidence-based context appropriate public policy reform models that coherently promote healthy food environments and food consumption patterns in Zambia

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Abstract

Background: The double burden of malnutrition is a growing concern globally. In Zambia, it is estimated that of children under five years, 35% are stunted, while 5% are either overweight or obese. In the adult population, 24% are overweight, while 90% do not meet the dietary requirement of consuming five portions of fruit a day. Evidence suggests that unhealthy dietary habits developed by children can contribute to poor health outcomes in adulthood. However, Zambia's nutrition policies are not changing rapidly enough to address the development of new challenges associated with the double burden of malnutrition. Policy reforms should be implemented to re-engineer food environments to support access to healthier food options and make these foods preferable to consumers in critical age groups like adolescence.

Aim: This research aimed to analyze and prospectively explore opportunities for strengthening policies to better address the food environment drivers of the double burden of malnutrition, especially for the adolescent age group in Zambia.

Method: A multi-component approach that combined an explanatory sequential mixed method design and a prospective policy analysis was used for this study. The quantitative component of the mixed-method design was used to determine the dietary patterns of adolescents using a non-quantified food frequency questionnaire administered to 404 Grade 10 learners from ten secondary schools in Lusaka. Descriptive statistics, principal component analysis and multilevel modeling, were conducted to analyze quantitative data using Stata version 15. In the qualitative component, the school food environment around the ten secondary schools was mapped, and 20 focus group discussions were conducted with a subgroup of adolescents who completed the non-quantified food frequency questionnaire to understand the drivers of the dietary patterns identified from the quantitative survey. Data from these two methods were integrated to explain the prevailing nutrition patterns and the key contributing factors. This

phase was followed by prospective policy analysis – conducted in two steps – to explore the feasibility of policy options that would address the prevailing nutrition patterns established in Phase 1. In the first step of the policy analysis, a qualitative document analysis of 17 Zambian policy documents from key economic sectors was analyzed to determine the availability of policies supporting healthy food environments and dietary patterns. In the second step, 17 in-depth interviews with nutrition policy stakeholders and a consultative workshop with ten stakeholders were conducted to explore opportunities for strengthening public policies to address the food environment drivers of the double burden of malnutrition in Zambia. A hybrid deductive and inductive thematic analysis approach was used to analyze qualitative data.

Results: The quantitative component of this research found that the 'snacking dietary pattern' characterized by the consumption of ultra-processed food rich in sugar and salt was predominant among school-going adolescents. Quantitative analysis of the determinants of the identified dietary patterns showed that the snacking diet was significantly associated with the presence of shops that sell fast food within the school vicinity. In the qualitative component, adolescents in the focus group discussions identified the wide availability of cheap, unhealthy food in and around the schools as a key influencer of their dietary patterns. Moreover, this research found from the document analysis that Zambia does not have internationally recommended legislative policy measures that are effective for fostering healthy food environments and consumer dietary patterns. Finally, nutrition-related stakeholders perceived legislative policy measures as unfeasible for Zambia and instead recommended information-based policy options to address the DBM. After the integration and triangulation of findings across the different components of this research, the influence of food environments on vulnerable populations, like adolescents' poor dietary habits, was generally acknowledged. Despite this, barriers against developing policy-level interventions that will effectively address food environment drivers of the double burden of nutrition exist.

Conclusion: Unhealthy food environments contribute to unhealthy dietary patterns in school-going adolescents in Zambia. Policy reforms are required so that legislative policy measures that address the food environment-related drivers of the double burden of malnutrition among vulnerable groups like adolescents can be prioritized in Zambia's policy agenda.

Keywords

Adolescents

Dietary patterns

The double burden of malnutrition

Food environments

Low- and Middle-Income Countries

Nutrition transition

Policy analysis

Policy reforms

Zambia

Declaration

I declare that *Development of evidence-based context appropriate public policy reform models that coherently promote healthy food environments and food consumption patterns in Zambia* is my own work. I declare that this work has not been submitted for any degree or examination in any other university and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

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Date: November 2022

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Dedication

I dedicate this work to my mother, Bernadette Chanda Bwalya, a woman who sacrificed so much to give me the opportunity to pursue my dreams.

Acronyms

CSO Civil Society Organisation

DBM Double burden of Malnutrition

DDS Dietary Diversity Score

DHS Demographic and Health Surveys

FFQ Food frequency questionnaire

FGD Focus Group Discussion

NCD Non-communicable diseases

NFNC National Food and Nutrition Commission

LMIC Low- and Middle-Income Countries

WFP World Food Programme

WHO World Health Organisation

Definitions of key nutrition terms

The double burden of malnutrition: This is a phenomenon characterized by the coexistence of undernutrition along with overweight, obesity or diet-related non-communicable diseases within individuals, households and populations and across the life course (WHO, 2016)

Healthy diet: A healthy diet contains adequate food to maintain life, support physical activity and achieve and maintain healthy body weight with sufficient macro- and micronutrients to meet individual nutrition and health needs. A healthy diet includes a variety of geographic- and context-specific nutrient-dense foods from basic food groupings, including vegetables, fruits, whole grains and cereals, dairy foods and animal- and plant-based protein foods, while overconsumption, particularly of nutrient-poor foods high in energy, saturated and trans fats, added sugars and salt is limited (High Level Panel of Experts, 2017). The World Health Organization recommends that energy intake (calories) should be in balance with energy expenditure, with total fat not exceeding 30% of total energy intake, saturated fats less than 10% of total energy intake, and trans-fats less than 1% of total energy intake; free sugars should be less than 10% of total energy intake; salt intake should be less than 5 g per day (equivalent to sodium intake of less than 2 g per day); and at least 400 g (i.e. five portions) of fruit and vegetables per day, excluding potatoes, sweet potatoes, cassava and other starchy roots should be consumed (WHO, 2019)

Overnutrition: This is a form of malnutrition arising from excessive intake of nutrients, leading to the accumulation of body fat that impairs health (WHO, 2020)

Undernutrition: This is a form of malnutrition characterized by insufficient intake of energy and nutrients to meet an individual's needs to maintain good health (WHO, 2020)

Malnutrition: Malnutrition refers to deficiencies or excesses in nutrient intake, imbalance of essential nutrients or impaired nutrient utilization (WHO, 2020)

Unhealthy diet: This is a diet low in fruits, vegetables, whole grains, nuts and seeds, milk, fibre, calcium, seafood and fish high in omega-3 fatty acids, and polyunsaturated fatty acids, and diets high in red meat, processed meat (smoked, cured, salted or chemically preserved), sugar-sweetened beverages, trans fats and sodium (Forouzanfar *et al.*, 2016)

Ultra-processed food: This is food usually characteristically high in salt, trans fats and added sugar and include pre-prepared mixed dishes, refined-grain bread, ready-to-eat cereals, salty snacks, cookies, candy, sugar-sweetened beverages, margarine and mayonnaise (Monteiro *et al.*, 2013; Baker and Friel, 2014; Askari *et al.*, 2020).

Western diet: These are diets rich in fats, sugars, meat and highly ultra-processed foods. A key feature of the western diet is the high-calorie content from the high content of saturated fats and sugar as well as the large portion sizes (Popkin, 1994; Cordain *et al.*, 2005)

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CHAPTER 1: INTRODUCTION

This chapter presents a brief background that locates the research within the broader body of knowledge, introduces the country context and details the problem statement, research questions, aim and objectives.

1.1 Background

Nutrition remains a global health issue. The need for better nutrition has been recognized in the Sustainable Development Goals (SDGs): SDG 2 aims to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture, while SDG 3 aims to ensure healthy lives and promote well-being for all ages (United Nations, 2016). Governments, donors and the private sector committed to improving nutrition-related outcomes (United Nations, 2017). Poor nutrition has far-reaching consequences, including poor cognitive development and non-communicable diseases (NCDs), which negatively affect national and global development. Globally, 150.8 million children are stunted, while 50.5 and 38.3 million are wasted and overweight, respectively, and 2.01 billion adults are overweight and obese (Development Initiatives, 2021). Economically, an estimated 3.5 trillion dollars is lost globally a year through loss of productivity, increased healthcare costs and deficits due to consequences of poor cognitive development (UNICEF, 2019). The effects of poor nutrition are more pronounced in Low and Middle-Income Countries (LMICs) (Popkin, Corvalan and Grummer-Strawn, 2019). Ensuring that people eat healthily and have good nutrition is imperative for governments, especially in LMICs.

1.2 Nutrition transition and the double burden of malnutrition

The “nutrition transition” is a term used to describe the changes in diets, physical activity and causes of disease that have occurred over time due to economic development and accompanied lifestyle changes, urbanization, and demography (Popkin, 2015). The change in diets that characterizes the nutrition transition shows a move from traditional diets characterized by

consumption of fruits and vegetables, whole nuts and unprocessed foods to "Western" diets rich in fats, sugars, meat and ultra-processed foods (Popkin, 1994). A vital feature of the western diet is the high-calorie content from the high content of saturated fats and sugar and the large portion sizes (Cordain *et al.*, 2005; Rakhra *et al.*, 2020). This western diet, accompanied by a sedentary lifestyle, results in an imbalance between the number of calories ingested and expended, which has been implicated in the obesity pandemic (Kopp, 2019; Rakhra *et al.*, 2020; Seifu *et al.*, 2021).

The drivers of the nutrition transition can be grouped into four categories: (i) the health/biological environment; (ii) the economic/food environment; (iii) the physical/built environment; and (iv) the socio/cultural environment (ibid). Technological advancements allowing for cheaper food production, urbanization, and a rise in per capita income coupled with falling food prices and globalization with its opening up of global trade are critical drivers accelerating the nutrition transition in LMICs (Popkin, 2014). Countries around the globe are at different stages of the transition – high-income countries are in advanced stages, while most LMICs are in the early stages of the transition (Abrahams, Mchiza and Steyn, 2011). In addition, the relatively early stage of the transition in LMICs provides an opportunity to implement measures that will slow the transition.

A consequence of the nutrition transition, especially in LMICs, is that countries are now faced with multiple forms of malnutrition within the same population, termed the Double Burden of Malnutrition (DBM) and syndemic of malnutrition (Swinburn *et al.*, 2019). The DBM and malnutrition syndemic is mainly concentrated in Sub-Saharan Africa, South Asia, East Asia and the Pacific, where undernourishment is still prevalent, and obesity and its related co-morbidities, including chronic NCDs, are emerging and contributing increasingly to morbidity and mortality (Development Initiatives, 2021). The DBM poses serious challenges for most

LMICs as they have limited capacity to deliver the multisectoral interventions necessary to reduce the DBM, as nutrition programs are focused on undernutrition and spearheaded by the health sector (Balarajan and Reich, 2016). The governance mechanisms required to coordinate the delivery of effective multisectoral interventions are weak, and funding is limited. No country has established governance mechanisms for nutrition that cover the DBM and include all necessary aspects, including food security, food safety, nutrition, and diet-related non-communicable diseases.

1.3 Determinants of dietary behaviours

There is no doubt that consumer behaviour determines what type of food a person consumes. This food-related behaviour is not independent but is driven by four main underlying factors: 1) Biological – hunger, appetite and taste; 2) Economic – Cost of food, personal or household income and availability of food; 3) Physical – access and availability of markets; and 4) social – pressure from culture, family, peers (Steenkamp, 1993).

Several models have been developed over the years to understand health related behaviours. Among the frequently used are the health belief model, the stages of change model and the social-ecological model. The health belief model theorizes that people's beliefs about whether or not they are at risk for a disease or health problem and their perceptions of the benefits of taking action to avoid it influence their readiness to take action (Becker, 1974). The stages of change theory propose that people are at different stages of readiness to adopt healthful behaviours, and interventions should be tailored to respond to their stage (Prochaska, 2020). The social ecological model, which is widely used in public health, considers the influence of both personal and social factors on behaviour (Bronfenbrenner, 1986). According to this model, behaviour is influenced by multiple factors at individual, interpersonal, organisational, community and public policy levels (Figure 1).

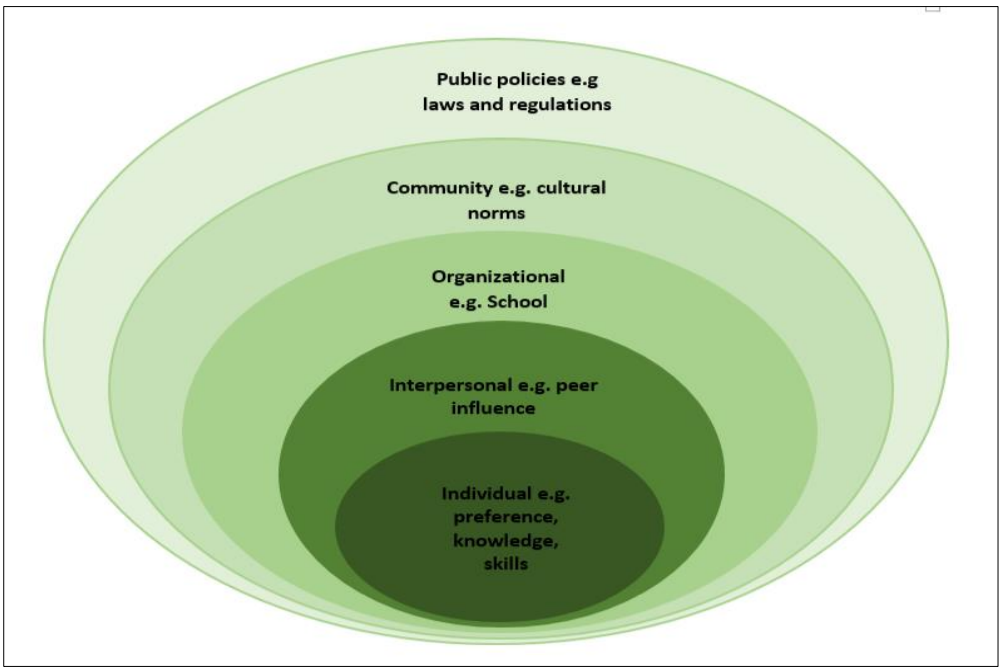

Figure 1: Socio-ecological model (Author's depiction)

The socio-ecological model has been applied in studies of nutrition behaviours and the design of nutrition interventions (Swinburn, Egger and Raza, 1999; Gregson *et al.*, 2001; Ohri-Vachaspati *et al.*, 2015; Mahmudiono, Segalita and Rosenkranz, 2019). The socio-ecological model suggests that the different levels of influence reinforce each other: creating an environment conducive to change makes it easier for individuals to adopt healthy behaviours. As a result, there has been growing evidence that suggest environmental level interventions to be best in addressing the double burden of malnutrition (Swinburn *et al.*, 2013). The social-ecological model shows that the physical food environment surrounding a consumer and the public policies that influence them are vital in shaping their food related behaviour and choices as they affect accessibility and availability of different food groups.

1.4 Food environments as a key driver of nutrition

Despite their importance in shaping dietary behaviours, food environment factors have been relatively understudied in LMICs. Food environments constitute the physical, economic, political and sociocultural context that surrounds consumers and influences their food

behaviours (Swinburn *et al.*, 2013; Turner *et al.*, 2018). Food environments are shaped by policies in the wider food system that influence food production, transportation, storage and processing (ibid). A lack of nutritious, healthy foods that are available, affordable and accessible to populations and individuals can affect the risks of an inadequate and unbalanced diet (FAO, 2016). The food environment shapes a consumer's food choice since they determine the proximity, affordability, promotion, quality and safety of food (Swinburn *et al.*, 2013; Hawkes and Popkin, 2015).

The quality of food environments determines nutrition outcomes. Evidence shows that food environments across the globe are mainly unhealthy, promoting unhealthy food choices by consumers and perpetuating all forms of malnutrition (Thow *et al.*, 2016; Swinburn *et al.*, 2019; Willett *et al.*, 2019). Structural, environmental and commercial drivers are associated with poor nutrition and the obesity pandemic. For example, outlets (such as shops or school cafeterias) selling unhealthy food near schools are linked to poor health outcomes in children (Azeredo *et al.*, 2016; Kelly *et al.*, 2019). Proximity to fast food outlets, convenience stores and supermarkets is also associated with an increased likelihood of consuming unhealthy food from such outlets (Rischke *et al.*, 2015; Demmler, Ecker and Qaim, 2018; Wu *et al.*, 2021). There is a growing focus on the role of the food industry whose activities like pervasive marketing and intense lobbying, which shape food consumption and food environments in many LMICs (Moodie *et al.*, 2013). Public health scholars use the term 'commercial determinants of health' to highlight the role of industry in the obesity pandemic as their exploitative practices contribute to making nutrient-poor foods desirable, readily available and cheaper (Kickbusch, Allen and Franz, 2016; McKee and Stuckler, 2018; de Lacy-Vawdon and Livingstone, 2020; Mialon, 2020). The food industry spends billions of dollars on marketing campaigns, often targeting vulnerable populations, including children in new and emerging markets (Ireland *et al.*, 2019). The food industry has been shown to use different strategies, including product

placement and point-of-sale food promotion (Schmitt, Wagner and Kirch, 2007; Alruwaily *et al.*, 2020); brand recognition (Harris, Schwartz and Brownell, 2010); and pricing strategies (Story and French, 2004), aimed at luring children and adolescents. Social media (Weber, Story and Harnack, 2006; Montgomery and Chester, 2009; Boelsen-Robinson, Backholer and Peeters, 2015) and sports platforms (Bragg *et al.*, 2018) have also been used for marketing unhealthy food and beverages to adolescents. Similarly, international trade partnerships have been linked to the increased supply of unhealthy foods in LMICs (Schram et al., 2015). Legislative policy interventions targeted at the commercial determinants can hold the unhealthy food industry accountable and help counter pervasive marketing strategies which contribute to the obesogenic diets in many LMICs (Moodie *et al.*, 2013; Schram *et al.*, 2015; Otterbach *et al.*, 2021).

1.5 Adolescents and nutrition

The World Health Organisation (WHO) defines adolescents as young people between 10 and 19 years (WHO, 2018). Adolescence is a crucial stage in a person's life, characterized by important physiological and behavioural transitions. During the formative period of adolescence, people can develop and adopt behaviours (including those related to nutrition) carried into adulthood (Nicklas, 1995; Barlow and Blair, 2012). Further, research in the developmental origins of health and disease supports a targeted life course approach to preventing metabolic conditions like obesity and type 2 diabetes, which have drivers in nutrition (Baird *et al.*, 2017). One study showed that adolescents had established dietary preferences by 13 years (Feeley *et al.*, 2012). Further, studies have shown that adolescents have a level of food autonomy (Anderson, Macintyre and West, 1993).

Qualities of the adolescence period make this age group prone to unhealthy dietary patterns that predispose them to nutrition-related diseases. Peer influences determine adolescent food

choices. Healthy food consumption is linked to maintaining an appropriate body image, especially among adolescent girls, while consuming snacks and fast foods is linked to desirability due to peer influence, taste and appearance of food (Askari Majabadi *et al.*, 2016).

However, food environments also influence adolescent nutrition. Adolescents are among the target of pervasive marketing activities by the unhealthy food industry (Truman & Elliott, 2019). Regular exposure to unhealthy food advertisements on television has been associated with a higher likelihood of consuming fast foods and soft drinks (Norman *et al.*, 2016). In addition, adolescents' use of smartphones and social media makes them an easy target for predatory marketing, where unhealthy foods are portrayed as cool and exciting (Potvin Kent *et al.*, 2019; Qutteina *et al.*, 2019).

The school food environment further influences adolescents' food choices due to the considerable time spent at school (Larson and Verma, 1999). The school food environment includes the spaces, infrastructure and conditions within and beyond the school premises where food is made available, obtained or purchased and consumed, together with the presence of food information, promotion and pricing of foods and food products within the school premises (Cruz, 2020). Studies have shown that the type of food present within the school's vicinity influences the dietary habits of children (Wechsler *et al.*, 2000; Battersby and Peyton, 2014; Bekker, Marais and Koen, 2017; Micha *et al.*, 2018, 2018). For instance, having unhealthy food in and around school premises has been associated with an increased likelihood of children consuming such food in many settings (Kubik *et al.*, 2003; Azeredo *et al.*, 2016; Kelly *et al.*, 2019; Gonçalves *et al.*, 2021)

Adolescents are considered an active and healthy age group and are overlooked in terms of nutrition interventions. While evidence shows that adolescents actively engage with the food environment, interventions targeted at protecting the health of adolescents – who comprise

60% of the African population – beyond education campaigns are generally lacking (Turner *et al.*, 2020). Adolescence provides an opportunity for cost-effective policy action and investment to help establish healthy dietary patterns to reduce the risk of nutrition-related health outcomes like obesity, type 2 diabetes and hypertension later in adulthood (Baird *et al.*, 2017). Furthermore, the school environment presents one of the entry points to promote healthy food consumption behaviours.

1.6 Policy reforms are required to address the double burden of malnutrition

Several policy options have been proposed to achieve the transformation of nutrition policies to better address the DBM. The WHO 'best buys' policy interventions aimed at reducing harmful components like sugar, salt and fats in diets and promoting fruit and vegetable consumption are recommended for addressing nutrition-related NCDs (WHO, 2015, 2017). The WHO encourages governments to protect population's health by implementing various policy measures. Public health interventions like front-of-pack labelling, legislation that bans the use of industrial trans-fats in the food chain or taxation of sugar-sweetened beverages to reduce sugar consumption are considered best buy as they are evidence-based and cost-effective to implement even in the LMIC context. Other effective interventions include the reformulation of food products, behaviour change communication and mass media to limit the consumption of unhealthy food (ibid).

Recent evidence showing that the DBM has shared drivers and solutions has opened a window of opportunity for integrated nutrition action through double-duty policy interventions. Double-duty actions include interventions, programmes and policies that have the potential to simultaneously reduce the risk or burden of both undernutrition and overweight, obesity or diet-related NCDs (Hawkes *et al.*, 2020). Similarly, the global syndemic approach whereby double- or triple-duty intervention is used to simultaneously address the common underlying causes of undernutrition, obesity and climate change has been proposed (Nugent, 2019;

Swinburn *et al.*, 2019). Evidence suggests a strong correlation between food insecurity, inequality, poverty, and obesity (Mendenhall, 2017; B. A. Swinburn *et al.*, 2019; Nugent, 2019). Implementing double-duty actions will require leveraging existing nutrition structures to address or improve new or other forms of malnutrition; and developing new, integrated policy actions that comprehensively address the DBM (Hawkes *et al.*, 2020).

Progress by governments in LMICs to tackle the DBM remains unacceptably slow. Nutrition policy interventions have historically used biomedical and individual-centric approaches to address undernutrition and the consequences of stunting resulting from food insecurity (Doak, 2002; Benson, 2008; Hillocks, 2011; Mwanamwenge and Harris, 2017; Thow *et al.*, 2021). Such nutrition policies are sector-specific, either through agriculture to increase the production of staple foods to ensure food security or through the health sector to prevent and treat poor nutrition outcomes (Garret, Bassett and Levinson, 2011a). While there has been success in reducing childhood stunting – one side of the DBM – the impetus with which obesity and NCDs are being addressed is inadequate. The nutrition transition, coupled with the burgeoning problem of obesity, requires nutrition policy reforms across many African countries.

Policy reform aims to change 'the rules of the game' by challenging the status quo, often aiming to improve the status of vulnerable groups by redistributing access to finite resources to address a problem or achieve a goal (Reich, 1995). The changing face of nutrition problems requires governments to adapt their solutions and put in place the right tools that respond to the nature of the problem. However, the transfer of nutrition policy from global to LMICs remains a challenge, and most recommended policy interventions are not on national policy agendas for nutrition. Nutrition policy reforms continue to suffer challenges due to poor coordination, lack of multisectoral action and weak policy coherence (Bach *et al.*, 2020; Ezezika *et al.*, 2021)

1.7 Implementing nutrition policies is challenging

Developing and implementing nutrition policies that address the double burden of malnutrition in most African countries are still in their infancy (Popkin, Adair and Ng, 2012; Thow *et al.*, 2018), and policy interventions have been patchy than comprehensive (Roberto *et al.*, 2015). While policies for undernutrition are available, various barriers hamper policy action to address the newer problem of overnutrition.

One key issue is the entrenched framing of nutrition problems as arising from poor lifestyle choices by individuals (Jenkin, Signal and Thomson, 2011; McIntyre, 2020; Namugumya *et al.*, 2021). Godziewski (2021) uses the term 'lifestyle drift' to explain how policymakers return to designing policies targeted at individual behaviour change despite a recognition of the systemic drivers of poor health. Such framing negates the responsibilities of other factors like the policies shaping food environments, which make eating healthy difficult and might preclude meaningful engagement of other sectors outside the 'traditional' sectors of health and agriculture (Garret, Bassett and Levinson, 2011b). Multisectoral action for addressing nutrition problems is required, given that the drivers of malnutrition are spread across multiple sectors. However, this is difficult to achieve due to limited human and fiscal resources and interference from donors and the food industry (Kennedy et al., 2016; Fox, Law and Baker, 2022). Poor multisectoral action and weak policy coherence are serious threats to any policy reforms.

Policy conflicts which arise from the government's competing interests in the health and economic sectors (Swinburn *et al.*, 2019) impact the development and implementation of nutrition policies. The top policy priority for governments in LMICs is to achieve economic prosperity and poverty alleviation, which at times occur at the expense of population health (Schram, Labonté and Sanders, 2013; Baker, Kay and Walls, 2014; Baker *et al.*, 2016; Ravuvu *et al.*, 2017, 2021). Resolution of these policy conflicts might require approaching food system transformation with an economic lens and exploring win-win policy reforms that can contribute

to economic prosperity and support healthier food environments (Haggblade *et al.*, 2016; Branca *et al.*, 2019). However, fixing incoherence in nutrition will only be effective if analysis considers the entire food system. The policy environment should allow the food system to deliver enough food; make healthy diets available and affordable; provide decent jobs; protect the planet; and nurture social cohesion, all while supporting economic development equitably. Deliberate effort is required to design nutrition-sensitive policies, ensuring that policies aiming to improve one outcome of the food system do not undermine others.

Nutrition policy reforms attract the interests of a wide array of actors due to the multifaceted nature of the risk factors of nutrition problems (Balarajan and Reich, 2016). Though available, policy measures to improve the quality of food environments are challenging to implement. Food industry interests and power influences nutrition policy-making, making it difficult for more effective policy provisions to get onto the agenda of governments (Miller and Harkins, 2010; Thow and McGrady, 2014; Williams, 2015; Capewell and Lloyd-Williams, 2018). The food industry has continued to position itself as part of the solution by advocating for less effective voluntary measures to promote healthier food consumption instead of government-led legislative policy measures (Karsten Ronit and Jensen, 2014; Nixon *et al.*, 2015). Pro-economic growth policies from the economic sectors of government usually support interference by industry. In LMICs for instance, most governments have prioritized economic growth by encouraging foreign direct investments, which results in the proliferation of industries for unhealthy commodities like food and alcohol (Baker, Kay and Walls, 2014; Schram *et al.*, 2015; Friel and Jamieson, 2019). The financial resources and enabling liberalized economic systems give the food industry power to influence policy development and protect their interests through corporate political activities such as lobbying and corporate social responsibility (Mialon, Swinburn and Sacks, 2015; Delobelle, 2019).

1.8 Overview of nutrition in Zambia

The DBM is present in Zambia: thirty-five percent of children under five years are stunted, and four percent of children under five years are acutely malnourished or wasted (Central Statistical Office, Ministry of Health and ICF, 2019). Recent estimates show that 46 percent of Zambians cannot afford a healthy diet (World Food Programme, 2021). In the adult population, 24 percent are overweight, while 90 percent do not meet the dietary requirement of consuming five portions of fruit a day, and 40 percent add salt to their food at the table (WHO, 2018). Data on nutrition outcomes in adolescents is lacking.

Nutrition is a policy priority for Zambia. Zambia is implementing the second phase of the most critical days program (MCDP II), which provides guidelines for multisectoral approaches to reducing stunting (NFNC, 2018). Governance and multisectoral nutrition coordination are provided through the National Food and Nutrition Commission (NFNC), whose mandate is provided for through the National Food and Nutrition Act. The government recently developed national food-based dietary guidelines that provide context-specific recommendations of what constitutes a healthy diet (Ministry of Agriculture, 2021). In addition, the Healthy Diets Campaign and a Good Foods Logo are being implemented to raise awareness and accountability of diverse stakeholders for promoting nutritious foods.

While Zambia has made some progress in addressing malnutrition, the efforts are skewed towards undernutrition and nutrition policy reforms are required to address the DMB adequately. For a long time, Zambia's nutrition-related policy agenda focused on addressing food insecurity, hunger, and the resulting micronutrient deficiencies (Harris, 2019; Mukanu *et al.*, 2020). Agriculture policies perpetuate the lack of diversity in the Zambian diet as they predominantly support maize production by small-scale farmers (Mwanamwenge and Harris, 2017). Liberalized economic systems coupled with globalization have contributed to shifts in the food system resulting in the increased availability and affordability of processed, energy-

dense foods high in sugar, salt and fats (Harris *et al.*, 2019). Nutrition problems are predominantly framed as related to behavioural factors, and interventions that address the systemic drivers, such as fiscal and regulatory interventions, are lacking (Mukanu *et al.*, 2020). Thus, significant policy improvements are required to build healthy food systems to support healthy diets.

1.9 Rationale for the study

Zambia's nutrition transition is becoming evident (Harris *et al.*, 2019). The consumption of unhealthy food, including animal fat, sugar, salt, and processed food products, has steadily risen, especially among the urban population. Findings from the 2017 World Health Organisation Stepwise Approach to Non-communicable Disease Risk-Factor Surveillance (WHO STEPs survey), show that only 10 percent of adults consumed at least five portions of fruit and vegetables a day, while six percent of adults often consume processed food high in salt (Mutale and Chilengi, 2018). Interestingly, nationally representative data on dietary patterns under-represents adolescents despite a quarter of Zambia's population being between 10 to 19 years old (Central Statistical Office, 2012).

Given the relatively early stage of the nutrition transition in Zambia (Harris *et al.*, 2019), the government is well poised to avoid the negative impact of the DBM seen elsewhere by making targeted investments that promote nutritious diets for all. The government's developmental goal is to create a diversified and resilient economy for sustained growth and socio-economic transformation. This goal will be achieved through investments in the key economic sectors of agriculture, livestock and fisheries, commerce, trade and industry, education, health, energy and finance (Ministry of National Development and Planning, 2017). Literature shows that policies in these sectors can affect food environments and dietary patterns as they influence food availability, access and use (High Level Panel of Experts, 2017; Turner *et al.*, 2018). Thus, Zambia must understand how the food environment shapes consumer dietary patterns and

identify policy solutions to provide nutrition security, improve nutrition, and promote sustainable food systems while contributing to its economic priorities (Branca *et al.*, 2019). This research was conceptualized to address this knowledge gap. A multi-component approach comprising a sequential explanatory mixed methods design and policy analysis was used to study the prevailing dietary patterns and to recommend evidence-based policy interventions appropriate for the Zambian context.

1.10 Research questions

Government is a critical stakeholder in ensuring that food environments supply healthier foods that meet the needs of the population. Overcoming the DBM requires governments to consider deliberate policy solutions that go beyond increasing food availability through staple grain production. Future food policies should include a combination of nutrition-specific interventions, infrastructure investments, and producer incentives that complement each other (High Level Panel of Experts, 2017; Pingali and Sunder, 2017). Policies should provide an environment that supports and promotes healthy consumer food practices (Hawkes *et al.*, 2015) and that is resilient to adequately address shocks like the Covid-19 crisis. The research agenda for food system research in LMICs thus needs to begin exploring how food environments in LMICs can support healthy and nutritious diets for all. This research aims to answer the following questions:

1. What are the Zambian population's dietary patterns, especially school-going adolescents?
2. How do consumers, especially adolescents, interact with the food environment to access food, and how does this influence their dietary patterns?
3. What are opportunities to promote public policy coherence in Zambia’s key economic sectors of agriculture, livestock and fisheries, commerce, trade and industry, education,

health, energy and finance to support healthier food environments and consumer consumption patterns?

1.11 Aims and objectives

This research aimed to analyse and prospectively explore opportunities for strengthening policies to better address the food environment drivers of the DBM, especially for the adolescent age group. The study was conducted in two phases:

Phase 1: To identify existing dietary patterns and the food environment drivers of these patterns in Zambia:

1. To administer a food frequency questionnaire to school-going adolescents aged 14 – 16 years to identify food decisions and consumption patterns by gender, age and socio-economic status;
2. To record the physical food environment in order to record the number, type and location of food vendors, types of food sold and presence of food adverts within schools and local food outlets/shops in the proximity of the school;
3. To conduct focus group discussions with school-going adolescents to investigate what food environment factors shape their food choices and consumption patterns;

Phase 2: To analyse and explore opportunities for nutrition-related public policies to support healthy food environments and dietary patterns:

4. To conduct a document analysis of nutrition-relevant policies to explore how public policies in key economic sectors support healthy food environments and consumer dietary patterns in Zambia;

5. To recommend policy interventions that support healthier food environments and dietary patterns among school-going adolescents and explore stakeholders' perceptions about the feasibility of these interventions for the Zambian context.

1.12 Overview of the thesis

This thesis is compromised of eight chapters (See Figure 2). Chapter one introduces the research topic and provides the rationale and objectives of the study. It introduces the fundamental concepts of the nutrition transition, the double burden of malnutrition and food environments, the overview of the nutrition landscape in Zambia, and the researcher's positionality. Chapter two provides findings of the literature review on the nutrition status and nutrition interventions in Zambia. Chapter three details the overall methodological approaches to implement the study, including the research paradigms and theoretical and conceptual frameworks. Chapter four to seven presents the results of the different studies conducted to answer the objectives of this study. Chapter eight provides the discussion, where the overall findings from the four studies are integrated and lessons for the nutrition policy reforms are outlined. This chapter also includes a discussion of the strengths and limitations of this thesis, the conclusion and outlines the recommendations for adolescent food environment policy for Zambia.

This thesis was by publication, and the results are presented in the form of four peer-reviewed papers drawn from the empirical findings of this research, as listed below. Papers 1 and 2 have been published, while papers 3 and 4 are currently under review.

Paper 1: Mukanu, M.M., Thow, A.M., Delobelle, P. and Mchiza, Z.J.R. 2022. Determinants of dietary patterns in school-going adolescents in Urban Zambia. Frontiers in Nutrition. 9:956109. doi: 10.3389/fnut.2022.956109.

Paper 2: Mukanu, M.M., Thow, A.M., Delobelle, P. and Mchiza, Z.J.R., 2022. School Food Environment in Urban Zambia: A Qualitative Analysis of Drivers of Adolescent Food Choices and Their Policy Implications. *International journal of environmental research and public health, 19*(12), p.7460.

Paper 3: Mukanu, M.M., Thow, A.M., Delobelle, P. and Mchiza, Z.J.R., 2022. Mapping of food environment policies in Zambia: A qualitative document analysis. ***Under review in BMC Nutrition***

Paper 4: Mukanu, M.M., Thow, A.M., Delobelle, P. and Mchiza, Z.J.R., 2022. Nutrition policy reforms to address the double burden of malnutrition in Zambia: A prospective policy analysis. ***Under review in Health Policy and Planning***

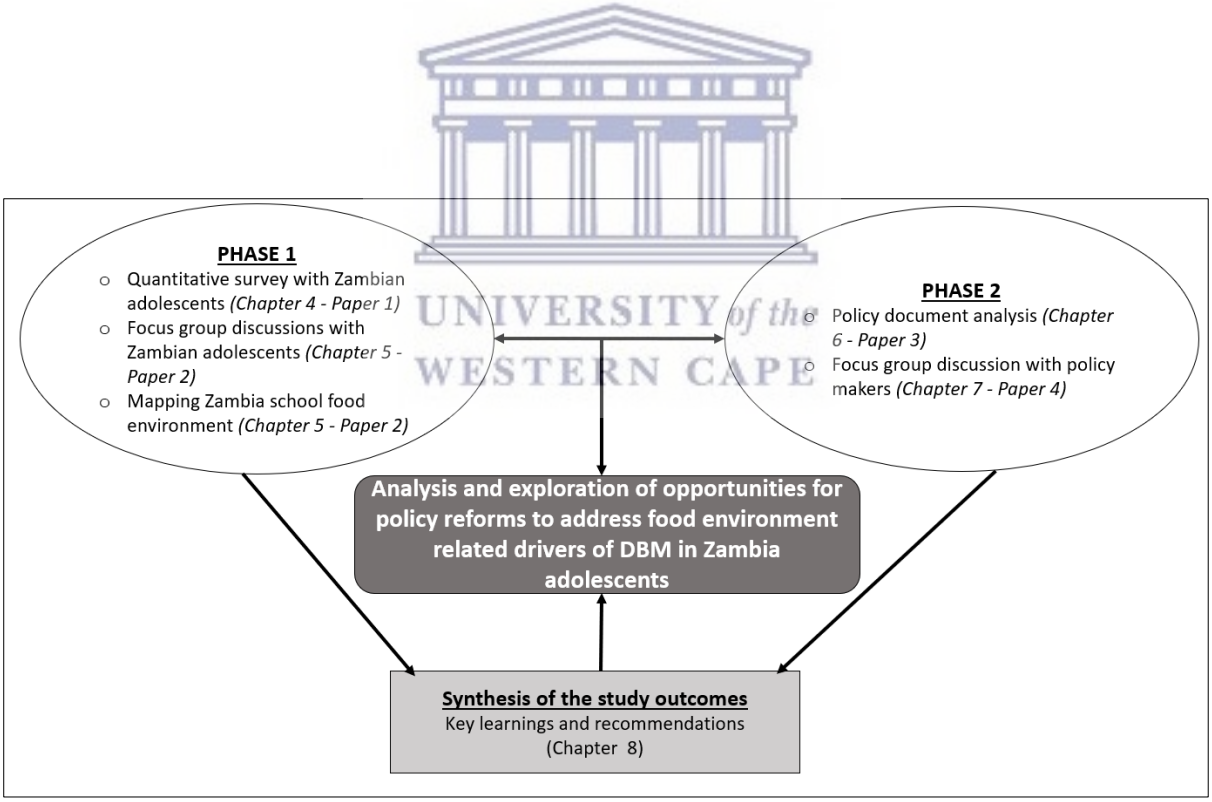

Figure 2: Thesis overview

CHAPTER 2: LITERATURE REVIEW

This chapter aims to outline an overview of the dietary patterns in the Zambian population by summarizing available literature on nutrition status and prevalent dietary patterns and their determinants. It also acknowledges food environment-related research gaps in Zambia.

I reviewed academic and grey literature to determine the dietary habits, nutritional status and its determinants in the Zambian population. A literature search was performed in PubMed, Google Scholar and Google search. The search terms used were 'dietary patterns', 'food consumption patterns', 'nutritional status', 'diet quality', 'dietary intake', 'overweight', 'obesity', 'underweight', 'stunting', 'adolescents' and 'Zambia'. Grey literature was also searched by checking the websites of both government and non-governmental institutions involved in nutrition-related research in Zambia, such as Indaba for Agricultural Research in Zambia, Cuts Zambia, National Food and Nutrition Commission (NFNC), World Food Program (WFP), Food and Agriculture Organisation (FAO).

2.1 Dietary patterns in Zambia

Dietary pattern refers to the quantities, proportions, variety, or combination of different foods, drinks, and nutrients, and the frequency with which they are habitually consumed (Hu, 2002). Dietary pattern analysis is one method used to profile a population's nutritional status (Food and Agriculture Organisation, 2018). Studying the dietary patterns in a population provides information on the diversity of diets. These data are useful for understanding the health of a population. They can be used to project future health outcomes as well as guide the development of interventions to promote good health.

Typical Zambian diets are plant-based

A typical Zambian diet is made of staples in the form of maize, and vegetables (Mwanamwenge and Harris, 2017). Several studies indicate that staples and vegetables are the most consumed

foods in Zambia (Duffy *et al.*, 2017; CUTS and WFP, 2018; Lubungu and Singogo, 2021). One study found that on average, 24 percent of household food expenditure went toward vegetables and 15 percent towards cereals (Ryckman *et al.*, 2021). The main cereals consumed especially in rural areas, are maize, while some rural Zambian households also consume cassava, millet and sorghum (Duffy *et al.*, 2017). Despite the Zambian diets being plant-based, seeds, legumes, and fruit intake are insufficient. In a population survey, the prevalence of low fruit and vegetable consumption was 90.4 percent (Pengpid and Peltzer, 2020). One study found that fruit consumption was significantly higher in rural areas than in urban areas, with weekly consumption of fruit at 48.5 percent of rural and 17.1 percent in urban areas, respectively (Rush et al., 2018).

Diary, meat and eggs are rarely consumed in Zambia (Lubungu and Singogo, 2021; Ryckman *et al.*, 2021). In some rural communities, a study found that children eat less than 0.2 servings/d of meat and eggs (Caswell *et al.*, 2018). Other studies in urban Zambia have found that diary was significantly more often consumed in a household with a higher socio-economic status than those of lower status. For example, only seven percent of the poorer households said they consume dairy products at least once a day while 34 percent eat at least once a week (CUTS and WFP, 2018).

Fish is Zambia's most consumed animal protein (Miyoba, Ogada and Mulenga, 2018). Fish is relatively cheap and accessible source of animal protein for human consumption, even in rural communities. Fish consumption is associated with good health outcomes in both children and women of reproductive age, with children consuming fish less likely to be stunted (Marinda *et al.*, 2018; Byrd *et al.*, 2021). However, fish consumption in the Zambian population is inadequate, with districts near water bodies having a relatively higher consumption. The common type of fish consumed in Zambia is *Kapenta*, the commonly consumed fish type in urban areas, and it has been associated with better nutritional outcomes in children in urban

poor urban households in Zambia (Marinda *et al.*, 2018). Some studies among pregnant women attending antenatal care in urban areas reported fish consumption averaging 2–3 times per week (Chunda-Liyoka *et al.*, 2020).

Patterns of consumption of ultra-processed food in Zambia are relatively unknown. High consumption of ultra-processed food has been linked to the obesity pandemic (Popkin, Adair and Ng, 2012; Kimenju *et al.*, 2015; Roberto *et al.*, 2015). A study on household access to modern retailers found that around 35 percent of total food expenditure was spent on ultra-processed foods (Khonje, Ecker and Qaim, 2020). Another study in urban Zambia found that snacks were consumed regularly by 24 percent of households. The most common types of snacks consumed include bread, scones, fritters, cookies or biscuits and processed maize-based snacks. This study also found that 77 percent of households reported consuming chicken or sausage and chips, pizza and *shawarma* from fast food restaurants such as *Hungry Lion* (CUTS and WFP, 2018). Dietary habits that predispose to NCDs have been found in the Zambian population. For instance, high fat and sodium intake and low numbers of fruit and vegetable servings characterized participants' diets in a study conducted among adults in urban and rural areas of Western Zambia (Oelke *et al.*, 2016). Adding salt to food at the table is commonly practised in Zambia, and the WHO STEPs survey found that 40 percent of the population added salt to the food at the table and a mean total weight of 9.5g of salt being added to food daily (Mutale and Chilengi, 2018). The WHO has recommended a salt intake of 5 g/day (WHO, 2017).

Dietary diversity across the Zambian population is low

Studies have shown that relative to other developing countries, the dietary quality in Zambia is low, with an average daily diversity score of around 3 for adults and children (Khonje, Ecker and Qaim, 2020). The typical Zambian diet lacks the diversity to promote population health

and nutritional status (Maila, Audain and Marinda, 2021; Ministry of Finance and National Development, 2021). The predominantly maize-based staples do not provide a good range of nutrients to meet the required daily intakes for micro- and macro-nutrients for different population groups. For instance, a study of rural Zambian women of reproductive age (15 to 49 years) found inadequate vitamin intake (Kaliwile *et al.*, 2019). Similarly, rural children were found to have inadequate intake of essential micronutrients like calcium, folate, vitamins and iron (Caswell *et al.*, 2018). Another study among rural children found that carbohydrate intake was high, protein intake (mainly from plant-based sources) met the recommended level, and fat intake was relatively low (Mitsunaga and Yamauchi, 2022). Zyambo et al., (2022) found high selenium deficiency in adults (84 percent) compared to children (24 percent). Macronutrient intake, except for carbohydrates, is significantly higher in the urban than in the rural population (Asamane *et al.*, 2021). Findings from the recent ZDHS of 2018 also indicate low dietary diversity in complementary feeding among children 6 to 23 months, of whom only 23 percent of were fed with recommended minimum dietary diversity and 13 percent were fed with recommended minimum acceptable diet (Central Statistical Office, Ministry of Health and ICF, 2019).

2.2 Nutrition status of Zambians

Stunting is slowly improving

Zambia has recorded some improvements in childhood nutrition outcomes in the past years. The prevalence of stunting among children aged five years and below has improved from 40 percent in 2013 (CSO, 2014) to 35 percent in 2018 (Central Statistical Office, Ministry of Health and ICF, 2019). Underweight and wasting also reduced to 12 percent from 14.8 percent to 4 percent from 6 percent, respectively. The multisectoral approach adopted in tackling nutrition through programmes such as micro-nutrient fortification and supplementation,

especially during the first 1,000 critical days in the lifecycle of a child, contributed to the steady strides made during the review period.

Obesity and nutrition-related non-communicable diseases are on the rise

The prevalence of 'overnutrition' related conditions like obesity and the associated nutrition-related NCDs like type 2 diabetes and hypertension have increased in the adult population in Zambia. The prevalence of obesity among women increased significantly from 22.8 percent in 2014 to 32.5 percent in 2017. The WHO STEPS survey estimated the prevalence of overweight, obesity, type 2 diabetes and hypertension among Zambia adults as 24.2 percent, 7.5 percent, 19.1 percent and 6.2 percent respectively (Mutale and Chilengi, 2018). However, other smaller studies have found a higher prevalence for specific populations. For instance, the prevalence of overweight has been found to range between 26.8 percent in some rural settings (Tateyama *et al.*, 2018) to as high as 50 percent in urban settings (Khonje, Ecker and Qaim, 2020), while that of obesity as high as 19 percent (Oelke *et al.*, 2016). Similarly, studies have found the prevalence of type 2 diabetes among the working-class urban population to be as high as 15 percent (Msopa and Mwanakasale, 2019), while that of hypertension ranged between 25 - 30 percent in rural populations (Mulenga *et al.*, 2013). A more recent study found a significantly higher prevalence of hypertension in rural (46.9 percent) compared to urban (22.9 percent) populations, in contrast with numerous studies showing a higher prevalence of hypertension in urban African populations (Rush *et al.*, 2018).

There is generally limited data on the nutritional outcomes of adolescents. A school-based study of primary school-going children in Lusaka found a prevalence of 8.8 percent for obesity and 12.6 percent overweight with the burden increasing with age (Chirwa, Musuku and Pandey, 2019) A study among secondary school adolescents found that seven percent of the 400 pupils survey were either overweight or obese (Makashini, Mulenga and Siziya, 2017)

2.3 Determinants of dietary patterns

Demographic and socio-economic factors

Socio-economic status is a well-known determinant of nutritional status. Several studies from LMICs have shown that people from lower wealth quintiles are associated with poor nutritional habits and outcomes like stunting and micronutrient deficiencies (Galgamuwa *et al.*, 2017; Phooko-Rabodiba *et al.*, 2019). Conversely, higher socio-economic status is associated with a higher likelihood of healthier food consumption. The correlation is likely mediated by the accessibility of food which is cost dependent: nutrient-poor energy-dense foods are relatively cheaper and are consumed by people of low socio-economic status while more nutritious foods cost more (Rao *et al.*, 2013; Jones *et al.*, 2014). Education also influences dietary patterns; the more educated a person is, the more likely they are to have a higher income and better understand the nutritional value of different food types.

Studies in Zambia have shown a similar correlation between nutritional outcomes and socio-economic factors like asset ownership, age and education. For example, livestock ownership and other household assets were positively associated with higher individual dietary diversity scores (DDS) in a study conducted in a rural population in Eastern Zambia (Masa, Chowa and Nyirenda, 2018). Mallard et al. (2014) found an association between greater household wealth and maternal education and improved nutritional outcomes due to increased likelihood of iron-rich food intake in children. Similarly, (Alamu *et al.*, 2019) found that DDS was correlated positively with the educational level of the household heads and negatively with the age of mothers. Data from population surveys have consistently shown that urban households, households with higher income, and households with younger, more educated and male heads were more likely to be food secure (Bulawayo, Ndulo and Sichone, 2019) with children less likely to be stunted (Mzumara *et al.*, 2018; Hoffman *et al.*, 2021). Such findings imply that

multisectoral approaches for addressing nutrition challenges should also target improving socio-economic factors.

Affordability of food

The nutrition transition and urbanization have resulted in households having to purchase significant proportions of the food they consume. In Eastern and Southern Africa, 50–60 per cent of food consumption (by value) is purchased, meaning that markets have overtaken home produce as the primary food source, even in rural areas (Crush and Frayne, 2011; Harris *et al.*, 2019). Food expenditure accounts for a significant proportion of household budgets, with low-income households spending significantly more than higher-income households (Zezza *et al.*, 2017; Murendo, Chirongwe and Sisito, 2022). According to the Living Conditions Monitoring Survey (LMCS), Zambians, on average, spend 41 percent of household expenditure on food, which is higher in lower-income strata in both urban (42 percent) and rural (59 percent) areas (Cheelo *et al.*, 2021).

The affordability of food is a determinant of dietary quality and nutrient intake. In Zambia, like other LMICs, it costs less for a household to purchase food, only meeting their energy needs than it does to meet their nutrient needs. A study conducted by the WFP estimated that a nutritious diet costs three times as much as an energy-only diet in Zambia (World Food Programme, 2021). Generally, animal-source foods are the most expensive food group in Zambia hence their low consumption in the population.

The high poverty rates in Zambia imply that almost 59 percent of the population who survive on less than a dollar a day cannot afford nutritionally adequate diets that cost two dollars a day on average. Some studies have found that low-income households cannot afford to fill the complementary feeding gaps for zinc, animal-source protein, iron, calcium, and folate as they rely on cheap energy-dense staple foods and struggle to meet energy and nutrient requirements

(Cheelo *et al.*, 2021). Therefore, nutrition-sensitive social protection programmes are required to support good nutrition in these population groups.

Availability of food

Availability of food varies across the different geographical regions of the country. Rural areas predominantly have a traditional food system which provides minimally processed seasonal foods, collected or produced for self-consumption or sold mainly through informal markets. Because of supply chain challenges of the traditional food system, access to perishable foods such as animal-source foods, dairy, fruits, and vegetables are not readily available (High Level Panel of Experts, 2017). Food production in rural Zambia largely depends on rain-fed agriculture, so food availability and consumption are affected by seasonal changes. This dependence on rain-fed agriculture results in seasonal variations in food availability, diversity, market prices and access. Most rural households engage in small-scale subsistence farming often growing maize and other food crops like beans and groundnuts. However, many such households lack improved technologies for food storage, processing and preservation and therefore suffer high post-harvest losses, which impacts their dietary intake. Nutrient intakes have been shown to vary significantly by season in rural communities. A study by Caswell et al. (2020) among rural children showed that the intake of most nutrients was highest in the early lean season and lower in the late post-harvest and late lean seasons. There was a decrease in fish consumption from December onward due to fisheries management restrictions in Northern Zambia (Kaminski *et al.*, 2022).

Urban areas like Lusaka have traditional and modern food systems, increasing the variety of food available for consumption. Modern food systems are characterized by more diverse food options all year long and by processing and packaging to extend food shelf life (High Level Panel of Experts, 2017). The growth of the modern food system is associated with the growth of the formal retail food sector. For example, the number of large shopping malls in Lusaka

rose from 1 in 1995 to 25 in 2018 (Khonje and Qaim, 2019). In addition, the number of international supermarkets and fast-food restaurants has grown exponentially, and outlets are expanding to other provinces outside Lusaka and Copperbelt (Ziba and Phiri, 2017). For instance, *Hungry Lion*, a popular fast-food restaurant specialising in fried chicken and chips, has opened 51 outlets nationwide. Studies show that modern food systems can influence diets and nutrition in positive and negative ways. Proximity to fast-food outlets has been associated with high consumption of unhealthy food (Askari Majabadi *et al.*, 2016; Otterbach *et al.*, 2021; Wu *et al.*, 2021). Data from randomly selected households in Lusaka, Zambia, show a similar pattern of modern retailers contributing to higher consumption of ultra-processed foods and calories (Khonje, Ecker and Qaim, 2020). Adults and children in households using modern retailers have higher food variety scores, a higher healthy eating index, and higher vitamin A intake than their counterparts in households that obtained all their food from traditional sources. Nevertheless, they also increase protein and micronutrient intakes among adults and children, mainly through higher meat and dairy consumption.

Knowledge, attitudes, beliefs and practices

Food literacy is important for guiding food choices. Knowledge about the benefits of fruit and vegetables has been associated with higher consumption of these foods (Grosso *et al.*, 2013). Risk factors for NCDs are well known, and adults in urban and rural Zambia adults understand the connection between diet and diseases as they associated cardiovascular disease with nutrition-related factors such as consumption of excessive salt, sugar, and cooking oil (Oelke *et al.*, 2016; Tateyama *et al.*, 2019). Tateyama et al. (2019) further found that study participants preferred salty and sugar-sweetened foods because they are more palatable, while frying as a method of food preparation was preferred because it is convenient.

Myths and misconceptions relating to food also determine dietary patterns, as they can negatively impact the consumption of certain foods (M'soka, Mabuza and Pretorius, 2015).

Some studies have found a high awareness of exclusive breastfeeding among mothers in rural and urban settings (Alamu *et al.*, 2018). A hospital-based study of pregnant women found that women correctly identified foods recommended for use in pregnancy, including fruits, vegetables, meat, and fish (Chunda-Liyoka *et al.*, 2020). In the same study, participants stated that some foods and beverages such as those high in salt and fat, soft drinks, and alcohol, should be avoided during pregnancy (Chunda-Liyoka *et al.*, 2020). A study among pregnant women in a low-income setting in urban Lusaka (Chawama Clinic) shows that while 96.2 percent of pregnant women agreed that eating a balanced diet is essential in pregnancy 53.8 percent, also believed that eating eggs can cause a child to be born with no hair. Myths with implications on childhood feeding practices include beliefs that *bambara* nuts delay a child's speech or the growth of their teeth, catfish delay the development of a child's teeth, pumpkins cause diarrhoea and sour milk cause weak joints (Duffy *et al.*, 2017).

Cultural perceptions about food and body image also determine food consumption. An aspect of culture likely to affect dietary patterns is the perception of body size, whereby most African settings affirm bigger body size as a sign of good health (Siervo *et al.*, 2006; Puoane, Tsolekile and Steyn, 2010; Airhihenbuwa, Ford and Iwelunmor, 2014; Mchiza *et al.*, 2016; Okop *et al.*, 2016). Similar perceptions were found in Zambia in a study indicating that participants preferred being overweight because they looked attractive, wealthy and healthy or did not want to be seen as poor or sick (Tateyama *et al.*, 2018). In Zambia, food such as meat, for example, has a symbolic meaning associated with affluence. In a study conducted in Eastern Zambia, increased meat consumption was associated with prosperity, authority and respect within society (Asamane *et al.*, 2021).

2.4 Nutrition-related interventions and impact

Nutrition is a policy priority for the government, with improved health, food and nutrition among the key developmental outcomes. The Zambia government has continued to build on

the commitments of the Vision 2030 of ensuring healthy and productive populations (Republic of Zambia, 2006). In the current National Development Plan, the government is committed to enhancing the nutrition status of Zambians by eliminating all forms of malnutrition through various programs, including school feeding programs, micronutrient fortification and supplementation, and scaling-up nutrition programmes. The government has also prioritized multisectoral responses to address food security and nutrition challenges and plans to strengthen the institutional framework for coordinating national nutrition and sustainable food systems (Ministry of Finance and National Development, 2021 pg 52).

Nutrition-related policies are anchored in the four key sectors of health, agriculture, education, and community development and social welfare. Zambia's nutrition-related investments are currently guided by the Most Critical Days Programme II (MCDP II). This program primarily targets at reducing the high stunting rates of children below two years in the country. In the MCDP II, the government has prioritized six high-impact evidence-based interventions for reducing stunting, including social and behaviour change communication campaigns to reduce stunting; promoting improved infant and young child feeding and caring practices; promoting maternal nutrition; and dietary diversification through nutrition-sensitive agriculture. In addition, the Zambia government aims to, among others, improve policy coordination and advocacy, which will be required to implement the high-impact interventions (NFNC, 2018).

The health sector drives most nutrition related policy interventions in Zambia. Key policy measures of the health sector include micronutrient deficiency prevention and control, implementation of infant and young child feeding programmes, coordination of multisectoral nutrition programs and providing health promotion (Ministry of Health, 2012b). Micronutrients and vitamin supplementation target women of reproductive age and children under five. The health sector also provides nutrition education through hospital-based and population-level

campaigns. One study found that group nutrition counseling is provided in 88 percent of hospitals, while 92 percent offered individual nutrition counseling to their clients (Banda *et al.*, 2020).

Under the agriculture sector, policy strategies are in place to address the inadequate consumption of nutritious diverse. The key policy measures aimed at improving nutrition and food security as contained in the current national agriculture policy include the promotion of agricultural diversification; enhancing local food processing and preservation; improving access to bio-fortified seed or vines for the production nutrient enhanced foods; promoting the preservation and utilisation of nutrient-rich food; promote nutrition education; and promote production and utilisation of nutritious food and varieties including indigenous crop varieties (Ministry of Agriculture and Ministry of Livestock, 2016). While the government, through the MCDP II, plans to promote dietary diversity by supporting the production of diverse and nutritious food, including fish and livestock, these activities are underfunded as the majority of the agriculture budget is allocated to the Farmer Input Support Programme, an agriculture subsidy program that promotes maize production (Mwanamwenge and Harris, 2017).

Agriculture subsidy programs have been criticized for their implementation challenges, such as poor targeting and lack of impact on improving nutrition (Siegel *et al.*, 2016). Some studies in Zambia show that the Farmer Input Support Programme (FISP) does not contribute to household dietary diversity (Kuntashula and Mwelwa-Zgambo, 2022; Kwon, Myers and Mason, 2022). Despite this, in its 2023 budget, the government increased the allocation towards FISP from 5.4 billion Kwacha in 2022 to 9.1 billion Kwacha in 2023 (68.5 percent increment). In addition, the Zambia government plans to pilot the Comprehensive Agriculture Support Programme, an expansion of the FISP, which will include irrigation development, financing services, storage and logistics, and value addition support (Zipar, 2022). The increased

investment in agriculture subsidy programs should include incentives along the supply chain to support growing healthy food to make it easier and economically attractive for farmers (Lencucha *et al.*, 2020).

The government is also implementing some nutrition-sensitive social protection programs. A Home-Grown School Feeding (HGSF) program has been implemented through the education and community development sectors with support from the WFP. Child nutrition interventions are essential in Zambia, as nearly 60 percent of the population lives below the poverty line and lacks adequate nutrition, and mortality and morbidity due to undernutrition are high (Munthali *et al.*, 2015; Dayton Eberwein *et al.*, 2016). Zambia's HGSF program was initiated in 2003 and initially donor-funded, but government funding has steadily increased, and as of 2021, the HGSF program was implemented in 70 districts, reaching about 1.9 million learners. School feeding programmes have been implemented globally with positive educational, nutritional and economic outcomes (Jomaa, McDonnell and Probart, 2011; Hawkes *et al.*, 2016; Borish, King and Dewey, 2017; Verguet *et al.*, 2020; Chakrabarti *et al.*, 2021). For example, Brazil successfully implemented an HGSF program approach requiring that at least 30 percent of foods used in school feeding programs be sourced from family farmers and local rural enterprises (Hawkes *et al.*, 2016). This program helped provide a ready market and income for farmers (Borish, King, and Dewey 2017 Fernandes et al. 2016).

Zambia is also implementing other nutrition-relevant social protection measures. The food security pack is targets at vulnerable but viable farmer households who lose their productive assets due to recurrent unfavourable climatic conditions. The programme empowers beneficiaries with agricultural inputs and livelihood skills to improve their productivity to enhance their food, nutrition and income security for self-sustainability and poverty reduction. As of 2022, food security packs were provided to 290000 households, and the government has allocated 1.1 billion Kwacha in the 2023 budget to the program (Ministry of Finance and

National Development, 2022). A social cash transfer is also being implemented, targeting vulnerable households. Evidence shows that unconditional cash transfers improve household food consumption, diet diversity, food security, and child nutrition (Seidenfeld *et al.*, 2014).

2.5 Knowledge gaps and areas of future research

In this literature review, I established that data on dietary patterns is not comprehensive as it is not routinely and consistently collected at the population level. Furthermore, I identified two key knowledge gaps this research aimed to address. Firstly, research on food environments and their influence on dietary patterns and the DBM is limited in Zambia. For a long time, Zambia's nutrition-related policy agenda focused on addressing the historically dominant problem of food insecurity, hunger and micronutrient deficiencies. However, with the recent emergence of evidence linking nutritional outcomes to food environment factors (FAO, 2016; Kickbusch, Allen and Franz, 2016; Global Panel, 2017; Lencucha *et al.*, 2018; Mialon, 2020), there is a need to examine how the Zambian government is positioned at policy level to address these issues. Secondly, there is limited data on adolescents' dietary patterns and nutritional outcomes. Nutrition-related population surveys do not routinely include the adolescent age group. One exception is the DHS, which until the last round, collected reproductive health-related nutrition data (body mass index and child feeding patterns) from adolescent girls aged 15 to 19 years. Evidence shows that adolescence is a critical age group which should be targeted for nutrition-related policy investments. These investments will ensure that adolescents develop healthy habits that reduce their risk of nutrition-related NCDs later in life (WHO, 2018; Patton *et al.*, 2022).

CHAPTER 3: METHODOLOGY

This chapter presents an overview of the methods used to conduct the research. The chapter begins with a reflexivity statement and reflection on my positionality as a researcher to give a basis for the methods I chose to undertake this study. I then describe the paradigm in which the research is anchored, as this is important in situating the choices of methods used. A description of the conceptual and theoretical frameworks underpinning the study is provided. The chapter then provides an overview of the study designs, study populations and sampling techniques, and the data-collection procedures and data analysis approach, which are described in more detail in the four papers. The chapter finally discusses the steps involved in ensuring rigor in the research and concludes with some comments on ethical considerations.

3.1 Reflexivity and Researcher Positionality

My approach to understanding nutrition problems and their solutions centers on non-biological, policy-level factors. This perspective stems from my interaction with the food system, which I have witnessed evolve over the years in Zambia. I was in primary school in 1995 when the first Shoprite store opened in Lusaka, Zambia. I remember the excitement among Zambian households like mine as the store offered access to a broader range of quality food choices. In the years that followed, the free market economic system led to an influx of international fast-food franchises, which rapidly opened up across Lusaka, my home town. These stores represented positive economic development and modernity. In addition, satellite television services with international programs became widely available in most urban homes in the 2000s. As portrayed in the South African and American shows and adverts, eating fast foods soon became aspirational and a status symbol for many Zambians.

My experience working as a pharmacist and researcher in the public health system with people of low socio-economic status has shown me that behaviour change, even with the availability of information, is challenging to achieve, especially in resource-constrained environments. For instance, it is common for women who know the value of feeding their infants nutritious food options to go for less nutritious options like *fritters* because that is what they can afford. Similarly, while people might appreciate the need to have backyard vegetable gardens, lack of space and erratic water supply in most unplanned settlements in urban areas makes this impossible. Despite this, nutrition-related interventions focus on educating people to eat healthily. These experiences have shaped my research focus on policy-level solutions to social challenges like nutrition. In conducting this research, I identified with the position of an advocate as I want to contribute to changing the status quo of nutrition policy interventions in Zambia and draw attention to food environment-based policy solutions.

My positionality in nutrition research is that of an outsider, as I lack nutrition-related academic qualifications.. Similarly, pursuing my studies at a University outside Zambia could have reinforced my position as an outsider. However, my experience in working in the Ministry of Health and conducting nutrition-relevant research with the University of Zambia and the Ministry of Health allowed me to access policymakers in the health sector and contributed to my credibility. In addition, I have engaged with key nutrition stakeholders through my research projects which added to my credibility.

3.2 Research paradigm

Locating research within a paradigm is essential and helps the research users understand the researcher's belief system that influenced the way knowledge was studied and interpreted (Lincoln, Lynham and Guba, 2011). The enquiry in this study was underpinned by a pragmatic/pluralistic paradigm and used a mixed-method research design that leveraged the insights provided by qualitative and quantitative research (Johnson and Onwuegbuzie, 2004).

A mixed-method research paradigm uses qualitative and quantitative approaches to answer a broader scope of questions, providing a more comprehensive and in-depth picture of a complex problem that cannot be achieved by either approach alone (Creswell and Clark, 2017).

The increasing popularity of the pragmatic paradigm is the need for a middle ground between the two dominant worldviews of positivism and constructivism (Maxcy, 2003; Creswell and Poth, 2016). Positivists view the world as comprising discrete, observable elements and events that interact in an observable, determined and regular manner. This worldview is the basis of quantitative research approaches and assumes that a single tangible reality exists. In contrast, the constructivist worldview, the basis of qualitative research approaches, assumes knowledge is created by human perception and social experience and thus assumes the existence of multiple realities dependent on context and time (Coll and Chapman, 2000).

Both worldviews have implications of the role of the researcher in social inquiry. In the positivist approach, the researcher engages in social inquiry as an objective analyst independent from data collection and interpretation. Constructivists believe knowledge and knower are inseparable: all knowledge is constructed from human experience, and the researcher makes meaning of the phenomenon of interest through their experience (Cresswell and Clark, 2007).

While positivist and constructivist worldviews have merits and demerits, fitting research into either is not always practical, especially for complex multidimensional problems. Pragmatists argue that 'research should no longer aim to most accurately represent reality, to provide an ''accurate account of how things are in themselves'' but to be useful, to ''aim at the utility for us"' (Kaushik and Walsh, 2019). Moreover, evidence-informed decision-making requires generating relevant and useable evidence, which a single worldview can rarely achieve. The pragmatic paradigm allows for a utilitarian view of knowledge by embracing a plurality of methods and focuses on using 'fit for purpose' approaches to social inquiry (Johnson and Onwuegbuzie, 2004; Creswell and Clark, 2017). However, researchers have to engage in

reflexive research practice and show how they identify themselves in the research process and how their values influence the inquiry (Dickinson *et al.*, 2015).

Using the pragmatic paradigm for this research allowed for flexibility in the choice of methods to answer the questions posed in this research comprehensively. Conducting an evidence-based prospective policy analysis, the ultimate focus of this research, required constructing a 'prevailing reality' of the phenomenon of interest by triangulating data from multiple sources. Quantitative methods were used to measure dietary patterns in the population objectively. Qualitative approaches were used to understand the factors perceived by the study population as important for influencing their dietary behaviours, as well as the perception of the factors that can facilitate or hinder policy change. Moreover, policy analysis is 'value laden' (Reich, 1995). With the pragmatic paradigm, the researcher was able to reflexively engage with the research by clarifying the positionality, values and reason for the choice of methods to generate knowledge.

3.3 Conceptual framework

The role of food environments in shaping transitioning diets and the DBM in LMICs is increasingly gaining policy attention. Globalization, economic development, technological advancement and shifts in agricultural systems have been rapidly transforming diets worldwide, including Africa, in recent decades. Collectively, these factors have led to a transition away from the reliance on staple grains, legumes, vegetables and fruits to dietary patterns that include more processed foods, away-from-home foods (from street vendors and food franchises), animal source foods, refined carbohydrates, edible oils and sugar-sweetened beverages (Popkin, Adair and Ng, 2012; Popkin, 2015).

This study used the conceptual framework for exploring food environments in LMICs developed by Turner et al. (2018) to understand the key dimensions of food environments which influence consumers' dietary choices. This information was critical for identifying

opportunities for nutrition policy reforms. In their work, Turner et al (2018) situate the food environment within the broader food system, which spans from production to consumption: 'farm to flush'. Turner et al. (2018) describe the food environment as an interface where people interact with the wider food system to acquire and consume foods. In understanding the food environment from consumers' perspective, Turner et al. (2018) categorize dimensions that mediate the acquisition and consumption of food into two domains: external (availability, pricing, vendor and product properties, and marketing and regulation of food) and internal (accessibility, affordability, convenience, and desirability of food). Within these domains, 1) influences on consumer dietary decisions and 2) the potential for policies to shape food environments were studied.

3.4 Study setting

This research was primarily conducted in Lusaka, the capital of Zambia. Lusaka has a population of nearly four million people and is the most urbanized, densely populated and multiethnic city in Zambia (Central Statistical Office, 2010). This makes it a good setting to study how changes in the food environment affect consumers. Primary data collection was centered around a sample of secondary schools in Lusaka. The school system was purposively selected for this study because evidence shows that owing to the amount of time students spend at school, the school environment influences dietary habits (Centers for Disease Control and Prevention 1997; Kubik et al. 2003; Carter and Swinburn 2004; Wechsler et al. 2000). Nutrition policy stakeholders were drawn for both government and non-governmental organisations that contribute to nutrition policy development in Zambia.

3.5 Study design

This research was implemented in three phases and comprised four separate but integrated studies.

Phase 1: Explanatory sequential mixed methods design

Phase 1 used an explanatory sequential mixed method design with distinct quantitative and qualitative components to answer Research questions 1 and 2. This research design is best suited for in-depth understanding of dietary patterns in Zambia and provides a good base to guide policy analysis.

Quantitative component

For the quantitative component, a non-quantified food frequency questionnaire (FFQ) was administered to school-going adolescents to collect quantitative data to analyse existing dietary patterns in this age group not covered by national surveys.

A total of 404 Grade 10 pupils from 10 secondary schools in Lusaka district were sampled to participate in a cross-sectional survey. The survey assessed learners' dietary intake practices using a 108 item unquantified FFQ. The survey also included a mapping of food vendors and types of food sold in the same ten schools using a semi-structured observation checklist. Principal component analysis was used to derive dietary patterns from the 108 food items, which were grouped into 15 nutrition-sensitive food groups based on Food and Agriculture Organisation's Global Individual Food consumption data Tool (GIFT) (FAO and WHO, 2021). The learners' nutrition-related behaviours were assessed using the nutrition module of WHO's Global School Health Survey (WHO, 2014b). Multilevel regression was used to analyse the individual and school-level determinants of adolescent dietary patterns. All data analyses were conducted using Stata v15 (StataCorp, 2017). Table 1 shows some of the characteristics of the adolescents inclded in the cross-sectional survey.

Table 1:Cross-section survey participant characteristics

Characteristic	Frequency (percentage)
Gender	
Female	234 (58%)
Male	170 (42%)
Age	
14 – 16	268 (67%)
17 and above	136 (33%)
Guardian employed	
Employed	321 (79%)
Unemployed	83 (21%)
Had weekly pocket money	
Yes	303 (75%)
No	101 (25%)
Household size	
Up to 5	158 (39%)
6 – 10	234 (58%)
More than 10	12 (3%)
Residence	
High density	220 (54%)
Medium density	109 (27%)
Low density	75 (19%)
Eat breakfast at home	
Always	170 (42%)
Regularly	164 (41%)
Rarely	55 (13%)
Never	15 (4%)
Saw TV advertisement for fast foods (n = 389)	
Always	104 (27%)
Regularly	247 (63%)
Rarely	34 (9%)
Never	4 (1%)
Bought sugar sweetened beverage at school	
Yes	247 (39%)
No	157 (61%)
Bought fast food at school	
Yes	233 (58%)
No	171 (42%)
Healthy eating taught at school (n=374)	
Yes	235 (63%)
No	139 (37%)
Benefits of fruit and vegetables taught at school (n=379)	
Yes	248 (65%)
No	131 (35%)

Qualitative component

For the qualitative component, focus group discussions (FGDs) were conducted with a sample of the population of adolescents who completed the FFQ to get an in-depth understanding of the determinants of their dietary choices.

Twenty (20) FGDs comprised an average of 10-12 Grade 10 pupils from each of the ten secondary schools included in the cross-sectional survey described above were conducted. The adolescents who participated in the FGDs were randomly selected from the 404 adolescents that completed the FFQ in the cross-sectional survey. An interview guide was developed based on the domains in the Turners framework for food environments (Turner *et al.*, 2018). Thematic analysis using a hybrid approach which included deductive framework analysis (using Turner's framework) and inductive theme development, was used to analyse the FGDs (Fereday and Muir-Cochrane, 2006). Coding was conducted manually by the authors and checked by the supervisors.

Phase 2: Prospective policy analysis

In Phase two, a prospective policy analysis – which included document analysis and in-depth interviews with nutrition policy stakeholders - was used to answer Research question 3. Building on the findings from Phase 1 of this research, the objective of this prospective policy analysis was to 1) map the availability of policies that support healthy food environments and 2) explore opportunities to develop new policies or strengthen existing ones to better address food environment drivers of poor nutrition, especially among school going adolescents. This phase also included a consultative stakeholder workshop to validate all the research findings and discuss ways to overcome identified barriers against healthy food environment policy reforms.

Document analysis

A qualitative policy documents analysis was conducted to assess the availability of policy provisions to support healthy food environments.

The document analysis covered both global and Zambia-specific nutrition-related policy documents. Global policy documents were analysed to develop a reference point for globally recommended policies for healthy food environments. Zambia's nutrition-related policies were analysed to identify content relating to healthy food environments. The identified policy content was then mapped against the global reference point to identify food environment policy gaps. Global policy documents of interest included global strategic plans, frameworks of action, and global action plans from institutions and organisations that issue nutrition-related policy recommendations like WHO, (FAO) and the United Nations (UN) and its affiliated organizations, of which Zambia is a member state. Zambia's policy documents of interest included those from key government ministries and institutions, including the Ministries of Health, Education, Agriculture, Youth, Sports and Child Development, Community Development and Social Services, Commerce Trade, and Industry and National Development Planning. A total of 11 global and 17 Zambian policy documents were included in the analysis as shown in Table 2. Deductive thematic analysis using the themes developed based on the definition of food environments by the HLPE (High Level Panel of Experts, 2017) was used to analyse the data extracted from the documents.

Table 2: List of documents analysed

Zambian policy documents	**Global policy documents**
1. Vision 2030 (Republic of Zambia, 2006)	1. Global Strategy for Diet and Physical Activity (WHO, 2004)
2. The Competition and Consumer Protection Act (Government of the Republic of Zambia, 2010)	2. Set of recommendations on the marketing of foods and non-alcoholic beverages to children (WHO, 2010)

3. Food Safety Act (Government of the Republic of Zambia, 2020)	3. Comprehensive Implementation Plan for Maternal, Infant and Young Child Nutrition (WHO, 2014a)
4. Food and Nutrition Act (Government of the Republic of Zambia, 2019)	4. Global Action Plan for the Prevention and Control of Non-Communicable Diseases (NCDs) 2013-2020 (extended to 2030)
5. Seventh National Development Plan (Ministry of National Development and Planning, 2017)	5. Second International Conference on Nutrition: Framework of Action (WHO and FAO, 2014)
6. Educating Our Future: National Education Policy (Ministry of Education, 1996)	6. Sustainable Development Goals (SDGs) (United Nations, 2016)
7. National School Health and Nutrition Policy (Ministry of Education, 2006)	7. UN Decade of Action on Nutrition 2016 to 2025 (United Nations, 2017)
8. Guidelines for implementing School Health Nutrition Programme activities (Ministry of Education, 2018)	8. Global Action Plan on Physical Activity 2018-2030 (WHO, 2013)
9. National Food and Nutrition Policy	9. UN Political Declaration on NCDs (UN, 2011)
10. National Food and Nutrition Strategic plan (National Food and Nutrition Commission, 2011)	10. Legal guide on school food and nutrition: legislating for a healthy school food environment (Cruz, 2020)
11. Most Critical Days Programme II: "Zambia's Five Year Flagship Stunting Reduction Programme" (NFNC, 2018)	11. Voluntary Guidelines on Food Systems and Nutrition (CFS, 2021)
12. National Health Policy (Ministry of Health, 2012b)	
13. Adolescent Health Strategic plan (Ministry of Health, 2012a)	
14. Zambian Strategic Plan 2013-2016 Non-Communicable Diseases and Their Risk Factors (Ministry og Health, 2013)	
15. National Health Strategic Plan 2017 – 2021 (Ministry of Health, 2017)	
16. National Youth Policy (Ministry of Youth, Sport and Child Development, 2015)	
17. National Agriculture Policy (Ministry of Agriculture and Ministry of Livestock, 2016)	

In-depth interviews with stakeholders

Interviews with nutrition stakeholders/policymakers were conducted to prospectively explore the opportunities for policy reforms to address the food environment drivers of DBM, especially among adolescents, to identify barriers and facilitators to such policy reforms.

Thirty (30) respondents with a wide range of expertise important to food environments and nutrition policy in Zambia were invited to participate in the study. Of these, 17 stakeholders were interviewed, mainly senior-level officials with current or previous involvement in policy-making drawn from government, civil society, multilateral organisations, academia and industry. Table 3 shows the sector and expertise of the respondents interviewed. Thematic analysis was used to analyse the findings from the indepth interviews. The broad themes based on Kingdon's multiple streams of problem, policy solutions and politics were used to categorize the barriers and facilitators to prospective policy reforms.

Table 3: Stakeholders interviewed

Sector	**Area of expertise**	**Number interviewed**
Government ministries and agencies		
• Health	Nutrition policy development	2
• Education	School health nutrition	1
• Agriculture	Policy development	1
• Commerce, trade and industry	Economic policy	1
• Community development	Adolescent nutrition	1
• Local government	Public health regulation	1
Manufacture related associations	Policy and regulation	1
Commerce and trade affiliated organisations	Marketing and competition	1
Civil society organisations	Nutrition advocacy	3
Bilateral and multilateral organisations	Nutrition program design and implementation	2
UN agencies	Technical support to government	2
Academia/Think tanks	Nutrition research and policy development advisory	1
TOTAL		17

Consultative workshop

A consultative workshop with nutrition policy stakeholders in Zambia was also conducted. The consultative workshop was used to validate the findings from the different studies and for stakeholders to consultatively propose a way forward for policy reform models that support healthy food environments and food consumption patterns. A total of ten stakeholders, including seven who had participated in the in-depth interviews, attended the workshop.

Phase 3: Integration

Phase three involved the integration of key findings from all the components of the research in order to synthesise learnings and recommendations for the way forward for nutrition policy reforms in Zambia. An explanatory narrative approach (Ivankova, Creswell and Stick, 2006) was used to present the synthesised findings in the discussion section. The integration process involved a critically analysing of the finding to draw out key lessons. The key lessons were then mapped across the different studies, and their implications discussed.

This multi-component approach to answering the research questions was well suited for understanding a complex problem like nutrition and providing tailored, context-specific solutions. The different phases of the research design are presented in Figure 3, while Table 4 provides a summary of the methods for each of the four studies and how the outcomes from these studies were synthesised to be able to make recommendations for adolescent food environment policy reforms. Detailed methodology is provided in each of the papers in the results sections.

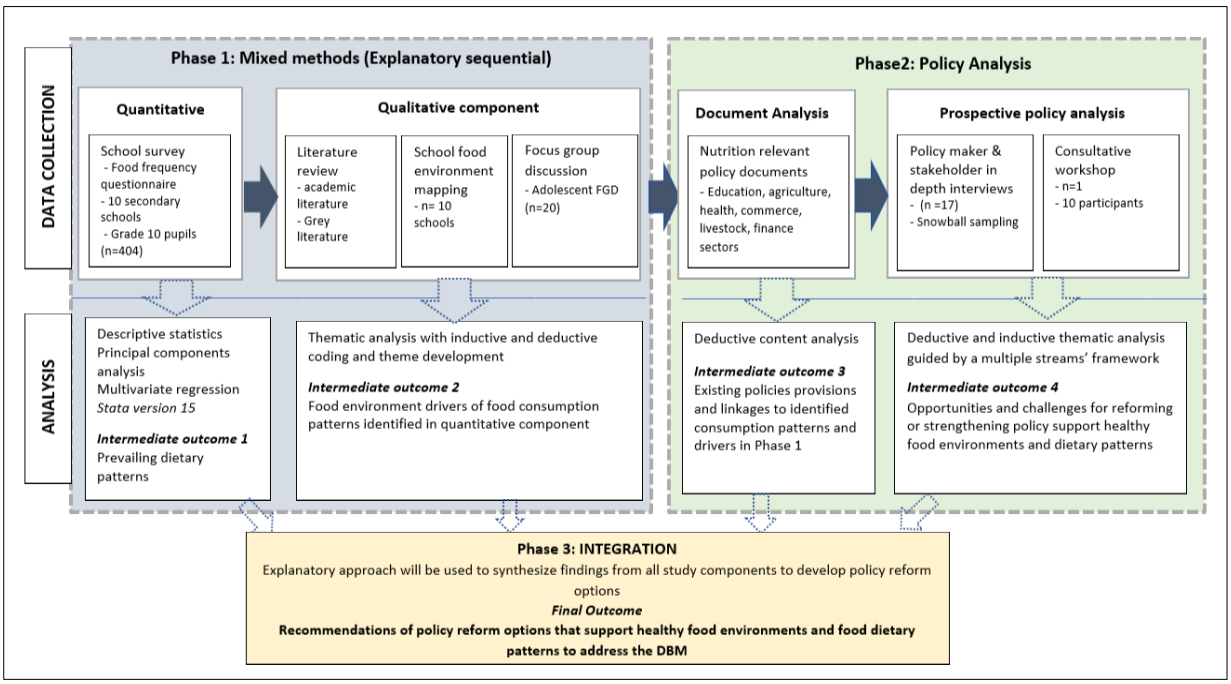

Figure 3: Summary of study methodology

Table 4: Overview of the study methodologies for the studies in the research

Aim	To analyse and prospectively explore opportunities for strengthening policies to better address the food environment drivers of the double burden of malnutrition especially for the adolescent age group.					
	Phase 1			**Phase 2**		
	Study 1	Study 2 A	Study 2 B	Study 3	Study 4	Study 5
Objectives	To determine the nutrition status and dietary habits present in the general population of Zambia	To identify the prevailing dietary patterns and their associated individual and school environment factors among school going adolescents in Lusaka, Zambia	To map the school food environment of adolescents and to identify the drivers under-pinning food choice among school going adolescents in order to analyse the implication of these outcomes on food policy	To map and assess food environment policies in Zambia.	To examine stakeholder perspectives on how nutrition policy in Zambia can be strengthened, with a particular focus on assessing the feasibility of developing and implementing nutrition policy options that address the DBM among adolescents in Zambia	To recommend the way forward for nutrition policy reforms for DBM in Zambia
Design	Literature review with secondary analysis of data	Mixed method explanatory (Quantitative component)	Mixed method explanatory (Qualitative component)	Qualitative document analysis	Prospective policy analysis	Theory driven prospective policy analysis
Study population/data source	Academic papers Raw data from population surveys	School going adolescents	School going adolescents Guardians	Global policy documents Government Policy documents	Nutrition policymakers	Nutrition policymakers Findings from study 1-4

Data collection method	Literature review	Cross sectional survey	Focus group discussion Structured Observations	Document review	In depth interviews	
Tools		FFQ questionnaire (Appendix 1)	Adolescent interview guide (Appendix 2) Observation checklist (Appendix 3)	Data extraction guide (Appendix 4)	Stakeholder interview guide (appendix 5)	
Analysis	Thematic analysis	Principal components analysis Multilevel regression	Hybrid thematic analysis	Hybrid thematic analysis	Hybrid thematic analysis	Deductive thematic analysis
Sample size		404 adolescents 10 schools	220 adolescents 10 schools	17 Zambian policy documents 11 global policy documents	17 policymakers	10 policymakers
Integration: synthesis of study outcomes						
• Summary of the findings and how they contribute to addressing the study objectives • Key learnings from the studies highlighting opportunities for nutrition policy reforms						
Recommendation development						
• Proposed nutrition policy reforms for DBM in Zambia using Kingdon (2010) multiple streams framework • Highlights of areas for future research						

3.6 Theoretical framework

The ultimate focus of this work was to understand opportunities for policy reforms to address the DBM in Zambia. Therefore, theories on policy change and agenda setting provided a useful lens through which the policy process for reforms could be studied. The multiple streams theory (Kingdon, 1984) was applied to explore the process prospectively. This theory explains that policy change occurs when there is a coupling of three parallel but independent streams of problem, policy and politics, facilitated by the opening of a window of opportunity (See figure 4). Each of the three streams includes a specific dynamic intended to raise attention towards a policy issue so that it is prioritized on the political agenda and triggers policy development or change.

The problem stream captures how policy actors portray and understand the policy issue. Policy actors use frames, the distinct and coherent interpretation of an issue containing a problem definition, causal attributions and recommended prescriptions, to define policy issues. Evidence about the extent and impact of the policy issue is used to support the desired framing of the problem. The policy stream includes dynamics about perceived solutions to the policy problem often proposed by subject experts. Various policy alternatives, including the impact of policy action and inaction, are identified, assessed, and narrowed down until a subset of ostensibly feasible options are proposed. Policymakers are likely to support policy solutions that protect their interests. The political stream comprises factors that influence the political environment such as changes in political regimes and public demand in response to advocacy campaigns or policy and institutional legacies.

Kingdon also highlights 'windows of opportunity', the often brief, favourable moments for policy change whose opening is facilitated by focusing events. Focusing events, such as changes in political regimes, worsening of social conditions, or humanitarian crises arising from natural calamities can provide an impetus for policymakers to act. In addition, because

of the brevity of the policy windows, the critical role of actors in the policy process is well appreciated (Walt and Gilson, 1994; Shearer *et al.*, 2016). In the multiple streams theory, Kingdon identifies the important role of policy entrepreneurs who work to present a readily available package of problems and solutions to policymakers at the right moment. Policy entrepreneurs are usually powerful political and social actors who use evidence, interests, values, and emotions to influence the dynamics in any of the three streams to compel policymakers to act. Policy entrepreneurs who understand political and cultural contexts are critical for facilitating the coupling of the three streams when a policy window opens where they broker policy solutions for the policy problem.

Based on this framework, we studied what would be required under each of the three streams to achieve nutrition policy reforms in Zambia.

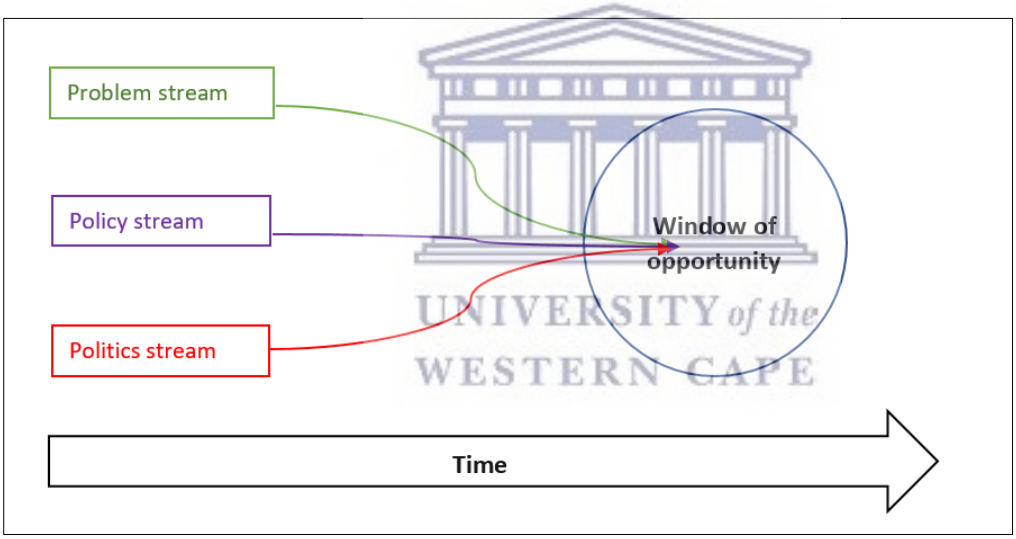

Figure 4: Kingdon's multiple streams theory (author's depiction)

3.7 Rigor

Reliability and validity of quantitative data

The validity of quantitative data was assured by using standardized tools that have been used in different settings and at different time points to collect nationally representative data (Corsi

et al., 2012; Fabic, Choi and Bird, 2012; Wagenaar *et al.*, 2015; Riley *et al.*, 2016). To ensure the reliability of findings, the quantitative FFQ was first piloted to 50 adolescents from a school in Lusaka not included in the study sample. Furthermore, the instrument's face, construct and content validity was ascertained by experts from the National Food and Nutrition Commission in Zambia.

Trustworthiness of qualitative findings

Trustworthiness of the qualitative findings was assured by the following provisions that address Guba's four criteria: credibility, transferability, dependability and confirmability (Lincoln and Guba, 1986). To ensure credibility, the findings from the two phases during the integration phase of the research were triangulated. In addition, the qualitative methods in the research i.e. FGDs, in-depth interviews and qualitative document analysis are well recognized, and fit the purpose for which they were applied. Transferability refers to the extent to which information is provided so that readers can understand if the findings can be applied to other contexts, situations, times, and populations. This research provided a detailed description of the study problem and the study setting, including the typical dietary habits in the population and the prevailing policy landscape. Dependability refers to the reliability of the research findings and the degree to which research procedures are documented, allowing someone outside the research to follow, audit, and critique the research process (Lincoln and Guba, 1986). The findings in this research are dependable because the study design, including details on paradigm, conceptual and theoretical framework and methodology, are all provided to allow auditing and replication. Limitations and potential implications for each research component have been acknowledged and discussed. Confirmability refers to assuring confidence in one's research findings that they represent participants' narratives and are free from potential researcher biases (Anney, 2014). The findings in this research are confirmable because an audit

trail highlighting steps taken in the data analysis was maintained to provide a rationale for the analytical decisions taken. In addition, my supervisors reviewed and examined the research process and data analysis in to ensure that the findings are consistent and dependable. I also provided a reflexivity statement to account for my positionality as a researcher.

3.7 Ethical considerations

Ethics approval was obtained from the University of the Western Cape's Humanity and Social Sciences Research Ethics Committee (Appendix 6) and the ERES Converge Ethics Review Board in Zambia (Appendix 7), and National Health Research Authority (Appendix 8). Participation in all the studies in this research was voluntary, following a process of informed consent. An information sheet with a summary of the study, expectation from the participant, confidentiality statement and anticipated risks and benefits of participation and contact details of the researcher was shared with all participants.

In line with Zambian regulations, no children below 18 years participated in the study without their assenting and informed consent obtained from their parent/guardian. Participants were informed that they were free to decline to participate in the study, or withdraw participation after initial consenting without negative implications. The confidentiality of study participants was assured by adhering to standard practices of recording, transcription and storage of data. Data from the quantitative survey, in depth interviews and focus group discussions, was anonymized, and transcripts and audios of interviews and discussions were kept in a password-protected computer. All printed information was kept in a locked cabinet accessible to research team members only.

This study posed minimum risks to the participants. It was anticipated that questions about where and how one sources for food might cause embarrassment for some participants.

However, this was not experienced by any participant in this study. The plan to mitigate this had it occurred was to assure the participant that all data shared would be confidential and would not be linked back to them. Interviews and discussions were also conducted in private and secure locations within the school premises. It was also anticipated that participating in the study activities would result in opportunity costs where participants might miss out on other activities they could have usually been doing. This risk was mitigated by scheduling study activities at the most convenient times, such as after classes for children. In addition, focus FGD participants were provided with a snack to compensate for their time.

CHAPTER 4: DETERMINANTS OF DIETARY PATTERNS IN SCHOOL GOING ADOLESCENTS IN URBAN ZAMBIA

In Chapter 2, I provided an overview of nutrition in the Zambian population by reviewing the existing dietary patterns, nutrition status and associated determinants and the government policy interventions for nutrition. In this chapter, I build on these findings using primary research to identify dietary patterns and their determinants among adolescents. This study filled a vital research gap as little is known about the dietary habits in the adolescent age group because nutrition-related surveys do not collect data for this age group in Zambia.

To identify the dietary patterns of school-going adolescents, I administered a non-quantified 108-item FFQ to a sample of 404 Grade 10 learners from ten purposively selected secondary schools in urban Lusaka. I conducted principal component analysis in Stata version 15 to generate dietary patterns from the FFQ data. Four dietary patterns were identified: snacking, vegetarian, health-conscious and traditional. I used multilevel regression in Stata version 15 to identify the individual and school food environment factors associated with the four identified dietary patterns.

An important finding from this paper is that snacking dietary pattern is common among school-going adolescents and is significantly associated with individual-level factors (such as having weekly pocket money) and school food environment factors (such as the presence of food vendors within and around the school premises). This paper contributed to answering the second of the research. The study was published in 2022 in the Frontiers in Nutrition journal and can be accessed here: https://www.frontiersin.org/articles/10.3389/fnut.2022.956109/full

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Determinants of dietary patterns in school going adolescents in Urban Zambia

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Background: Understanding dietary patterns in a population is critical for decision making. This study aimed to identify the prevailing dietary patterns and their associated individual and school environment factors among school going adolescents in Lusaka, Zambia.

Method: A cross-sectional study involving 404 Grade 10 pupils from 10 secondary schools in Lusaka district was conducted. A 108-item unquantified Food Frequency Questionnaire (FFQ) was used to assess the learner's food intake practices. Principal component analysis (PCA) was used to derive dietary patterns from the 108 food items. In addition, a mapping of food vendors and types of food sold was conducted in the same 10 schools using a semi-structured observation checklist. Bivariate and multivariate multilevel regression was used to analyse the individual and school level determinants of the adolescent dietary patterns.

Results: The average age of learners was 16.1 years (SD 1.4 years); 234 (58%) were female while 170 (42%) male. "Snacking," "vegetarian," "health conscious," and "traditional" dietary patterns accounting for 54.5% of variability in learner's diets were identified using PCA. At individual level, having weekly pocket money was significantly associated with snacking ($p \leq 0.0001$). Self-identified poverty was associated with snacking ($p \leq 0.0001$), vegetarian ($p = 0.009$) and traditional ($p = 0.009$) dietary patterns. School level factors like a school tuckshop (similar to canteen) that sells fast foods or a *kantemba (semi-permanent makeshift store)* within the school vicinity ($p = 0.023$) were significantly associated with a snacking dietary pattern. School tuckshop selling *nshima (a thick maize based porridge)* was significantly associated with vegetarian ($p = 0.007$), health conscious ($p = 0.02$) and traditional dietary patterns (p=0.01) while a tuckshop with fruit significantly predicted traditional ($p \leq 0.0001$), vegetarian ($p = 0.041$), and snacking ($p = 0.002$), dietary patterns. Having a supermarket or fast food restaurants in the school vicinity did not significantly influence any dietary pattern.

Conclusion: Both individual behavioral and school environment level factors were found to be significant determinants of the four dietary patterns identified in this study.

KEYWORDS

food environment, Zambia, school nutrition, nutrition policy, adolescents

Introduction

Dietary practices have drastically shifted in Low- and Middle-Income Countries (LMICs) in recent years (1, 2). Most countries are experiencing the nutrition transition and dealing with the double burden of malnutrition (3). Understanding prevailing dietary practices in a population is critical for decision making as it provides insights into short term and long-term diseases outcomes in the population (4). Consequently, there is a growing interest in understanding the dietary practices of adolescents as it represents one of the key intervention points in the lifecycle of a person (5). The adolescence period provides an opportunity for cost effective policy action and investments that can help establish healthy dietary patterns that reduce the risk of nutrition related health outcomes like obesity, diabetes and hypertension later in adulthood (6, 7).

Dietary pattern analysis is one of the methods used to profile the nutrition status of a population (8). The term dietary pattern refers to the quantities, proportions, variety, or combination of different foods, drinks, and nutrients in diets, and the frequency with which they are habitually consumed (9). The dietary pattern analysis approach has gained popularity over more traditional methods like single food or nutrient analysis because of the recognition that no single nutrients are consumed in isolation but are part of a larger diet (10). Studying the whole diet therefore provides a better way to explore correlations between different dietary components and the interactions between diet and health.

Adolescents are generally associated with the snacking dietary pattern, characterized by consumption of snacks, sugar sweetened drinks, and fast foods (11). Demographic factors like age and gender as well as social economic status (SES) factors like income (12) are among the well-known individual level influencers of dietary patterns in adolescents. The school food environment is another important factor that influences adolescents' dietary patterns as adolescents spend a significant amount of time in school. The school structure provides an opportunity for adolescents to express their autonomy through independent food choices (13). Healthy dietary patterns characterized by frequent consumption of fruit and vegetables has been associated with availability of these food options in school tuck-shops (14). Conversely, availability of fast food outlets within school vicinities has been associated with unhealthy dietary patterns (15, 16).

While there is a growing body of knowledge on adolescent dietary patterns and their determinants from LMICs (17–20), this area remains understudied in Zambia. Adolescent nutrition assessments have largely focused on micronutrient deficiencies in girls of child bearing age (21, 22). Moreover, other assessments with a nutrition component like the WHO STEPS survey only include people above 18 years (23), under-representing adolescents who make up a quarter of Zambia's population (24). The Global School Health Survey which generates nutrition related data on school going children was last conducted in 2004 (25). This study therefore aims to identify the prevailing dietary patterns and the individual and school environment factors associated with dietary patterns among school going adolescents. The study will generate evidence that can guide decisions on nutrition policy reforms that might be required to support healthier dietary patterns among school going adolescents in urban settings.

Materials and methods

Study design

A cross sectional survey of school going adolescents in selected secondary schools in Lusaka District was conducted in order to establish their dietary patterns and to map the food environment surrounding the schools. The survey involved administration of a food frequency questionnaire (FFQ) to school going adolescents in 10 sampled schools.

Study sites

The study was conducted in ten purposively sampled secondary schools in in Lusaka District of Lusaka, the capital city of Zambia. At the time of the research, Lusaka District had fifty-four secondary schools (seven private-owned and forty-one government) registered with the Ministry of General Education.

Study population

The survey was administered to randomly selected, consenting Grade 10 pupils in the sampled schools. Only Grade 10 learners (both male and female) in the selected schools participated in the study, because this class is a non-exam class and participation would hence cause minimum disruption of the adolescent's school activity. In addition, it is expected that Grade 10 pupils (on average aged between 14 and 16 years) would have well developed food preferences to accurately complete the questionnaire (26).

Study tools

We administered a three-part questionnaire to collect data used to determine the dietary patterns of the adolescents. The first part of the questionnaire collected socio-demographic data including age, sex, residence, and self-assessed poverty. The second part was adapted from the nutritional behavior module of the global school health survey (27) and included questions assessing nutrition related practices such as consumption of fruit and vegetables or snacks and exposure to fast food advertisements in the previous 30 days. The third part was the unquantified food frequency questionnaire (FFQ) which was developed based on the Food and Agriculture Organization (FAO)'s dietary assessment guide for low resource settings (8). The 108 food items included in the FFQ in this study were adapted from the Zambian food guidelines produced by the National Food and Nutrition Commission (NFNC) (28). The questions in the FFQ asked learners to rate how often they consumed a food item in the previous month on an ordinal scale of never; seldom (less than once a month); 1–3 times per month; 1–2 times per week; 3–4 times per week; or daily.

A semi-structured observation checklist was developed and used to map typology of vendors and food sold around the school environment. The food types were categorized into seven main groups: (1) fruits; (2) snacks (such as biscuits, potato crisps, fritters, doughnuts, roasted groundnuts, roasted maize); (3) fast foods (including fried chicken, sausage, pizza, pies, chips, samosas); (4) soft drinks (including carbonated sugar sweetened drinks and energy drinks); (5) water; (6) milk and (7) *nshima* (a thick maize based porridge eaten with relish). Food vendors were categorized as either school tuckshops, street vendors, *kantemba* (a semi-permanent makeshift store), supermarket, grocery or convenience store.

Construct validity of the FFQ, including face and content validity was assessed by a nutrition expert from the NFNC. Both tools were pilot tested among 40 learners in two schools with similar characteristics to the schools included in the study sample before data collection. The purpose of the pilot testing was to assess the readability, logic of questions and length of interviews. Based on feedback from the pilot test, the FFQ was revised to include local names of some food items. The data collection tools were not translated into the local languages, but administered in English, Bemba or Nyanja by trained research assistants.

Sampling

Ten secondary schools, representing 20% of the total population of secondary schools in Lusaka District were purposively selected for the research. The 10 schools (nine government owned and one private owned) were purposively selected to ensure a representation of various demographics and socio-economic status of adolescents in Lusaka. Purposive sampling based on the residential area where a school was located was used as proxy for socio-economic status of adolescents. This is based on studies that have shown an inverse relationship between population density of a residential area and economic status (29). Data was collected from a total of 404 adolescents in the ten sampled secondary schools based on calculation of the minimum sample size for infinite populations (with a 95% confidence level and +/−5% precision) (30).

Recruitment and data collection

The lead author sought and obtained permission first from the Ministry of General Education and then from individual school administrators before the study was conducted. Data was collected over a period of 2 days for each school. On the first day, the trained research assistant obtained the sampling frame, consisting of the names of all grade 10 learners (available on that day[1]), from the teacher assigned by the school administrator to oversee the study once the school granted permission to proceed with the research. The lead author then entered the sampling frame into Stata and assigned each learner a unique random number. The random numbers were then sorted in ascending order and the first 40 learners on the list were invited to participate in the study. Where a learner declined to participate, a replacement was made with the next learner on the list. The selected learners were given information sheets and parent permission forms for their guardian to consent to their participation. On the second day, all learners with parental permission where further asked to provide assent to participate in the research by completing an assent form. Learners were informed that they still had the right to choose not to participate in the research with no negative consequences for them. The FFQ was only administered to learners who assented and had parental permission.

Data was collected in November 2020. The FFQ and school food environment checklist were programmed into electronic

1 Because of the COVID-19 prevention measures, we found that schools had randomly split classes to report on different days in order to maintain social distancing.

versions using Open Data Kit for ease of data collection. Data was collected by five research assistants who were trained and supervised by the lead author. All research assistants had a minimum of a bachelor's degree, at least 1-year experience collecting quantitative data and native speakers of Bemba or Nyanja, the main local languages used in Lusaka. The research assistants were trained on ethical conduct of research where justice, beneficence and right of person was emphasized. Research assistant were also trained on dietary assessment in adolescents using a FFQ and how to administer the questions in both English, Bemba and Nyanja. All interviews were conducted within the school premises after class.

Data analysis

Data analysis was done in three steps for each type of data from the different sections of the tool as described below. All data analyses were conducted in Stata version 15 (31).

Step 1: Analysis of demographic, nutritional behavior, and school environment

Descriptive statistics were used to summarize the categorical demographic and nutritional behavior data (see Table 1) as well as school environment data on food and vendors types (Table 2) into proportions or frequencies. In addition, food intake variables were summarized into three categories of frequency of consumption (Supplementary Table 1).

Step 2: Analysis of dietary patterns

Principal component analysis (PCA) was used to obtain a dietary pattern for each adolescent in the study based on data from the food intake variables. Principal component analysis is an exploratory data driven approach that uses a correlation matrix of food intake variables to identify common patterns of food consumption within the data to account for the largest amount of variation in diet [i.e., statistical technique to determine dietary patterns based on shared variance across dietary variables].

The reduction of food intake variables into food groups was done in three steps. In the first step, the food intake variables, which were measured on an ordinal scale, were recoded and converted to frequency of consumption per week. The conversion of variables was done as follows: "never" = 0; "seldom (less than once a month)" = 0; "1–3 times per month" = 0.5; "1–2 times per week" = 1.5; "3–4 times per week" = 3.5; and "daily" = 7. In the second step, all the food intake variables were allocated to one of the 15 broad food groups based on the FAO/WHO Global Individual Food consumption data Tool (GIFT) nutrition-sensitive food grouping (see Supplementary Table 2) (32). In the last step, a compound score for the food group was obtained by summing the individual scores of the food intake variables in each food group. A higher compound score for a food group indicated a higher frequency of consumption of the food items under that food group.

Principal component analysis was then performed on the 15 food groups to identify correlations that point to particular dietary patterns. The Kaiser–Meyer–Olkin (KMO) test, a measure of sampling adequacy used to assess the suitability of the data for PCA retained an overall value of 0.84 warranting a factor analysis. Varimax (orthogonal) rotation was performed following PCA to improve the interpretability of results. Orthogonal rotation following PCA is useful as it maximizes loadings of variables on extracted factors while minimizing loading on other factors. Four components were retained using the scree plot (Supplementary Figure 1) and Kaiser's stopping rule (33) of an eigenvalue of ≥ 1, which has been applied in other studies (12, 20). The four components accounted for 54.6% of total variance in food intake among the school going adolescents (see Supplementary Table 3). A cut off point of >0.30 on the factor loading was used to identify significant food groups in each component and to determine which dietary pattern best described the component.

Step 3: Analysis of determinants of identified dietary patterns

Multilevel regression analysis was conducted to determine the statistically significant determinants of the dietary patterns identified in the PCA of food groups. This analysis method addressed the possible non-independence in the sample which might result in clustering of learner behaviors at school level. An intra-cluster correlation (ICC) analysis was conducted using a cut off level of 0.05 to confirm the presence of clustering and the need for a multilevel model.

The dependent variables in the multilevel model were the four dietary patterns represented by the components retained from the PCA. Predictor variables were classified into two groups. The first group contained demographic characteristics such as age, gender, and household size. The second group included variables related to the food environment, such as presence of a tuck shop at school, exposure to food marketing and types of food vendors around a school. An investigator led step wise approach was used to fit the model. In the first step, a bivariate regression between each identified dietary pattern and predictor variables was conducted to identify significant predictors with a 95% confidence interval (Table 4). This was followed by fitting of the full model containing both the individual level and food environment predictors. The model with the least ICC and without any multicollinearity was retained and reported in Table 5.

TABLE 1 Survey participant characteristics ($n = 404$).

Characteristic	Frequency	Percentage (%)
Gender		
Female	234	58
Male	170	42
Age		
14–16	268	67
17 and above	136	33
Self-assessed poverty		
Poor	83	21
Non-poor	321	79
Guardian employed		
Employed	321	79
Unemployed	83	21
Had weekly pocket money		
Yes	303	75
No	101	25
Household size		
Up to 5	158	39
6–10	234	58
More than 10	12	3
Residence		
High density	220	54
Medium density	109	27
Low density	75	19
Eat breakfast at home		
Always	170	42
Regularly	164	41
Rarely	55	13
Never	15	4
Eat breakfast at school		
Always	11	3
Regularly	16	4
Rarely	6	1
Never	371	92
Eat lunch at school		
Always	12	3
Regularly	18	4
Rarely	8	2
Never	366	91
Saw TV advertisement for fast foods ($n = 389$)		
Always	104	27
Regularly	247	63
Rarely	34	9
Never	4	1
Bought sugar sweetened beverage at school		
Yes	247	39
No	157	61
Bought fast food at school		
Yes	233	58
No	171	42
Healthy eating taught at school ($n = 374$)		
Yes	235	63
No	139	37
Benefits of fruit and vegetables taught at school ($n = 379$)		
Yes	248	65
No	131	35

Ethics considerations

Ethics clearance for the study was obtained from the University of the Western Cape's Humanities and Social Sciences Research Ethics Committee (HSSREC) in South Africa (reference number HS20/6/19) and Eres Converge ethic review board in Zambia [reference number 2020-Aug-012). Parental consent was sought for learners to participate in the study and individual assent obtained from learners.

Results

Participant characteristics

Table 1 summarizes the demographic characteristics of the learners who completed the food frequency questionnaire. A total of 404 students were interviewed of whom 234 (58%) were female and 170 (42%) male. The average age of learners was 16.1 years (SD 1.4 years).

Analysis of SES characteristics showed that most students identified as being non-poor (79%); had a guardian who was employed (79%) and had weekly pocket money (75%) averaging K38 (US$2). A little over half of the students (54%) were from high-density neighborhoods and the most common household size was 6–10 people (58%).

In terms of dietary patterns, most students reported that they always or regularly ate breakfast (80%); were not on a diet (80%); and did not eat breakfast (91%) or lunch (92%) at school. More students said they bought fast foods (58%) than sugar sweetened beverages (39%) at school.

A similar proportion of students reported learning about healthy eating (63%) and benefits of eating fruit and vegetables (65%) at school.

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TABLE 2 Food environment characteristics of the schools ($n = 10$).

Characteristic	Frequency	Percentage
Tuck shop present		
Yes	10	100
Types of food sold in the school tuck shop		
Snacks		
Yes	10	100
No		
Fruit		
Yes	1	10
No	9	90
Fast foods		
Yes	3	30
No	7	70
Nshima		
Yes	2	20
No	8	80
Sugar sweetened beverages		
Yes	10	100
No		
Milk		
Yes	1	10
No	9	90
Water		
Yes	10	100
No		
Food sold by vendors around school ($n = 10$)		
Snacks		
Yes	10	100
No		
Fruit		
Yes	9	90
No	1	10
Fast food		
Yes	7	70
No	3	30
Nshima		
Yes	6	60
No	4	40
Sugar sweetened beverages		
Yes	10	100
No		
Milk		
Yes	8	80
No	2	20
Water		
Yes	10	100
No		
Types of vendors around school ($n = 10$)		
Supermarket		
Yes	2	20
No	8	80
Kantemba		
Yes	5	50
No	5	50
Street vendors		
Yes	10	100
No		
Grocery		
Yes	6	60
No	4	40
Fast food restaurant		
Yes	5	50
No	5	50

Description of the school food environment

Table 2 summarizes the characteristics of the school environment for the 10 secondary schools. All schools had a tuckshop within the school premises. While snacks, SSBs and water were sold in 100% of the tuckshops, only a few schools had tuckshops selling fruit (10%), milk (10%), and *nshima* (20%). The most common type of food vendors outside the school premises was street vendors who were present around all of the schools. Groceries were found around 60% of the schools while fast food restaurants and *kantemba* were present outside 50% of the schools. Only 20% of the schools had a supermarket within walking distance of the school premises.

Description of the identified dietary patterns

The factor loading of the 15 food groups for the four retained components from the PCA are presented in Table 3. Based on these factor loadings, we identified 4 main dietary patterns as prevalent among the students and these are described below. The name for each dietary pattern was chosen to represent the food groups with high factor loadings accounting for the most significant variation in that dietary pattern. The first component explained 29.9 % variance; the three remaining components explained 8.8, 8.5, and 7.3% of the variance in food intake, respectively.

TABLE 3 Factor loadings of the 15 food groups in the four principal components extracted from the PCA.

Variable	Comp1: Snacking (29.9%)	Comp2: Vegetarian (8.8%)	Comp3: Health conscious (8.5%)	Comp4: Traditional (7.3%)
Cereal	−0.0547	0.0947	0.1100	**0.6172**
Roots	0.0264	**0.3530**	−0.0830	0.2755
Pulses	0.0187	**0.4591**	0.0923	−0.0124
Milk	**0.3671**	−0.1337	0.1892	0.1604
Fish	−0.0545	**0.5662**	−0.1786	0.1389
Meat	0.2609	−0.0714	−0.0032	**0.4658**
Insect	0.2643	0.0276	−0.0536	**−0.3309**
Vegetables	0.0061	**0.4570**	0.2257	−0.2035
Fruit	0.1536	0.1745	**0.4144**	−0.2615
Fats	**0.3452**	−0.0179	−0.0335	0.1723
Sweets	**0.4611**	−0.1464	−0.0131	0.0008
Soft drink	**0.3584**	0.1913	−0.2254	−0.0233
Beverage	0.2119	0.0478	**0.3284**	0.0050
Savory snacks	**0.4322**	0.0936	−0.1027	−0.1452
Egg products	−0.0695	−0.0514	**0.7133**	0.1019

The bold values indicate the food groups with factor loading above the cut off point of >0.30, which significantly contribute to the dietary pattern identified.

"Snacking" dietary pattern

Component 1 was named "snacking" dietary pattern because it had high positive factor loadings for snacks, sweets, soft drinks, fats and milk. The most commonly consumed food items in the snacks group were *jiggies (processed corn-based snacks)* (59%), potato chips (20%), and potato crisps (15%). Fritters and sweets were the most consumed food items in the sweets group with over a quarter of adolescents saying they eat them at least three times a week. Ice-cream, chocolate and cake were relatively less frequently consumed. In the soft drinks group, locally produced products like *freezits (sugary beverage sold frozen)* (64%) and various brands of carbonated SSBs (22%) were frequently consumed compared to international brands like Coca-Cola (14%).

"Vegetarian" dietary pattern

Component 2 was named "vegetarian" pattern as it had high positive factor loadings for roots, pulses, fish and vegetables. In the pulses food group, dried beans (14%) was the most commonly consumed legume followed by soya (11%). Modern vegetables like rape (64%), cabbage (15%), and cucumber (17%) and more traditional vegetables like pumpkin leaves (21%), sweet potato leaves (19%), and okra (15%) were most frequently consumed in the vegetable group. Dried *kapenta (small sardine like fish)* (17%) followed by fresh fish was the most frequently consumed food in the fish and shellfish group.

"Healthy conscious" dietary pattern

Component 3 was named "health conscious" because of the high positive factor loading on fruits and eggs, and negative factor loadings on snacks, soft drinks, sweets, and fats. Bananas (41%), oranges (19%) and apples (16%) compared to local or home-grown fruits like watermelon (14%), guava (8%), and pineapples (5%) were frequently consumed in the fruits group. Nearly almost half of the adolescents reported they consume eggs three times a week or more and as many as 80% consume them at least once a week.

Traditional dietary pattern

Component 4 was named "traditional" based on high factor loadings for cereals and meat and negative factor loadings on fruit, vegetables and snacks. The majority of adolescents (80%) said they eat breakfast meal *nshima* three times a week or more compared to roller meal *nshima* (23%). Chicken was the most common meat protein consumed with two-thirds of the adolescents reporting they ate it at least once a week. Small livestock like rabbit and goal were rarely consumed.

Determinants/drivers of dietary patterns

Table 4 shows the results of the bivariate analysis of the dependent variables and the individual and school environment level predictors while Table 5 shows the results of multilevel analysis of the fitted model.

TABLE 4 Bivariate analysis of the individual and food environment predictors of dietary patterns of adolescents.

Predictor	Snacking			Vegetarian			Healthy			Traditional		
	Mean pattern score	*P*-value	95% CI	Mean pattern score	*P*-value	95% CI	Mean pattern score	*P*-value	95% CI	Mean pattern score	*P*-value	95% CI
Individual level predictors												
Gender												
Female	1			1			1			1		
Male	−0.526	**0.002**	−0.860, −0.192	−0.103	0.423	−0.357, 0.150	−0.112	0.366	−0.356, 0.131	0.059	0.580	−0.150, 0.268
Age												
14–16	1			1			1			1		
17 and above	−0.412	**0.020**	−0.765, −0.060	0.082	0.544	−0.184, 0.345	−0.024	0.857	−0.279, 0.232	−0.078	0.489	−0.297, 0.142
Guardian employed	−0.014	0.944	−0.421, 0.392	−0.317	**0.040**	−0.620, −0.014	0.194	0.194	−0.099, 0.488	0.222	0.082	−0.028, 0.473
Poor	−1.053	**0.0001**	−1.449, −0.657	−0.360	**0.020**	−0.664, −0.056	−0.375	**0.012**	−0.668, −0.083	−0.434	**0.001**	−0.684, −0.185
Had weekly income	0.006	**0.0001**	0.003, 0.009	0.001	0.645	−0.002, 0.003	0.002	0.174	−0.001, 0.004	−0.001	0.506	−0.003, 0.001
Eating breakfast at home												
Always	1			1			1			1		
Regularly	−0.274	0.140	−0.637, 0.090	0.679	0.628	−0.206, 0.342	−0.123	0.356	−0.385, 0.138	−0.364	**0.001**	−0.586, −0.142
Rarely	−0.417	0.129	−0.956, 0.121	−0.053	0.798	−0.461, 0.354	−0.055	0.780	−0.440, 0.330	−0.372	**0.027**	−0.702, −0.042
Never	−0.744	0.099	−1.628, 0.139	−0.243	0.473	−0.918, 0.431	−0.835	0.010	−1.470, −0.196	−0.936	**0.001**	−1.474, −0.397
Saw fast food adverts on TV												
Always	1			1			1			1		
Regularly	−0.183	0.342	−0.560, 0.194	−0.209	0.142	−0.487, 0.070	−0.088	0.527	−0.361, 0.185	−0.098	0.407	−0.329, 0.133
Rarely	−0.536	0.103	−1.182, 0.109	−0.428	0.079	−0.906, 0.050	0.145	0.635	−0.353, 0.578	−0.150	0.458	−0.547, 0.247
Never	−0.841	0.316	−2.486, 0.803	−0.064	0.931	−1.271, 1.163	1.611	0.095	−0.177, 2.201	0.450	0.382	−0.560, 1.459
Benefits of fruit and vegetables taught	0.063	0.731	−0.298, 0.425	−0.006	0.966	−0.277, 0.265	−0.017	0.896	−0.278, 0.243	0.158	0.164	−0.065, 0.381
School food environment predictors												
School tuck shop sells *tuhima*	0.060	0.917	−1.063, 1.183	−0.857	0.142	−2.005, 0.288	−0.364	0.250	−0.984, 0.257	0.065	0.905	−1.000, 1.130
School tuck shop sells fruit	1.039	0.119	−0.266, 2.345	1.194	0.112	−0.277, 2.668	0.624	0.102	−0.125, 1.372	0.436	0.535	−0.943, 1.816
School tuckshop sells milk	−0.541	0.451	−0.866, 1.949	−0.377	0.651	−2.001, 1.255	−0.550	0.150	−1.299, 0.198	1.606	**0.001**	0.640, 2.573
Vendor sells snacks	−0.816	0.114	−1.828, 0.196	−0.400	0.535	−1.665, 0.864	0.014	0.965	−0.630, 0.658	−0.873	**0.042**	−1.717, −0.030
Vendor sells fruit	−0.816	0.114	−1.828, 0.196	−0.400	0.535	−1.665, 0.864	0.014	0.965	−0.630, 0.658	−0.873	**0.042**	−1.717, −0.030
Vendor sells *tuhima*	−0.007	0.987	−0.892, 0.877	0.686	0.051	−0.004, 1.737	−0.091	0.956	−0.512, 0.510	0.318	0.407	−0.434, 1.071
Vendor sells SSB	−0.816	0.114	−1.828, 0.196	−0.400	0.535	−1.665, 0.864	0.014	0.965	−0.630, 0.658	−0.873	**0.042**	−1.717, −0.030
Vendor sells fast foods	−0.481	0.278	−1.351, 0.389	−0.166	0.754	−1.201, 0.869	−0.297	0.244	−0.796, 0.202	0.568	0.129	−0.166, 1.301
Vendor sells milk	−0.685	0.131	−1.575, 0.203	−0.024	0.967	−1.140–1.092	0.185	0.508	−0.362, 0.731	−0.932	**0.005**	−1.589, −0.277
Vendor sells water	−0.816	0.114	−1.828, 0.196	−0.400	0.535	−1.665, 0.864	0.014	0.965	−0.630, 0.658	−0.873	**0.042**	−1.717, −0.030
Fast food restaurant	0.133	0.768	−0.748, 1.013	0.429	0.328	−0.8574, 1.433	0.189	0.458	−0.309, 0.687	−0.125	0.751	−0.894, 0.645
Grocery	0.308	0.486	−0.559, 1.176	−0.364	0.466	−1.344, 0.615	0.339	0.161	−0.136, 0.815	−0.351	0.386	−1.079, 0.417
Kantemba	−0.474	0.273	−1.322, 0.373	−0.498	0.310	−1.460, 0.464	0.059	0.822	−0.453, 0.570	−0.673	**0.048**	−1.341, −0.005
Street vendor	−1.035	0.138	−2.403, 0.333	−1.215	0.127	−2.778, 0.347	−0.515	0.154	−1.361, 0.215	0.025	0.970	−1.302, 1.352
Supermarket	−0.192	0.736	−1.314, 0.929	0.943	0.110	−0.214, 2.105	0.170	0.604	−0.472, 0.812	0.152	0.762	−0.837, 1.142

Predictors with a $p < 0.05$ were considered significant. The bold values represent the significant predictors of the diatary patterns at 95% confidence level.

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TABLE 5 Multivariate analysis of the individual and food environment predictors of dietary patterns of adolescents.

Predictor	Snacking			Vegetarian			Healthy			Traditional		
	Mean pattern score	*P*-value	95% CI	Mean pattern score	*P*-value	95% CI	Mean pattern score	*P*-value	95% CI	Mean pattern score	*P*-value	95% CI
Individual level predictors												
Gender												
Female	1			1			1			1		
Male	−0.285	0.157	−0.678, 0.109	−0.017	0.913	−0.325, 0.291	−0.036	0.812	−0.336, 0.263	0.112	0.366	−0.131, 0.354
Age												
14–16	1			1			1			1		
17 and above	−0.225	0.279	−0.634, 0.183	0.229	0.161	−0.091, 0.549	0.047	0.768	−0.264, 0.357	0.036	0.777	−0.215, 0.287
Guardian employed	−0.639	**0.006**	−1.097, −0.182	−0.617	**0.001**	−0.977, −0.256	0.055	0.757	−0.293, 0.403	0.011	0.938	−0.270, 0.292
Poor	−0.679	**0.009**	−1.186, −0.172	−0.511	**0.012**	−0.911, −0.112	−0.101	0.609	−0.486, 0.285	−0.412	**0.010**	−0.724, −0.100
Had weekly income	0.004	**0.01**	0.001, 0.008	0.0001	0.889	−0.003, 0.002	0.001	0.291	−0.001, 0.004	−0.002	**0.029**	−0.004, 0.0001
Eating breakfast at home												
Always	1			1			1			1		
Regularly	−0.575	**0.005**	−0.981, −0.169	−0.037	0.822	−0.358, 0.284	−0.256	0.103	−0.565, 0.052	−0.428	**0.001**	−0.677, −0.179
Rarely	−0.628	**0.035**	−1.213, −0.043	−0.226	0.344	−0.696, 0.243	0.145	0.523	−0.589, 0.300	−0.312	0.088	−0.671, 0.046
Never	−0.526	0.279	−1.479, 0.426	−0.052	0.891	−0.801, 0.697	−0.892	0.015	−1.624, −0.175	−0.860	**0.004**	−1.446, −0.275
Saw fast food adverts on TV												
Always	1			1			1			1		
Regularly	−0.285	0.169	−0.690, 0.121	−0.288	0.075	−0.605, 0.029	−0.079	0.616	−0.388, 0.230	−0.175	0.171	−0.425, 0.075
Rarely	−0.646	0.059	−1.318, 0.025	−0.554	0.039	−1.081, −0.027	0.192	0.462	−0.319, 0.702	−0.291	0.167	−0.704, 0.122
Never	−1.113	0.18	−2.740, 0.514	−0.843	0.32	−2.525, 1.125	1.008	0.110	−0.230, 2.245	0.724	0.157	−0.278, 1.726
Benefits of fruit and vegetables taught	0.245	0.228	−0.153, 0.643	0.084	0.598	−0.226, 0.396	0.055	0.722	−0.248, 0.358	0.163	0.193	−0.082, 0.408
School food environment predictors												
School tuck shop sells fruit	1.747	**0.002**	0.637, 2.857	1.332	**0.041**	0.053, 2.610	0.443	0.296	−0.389, 1.276	1.333	**<0.0001**	0.689, 1.976
School tuck shop sells nshima	0.003	0.992	−0.561, 0.566	−0.884	**0.007**	−1.524, −0.244	−0.502	**0.020**	−0.924, −0.079	0.431	**0.010**	0.103, 0.759
School tuckshop sells SSB	−0.449	0.262	−1.233, 0.335	0.616	0.201	−0.327, 1.559	0.650	**0.030**	0.063, 1.236	−1.398	**<0.0001**	−1.848, −0.948
School tuckshop sells fast food	−0.656	**0.025**	−1.232, −0.080	−0.492	0.162	−1.182, 0.198	−0.278	0.206	−0.708, 0.152	0.064	0.702	−0.265, 0.394
Supermarket	−0.687	0.107	−1.521, 0.148	0.193	0.508	−0.368, 1.162	−0.248	0.437	−0.873, 0.377	−0.372	0.131	−0.854, 0.111
Kantemba	−0.719	**0.023**	−1.338, −0.101	−0.902	**0.012**	−1.605, −0.198	0.051	0.831	−0.414, 0.515	−0.578	**0.002**	−0.938, −0.218
Fast food restaurant	0.095	0.779	−0.567, 0.756	−0.027	0.944	−0.783, 0.729	0.046	0.856	−0.450, 0.542	0.052	0.79	−0.332, 0.436

Predictors with a $p < 0.05$ were considered significant. The bold values represent the significant predictors of the dietary patterns at 95% confidence level.

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Individual-Level predictors of dietary patterns

From the bivariate analysis, being male ($p = 0.002$) and being above 17 years were significant predictors of snacking dietary pattern. Being poor significantly predicted all the dietary patterns while having a guardian who is employed ($p = 0.040$) and having pocket money ($p \leq 0.0001$) predicted vegetarian and snacking dietary patterns, respectively. Eating breakfast at home also predicted traditional dietary pattern.

From the multivariate model, SES and dietary habit variables were found to be significant predictors of dietary patterns. Pocket money was a significant predictor of the snacking dietary pattern: a higher amount of weekly pocket money was associated with a higher factor score and a high likelihood for the snacking dietary pattern ($p = 0.01$). Paradoxically, students who self-identified as poor were also likely to have a snacking dietary pattern ($p \leq 0.0001$) as well as vegetarian ($p = 0.009$) and traditional ($p = 0.009$) dietary pattern. In addition, vegetarian dietary pattern was significantly predicted by exposure to food advertisements: adolescents who rarely saw adverts for fast food and drinks on TV were more like to have a vegetarian dietary pattern compared to those who saw such adverts frequently. Neither age, gender nor being taught about benefits of eating fruit and vegetables significantly predicted any dietary pattern.

School-Level predictors of dietary patterns

From the bivariate analysis, we found that none of the school level predictors significantly influenced the snacking, vegetarian and healthy dietary patterns. However, having a school tuckshop sells milk (0.001), vendor that sells milk (0.005), and *kantemba* ($P = 0.045$) predicted the traditional dietary pattern.

Results from the multivariate analysis showed the snacking dietary pattern was significantly predicted by having a tuckshop that sells fast foods within the school and the presence of a *Kantemba* ($p = 0.023$) within the school vicinity. A school tuckshop selling *nshima* significantly predicted vegetarian ($p = 0.007$), health conscious ($p = 0.02$) and traditional dietary patterns ($p = 0.01$) while a tuckshop with fruit significantly predicted traditional ($p \leq 0.0001$), vegetarian ($p = 0.041$), and snacking ($p = 0.002$), dietary patterns. Having a supermarket or fast food restaurants in the school vicinity did not significantly influence any dietary pattern.

Discussion

This study assessed the dietary patterns of school going adolescents in urban Zambia as well as the individual and school-level determinants of these patterns. Four main dietary patterns were identified as most prevalent among the adolescents: (1) snacking pattern characterized by consumption of snacks and sweets; (2) vegetarian characterized by consumption of pulses, fish and vegetables; (3) health conscious characterized by fruits and eggs; and (4) traditional characterized by consumption of cereals and meat. Individual level SES factors like having weekly pocket money, a guardian who is employed and self-assessed poverty as well as school environment factors like having a tuckshop that sells fruits or *nshima* and having street vendors outside the school were significant predictors of the identified dietary pattern.

The snacking dietary pattern identified in this study is common and has been demonstrated in school going adolescents in developing countries (34). The predominance of the snacking dietary pattern is evidence of the ongoing nutrition transition toward more westernized diets which features fast foods, snacks and sweets, and is associated with development of cardiometabolic conditions (35). Interestingly, while the focus of nutrition advocates has largely been on the role of "big food" in the dual burden of malnutrition (36, 37), the snacking dietary pattern observed in our study was characterized by consumption of locally manufactured brands of biscuits, carbonated drinks and sweets and less of international brands. This observed difference could be because locally produced snacks are relatively cheaper than international brands. These findings highlight the need for a contextualized approach that account for country specific nuances like locally manufactured unhealthy foods in finding solutions for addressing the dual burden of malnutrition. For instance, the Zambia government has prioritized the food and beverage subsector which currently makes up 65% of the local manufacturing industry as a key driver of economic growth through job creation (38). It would be worthwhile for the government to also incentivize healthy food production so that the economic needs are balanced with promoting population health.

This study found that the relatively healthier and less common vegetarian and healthy conscious dietary patterns were also present among adolescents. The vegetarian dietary pattern in our study was characterized by high factor loadings on roots, pulses, fish, and vegetables. Consumption of similar food groups by vegetarian adolescents has been demonstrated in other contexts (39, 40). Vegetarian dietary patterns are associated with better long-term health outcomes like lower cardiovascular risk scores (41) and better bone structure (42), and should thus be promoted among adolescents. However, vegetarian dietary pattern has also been associated with negative behaviors such as eating and weight disorders among adolescents in high income countries (43). As the vegetarian dietary pattern is relatively uncommon in Zambia, additional qualitative research using phenomenological designs might be required to understand the factors associated with this dietary pattern to better inform interventions aimed at promoting uptake of such diets among adolescents.

Dietary patterns termed "traditional" are usually country specific, consisting of indigenous foods and country specific staples (19, 20, 44–46). Similarly, the traditional dietary pattern identified in this study was characterized by high factor

loadings on cereals and meat, exemplifying the typical Zambian meal that consists of *nshima* and protein and/or relish. The persistence of consumption of traditional foods like *nshima* and vegetables associated with the vegetarian and traditional dietary patterns presents an opportunity to promote preservation of indigenous foods that has potential to contribute to slowing the nutrition transition.

Socio-economic factors like income have consistently been shown to influence dietary patterns (47). Studies from high- and middle-income countries suggest that unhealthy food consumption is relatively higher in low income populations compared to those with higher incomes (48, 49). In developing countries, evidence shows an inverse relationship between SES and unhealthy food consumption (12). Similarly, this study found a significant association between SES and dietary patterns, but the effects were observed across all dietary patterns. On one hand, adolescents who had weekly pocket money were more likely to exhibit a snacking and traditional dietary pattern while those who had an employed guardian likely had a snacking and vegetarian dietary pattern. On the other hand, self-assessed poverty significantly predicted snacking, vegetarian and traditional dietary patterns.

Unhealthy dietary patterns have been linked to lack of nutrition-related knowledge (50). For instance, a study in rural Italy found an association between nutrition knowledge scores and the number of snacks a student consumed in a day (51). Generally, adolescents in our study had a good nutrition knowledge with 75% reporting having "been taught" about the benefits of fruits and vegetables. However, having knowledge on the benefits of fruit and vegetable consumption did not significantly influence any dietary pattern in our study population. While we did not assess the accuracy of the self-reported nutrition-related knowledge, there might be need to evaluate the method used to educate adolescents on nutrition to identify how knowledge can translate to better dietary habits. This finding also supports the need for additional non-informational policy measures to promote healthier dietary patterns. Information-based interventions have been widely used for addressing nutrition related problems owing to their ease of implementation and relative lack of resistance from stakeholders (52). Despite their popularity, evidence of the impact of information-based interventions on nutrition behavior change is mixed (53). However, information-based interventions like mass campaigns remain valuable for raising public awareness in support of more effective, more contentious policy options like taxations and restrictions (54, 55).

The school food environment is an important influencer of dietary patterns as it determines the proximity, availability and cost of different food options (56). School tuckshops and semi-permanent food vendors were significantly associated with adolescents' dietary patterns in our study population compared to supermarkets and fast food restaurants, which have been identified in other studies (14–16). One reason for this finding might be that supermarkets are cost prohibitive for adolescents who our findings showed only have on average $2 dollar per week of pocket money. Our findings suggest that more informal semi-permanent vendors are key stakeholders in promoting healthy dietary patterns in urban school environments as they had a higher food variety and healthier food options compared to school tuckshops and were likely to be more affordable than supermarkets. Similar findings linking informal food vendors to increased fruit and vegetable consumption have been shown in Tanzania (57) and the US (58).

This study found that school environment level factors in addition to individual factors were significant determinants of dietary patterns in adolescents. Currently, school nutrition interventions as outlined in the school health and nutrition policy largely focus on behavior change of adolescents through educational measures (59). However, our findings imply that there is an urgent need for policy measures that will promote healthier school environments. The government in Zambia should consider implementing policies that have been shown to be effective for the school going adolescents such as healthy food provisioning policies, school food meals and school food standards (60). These policy measures should be adapted to make them relevant for the Zambian context.

This study used PCA to determine dietary patterns of school going adolescents in urban Zambia from data collected using a FFQ. Data from FFQs have been associated with recall bias because it is dependent on a respondent's memory to report what they ate over a long period of time (10). The self-reported measures of poverty and income that were used as measures of SES are also associated with social desirability bias (61). In addition, PCA does not provide information about the actual quantities consumed for each food group in each pattern (62). Therefore, these findings should be interpreted with these limitations in mind. Despite this, the large sample size and high response rate contribute to the strength of the findings. Moreover, the approach of using PCA with FFQ data has been shown to be reliable and widely used to study dietary patterns of a specific population (63, 64). Our findings therefore remain useful as they have provided insight into existing dietary patterns of school going adolescents in Zambia, a very under-researched population, and are essential for developing public health interventions. Because dietary patterns are highly context specific, the generalizability of our findings is limited to other urban settings similar to Lusaka. Future research is required to: (1) determine the dietary patterns and food environments in rural settings and (2) analyse how the different dietary patterns correlated with nutritional outcomes like body mass index which can be used to estimate risk for adverse health outcomes like diabetes and hypertension.

Conclusion

Dietary behavior among school going adolescents in Urban Lusaka was found to be characterized by four dominant dietary patterns in this study: snacking, vegetarian, health-conscious and traditional. Individual level predictors of these dietary patterns included socio-economic characteristics such as having a guardian who was employed and an adolescent having pocket money or self-assessed poverty. School environment characteristics such as having a tuckshop that sold fruits or *nshima* and having street vendors and *kantemba* outside the school vicinity were also associated with the four identified dietary patterns. The significance of both individual behavioral and school environment level factors in influencing dietary patterns in this context points to the need for solutions that go beyond behavior change based educational interventions if Zambia is to promote healthy food consumption patterns among its school-going adolescents.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by ERES Converge (2020-Aug-012) in Zambia and the University of the Western Cape's Humanities and Social Sciences Research Ethics Committee (HSSREC) in South Africa (Reference Number: HS20/6/19). Participation in the study was voluntary. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin. All the participants below 18 years provided written assent before the could be enrolled in the study.

Author contributions

MM: conceptualization, formal analysis, investigation, and writing—original draft preparation. MM, AT, PD, and ZM methodology and writing—review and editing. AT, PD, and ZM validation. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fnut.2022.956109/full#supplementary-material

References

1. Hagblade S, Duodu KG, Kabasa JD, Minnaar A, Ojijo NK, Taylor JR. Emerging early actions to bend the curve in sub-Saharan Africa's nutrition transition. *Food Nutr Bull.* (2016) 37:219–41. doi: 10.1177/0379572116637723

2. Pingali P, Sunder N. Transitioning toward nutrition-sensitive food systems in developing countries. *Ann Rev Resourc Econ.* (2017) 9:439–59. doi: 10.1146/annurev-resource-100516-053552

3. Popkin BM, Corvalan C, Grummer-Strawn LM. Dynamics of the double burden of malnutrition and the changing nutrition reality. *Lancet.* (2020) 395:65–74. doi: 10.1016/S0140-6736(19)32497-3

4. Schulze MB, Martínez-González MA, Fung TT, Lichtenstein AH, Forouhi NG. Food based dietary patterns and chronic disease prevention. *BMJ.* (2018) 361:k2396. doi: 10.1136/bmj.k2396

5. Patton GC, Neufeld LM, Dogra S, Frongillo EA, Hargreaves D, He S, et al. Nourishing our future: the lancet series on adolescent nutrition. *Lancet.* (2022) 399:123–5. doi: 10.1016/S0140-6736(21)02140-1

6. Lloyd LJ, Langley-Evans SC, McMullen S. Childhood obesity and risk of the adult metabolic syndrome: a systematic review. *Int J Obes.* (2012) 36:1–11. doi: 10.1038/ijo.2011.186

7. Baird J, Jacob C, Barker M, Fall CH, Hanson M, Harvey NC, et al. Developmental origins of health and disease: a lifecourse approach to the prevention of non-communicable diseases. *Healthcare.* (2017) 5:14. doi: 10.3390/healthcare5010014

8. Food and Agriculture Organization. *Dietary Assessment: A Resource Guide to Method Selection and Application in Low Resource Settings.* Rome: FAO (2018). Available online at: http://www.fao.org/3/i9940en/I9940EN.pdf (accessed January 15, 2020).

9. Hu FB. Dietary pattern analysis: a new direction in nutritional epidemiology. *Curr Opin Lipidol.* (2002) 13:3–9. doi: 10.1097/00041433-200202000-00002

10. Naska A, Lagiou A, Lagiou P. Dietary assessment methods in epidemiological research: current state of the art and future prospects. *F1000Research.* (2017) 6:926. doi: 10.12688/f1000research.10703.1

11. Li L, Sun N, Zhang L, Xu G, Liu J, Hu J, et al. Fast food consumption among young adolescents aged 12–15 years in 54 low- and middle-income countries. *Glob Health Action.* (2020) 13:1795438. doi: 10.1080/16549716.2020.1795438

12. Hinnig PDF, Monteiro JS, De Assis MAA, Levy RB, Peres MA, Perazi FM, et al. Dietary patterns of children and adolescents from high, medium and low human development countries and associated socioeconomic factors: a systematic review. *Nutrients.* (2018) 10:436. doi: 10.3390/nu10040436

13. Bekker F, Marais M, Koen N. The provision of healthy food in a school tuck shop: does it influence primary-school students' perceptions, attitudes and behaviours towards healthy eating?. *Public Health Nutr.* (2017) 20:1257–66. doi: 10.1017/S1368980016003487

14. Goncalves VS, Figueiredo AC, Silva SA, Silva SU, Ronca DB, Dutra ES, et al. The food environment in schools and their immediate vicinities associated with excess weight in adolescence: a systematic review and meta-analysis. *Health Place.* (2021) 71:102664. doi: 10.1016/j.healthplace.2021.102664

15. Azeredo CM, de Rezende LFM, Canella DS, Claro RM, Peres MFT, do Carmo Luiz O, et al. Food environments in schools and in the immediate vicinity are associated with unhealthy food consumption among Brazilian adolescents. *Prev Med.* (2016) 88:73–9. doi: 10.1016/j.ypmed.2016.03.026

16. Kelly C, Callaghan M, Molcho M, Gabhainn SN, Thomas AA. Food environments in and around post-primary schools in Ireland: associations with youth dietary habits. *Appetite.* (2019) 132:182–9. doi: 10.1016/j.appet.2018.08.021

17. Kotecha PV, Patel SV, Baxi RK, Mazumdar VS, Shobha M, Mehta KG, et al. Dietary pattern of schoolgoing adolescents in urban Baroda, India. *J Health Popul Nutr.* (2013) 31:490–6. doi: 10.3329/jhpn.v31i4.20047

18. Rathi N, Riddell L, Worsley A. Food consumption patterns of adolescents aged 14–16 years in Kolkata, India. *Nutr J.* (2017) 16:50. doi: 10.1186/s12937-017-0272-3

19. Borges CA, Marchioni DML, Levy RB, Slater B. Dietary patterns associated with overweight among Brazilian adolescents. *Appetite.* (2018) 123:402–9. doi: 10.1016/j.appet.2018.01.001

20. Abizari AR, Ali Z. Dietary patterns and associated factors of schooling ghanaian adolescents. *J Health Popul Nutr.* (2019) 38:5. doi: 10.1186/s41043-019-0162-8

21. NFNC. *Most Critical Days Programme II: "Zambia's Five Year Flagship Stunting Reduction Programme". 2018–2020.* National Food and Nutrition Commission (2018). Available online at: https://www.nfnc.org.zm/download/the-first-1000-most-critical-days-programme-mcdp-ii-zambias-five-year-flagship-stunting-reduction-programme-2017-2021/ (accessed May 6, 2021).

22. Hewett PC, Willig AL, Digitale J, Soler-Hampejsek E, Behrman JR, Austrian K. Assessment of an adolescent-girl-focused nutritional educational intervention within a girls' empowerment programme: a cluster randomised evaluation in Zambia. *Public Health Nutr.* (2021) 24:651–64. doi: 10.1017/S1368980020001263

23. Mutale W, Chilengi R. *STEPS Survey Results for Zambia.* Lusaka: World Health Organization; Ministry of Health; Central Statistical Office (2018).

24. Central Statistical Office. *Zambia 2010 Census of Population and Housing'.* Lusaka: Central Statistical Office (2012).

25. WHO, CDC, Ministry of Health. *Zambia Global School Health Survey – 2004.* Lusaka: World Health Organization; Ministry of Health (2004). Available online at: https://www.who.int/ncds/surveillance/gshs/ZambiaFullReport-04.pdf (accessed February 22, 2020).

26. Feeley A, Musenge E, Pettifor JM, Norris SA. Changes in dietary habits and eating practices in adolescents living in urban South Africa: the birth to twenty cohort. *Nutrition.* (2012) 28:e1–6. doi: 10.1016/j.nut.2011.11.025

27. WHO. *Global School-Based Student Health Survey.* WHO (2014). Available online at: https://www.who.int/ncds/surveillance/gshs/methodology/en/ (accessed January 15, 2020).

28. Ministry of Agriculture. *Zambia Food-Based Dietary Guidelines: Technical Recommendations'.* Lusaka: Ministry of Agriculture, Zambia (2021).

29. Mweemba AJM, Webb E. Residential area as proxy for socio-economic status, paediatric mortality and birth weight in Lusaka, Zambia. *J Trop Pediatr.* (2008) 54:406–9. doi: 10.1093/tropej/fmn041

30. Kotrlik J, Higgins C. Organizational research: determining appropriate sample size in survey research appropriate sample size in survey research. *Inform Technol Learn Perform J.* (2001) 19:43.

31. StataCorp. *Stata Statistical Software'.* College Station, TX: StataCorp LLC (2017).

32. FAO, WHO. *Global Individual Food consumption Data Tool.* FAO; WHO (2021). Available online at: http://www.fao.org/gift-individual-food-consumption/methodology/food-groups-and-sub-groups/en/ (accessed July 7, 2021).

33. Kaiser HF. The application of electronic computers to factor analysis. *Educ Psychol Meas.* (1960) 20:141–51. doi: 10.1177/001316446002000116

34. Ochola S, Masibo PK. Dietary intake of schoolchildren and adolescents in developing countries. *Ann Nutr Metab.* (2014) 64:24–40. doi: 10.1159/000365125

35. Chisanga B, Drimie S, Kennedy G. Nutrition transition in Zambia: changing food supply, food prices, household consumption, diet and nutrition outcomes. *Food Sec.* (2019) 11:371–87. doi: 10.1007/s12571-019-00903-4

36. Stuckler D, Nestle M. Big food, food systems, global health. *PLoS Med.* (2012) 9:e1001242. doi: 10.1371/journal.pmed.1001242

37. Delobelle P. Big tobacco, alcohol, and food and NCDs in LMICs: an inconvenient truth and call to action. *Int J Health Policy Manage.* (2019) 8:727–31. doi: 10.15171/ijhpm.2019.74

38. Ministry of Commerce Trade and Industry. *National Industrial Policy.* Lusaka: Ministry of Commerce Trade and Industry (2018).

39. Perry CL, McGuire MT, Neumark-Sztainer D, Story M. Adolescent vegetarians: how well do their dietary patterns meet the healthy people 2010 objectives? *Arch Pediatr Adolesc Med.* (2002) 156:431–7. doi: 10.1001/archpedi.156.5.431

40. Man CS, Salleh R, Ahmad MH, Baharudin A, Koon PB, Aris T. Dietary patterns and associated factors among adolescents in Malaysia: findings from adolescent nutrition survey 2017. *Int J Environ Res Public Health.* (2020) 17:3431. doi: 10.3390/ijerph17103431

41. Sabat,é J, Wien M. A perspective on vegetarian dietary patterns and risk of metabolic syndrome. *Br J Nutr.* (2015) 113:S136–43. doi: 10.1017/S0007114514004139

42. Movassagh EZ, Baxter-Jones AD, Kontulainen S, Whiting S, Szafron M, Vatanparast H. Vegetarian-style dietary pattern during adolescence has long-term positive impact on bone from adolescence to young adulthood: a longitudinal study. *Nutr J.* (2018) 17:36. doi: 10.1186/s12937-018-0324-3

43. Sergentanis TN, Chelmi ME, Liampas A, Yfanti CM, Panagouli E, Vlachopapadopoulou E, et al. Vegetarian diets and eating disorders in adolescents and young adults: a systematic review. *Children.* (2021) 8:12. doi: 10.3390/children8010012

44. Lee JW, Hwang J, Cho HS. Dietary patterns of children and adolescents analyzed from 2001 Korea national health and nutrition survey. *Nutr Res Pract.* (2007) 1:84–8. doi: 10.4162/nrp.2007.1.2.84

45. Smith AD, Emmett PM, Newby PK, Northstone K. A comparison of dietary patterns derived by cluster and principal components analysis in a UK cohort of children. *Eur J Clin Nutr.* (2011) 65:1102–9. doi: 10.1038/ejcn.2011.96

46. Zhen S, Ma Y, Zhao Z, Yang X, Wen D. Dietary pattern is associated with obesity in Chinese children and adolescents: data from China health and nutrition survey (CHNS). *Nutr J.* (2018) 17:68. doi: 10.1186/s12937-018-0372-8

47. Galván-Portillo M, Sánchez E, Cárdenas-Cárdenas LM, Karam R, Claudio L, Cruz M, et al. Dietary patterns in Mexican children and adolescents: characterization and relation with socioeconomic and home environment factors. *Appetite.* (2018) 121:275–84. doi: 10.1016/j.appet.2017.11.088

48. Darmon N, Drewnowski A. Does social class predict diet quality? *Am J Clin Nutr.* (2008) 87:1107–17. doi: 10.1093/ajcn/87.5.1107

49. Desbouys L, Méjean C, De Henauw S, Castetbon K. Socio-economic and cultural disparities in diet among adolescents and young adults: a systematic review. *Public Health Nutr.* (2020) 23:843–60. doi: 10.1017/S1368980019002362

50. Sharma S, Akhtar F, Singh RK, Mehra S. Relationships between nutrition-related knowledge, attitude, and self-efficacy among adolescents: a community-based survey. *J Fam Med Prim Care.* (2019) 8:2012–6. doi: 10.4103/jfmpc.jfmpc_217_19

51. Grosso G, Mistretta A, Turconi G, Cena H, Roggi C, Galvano F. Nutrition knowledge and other determinants of food intake and lifestyle habits in children and young adolescents living in a rural area of Sicily, South Italy. *Public Health Nutr.* (2013) 16:1827–36. doi: 10.1017/S1368980012003965

52. Gorski MT, Roberto CA. Public health policies to encourage healthy eating habits: recent perspectives. *J Healthc Leadersh.* (2015) 7:81–90. doi: 10.2147/JHL.S69188

53. Ashton LM, Sharkey T, Whatnall MC, Williams RL, Bezzina A, Aguiar EJ, et al. Effectiveness of interventions and behaviour change techniques for improving dietary intake in young adults: a systematic review and meta-analysis of RCTs. *Nutrients.* (2019) 11:825. doi: 10.3390/nu11040825

54. Boles M, Adams A, Gredler A, Manhas S. Ability of a mass media campaign to influence knowledge, attitudes, and behaviors about sugary drinks and obesity. *Prev Med.* (2014) 67 (Suppl. 1):S40–5. doi: 10.1016/j.ypmed.2014.07.023

55. Murukutla N, Cotter T, Wang S, Cullinan K, Gaston F, Kotov A, et al. Results of a mass media campaign in south africa to promote a sugary drinks tax. *Nutrients.* (2020) 12:E1878. doi: 10.3390/nu12061878

56. Cruz L. *Legal Guide on School Food and Nutrition—Legislating for a Healthy School Food Environment. Legal Guide 2.* Rome: Food and Agriculture Organization of the United Nations (2020). Available online at: http://www.fao.org/3/ca9730en/CA9730EN.pdf (accessed May 5, 2021).

57. Ambikapathi R, Shively G, Leyna G, Mosha D, Mangara A, Patil CL, et al. Informal food environment is associated with household vegetable purchase patterns and dietary intake in the DECIDE study: empirical evidence from food vendor mapping in peri-urban Dar es Salaam, Tanzania. *Glob Food Sec.* (2021) 28:100474. doi: 10.1016/j.gfs.2020.100474

58. Tester JM, Yen IH, Laraia B. Using mobile fruit vendors to increase access to fresh fruit and vegetables for schoolchildren. *Prev Chron Dis.* (2012) 9:E102. doi: 10.5888/pcd9.110222

59. MOE. *Guidelines for Implementing School Health and Nutrition Programme Activities'.* Ministry of Education, Zambia (2018). Available online at: https://hivhealthclearinghouse.unesco.org/sites/default/files/resources/iiep_zambia_guidelines_school_health_and_nutrition_2008.pdf (accessed May 6, 2021).

60. Micha R, Karageorgou D, Bakogianni I, Trichia E, Whitsel LP, Story M, et al. Effectiveness of school food environment policies on children's dietary behaviors: a systematic review and meta-analysis. *PLoS ONE.* (2018) 13:e0194555. doi: 10.1371/journal.pone.0194555

61. Althubaiti A. Information bias in health research: definition, pitfalls, adjustment methods. *J Multidiscip Healthc.* (2016) 9:211–7. doi: 10.2147/JMDH.S104807

62. Hearty AP, Gibney MJ. Comparison of cluster and principal component analysis techniques to derive dietary patterns in Irish adults. *Br J Nutr.* (2009) 101:598–608. doi: 10.1017/S0007114508014128

63. Ali A, Margetts BM, Zainuddin AA. Exploration of the principal component analysis (PCA) approach in synthesizing the diet quality of the Malaysian population. *Nutrients.* (2020) 13:70. doi: 10.3390/nu13010070

64. Adeomi AA, Fatusi A, Klipstein-Grobusch K. Food security, dietary diversity, dietary patterns and the double burden of malnutrition among school-aged children and adolescents in two Nigerian states. *Nutrients.* (2022) 14:789. doi: 10.3390/nu14040789

CHAPTER 5: SCHOOL FOOD ENVIRONMENT IN URBAN ZAMBIA: A QUALITATIVE ANALYSIS OF ADOLESCENT FOOD CHOICES AND THEIR POLICY IMPLICATION

In Chapters 2 and 4, I identified existing dietary patterns in Zambia, especially among urban school-going adolescents. In Chapter 5, I built on the findings of dietary patterns in adolescents and qualitatively explored the factors driving these patterns. I used a food environment lens to explore the factors because quantitatively, I found that school food environment factors were significant determinants of adolescent food choices. This study filled a knowledge gap as previous studies in Zambia have yet to explore how food environment factors shape adolescents' diets.

In this study, I conducted 20 FGDs with 202 Grade 10 learners randomly selected from among those that completed the FFQ in the study presented in Chapter 4. I developed a discussion guide based on Turner's conceptualization of the food environments to explore adolescents' perceptions of how the two domains – external (availability, pricing, vendor and product properties, and marketing and regulation of food) and internal (accessibility, affordability, convenience, and desirability of food) – affect their food choices. In addition, I observed the food environment around the ten selected schools to understand the presence and location of food vendors and the types of food sold. The data from the observations were triangulated with the data from adolescents.

Key findings from this study were that food environment factors contribute to unhealthy dietary patterns in adolescents. Adolescents stated that their food choices were influenced by the wide availability of cheap, processed snacks in and around the school premises, exposure to unhealthy food marketing strategies as well as the affordability of different food options. From this study, I concluded that there was a need to implement policies promoting affordable healthy food options for adolescents.

This study contributed to addressing the third and fourth study objectives. The study was published in 2022 in the International journal of environment research and public health and can be accessed here: https://www.mdpi.com/1660-4601/19/12/7460

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School Food Environment in Urban Zambia: A Qualitative Analysis of Drivers of Adolescent Food Choices and Their Policy Implications

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Abstract: Identifying context specific points for reforming policy to promote healthier food environments and consumer behavior in critical life stages like adolescence is crucial in addressing the double burden of malnutrition. Using a qualitative study design, we conducted 20 focus group discussions with grade 10 pupils from ten secondary schools in Lusaka. Turner's framework which conceptualizes the food environment into two domains—the external domain (availability, pricing, vendor and product properties, and marketing and regulation of food) and the internal domain (accessibility, affordability, convenience, and desirability of food)—was used to guide thematic data analysis and results interpretation. Adolescents stated their food choices are largely based on personal preference linked to the need for social acceptability among peers. Adolescents felt their food choice is limited to 'cheap junk foods' which are affordable and readily available at school. Healthy foods like fruits were said to be inaccessible and unaffordable by the majority of adolescents. Some adolescents stated they were attracted to certain foods by adverts they see on TV and social media. School food environments in urban Lusaka do not support healthy food choices. Policy reforms are required to increase access to affordable healthy food options in schools, and to curb the indiscriminate marketing of unhealthy foods to adolescents.

Keywords: policy interventions; school food environments; adolescents; food choice

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1. Introduction

Adolescence is one of the critical life stages as behaviors and habits developed during this formative period are likely to be carried into adulthood [1]. If these behaviors are not monitored, and effective policy interventions developed, this period of life can be the beginning of negative health outcomes like obesity. The World Health Organization classifies adolescents as those aged between 10 to 19 years [2]. Therefore, understanding the factors shaping food choices during adolescence is important as this may provide a point of entry for targeted and cost-effective interventions aimed at addressing the double burden of malnutrition.

Social cognitive factors at individual, community and societal level have been shown to influence food choices of adolescents in many contexts [3,4]. At individual level, consumption of snacks and fast foods, especially among adolescent girls, is desirable due to peer influence, taste, and appearance of food [5]. Adolescents concerns about food safety and hygiene also increases the desirability of snack foods which are usually conveniently

packaged [6]. Family, cultural norms and expectations constitute some of the community level influencers of food choice as they influence food production, food selection, food preparation, and consequently food consumption and overall nutritional outcomes [7–9]. For example, improved diet quality has been demonstrated in adolescents who eat meals with their parents [10]. Media, as a channel of marketing food and beverages to children remains one of the dominant societal influencers of food choice. For instance, there is growing evidence to suggest that adolescents who are regularly exposed to unhealthy food advertisements on television are more likely to choose and consume fast foods and soft drinks [11,12]. In addition, the adolescents' high use of smartphones and social media platforms exposes them to predatory food marketing where unhealthy foods are portrayed as cool and exciting [13,14].

Of particular importance in the understanding of food choices of adolescents is the school food environment. The school food environment is defined as the 'spaces, infrastructure and conditions within and beyond the school premises where food is available, obtained or purchased and consumed' [15]. This includes the food information available within school premises as well as promotion and pricing of foods and food products [15]. Having unhealthy food in and around school premises has been associated with increased likelihood of children consuming such food in many settings [16,17]. Such evidence coupled with statistics of the growing epidemic of obesity in children [18] calls for deliberate efforts to build school environments that support healthy food consumption behaviors.

Consumer food choices, demand and habit formation are affected by food environments [16,19–21]. The food environment has been defined as the 'physical, economic, political and socio-cultural context in which consumers engage with the food system to make their decisions about acquiring, preparing and consuming food' [20]. As such, food system research advocates for policy measures that influence availability, desirability, and accessibility of different food types to promote healthier dietary patterns. Experts suggest that policies relating to food composition, labeling, promotion, provisioning, retailing, pricing, trade, and investment are required to make food environments healthier [20]. Similarly, the WHO recommends that schools and other settings for children implement comprehensive interventions to create healthy school food environments that will prevent the double burden of malnutrition and NCDs [22]. Establishing standards of foods and beverages sold in schools to ensure that they meet healthy nutrition guidelines, eliminating the provision or sale of unhealthy foods in the school environment through zoning of food vendors and inclusion of nutrition and health education within the core curriculum in schools are policy measures that are showing promise of making the school food environment healthier [14,22]. However, the adoption and implementation of such policy measures remains low in many African contexts [23–25].

The growing double burden of malnutrition is an emerging public health concern in Zambia. Early evidence shows that Zambia is undergoing a nutrition transition with a shift from the traditional Zambian diet of *nshima* (a thick porridge made from maize meal) (which is consumed with a variety of protein and/or vegetable relish) to more processed fast foods [26]. Consequently, nearly a quarter of the adult population are overweight or obese [27] while 35% of children under five years are stunted [28]. Data on the nutrition outcomes of adolescents is largely lacking and policy gaps relating to adolescent nutrition still remain despite nutrition being a policy priority in Zambia. Our unpublished data indicate that regulations restricting marketing of unhealthy food to children and standards for healthy provisioning of food in the school food environment are absent in Zambia [29].

Despite the importance of adolescent nutrition, food environments as key determinants of food choices remain an understudied area in the African context, especially in Zambia. Hence, this study used a food environment lens [30] as follows: (1) to map the school food environment of adolescents; (2) to identify the drivers underpinning food choice among school going adolescents in Zambia and (3) to analyze the implication of these outcomes on food policy. Such an approach is best placed to identify context specific points of intervention for reforming policy to promote healthier food environments and consumer behaviors.

2. Materials and Methods

2.1. Study Design

A qualitative research design was used for this study. We conducted structured observations of the school food environment of selected secondary schools in Lusaka District and focus group discussions [FGDs] to obtain an in-depth understanding of factors that influence dietary patterns of school-going adolescents. The findings from the school food environment mapping and FGDs were then integrated, and their implications for policy examined.

Conceptual Framework

We applied the conceptual framework for exploring food environments in low to middle income countries (LMICs) proposed by Turner and colleagues [31]. This work places the food environment within the broader food system and describes it as an interface where people interact with the wider food system to acquire and consume food. In understanding the food environment from the consumers' perspective, Turner and colleagues (2018) categorize dimensions that mediate acquisition and consumption of food into two domains: external (availability, price, vendor and product properties and marketing and regulation of food) and internal (affordability, convenience, accessibility and desirability of food). It is within these domains that we explored the key influencers of adolescents' food choices through FGDs.

2.2. Study Sites

The study was conducted in Lusaka District in Lusaka, the capital city of Zambia. Lusaka District has 4 main types of residential areas based on the population density: (1) unplanned high-density residential areas, (2) unplanned low density residential areas, (3) planned medium-high density residential area and, (4) planned low density residential areas [32] For the purpose of this study, the status of whether a residential area is planned or not was not considered and consequently unplanned and planned low residential areas were merged into one category. The population density of the neighborhood a school was located in was used as a proxy for the general socio-economic status of the learners attending that school, an approach which has been used in other studies [33].

The study was conducted in 10 purposively sampled secondary schools in urban Lusaka of which 9 were government funded and 1 was privately owned. The purposive sampling of the schools was done to ensure diversity in terms of socio-economic status and ownership. According to a list of secondary schools obtained from the Ministry of Education, they were at the time of this research, a total of 54 government and 7 private owned schools in Lusaka district. From these schools at least 20% from both the government- and private owned schools were selected. Table 1 shows the characteristics of the selected schools included in the study. Two private schools were approached for participation; however, permission was only granted by one school. Permission was granted by nine government owned schools, with one low density residential school denying participation.

Table 1. Secondary schools in Lusaka district included in the study.

School Code	Population Density of School Neighborhood	Ownership
1	High density	Government
2	High Density	Government
3	High Density	Government
4	Medium density	Government
5	Medium density	Government
6	Medium density	Government
7	Low density	Government
8	Low density	Government
9	Low density	Government
10	Low density	Private

2.3. Study Tools

A semi-structured guide for the FGDs was developed based on the eight dimensions from Turner's conceptual framework. The questions assessed how the dimensions of the food environment impacted the food choices of school going adolescents (see Supplementary Table S1). The tool was pilot tested through two FGDs at a school with similar characteristics to the schools included in the sample.

A semi-structured observation checklist was developed and used to conduct the school food environment mapping (see Supplementary Table S2). The observations belong to a qualitative research methodology where a phenomenon is observed in its natural setting and recorded by a researcher [34–37]. The mapping checklist was developed to collect information on the typology and location of food vendors in and around all the sampled school premises as well as the type of food sold, based on the external domains of the Turner's conceptual framework. The checklist was completed by a research assistant.

2.4. Sampling and Data Collection

Participants in the FGDs were randomly selected from Grade 10 learners who completed the food frequency questionnaire in the larger quantitative study. Authorization to conduct the study was sought from the Ministry of General Education. Permission was sought from the school administration before any study activities could be conducted by presenting the authorization letter from the Ministry of General Education to the school administrator of a selected school. Once the school granted permission, the trained research assistant obtained the sampling frame, consisting of names of all grade 10 learners (available on that day), from the teacher assigned by the school administrator to oversee the study. Random sampling was then conducted by the main author to select a random sample of 40 learners in each school to whom the food frequency questionnaire was administered. Each learner was assigned a unique random number and the numbers were then sorted from smallest to largest. The first 40 learners on the list were invited to complete a food frequency question after which they were also invited to participate in the FGD the following day. The selected learners were given information sheets and parent permission forms for their guardian to complete before they participated in any study activities. Learners had to further assent to participate in the study by completing an assent form, and they were informed that they still had the right to choose not to participate with no negative consequences for them.

A total of 20 FGDs with adolescents (two from each of the ten schools) were conducted. Each FGD had an average of 10 learners, resulting in an overall 200 participants. The discussions were conducted after classes within the school premises in a quiet environment such as the school hall or the sports field. The FGDs lasted an average of one hour forty minutes. Learners participating in the FGDs were provided with refreshments as required by the local ethics review board. Data collection was conducted in November 2020.

All data collection was conducted by trained research assistants who were supervised by the lead author of the current manuscript. A total of five research assistants were used to collect the data. All research assistants have a minimum of a bachelor's degree and have had at least one year experience collecting qualitative data. The research assistants were trained on ethical conduct of research where justice, beneficence and right of person was emphasized. Research assistant training also included an introduction to qualitative research methods and principles of collecting qualitative data as well as an introduction to dietary assessment in adolescents.

2.5. Data Analysis

2.5.1. Focus Group Discussions

Thematic analysis using a hybrid approach, including deductive framework analysis and inductive theme development [38] was used for the analysis of FGDs. We developed a set of predetermined themes based on the study's conceptual framework [31], as well as emergent themes arising from the data; these were mainly related to broader, context

specific understanding of the drivers of dietary patterns. The hybrid thematic analysis was conducted manually in five stages [38] and included a reflexive process. First, FGD transcripts were read for familiarization and understanding. Second, framework analysis was conducted where data was coded to the eight 'overarching' a priori themes based on the aforementioned conceptual framework. Third, data coded to these 'overarching' a priori themes (outlined in Table 1) were analyzed to inductively identify codes which constituted key attributes of food or food environments that adolescents felt influence food choice. These codes were then grouped into subthemes (where possible) under each overarching theme. This process was repeated until data saturation was reached where no new attributes were identified from the data. Fourth, the identified codes were reviewed to check for divergent attributes that might have not been captured by the a priori themes. Furthermore, subthemes under each overarching theme were also reviewed to ensure they correctly captured the attributes under them. In the fifth step, each theme and accompanying subthemes were analyzed to identify the common thread and were organized in a way that best reflected the data. The codes applied to data from FGDs under each main theme are summarized in Table 2. For quality assurance the coding and analysis processes were independently checked and approved by the co-authors of the current manuscript.

Table 2. Codes, subthemes and themes used in data analysis.

Example of Codes	Sub Themes	Themes (Based on the Conceptual Framework)
• Healthy food does not look and taste appealing • Appetite and cravings determine what you eat • Experimenting with different food • Eating outside the home is a chance to eat other things aside from the monotonous staple food • Fast food is trendy among adolescents • Fast foods like hungry lion and burgers look appealing • Young people like food that gives energy because they are very active • Young people like food that is enjoyable to eat • Eating healthy food like fruit and salad makes one unique	Taste and preference	Desirability
• Each household has what they eat • Parents are role models of what to eat	Culture	Desirability
• Healthy food provides nutrients for good health • Junk food has no nutrients • Modern food makes people sick • Fast food reduces appetite for healthier food • Food preparation method determines whether food is healthy or not • Quantity of food consumed will determine whether it is healthy or not • Junk food is related to diseases like diabetes and dental caries • Fruits eaten when one is unwell • Traditional food is healthy • Healthy food is eaten at home	Nutrition related knowledge	Desirability
• Young people cannot afford healthy food like fruits • Young people do not have much money • Healthy food requires a lot of ingredients		Affordability
• Fruits are sold very far from school		Accessibility

Table 2. *Cont.*

Example of Codes	Sub Themes	Themes (Based on the Conceptual Framework)
• Young people do not have time to prepare traditional food • Traditional food is messy to eat • Healthy food takes long to prepare • Young people like food that is easy to cook • Noodles and bread are easy to prepare by adolescents		Convenience
• Healthy food costs more money than junk food		Price
• Cheap junk food is readily available at school • Fruits and other healthy food are not sold by school tuck shops • Vendors only sell what young people can afford • Fruit trees are available at the school		Availability
• Some adverts for soft drinks are targeted at young people as they use songs by celebrities that appeal to young people • Adverts make young people start consuming fast foods • There are a lot of adverts for sugar sweetened beverages on TV and billboards • Social media has adverts for soft drinks • Celebrities promote food and drinks		Marketing
• Hygiene of the vendor premises is very important • Presence of hand washing station for preventing COVID • Location of the vendor • Packaging for food items should be clean • Food packaging should have expiry date • Vendor should be popular with other young people		Vendor and product properties

2.5.2. School Environment Mapping

The structured observations of the school food environment were summarized, and descriptive statistics computed in the form of frequencies and proportions using Stata version 15 [39] statistical analysis software. Findings from both the FGDs and school food environment mapping were synthesized and integrated in the discussion of policy implications.

3. Results

In this section we present a description of the school food environment mapping as well as the adolescents' perceptions of the drivers of their food choices obtained from the FGDs. We adopted an integrated approach to understand the adolescent's perceived drivers of food choices in the context of their corresponding school food environment in order to provide a comprehensive discussion of policy implications.

3.1. Description of Food Sold in the School Environment

In all the 10 schools there were tuck shops within the school premises and other food vendors outside the schools. Food vendors outside the school premises included street vendors who are mobile or operate from semi-permanent structures locally called *kantemba* as well as groceries, supermarkets, and convenience shops. Mobile street vendors were mainly observed stationed at the entrance of the school while semi-permanent structures were often set up on busy street corners near the school. Groceries and supermarkets often carried food and sugar sweetened beverage advertisements. Healthy foods including fruits and traditional snacks like roasted maize were observed to be mainly available from street vendors.

The types of food we observed being sold in the school food environment are presented in Figure 1, summarized by availability in school tuck-shops versus other food vendors outside the school. Snacks—i.e., biscuits, chocolates, *jiggies* (corn-based processed packaged snacks), *freezits* (sugar sweetened drink sold frozen), potato crisps, sugar sweetened beverages (SSBs)—and water were available in 100% of the schools and were sold in both the school tuck shops and by other vendors outside the school. Milk and fruits were more readily available with other vendors than in school tuck-shops. Only 10% of the schools had tuck-shops selling milk and fruit. In comparison, 90% of schools had other vendors selling fruit and 30% had milk available. However, fast foods (i.e., fried chicken, chips, sausages, pies, shawarmas) were more available with other vendors than in school tuck shops.

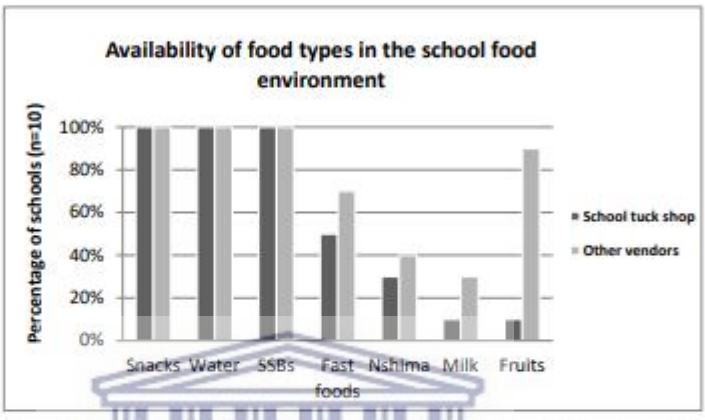

Figure 1. Food availability in the school food environment (Source: School food environment observations).

3.2. *Focus Group Participants' Characteristics*

A total of 200 Grade 10 learners participated in the FGDs. Only one FGD was conducted with learners from a private school. Of the 19 FGDs conducted with learners in government funded schools, seven of these were in low density neighborhood schools while six were in middle and six in high density neighborhood schools. The majority of these learners were females (68%) while 32% were males.

3.3. *Drivers of Food Choice*

In the sections below we present the identified key drivers of food choices based on the domains outlined in the conceptual framework of Turner et al. [28].

3.3.1. Internal Drivers of Food Choice

- Desirability

Personal preference was identified by adolescents as a strong determinant of what they choose to eat. Adolescents largely linked their desire/food preference to taste and appearance of the food items. Traditional and 'healthy' food was generally seen as less exciting and visually unappealing. Adolescents stated that they usually consume traditional foods for inherent health benefits. Some adolescents reported unhealthy habits such as adding more salt as a way to improve the palatability of some traditional food eaten at home. The majority of adolescents stated that they desired fast food like *Hungry Lion* (an international franchise selling fried chicken and chips) because such food looks appealing and tastes delicious.

Food choice was linked to the need for expression of autonomy by young people. Most adolescents felt that eating outside the home was an opportunity to break the culture

of the traditional staple diet (*nshima* and relish) eaten at home, in which they usually have no choice in deciding. Adolescents stated that they felt happy when they bought and ate food of their choice.

"It is empowering in the sense that I now have a choice. I can make a choice to buy what I want, something healthy or something junky, something tasty, something sweet, I can make a choice." Female, 15 years, Low density neighborhood school.

Social acceptability contributed to the desire for particular food items. The majority of adolescents said they favor franchise fast food because it is what is trendy among their peers and they do not want to be left behind. While healthy food consumption was generally frowned upon, some adolescents saw it as an opportunity to be trendy and unique.

> *"Purchasing healthy food is also nice because you get to standout because most people like to eat junk food and when you are just eating healthy food you look unique and it's just nice when you feel good about yourself." Female, 15 years, Low density neighborhood school.*

Adolescents related food choices to nutritional knowledge. The majority of adolescents had knowledge of the negative implications of consuming certain foods. 'Modern foods' were associated with development of ill health. For instance, consuming sweets, chocolate, and carbonated drinks was linked to dental carries and 'sugar disease' (i.e., diabetes) while fatty foods were linked to the development of obesity and hypertension. In addition, adolescents were able to identify the nutritional benefits of different food groups. Adolescents explained that fruits and vegetables provide nutrients and vitamins required for good growth and carbohydrates provide energy while snacks provide no nutritional value to the body. Vegetables like *bondwe* (a species of amaranthus), spinach and beetroot were also identified for their benefits of blood building. A few adolescents added that the food preparation method and quantity consumed also determine how healthy the food will be.

However, adolescents also had misconceptions about food. The perception that healthy food is only eaten at home or when one is unwell was common among the adolescents. Some adolescents associated the cost of food to its 'healthiness'. The relatively expensive fast foods like *shawarma* (a flat bread-based wrap filled with chips, meat, and sauce), burgers and pizza were viewed as healthy by some adolescents. Overall, adolescents felt that healthy food consumption is hindered by lack of knowledge on what constitutes healthy food and lack of skills for healthy food preparation.

> *"Mostly people my age are not actually aware of what healthy foods they need to eat because mostly parents or guardians are usually busy and they don't have time for us to educate us on what we are supposed to eat" Female, 16 years, Medium density neighborhood school.*

- Affordability

Adolescents in the FGDs reported that their choice of what to eat is largely determined by their purchasing power. Adolescents felt that their purchasing power as school going learners was low since they do not have a source of income, and this only allows them to afford cheap food like snacks. Adolescents identified franchise fast foods like *Hungry Lion* and *Debonairs Pizza* among the foods they are unable to purchase. Adolescents unanimously agreed that healthy food options were too expensive for them to afford. They felt that they would eat healthier food options like fruits if this was more affordable as well as available within their school food environment.

- Accessibility

Lack of accessibility was one of the barriers to consuming healthy food identified by adolescents. The majority of adolescents stated that vendors that sell healthy foods like fruits were a distance from the school and they were not allowed to leave school premises during school hours. As a result, they are 'forced' to eat junk food because vendors who sell such foods are readily accessible within the school (tuck-shop) and outside (*Kantemba* and street vendors). Our observation of the school food environments shows that street vendors selling fruit were often found on busy street corners near the schools and only accessible to learners after school hours, supporting the assertion by adolescents.

Technological and developmental advances were also associated with the shift in dietary patterns of young people compared to their parents. Adolescents attributed the desire and increased consumption of fast foods among their age group to the accessibility of these foods in the community. They explained that the coming of malls and delivery services offered by fast food companies are making fast food ubiquitous.

> *"When they [parents] were younger I think the availability of junk foods wasn't as common as it is here for us. For them it was harder and more expensive to find junk foods like burgers unlike foods that is more traditional. For us you can just go anywhere and you find a Hungry Lion store". Male participant, 17 years, High density neighborhood school.*

- Convenience

Food that is easier to prepare and consume appeals to young people. The majority of adolescents stated that in the home setting, they usually feel lazy about preparing food that takes a lot of skill and time such as *nshima* and other healthy foods. They explained that healthy food also needs a lot of ingredients which are not readily available. Noodles, eggs, bread, sausage, and cereal were listed as the common foods prepared as they require only a few minutes to be ready. Some adolescents added that their preferred cooking method is frying because it is fast and the food tastes good when fried and crisp.

3.3.2. External Drivers of Food Choice

- Price

Price of food items determines the type of food young people will eat. All the adolescents agreed that they were drawn to buy and eat snacks and junk food because the price of these food items was less than that of more expensive food options. The commonly consumed food items bought in and around the school (such as *jiggies*, *freezits*, fritters, cookies, and popcorn) were reported to cost less than K2 (US$0.08). Fruits such as apples were generally considered expensive by adolescents. They stated that on average, a banana costs K2 (US$0.08), an apple costs K4 (US$ 0.16) while an orange costs K8 (US$0.32).

> *"Healthy foods are very expensive when you compare them to these junky foods that we like to buy. For example, one apple is K3 and then I think if am going to buy Jiggies which are K0.50, I am going to have maybe about six! So I'll decide to buy those ones [jiggies] which I am going to have more rather than buying the apple" Male, 15 years, Medium density neighborhood school.*

- Availability

Adolescents used the term 'snacks' and 'junk food' to classify the food available in the tuck shop at their school. They explained that the availability of cheap snacks responds mainly to their purchasing power as adolescents as well as their tastes and preferences as young people. Adolescents from two schools mentioned availability of fruits such as mangoes, oranges, and guavas on the school premises where they get fruits when in season. Our school food environment observation also found wide availability of snacks, fast foods, and SSBs being sold by vendors in and around all the schools.

Adolescents unanimously felt that the food available in the school tuck shops lacked variety and there was no healthy food in stock. However, when asked about additional

food that should be stocked in tuck shops, adolescents still chose fast food options like fried chicken and chips, pizza, and *shawarma*. Only a few adolescents felt the school tuck shops also needed to have fruits and pure fruit juices, smoothies and salads, which they categorized as 'healthy', in order to cater for those who are health conscious.

> *"Personally, I would like them to sell fruits in school because some of us are just gaining weight at school because of the junk foods they are selling." Female, 14 years, Low density neighborhood school.*

- Marketing

Adolescents reported seeing adverts for food and beverages frequently on TV. Other advertising channels mentioned were radio, internet social media platforms, billboards, newspapers, and catalogues produced by supermarkets. Food and beverage adverts were also observed on store fronts of formal food vendors such as groceries in the school food environment.

Social media marketing especially was an influencer of food choices and was linked to social acceptability. Adolescents said that they often learn about trending eating places, or the foods they should eat, from posts on social media platforms such as Facebook, Instagram, and YouTube. Some adolescents said they follow the dietary pattern of favorite celebrities so that they can have a similar body image.

> *"As for me, let me give an example of tamarind: I heard Kim Kardashian on that show [Keeping up with the Kardashians] say that for her body to be like that, she eats tamarind. If she eats that, even us to keep our bodies the way she looks, now we start eating tamarind" Female, 14 years, Medium density neighborhood school.*

Zambian food manufacturers of SSBs engaged in marketing activities that directly targeted young people. Adolescents explained that these Zambian companies use advertising tactics such as road shows which are appealing to young people when they want to introduce a new drink, so that young people know about their product and buy it.

> *"I have seen road shows . . . It's when they bring trucks with music such that when you go up on the platform in the truck and dance; you are given mojo [a brand of carbonated drink] so that know that there are drinks like mojo." Male, 17 Years, Medium density neighborhood school.*

- Vendor and product properties

Adolescents considered the hygiene of food vendors when deciding where to source food from in addition to the pricing of food items. All the adolescents were conscious that buying food from a dirty environment is associated with a risk of diarrheal diseases and COVID-19. Other attributes considered during vendor selection were the popularity of the vendor and facilities for in-house dining. However, the majority of adolescents added that while they are aware of the standard that food vendors are supposed to maintain, where they buy food is ultimately determined by the price as they have very low purchasing power. Some adolescents further added that they consider the packaging of a food item as it tells a lot about the quality of the product and the standards of the manufacturer.

> *"We look at the quality, the way products are looking. This is important because I cannot buy food anyhow; I have to buy food that is profitable to my health, not eating because you just want to eat. Nowadays there are a lot of cheap things that are of low quality." Female, 15, High density neighborhood school.*

4. Discussion

Our research aimed to map school food environments and identify the food environmental factors influencing food choices of school going adolescents in Zambia. We found that the school food environments do not adequately support healthy food choices with unhealthy food commonly sold in and around the school with limited access to healthier options. We also found that the influential drivers of food choice included desirability and

affordability in the internal domain, and availability and marketing in the external domain of the conceptual framework of Turner et al.

As this is the first study in Zambia to document adolescent engagement with school food environments, these findings provide insights for Zambian food and nutritional policy. The discussion thus focuses on the policy implication of our findings in the light of international and evidence based best practices for improving food environment and promoting healthier food choices among school-going adolescents.

4.1. Improving Availability of Healthy Food

Our study findings suggest that school food environments in urban Lusaka are largely unhealthy owing to the wide availability of cheap ultra-processed snacks like biscuits, corn-based snacks, sweets, and sugar sweetened beverages. A similar profile of school food environment has been shown in other African countries [40,41]. Interventions that will support availability and accessibility of healthier food in the school food environment of urban schools in Zambia are therefore required.

Policy interventions targeted at food provisioning and retailing within and around schools have the potential to promote the availability of healthy food in the school environment [42–45]. Healthy food provisioning in schools can be achieved through the introduction of school feeding programs, school gardens, and healthy food supplies in school tuck shops/cafeteria [8,14]. Availability of healthy food in the school food environment results in relatively higher consumption of healthy foods like fruits [46]. However, a South African study showed that older adolescents may not appreciate healthy food provisioning as this is seen as infringing on their autonomy on food choices [47]. The Ministry of Education in Zambia through the School Health and Nutrition policy requires school tuck shops/cafeteria to sell healthy food as one of the measures of improving the nutritional status of learners [48]. However, it is clear that this policy measure is not enforced as shown from our finding where only 1 out of 10 schools in our study sold healthy food. This is not a unique situation as poor implementation of school food policies has been shown in other settings in LMICs [23,49,50].

Recent evidence from LMICs in Africa and Asia implicates the density of unhealthy food outlets in an environment to poor dietary patterns and health outcomes [51–53]. Zoning laws that work to limit the spatial distribution of unhealthy food outlets could be of use in Zambia, given the outcomes we presented that suggest a high density of food vendors selling unhealthy food in the Zambian schools. Such initiatives of zoning food outlets around schools have been successfully implemented in some high-income country communities, especially in the United States of America [52]. These initiatives are supported by the powers granted to municipal authorities. While zoning laws have shown good promise in high income settings, such policies might have limited applicability in LMICs as they require enforcement and monitoring, which are important policy making components that are weak in most LMICs including Zambia [23–25,54,55]. Our findings also indicate that informal food vendors are important players in healthy food provisioning in the school food environment as they were found to be the main sellers of fruit in the current study. This finding is corroborated by the findings of Steyn, Labadarios and Nel [56], where they showed that fruit was the most commonly purchased street food in South African schools. Designing of zoning laws in Zambia will therefore need to be nuanced in order to support informal vendors' healthy food provisioning in a safe environment.

Additional supportive policies from other sectors dealing with community development, agriculture and water and sanitation are also required to promote availability of healthy foods. Our study also shows that fruit trees within school premises are a source of fruits for adolescents. The Zambian agriculture sector can thus support planting of fruit trees in and around schools to improve seasonal availability of home-grown local fruits. Evidence from low-income settings in Uganda links the availability of fruit trees to improved nutritional outcomes of children [57].

4.2. Improving Affordability of Healthy Food

Adolescents in our study generally felt they had limited purchasing power, hence they could not afford healthy food. A quarter of adolescents from our sampled schools reported not having pocket money while 75% reported receiving pocket money that amounted to an average of $0.50 (K10) [58]. Policy interventions are therefore required to address the price and affordability of healthy foods which currently might be restrictive for an average school going adolescent.

Price related polices have widely been used as a measure to regulate affordability of both healthy and unhealthy foods. Sugar sweetened beverage taxation is one of the recommended policy measures which aims to increase the price and thus curtail the consumption of sugary drinks linked to the rising obesity burden [59]. Reduced consumption of sugar sweetened drinks has been recorded in countries like Mexico, the UK and South Africa which have implemented a sugar tax [60–62]. Fiscal measures are difficult to implement as they often face strong opposition from powerful industry [63,64]. This is true for Zambia where a sugar tax of 3% was adopted as opposed to the recommended 12% in part due to strong industry lobbying [65,66]. Further strengthening of the sugar tax being implemented Zambia is required to address the negative impacts of the nutrition transition which is underway [27]. However, lobbying for a higher sugar tax should not only be led by the health sector but should garner stronger public support with civil society involvement. Public demand and civil society lobbying were critical in countries that have managed to adopt higher tax rates like South Africa [4,67].

Subsidies to improve affordability of healthy food can also contribute to improved food environments and support healthier choices, as adolescents in our study were shown to have limited purchasing power. Pricing strategies including subsidies on fruit and vegetables have been shown to significantly increase the purchase and consumption of these products in high income contexts [68]. A study in United States of America recorded increased consumption of fruits in adolescents using vouchers in supermarkets that offer subsidies to school-going children [68]. However, the resource constraints of most governments in LMICs might not favor the implementation of such subsidies. One way to support the subsidies would be to use a bundled approach of earmarking revenue from taxation of unhealthy commodities to support healthy food provisioning to critical population groups, which can be carried out through existing nutrition interventions/programs [69]. In Zambia, existing social cash transfers platform can be leveraged to target vulnerable urban adolescents using a voucher system. Public private partnership between retailers and schools can be used for adolescents to redeem vouchers from selected retailers. Such public private partnerships can promote shared responsibility in creating a healthier food supply by stocking, promoting, and reducing costs of healthier foods in their stores [44].

The adolescent's inability to purchase healthy food due to financial constraints can be overcome by scaling up school feeding programs. School feeding programs have been shown to improve educational and nutritional outcomes of learners, and when coupled with a home-grown component, economical outcomes of communities in many LMICs including Tanzania, India and South Africa have been positively impacted [70–72]. Zambia's school feeding program, like many LMICs, is predominately targeted at learners in lower grades of primary school in rural areas [73]. However, the high rates of urban poverty [21], and inability of adolescents to purchase healthy food as demonstrated by this study provides impetus for expanding the program to urban districts.

4.3. Regulating the Marketing of Unhealthy Foods

Our findings also indicate that the adolescents were exposed to food and beverage advertisements through a variety of media platforms like TV, radio, print, and internet. Children and adolescents continue to be the target of marketing activities by the food industry across the globe [13,74,75]. Stricter regulation of unhealthy food marketing to Zambian children via these media platforms is required to minimize the influence of the media on adolescent food choices, as recommended by the WHO [76]. A number of middle-

and high-income countries in Europe, Asia and Africa have statutory regulation against marketing of unhealthy food to children [77]. In Chile for example, food advertisements on TV channels popular with children were significantly reduced, following a restriction on food marketing implemented in 2016 [78].

In many LMICs including Thailand and Nepal, implementation and enforcement of marketing regulations remains suboptimal due to lack of political will, evidence to support the regulation and limited capacity to monitor compliance [48,79]. As with other legislative measures like taxation, marketing regulations have been contested in favor of self-regulation by industry, which studies have shown to be ineffective [80,81]. In South Africa for instance, SSB advertisements were still present in most primary schools despite the voluntary pledge made by industry not to advertise their products in schools [82]. Zambia could draw an implementation lesson from the restriction of marketing of breast milk substitutes, which has been in place for over a decade [83], to strengthen the design of marketing restriction of unhealthy food and beverages.

While the policies for regulating marketing are mainly tailored for traditional media such as radio and TV, guidelines on how to regulate social media are still underdeveloped. Regulating the rapidly evolving social media marketing landscape of influencer marketing and user co-created marketing remains a challenge even for high income countries [84–86].

4.4. Improving Desirability of Healthy Food

Adolescents in our study had a strong desire for unhealthy food which they described as trendy, tasty and appealing as compared to healthy food. Traditional foods, including *nshima*, which is usually eaten by hand, was classified as healthy food but largely seen as unappealing and inconvenient to eat. Modern fast foods like pizzas, burgers, fried chicken, and chips from international franchises like *Hungry Lion* and *Debonairs Pizza* were generally preferred for consumption outside the home. These findings imply the need for interventions to motivate desire for healthy food among adolescents.

The secondary school curriculum in Zambia offers some nutritional education as evidenced by 65% of school-going adolescents who reported having been taught about healthy eating and benefits of consuming fruit and vegetable [52]. School based lessons must be reinforced by social media communication campaigns tailored to adolescents, as these have been shown to improve healthy food habits among adolescents in countries like Indonesia [87,88]. Communication campaigns provide an opportunity to address concerns about affordability of healthy food by promoting consumption of locally available healthy foods that are relatively cheaper. Other communication platforms such as road shows and celebrity endorsement, which we found in this study to appeal to adolescents, should be used to promote the acceptability of healthy food options. In addition, national awareness campaigns promoting healthy dietary habits including healthy food preparation and interpretation of nutritional information are required to support the whole of society's behavioral change [89]. While education-based policy interventions show a weak positive effect on improving diets [36], they increase population awareness which is required to promote demand and advocacy for more effective nutrition related interventions like taxation and food labelling requirements.

4.5. Strengths and Limitation

This study included a large sample size of 200 adolescents from different social economic backgrounds contributing to the credibility of the findings. The approach of triangulating data from FGDs with observations of the school food environment strengthens the trustworthiness of our findings on the food environment factors influencing food choices of adolescents. However, our findings largely represent perspectives of urban school going adolescents and therefore contextual issues should be considered when generalizing to other sub populations of adolescents. In addition, the study only included grade 10 pupils with average of 16 years and therefore the views of younger adolescents might be underrepresented. Future studies are required to understand the food environ-

ments and food choices of other adolescent subgroups such as those in the younger age range, rural residents or the out of school, to understand how they compare with in school adolescents included in this study.

5. Conclusions

Food environment factors play a role in influencing food choices of school going adolescents in Zambia. Our findings show that the school food environment generally promotes adolescent's unhealthy food choices due to the wide availability and affordability of unhealthy foods. Food provisioning and retailing polices as well as zoning laws which work to limit the spatial distribution of unhealthy food vendors in the school environment should be considered to improve availability of healthy food. Price related polices such as subsidies on fresh fruits and school feeding programs can contribute to improving access to health food, especially for low social economic status who cannot afford to purchase the relatively expensive healthy food. Regulations restricting marketing of unhealthy food and beverages to children in Zambia are also urgently required. This is because our findings show that adolescents are exposed to food and beverage advertisements via TV, radio, print, and internet channels and such adverts contribute to the desirability of unhealthy foods. Communication campaigns that will empower adolescents and the general public with information to make healthy food choices as well as to demand and advocate for healthy food environments are thus required.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph19127460/s1, Table S1: Student FGD guide; Table S2: Food environment check list.

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References

1. Baird, J.; Jacob, C.; Barker, M.; Fall, C.H.D.; Hanson, M.; Harvey, N.C.; Inskip, H.M.; Kumaran, K.; Cooper, C. Developmental origins of health and disease: A lifecourse approach to the prevention of non-communicable diseases. *Healthcare* **2017**, *5*, 14. [CrossRef] [PubMed]
2. WHO. Adolescent Health. *World Health Organization*. Published 2021. Available online: https://www.who.int/health-topics/adolescent-health#tab=tab_1 (accessed on 25 October 2021).
3. Fitzgerald, A.; Heary, C.; Nixon, E.; Kelly, C. Factors influencing the food choices of Irish children and adolescents: A qualitative investigation. *Health Promot. Int.* **2010**, *25*, 289–298. [CrossRef] [PubMed]
4. Munt, A.E.; Partridge, S.R.; Allman-Farinelli, M. The barriers and enablers of healthy eating among young adults: A missing piece of the obesity puzzle: A scoping review. *Obes. Rev.* **2017**, *18*, 1–17. [CrossRef] [PubMed]
5. Majabadi, H.A.; Solhi, M.; Montazeri, A.; Shojaeizadeh, D.; Nejat, S.; Farahani, F.K.; Djazayeri, A. Factors Influencing Fast-Food Consumption Among Adolescents in Tehran: A Qualitative Study. *Iran Red Crescent Med. J.* **2016**, *18*, e23890. [CrossRef]

6. Trübswasser, U.; Baye, K.; Holdsworth, M.; Loeffen, M.; Feskens, E.J.; Talsma, E.F. Assessing factors influencing adolescents' dietary behaviours in urban Ethiopia using participatory photography. *Public Health Nutr.* **2021**, *24*, 3615–3623. [CrossRef] [PubMed]
7. Counihan, C.; Van Esterik, P. *Food and Culture: A Reader*; Routledge: London, UK, 2012; pp. 1–19.
8. Atkins, P.; Bowler, I. *Food in Society: Economy, Culture, Geography*; Routledge: London, UK, 2016; pp. 255–296.
9. FAO. *Influencing Food Environments for Healthy Diets*; Food and Agriculture Organization of the United Nations: Rome, Italy, 2016; Available online: http://www.fao.org/3/a-i6484e.pdf (accessed on 12 December 2019).
10. Martins, B.G.; Ricardo, C.Z.; Machado, P.P.; Rauber, F.; Azeredo, C.M.; Levy, R.B. Eating meals with parents is associated with better quality of diet for Brazilian adolescents. *Cad. Saude Publica* **2019**, *35*, e00153918. [CrossRef] [PubMed]
11. Andreyeva, T.; Kelly, I.R.; Harris, J.L. Exposure to food advertising on television: Associations with children's fast food and soft drink consumption and obesity. *Econ. Hum. Biol.* **2011**, *9*, 221–233. [CrossRef]
12. Norman, J.; Kelly, B.; Boyland, E.; McMahon, A.T. The Impact of Marketing and Advertising on Food Behaviours: Evaluating the Evidence for a Causal Relationship. *Curr. Nutr. Rep.* **2016**, *5*, 139–149. [CrossRef]
13. Potvin Kent, M.; Pauzé, E.; Roy, E.A.; de Billy, N.; Czoli, C. Children and adolescents' exposure to food and beverage marketing in social media apps. *Pediatr. Obes.* **2019**, *14*, e12508. [CrossRef]
14. Qutteina, Y.; Hallez, L.; Mennes, N.; De Backer, C.; Smits, T. What Do Adolescents See on Social Media? A Diary Study of Food Marketing Images on Social Media. *Front. Psychol.* **2019**, *10*, 2637. [CrossRef]
15. Cruz, L. *Legal Guide on School Food and Nutrition—Legislating for a Healthy School Food Environment*; Food and Agriculture Organization of the United Nations: Rome, Italy, 2020; Available online: http://www.fao.org/3/ca9730en/CA9730EN.pdf (accessed on 5 May 2021).
16. Azeredo, C.M.; de Rezende, L.F.M.; Canella, D.S.; Claro, R.M.; Peres, M.F.T.; Luiz, O.D.C.; França-Junior, I.; Kinra, S.; Hawkesworth, S.; Levy, R.B. Food environments in schools and in the immediate vicinity are associated with unhealthy food consumption among Brazilian adolescents. *Prev. Med.* **2016**, *88*, 73–79. [CrossRef] [PubMed]
17. Kelly, C.; Callaghan, M.; Molcho, M.; Nic Gabhainn, S.; Alforque Thomas, A. Food environments in and around post-primary schools in Ireland: Associations with youth dietary habits. *Appetite* **2019**, *132*, 182–189. [CrossRef] [PubMed]
18. Güngör, N.K. Overweight and obesity in children and adolescents. *J. Clin. Res. Pediatr. Endocrinol.* **2014**, *6*, 129–143. [CrossRef]
19. Driessen, C.E.; Cameron, A.J.; Thornton, L.E.; Lai, S.K.; Barnett, L.M. Effect of changes to the school food environment on eating behaviours and/or body weight in children: A systematic review. *Obes. Rev.* 2014, *15*, 968–982. [CrossRef] [PubMed]
20. High Level Panel of Experts. Nutrition and Food Systems. A Report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. 2017. Available online: http://www.fao.org/3/a-i7846e.pdf (accessed on 20 September 2019).
21. Battersby, J.; Watson, V. *Urban Food Systems Governance and Poverty in African Cities*; Routledge: London, UK, 2019; Available online: http://library.oapen.org/handle/20.500.12657/29599 (accessed on 28 February 2022).
22. WHO. Report of the Commission on Ending Childhood Obesity. 2016. Available online: http://apps.who.int/iris/bitstream/handle/10665/204176/9789241510066_eng.pdf (accessed on 24 November 2021).
23. Laar, A.; Barnes, A.; Aryeetey, R.; Tandoh, A.; Bash, K.; Mensah, K.; Zotor, F.; Vandevijvere, S.; Holdsworth, M. Implementation of healthy food environment policies to prevent nutrition-related non-communicable diseases in Ghana: National experts' assessment of government action. *Food Policy* **2020**, *93*, 101907. [CrossRef] [PubMed]
24. McIsaac, J.-L.D.; Spencer, R.; Chiasson, K.; Kontak, J.; Kirk, S.F.L. Factors Influencing the Implementation of Nutrition Policies in Schools: A Scoping Review. *Health Educ. Behav.* 2019, *46*, 224–250. [CrossRef]
25. Ng, S.; Yeatman, H.; Kelly, B.; Sankaranarayanan, S.; Karupaiah, T. Identifying barriers and facilitators in the development and implementation of government-led food environment policies: A systematic review. *Nutr. Rev.* **2022**, nuac016. [CrossRef]
26. Nguyen, B.; Cranney, L.; Bellew, B.; Thomas, M. Implementing Food Environment Policies at Scale: What Helps? What Hinders? A Systematic Review of Barriers and Enablers. *Int. J. Environ. Res. Public Health* **2021**, *18*, 10346. [CrossRef]
27. Harris, J.; Chisanga, B.; Drimie, S.; Kennedy, G. Nutrition transition in Zambia: Changing food supply, food prices, household consumption, diet and nutrition outcomes. *Food Secur.* **2019**, *11*, 371–387. [CrossRef]
28. MOH. *WHO STEPs Survey for Non-Communicable Diseases and Risk Factors 2017*; Minstry of Health: Lusaka, Zambia, 2018. Available online: https://www.afro.who.int/sites/default/files/2019-05/Zambia%20NCD%20STEPS%20Survey%20Report%202018.pdf (accessed on 21 September 2019).
29. Central Statistical Office, Ministry of Health, ICF. *Zambia Demographic and Health Survey 2018: Key Indicators*; Central Statistical Office: Lusaka, Zambia; Ministry of Health: Lusaka, Zambia; ICF: Rockville, MD, USA, 2019. Available online: https://dhsprogram.com/pubs/pdf/PR113/PR113.pdf (accessed on 21 September 2019).
30. Mukanu, M.; Mchiza, Z.; Delobelle, P.; Thow, A.M. Status of healthy diets and food environments policies in Zambia: A policy content analysis. *Unpublished*.
31. Turner, C.; Kalamatianou, S.; Drewnowski, A.; Kulkarni, B.; Kinra, S.; Kadiyala, S. Food Environment Research in Low- and Middle-Income Countries: A Systematic Scoping Review. *Adv. Nutr.* **2020**, *11*, 387–397. [CrossRef]
32. Turner, C.; Aggarwal, A.; Walls, H.; Herforth, A.; Drewnowski, A.; Coates, J.; Kalamatianou, S.; Kadiyala, S. Concepts and critical perspectives for food environment research: A global framework with implications for action in low-and middle-income countries. *Glob. Food Secur.* **2018**, *18*, 93–101. [CrossRef]

33. Simwanda, M.; Murayama, Y. Integrating Geospatial Techniques for Urban Land Use Classification in the Developing Sub-Saharan African City of Lusaka, Zambia. *ISPRS Int. J. Geo-Inf.* **2017**, *6*, 102. [CrossRef]
34. Mweemba, A.M.; Webb, E. Residential area as proxy for socio-economic status, paediatric mortality and birth weight in Lusaka, Zambia. *J. Trop. Pediatrics* **2008**, *54*, 406–409. [CrossRef] [PubMed]
35. Sofaer, S. Qualitative research methods. *Int. J. Qual. Health Care* **2002**, *14*, 329–336. [CrossRef]
36. Phellas, C.N.; Bloch, A.; Seale, C. Structured methods: Interviews, questionnaires and observation. *Res. Soc. Cult.* **2011**, *3*, 23–32.
37. Jamshed, S. Qualitative research method-interviewing and observation. *J. Basic Clin. Pharm.* **2014**, *5*, 87. [CrossRef]
38. Fereday, J.; Muir-Cochrane, E. Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *Int. J. Qual. Methods* **2006**, *5*, 80–92. [CrossRef]
39. StataCorp. *Stata Statistical Software*; StataCorp LLC: College Station, TX, USA, 2017.
40. Wojcicki, J.M.; Elwan, D. Primary school nutrition and tuck shops in Hhoho, Swaziland. *J. Child Nutr. Manag. Internet.* **2014**, *38*.
41. Faber, M.; De Villiers, A.; Hill, J.; Van Jaarsveld, P.J.; Okeyo, A.P.; Seekoe, E. Nutrient profile and energy cost of food sold by informal food vendors to learners in primary and secondary schools in the Eastern Cape, South Africa. *Public Health Nutr.* **2019**, *22*, 521–530. [CrossRef]
42. Brambila-Macias, J.; Shankar, B.; Capacci, S.; Mazzocchi, M.; Perez-Cueto, F.J.; Verbeke, W.; Traill, W.B. Policy Interventions to Promote Healthy Eating: A Review of What Works, What Does Not, and What is Promising. *Food Nutr. Bull.* **2011**, *32*, 365–375. [CrossRef]
43. Bihan, H.; Méjean, C.; Castetbon, K.; Faure, H.; Ducros, V.; Sedeaud, A.; Galan, P.; Le Clésiau, H.; Péneau, S.; Hercberg, S. Impact of fruit and vegetable vouchers and dietary advice on fruit and vegetable intake in a low-income population. *Eur. J. Clin. Nutr.* **2012**, *66*, 369–375. [CrossRef] [PubMed]
44. Budd, N.; Cuccia, A.; Jeffries, J.K.; Prasad, D.; Frick, K.D.; Powell, L.; Katz, F.A.; Gittelsohn, J. B'More Healthy: Retail Rewards–design of a multi-level communications and pricing intervention to improve the food environment in Baltimore City. *BMC Public Health* **2015**, *15*, 283. [CrossRef] [PubMed]
45. Global Panel. *Improving Nutrition through Enhanced Food Environments*; Global Panel on Agriculture and Food Systems for Nutrition: London, UK, 2017; Available online: https://glopan.org/sites/default/files/FoodEnvironmentsBrief.pdf (accessed on 6 May 2021).
46. Micha, R.; Karageorgou, D.; Bakogianni, I.; Trichia, E.; Whitsel, L.P.; Story, M.; Peñalvo, J.L.; Mozaffarian, D. Effectiveness of school food environment policies on children's dietary behaviors: A systematic review and meta-analysis. *PLoS ONE* **2018**, *13*, e0194555. [CrossRef]
47. Bekker, F.; Marais, M.; Koen, N. The provision of healthy food in a school tuck shop: Does it influence primary-school students' perceptions, attitudes and behaviours towards healthy eating? *Public Health Nutr.* **2017**, *20*, 1257–1266. [CrossRef] [PubMed]
48. MoE. National School Health and Nutrition Policy. Published online 2006. Available online: https://extranet.who.int/nutrition/gina/sites/default/files/ZMB%202006%20School%20Health%20and%20Nutrition%20Policy%20%202006.pdf (accessed on 28 October 2019).
49. Rathi, N.; Riddell, L.; Worsley, A. Food consumption patterns of adolescents aged 14–16 years in Kolkata, India. *Nutr. J.* **2017**, *16*, 50. [CrossRef]
50. Reeve, E.; Thow, A.M.; Bell, C.; Engelhardt, K.; Gamolo-Naliponguit, E.C.; Go, J.J.; Sacks, G. Implementation lessons for school food policies and marketing restrictions in the Philippines: A qualitative policy analysis. *Glob. Health* **2018**, *14*, 8. [CrossRef]
51. Demmler, K.M.; Ecker, O.; Qaim, M. Supermarket shopping and nutritional outcomes: A panel data analysis for urban Kenya. *World Dev.* **2018**, *102*, 292–303. [CrossRef]
52. Westbury, S.; Ghosh, I.; Jones, H.M.; Mensah, D.; Samuel, F.; Irache, A.; Azhar, N.; Al-Khudairy, L.; Iqbal, R.; Oyebode, O. The influence of the urban food environment on diet, nutrition and health outcomes in low-income and middle-income countries: A systematic review. *BMJ Glob. Health* **2021**, *6*, e006358. [CrossRef]
53. Wu, Y.; Wang, L.; Zhu, J.; Gao, L.; Wang, Y. Growing fast food consumption and obesity in Asia: Challenges and implications. *Soc. Sci. Med.* **2021**, *269*, 113601. [CrossRef]
54. Fisher, L.; Dahal, M.; Hawkes, S.; Puri, M.; Buse, K. Barriers and opportunities to restricting marketing of unhealthy foods and beverages to children in Nepal: A policy analysis. *BMC Public Health* **2021**, *21*, 1351. [CrossRef]
55. Mukanu, M.M.; Zulu, J.M.; Mweemba, C.; Mutale, W. Responding to non-communicable diseases in Zambia: A policy analysis. *Health Res. Policy Syst.* **2017**, *15*, 34. [CrossRef] [PubMed]
56. Steyn, N.P.; Labadarios, D.; Nel, J.H. Factors which influence the consumption of street foods and fast foods in South Africa–a national survey. *Nutr. J.* **2011**, *10*, 104. [CrossRef] [PubMed]
57. Miller, D.C.; Muñoz-Mora, J.C.; Rasmussen, L.V.; Zezza, A. Do Trees on Farms Improve Household Well-Being? Evidence From National Panel Data in Uganda. *Front. For. Glob. Chang.* **2020**, *3*, 101. [CrossRef]
58. Mukanu, M.; Delobelle, P.; Thow, A.M.; Mutale, W.; Mchiza, Z. Dietary patterns and school food environment of school going adolescents in Urban Zambia. *Unpublished*.
59. WHO. *Fiscal Policies for Diet and Prevention of Noncommunicable Diseases*; World Health Organization: Geneva, Switzerland, 2015; Available online: https://apps.who.int/iris/bitstream/handle/10665/250131/9789241511247-eng.pdf?sequence=1 (accessed on 28 April 2019).

60. Colchero, M.A.; Rivera-Dommarco, J.; Popkin, B.M.; Ng, S.W. In Mexico, evidence of sustained consumer response two years after implementing a sugar-sweetened beverage tax. *Health Aff.* **2017**, *36*, 564–571. [CrossRef] [PubMed]
61. Pell, D.; Mytton, O.; Penney, T.L.; Briggs, A.; Cummins, S.; Penn-Jones, C.; Rayner, M.; Rutter, H.; Scarborough, P.; Sharp, S.J.; et al. Changes in soft drinks purchased by British households associated with the UK soft drinks industry levy: Controlled interrupted time series analysis. *BMJ* **2021**, *372*, n254. [CrossRef]
62. Essman, M.; Taillie, L.S.; Frank, T.; Ng, S.W.; Popkin, B.M.; Swart, E.C. Taxed and untaxed beverage intake by South African young adults after a national sugar-sweetened beverage tax: A before-and-after study. *PLoS Med.* **2021**, *18*, e1003574. [CrossRef]
63. Tselengidis, A.; Östergren, P.O. Lobbying against sugar taxation in the European Union: Analysing the lobbying arguments and tactics of stakeholders in the food and drink industries. *Scand. J. Public Health* **2019**, *47*, 565–575. [CrossRef]
64. Kruger, P.; Abdool Karim, S.; Tugendhaft, A.; Goldstein, S. An Analysis of the Adoption and Implementation of A Sugar-Sweetened Beverage Tax in South Africa: A Multiple Streams Approach. *Health Syst. Reform.* **2021**, *7*, e1969721. [CrossRef]
65. Hangoma, P.; Bulawayo, M.; Chewe, M.; Stacey, N.; Downey, L.; Chalkidou, K.; Hofman, K.; Kamanga, M.; Kaluba, A.; Surgey, G. The potential health and revenue effects of a tax on sugar sweetened beverages in Zambia. *BMJ Glob. Health* **2020**, *5*, e001968. [CrossRef]
66. Mukanu, M.M.; Abdool Karim, S.; Hofman, K.; Erzse, A.; Thow, A.M. Nutrition related non-communicable diseases and sugar sweetened beverage policies: A landscape analysis in Zambia. *Glob. Health Action* **2020**, *14*, 1872172. [CrossRef]
67. Bosire, E.N.; Stacey, N.; Mukoma, G.; Tugendhaft, A.; Hofman, K.; Norris, S.A. Attitudes and perceptions among urban South Africans towards sugar-sweetened beverages and taxation. *Public Health Nutr.* **2020**, *23*, 374–383. [CrossRef] [PubMed]
68. An, R. Effectiveness of Subsidies in Promoting Healthy Food Purchases and Consumption: A Review of Field Experiments. *Public Health Nutr.* **2013**, *16*, 1215–1228. [CrossRef] [PubMed]
69. Herman, D.R.; Harrison, G.G.; Afifi, A.A.; Jenks, E. Effect of a Targeted Subsidy on Intake of Fruits and Vegetables Among Low-Income Women in the Special Supplemental Nutrition Program for Women, Infants, and Children. *Am. J. Public Health* **2008**, *98*, 98–105. [CrossRef] [PubMed]
70. Jomaa, L.H.; McDonnell, E.; Probart, C. School feeding programs in developing countries: Impacts on children's health and educational outcomes. *Nutr. Rev.* **2011**, *69*, 83–98. [CrossRef]
71. Drake, L.; Woolnough, A.; Bundy, D.; Burbano, C. *Global School Feeding Sourcebook: Lessons from 14 Countries*; World Scientific: Singapore, 2016.
72. Chakrabarti, S.; Scott, S.P.; Alderman, H.; Menon, P.; Gilligan, D.O. Intergenerational nutrition benefits of India's national school feeding program. *Nat. Commun.* 2021, *12*, 4248. [CrossRef] [PubMed]
73. Nikoi, C.; Cammelbeeck, S. *Country Programme: Zambia*; World Food Programme: Rome, Italy, 2020.
74. Ustjanauskas, A.E.; Harris, J.L.; Schwartz, M.B. Food and beverage advertising on children's web sites. *Pediatr. Obes.* **2014**, *9*, 362–372. [CrossRef]
75. Sacks, G.; Looi, E.S.Y. The Advertising Policies of Major Social Media Platforms Overlook the Imperative to Restrict the Exposure of Children and Adolescents to the Promotion of Unhealthy Foods and Beverages. *Int. J. Environ. Res. Public Health* **2020**, *17*, 4172. [CrossRef]
76. WHO. Set of Recommendations on the Marketing of Foods and Non-Alcoholic Beverages to Children. Published online 2010. Available online: http://apps.who.int/iris/bitstream/handle/10665/44416/9789241500210_eng.pdf?sequence=1 (accessed on 6 May 2021).
77. Kovic, Y.; Noel, J.K.; Ungemack, J.A.; Burleson, J.A. The impact of junk food marketing regulations on food sales: An ecological study. *Obes. Rev.* **2018**, *19*, 761–769. [CrossRef]
78. Correa, T.; Reyes, M.; Taillie, L.S.; Corvalán, C.; Dillman Carpentier, F.R. Food Advertising on Television Before and After a National Unhealthy Food Marketing Regulation in Chile, 2016–2017. *Am. J. Public Health* 2020, *110*, 1054–1059. [CrossRef]
79. Phulkerd, S.; Sacks, G.; Vandevijvere, S.; Worsley, A.; Lawrence, M. Barriers and potential facilitators to the implementation of government policies on front-of-pack food labeling and restriction of unhealthy food advertising in Thailand. *Food Policy* **2017**, *71*, 101–110. [CrossRef]
80. Hebden, L.A.; King, L.; Grunseit, A.; Kelly, B.; Chapman, K. Advertising of fast food to children on Australian television: The impact of industry self-regulation. *Med. J. Aust.* **2011**, *195*, 20–24. [CrossRef] [PubMed]
81. Ronit, K.; Jensen, J.D. Obesity and industry self-regulation of food and beverage marketing: A literature review. *Eur. J. Clin. Nutr.* **2014**, *68*, 753–759. [CrossRef] [PubMed]
82. Erzse, A.; Christofides, N.; Stacey, N.; Lebard, K.; Foley, L.; Hofman, K. Availability and advertising of sugar sweetened beverages in South African public primary schools following a voluntary pledge by a major beverage company: A mixed methods study. *Glob. Health Action* **2021**, *14*, 1898130. [CrossRef] [PubMed]
83. Funduluka, P.; Bosomprah, S.; Chilengi, R.; Mugode, R.H.; Bwembya, P.A.; Mudenda, B. Marketing of breast-milk substitutes in Zambia: Evaluation of compliance to the international regulatory code. *J. Public Health* **2018**, *40*, e1–e7. [CrossRef]
84. Dunlop, S.; Freeman, B.; Jones, S.C. Marketing to Youth in the Digital Age: The Promotion of Unhealthy Products and Health Promoting Behaviours on Social Media. *Media Commun.* **2016**, *4*, 35–49. [CrossRef]
85. De Veirman, M.; Hudders, L.; Nelson, M.R. What Is Influencer Marketing and How Does It Target Children? A Review and Direction for Future Research. *Front. Psychol.* **2019**, *10*, 2685. [CrossRef]

86. van der Bend, D.L.M.; Jakstas, T.; van Kleef, E.; Shrewsbury, V.A.; Bucher, T. Making sense of adolescent-targeted social media food marketing: A qualitative study of expert views on key definitions, priorities and challenges. *Appetite* **2022**, *168*, 105691. [CrossRef]
87. Chau, M.M.; Burgermaster, M.; Mamykina, L. The use of social media in nutrition interventions for adolescents and young adults—A systematic review. *Int. J. Med. Inf.* **2018**, *120*, 77–91. [CrossRef]
88. Januraga, P.P.; Izwardi, D.; Crosita, Y.; Indrayathi, P.A.; Kurniasari, E.; Sutrisna, A.; Tumilowicz, A. Qualitative evaluation of a social media campaign to improve healthy food habits among urban adolescent females in Indonesia. *Public Health Nutr.* **2021**, *24*, s98–s107. [CrossRef]
89. Boles, M.; Adams, A.; Gredler, A.; Manhas, S. Ability of a mass media campaign to influence knowledge, attitudes, and behaviors about sugary drinks and obesity. *Prev. Med.* **2014**, *67* (Suppl. 1), S40–S45. [CrossRef]

CHAPTER 6: MAPPING OF FOOD ENVIRONMENT POLICIES IN ZAMBIA: A QUALITATIVE DOCUMENT ANALYSIS

From the studies presented in Chapter 2 and 4, I found that unhealthy dietary patterns were common among school-going adolescents and food environment factors were associated with these patterns. I also food that school food environments were generally unhealthy, as unhealthy snacks were widely available relative to healthier food options. In Chapter 6, I built on these findings and aimed to analyze how government policies support healthy food environments and dietary patterns in Zambia. This paper filled a research gap regarding Zambia's policy response to the evolution of the causes of malnutrition from historical problems of food insecurity, hunger and micronutrient deficiencies to the rise of the DBM, which had yet to be studied.

Using a qualitative document analysis approach, I assessed nutrition-related policies for healthy food environments in Zambia's national policies against international recommendations to identify gaps. Seventeen government policy documents and 11 international policy documents were analysed.

The key finding from this study is that legislative policy levers that are effective for fostering healthier food environments are generally lacking in Zambia's policy agenda. Consequently, a key area for nutrition policy reforms is for government to introduce legislative policy measures such as taxation of unhealthy food commodities. However, additional research is required to understand how best to tailor such policies to the Zambian context.

This study addressed the fifth study objective. The paper is currently under review in the BMC Nutrition journal.

Mapping of food environment policies in Zambia: A qualitative document analysis

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Abstract

Background: The food environment in which people exercise food choices greatly impacts their dietary patterns. Policies that limit availability, affordability and access to unhealthy food while increasing healthier alternatives help build healthy food environments required to address the double burden of malnutrition. This study aimed to assess the availability of food environment policies in Zambia.

Method: We applied a two-step qualitative document analysis to identify policy content relating to healthy food environments from global and Zambia-specific nutrition-related policy documents. In the first step, global policy documents were analyzed to develop a reference point for globally recommended policies for healthy food environments. In the second step, Zambia's nutrition-related policies were analyzed to identify content relating to healthy food environments. The identified policy content was then mapped against the global reference point to identify food environment policy gaps.

Results: Our analysis of global policy recommendations identified five broad categories of policy provisions: information and education based; regulatory and legislative tools; strategies to promote production and access to healthy food production; social protection-based strategies and guiding principles for governments relating to multisectoral collaboration and governance. Our analysis found that Zambian Government policy documents in the health, agriculture, education and national planning and development sectors have policy provisions for healthy food environments. While these policy provisions generally covered all five reference categories, we found policy gaps in the regulatory and legislative tools category relative to global recommendations.

Conclusion: Zambia's food environment policy landscape lacks globally recommended regulatory and legislative policy measures like restricting the marketing of unhealthy foods and non-alcoholic beverages to children. Nutrition policy reforms are required to facilitate the introduction of regulatory and legislative policy measures that effectively address the double burden of malnutrition in Zambia.

Keywords:

Food environments

Zambia

Healthy diets

Qualitative document analysis

Introduction

Nutrition-related health problems are among the top causes of morbidity and mortality in many developing countries (1). For instance, the 2021 *Global Nutrition Report* noted that 149.0 million children under five are stunted, and 49.5 million are wasted, 40.1 million are overweight, and 677.6 million are obese. These health consequences of malnutrition have been estimated to cost the global economy up to $3.5 trillion annually (2).

The food environment in which people exercise food choices greatly impacts their dietary patterns. Food environments are 'the physical, the economic, political and socio-cultural context in which consumers engage with the food system to make their decisions about acquiring, preparing and consuming food' (3). Food environment approaches to addressing nutrition problems challenge the dominant perspective that places the responsibility of good nutrition on individuals and neglects the role of environmental and structural factors, which are usually outside the health sector (4,5). For instance, regulatory policy interventions can help counter pervasive marketing strategies by the unhealthy food industry, contributing to obesogenic diets in many low-to-medium income countries (6–8).

Policy measures aimed at improving nutrition outcomes using a food environment approach aim to influence physical and economic access, promotion, advertising and information, and food quality and safety (3). These include social welfare initiatives, taxation of unhealthy foods, provisioning of healthy foods, or limiting the marketing of unhealthy food to children (9–11). Developing food environment policies, therefore, requires cross-sector coordination that facilitates the implementation of nutrition interventions in non-health sectors (12–15). However, in many developing countries, improving nutrition outcomes often remains consigned to the Ministry of Health and, to a lesser extent, to the Ministry of Agriculture, with weak inter-sector coordination across these two government sectors (16). As such, nutrition-related investments and policy solutions are often directed towards improving health care and the production of staple cereals to improve food security (17). Few countries have successfully implemented cross-sectoral policies that promote healthy food environments (9–11).

Zambia is currently experiencing a double burden of malnutrition where both undernutrition and overnutrition (including obesity and diet-related noncommunicable diseases) are present in the same population (18,19). However, this double burden has emerged relatively recently, and little is known about how the Zambian government is positioned at the policy level to address it. For a long time, Zambia's nutrition-related policy agenda focused on addressing the historically dominant problem of food insecurity, hunger and micronutrient deficiencies (20,21). More recently, political priority has increased for multisectoral policy intervention to reduce stunting, demonstrating the influence of emergent global policy priorities on the domestic nutrition policy

agenda (ibid). Political science scholars suggest policy legacies (which include the performance of previous policies) are strong influencers of policy priorities of policymakers, and this has also been seen in a nutrition policy context (17). Since governments use policies to formally communicate intent on an issue, one way to gain insight into a government's policy agenda and priorities is to analyze current content of national policy documents. We applied a document analysis methodology to assess the availability of nutrition-related policies for healthy food environments in Zambia's national policies. We assessed them against international recommendations to identify gaps. Mapping Zambia's current nutrition policy landscape is a good starting point for strengthening and reforming nutrition policy. It will help document any existing gaps and identify priority areas for investment.

Methods

A qualitative document analysis was applied in this study. Document analysis is a research method primarily using written documents to investigate a phenomenon of interest systematically (Bailey 1994). Document analysis generally involves identifying, selecting, retrieving and interpreting physical and electronic documents to develop new empirical knowledge. While there are many approaches to implementing a document analysis, we applied Dalglish et al.'s (22) 'READ' approach in this study because it provided a replicable systematic approach.

Identification of documents

This document analysis was centered on two policy documents: global policy documents with nutrition-related recommendations and Zambia's government policy documents. We used the High-Level Panel of Experts (HLPE)'s definition of food environments (3) to develop our inclusion criteria and our included policy documents that had content relevant to the three main dimensions of physical access, economic access and promotion and marketing of food environments as described in Box 1. In addition, we only considered policy documents published between 2002 and 2021. We chose 2002 as a reference point because it was the year WHO released the World Health Report (23), which drew global attention to actions required to promote healthy lives by reducing nutrition-related risk factors.

Global policy documents were identified from websites of institutions and organizations that issue nutrition-related policy recommendations, including the World Health Organisation (WHO), the Food and Agriculture Organisation (FAO) and the United Nations (UN) and its affiliated organizations of which Zambia is a member state. Documents of interest included global strategic plans, frameworks of action, and global action plans. Search terms used included those based on the food environment domains (see inclusion criteria) and document type keywords *'global strategic plan', 'global strategy', 'global policy', 'global standards', global guidelines', 'framework of action', global recommendations',* and *'global action plan'.* The search term was built by combining the food environment-related and document-type keywords e.g. '*healthy diet strategic plan'* or '*global standards unhealthy food advertisements'*. The document search was primarily conducted on the Google search engine and in the search bar on the global organization's

main website or the publications or resources pages. Additional documents were identified by checking through the references of the initial documents.

Box 1: Inclusion criteria and search terms

Physical access

This dimension relates to the physical availability of healthy food in close proximity to consumers. Examples include policies that encourage healthier diets through public procurement of foods and policies and investments that support diversification and the production of nutrient-rich foods (e.g. fruits and vegetables and legumes).

Key search terms: healthy diet, healthy food, healthy food access, food security

Economic access

This dimension relates to influence of affordability and the price of healthy food. Policy measures under this component might involve making nutritious foods cheaper and unhealthy foods more expensive. Examples include discriminatory trade policies and taxations of unhealthy food options or subsidies on healthy food options like fruits and vegetables.

Key search terms: unhealthy food tax, healthy food subsidies, healthy food affordability, trade policy

Promotion, advertising and information

This dimension relates to exposure of consumers to information that will influence their food choices. This might involve limiting the exposure of vulnerable populations such as children to industry driven promotions of unhealthy foods or conducting public health campaigns that promote healthy food habits. Examples include strengthening regulations for advertising and marketing and increasing transparency of information on labels

Key search terms: Food marketing to children, unhealthy food advertisements to children, healthy food choices

Zambia's policy documents were identified by checking through the publication section on the websites of government ministries and organizations, including the Ministries of Health, Education, Agriculture, Youth, Sports and Child Development, Community Development and Social Services, Commerce Trade, and Industry and National Development Plan for their policy

documents. Previous research shows that these government ministries have nutrition-relevant mandates (21). In order to capture possible policies that might not have been available on the online platform searched, we validated the list of policies identified with officials from the education, health and agriculture sectors where the majority of nutrition policies are concentrated as well as the National Food and Nutrition Commission.

A total of eleven global and seventeen Zambian policy documents were included in the analysis as shown in Table 1.

Table 1: List of policy documents analysed

Document title	Year	Organisation/institution
Global policy documents		
12. Global Strategy for Diet and Physical Activity	2004	World Health Organisation.
13. Set of recommendations on the marketing of foods and non-alcoholic beverages to children	2010	World Health Organisation.
14. Comprehensive Implementation Plan for Maternal, Infant and Young Child Nutrition	2014	World Health Organisation
15. Global Action Plan for the Prevention and Control of Non-Communicable Diseases (NCDs) 2013-2020 (extended to 2030)	2014	World Health Organisation
16. Second International Conference on Nutrition: Framework of Action	2014	World Health Organisation and Food and Agriculture Organisation
17. Sustainable Development Goals (SDGs)	2016	United Nations
18. UN Decade of Action on Nutrition 2016 to 2025	2017	United Nations
19. Global Action Plan on Physical Activity 2018-2030	2018	World Health Organisation
20. UN Political Declaration on NCDs	2018	United Nations
21. Legal guide on school food and nutrition: legislating for a healthy school food environment	2020	Food and Agriculture Organisation
22. Voluntary Guidelines on Food Systems and Nutrition	2021	Food and Agriculture Organisation
Zambia's policy documents		
Vision 2030	2005 – 2030	Ministry of Finance

The Competition and Consumer Protection Act	2010	Government of the Republic of Zambia
Food Safety Act	2019	Government of the Republic of Zambia
Food and Nutrition Act	2020	Government of the Republic of Zambia
Seventh National Development Plan	2017 – 2021	Ministry of Planning and National Development
Educating Our Future: National Education Policy	2006	Ministry of Education
National School Health and Nutrition Policy	2008	Ministry of Education
Guidelines for implementing School Health Nutrition Programme activities	2008	Ministry of Education.
National Food and Nutrition Policy	2006	National Food and Nutrition Commission
National Food and Nutrition Strategic plan	2017	National Food and Nutrition Commission.
Most Critical Days Programme II: "Zambia's Five Year Flagship Stunting Reduction Programme"	2018 – 2020	National Food and Nutrition Commission
National Health Policy	2012	Ministry of Health
Adolescent Health Strategic plan	2012	Ministry of Health
Zambian Strategic Plan 2013-2016 Non-Communicable Diseases and Their Risk Factors	2013	Ministry of Health
National Health Strategic Plan 2017 – 2021	2017	Ministry of Health
National Youth Policy	2015	Ministry of Youth, Sport and Child Development
National Agriculture Policy	2016	Ministry of Agriculture

Document Analysis

Our analysis focused on identifying policy content relating to healthy food environments from global and Zambia-specific nutrition-related policy documents and was conducted in two steps. The document analysis's first step was to develop a 'reference point' of globally recommended policies required for healthy food environments. In the second stage, Zambia's nutrition-related policies were analyzed to identify content relating to healthy food environments. The identified policy provisions were then mapped against the reference point developed in Stage 1 to identify food environment policy gaps.

Step 1: Developing a reference point of global policy recommendations for healthy food environments

Our analysis followed the READ approach for document analysis as proposed by Dalglish et al. 2020 (22): (1) ready materials, (2) extract data, (3) analyze data and (4) distil your findings.

Firstly, the identified policy documents were screened to assess their relevance to nutrition and food environments. Secondly, a more detailed review of the content was conducted to determine the data to be extracted. We extracted content from the documents relating to the four dimensions of food environments, i.e. physical access, economic access, promotion, advertising and information, and food safety (see Box 1). The extracted excerpts and information on the year of publication, issuing institution and objective were transferred to an excel spreadsheet for analysis. Thirdly, thematic analysis was used to make meaning of the data. The thematic analysis is a suitable approach to identifying, describing and interpreting key patterns within and across cases of interest. In the fourth and final step, themes and patterns identified from the extracted data were distilled into a framework for global healthy food environment policy recommendations (Table 2).

Step 2: Mapping Zambia's nutrition policies against global policy recommendations for healthy food environments

The READ approach, as described above, was used. However, in the fourth step, thematic analysis was used to assess data from the Zambia policy documents against the reference point of global policy recommendations developed in Step 1. Using this approach, we identified the gaps in Zambia's policy provisions relative to the global recommendations. This approach to identifying policy gaps has been used in other nutrition-related studies (24–27).

Results

Global policy recommendations for healthy food environments

Table 2 shows the list of recommended global policy measures for healthy food environments based on the global policy documents analyzed in this study (see Table 1). Using thematic analysis, we categorized the policy recommendations into four main groups. The education-related policy recommendations under Category I were oriented toward improving knowledge and people's capacity to make healthy food choices. Category II captured the regulatory and legislative policy recommendations that could impact the availability, affordability, accessibility, and marketing of food in the food environment. Measures for improving access to healthy food through increased production of nutritious food were captured in Category III. The policy recommendations in Category IV focused on using social protection structures to provide nutrition-related interventions mainly targeted at vulnerable populations. Category V included general guiding principles governments can use when implementing nutrition policy, such as governance structures and multisectoral collaboration. Our analysis found strong coherence in food environment policy measures recommended by the different global institutions across the five categories.

Table 2: Global policy recommendations for healthy food environments

Category I: Strategies to promote food and nutrition education and awareness of healthy diets
1. Include nutrition (health literacy) in the curricula offered in primary and secondary schools (28–31)
2. Develop national food or nutrient based guidelines (31)
3. Implement mass media/public and social marketing campaigns based on national dietary guidelines to promote healthy diets and consumption of nutritious foods including traditional foods (29,32,33)
Category II: Regulations and legislative tools price
4. Implement tax measures on unhealthy foods (29–31,33)
5. Provide incentives such as subsidies for production of healthy food options including reformulation (29–31,33,34)
6. Implement comprehensive policy on labeling of food (29–31,33)
7. Regulate marketing of food and non-alcoholic beverages to children including in schools (30,31,33–36)
Category III: Strategies to promote healthy food production and access to healthy food
8. Strengthening of agriculture policy to improve supply of locally grown nutritious food (28–31,34)
9. Strengthen linkages between production, demand and consumption of nutritious food through value chain development (28,34)
10. Adopt policies that support healthy diets at school by engaging food retailers and caterers including school tuck-shops to improve the availability, affordability and acceptability of healthier food products (33,34) and limit the availability of products high in salt, sugar and fats (30)
11. Explore potential of urban and peri-urban agriculture initiatives such as school and community gardens and issuing contracts to local food growers to supply fresh produce and support the diversification of school meals and diets of schoolchildren and adolescents in cities (28,30)
12. Develop and enforce national food safety legislation and regulations ensure that food producers and suppliers throughout the food chain operate within internationally recognized standards, guidelines and codes of practice on food safety and quality (WHO, 2004; WHO and FAO, 2014; United Nations, 2017)
Category IV: Social protection strategies
13. Incorporate nutrition objectives into social protection measures for vulnerable populations e.g. cash transfer and school feeding program (29,35)
Category V: Guiding principles for governments
14. Governance • Provide political will and commitment to nutrition (29,31) • Coordinate action and ensure policy coherence across sectors such as agriculture, youth, recreation, sports, education, commerce and industry, finance, transportation, media and communication, social affairs and environmental and urban planning (29–31,35,36) • Establish nutrition coordinating mechanism such as task force or advisory bodies (30,35) • Develop responsive, culturally appropriate policies to the specific country context (28,29,33,36)

• Provide means and platform for monitoring progress towards targets (29,31,37)
15. Multisectoral collaboration • Engage all relevant stakeholders including NGOs, civil society, communities, the private sector and the media pupils, parents (28,30,31,37) • Manage potential conflicts of interests (36,37) • Integrate nutrition objectives into food and agriculture policy, programme design and implementation, to enhance nutrition sensitive agriculture, ensure food security and enable healthy diets (31,37)

Mapping Zambia's policy provisions for healthy food environments against global recommendations

Table 3 shows the mapping of food environment-related content extracted from Zambian Government policy documents against the global recommendations for healthy food environments. Our analysis found that Zambia has policies supporting healthy food environments under all five categories. These policy recommendations were mainly found in policy documents from the health, education, agriculture, and national planning and development sectors.

Information and education-based policy recommendations of Category I were available in policies from the education and health sectors. Through the Ministry of Education (MoE), the government has incorporated nutrition education into the national school curriculum to improve learners' nutrition knowledge and dietary habits. In addition, the government, through the Ministry of Health (MoH) and its agencies like the National Food and Nutrition Commission (NFNC), has plans for population-based health awareness campaigns that will address nutrition-related risk factors to health. These awareness campaigns will be anchored in the national food-based dietary guidelines which were recently launched in 2021 through the Ministry of Agriculture with support from other nutrition-related sectors. The overall focus of education is to improve the health of learners

Our analysis found policy gaps under the regulatory and legislative policy recommendations of Category II. None of the analyzed policy documents included policies or plans to implement taxation on unhealthy food or provide incentives for producing healthy food options. Policies supporting the regulation of marketing of food and non-alcoholic beverages to children including in school environments were also absent in the documents included in this study. Policy provisions for food labeling were, however, available. Through the Ministry of Health in the NCD strategic plan of 2013 to 2016, the government did plan for mandatory nutrition labeling for all prepackaged foods, but this plan has since expired. More recent legislation generally addresses labeling and advertisements of all food. In the Competition and Consumer Protection Act of 2010, the government prohibits deception in the labeling, packaging, and selling food. However, the Act stipulates the information be included on a food label; information on the dietary quality of the food or its health implications is not a requirement.

Policy strategies for promoting the production of and access to healthy food under Category III were mainly found in the Ministry of Agriculture and Education policy documents. The key agriculture-related policies under this Category include the promotion of cultivation and consumption of diverse indigenous foods through nutrition-sensitive agriculture and investments in agriculture value chains. The education-related policies promote access to healthy foods in learning institutions by ensuring vendors in the school sell healthy foods, among other provisions. The government also plans to revitalize food production in learning institutions to further enhance access to healthy food by learners and surrounding communities. In addition, food safety is regulated through the Food Safety Act, which is a domestication of the Codex Alimentarius and has provisions relating to food standard items produced or imported and sold to consumers.

The government's policy recommendation under Category IV of social protection strategies for improving nutrition primarily focused on improving social protection interventions like school feeding programs. These were contained in the whole of government, education and agriculture sector documents.

The guiding principles of Category V are found in the governance and coordination mechanisms section, which was included in most policy documents. The government called for multisectoral collaboration in these sections to implement government policies. A few documents, such as the school health nutrition policy (38) of the education sector and the national health policy in the health sector, explicitly included a list of stakeholders and their roles in implementation, while the rest broadly called for collaboration among key stakeholders including government ministry, non-governmental organizations, private sector and beneficiaries.

Evidence of policy coherence across some government sectors was present. Policy documents from the health, education and agriculture sectors all had provisions that aimed to encourage/promote healthy food consumption in the population (39–41). Homestead food production models that promote the production of diverse, nutrient-dense foods were prioritized in health (40) and agriculture (42) sector policy documents. Nutrition-sensitive social protection measures were present in the whole of government (43) as well as education (39), health (44) and agriculture sector policy documents (42). The government's nutrition-related social protection programs include school feeding programs, social cash transfers and food security packs whose aim is to improve access to nutritious food by vulnerable populations.

INSERT TABLE 3

Discussion

The current study aimed to assess the availability of nutrition-related policies for healthy food environments in Zambia and to identify existing policy gaps, using global recommendations as a

reference point. Our analysis of global policy recommendations identified five broad categories of policy provisions: information and education based; regulatory and legislative tools; strategies to promote production and access to healthy food production; social protection-based strategies and guiding principles for governments relating to multisectoral collaboration and governance. Our analysis found that government policy documents in the health, agriculture, education and national planning and development sectors have policy provisions for healthy food environments. While these policy provisions generally covered all the categories of the framework, we found policy gaps in the regulatory and legislative tools category relative to global recommendations.

Government regulatory and legislative policies are critical for building healthy food environments as they limit unhealthy food availability, affordability and access while increasing healthier alternatives (45,46). The most commonly used regulatory and legislative policy interventions are targeted to restrict the amount of harmful ingredients like sugar, salt and fats in foods. While these interventions' cost-effectiveness and public health impact has been demonstrated (47), it is widely acknowledged that they are challenging to develop and implement mainly due to their perceived negative impact on economic sectors (48). For instance, South Africa is one of the few African countries that has implemented a 'sugar tax' at 10-11% per litre of sugar-sweetened drinks for health purposes (49). In contrast, the small tax in place in Zambia was introduced primarily for revenue-raising purposes (21,50). The 'big food' industry will likely exploit this weak regulatory and legislative policy environment for nutrition in Zambia as it expands to newer markets in developing countries (51,52).

Policy development theories show that successful prioritization and effective policy design depend not only on government and political will. The key stages in policy development of complex problems like nutrition, including agenda setting, policy formulation and implementation, require a combination of actors. Therefore, they are prone to actor influences according to their interests and power (53,54). Evidence shows that activities of industry-affiliated actors, like lobbying and litigation against governments, continue challenging the introduction of effective measures, such as taxation, in many countries (55–60). In Zambia, lobbying by industry and government stakeholders from the economic sector was instrumental in the very minimal sugar tax of 3% being recommended (21). Adding to the complexity of regulatory and legislative food environment policy measures is the fact that implementation requires additional policy frameworks outside the primary sector. Our analysis identified key regulatory frameworks such as the competition and consumer protection act, food safety act and food and nutrition act that can be leveraged to introduce or strengthen regulatory policies, including marketing restrictions and labeling. In addition, there is evidence of cross-sectoral policy coherence on some nutrition goals in Zambia's policy documents. There is a critical opportunity for the Government of Zambia to strengthen the coherence of policies across key nutrition-sensitive sectors to increase the likelihood of implementing cross-sectoral programmes like taxation and ensure the policy measures in one sector do not undermine the goals of other sectors.

Although the Government of Zambia encourages multisectoral coordination for nutrition policy implementation in policy content - an important first step - achieving strong multisectoral cooperation is challenging. Evidence supports multisectoral approaches to addressing nutrition-related problems over traditional vertical programming, as the latter has little success in effectively addressing the multifaceted drivers of the double burden of malnutrition(61,62). Key lessons for successful integration from countries like Ethiopia include strong political will with national nutrition prioritization and strong governance structures that promote stakeholder accountability (63). In Zambia, multisectoral coordination is still suboptimal despite the availability of policy provisions supporting multisectoral collaboration identified in this study and the presence of governance structures such as the nutrition coordination committee at the provincial and district level that have been reported in the literature (64,65). Additional mechanisms for implementing and measuring multisectoral collaboration might be required to strengthen nutrition coordination. These might include incentives that will motivate stakeholders to pursue collaboration as most policy actors weigh the perceived costs and benefits of collaborating (66), identifying a champion and developing a strategy that outlines the key responsibility of each stakeholder (67).

The major strength of the current study is that it demonstrated that qualitative document analysis is a valuable tool for policy analysis that can be used to assess the availability of policies and, when coupled with an appropriate reference point (in this case, global recommendations policy measures), can identify gaps in the policy environment. The identified policy gaps can be the basis of additional research or advocacy activities. Our findings contribute to the evidence body on the status of food environment policies in developing countries facing the double burden of malnutrition.

However, the findings in this current paper are limited by our reliance on historical documentary data; the government's policy priorities could have evolved since the publication of the documents. In addition, government policies communicate aspiration or intent, as policy availability does not guarantee implementation. Therefore, to further the knowledge of healthy food environments in Zambia, future research should examine how the available policies identified in this study have been translated into programs and evaluate the impact of policies on nutrition-related outcomes. An analysis of the interests and power relations among nutrition policy actors would be helpful to understand Zambia's nutrition agenda-setting further.

Conclusion

The nutrition policy landscape in Zambia includes some policy provisions that foster healthy food environments in the five categories identified from the review of global recommendations. These policies span government sectors, including health, education and agriculture. However, the lack of recommended regulatory and legislative policies, including taxation of unhealthy foods and restrictions on the marketing of unhealthy food and non-alcoholic beverages to children, is a key policy gap that might require policy reforms if the country is effectively addressing the double burden of malnutrition present in the population.

Abbreviations and acronyms

FAO Food and Agriculture Organisation

MoE Ministry of Education

MoH Ministry of Health

NCD Non-communicable diseases

NFNC National Food and Nutrition Commission

WHO World Health Organisation

UN United Nations

Declarations

- Ethics approval and consent to participate

This study was part of a larger doctorate research project for M.M.M. The study was approved by the Institutional Review Board ERES Converge (12 August 2020) in Zambia and by the University of the Western Cape's Humanities and Social Sciences Research Ethics Committee (HSSREC) in South Africa (Reference Number: HS20/6/19).

- Consent for publication

Not applicable

- Availability of data and materials

All data generated or analysed during this study are included in this published article.

- Competing interests

The authors declare that they have no competing interests

- Funding

This study received no external funding

- Authors' contributions

M.M.M. designed and implemented the study. M.M.M wrote the manuscript. A.M.T., P.D. and Z.J-R.M. reviewed and edited the manuscript. All authors and approved the final version of the paper.

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References

1. Development Initiatives. 2021 Global Nutrition Report: The state of global nutrition [Internet]. Bristol, UK: Development Initiatives; 2021 [cited 2022 Jun 30]. Available from: https://globalnutritionreport.org/reports/2021-global-nutrition-report/

2. Global Panel. The cost of malnutrition. Why policy action is urgent [Internet]. London, UK: Global Panel on Agriculture and Food Systems for Nutrition.; 2016 [cited 2021 May 6]. Available from: https://www.glopan.org/cost-of-malnutrition/#:~:text=Malnutrition%2C%20in%20all%20its%20forms,or%20US%24500%20per%20individual.

3. High Level Panel of Experts. Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security [Internet]. Rome; 2017 [cited 2019 Sep 20]. Report No.: 12. Available from: http://www.fao.org/3/a-i7846e.pdf

4. Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, Moodie ML, et al. The global obesity pandemic: shaped by global drivers and local environments. The Lancet. 2011 Aug 27;378(9793):804–14.

5. Roberto CA, Swinburn B, Hawkes C, Huang TTK, Costa SA, Ashe M, et al. Patchy progress on obesity prevention: emerging examples, entrenched barriers, and new thinking. The Lancet. 2015 Jun 13;385(9985):2400–9.

6. Moodie R, Stuckler D, Monteiro C, Sheron N, Neal B, Thamarangsi T, et al. Profits and pandemics: prevention of harmful effects of tobacco, alcohol, and ultra-processed food and drink industries. The Lancet. 2013 Feb 23;381(9867):670–9.

7. Schram A, Labonté R, Sanders D. Urbanization and international trade and investment policies as determinants of noncommunicable diseases in Sub-Saharan Africa. Prog Cardiovasc Dis. 2013 Dec;56(3):281–301.

8. Otterbach S, Oskorouchi HR, Rogan M, Qaim M. Using Google data to measure the role of Big Food and fast food in South Africa's obesity epidemic. World Dev. 2021 Apr 1;140:105368.

9. WHO. Assessing national capacity for the prevention and control of noncommunicable diseases: report of the 2017 global survey [Internet]. Geneva: World Health Organisation; 2018 [cited 2019 Mar 31]. Available from: https://apps.who.int/iris/bitstream/handle/10665/276609/9789241514781-eng.pdf?ua=1

10. Taillie LS, Busey E, Stoltze FM, Dillman Carpentier FR. Governmental policies to reduce unhealthy food marketing to children. Nutr Rev. 2019 Nov 1;77(11):787–816.

11. Karim SA, Erzse A, Thow AM, Amukugo HJ, Ruhara C, Ahaibwe G, et al. The legal feasibility of adopting a sugar-sweetened beverage tax in seven sub-Saharan African countries. Glob Health Action. 2021 Jan 1;14(1):1884358.

12. Alderman HH, Elder LK, Goyal A, Herforth AW, Hoberg YT, Marini A, et al. Improving nutrition through multisectoral approaches. The World Bank; 2013.

13. Reinhardt K, Fanzo J. Addressing Chronic Malnutrition through MultiSectoral, Sustainable Approaches: A Review of the Causes and Consequences. Front Nutr [Internet]. 2014 [cited 2022 Aug 21];1. Available from: https://www.frontiersin.org/articles/10.3389/fnut.2014.00013

14. Lamstein S, Pomeroy-Stevens A, Webb P, Kennedy E. Optimizing the Multisectoral Nutrition Policy Cycle: A Systems Perspective. Food Nutr Bull. 2016 Dec 1;37(4_suppl):S107–14.

15. Cejudo GM, Michel CL. Addressing fragmented government action: coordination, coherence, and integration. Policy Sci. 2017 Dec 1;50(4):745–67.

16. Garret J, Bassett L, Levinson J. Multisectoral Approaches to Nutrition: Rationale and Historical Perspectives. In: Working Multisectorally in Nutrition: Principles, Practises and Case Studies [Internet]. Washington DC: International Food Policy Research Institute (IFPRI); 2011 [cited 2022 Sep 6]. p. 34. (IFPRI Research Monograph). Available from: https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/129738/filename/129949.pdf

17. Thow AM, Apprey C, Winters J, Stellmach D, Alders R, Aduku LNE, et al. Understanding the Impact of Historical Policy Legacies on Nutrition Policy Space: Economic Policy Agendas and Current Food Policy Paradigms in Ghana. Int J Health Policy Manag. 2021 Dec 1;10(Special Issue on Political Economy of Food Systems):909–22.

18. Mukuka RM, Mofu M. THe status of hunger and malnutrition in Zambia: A review of methods and indicators. 2016;

19. Harris J, Chisanga B, Drimie S, Kennedy G. Nutrition transition in Zambia: Changing food supply, food prices, household consumption, diet and nutrition outcomes. Food Secur. 2019;1–17.

20. Harris J. Advocacy coalitions and the transfer of nutrition policy to Zambia. Health Policy Plan. 2019 Apr;34(3):207–15.

21. Mukanu MM, Abdool Karim S, Hofman K, Erzse A, Thow AM. Nutrition related non-communicable diseases and sugar sweetened beverage policies: a landscape analysis in Zambia. Glob Health Action. 2020 Dec 31;14(SI1):1872172.

22. Dalglish SL, Khalid H, McMahon SA. Document analysis in health policy research: the READ approach. Health Policy Plan. 2020 Dec 1;35(10):1424–31.

23. WHO. The World Health Report 2002: Reducing Risks, Promoting Healthy Life [Internet]. World Health Organisation; 2002 [cited 2022 Sep 6]. Available from: https://www.who.int/publications/i/item/9241562072

24. Chimeddamba O, Peeters A, Walls HL, Joyce C. Noncommunicable Disease Prevention and Control in Mongolia: A Policy Analysis. BMC Public Health. 2015 Jul 14;15(1):660.

25. Karn S, Devkota MD, Uddin S, Thow AM. Policy content and stakeholder network analysis for infant and young child feeding in Nepal. BMC Public Health. 2017 Jun 13;17(2):421.

26. Thow AM, Karn S, Devkota MD, Rasheed S, Roy S, Suleman Y, et al. Opportunities for strengthening infant and young child feeding policies in South Asia: Insights from the SAIFRN policy analysis project. BMC Public Health. 2017 Jun 13;17(2):404.

27. Al-Ansari B, Thow AM, Mirzaie M, Day CA, Conigrave KM. Alcohol policy in Iran: Policy content analysis. Int J Drug Policy. 2019 Nov;73:185–98.

28. Cruz L. Legal Guide on school food and nutrition - Legislating for a healthy school food environment [Internet]. Rome, Italy: Food and Agriculture Organisation of the United Nations; 2020 [cited 2021 May 5]. Report No.: 2. Available from: http://www.fao.org/3/ca9730en/CA9730EN.pdf

29. United Nations. UN Decade of Action on Nutrition 2016 to 2025 [Internet]. United Nations; 2017 [cited 2021 May 6]. Available from: https://www.who.int/nutrition/decade-of-action/workprogramme-doa2016to2025-en.pdf?ua=1

30. WHO. Global Strategy for Diet and Physical Activity [Internet]. World Health Organisation; 2004 [cited 2021 May 6]. Available from: https://www.who.int/dietphysicalactivity/strategy/eb11344/strategy_english_web.pdf

31. WHO, FAO. Second International Conference on Nutrition: Framework of Action [Internet]. World Health Organisation and Food and Agriculture Organisation; 2014 [cited 2021 May 6]. Available from: http://www.fao.org/3/ml542e/ml542e.pdf

32. United Nations. Transforming our world: the 2030 Agenda for Sustainable Development [Internet]. United Nations; 2016 [cited 2021 May 6]. Available from: https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf

33. WHO. Global action plan for the prevention and control of noncommunicable diseases 2013-2020. World Health Organisation; 2013.

34. Global Panel. Improving nutrition through enhanced food environments: Policy Brief No. 7 [Internet]. London, UK: Global Panel on Agriculture and Food Systems for Nutrition; 2017 [cited 2020 Mar 30]. Available from: https://www.glopan.org/wp-content/uploads/2019/06/FoodEnvironmentsBrief.pdf

35. WHO. Comprehensive Implementation Plan for Maternal, Infant and Young Child Nutrition [Internet]. World Health Organisation; 2014. Available from: https://apps.who.int/iris/bitstream/handle/10665/113048/WHO_NMH_NHD_14.1_eng.pdf

36. WHO. Set of recommendations on the marketing of foods and non-alcoholic beverages to children [Internet]. World Health Organisation; 2010 [cited 2021 May 6]. Available from: http://apps.who.int/iris/bitstream/handle/10665/44416/9789241500210_eng.pdf?sequence=1

37. CFS. CFS Voluntary Guidelines on Food Systems and Nutrition [Internet]. Committe on World Food Security at Food and Agriculture Organisation; 2021 [cited 2022 Sep 5]. Available from: https://www.fao.org/fileadmin/templates/cfs/Docs2021/Documents/CFS_VGs_Food_Systems_and_Nutrition_Strategy_EN.pdf

38. MoE. National School Health and Nutrition Policy [Internet]. Ministry of Education, Zambia; 2006 [cited 2019 Oct 28]. Available from: https://extranet.who.int/nutrition/gina/sites/default/files/ZMB%202006%20School%20Health%20and%20Nutrition%20Policy%20%202006.pdf

39. MoE. Guidelines for implementing School Health and Nutrition Programme activities [Internet]. Ministry of Education, Zambia; 2018 [cited 2021 May 6]. Available from: https://hivhealthclearinghouse.unesco.org/sites/default/files/resources/iiep_zambia_guidelines_school_health_and_nutrition_2008.pdf

40. NFNC. Most Critical Days Programme II: "Zambia's Five Year Flagship Stunting Reduction Programme". 2018 – 2020 [Internet]. National Food and Nutrition Commission; 2018 [cited 2021 May 6]. Available from: https://www.nfnc.org.zm/download/the-first-1000-most-critical-days-programme-mcdp-ii-zambias-five-year-flagship-stunting-reduction-programme-2017-2021/

41. Ministry of Agriculture. Zambia Food-Based Dietary Guidelines: Technical Recommendations [Internet]. Ministry of Agriculture, Zambia; 2021 [cited 2021 Aug 1]. Available from: https://www.fao.org/3/cb7674en/cb7674en.pdf

42. Ministry of Agriculture, Ministry of Livestock. Second national agriculture policy [Internet]. Ministry of Agriculture and Ministry of Fisheries and Livestock; 2016 [cited 2019 Sep 20]. Available from: http://cbz.org.zm/public/downloads/SECOND-NATIONAL-AGRICULTURAL-POLICY-2016.pdf

43. Ministry of National Development and Planning. Seventh National Development Plan 2017 - 2021 [Internet]. Lusaka, Zambia: Ministry of National Development Planning; 2017 [cited 2019 Sep 27]. Available from: http://extwprlegs1.fao.org/docs/pdf/zam170109.pdf

44. MOH. National Health Policy [Internet]. Ministry of Health, Zambia; 2012 [cited 2019 Oct 28]. Available from: http://www.moh.gov.zm/docs/healthpolicy.pdf

45. WHO. Fiscal Policies for Diet and Prevention of Noncommunicable Diseases [Internet]. Geneva: World Health Organisation; 2015 [cited 2019 Apr 28]. Available from: https://apps.who.int/iris/bitstream/handle/10665/250131/9789241511247-eng.pdf?sequence=1

46. Thow AM, Downs SM, Mayes C, Trevena H, Waqanivalu T, Cawley J. Fiscal policy to improve diets and prevent noncommunicable diseases: from recommendations to action. Bull World Health Organ. 2018 Mar 1;96(3):201.

47. Afshin A, Penalvo J, Del Gobbo L, Kashaf M, Micha R, Morrish K, et al. CVD Prevention Through Policy: a Review of Mass Media, Food/Menu Labeling, Taxation/Subsidies, Built Environment, School Procurement, Worksite Wellness, and Marketing Standards to Improve Diet. Curr Cardiol Rep. 2015 Nov;17(11):98.

48. Mozaffarian D, Angell SY, Lang T, Rivera JA. Role of government policy in nutrition—barriers to and opportunities for healthier eating. BMJ. 2018 Jun 13;361:k2426.

49. Stacey N, Tugendhaft A, Hofman K. Sugary beverage taxation in South Africa: Household expenditure, demand system elasticities, and policy implications. Prev Med. 2017 Dec;105(Suppl):S26–31.

50. Hangoma P, Bulawayo M, Chewe M, Stacey N, Downey L, Chalkidou K, et al. The potential health and revenue effects of a tax on sugar sweetened beverages in Zambia. BMJ Glob Health. 2020 Apr 1;5(4):e001968.

51. Williams SN. The incursion of 'Big Food' in middle-income countries: a qualitative documentary case study analysis of the soft drinks industry in China and India. Crit Public Health. 2015 Aug 8;25(4):455–73.

52. Delobelle P. Big Tobacco, Alcohol, and Food and NCDs in LMICs: An Inconvenient Truth and Call to Action. Int J Health Policy Manag. 2019 Sep 15;8(12):727–31.

53. Shiffman J. Generating Political Priority for Maternal Mortality Reduction in 5 Developing Countries. Am J Public Health. 2007 May;97(5):796–803.

54. Shiffman J. Agenda Setting in Public Health Policy. Int Encycl Public Health. 2016 Oct 6;16–21.

55. Hawkes N. Soft drink makers consider legal challenge against sugar tax. BMJ. 2016 Mar 21;352:i1661.

56. Myers A, Fig D, Tugendhaft A, Mandle J, Myers J, Hofman K. Sugar and health in South Africa: potential challenges to leveraging policy change. Glob Public Health. 2017;12(1):98–115.

57. Fraser A. Mexico's "Sugar Tax": Space, Markets, Resistance. Ann Am Assoc Geogr. 2018 Nov 2;108(6):1700–14.

58. Abdool Karim S, Kruger P, Hofman K. Industry strategies in the parliamentary process of adopting a sugar-sweetened beverage tax in South Africa: a systematic mapping. Glob Health. 2020 Dec 10;16(1):116.

59. Bridge G, Lomazzi M, Bedi R. Implementation of a sugar-sweetened beverage tax in low- and middle-income countries: recommendations for policymakers. J Public Health Policy. 2020 Mar 1;41(1):84–97.

60. Thow AM, Abdool Karim S, Mukanu MM, Ahaibwe G, Wanjohi M, Gaogane L, et al. The political economy of sugar-sweetened beverage taxation: an analysis from seven countries in sub-Saharan Africa. Glob Health Action. 2021 Jan 1;14(1):1909267.

61. Hawkes C, Ruel MT, Salm L, Sinclair B, Branca F. Double-duty actions: seizing programme and policy opportunities to address malnutrition in all its forms. The Lancet. 2020;395(10218):142–55.

62. Fox A, Law JR, Baker K. The case for metagovernance: The promises and pitfalls of multisectoral nutrition service delivery structures in low- and middle-income countries. Public Adm Dev. 2022;42(2):128–41.

63. Bach A, Gregor E, Sridhar S, Fekadu H, Fawzi W. Multisectoral Integration of Nutrition, Health, and Agriculture: Implementation Lessons From Ethiopia. Food Nutr Bull. 2020 Jun 1;41(2):275–92.

64. Drimie S, Kumar Chakrabarty S, Dube C, Smit-Mwanamwenge M, Rawat R, Harris J. Intersectoral coordination for nutrition in Zambia. 2014;

65. Harris J, Drimie S, Roopnaraine T, Covic N. From coherence towards commitment: Changes and challenges in Zambia's nutrition policy environment. Glob Food Secur. 2017 Jun 1;13:49–56.

66. Garret J, Bassett L, Levinson J. Principles and a Conceptual Model for Working Multisectorally. In: Working Multisectorally in Nutrition: Principles, Practises and Case Studies [Internet]. Washington DC: International Food Policy Research Institute (IFPRI); 2011 [cited 2022 Sep 6]. p. 20–47. (IFPRI Research Monograph). Available from: https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/129738/filename/129949.pdf

67. USAID. Operationalizing Multisectoral Coordination and Collaboration for Improved Nutrition [Internet]. SPRING. 2016 [cited 2022 Sep 6]. Available from: https://www.spring-nutrition.org/publications/briefs/operationalizing-multisectoral-coordination-and-collaboration-improved

Table 3: Mapping of Zambian policy provisions related to the food environment against global policy recommendations

Category I: Strategies to promote food and nutrition education and awareness of healthy diets.	
1. Include nutrition (health literacy) in the curricula offered in primary and secondary schools	
2. Develop national food or nutrient based guidelines (WHO and FAO, 2014)	Zambia developed food-based guidelines (Ministry of Agriculture, 2021)
3. Implement mass media/public and social marketing campaigns based on national dietary guidelines to	
Category II: Regulatory and legislative tools	
4. Implement tax measures on unhealthy foods	

5. Provide incentives such as subsidies for production of healthy food options including reformulation	
6. Implement comprehensive policy on labeling of food	Promote mandatory nutrition labeling for all prepackaged foods (MOH, 2013)
7. Regulate marketing of food and non-alcoholic beverages to children including in schools	
Category III: Strategies to promote production of and access to healthy food	
8. Strengthening of agriculture policy to improve supply of locally grown nutritious food	Ministry of Agriculture promotes cultivation and consumption of indigenous crop varieties (Ministry of Agriculture and Ministry of Livestock, 2016; GRZ, 2019)
9. Adopt policies that support healthy diets at school by engaging food retailers and caterers including school tuck-shops to improve the availability, affordability and acceptability of healthier food products and limit the availability of products high in salt, sugar and fats	To improve feeding and eating practices, schools shall: 1) establish a tuck shop which should be selling healthy foods 2) encourage the family to prepare and pack healthy foods for leaners 3) ensure that learners are counseled on good feeding practices 4) encourage consumption of traditional food (MoE, 2008) Production units to teach children improved food production methods and agro entrepreneurship skills (MoE, 2006)
10. Explore potential of urban and peri-urban agriculture initiatives such as school and community gardens and issuing contracts to local food growers to supply fresh produce and support the diversification of school meals and diets of schoolchildren and adolescents in cities (WHO, 2004; Cruz, 2020)	Improve Dietary Diversification through Nutrition-Sensitive Agriculture by increasing production and consumption of dietary-diverse nutrient-dense foods by 1) Develop and scale up a comprehensive homestead food production model. 2) Support school demonstration gardens in production of micronutrient rich foods (NFNC, 2018)

11. Develop and enforce national food safety legislation and regulations	Government enacted the Food Safety Act of 2020 which contains provisions for the production, manufacture, handling, preparation and storage of food in a manner that prevents food related diseases and harm (GRZ, 2020)
Category IV: Social protection strategies	
12. Incorporate nutrition objectives into social protection measures for vulnerable populations e.g. cash transfer and school feeding program (WHO, 2014; United Nations, 2017)	School feeding program

CHAPTER 7: NUTRITION POLICY REFORMS TO ADDRESS THE DOUBLE BURDEN OF MALNUTRITION IN ZAMBIA: A PROSPECTIVE POLICY ANALYSIS

In chapters 2 and 4-6, I established that despite adolescents having unhealthy dietary patterns influenced by food environment factors, Zambia does not have internationally recommended legislative policy measures that are effective for fostering healthy food environments. Therefore, this study aimed to examine stakeholder perspectives on how nutrition policy in Zambia can be strengthened and identify existing barriers and facilitators to policy change. Using Kingdon's multiple streams theory, I conducted a prospective policy analysis to assess the feasibility of developing and implementing nutrition policy options that address food environment drivers for the DBM among adolescents in Zambia. The barriers and facilitators to prospective policy reforms were categorized into those related to the problem, policy solutions, and politics stream. I conducted 17 in-depth interviews with nutrition stakeholders drawn from government and related agencies (n=7), civil society (n=3), multilateral organisations (n=4), academia (n=1) and industry (n=1).

A key takeaway from this paper is that stakeholders perceived legislative policy measures as not feasible for the Zambian context and that power and influence of stakeholders would significantly influence the policy reform process.

This study addressed study objective six and is under review in the Health Policy and planning journal.

Nutrition policy reforms to address the double burden of malnutrition in Zambia: A prospective policy analysis

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Author contributions

- Conception or design of the work: MMM
- Data collection: MMM
- Data analysis and interpretation: MMM, AMT
- Drafting the article: MMM
- Critical revision of the article: AMT, ZJM, PD
- Final approval of the version to be submitted - all named authors should approve the paper prior to submission: MMM, AMT, ZJM, PD

Keywords: Policy analysis, food environments, policy reforms, double burden of malnutrition, adolescents

abbreviated running title: Nutrition policy reforms in Zambia

Key messages, detailing the main points made in the paper

- Addressing nutrition problems in adolescents was not perceived as a priority, however there was a general acknowledgement that this age group requires to be prioritized.
- Regulating marketing of unhealthy food and beverages to children was as a policy option was perceived as not for the Zambia context while healthy food provisioning in schools was perceived feasible.

- Manufacturing companies were perceived as having strong influence and interest to challenge legislative policy reforms.

Reflexivity Statement

The authors of this work include three females and one male of varying levels of seniority. The main author is a doctoral student from Zambia while the co-authors are associate professors from South Africa, Belgium and Australia. All the authors have extensive experience in nutrition policy processes and prevention of nutrition-related non-communicable diseases in low to middle income countries in sub-Saharan Africa and the Pacific region.

As the main author, I identified with the position of advocate when conducting this research as I want to contribute to changing the status quo of nutrition policy interventions in Zambia by draw attention to food environment-based policy solutions. My approach to understanding of nutrition problems and their solutions centres on non-biological, policy level factors. This perspective stems from my interaction with the food system which I have witnessed evolve over the years in Zambia as well as my experience working in the public health sector. As a pharmacist and public health researcher, interacting with people of low socio-economic status has shown me that behaviour change even with the availability of information is not easy to achieve, especially in resource constrained environments. For instance, it is common for women who know the value of feeding their infants with nutritious food options to go for less nutritious options like fritters because that is what they can afford. Similarly, while the people might appreciate the need to have back yard vegetable gardens, lack of space and erratic water supply in most of the unplanned settlements in urban areas makes it impossible. Despite this, the main stay of nutrition related interventions focuses on educating people to eat healthy. These experiences have shaped my research focus on policy level solutions to social challenges like nutrition.

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Abstract

The evolution of nutrition patterns in Zambia has resulted in the coexistence of both undernutrition and overnutrition in the same population, what is termed double burden of malnutrition. While Zambia has strong policies addressing undernutrition and stunting, these do not adequately address food environment drivers of the double burden of malnutrition and the adolescent age group, hence the need for nutrition policy reforms. We conducted a theory based qualitative prospective policy analysis involving in-depth interviews with nutrition policy stakeholders and policy documents review to examine the feasibility of introducing nutrition policy options that address the double burden of malnutrition among adolescents in order to identify barriers and facilitators to such policy reforms. Using the multiple streams theory, we categorized the barriers and facilitators to prospective policy reforms into those related to the problem, policy solutions and politics stream. We found that the use of a life course approach in nutrition programming could facilitate policy reforms as the adolescence period is one of the critical invention points in a person's lifecycle. Availability of existing institutional infrastructure that could be leveraged to deliver adolescent focused policies was another key facilitator of policy reform. However, the lack of evidence on the burden and long-term impacts of adolescent nutrition problems; food industry strong influence over governments policy agenda setting; and lack of public awareness to demand for better nutrition were perceived as key barriers to policy reforms. Stakeholders did not perceive legislative nutrition policy options that effectively address food environment drivers of the double burden of malnutrition to be feasible for the Zambian context. Policy entrepreneurs are required to broker policy reforms that will get legislative policy options on governments agenda as they can help raise public support as well as re-engineering the framing of nutrition problems and their solutions in Zambia.

Introduction

The nutrition problem landscape in Zambia has evolved from predominately undernutrition related issues to include overweight and obesity as well as nutrition-related chronic conditions like type 2 diabetes and hypertension (Harris *et al.*, 2019). This coexistence of both undernutrition and overnutrition in the same population is termed double burden of malnutrition (Popkin, Corvalan and Grummer-Strawn, 2019). Latest estimates indicate that 35% of children under 2 years are stunted while 5% of children under 5 years are either overweight or obesity (Central Statistical Office, Ministry of Health and ICF, 2019). In the adult population, 24% are overweight while 90% do not meet the dietary requirement of consuming five portions of fruit a day (WHO, 2018). Recent studies in the adolescent age group shows that the snacking dietary pattern characterized by consumption of processed food high in sugar, salt and fats is prevalent among urban school going adolescents (Mukanu, Delobelle, *et al.*, 2022). However, Zambia's nutrition policies are not changing rapidly enough to address the development of new challenges associated with the nutrition transition.

The nutrition transition and associated double burden of malnutrition being experienced in Zambia has food system drivers. The undernutrition component has been linked to agriculture policies which perpetuate the lack of diversity in the Zambian diet (Mwanamwenge and Harris, 2017). Liberalized economic systems coupled with globalization have contributed to the increased availability and affordability of processed, energy dense foods (Harris *et al.*, 2019). Nutrition problems are predominate framed as related to behavioural factors, and legislative interventions addressing food environment divers are lacking (Mukanu *et al.*, 2020). In addition, although the adolescent age group has been identified as a 'second window of opportunity' for preventing adverse nutrition related problems later in life (Patton *et al.*, 2022), little attention is paid to this population group in Zambia, despite being exposed to unhealthy food environments that foster unhealthy diets (Mukanu, Thow, *et al.*, 2022). While Zambia

has strong policies addressing undernutrition and stunting (NFNC, 2018), these do not adequately tackle food environment drivers of the double burden of malnutrition, hence the need for nutrition policy reforms.

Policy reform is an inherently political process that aims to change 'the rules of the game' by challenging the status quo, often aiming to improve the status of vulnerable group by redistributing access to finite resources to address a problem or achieve a goal (Reich, 1995). Policy reforms thus attract interest of stakeholders who are likely to benefit from the maintaining the status quo or from the change promised by reforms. The process of reforming policy involves use of persuasive tactics to re-engineering of how problems and their solutions are perceived by stakeholders to facilitates (or block) a change of the status quo. Evidence characterizing the extent, intensity of a problem and its associated outcomes is one of the tools used to push for policy reforms. However, evidence while important is not the only determinant of policy reform. Political science theories explain how social and political factors also influence the policy reforms. For instance, institutions (government structures, policy networks, and policy legacies) and interest (agendas of societal groups, elected officials, civil servants, researchers, and policy entrepreneurs) can shape the ideas (what is known about the problem) about a policy issue, and influence the policy options considered legitimate to address that particular issue (Shearer *et al.*, 2016).

Policy actors (participants who impact on, and are impacted by, policy processes) are central to policy reforms (Buse, Mays and Walt, 2012). Actor interests are reflected in frames they adopt to understand and communicate a policy 'problem' (policy narratives), which in turn influences the solutions they are likely to support (Koduah, Agyepong and van Dijk, 2016). Frames can be understood as 'distinct and coherent interpretations of an issue containing a problem definition, casual attributions and recommended prescriptions' (Van Hulst and Yanow, 2016). Policy actors also carry power which can be often associated with institutions

and/or policy networks they are part of. Scholars have shown that with this power, actors can garner support and build policy networks with likeminded actors to influence policy direction in ways that protects and favours their interests as a group (Shearer *et al.*, 2016; Mukuru *et al.*, 2020).

Nutrition policy reforms attract interests of wide array of actors as nutrition problems are complex and with political, economic and health dimensions (Balarajan and Reich, 2016). For example, food industry actors have emerged as a powerful and highly interested in nutrition policy development across the globe with the growing recognition of the role of 'commercial determinants of health' in poor nutrition (Kickbusch, Allen and Franz, 2016; Mialon, 2020).The financial resources and enabling liberalized economic systems gives the food industry power to influence policy development and protect their interests through corporate political activities such lobbying and corporate social responsibility (Mialon, Swinburn and Sacks, 2015). Policy actors from economic sectors of government also have high interest in nutrition policy reforms. In developing countries for instance, most government have prioritized economic growth often by encouraging foreign direct investments which results in proliferation of industries for unhealthy commodities like food and alcohol (Baker, Kay and Walls, 2014; Schram *et al.*, 2015; Friel and Jamieson, 2019).

Zambia requires nutrition policy reforms where among others, effective legislative policy options for addressing food environment drivers of the double burden of malnutrition will be prioritized. The aim of this study was to examine stakeholder perspectives on how nutrition policy in Zambia can be strengthened, with a particular focus on assessing the feasibility of developing and implementing nutrition policy options that address food environment drivers for the double burden of malnutrition among adolescents in Zambia. In so doing, we aim to identify existing barriers and facilitators to policy change which can inform targeting of advocacy efforts.

Materials and methods

Study design

Qualitative prospective policy analysis research design involving in-depth interviews with nutrition policy stakeholders and review of policy documents was used. Prospective policy analysis 'seeks to understand the unfolding political-economy environment of policy change so as to support stakeholders to more effectively engage in policy processes' (Buse, 2008). Key to health policy analysis studies is application of theoretical frameworks to understand determinants of policy change (Walt *et al.*, 2008; Reeve *et al.*, 2021).

Theoretical frameworks

Given that agenda setting is a critical first step in policy reforms, we applied Kingdon's (1984) multiple streams theory as the overarching theoretical framework for this study to prospectively assess the feasibility of nutrition policy reforms for the double burden of malnutrition based on the stakeholder perspectives and policy document data. This involved analyzing the current status of the factors under each of the three streams and reflecting on the presence (or lack thereof) of focusing events that might facilitate opening of a window of opportunity.

According to the multiple streams theory, policy change depends on factors in three parallel 'streams': the problem stream which considers how problems and their solutions are understood by stakeholders; the policy solutions stream which considers solutions proposed by actors and the politics stream which considers the contextual factors including interests and influence of different policy actors. Policy change has been shown to occur when the three streams converge usually in response to an open window of opportunity. Important to the opening of windows of opportunity are focusing events that facilitate the coupling of the streams such changes in political office or presence of policy champions or entrepreneurs.

Data collection

Stakeholder interviews

A two-section interview guide was used to collect data from nutrition stakeholders. The first section was structured to collect information on how stakeholders perceive nutrition problems and the solutions required, corresponding to the problem and policy solutions streams. In the second section, we aimed to understand the feasibility of policy options by exploring facilitating and inhibiting factors as well as we power and influence of policy actors, corresponding to the politics stream of the multiple streams theory. We further included questions to explore what would be required to develop and implement two specific policy options recommended for health food environments: regulating marketing of unhealthy food and beverages to children and healthy food provisioning in schools. The choice of these two policy options was based on our previous research on Zambia's adolescent nutrition policy environment (Mukanu *et al.*, 2020) and global recommendations (WHO, 2017). The interview guide was piloted with three stakeholders from the health and education sector before data collection.

We used purposive sampling to identify and recruit relevant stakeholders to participate. Respondents were identified through networks developed by the authors from previous nutrition related research in Zambia (Mukanu *et al.*, 2020). We used experience from previous studies to identify respondents and snowballing was used to identify additional respondents. Potential participants were invited to participate via phones calls or email. For government institutions, an official letter was written requesting permission to interview the relevant staff experience on nutrition policy making. Interviews were conducted virtually and in person by the lead author. Data was collected between March and July 2022. Interviews took an average of 40 minutes and were recorded with consent from the participants.

An initial 30 respondents were identified and invited to participate in the study. Of these, 25 responded and 13 were interviewed in the first round of data collection. Seven additional stakeholders were identified through snowballing during the first round of interviews; of these,

4 agreed to be interviewed in the second round. After the two rounds of interviews, the range of respondents to reflected the different perspectives that were important regarding food environment nutrition policy in Zambia, indicating theoretical saturation. The 17 respondents interviewed were drawn from government and related agencies (n=7), civil society (n=3), multilateral organisations (n=4), academia (n=1) and industry (n=1) as shown in Table 1. Types of respondents interviewed were senior level official with current or previous involvement in policy making.

Table 2: Respondents interviewed in the study

Sector	**Number invited to participate**	**Number who responded**	**Number interviewed**	**Interviewee code**
Government ministries and agencies				
• Health	3	3	2	Govt-Hea-1, Govt-Hea-2
• Education	2	1	1	Govt-Ed-1
• Agriculture	2	1	1	Govt-Agric-1
• Commerce, trade and industry	3	2	1	Govt-Com-1
• Community development	3	2	1	Govt-Cdev-1
• Local government	1	1	1	Govt-Lgov-1
Manufacture related associations	1	1	1	Man-1
Commerce and trade affiliated organisations	1	1	1	Com-1
Health related association	1	1	0	

Civil society organisations	4	4	3	CSO-1, CSO-2, CSO-3
Bilateral and multilateral organisations	3	2	2	Bil-1, Bil-2
UN agencies	3	2	2	UN-1, UN-2
Academia/Think tanks	3	1	1	Acad-1
TOTAL	30	20	17	

Documentary data

We reviewed policies (n = 17) related to nutrition policy and food environments in Zambia to further understand the framing of malnutrition in policy documents. The policy documents were identified by checking through the publication section on the websites of government ministries with nutrition-relevant mandates, including the Ministries of Health, Education, Agriculture, Youth, Sports and Child Development, Community Development and Social Services, Commerce Trade, and Industry and National Development Plan. A data extraction matrix was developed to facilitate collection of relevant content from the policy documents, which included date of publication, situation analysis of nutrition and nutrition related policy strategies and interventions. Detail of the documentary data collection and analysis is provided in another paper (Mukanu, Mchiza, *et al.*, 2022).

Analysis

Data analysis focused on identifying factors that would influence the development, implementation and prioritization of nutrition policy reforms with a special focus on adolescents by government in Zambia. To achieve this, thematic analysis was used to systematically organise and identify patterns of meaning (themes) across the dataset in order to generate new knowledge (Braun and Clarke, 2012).

The first step of the analysis involved deductive broad coding of data from stakeholder interviews and documents to three predetermined codes: problem, policy and politics derived from the multiple streams theory. This was followed by further sub-analysis of the data under each stream to inductively derive subthemes and patterns. Under the problem stream, we applied a framing analysis to both documentary and interview data to examine the 'frames' used by stakeholders to make meaning of nutrition problems. This is important in a prospective policy research as the frames chosen by policy actors to problematize an issue often determines the attention it receives and actions chosen to address it and who is seen as responsible for acting (Shiffman, 2009; McIntyre, 2020). Data coded to the policy solutions stream was further analysed to identify perceived policy solutions as well facilitators and barriers to developing and implementing the said policy options for fostering healthy food environments. Under the politics stream, data was analysed to identify the perceived power and influence of policy actors overnutrition policy development and implementation. Table 2 illustrates the overarching themes and subthemes and example quotes under each stream of the multiple stream theory.

Table 3: Summary of the thematic analysis illustrating themes, subthemes and example quotes

Code	Overarching themes	Sub- themes	Example quotes
Problem stream	Nutrition problems in adolescents/definition of nutrition problems	Adolescents not part of vulnerable populations	*'We haven't done so much with adolescents, we have been more focused in the vulnerable groups the under-five and the pregnant women'* Bil-1 *'We target mothers and children but we forget to address the nutrition needs of the adolescents, the adolescent period is actually one of the critical areas that we should focus on because that prepares the body for the upcoming future happenings' Bil-2* *'Unfortunately, the way that financing has been designed a lot of nutrition money goes into maternal and child health' CSO-3*
		Dual burden of malnutrition	*'Double burden of malnutrition is present, of late overnutrition has been on the rise especially in the affluent populations' Govt-Ed-1* *'Primarily undernutrition is the problem because of the poverty but when you look at Lusaka or Livingstone you find that its overnutrition is a problem and that's where obesity comes in' Govt-Cdev-1*
		No information on burden of nutrition problems	*'We haven't like done specific studies focusing on adolescents, we've been doing studies in women of reproductive age that is starting from 15 to 49 and in the 15 to 19 segment, anemia is a problem'Govt-Hea-3* *The issue is to provide evidence on what is the biggest issue because there isn't much on the adolescents, we have not done a lot research like we have done for children' Acad-1*

	Drivers of nutrition problems	Lack of information on what constitutes healthy food	*'Specifically, in the urban areas, lifestyle choices are leading or causing malnutrition' Govt-Cdev-1* *'I have never seen anyone standing at the mall giving out booklets to sensitize people on healthy diets, our fast foods outlets do not even have any warning to say sugar is not good for your health' Govt-Agric-1* *'If you place a tax a sugar tax on a number of sugar processed commodities but then the consumer doesn't even know why they shouldn't take those commodities, they will continue looking for that commodity' Man-1*
		Availability of unhealthy food in the in the environment	*'Most snack produced in Zambia are either high in sugar, salt or sodium or high in fat like fries, sausage. Those are the type of snacks that you find in school tuck shops' Bil-1* *'Food is not a simple choice, environment matter, school tuck shops do not stock fruit' UN-1* *'I think is like the world over what determines the foods that we are eating is large corporations' CSO-1*
		Affordability of food	*'Maybe what adolescents are eating in school because it's easier to get a snack like chips, soda drinks at an eating place because they are cheaper than the nutritious options'UN-2* *'A person would rather spend less on that food that looks very appetizing regardless of how much sugar or salt content because its affordable' Bil-1*
		Advertisements for fast foods	*'How food is advertised in Zambia is quite concerning, issues of food and nutrition are not taken seriously' CSO-3*

			'Companies make adverts are very appealing to the young ones and they think that's the way to go so they easily go for it' Govt-Agric-1
		Convenience of food preparation	*'Sometimes you don't have time to prepare certain foods e.g. cooking beans, you need time to be there waiting, how many people have the time to do that?' Govt-Hea-2* *'In a home where parents are not oriented on what they should pack for their children they will quickly think of something that's easy and fast,* *most parents will even stop by the mall in the morning to get snacks for the children as they go to school' UN-1* *'It is easier for a shop to have crisps and biscuits because you don't need to store them in the fridge don't have to worry about spoilage so extra costs for business owners' Govt-Cdev-1*
		Cultural/social influence	*'There is a lot to do also with perception if you live in Lusaka you don't go home for lunch but people would want to quickly grab a bite with colleagues' Govt-Lgov-1* *'This is an age group which copies mostly from their peers, if their friends are snacking they look at it to be a normal' UN-2*
Policy stream	Proposed solutions to nutrition problems	Public education using food based dietary guidelines	*'If we provide people with good adequate information, they're going to make informed based choice and they are going to make good choices so that's what we need to do' Govt-Hea-1* *'SHN policies are present, but education of the masses is still required. We need to normalize healthy food on TV and radio' UN-2* *'It's better to educate somebody on nutritious*

			foods, balanced diets to break all those cycles of bad nutrition habits due to life style choice'. Govt-Cdev-1 *'It should start with teaching good health in schools so that while people are young it's been instilled in their minds and they would be more cautious as they grow' Man-1*
		Regulate marketing of unhealthy foods to children	*'We need regulations that can guide content of food related adverts, currently there is no mention of the nutrition value that is contained that particular drink or snack or food' Bil-2* *'If we have less people thinking that an energy drink is nutritious I think that will help, so marketing should be regulated' CSO-1*
		Healthy food provisioning in schools	
	Facilitators of policy reform	Existing infrastructure	*'Existing institutions like ZABS can have more of a say on kind of labeling and advertisements of food' CSO-2* *'ZABS to look at how we are complying to the set standards for one to be able to sell better package, better hygiene foods for the streets' Bil-2* *'The evidence is there, school environments are unhealthy, and the PTA can demand better' UN-1* *'Marketing is under the jurisdiction of the Zambia Institute of Marketing and I know that there is a bill that is under revision that is trying to enhance the provision of how the institution can regulate marketing' Govt-com-1*
	Barriers to policy reform	Weak governance coordination mechanisms	*'To monitor the activities in the whole Lusaka at hasn't been easy that's why we need to digitalizing the operations and use technology or to ensure that we monitor or protect public health in this city' Govt-Lgov-1*

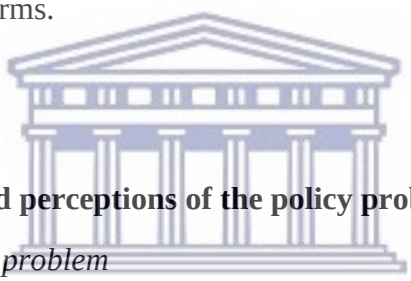
		Weak nutrition advocacy	*'Introduction of more effective policy options is not yet feasible. Civil society haven't done enough to get the public aware for them to demand for better nutrition there is not enough public momentum in the country' CSO-1* *'We acknowledge that government has invested a lot in maternal and child nutrition but for adolescents we need more players and advocacy groupings to be able to show that this very important demographic group also' Acad-1* *'We have a few civil society organisations that may try to speak out on issues but I think that there is more that needs to be done and mainly those are based in Lusaka' UN-1*
		Lack of evidence on the extent of nutrition burden	*'We need strong scientific evidence to say if we do this these are the expected results that way you can convince the policymakers. science should inform the decision not emotions' Govt-Lgov-1* *'We need to establish what is the problem in our adolescents, it undernutrition or overnutrition? If we don't know, this age group will not be prioritized' Govt-Hea-1* *'We need to get to a point where there is enough data so that people can't refuse that there is a need to do something about nutrition problems in adolescents' CSO-1*
		Rights of individuals	*'It's a tough one, people should make choices and individual decisions so you don't want policies infringing on people's rights. so best that schools can do is pass on the information on good nutrition' Bil-1* *'If the government limits these adverts for foods what am saying is that there is going to be an uproar as everyone has freedom of expression' Com-1*

Politics stream	Influencers of policy change	Industry	*'It is not an easy space to navigate in Zambia, companies are not concerned about being shamed for their practices unlike global corporations are more cautious about appearing woke' CSO-2* *'Imagine a business that is trying to come up in Zambia and then you limit the ability to expand because of restrictions, it means you are also limiting the farmers who are bringing the potatoes, the farmers who are rearing the chickens, there will be ripple effect. So, you really need to take into consideration of all these things so you need to balance as well' Govt-Cdev-1* *'School children are the biggest market for snacks and sugary drinks, so anything to do with any issue that will brings down their profit they will oppose'Govt-Hea-1*
		Free market economy	*'We need to be careful, the additional policies for school environment should not stifle the business environment remember we are in a free market economy' Govt-com-1* *'This approach of regulations is difficult, we are a free market economy so it would be very difficult to draw the line at who can advertise and how they can advertise' Govt-Cdev-1* *'In a liberal market system, everybody can sell something that has not been proven to be toxic so people engage in strategies to optimize their profits, celebrities are hired to increase coverage and acceptability by the general population, you can't stop that' Acad-1*
		Framing of the problem using evidence	*'We need to show that unhealthy dietary patterns in adolescents has big impact on the economy and health of the population, we should say that by intervening and providing a healthy food environment in schools, we are going to save not*

			only the children's health but also the nation from having unnecessary expenditures' Acad-1

Results

We used a narrative approach to present the findings from the analysis of data from documentary analysis and stakeholder interviews. The findings are categorized according to the three domains of the multiple streams theory (Kingdon, 1984), the overarching framework applied in the study. Under the problem stream, nutrition problems in adolescents were not perceived as a priority, however there was a general acknowledgement that this age group requires to be prioritized. Under the policy solutions stream, regulating marketing of unhealthy food and beverages to children was as a policy option was perceived as not for the Zambia context while healthy food provisioning in schools was perceived feasible. Under the politics stream, manufacturing companies were perceived as having strong influence and interest to challenge legislative policy reforms.



Problem stream: Evidence and perceptions of the policy problem

Nutrition is a recognized policy problem

The perception of nutrition as an important national policy issue is an opportunity for nutrition policy reforms. From documentary data, poor nutrition in the vulnerable age groups was linked to negative long-term consequences such as poor cognitive development due to childhood stunting and increased risk of obesity and its related chronic conditions (NFNC, 2018) while 'well-nourished and healthy population' were identified as critical to national economic development (Republic of Zambia, 2006). Further, women, children and to a certain extent adolescent were perceived as key populations who are vulnerable to nutrition related problems (MoFND, 2022).

There is limited prioritization of adolescents in nutrition policy

Some stakeholders acknowledged the need to better address adolescents in nutrition programming as they are a critical age group (Gov-Hea-1, Gov-Ed-1, CSO-1, UN-1, UN-2, Bil-2). Stakeholders noted that adolescents needed to be protected to ensure they develop good nutrition habits that would prevent development of chronic conditions in adult life (Gov-Hea-2, Gov-Ed-1). The focus of nutrition programming and policies as contained in policy documents was on women of reproductive age and children under 2 years (NFNC, 2018) despite some stakeholders stating that a life course approach was being used to address nutrition problem (Acad-1). Despite adolescents being identified as part of the vulnerable population in policy documents, stakeholders noted that there was a dearth of 'formal' evidence on the nutrition status of adolescents. This lack of evidence rendered adolescents invisible and not high risk to be prioritized for nutrition policy investments (UN-2). Data were only available on some nutrition related outcomes like prevalence of anaemia and body mass index among adolescent girls who are targeted because of the high risk for pregnancy. Anecdotally, stakeholders noted a rise in obesity among urban adolescents which was associated with increased consumption of processed foods high in sugar, fats and salt (Gov-Cdev-1, Govt-Lgov-1, Acad-1).

There is concern but a lack of clarity regarding adolescent nutrition

The identification of food environment factors as influencers of adolescent's dietary choices by stakeholders and in policy documents is an opportunity to introduce policy options that address food environment drivers. Stakeholders noted that the availability of junk food around schools, prevalent advertisements of junk food usually combined with false claims about the nutritional value of food and attractiveness and convenience of acquiring and consuming fast foods made unhealthy a popular choice among adolescents and there was need to urgently address this in Zambia (CSO-1, CSO-2, UN-2, Acad-1, Gov-Lgov-1, Bil-1). However, the entrenched beliefs on the drivers of nutrition problems in adolescents might present barriers to

policy reform. Nutrition problems in documentary data were framed as arising due to 'lifestyle choices' and 'risky behaviour' or 'personal preferences' (MOH, 2013; MoYSCD, 2015). Some stakeholders also perceived that the lack of information on what healthy eating consists of or the consequences of unhealthy eating were the biggest driver of poor nutrition choices (Gov-Cdev-1, Bil-2, Gov-Hea-1). This framing of nutrition problems might limit the extent to which food environment policy solutions are considered.

Policy/solutions stream: Proposed policy solutions and barriers

There was a clear preference for education-based policy approaches

Perceptions about the causes of nutrition problems influenced perceptions about the feasibility of policy reforms. All the stakeholders acknowledged that additional policy measures are required to match the spectrum of nutrition problems in different population groups. However, because of the perception that poor nutrition habits were caused by lack of knowledge, stakeholders proposed that education and information-based policy measures were required to raise awareness on the negative impacts of unhealthy diets and foster behaviour change in the entire population. Stakeholders proposed that Government should lead efforts to foster behaviour change through public campaigns and the expansion of the nutrition component in the school curriculum. The Eat Well campaign being implemented by government through the NFNC with support from the World Food Programme was cited as an example of governments efforts to educate the public (UN-1, Gov-Hea-1, Acad-1). The campaign uses local celebrities to promote healthy diets on radio and social media. The availability of national food based dietary guidelines would further guide the content of the educational interventions (Gov-Agric-1, Acad-1).

First, we need to start with education like I have said. We need to sensitize our communities on the health benefits of some of these foods. Without that knowledge it becomes very difficult. I can have a lot of money but if I don't know that what is healthy for me is there probably on the market, I might end up buying a very sugary drink when I am supposed to be getting a fruit. So, sensitization is very key' ***Gov-Agric-1***

Legislative policy options that are effective for addressing food environment drivers of the double burden of malnutrition were generally perceived as challenging to develop and implement and not yet feasible for Zambia (CSO-2, Gov-Cdev, Acad-1. Few stakeholders noted that policy options like taxations of unhealthy foods are useful for improving the quality of food environments. Stakeholders noted that the country lacks the technology, capacity, resources and required to implement such policies (Gov-Com-1, Com-1, Gov-Lgov-1, Gov-Cdev-1). Such perceptions might be rooted in the policy legacy of implementation of a similar legislation policy such as the statutory instrument restricting the promotion of breastmilk supplements. Stakeholders noted that government has struggles to enforce this law due to lack of capacity. In addition, manufacturers have reportedly found loop holes in other supporting laws such as the lack of advertising standards (Gov-Com, Gov-Hea-1). Stakeholders noted that legislative policy options also have potential to infringe the rights of persons and this might make them unpopular to the public and policymakers. With regards to rights of individuals, stakeholders felt individuals should retain the right to choose what food they want (Gov-Lgov-1). Protecting the rights of individuals as well as ensuring that vulnerable groups like women traders are not disempowered was seen as cardinal for securing public support for legislative policy measures.

Feasibility of regulating marketing of unhealthy food and beverages to children:

Despite acknowledging the influence of advertisements on adolescent food choices, introduction of marketing regulations was perceived as not feasible for the Zambia. The government currently has no regulation targeted at marketing of unhealthy food and beverages to children. Perceived barriers to the introduction of this policy option include difficulty of tailoring the policy to the different types of media such as radio, internet, (Bil-1), lack of government capacity and resources for enforcement (Govt-Lgov-1, Govt-Hea-2) and negative impact on small businesses (Govt-Cdev-1].

Stakeholders identified some existing structures that could be leveraged to implement legislative nutrition policy options. Competition and Consumer Protection Commission and the Zambia Bureau of Standards were seen as government institutions that could have a key role in enforcing marketing regulations. It was proposed that Competition and Consumer Protection Commission in its mandate to address misrepresentation by business owners could help enforce a regulation on false claims in advertisements while Zambia Bureau of Standards could develop food standards required to verifying claims about food quality.

Feasibility of healthy food provisioning in the school environment:

Restricting availability of unhealthy food within the school environment was perceived by stakeholders as relatively feasible for the Zambian context. NFNC, Ministry of Education with support from United Nations Children Emergency Fund have plans to introduce nutrition friendly schools in some pilot districts across the country (Gov-Hea-1, gov-Ed-1). The school environment was seen as easy to gain access to and implement policies as opposed to targeting the general population. The Parent Teacher Committees were perceived as key stakeholders in the success of this policy option as they would garner the support required for implementation from stakeholders including food vendors, learners and their guardians (Gov-Ed-1, Acad-1, Gov-Com-1). Availability of national food-based guidelines and the school health and nutrition

policy were also identified as critical for facilitating development of standards to guide the types of food that should be permitted in schools (Gov-Agric-1, Gov-Hea-2). The local government stakeholders added that using their city planning mandate, they could restrict the issuing of trading licenses to regulate the types of businesses that can be allowed to operate within a particular radius around school premises, thus contributing to healthy environments. Additional policy options that would further support the affordability of healthy food such as subsidies were also called for (Acad-1).

Politics stream: Influence and power of policy actors

NFNC has power to influence policy reform, but needs to be further strengthened

Stakeholders indicated that stronger coordination and policy networks among nutrition policy actors would be required for policy reforms. From documentary data, NFNC has the mandate of coordinating nutrition in Zambia (GRZ, 2019). All government stakeholders perceived this mandate as providing power influence to the NFNC to drive nutrition policy change. For instance, stakeholders from the health sector stated that the NFNC was powerful because they convene the committee of permanent secretaries on nutrition, which is a key decision-making body for nutrition in Zambia. Stakeholders further added that NFNC's influence is shown through its coordination of the Most Critical Days Program (MCDP) which guides the scaling up nutrition activities of different government sectors including health, WASH, agriculture, education and community development. While government stakeholders were confident in the NFNC's coordination role, some non-governmental stakeholders perceived that NFNC being under Ministry of Health made nutrition seem like a problem of the health sector and weakens the Commission's influence over non-health sectors (Bil-1, UN-1). These stakeholders proposed that the NFNC siting under a 'neutral' organ of the government like Office of the

Vice President would be a better alternative. They added that the lack of an enforcement wing in the NFNC weakens the commissions power to influence implementation of policies.

Manufacturing companies likely to block policy reforms

All the stakeholders perceived manufacturing companies as having high interest and strong influence overnutrition policy making in Zambia. The power of manufacturing industry to influence government's policy agenda was primarily linked to the financial support that big manufacturers render to government ministries under the guise of corporate social responsibility (UN-2) and free market economic system which was perceived to favour business interests of companies (Acad-1, Gov-Lgov-1, Com-1). Stakeholders from industry further added that the affiliation of manufacturers, represented by the Zambia Association of Manufacturers with the Ministry of Commerce, Trade and Industry was useful network for pushing back on policies that negatively impact manufacturers. Stakeholders from the health sector seemed resigned to the fact that manufacturer would always oppose and find a way around policies that they feel interfere with profits such as restricting the marketing or taxation of unhealthy food. However, other stakeholders saw this interest is an opportunity for government to proactively engage with manufacturers and incentivize their adoption of policy reforms by reducing their cost of doing business (Gov-Cdev-1, Gov-Lgov-1 and Gov-Agric-1). For instance, small business owners operating in the school food environment could be incentivized to provide healthy food options like fresh fruits by given access to loan facilities that will help them procure refrigeration equipment required to prolong the shelf life of perishable fruits (Gov-Agric-1). Some stakeholders added the uptake of existing initiatives like the good food logo, a voluntary front of pack label spearheaded by the NFNC and Scaling Up Nutrition Business Network would be increased if it was coupled with an incentive like tax exemption on importation of equipment or ingredients required for the reformulation of unhealthy food (Man-1, Gov-Com-1).

Public support required for policy reforms, but currently lacking

Stakeholders perceived that generating strong public support is critical for nutrition policy reforms in Zambia. Stakeholders felt that currently the public and policymakers can not relate to nutrition problems in adolescents as evidence showing the burden or impact of the nutrition-related problems like obesity in this age group is lacking (CSO-3, Acad-1, UN-1). Some stakeholders proposed that the general population should be educated on the causes of poor nutrition so that they can appreciate and support legislative policy measures (Gov-Hea-1, Gov-Cdev-1, Bil-2). All stakeholders perceived civil society organisations as having great potential to influence public demand for nutrition policy reforms in Zambia because of the ability to mobilize public support through advocacy activities. Civil society organisation can help tailor the framing of nutrition problems to show both short term and long-term impact on health and the economy so that everyone including government, private sector and the general public can begin to realize how big of an issue poor nutrition is (Acad-1, CSO-2).

'In our efforts as researchers and civil society we want to show that eating very badly in adolescents has big impact on the economy a big impact on the health of the population. if that is the case then you could say that by intervening and proving the healthy food environment in schools we are going to save not only the children's health but also the nation from having unnecessary bills that are coming' Acad-1

Discussion

This study examined the feasibility of introducing nutrition policy options that address the double burden of malnutrition among adolescents in order to identify barriers and facilitators to such policy reforms. Of the two focus policies, healthy food provisioning in schools was

perceived as a feasible policy option while regulating marketing of unhealthy food to children was seen as not feasible. Based on the multiple streams theory, we categorized the barriers and facilitators into those related to the problem stream (Perception of the problem), policy stream (existing and proposed policy solutions) and politics stream (political and institutional contexts). The study indicated that the use of a life course approach in nutrition programming could facilitate policy reforms as the adolescence period is one of the critical invention points in a person's lifecycle. Availability of existing institutional infrastructure that could be leveraged to deliver adolescent focused policies was another key facilitator of policy reform. However, the lack of evidence on the burden and long-term impacts of adolescent nutrition problems was identified as a potential barrier. Although nutrition is a priority for the government of Zambia, food industry strong influence over governments policy agenda setting, economic ideologies and lack of public awareness to demand for better nutrition were perceived as key barriers to policy reforms.

Power and influence of policy actors are important in brokering nutrition policy reforms (Knaggård, 2015; Cullerton *et al.*, 2017). In this study, industry, NFNC and civil society working through the public were identified as the three main policy actors [potentially] influential in nutrition policy reforms in Zambia. Food manufacturers were perceived to have the most power to block more effective nutrition policies that they frame as 'unfavourable' for their business interests. Literature has numerous examples of tactics used by food industry steer the policy process in their favour (Dorfman *et al.*, 2012; Ronit and Jensen, 2014; M. Mialon, Swinburn and Sacks, 2015; Nixon *et al.*, 2015; Freudenberg, 2018). The government relies on public private partnerships to help finance programs in the social sectors including health (MoFND, 2022). For instance, a food manufacturer affiliated foundation provided 28-million-kwacha (approximately USD1.4m) to the Ministry of Health to support the fight against COVID-19 (Chanda, 2020). Such partnerships between a government and private sector entity

that produces health harming commodities are discouraged as they present an inherent conflict of interest on the side of the government which might weaken their ability to exercise their regulatory functions (Parker, Zaragoza and Hernández-Aguado, 2019). Similarly, health sector respondents in this study felt that the government receiving support from big players in the food manufacturing industry is a serious conflict of interest. Through such large donations and other corporate social responsibilities, the food industry in Zambia has bought their seat at the nutrition policy table making introduction and implementation of effective policy options like regulating of marketing very unlikely.

Information based policy solutions were perceived as very feasible for the Zambian context. This could be due to the fact that majority of respondents framed unhealthy dietary patterns to lack of knowledge especially in the adolescent age group. Choice of frames used for nutrition problems can influence policy reforms as it determines the support the problem receives from stakeholders and solutions proposed to address the problem, which determines whether these problems get prioritized on the policy agenda or not (Jenkin, Signal and Thomson, 2011). Globally, information-based nutrition policy interventions are popular owing to their relative ease of implementation and lack of contention from policy actors like food industry (Gorski and Roberto, 2015). Frames in nutrition health promotion messaging often alludes to individual responsibility for heathy eating (Orste *et al.*, 2021). The individual-centric framing can however be a barrier to policy reform as it perpetuates the ideas that nutrition-related problems are driven by poor lifestyle choices and/or should be addressed by the health sector negating the role of other determinants. Incorporating frames that include food environment drivers of nutrition problems in information-based interventions might be helpful for building public awareness, increasing demand for healthy food and/or fostering behaviour change. Public awareness campaigns coupled with strong advocacy by civil society can contribute to transforming the public into powerful actors who in some settings were instrumental in passing

of effective nutrition policies like sugar taxes (Lee, 2010; Buse et al., 2020). Currently, the weak advocacy and lack of public pressure remains on the barriers to more effective policies to address nutrition problem in Zambia.

This study shows that perceptions about free market systems strongly determined what policy solutions were perceived feasible for the Zambian context by respondents. Legislative policy options such as restricting marketing of unhealthy foods to children taxations of unhealthy commodities were perceived as not feasible and difficult to implement because respondents felt such policies might infringe upon the liberties of businesses in a free market system. This perspective inhibits policy reforms as it entrenches the alternative narrative that behavioural factors are the key drivers of nutrition problem and relegates the role of the government to that of educating the population. Neoliberal political ideologies have been shown to facilitate nutrition-related problem by scholars (Glasgow and Schrecker, 2016). The main pathways include providing a conducive environment for unhealthy food industry expansion (Lee and Crosbie, 2019; Lencucha and Thow, 2019) and limiting the policy space for governments to undertake its regulatory functions (Tienhaara, 2010; Kelsey, 2017).

The lack of prioritization of adolescents in nutrition policies was linked with lack of evidence on the burden and impact of nutrition problems in this age group. This indicates that respondents in this study might hold a simplistic view of policy reform as occurring in a rational system where availability of evidence is enough to result in policy reform (Walt, 1994). However, this might not be the case as previous research found that nutrition policy reforms in Zambia are strongly influenced by policy networks and advocacy coalitions. For instance, despite availability of evidence on the potential public impact of sugar tax on the Zambian population (Hangoma *et al.*, 2020), strong opposition from economic sector policy network was a barrier during agenda setting process and the evidence informed recommended rate was not adopted (Mukanu *et al.*, 2020). Harris (2019) also found that advocacy coalitions and health

sector policy networks helped facilitate the transfer of the global prioritization of stunting into Zambia's policy agenda.

Guided by the multiple streams theory, this study identified factors within the problem, policy and politics streams that can facilitate or impede nutrition policy reforms for addressing food environment drivers of the double burden of malnutrition in adolescents. Fostering nutrition policy reforms will require addressing the barriers in each stream so that once a window of opportunity opens, there will be higher chance of the streams coupling resulting in policy reform. It also calls for realignment of the existing ideology among policymakers that generating evidence on nutrition problems will be enough to bring about change as there are strong political factors at play that need to be accounted for. Key to overcoming the identified barriers and leveraging the opportunities identified in this study will be policy entrepreneurs and or advocacy coalitions. Policy entrepreneurs, 'the powerful political and social actors' (Béland and Katapally, 2018) will be required to help reframe the dominant narrative of nutrition problems and promote policy solutions that are suited for the economic and social context and that leverage the existing institutions in Zambia. In the past, political figures have contributed to public health policy reforms such as the banning of smoking in public places. However, influence and power of political champions is tied to their political office, and might not be sustained after change of political regimes as has been the case with anti-smoking campaign which is no longer enforced in Zambia. Therefore, advocacy coalitions – the collection of people from different institutions with similar beliefs and aspiration about a policy issue who work over time to influence policymakers to achieve their aspirations (Sabatier, 1988) – will be required for sustained support for development and implementation of policy reforms. Evidence shows the activities of the advocacy coalition for stunting within the nutrition policy subsystem in Zambia have over time contributed to the prioritization and implementation of intervention for reducing stunting (Harris, 2019).

A strength of the current study is the good representation of stakeholders from key sectors involved in nutrition policy making in Zambia. This means the findings reflect the different perspectives that are important in considering food environment policies in Zambia. The triangulation of documentary and interview data also provided a comprehensive understanding of the problem. One limitation of our findings is that the stakeholders interviewed provided perspectives based on their experiences and it is unclear how representative these perspectives are of the sectors that they represented.

Conclusion

Information-based as opposed to legislative policy options were perceived as more feasible for the Zambian context. The preference for 'softer' nutrition policy interventions like public campaigns by governments lies in the ease of implementation as they require relatively less capacity. Legislative policies however require additional mechanism for enforcing or monitoring compliance and are hotly contested by powerful policy actors like the food manufacturing industry. While legislative policies were deemed as not feasible, the identification of existing infrastructure that can be leveraged for enforcement of nutrition policy regulation is a bright spot as it implies recognition of intersectoral linkages in nutrition. The nutrition policy landscape requires policy entrepreneurs and advocacy coalitions that will broker policy reforms for addressing food environment drivers of the double burden of malnutrition by helping raise public support as well as re-engineer the framing of nutrition problems and their solutions in Zambia.

Abbreviations

NFNC – National Food and Nutrition Commission

References

Bach, A. *et al.* (2020) 'Multisectoral Integration of Nutrition, Health, and Agriculture: Implementation Lessons from Ethiopia', *Food and Nutrition Bulletin*, 41(2), pp. 275–292. Available at: https://doi.org/10.1177/0379572119895097.

Baker, P. *et al.* (2016) 'Trade and investment liberalization, food systems change and highly processed food consumption: a natural experiment contrasting the soft-drink markets of Peru and Bolivia', *Globalization and Health*, 12(1), p. 24. Available at: https://doi.org/10.1186/s12992-016-0161-0.

Balarajan, Y. and Reich, M.R. (2016) 'Political economy challenges in nutrition', *Globalization and Health*, 12(1), p. 70. Available at: https://doi.org/10.1186/s12992-016-0204-6.

Béland, D. and Katapally, T.R. (2018) 'Shaping policy change in population health: policy entrepreneurs, ideas, and institutions', *International Journal of health policy and management*, 7(5), p. 369.

Brambila-Macias, J. *et al.* (2011) 'Policy Interventions to Promote Healthy Eating: A Review of What Works, What Does Not, and What is Promising', *Food and Nutrition Bulletin*, 32(4), pp. 365–375. Available at: https://doi.org/10.1177/156482651103200408.

Braun, V. and Clarke, V. (2012) *Thematic analysis.* American Psychological Association.

Buse, K. (2008) 'Addressing the theoretical, practical and ethical challenges inherent in prospective health policy analysis', *Health Policy and Planning*, 23(5), pp. 351–360. Available at: https://doi.org/10.1093/heapol/czn026.

Buse, K., Mays, N. and Walt, G. (2012) *Making health policy*. McGraw-Hill education (UK).

Busse, H. *et al.* (2020) 'What Is the Role of Civil Society in Multisectoral Nutrition Governance Systems? A Multi-country Review', *Food and Nutrition Bulletin*, 41(2), pp. 244–260. Available at: https://doi.org/10.1177/0379572119877348.

Crichton, J. (2008) 'Changing fortunes: analysis of fluctuating policy space for family planning in Kenya', *Health Policy and Planning*, 23(5), pp. 339–350. Available at: https://doi.org/10.1093/heapol/czn020.

Cullerton, K. *et al.* (2017) 'Joining the dots: the role of brokers in nutrition policy in Australia', *BMC Public Health*, 17(1), p. 307. Available at: https://doi.org/10.1186/s12889-017-4217-8.

Dorfman, L. *et al.* (2012) 'Soda and Tobacco Industry Corporate Social Responsibility Campaigns: How Do They Compare?', *PLOS Medicine*, 9(6), p. e1001241. Available at: https://doi.org/10.1371/journal.pmed.1001241.

Fox, A., Law, J.R. and Baker, K. (2022) 'The case for metagovernance: The promises and pitfalls of multisectoral nutrition service delivery structures in low- and middle-income countries', *Public Administration and Development*, 42(2), pp. 128–141. Available at: https://doi.org/10.1002/pad.1974.

Freudenberg, N. (2018) 'Changing Food Industry Practices that contribute to diet-related chronic diseases', *CUNY, Urban food policy Institute* [Preprint].

Friel, S. and Jamieson, L. (2019) 'Political economy, trade relations and health inequalities: lessons from general health'.

Gittelsohn, J. and Lee, K. (2013) 'Integrating Educational, Environmental, and Behavioural Economic Strategies May Improve the Effectiveness of Obesity Interventions', *Applied*

Economic Perspectives and Policy, 35(1), pp. 52–68. Available at: https://doi.org/10.1093/aepp/pps044.

Glasgow, S. and Schrecker, T. (2016) 'The double burden of neoliberalism? Noncommunicable disease policies and the global political economy of risk', *Health & Place*, 39, pp. 204–211. Available at: https://doi.org/10.1016/j.healthplace.2016.04.003.

Grindle, M.S. and Thomas, J.W. (1991) *Public choices and policy change: the political economy of reform in developing countries*. Johns Hopkins Univ Pr.

GRZ (2019) 'Food and Nutrition Act'. Government of the Republic of Zambia. Available at: http://www.parliament.gov.zm/sites/default/files/documents/acts/The%20Food%20and%20Nutrition%20Act%20No.%203%20of%202020.pdf (Accessed: 6 May 2021).

Hangoma, P. *et al.* (2020) 'The potential health and revenue effects of a tax on sugar sweetened beverages in Zambia', *BMJ Global Health*, 5(4), p. e001968. Available at: https://doi.org/10.1136/bmjgh-2019-001968.

Harris, J. (2019) 'Advocacy coalitions and the transfer of nutrition policy to Zambia', *Health Policy and Planning*, 34(3), pp. 207–215. Available at: https://doi.org/10.1093/heapol/czz024.

Hawkes, C. *et al.* (2020) 'Double-duty actions: seizing programme and policy opportunities to address malnutrition in all its forms', *The Lancet*, 395(10218), pp. 142–155.

Jenkin, G.L., Signal, L. and Thomson, G. (2011) 'Framing obesity: the framing contest between industry and public health at the New Zealand inquiry into obesity', *Obesity Reviews*, 12(12), pp. 1022–1030. Available at: https://doi.org/10.1111/j.1467-789X.2011.00918.x.

Kelsey, J. (2017) 'Regulatory Chill: Learnings from New Zealand's Plain Packaging Tobacco Law', *QUT Law Review*, 17, p. 21.

Kickbusch, I., Allen, L. and Franz, C. (2016) 'The commercial determinants of health', *The Lancet Global Health*, 4(12), pp. e895–e896. Available at: https://doi.org/10.1016/S2214-109X(16)30217-0.

Lee, K. (2010) 'Civil Society Organisations and the Functions of Global Health Governance: What Role within Intergovernmental Organisations?', *Global health governance: the scholarly journal for the new health security paradigm*, 3(2), p. http://blogs.shu.edu/ghg/files/2011/11/Lee_Civil-Society-Organisations-and-the-Functions-of-Global-Health-Governance_Spring-2010.pdf.

Lee, K. and Crosbie, E. (2019) 'Understanding Structure and Agency as Commercial Determinants of Health Comment on "How Neoliberalism Is Shaping the Supply of Unhealthy Commodities and What This Means for NCD Prevention"', *International Journal of Health Policy and Management*, p. 1. Available at: https://doi.org/10.15171/ijhpm.2019.127.

Lencucha, R. *et al.* (2018) 'Fostering the Catalyst Role of Government in Advancing Healthy Food Environments', *International Journal of Health Policy and Management*, 7(6), pp. 485–490. Available at: https://doi.org/10.15171/ijhpm.2018.10.

Lencucha, R. and Thow, A.M. (2019) 'How Neoliberalism Is Shaping the Supply of Unhealthy Commodities and What This Means for NCD Prevention', *International Journal of Health Policy and Management*, 8(9), pp. 514–520. Available at: https://doi.org/10.15171/ijhpm.2019.56.

McIntyre, L. (2020) ‘Framing analysis: its usefulness as a tool for advocacy on public health nutrition problems’, *Public Health Nutrition*, 23(11), pp. 2053–2055. Available at: https://doi.org/10.1017/S1368980020000373.

Mialon, M. (2020) ‘An overview of the commercial determinants of health’, *Globalization and Health*, 16. Available at: https://doi.org/10.1186/s12992-020-00607-x.

Mialon, Melissa, Swinburn, B. and Sacks, G. (2015) ‘A proposed approach to systematically identify and monitor the corporate political activity of the food industry with respect to public health using publicly available information’, *Obesity reviews*, 16(7), pp. 519–530.

Mialon, M., Swinburn, B. and Sacks, G. (2015) ‘A proposed approach to systematically identify and monitor the corporate political activity of the food industry with respect to public health using publicly available information’, *Obesity Reviews*, 16(7), pp. 519–530. Available at: https://doi.org/10.1111/obr.12289.

Mukanu, M.M. *et al.* (2020) ‘Nutrition related non-communicable diseases and sugar sweetened beverage policies: a landscape analysis in Zambia’, *Global Health Action*, 14(SI1), p. 1872172. Available at: https://doi.org/10.1080/16549716.2021.1872172.

Nixon, L. *et al.* (2015) ‘“We’re Part of the Solution”: Evolution of the Food and Beverage Industry’s Framing of Obesity Concerns Between 2000 and 2012’, *American Journal of Public Health*, 105(11), pp. 2228–2236. Available at: https://doi.org/10.2105/AJPH.2015.302819.

Orste, L. *et al.* (2021) ‘Individual responsibilities, collective issues: The framing of dietary practices in Latvian media’, *Appetite*, 164, p. 105219. Available at: https://doi.org/10.1016/j.appet.2021.105219.

Pingali, P. and Sunder, N. (2017) 'Transitioning toward nutrition-sensitive food systems in developing countries', *Annual Review of Resource Economics*, 9, pp. 439–459.

Popkin, B.M., Corvalan, C. and Grummer-Strawn, L.M. (2019) 'Dynamics of the double burden of malnutrition and the changing nutrition reality', *The Lancet*, 0(0). Available at: https://doi.org/10.1016/S0140-6736(19)32497-3.

Randolph, W. and Viswanath, K. (2004) 'Lessons Learned from Public Health Mass Media Campaigns: Marketing Health in a Crowded Media World', *Annual Review of Public Health*, 25(1), pp. 419–437. Available at: https://doi.org/10.1146/annurev.publhealth.25.101802.123046.

Ronit, K. and Jensen, J.D. (2014) 'Obesity and industry self-regulation of food and beverage marketing: a literature review', *European journal of clinical nutrition*, 68(7), pp. 753–759.

Schram, A. *et al.* (2015) 'The role of trade and investment liberalization in the sugar-sweetened carbonated beverages market: a natural experiment contrasting Vietnam and the Philippines', *Globalization and Health*, 11(1), p. 41. Available at: https://doi.org/10.1186/s12992-015-0127-7.

Shearer, J.C. *et al.* (2016) 'Why do policies change? Institutions, interests, ideas and networks in three cases of policy reform', *Health Policy and Planning*, 31(9), pp. 1200–1211. Available at: https://doi.org/10.1093/heapol/czw052.

Shiffman, J. (2007) 'Generating Political Priority for Maternal Mortality Reduction in 5 Developing Countries', *American Journal of Public Health*, 97(5), pp. 796–803. Available at: https://doi.org/10.2105/AJPH.2006.095455.

Shiffman, J. (2009) ‘A social explanation for the rise and fall of global health issues’, *Bulletin of the World Health Organisation*, 87(8), pp. 608–613. Available at: https://doi.org/10.2471/blt.08.060749.

Swinburn, B.A. *et al.* (2019) ‘The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission report’, *The Lancet*, 393(10173), pp. 791–846. Available at: https://doi.org/10.1016/S0140-6736(18)32822-8.

Thow, A.M. *et al.* (2016) ‘Toward food policy for the dual burden of malnutrition: an exploratory policy space analysis in India’, *Food and nutrition bulletin*, 37(3), pp. 261–274.

Tienhaara, K. (2010) *Regulatory Chill and the Threat of Arbitration: A View from Political Science*. SSRN Scholarly Paper ID 2065706. Rochester, NY: Social Science Research Network. Available at: https://papers.ssrn.com/abstract=2065706 (Accessed: 4 January 2021).

Van Hulst, M. and Yanow, D. (2016) ‘From policy “frames” to “framing” theorizing a more dynamic, political approach’, *The American review of public administration*, 46(1), pp. 92–112.

Walt, G. (1994) ‘How far does research influence policy?’, *European Journal of Public Health*, 4(4), pp. 233–235. Available at: https://doi.org/10.1093/eurpub/4.4.233.

Walt, G. *et al.* (2008) ‘‘Doing ‘health policy analysis: methodological and conceptual reflections and challenges’, *Health policy and planning*, 23(5), pp. 308–317.

WHO (2017) ‘Tackling NCDs: “best buys” and other recommended interventions for the prevention and control of noncommunicable diseases. World Health Organisation.

Data availability statement

The data underlying this article will be shared on reasonable request to the corresponding author.

CHAPTER 8: DISCUSSION, RECOMMENDATIONS AND CONCLUSIONS

8.1 Introduction

This chapter discusses the overall findings from my research and implications for policy and future research. Section 8.2 summarizes the results and how they contribute to addressing the study objective. In Section 8.3, I present the key learnings about nutrition policy reforms for DBM that I synthesized from the overall thesis findings and discuss them in relation to the broader body of evidence. In section 8.4, I provide recommendations for nutrition policy reforms for DBM in Zambia, drawing on Kingdon's multiple streams framework and highlighting future research areas. In section 8.5, I discuss the strengths and limitations of this thesis, and finally, in section 8.6, I provide a conclusion.

8.2 Summary of findings

This thesis aimed to analyze and prospectively explore opportunities for strengthening policies to better address the food environment drivers of the DBM, especially for the adolescent age group in Zambia. This thesis used an explanatory sequential mixed method approach (Ivankova, Creswell and Stick, 2006) to conduct an evidence-based prospective policy analysis of the opportunity for policy reforms for DBM in Zambia. With this approach, I used the findings from one phase of the study to inform the design of the next phase. In the first phase, I aimed to generate evidence on existing dietary patterns and their determinants. The second phase built on the findings from phase one by first assessing the availability of food environment policies and then prospectively exploring the opportunity for nutrition policy reforms to address the food environment factors of DBM in Zambia. I applied Kingdon's multiple streams framework to integrate the overall research findings and develop recommendations on what is required for achieving nutrition policy reforms for DBM in Zambia.

The key findings from the different studies that made up this thesis are summarized in Table 5. Overall, this thesis has generated new knowledge on the DBM and the dynamics of nutrition policy reforms for addressing the DBM in Zambia, which can be applied to other settings. Through the assessment of the dietary patterns of adolescents (Objective 2) and observations of the school food environment (Objective 3), I established that school food environments are unhealthy and contribute to poor dietary choices identified among adolescents (Objective 4). These findings guided the policy document analysis as I assessed the availability of policy interventions that address food environment drivers of DBM in Zambia (Objective 5). I established that the current nutrition policy landscape does not adequately address the food environment drivers of the DBM as recommended legislative policy measures like regulating the marketing of unhealthy food to children were absent. Through the in-depth interviews with nutrition stakeholders, I explored the opportunities for strengthening the nutrition policy landscape so that food environment drivers of DBM – which my thesis had demonstrated were present – could be adequately addressed (Objective 6). This thesis established that stakeholders agreed with findings from the first phase of the research that showed that school food environments are unhealthy and contribute to poor dietary choices identified among adolescents. However, I established that nutrition stakeholders preferred information-based policy interventions for addressing the DBM and perceived legislative policy measures as unfeasible for Zambia.

Table 5: Key findings from thesis

Key findings	Data sources				
	Literature review	Adolescents nutrition assessment and FGD	School food environment observation	Policy document analysis	Policy stakeholders' interviews
Diets do not meet nutritional needs	X				X
DBM is present in Zambia and is a public health issue	X			X	X
There is limited data on the burden of DBM in adolescents	X			X	X
Snacking dietary pattern is common among school going adolescents	X	X			X
School food environments are unhealthy		X	X		X
School food environment factors like wide availability of unhealthy food influence dietary patterns of adolescents		X			X
Nutrition policies do not adequately address food environment drivers of DBM as legislative options are lacking				X	X
Adolescents not prioritized in nutrition related data and programming	X			X	X
Information policy interventions are most feasible to address nutrition				X	X
Legislative policy measures not feasible for Zambia					X

Food manufacturing industry is a powerful actor	X			X	X

8.3 Lessons on nutrition policy reforms for DBM in Zambia

Integrating the key finding from the four studies conducted in this research (see Table 2) yielded four main learnings about nutrition policy reforms from addressing the DBM in Zambia. Firstly, policy reforms are required to manage the food environment drivers of the DBM effectively. Secondly, legislative policy measures are perceived as unfeasible in the Zambian context. Thirdly, barriers relating to the power and influence of stakeholders and limited evidence of the burden of DBM in adolescents will challenge the introduction of policy reforms. Fourthly, strong advocacy is required to facilitate policy reforms. In the following sections, I draw on the body of literature and discuss the implication of these learnings for Zambia and other LMICs.

Learning 1: Policy reforms are required to effectively address the food environment drivers of the double burden of malnutrition

Findings from this research demonstrate that food environments influence the diets of adolescents. For instance, we found that the food environments around schools are unhealthy, influencing adolescent dietary patterns. We also found that the adolescents were exposed to food and beverage advertisements through various media platforms like TV, radio, print, and the internet, influencing their dietary choices. Other studies in Zambia have found that modern supermarkets have contributed to the increased consumption of processed foods (Khonje, Ecker and Qaim, 2020). In addition, nutritious food is generally more expensive, which limits accessibility as nearly two-thirds of the Zambian population is classified as poor (Central Statistical Office, 2016). This research also found entrenched beliefs about the cause of

nutrition problems. The framing that 'modern' nutrition problems are due to poor behavioural choices resulting from the lack of knowledge was shared among nutrition stakeholders and in policy documents.

In light of these findings, policy reforms that address the food environment drivers of the DBM on Zambia's agenda are required. Policy reforms are needed to shift perceptions about the cause of nutrition problems to open the door for other policy measures like legislative levers. Framings of policy issues are usually developed/adopted to support a particular interest of policy actors. The choice of the frame may also reflect existing policy legacies. Nutrition traditionally has been under the health sector, which provides health-promotive and curative interventions at the individual level. However, this individual-focused framing of nutrition problems precludes the type of policy solutions that policymakers might need. For example, we found a gap in the policies addressing the DBM as legislative policy measures that can effectively address food environment drivers were lacking.

The food environment drivers that influence the desirability, affordability and accessibility of unhealthy food, especially by vulnerable population groups like adolescents, cannot be adequately addressed with the existing nutrition policies that address undernutrition and stunting. Children and adolescents continue to be the target of marketing activities by the food industry across the globe and in Zambia (Ustjanauskas, Harris and Schwartz, 2014; Potvin Kent *et al.*, 2019; Sacks and Looi, 2020) and thus need to be protected. While changing dietary patterns are a recognized consequence of globalization and global advancement, measures should be implemented to slow the nutrition transition and its implications by making targeted investments in protecting population health.

Learning 2: Legislative policy levers are perceived as not feasible for the Zambian context

Stakeholders interviewed in this research acknowledged the role of environmental factors in influencing dietary choices. For instance, respondents unanimously agreed that school environments were unhealthy, contributing to unhealthy dietary patterns and obesity in adolescents. Despite this, stakeholders perceived legislative policy options as not feasible for addressing the problem of unhealthy food environments.

Policy interventions aimed at addressing the food environment drivers of the DBM mainly fall into two categories: information-based policies that support informed dietary choices and regulatory or legislative policies aimed at changing the market environment (Brambila-Macias *et al.*, 2011).

Legislative policies like taxation of sugar-sweetened beverages or restriction on the marketing of unhealthy food and beverages to children work by limiting the availability, affordability and accessibility of unhealthy food, especially to vulnerable populations like adolescents. Sugar taxes have reduced consumption of sugar-sweetened drinks in countries like Mexico, the UK and South Africa (Colchero *et al.*, 2016; Essman *et al.*, 2021; Pell *et al.*, 2021). Similarly, restricting the marketing of unhealthy food on TV channels popular with children significantly reduced food adverts (Correa *et al.*, 2020). Despite the public health benefits, developing and implementing legislative policy levers is difficult, especially in LMICs (Bridge, Lomazzi and Bedi, 2020). Firstly, these policies face opposition from policy actors, especially the 'big food' (Brownell and Warner, 2009; Miller and Harkins, 2010; Williams, 2015; Capewell and Lloyd-Williams, 2018). The food industry uses several tactics to oppose legislative policy levers. For instance, they lobby governments for more favourable measures, discredit research findings and sponsor their research, use corporate social responsibility and propose self-regulation (Sharma, Teret and Brownell, 2010; K. Ronit and Jensen, 2014; Mialon, Swinburn and Sacks, 2015; Kickbusch, Allen and Franz, 2016). Secondly, effective policy action on nutrition requires strong multisectoral coordination to establish the infrastructure needed to enforce and

monitor compliance. Most LMICs struggle with governance and coordination of nutrition programs (Drimie *et al.*, 2014; Michaud-Létourneau and Pelletier, 2017; Fox, Law and Baker, 2022). In Zambia, the health sector oversees nutrition programmes. However, our findings show that enforcement of regulatory policies is under other government sectors, like local government, which are not adequately resourced. Furthermore, the cost of implementing proposed solutions and monitoring compliance was also cited as a concern to governments (Kersh and Morone, 2002; Shill *et al.*, 2012; Crammond *et al.*, 2013).

Information-based policies include public information campaigns (e.g., to promote fruit and vegetable consumption and reduce salt intake), school-based nutrition education, nutritional labeling and nutritional information on menus (Brambila-Macias *et al.*, 2011). Among these, stakeholders perceived informational campaigns and school-based nutrition education as the solution in this research. The government is currently running the Eat Well campaign to primarily encourage healthy eating, especially of local foods and raise awareness about NCDs in the general population. Stakeholders felt this approach is what is required as they associated unhealthy dietary choices with a lack of information about nutrition and the consequences of poor diets. Stakeholders' preference for information-based policy interventions has been linked to their relative ease of implementation as opposed to legislative levers (Brambila-Macias *et al.*, 2011). However, these options are only sometimes effective for nutrition-related behaviour change. A study from Zambia found that exposure to the nutritional education programme did not meaningfully change adolescent outcomes (Hewett *et al.*, 2021). This study found that adolescents who received the nutrition education programme were less likely to identify healthy foods correctly and proper infant-feeding practices or less likely to be stunted, underweight and anaemic than adolescents not in the program (Hewett *et al.*, 2021). Such findings indicate that information-based interventions might not be enough to foster nutrition

behaviour change and that legislative options are still required, though perceived as not feasible.

Learning 3: While policy reforms are required, there are barriers that will challenge their introduction

The main perceived barriers to nutrition policy reforms identified in this study included influence from powerful policy actors, lack of evidence on the extent of the problem in adolescents and the neoliberal economic system.

The interests and power of policy actors influence nutrition policy in Zambia, like in other countries. Policy actors are participants (including individuals, institutions and organizations) that impact on or are impacted by policy processes and their outcomes (Buse, Mays and Walt, 2012). Policy actors influence the policy process by steering it in line with their interests. Policy actors can attempt to influence policy directly, advocating for introducing preferred policies. Indirectly, policy actors may affect the policy process by choice of frames they adopt to understand and communicate a policy 'problem' (policy narratives), influencing the solutions they are likely to support (Koduah, Agyepong and van Dijk, 2016).

Stakeholders in this study identified the food industry as a policy actor with high power and interest that could challenge the introduction of policy reforms addressing food environment drivers of the DBM. Stakeholders perceived that the food industry would oppose strict regulations such as legislative policy levers as they go against their profit-driven interests and could interfere with market-driven economies, similar to what has been documented elsewhere (Shill *et al.*, 2012).

Some stakeholders interviewed in this study proposed working with the food industry to develop policy solutions to address the food environment drivers of the DBM. However, the

WHO strongly recommends against including industries of harmful commodities like alcohol, tobacco and unhealthy food in the policy process as it introduces a conflict of interest. In addition, literature shows that industry-led approaches like self-regulatory mechanisms work only to protect self-interests as there are no mechanisms to monitor compliance and no real consequences for lack of compliance; hence these mechanisms are ineffective for behaviour change (Hebden *et al.*, 2011; K. Ronit and Jensen, 2014; Erzse, Christofides, *et al.*, 2021).

A further challenge in LMICs like Zambia is the manufacturing industry's power linked to their role in job creation and economic growth. The prioritizing of economic prosperity as a key barrier to policy change has been highlighted in the literature (Kersh and Morone, 2002; Tillotson, 2004; Vogel, Burt and Church, 2010; Allender *et al.*, 2012; Ceccarelli, 2012; Shill *et al.*, 2012; Crammond *et al.*, 2013). Political parties that form governments often promise job creation and poverty alleviation, which is hoped to be achieved through the manufacturing industry, and there is pressure to deliver on these. For instance, as of 2021, the manufacturing industry contributed 7.6 percent to Zambia's GDP, of which the food and beverage sub-sector accounted for 32.5 percent (Ministry of Finance and National Development, 2021). The growth of the food and beverage subsector, which currently makes up 65 percent of the local manufacturing industry, has been prioritized as a key driver of economic growth and job creation as part of the post-COVID recovery in Zambia (Ministry of Commerce, Trade and Industry, 2018; Ministry of Finance and National Development, 2021; PMRC, 2021). Under the guise of corporate social responsibility, the food industry further supports the social sector, including education and health, through infrastructure development and emergency responses e.g. COVID-19 (Chanda, 2020). The government's dependence on the private sector for financing government programs under the guise of public-private partnerships weakens the government's regulatory power over the industry as it results in a conflict of interest.

This study found that stakeholders perceived evidence as instrumental for agenda-setting and policy change in contexts of competing challenges and limited resources. Consequently, the lack of prioritization of the adolescent age group on the nutrition policy agenda was directly linked to a lack of evidence on the burden and impact of nutrition problems in this age group. Consistent population-level data characterizing the food environment in terms of consumption of unhealthy food and related health outcomes like obesity is lacking. The Demographic and Health Survey has consistently collected data on stunting in children under five at 5-year intervals since 1991. However, the body mass index for women of reproductive age has not been consistently collected in the previous surveys, including the latest DHS from 2018. The most recent surveys include the NCD risk factor survey (Mutale and Chilengi, 2018) and the food consumption and micronutrient survey, whose results are yet to be published. Among the adolescent age group, the last population-representative nutrition-related survey was the Global School Health Survey conducted in 2004. The paucity of data on the consumption of unhealthy food, including sugar-sweetened beverages, in Zambia, is similar to other countries in Sub-Saharan Africa (Erzse, Abdool Karim, *et al.*, 2021). Erzse et al. (2021) found that no national surveys collect data on intake and household expenditure on sugar-sweetened beverages or revenue from value-added tax from the sales of these products in Zambia. In addition, no study has evaluated the 3 percent value-added tax introduced on sugar-sweetened beverages in 2018. This lack of data might hinder advocacy efforts as there is no reference, and this might imply that nutrition problems are being underestimated.

Learning 4: Stronger advocacy is required to facilitate nutrition policy reforms

Stakeholders in this study felt that introducing policy levers that address food environment drivers of the DBM would require strong advocacy from influential policy actors. Stakeholders

perceived the current level of advocacy as inadequate partly due to the lack of high-level political champions to push for the agenda.

Advocacy by policy actors is essential in the policy process, as noted by several policy process theories (Kingdon, 1984; Sabatier, 1988; Baumgartner and Jones, 2010). The process of reforming policies takes time and requires ongoing advocacy efforts through engagement, discussion, argument, and negotiation by the policy elites. Policy advocates broker their ideas of policy solutions among influential networks and opinion leaders to convince policymakers to take ownership of these policy solutions and subsequently act upon them. This process usually requires building momentum and support behind the proposed policy idea or recommendation.

Based on Kingdon's Multiple Streams Theory (Kingdon, 1984), getting policy options on the government's agenda requires the catalytic work of policy entrepreneurs. Kingdon describes policy entrepreneurs as individuals or organizations that can be "in or out of government, in elected or appointed positions, in interest groups or research organizations willing to invest their resources – time, energy, reputation, and sometimes money – in the hope of a future return. Policy entrepreneurs disrupt status quo policy arrangements and attempt to transform policy ideas into innovations (Kingdon, 1984). The work of policy entrepreneurs is critical for defining the different streams and for coupling of the streams. Regarding nutrition policy reforms in Zambia, policy entrepreneurs can help foster the adoption of alternative framing of nutrition problems from the current individual-based focus to one which accounts for the social, economic, and structural determinants. This new framing can then help support the negotiation for legislative policy solutions tailored to address the food environment drivers of the DBM. In addition, the policy entrepreneur can help change the mindsets of policy actors on the feasibility of legislative change by brokering policy options that show how such policy measures can be innovatively implemented within the existing structures in Zambia.

Advocacy by policy actors such as political champions, policy networks/advocacy coalitions, policy entrepreneurs, civil society organizations, academic institutions or the general public has contributed to securing political and public support for the passage of contentious policies like the sugar-sweetened beverage tax. For instance, the Priority Cost-Effective Lessons for System Strengthening South Africa (PRICELESS), a research-to-policy unit at the University of the Witwatersrand, played a critical role in advocating for the introduction of sugar-sweetened beverage tax in South Africa (Cullinan *et al.*, 2020). PRICELESS engaged in evidence generation (Cabrera Escobar *et al.*, 2013; Manyema *et al.*, 2014; Tugendhaft *et al.*, 2016), media campaigns and lobbying of government policymakers (Cullinan *et al.*, 2020). Similarly, the ACT Health Promotion, a non-profit organization in Brazil, has actively advocated for public health policy promotion through networking and media mobilization. The ACT Health Promotion and members of the Alliance for Adequate and Healthy Food have been pressuring members of Congress to approve a ban on soft drink sales and promotion in Brazilian schools through lobbying and public mobilization activities. These efforts have garnered public support, with 86 percent supporting the prohibition of unhealthy product sales in schools.

Stakeholders in this research perceived civil society organizations (CSOs) as potential advocates for nutrition policy reforms, and their role was mainly tied to raising public support and motivating political will. Both public support and political will are essential factors in nutrition policy change (Cullerton *et al.*, 2016; Bosire *et al.*, 2020; Busse *et al.*, 2020). Civil society has a unique role in creating demand and building consciousness towards the importance of nutrition at all levels and among all key stakeholders in nutrition development. For instance, Brazil's Alliance of Adequate and Healthy Food (https://alimentacaosaudavel.org.br/) has been running media campaigns that provide information on the negative impacts of high sugar consumption and encourage the public to

sign petitions for government to act (https://doceveneno.org.br/). Similarly, CSOs in Zambia can contribute to policy reforms through public information campaigns to inform people of the negative implications of poor diets and persuade the demand for government-led policies to promote healthy diets. CSO can also help maintain momentum by tracking the actualization of government commitments. Moreover, the CSOs can tap into funding from philanthropic foundations that increasingly support research and advocacy work for food environments and NCDs in LMICs (Jailobaeva *et al.*, 2021).

The capacity and impact of advocacy are strengthened when different actors come together and form coalitions, especially in the context of fragmentation and competing interests between and within various groups of stakeholders (Gillespie et al. 2013). According to Sabatier's advocacy coalition framework (Sabatier, 1988), 'policy actors form advocacy coalitions with actors within a policy subsystem who share their beliefs, and often compete with other coalitions'. Advocacy coalitions leverage different actors' political and technical expertise with a common agenda to push for change, creating effective political demand for policy change. In Zambia, evidence shows that the food and nutrition policy subsystem has two main advocacy coalitions whose ideas, beliefs and resources shape government policies and investments to address malnutrition. On the one hand, the nutrition advocacy coalition consisting mainly of health-oriented organizations like the Ministry of Health, NFNC, Civil Society Scaling Up Nutrition (CSO-SUN) Alliance, and UN agencies like the World Food Program and FAO have a focus on multisectoral approaches to addressing stunting (Harris, 2019). On the other hand, the food security coalition, which mainly consists of government decision-making organs, focuses on agriculture-oriented policies aimed at increasing staple food production. This nutrition advocacy coalition, which already focuses on multisectoral approaches to addressing stunting, provides an entry point for advocating for prioritizing food environment drivers onto the policy agenda.

8.4 Recommendations for nutrition policy reforms for addressing DBM in Zambia

Kingdon's multiple streams theory (Kingdon, 1984) provides a valuable lens to develop a thesis on the possibility of policy reforms for DBM in Zambia. This theory explains that policy change occurs when there is a coupling of three parallel but independent streams of problem, policy and politics, facilitated by opening a window of opportunity. Each of the three streams includes a specific dynamic intended to raise attention towards a policy issue so that it is prioritized on the political agenda and triggers policy development or change. This thesis has established that despite the evidence showing the need for policy reforms, getting legislative measures that address the DBM on the nutrition policy agenda in Zambia will require work to address the barriers and or leverage opportunities under each stream.

The problem stream of the multiple stream's framework consists of how stakeholders understand policy problems. This thesis established that overnutrition and NCDs were predominantly framed as arising from lifestyle-related causes in policy documents. The alternative framing that considers food environments as drivers of poor nutrition still emerges among stakeholders. However, credible evidence demonstrating the effects and impact of food environments on nutritional outcomes is limited, a barrier to garnering support and advocating for this framing. Going forward, evidence will be required to support and catalyze the process of nutrition policy reforms for DBM. New evidence should be generated to demonstrate the link between the quality of food environments, food choices and nutritional outcomes. Similar to the work conducted by PRICELESS (Cullinan *et al.*, 2020), academia and other research institutes in Zambia can contribute to evidence generation by conducting studies that model legislative policies' health and economic impacts compared to the status quo. Using such evidence, advocates can frame nutrition problems as impacting the whole of society and not only individuals.

The policy stream of the multiple streams theory considers the solutions to policy problems proposed by policy actors. This thesis established that stakeholders identified information policy interventions as the solution for addressing the DBM while legislative policy measure like regulating the marketing of unhealthy food to children was perceived as not feasible. The preference for information-based policy measures like public campaigns can be linked to the fact that most stakeholders linked poor nutrition to poor lifestyle choices driven by a lack of knowledge. The perception by stakeholders that legislative policy measures are not feasible was linked to the limited capacity within government institutions required to implement such policies. Therefore, the government needs to strengthen the coordination of nutrition to support the introduction of regulatory and legislative policy measures that require a multisector approach, including sectors outside health for implementation and enforcement.

The politics stream of the multiple streams framework considers the contextual factors, including the interests and influence of different policy actors. This thesis established that the food industry, supported by the existing neoliberal economic system, has the power and interest to challenge the introduction of legislative policy measures for the DBM. Going forward, there will be a need for strong and sustained advocacy efforts that will raise public awareness and pressure the government to act. Civil society can spearhead advocacy efforts for more robust nutrition policies by creating coalitions and networks to lobby the government. Civil society will need to implement campaigns on various media platforms where the public can be educated on food environment-related drivers of malnutrition, similar to what has been done in other countries (Busse *et al.*, 2020)

Addressing the barriers in each stream will not automatically result in legislative policy measures being included on the policy agenda, as the policy process is rarely straightforward. Zambia requires policy entrepreneurs to catalyze the policy reform process by engaging in advocacy and tactfully negotiating the food environment framing of DBM. Policy

entrepreneurs can work towards leveraging possible windows of opportunities, including the upcoming revision of the flagship nutrition program as the MCDP II expires at the end of 2022.

8.5 Strengths and limitations

A multi-component approach involving an explanatory sequential mixed method design and a prospective policy analysis was required to understand a complex problem and provide tailored, context-specific solutions. The mixed-method design helped generate evidence to guide the prospective policy analysis.

A key strength of this thesis is that well-recognized methods and theories informed the design. The conceptualizing of food environments was informed by a conceptual framework that has been used for food environment studies in other LMICs (Turner *et al.*, 2018). The prospective policy analysis was grounded in Kingdon's Multiple Streams Theory which has been used to inform the process of exploring nutrition policy reforms by focusing on the dynamics in the problem, policy and politics streams (Kumar, Gleeson and Barraclough, 2018; Edalati *et al.*, 2020; Sainsbury *et al.*, 2020). Theory-guided research provides a well-defined basis for answering research questions and links research with the body of literature on a particular topic.

The variety of data sources and methods used to draw conclusions also added to the strength of the thesis. The literature review allowed for a scoping of available literature on dietary patterns in the Zambian population. The use of PCA with FFQ data is reliable and widely used to study the dietary patterns of a specific population (Ali, Margetts and Zainuddin, 2020; Adeomi, Fatusi and Klipstein-Grobusch, 2022). Both the adolescent dietary assessment and stakeholder interviews had a good sample size, contributing to the findings' credibility and reliability. A good representation of stakeholders participated in the in-depth and consultative workshop, which ensured diversity in the perspectives on policy reforms for food environments. The multiple data sources allowed for triangulation, increasing the findings'

validity. For instance, assessing adolescent dietary patterns using quantitative and qualitative measures allowed for triangulation and an in-depth understanding of the determinants of identified patterns. The adolescent's perspectives of their food environments were triangulated from the FGDs with observations of the school food environment, strengthening the trustworthiness of our findings on the food environment factors influencing adolescents' food choices. Similarly, triangulation of documentary data from the policy documents and interview data from stakeholders allowed for corroboration of finding on how nutrition problems are problematized.

Despite the strengths mentioned above, the methods used in this study have limitations. The data from the FFQ might have been inaccurate due to recall bias and social acceptability bias from the respondents (Althubaiti, 2016). The approach of using PCA to generate dietary patterns does not provide information on the actual quantities of food consumed and, therefore, can't be used to measure the nutrition status of the respondents (Hearty and Gibney, 2009). The policy document analysis provided historical data as the policy documents are static and do not capture changes in government policy positions that could have occurred since the documents were published. The stakeholders interviewed provided perspectives based on their experiences, and it needs to be clarified how representative these perspectives are of the sectors they represented. Although this research established an association between unhealthy food environments and unhealthy dietary patterns in school-going adolescents, it should be noted that this does not imply a causal link. The scope of the current study did not include a collection of data on other mediating factors that are assumed to mediate food environments and unhealthy dietary patterns.

While the findings of this thesis should be interpreted with the above limitations in mind, the methods for exploring the policy reforms for the DBM can be generalized to LMIC contexts similar to Zambia.

8.6 Conclusions

Unhealthy dietary patterns like snacking and inadequate intake of diverse nutrient-rich foods are present in the Zambian population. Food environment factors influence the unhealthy dietary patterns in adolescents in and around schools, indiscriminate marketing and more affordability of unhealthy foods. These food environment factors are best addressed with regulatory or legislative policy measures like taxation of unhealthy foods, restrictions on marketing of unhealthy food and beverages to children, food provisioning and zoning laws that limit the spatial distribution of unhealthy food vendors in the school environment. Despite having some information on social protection and agriculture-based policy provisions that foster healthy food environments, the lack of recommended regulatory and legislative policies is a key policy gap that needs to be addressed if the country is to manage the DBM effectively.

The introduction of legislative policy measures that foster healthy food environments will require investing in building a solid evidence base on the burden and impact of poor nutrition and sustained advocacy, which policy entrepreneurs or advocacy coalitions can do. There is a need to also invest in addressing the strong perception of policy actors that legislative policy reforms are not feasible. The government needs to address the perceived challenges related to the introduction of legislative policy measures, such as the need for additional mechanisms for enforcing or monitoring compliance or opposition from powerful policy actors like the food manufacturing industry. Therefore, a phased approach to policy reforms, in which the public and policymakers, through education and advocacy campaigns, are first informed about the role of food environment factors in nutrition and then guided towards the introduction of legislative measures by the government.

References

Abrahams, Z., Mchiza, Z. and Steyn, N.P. (2011) 'Diet and mortality rates in Sub-Saharan Africa: Stages in the nutrition transition', *BMC Public Health*, 11(1), p. 801. Available at: https://doi.org/10.1186/1471-2458-11-801.

Adeomi, A.A., Fatusi, A. and Klipstein-Grobusch, K. (2022) 'Food Security, Dietary Diversity, Dietary Patterns and the Double Burden of Malnutrition among School-Aged Children and Adolescents in Two Nigerian States', *Nutrients*, 14(4), p. 789. Available at: https://doi.org/10.3390/nu14040789.

Airhihenbuwa, C.O., Ford, C.L. and Iwelunmor, J.I. (2014) 'Why culture matters in health interventions: lessons from HIV/AIDS stigma and NCDs', *Health Education & Behavior*, 41(1), pp. 78–84.

Alamu, E.O. *et al.* (2018) 'Nutrient and aflatoxin contents of traditional complementary foods consumed by children of 6-24 months', *Food Science & Nutrition*, 6(4), pp. 834–842. Available at: https://doi.org/10.1002/fsn3.621.

Alamu, E.O. *et al.* (2019) 'Assessment of Dietary Diversity of Mothers and Children of 6–24 Months from Eastern and Southern Provinces of Zambia', *Journal of Nutrition and Metabolism*, 2019, p. e1049820. Available at: https://doi.org/10.1155/2019/1049820.

Ali, A., Margetts, B.M. and Zainuddin, A.A. (2020) 'Exploration of the Principal Component Analysis (PCA) Approach in Synthesizing the Diet Quality of the Malaysian Population', *Nutrients*, 13(1), p. 70. Available at: https://doi.org/10.3390/nu13010070.

Allender, S. *et al.* (2012) 'Policy change to create supportive environments for physical activity and healthy eating: which options are the most realistic for local government?', *Health promotion international*, 27(2), pp. 261–274.

Alruwaily, A. *et al.* (2020) 'Child social media influencers and unhealthy food product placement', *Pediatrics*, 146(5).

Althubaiti, A. (2016) 'Information bias in health research: definition, pitfalls, and adjustment methods', *Journal of Multidisciplinary Healthcare*, 9, pp. 211–217. Available at: https://doi.org/10.2147/JMDH.S104807.

Anderson, A.S., Macintyre, S. and West, P. (1993) 'Adolescent meal patterns: grazing habits in the west of Scotland.', *Health Bulletin*, 51(3), pp. 158–165.

Anney, V.N. (2014) 'Ensuring the quality of the findings of qualitative research: Looking at trustworthiness criteria', *Journal of emerging trends in educational research and policy studies*, 5(2), pp. 272–281.

Asamane, E.A. *et al.* (2021) 'Nutritional and social contribution of meat in diets: Interplays among young urban and rural men', *Appetite*, 156, p. 104959. Available at: https://doi.org/10.1016/j.appet.2020.104959.

Askari, M. *et al.* (2020) 'Ultra-processed food and the risk of overweight and obesity: a systematic review and meta-analysis of observational studies', *International Journal of Obesity*, 44(10), pp. 2080–2091.

Askari Majabadi, H. *et al.* (2016) 'Factors Influencing Fast-Food Consumption Among Adolescents in Tehran: A Qualitative Study', *Iranian Red Crescent Medical Journal*, 18(3), p. e23890. Available at: https://doi.org/10.5812/ircmj.23890.

Azeredo, C.M. *et al.* (2016) 'Food environments in schools and in the immediate vicinity are associated with unhealthy food consumption among Brazilian adolescents', *Preventive Medicine*, 88, pp. 73–79. Available at: https://doi.org/10.1016/j.ypmed.2016.03.026.

Bach, A. *et al.* (2020) 'Multisectoral Integration of Nutrition, Health, and Agriculture: Implementation Lessons From Ethiopia', *Food and Nutrition Bulletin*, 41(2), pp. 275–292. Available at: https://doi.org/10.1177/0379572119895097.

Baird, J. *et al.* (2017) 'Developmental origins of health and disease: A lifecourse approach to the prevention of non-communicable diseases', *Healthcare*, 5(1), p. 14. Available at: https://doi.org/10.3390/healthcare5010014.

Baker, P. *et al.* (2016) 'Trade and investment liberalization, food systems change and highly processed food consumption: a natural experiment contrasting the soft-drink markets of Peru and Bolivia', *Globalization and Health*, 12(1), p. 24. Available at: https://doi.org/10.1186/s12992-016-0161-0.

Baker, P. and Friel, S. (2014) 'Processed foods and the nutrition transition: evidence from A sia', *Obesity reviews*, 15(7), pp. 564–577.

Baker, P., Kay, A. and Walls, H. (2014) 'Trade and investment liberalization and Asia's noncommunicable disease epidemic: a synthesis of data and existing literature', *Globalization and Health*, 10(1), p. 66. Available at: https://doi.org/10.1186/s12992-014-0066-8.

Balarajan, Y. and Reich, M.R. (2016) 'Political economy challenges in nutrition', *Globalization and Health*, 12(1), p. 70. Available at: https://doi.org/10.1186/s12992-016-0204-6.

Banda, K. *et al.* (2020) 'Towards universal coverage for nutrition services in children under five years—A descriptive analysis of the capacity of level one hospitals to provide nutrition services in five provinces of Zambia', *PLoS ONE*, 15(5), p. e0232663. Available at: https://doi.org/10.1371/journal.pone.0232663.

Barlow, J. and Blair, M. (2012) 'Chapter 6: Life stage: Adolescence', in *Chief Medical Officer's annual report 2012: Our Children Deserve Better: Prevention Pays*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/252656/33571_2901304_CMO_Chapter_6.pdf (Accessed: 17 January 2020).

Battersby, J. and Peyton, S. (2014) 'Effect of changes to the school food environment on eating behaviours and/or body weight in children: a systematic review', in *Urban Forum*. Springer, pp. 153–164.

Baumgartner, F.R. and Jones, B.D. (2010) *Agendas and instability in American politics*. University of Chicago Press.

Becker, M.H. (1974) 'The health belief model and personal health behavior', *Health education monographs*, 2, pp. 324–473.

Bekker, F., Marais, M. and Koen, N. (2017) 'The provision of healthy food in a school tuck shop: does it influence primary-school students' perceptions, attitudes and behaviours towards healthy eating?', *Public Health Nutrition*, 20(7), pp. 1257–1266. Available at: https://doi.org/10.1017/S1368980016003487.

Benson, T.D. (2008) *Improving nutrition as a development priority: Addressing undernutrition within national policy processes in sub-Saharan Africa*. Intl Food Policy Res Inst.

Boelsen-Robinson, T., Backholer, K. and Peeters, A. (2015) 'Digital marketing of unhealthy foods to Australian children and adolescents', *Health promotion international*, 31(3), pp. 523–533.

Borish, D., King, N. and Dewey, C. (2017) 'Enhanced community capital from primary school feeding and agroforestry program in Kenya', *International Journal of Educational Development*, 52, pp. 10–18. Available at: https://doi.org/10.1016/j.ijedudev.2016.10.005.

Bosire, E.N. *et al.* (2020) 'Attitudes and perceptions among urban South Africans towards sugar-sweetened beverages and taxation', *Public Health Nutrition*, 23(2), pp. 374–383. Available at: https://doi.org/10.1017/S1368980019001356.

Bragg, M.A. *et al.* (2018) 'Marketing food and beverages to youth through sports', *Journal of Adolescent Health*, 62(1), pp. 5–13.

Brambila-Macias, J. *et al.* (2011) 'Policy Interventions to Promote Healthy Eating: A Review of What Works, What Does Not, and What is Promising', *Food and Nutrition Bulletin*, 32(4), pp. 365–375. Available at: https://doi.org/10.1177/156482651103200408.

Branca, F. *et al.* (2019) 'Transforming the food system to fight non-communicable diseases', *BMJ*, 364, p. l296. Available at: https://doi.org/10.1136/bmj.l296.

Bridge, G., Lomazzi, M. and Bedi, R. (2020) 'Implementation of a sugar-sweetened beverage tax in low- and middle-income countries: recommendations for policymakers', *Journal of Public Health Policy*, 41(1), pp. 84–97. Available at: https://doi.org/10.1057/s41271-019-00196-z.

Bronfenbrenner, U. (1986) 'Ecology of the family as a context for human development: Research perspectives.', *Developmental psychology*, 22(6), p. 723.

Brownell, K.D. and Warner, K.E. (2009) 'The Perils of Ignoring History: Big Tobacco Played Dirty and Millions Died. How Similar Is Big Food?', *The Milbank Quarterly*, 87(1), pp. 259–294. Available at: https://doi.org/10.1111/j.1468-0009.2009.00555.x.

Bulawayo, M., Ndulo, M. and Sichone, J. (2019) 'Socioeconomic Determinants of Food Insecurity among Zambian Households: Evidence from a National Household Survey', *Journal of Asian and African Studies*, 54(6), pp. 800–818. Available at: https://doi.org/10.1177/0021909619841655.

Busse, H. *et al.* (2020) 'What Is the Role of Civil Society in Multisectoral Nutrition Governance Systems? A Multicountry Review', *Food and Nutrition Bulletin*, 41(2), pp. 244–260. Available at: https://doi.org/10.1177/0379572119877348.

Byrd, K.A. *et al.* (2021) 'Dried small fish provide nutrient densities important for the first 1000 days', *Maternal & child nutrition*, 17(4), p. e13192.

Cabrera Escobar, M.A. *et al.* (2013) 'Evidence that a tax on sugar sweetened beverages reduces the obesity rate: a meta-analysis', *BMC Public Health*, 13(1), p. 1072. Available at: https://doi.org/10.1186/1471-2458-13-1072.

Capewell, S. and Lloyd-Williams, F. (2018) 'The role of the food industry in health: lessons from tobacco?', *British Medical Bulletin*, 125(1), pp. 131–143. Available at: https://doi.org/10.1093/bmb/ldy002.

Carter, M.-A. and Swinburn, B. (2004) 'Measuring the "obesogenic" food environment in New Zealand primary schools', *Health Promotion International*, 19(1), pp. 15–20. Available at: https://doi.org/10.1093/heapro/dah103.

Caswell, B.L. *et al.* (2018) 'Usual nutrient intake adequacy among young, rural Zambian children', *The British Journal of Nutrition*, 119(1), pp. 57–65. Available at: https://doi.org/10.1017/S000711451700335X.

Caswell, B.L. *et al.* (2020) 'Within-person, between-person and seasonal variance in nutrient intakes among 4- to 8-year-old rural Zambian children', *The British Journal of Nutrition*, 123(12), pp. 1426–1433. Available at: https://doi.org/10.1017/S0007114520000732.

Ceccarelli, A. (2012) 'Review of policies adopted in 34 countries to improve diet and physical activity', *Italian Journal of Public Health*, 8(2).

Central Statistical Office (2010) *Lusaka Province Analytical Report*. Lusaka, Zambia: Central Statistical Office (CSO). Available at: https://www.zamstats.gov.zm/phocadownload/2010_Census/2010_Census_Analytical_Reports/Lusaka%20Province%20Analytical%20Report%20-%202010%20Census.pdf (Accessed: 17 January 2020).

Central Statistical Office (2012) *Zambia 2010 census of population and housing: national analytical report*. Lusaka, Zambia, p. 13. Available at: https://www.zamstats.gov.zm/phocadownload/2010_Census/2010%20Census%20of%20Population%20National%20Analytical%20Report.pdf (Accessed: 29 January 2020).

Central Statistical Office (2016) *2015 Living Conditions Monitoring Survey*. Lusaka, Zambia. Available at: https://www.zamstats.gov.zm/phocadownload/Living_Conditions/2015%20Living%20Conditions%20Monitoring%20Survey%20Report.pdf (Accessed: 22 February 2020).

Central Statistical Office, Ministry of Health and ICF (2019) *Zambia demographic and health survey 2018: Key Indicators*. Lusaka, Zambia: Rockville, Maryland, USA: Central Statistical Office, Ministry of Health, and ICF. Available at: https://dhsprogram.com/pubs/pdf/PR113/PR113.pdf (Accessed: 21 September 2019).

Centres for Disease Control and Prevention (1997) 'Guidelines for School Health Programs to Promote Lifelong Healthy Eating', *Journal of School Health*, 67(1), pp. 9–26. Available at: https://doi.org/10.1111/j.1746-1561.1997.tb06289.x.

CFS (2021) ‘CFS Voluntary Guidelines on Food Systems and Nutrition’. Committe on World Food Security at Food and Agriculture Organization. Available at: https://www.fao.org/fileadmin/templates/cfs/Docs2021/Documents/CFS_VGs_Food_Systems_and_Nutrition_Strategy_EN.pdf (Accessed: 5 September 2022).

Chakrabarti, S. *et al.* (2021) ‘Intergenerational nutrition benefits of India’s national school feeding program’, *Nature Communications*, 12(1), pp. 1–10.

Chanda, V. (2020) *COVID-19: Trade Kings Foundation Donates K28m, Zambia National Broadcasting Services*. Available at: https://www.znbc.co.zm/news/covid-19-trade-kings-foundation-donates-k28m/ (Accessed: 12 September 2022).

Cheelo, C. *et al.* (2021) *Affordability of Protein-Rich Foods: Evidence from Zambia*. Lusaka, Zambia: Southern Africa Institute for Policy and Research. Available at: https://assets.cdcgroup.com/wp-content/uploads/2018/12/14110951/Affordability-of-Protein-Rich-Foods-Evidence-from-Zambia.pdf (Accessed: 3 November 2022).

Chirwa, U., Musuku, J. and Pandey, V. (2019) ‘Prevalence of obesity and associated risk factors among school children in primary schools in Lusaka, Zambia’, *Medical Journal of Zambia*, 46(2), pp. 90–99.

Chunda-Liyoka, C. *et al.* (2020) ‘Healthy pregnancies and essential fats: focus group discussions with Zambian women on dietary need and acceptability of a novel RUSF containing fish oil DHA’, *BMC pregnancy and childbirth*, 20(1), p. 93. Available at: https://doi.org/10.1186/s12884-020-2783-8.

Colchero, M.A. *et al.* (2016) ‘Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: observational study’, *bmj*, 352, p. h6704.

Coll, R.K. and Chapman, R. (2000) ‘Choices of methodology for cooperative education researchers’, *International Journal of Work-Integrated Learning*, 1(1), p. 1.

Cordain, L. *et al.* (2005) ‘Origins and evolution of the Western diet: health implications for the 21st century’, *The American Journal of Clinical Nutrition*, 81(2), pp. 341–354. Available at: https://doi.org/10.1093/ajcn.81.2.341.

Correa, T. *et al.* (2020) ‘Food Advertising on Television Before and After a National Unhealthy Food Marketing Regulation in Chile, 2016–2017’, *American Journal of Public Health*, 110(7), pp. 1054–1059. Available at: https://doi.org/10.2105/AJPH.2020.305658.

Corsi, D.J. *et al.* (2012) ‘Demographic and health surveys: a profile’, *International journal of epidemiology*, 41(6), pp. 1602–1613.

Crammond, B. *et al.* (2013) ‘The possibility of regulating for obesity prevention–understanding regulation in the C ommonwealth G overnment’, *obesity reviews*, 14(3), pp. 213–221.

Cresswell, J. and Clark, V.P. (2007) ‘Designing and Conducting Mixed Methods Research. Thousand Oaks CA: Sage’.

Creswell, J.W. and Clark, V.L.P. (2017) *Designing and conducting mixed methods research*. Sage publications.

Creswell, J.W. and Poth, C.N. (2016) *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

Crush, J. and Frayne, B. (2011) 'Supermarket expansion and the informal food economy in Southern African cities: implications for urban food security', *Journal of Southern African Studies*, 37(4), pp. 781–807.

Cruz, L. (2020) *Legal Guide on school food and nutrition - Legislating for a healthy school food environment*. Legal guide 2. Rome, Italy: Food and Agriculture Organization of the United Nations. Available at: http://www.fao.org/3/ca9730en/CA9730EN.pdf (Accessed: 5 May 2021).

CSO (2014) *Zambia Demographic and Health Survey 2013-14*. Rockville, Maryland, USA: Central Statistical Office (CSO) [Zambia], Ministry of Health (MOH) [Zambia] and ICF International.

Cullerton, K. *et al.* (2016) 'Playing the policy game: a review of the barriers to and enablers of nutrition policy change', *Public Health Nutrition*, 19(14), pp. 2643–2653. Available at: https://doi.org/10.1017/S1368980016000677.

Cullinan, K. *et al.* (2020) 'Lessons From South Africa's Campaign for a Tax on Sugary Beverages'. Vital Strategies. Available at: https://www.vitalstrategies.org/wp-content/uploads/Lessons-From-South-Africa-Campaign-for-a-Tax-on-Sugary-Beverages.pdf (Accessed: 23 October 2022).

CUTS and WFP (2018) *Identifying food consumption patterns in Lusaka - a perception survey*. Lusaka, Zambia: CUTS International. Available at: https://cuts-lusaka.org/pdf/Report-Identifying_food_consumption_Patters_in_Lusaka.pdf (Accessed: 31 October 2022).

Dayton Eberwein, J. *et al.* (2016) *An Investment Framework for Nutrition in Zambia*. World Bank (Health, Nutrition and Population Discussion Papers). Available at: https://doi.org/10.1596/28496.

Delobelle, P. (2019) 'Big Tobacco, Alcohol, and Food and NCDs in LMICs: An Inconvenient Truth and Call to Action', *International Journal of Health Policy and Management*, 8(12), pp. 727–731. Available at: https://doi.org/10.15171/ijhpm.2019.74.

Demmler, K.M., Ecker, O. and Qaim, M. (2018) 'Supermarket shopping and nutritional outcomes: a panel data analysis for urban Kenya', *World Development*, 102, pp. 292–303.

Development Initiatives (2021) *2021 Global Nutrition Report: The state of global nutrition*. Bristol, UK: Development Initiatives. Available at: https://globalnutritionreport.org/reports/2021-global-nutrition-report/ (Accessed: 30 June 2022).

Dickinson, L.M. *et al.* (2015) 'Pragmatic cluster randomized trials using covariate constrained randomization: A method for practice-based research networks (PBRNs)', *The Journal of the American Board of Family Medicine*, 28(5), pp. 663–672.

Doak, C. (2002) ‘Large-scale interventions and programmes addressing nutrition-related chronic diseases and obesity: examples from 14 countries’, *Public Health Nutrition*, 5(1a), pp. 275–277.

Drimie, S. *et al.* (2014) ‘Intersectoral coordination for nutrition in Zambia’.

Duffy, C. *et al.* (2017) *Cost of the Diet analysis in two districts: Sesheke District, Western Province and Namwala District, Southern Province, Zambia*. Zambia: Concern Worldwide. Available at: https://admin.concern.net/sites/default/files/media/migrated/cost_of_the_diet-analysis_in_two_zambian_districts.pdf (Accessed: 5 November 2022).

Edalati, S. *et al.* (2020) ‘Development and implementation of nutrition labelling in Iran: A retrospective policy analysis’, *The International Journal of Health Planning and Management*, 35(1), pp. e28–e44. Available at: https://doi.org/10.1002/hpm.2924.

Erzse, A., Christofides, N., *et al.* (2021) ‘Availability and advertising of sugar sweetened beverages in South African public primary schools following a voluntary pledge by a major beverage company: a mixed methods study’, *Global Health Action*, 14(1), p. 1898130. Available at: https://doi.org/10.1080/16549716.2021.1898130.

Erzse, A., Abdool Karim, S., *et al.* (2021) ‘The data availability landscape in seven sub-Saharan African countries and its role in strengthening sugar-sweetened beverage taxation’, *Global Health Action*, 14(1), p. 1871189. Available at: https://doi.org/10.1080/16549716.2020.1871189.

Essman, M. *et al.* (2021) ‘Taxed and untaxed beverage intake by South African young adults after a national sugar-sweetened beverage tax: A before-and-after study’, *PLOS Medicine*, 18(5), p. e1003574. Available at: https://doi.org/10.1371/journal.pmed.1003574.

Ezezika, O. *et al.* (2021) ‘Barriers and Facilitators to the Implementation of Large-Scale Nutrition Interventions in Africa: A Scoping Review’, *Global Implementation Research and Applications*, 1(1), pp. 38–52. Available at: https://doi.org/10.1007/s43477-021-00007-2.

Fabic, M.S., Choi, Y. and Bird, S. (2012) ‘A systematic review of Demographic and Health Surveys: data availability and utilization for research’, *Bulletin of the World Health Organization*, 90, pp. 604–612.

FAO (2016) *Influencing food environments for healthy diets*. Rome, Italy: Food and Agriculture Organization of the United Nations. Available at: http://www.fao.org/3/a-i6484e.pdf (Accessed: 12 December 2019).

FAO and WHO (2021) *Global Individual Food consumption data Tool*. Available at: http://www.fao.org/gift-individual-food-consumption/methodology/food-groups-and-sub-groups/en/ (Accessed: 7 July 2021).

Feeley, A. *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), pp. e1–e6. Available at: https://doi.org/10.1016/j.nut.2011.11.025.

Fereday, J. and Muir-Cochrane, E. (2006) ‘Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development’, *International journal of qualitative methods*, 5(1), pp. 80–92.

Fernandes, M. *et al.* (2016) 'Enhancing Linkages Between Healthy Diets, Local Agriculture, and Sustainable Food Systems: The School Meals Planner Package in Ghana', *Food and Nutrition Bulletin*, 37(4), pp. 571–584. Available at: https://doi.org/10.1177/0379572116659156.

Food and Agriculture Organization (2018) *Dietary Assessment: A resource guide to method selection and application in low resource settings*. Rome: FAO. Available at: http://www.fao.org/3/i9940en/I9940EN.pdf (Accessed: 15 January 2020).

Forouzanfar, M.H. *et al.* (2016) 'Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015', *The Lancet*, 388(10053), pp. 1659–1724.

Fox, A., Law, J.R. and Baker, K. (2022) 'The case for metagovernance: The promises and pitfalls of multisectoral nutrition service delivery structures in low- and middle-income countries', *Public Administration and Development*, 42(2), pp. 128–141. Available at: https://doi.org/10.1002/pad.1974.

Friel, S. and Jamieson, L. (2019) 'Political economy, trade relations and health inequalities: lessons from general health'.

Galgamuwa, L.S. *et al.* (2017) 'Nutritional status and correlated socio-economic factors among preschool and school children in plantation communities, Sri Lanka', *BMC Public Health*, 17(1), p. 377. Available at: https://doi.org/10.1186/s12889-017-4311-y.

Garret, J., Bassett, L. and Levinson, J. (2011a) 'Multisectoral Approaches to Nutrition: Rationale and Historical Perspectives', in *Working Multisectorally in Nutrition: Principles, Practises and Case Studies*. Washington DC: International Food Policy Research Institute (IFPRI) (IFPRI Research Monograph), p. 34. Available at: https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/129738/filename/129949.pdf (Accessed: 6 September 2022).

Garret, J., Bassett, L. and Levinson, J. (2011b) 'Principles and a Conceptual Model for Working Multisectorally', in *Working Multisectorally in Nutrition: Principles, Practises and Case Studies*. Washington DC: International Food Policy Research Institute (IFPRI) (IFPRI Research Monograph), pp. 20–47. Available at: https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/129738/filename/129949.pdf (Accessed: 6 September 2022).

Global Panel (2017) *Improving nutrition through enhanced food environments: Policy Brief No. 7*. London, UK: Global Panel on Agriculture and Food Systems for Nutrition. Available at: https://www.glopan.org/wp-content/uploads/2019/06/FoodEnvironmentsBrief.pdf (Accessed: 30 March 2020).

Godziewski, C. (2021) 'Is "Health in All Policies" everybody's responsibility? Discourses of multistakeholderism and the lifestyle drift phenomenon', *Critical Policy Studies*, 15(2), pp. 229–246. Available at: https://doi.org/10.1080/19460171.2020.1795699.

Gonçalves, V.S.S. *et al.* (2021) 'The food environment in schools and their immediate vicinities associated with excess weight in adolescence: A systematic review and meta-

analysis', *Health & Place*, 71, p. 102664. Available at: https://doi.org/10.1016/j.healthplace.2021.102664.

Government of the Republic of Zambia (2010) 'The Competition And Consumer Protection Act'. Government of the Republic of Zambia. Available at: http://41.77.4.165:6510/www.parliament.gov.zm/sites/default/files/documents/acts/The%20Competition%20and%20Consumer%20Protection%202010.pdf (Accessed: 6 May 2021).

Government of the Republic of Zambia (2019) 'Food and Nutrition Act'. Government of the Republic of Zambia. Available at: http://www.parliament.gov.zm/sites/default/files/documents/acts/The%20Food%20and%20Nutrition%20Act%20No.%203%20of%202020.pdf (Accessed: 6 May 2021).

Government of the Republic of Zambia (2020) 'Food Safety Act'. Government of the Republic of Zambia. Available at: http://www.parliament.gov.zm/sites/default/files/documents/acts/The%20Food%20Safety%20%20Act%20No.%207%2C%202019.pdf (Accessed: 6 May 2021).

Gregson, J. *et al.* (2001) 'System, environmental, and policy changes: using the social-ecological model as a framework for evaluating nutrition education and social marketing programs with low-income audiences', *Journal of nutrition education*, 33, pp. S4–S15.

Grosso, G. *et al.* (2013) 'Nutrition knowledge and other determinants of food intake and lifestyle habits in children and young adolescents living in a rural area of Sicily, South Italy', *Public Health Nutrition*, 16(10), pp. 1827–1836. Available at: https://doi.org/10.1017/S1368980012003965.

Haggblade, S. *et al.* (2016) 'Emerging early actions to bend the curve in sub-Saharan Africa's nutrition transition', *Food and Nutrition Bulletin*, 37(2), pp. 219–241. Available at: https://doi.org/10.1177/0379572116637723.

Harris, J. (2019) 'Advocacy coalitions and the transfer of nutrition policy to Zambia', *Health Policy and Planning*, 34(3), pp. 207–215. Available at: https://doi.org/10.1093/heapol/czz024.

Harris, J. *et al.* (2019) 'Nutrition transition in Zambia: Changing food supply, food prices, household consumption, diet and nutrition outcomes', *Food Security*, 11(2), pp. 371–387.

Harris, J.L., Schwartz, M.B. and Brownell, K.D. (2010) 'Marketing foods to children and adolescents: licensed characters and other promotions on packaged foods in the supermarket', *Public Health Nutrition*, 13(3), pp. 409–417.

Hawkes, C. *et al.* (2015) 'Smart food policies for obesity prevention', *The Lancet*, 385(9985), pp. 2410–2421. Available at: https://doi.org/10.1016/S0140-6736(14)61745-1.

Hawkes, C. *et al.* (2016) 'How to engage across sectors: lessons from agriculture and nutrition in the Brazilian School Feeding Program', *Revista de Saúde Pública*, 50, p. 47. Available at: https://doi.org/10.1590/S1518-8787.2016050006506.

Hawkes, C. *et al.* (2020) 'Double-duty actions: seizing programme and policy opportunities to address malnutrition in all its forms', *The Lancet*, 395(10218), pp. 142–155.

Hawkes, C. and Popkin, B.M. (2015) 'Can the sustainable development goals reduce the burden of nutrition-related non-communicable diseases without truly addressing major food system reforms?', *BMC Medicine*, 13(1), p. 143. Available at: https://doi.org/10.1186/s12916-015-0383-7.

Hearty, A.P. and Gibney, M.J. (2009) 'Comparison of cluster and principal component analysis techniques to derive dietary patterns in Irish adults', *The British Journal of Nutrition*, 101(4), pp. 598–608. Available at: https://doi.org/10.1017/S0007114508014128.

Hebden, L.A. *et al.* (2011) 'Advertising of fast food to children on Australian television: the impact of industry self-regulation', *Medical Journal of Australia*, 195(1), pp. 20–24. Available at: https://doi.org/10.5694/j.1326-5377.2011.tb03182.x.

Hewett, P.C. *et al.* (2021) 'Assessment of an adolescent-girl-focused nutritional educational intervention within a girls' empowerment programme: a cluster randomised evaluation in Zambia', *Public Health Nutrition*, 24(4), pp. 651–664. Available at: https://doi.org/10.1017/S1368980020001263.

High Level Panel of Experts (2017) *Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security*. 12. Rome. Available at: http://www.fao.org/3/a-i7846e.pdf (Accessed: 20 September 2019).

Hillocks, R.J. (2011) 'Farming for balanced nutrition: an agricultural approach to addressing micronutrient deficiency among the vulnerable poor in Africa', *African journal of food, agriculture, nutrition and development*, 11(2).

Hoffman, R.M. *et al.* (2021) 'Multimonth dispensing of up to 6 months of antiretroviral therapy in Malawi and Zambia (INTERVAL): a cluster-randomised, non-blinded, non-inferiority trial', *The Lancet Global Health*, 9(5), pp. e628–e638. Available at: https://doi.org/10.1016/S2214-109X(21)00039-5.

Hu, F.B. (2002) 'Dietary pattern analysis: a new direction in nutritional epidemiology', *Current Opinion in Lipidology*, 13(1), pp. 3–9.

Ireland, R. *et al.* (2019) 'Commercial determinants of health: advertising of alcohol and unhealthy foods during sporting events', *Bulletin of the World Health Organization*, 97(4), p. 290.

Ivankova, N.V., Creswell, J.W. and Stick, S.L. (2006) 'Using mixed-methods sequential explanatory design: From theory to practice', *Field methods*, 18(1), pp. 3–20.

Jailobaeva, K. *et al.* (2021) 'An analysis of policy and funding priorities of global actors regarding noncommunicable disease in low- and middle-income countries', *Globalization and Health*, 17(1), p. 68. Available at: https://doi.org/10.1186/s12992-021-00713-4.

Jenkin, G.L., Signal, L. and Thomson, G. (2011) 'Framing obesity: the framing contest between industry and public health at the New Zealand inquiry into obesity', *Obesity Reviews*, 12(12), pp. 1022–1030. Available at: https://doi.org/10.1111/j.1467-789X.2011.00918.x.

Johnson, R.B. and Onwuegbuzie, A.J. (2004) 'Mixed methods research: A research paradigm whose time has come', *Educational researcher*, 33(7), pp. 14–26.

Jomaa, L.H., McDonnell, E. and Probart, C. (2011) 'School feeding programs in developing countries: impacts on children's health and educational outcomes', *Nutrition reviews*, 69(2), pp. 83–98.

Jones, N.R.V. *et al.* (2014) 'The Growing Price Gap between More and Less Healthy Foods: Analysis of a Novel Longitudinal UK Dataset', *PLoS ONE*, 9(10), p. e109343. Available at: https://doi.org/10.1371/journal.pone.0109343.

Kaliwile, C. *et al.* (2019) 'Dietary Intake Patterns among Lactating and Non-Lactating Women of Reproductive Age in Rural Zambia', *Nutrients*, 11(2), p. E288. Available at: https://doi.org/10.3390/nu11020288.

Kaminski, A.M. *et al.* (2022) 'The Role of Aquaculture and Capture Fisheries in Meeting Food and Nutrition Security: Testing a Nutrition-Sensitive Pond Polyculture Intervention in Rural Zambia', *Foods (Basel, Switzerland)*, 11(9), p. 1334. Available at: https://doi.org/10.3390/foods11091334.

Kaushik, V. and Walsh, C.A. (2019) 'Pragmatism as a research paradigm and its implications for social work research', *Social sciences*, 8(9), p. 255.

Kelly, C. *et al.* (2019) 'Food environments in and around post-primary schools in Ireland: Associations with youth dietary habits', *Appetite*, 132, pp. 182–189. Available at: https://doi.org/10.1016/j.appet.2018.08.021.

Kersh, R. and Morone, J. (2002) 'The Politics Of Obesity: Seven Steps To Government Action', *Health Affairs*, 21(6), pp. 142–153. Available at: https://doi.org/10.1377/hlthaff.21.6.142.

Khonje, M.G., Ecker, O. and Qaim, M. (2020) 'Effects of Modern Food Retailers on Adult and Child Diets and Nutrition', *Nutrients*, 12(6), p. E1714. Available at: https://doi.org/10.3390/nu12061714.

Khonje, M.G. and Qaim, M. (2019) *Modernization of African food retailing and (un) healthy food consumption: Insights from Zambia*. GlobalFood Discussion Papers.

Kickbusch, I., Allen, L. and Franz, C. (2016) 'The commercial determinants of health', *The Lancet Global Health*, 4(12), pp. e895–e896. Available at: https://doi.org/10.1016/S2214-109X(16)30217-0.

Kimenju, S.C. *et al.* (2015) 'Do supermarkets contribute to the obesity pandemic in developing countries?', *Public health nutrition*, 18(17), pp. 3224–3233.

Kingdon, J. (1984) *Agendas, alternatives and public policies*. Boston: Longman.

Kopp, W. (2019) 'How Western Diet And Lifestyle Drive The Pandemic Of Obesity And Civilization Diseases', *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, 12, pp. 2221–2236. Available at: https://doi.org/10.2147/DMSO.S216791.

Kubik, M.Y. *et al.* (2003) 'The association of the school food environment with dietary behaviors of young adolescents', *American Journal of Public Health*, 93(7), pp. 1168–1173. Available at: https://doi.org/10.2105/AJPH.93.7.1168.

Kumar, M., Gleeson, D. and Barraclough, S. (2018) 'Australia's Health Star Rating policy process: Lessons for global policy-making in front-of-pack nutrition labelling', *Nutrition & Dietetics*, 75(2), pp. 193–199.

Kuntashula, E. and Mwelwa-Zgambo, L. (2022) 'Impact of the farmer input support policy on agricultural production diversity and dietary diversity in Zambia', *Food Policy*, p. 102329. Available at: https://doi.org/10.1016/j.foodpol.2022.102329.

Kwon, D., Myers, R.J. and Mason, N.M. (2022) 'How do input subsidy programs affect smallholder households' dietary diversity? Evidence from Zambia'.

de Lacy-Vawdon, C. and Livingstone, C. (2020) 'Defining the commercial determinants of health: a systematic review', *BMC Public Health*, 20(1), p. 1022. Available at: https://doi.org/10.1186/s12889-020-09126-1.

Larson, R.W. and Verma, S. (1999) 'How children and adolescents spend time across the world: work, play, and developmental opportunities.', *Psychological bulletin*, 125(6), p. 701.

Lencucha, R. *et al.* (2018) 'Fostering the Catalyst Role of Government in Advancing Healthy Food Environments', *International Journal of Health Policy and Management*, 7(6), pp. 485–490. Available at: https://doi.org/10.15171/ijhpm.2018.10.

Lencucha, R. *et al.* (2020) 'Government policy and agricultural production: a scoping review to inform research and policy on healthy agricultural commodities', *Globalization and Health*, 16(1), p. 11. Available at: https://doi.org/10.1186/s12992-020-0542-2.

Lincoln, Y., Lynham, S. and Guba, E.G. (2011) 'Paradigms and perspectives in contention', in *The Sage Handbook of Qualitative Research*. Thousand Oaks: Sage Publications, pp. 91–95.

Lincoln, Y.S. and Guba, E.G. (1986) 'But is it rigorous? Trustworthiness and authenticity in naturalistic evaluation', *New directions for program evaluation*, 1986(30), pp. 73–84.

Lubungu, M. and Singogo, F. (2021) *2021 Zambia Food Security and Nutrition Report*. Lusaka, Zambia: Indaba Agriculture Policy Research Institute. Available at: www.iapri.org.zm/wp-content/uploads/2022/04/2021_Zambia_food_security_and_nutrition.pdf (Accessed: 3 November 2022).

Mahmudiono, T., Segalita, C. and Rosenkranz, R.R. (2019) 'Socio-Ecological Model of Correlates of Double Burden of Malnutrition in Developing Countries: A Narrative Review', *International Journal of Environmental Research and Public Health*, 16(19), p. 3730. Available at: https://doi.org/10.3390/ijerph16193730.

Maila, G., Audain, K. and Marinda, P.A. (2021) 'Association between dietary diversity, health and nutritional status of older persons in rural Zambia', *South African Journal of Clinical Nutrition*, 34(1), pp. 34–39.

Makashini, T., Mulenga, D. and Siziya, S. (2017) 'Prevalence of adolescent overweight or obesity among secondary school students in urban Ndola, Zambia and associated factors', *The Health Press*, p. 65.

Mallard, S.R. *et al.* (2014) 'Dietary Diversity at 6 Months of Age Is Associated with Subsequent Growth and Mediates the Effect of Maternal Education on Infant Growth in Urban Zambia', *The Journal of Nutrition*, 144(11), pp. 1818–1825. Available at: https://doi.org/10.3945/jn.114.199547.

Manyema, M. *et al.* (2014) 'The potential impact of a 20% tax on sugar-sweetened beverages on obesity in South African adults: a mathematical model', *PloS One*, 9(8), p. e105287. Available at: https://doi.org/10.1371/journal.pone.0105287.

Marinda, P.A. *et al.* (2018) 'Dietary diversity determinants and contribution of fish to maternal and under-five nutritional status in Zambia', *PloS One*, 13(9), p. e0204009. Available at: https://doi.org/10.1371/journal.pone.0204009.

Masa, R., Chowa, G. and Nyirenda, V. (2018) 'Socioeconomic correlates of dietary diversity and its association with adherence and psychosocial functioning of people living with HIV in rural Zambia', *Nutrition and health*, 24(2), pp. 93–102. Available at: https://doi.org/10.1177/0260106018761282.

Maxcy, S.J. (2003) 'Pragmatic threads in mixed methods research in the social sciences: The search for multiple modes of inquiry and the end of the philosophy of formalism', *Handbook of mixed methods in social and behavioral research* [Preprint], (51–89).

Mchiza, Z.J. *et al.* (2016) 'Body-image perception and dissatisfaction: Acknowledging the sociocultural factors of obesity in South Africa'.

McIntyre, L. (2020) 'Framing analysis: its usefulness as a tool for advocacy on public health nutrition problems', *Public Health Nutrition*, 23(11), pp. 2053–2055. Available at: https://doi.org/10.1017/S1368980020000373.

McKee, M. and Stuckler, D. (2018) 'Revisiting the Corporate and Commercial Determinants of Health', *American Journal of Public Health*, 108(9), pp. 1167–1170. Available at: https://doi.org/10.2105/AJPH.2018.304510.

Mendenhall, E. (2017) 'Syndemics: a new path for global health research', *The Lancet*, 389(10072), pp. 889–891.

Mialon, M. (2020) 'An overview of the commercial determinants of health', *Globalization and Health*, 16. Available at: https://doi.org/10.1186/s12992-020-00607-x.

Mialon, M., Swinburn, B. and Sacks, G. (2015) 'A proposed approach to systematically identify and monitor the corporate political activity of the food industry with respect to public health using publicly available information', *Obesity reviews*, 16(7), pp. 519–530.

Micha, R. *et al.* (2018) 'Effectiveness of school food environment policies on children's dietary behaviors: A systematic review and meta-analysis', *PLOS ONE*, 13(3), p. e0194555. Available at: https://doi.org/10.1371/journal.pone.0194555.

Michaud-Létourneau, I. and Pelletier, D.L. (2017) 'Perspectives on the coordination of multisectoral nutrition in Mozambique and an emerging framework', *Food Policy*, 70, pp. 84–97. Available at: https://doi.org/10.1016/j.foodpol.2017.07.001.

Miller, D. and Harkins, C. (2010) 'Corporate strategy, corporate capture: Food and alcohol industry lobbying and public health':, *Critical Social Policy* [Preprint]. Available at: https://doi.org/10.1177/0261018310376805.

Ministry of Agriculture (2021) 'Zambia Food-Based Dietary Guidelines: Technical Recommendations'. Ministry of Agriculture, Zambia. Available at: https://www.fao.org/3/cb7674en/cb7674en.pdf (Accessed: 1 August 2021).

Ministry of Agriculture and Ministry of Livestock (2016) *Second national agriculture policy*. Ministry of Agriculture and Ministry of Fisheries and Livestock. Available at: http://cbz.org.zm/public/downloads/SECOND-NATIONAL-AGRICULTURAL-POLICY-2016.pdf (Accessed: 20 September 2019).

Ministry of Commerce,Trade and Industry (2018) *National industrial policy*. Lusaka, Zambia: Ministry of Commerce Trade and Industry.

Ministry of Education (1996) 'Educating our future: national policy on education'. Government of the Republic of Zambia.

Ministry of Education (2006) 'National School Health and Nutrition Policy'. Government of the Republic of Zambia. Available at: https://extranet.who.int/nutrition/gina/sites/default/files/ZMB%202006%20School%20Health%20and%20Nutrition%20Policy%20%202006.pdf (Accessed: 28 October 2019).

Ministry of Education (2018) 'Guidelines for implementing School Health and Nutrition Programme activities'. Government of the Republic of Zambia. Available at: https://hivhealthclearinghouse.unesco.org/sites/default/files/resources/iiep_zambia_guidelines_school_health_and_nutrition_2008.pdf (Accessed: 6 May 2021).

Ministry of Finance and National Development (2021) 'Eighth National Development Plan'. Government of the Republic of Zambia. Available at: https://www.nydc.gov.zm/wp-content/uploads/2022/04/8th-NDP-2022-2026.pdf (Accessed: 1 November 2022).

Ministry of Finance and National Development (2022) '2022 Budget speech'. Government of the Republic of Zambia.

Ministry of Health (2012a) 'Adolescent Health Strategic Plan'. Ministry of Health, Zambia. Available at: https://bettercarenetwork.org/sites/default/files/Zambia%20-%20Adolescent%20Health%20Strategic%20Plan%202011-2015.pdf (Accessed: 6 May 2021).

Ministry of Health (2012b) *National Health Policy*. Lusaka, Zambia: Ministry of Health.

Ministry of Health (2017) 'Zambia National Health Strategic Plan 2017 - 2021'. Government of the Republic of Zambia. Available at: https://www.moh.gov.zm/docs/ZambiaNHSP.pdf (Accessed: 28 October 2019).

Ministry of National Development and Planning (2017) *Seventh National Development Plan 2017 - 2021*. Lusaka, Zambia: Ministry of National Development Planning. Available at: http://extwprlegs1.fao.org/docs/pdf/zam170109.pdf (Accessed: 27 September 2019).

Ministry of Youth, Sport and Child Development (2015) 'National Youth Policy'. Government of the Republic of Zambia. Available at: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ed_emp_msu/documents/projectdocumentation/wcms_427020.pdf.

Ministry og Health (2013) 'Zambian Strategic Plan 2013-2016 NON-COMMUNICABLE DISEASES AND THEIR RISK FACTORS'. Government of the Republic of Zambia. Available at: https://www.iccp-portal.org/system/files/plans/ZMB_B3_NCDs%20Strategic%20plan.pdf.

Mitsunaga, A. and Yamauchi, T. (2022) 'Assessing Diet and Nutritional Intake of Rural Children in Zambia Using a Food Frequency Questionnaire', *Ecology of Food and Nutrition*, 61(4), pp. 484–502. Available at: https://doi.org/10.1080/03670244.2022.2028626.

Miyoba, N., Ogada, I. and Mulenga, J. (2018) 'Dietary adequacy of adult surgical orthopaedic patients admitted to a teaching hospital in Zambia; a hospital-based cross-sectional study', *BMC nutrition*, 4, p. 37. Available at: https://doi.org/10.1186/s40795-018-0245-8.

Monteiro, C.A. *et al.* (2013) 'Ultra-processed products are becoming dominant in the global food system', *Obesity reviews*, 14, pp. 21–28.

Montgomery, K.C. and Chester, J. (2009) 'Interactive food and beverage marketing: targeting adolescents in the digital age', *Journal of adolescent health*, 45(3), pp. S18–S29.

Moodie, R. *et al.* (2013) 'Profits and pandemics: prevention of harmful effects of tobacco, alcohol, and ultra-processed food and drink industries', *Lancet (London, England)*, 381(9867), pp. 670–679. Available at: https://doi.org/10.1016/S0140-6736(12)62089-3.

M'soka, N.C., Mabuza, L.H. and Pretorius, D. (2015) 'Cultural and health beliefs of pregnant women in Zambia regarding pregnancy and child birth', *Curationis*, 38(1), p. 1232. Available at: https://doi.org/10.4102/curationis.v38i1.1232.

Msopa, E. and Mwanakasale, V. (2019) 'Identification of risk factors of diabetes mellitus in bank employees of selected banks in Ndola town', *Diabetes & Metabolic Syndrome*, 13(2), pp. 1497–1504. Available at: https://doi.org/10.1016/j.dsx.2018.11.062.

Mukanu, M.M. *et al.* (2020) 'Nutrition related non-communicable diseases and sugar sweetened beverage policies: a landscape analysis in Zambia', *Global Health Action*, 14(SI1), p. 1872172. Available at: https://doi.org/10.1080/16549716.2021.1872172.

Mulenga, D. *et al.* (2013) 'District specific correlates for hypertension in Kaoma and Kasama rural districts of Zambia', *Rural and Remote Health*, 13(3), p. 2345.

Munthali, T. *et al.* (2015) 'Mortality and morbidity patterns in under-five children with severe acute malnutrition (SAM) in Zambia: a five-year retrospective review of hospital-based records (2009–2013)', *Archives of public health*, 73(1), pp. 1–9.

Murendo, C., Chirongwe, G. and Sisito, G. (2022) 'Food expenditure shares and income elasticities in Zimbabwe: Accounting for gender and poverty differences', *Cogent Economics & Finance*, 10(1), p. 2101241.

Mutale, W. and Chilengi, R. (2018) *STEPS survey results for Zambia*. Lusaka, Zambia: World Health Organization, Ministry of Health (Zambia), Central Statistical Office (Zambia).

Mwanamwenge, M. and Harris, J. (2017) *Agriculture, food systems, diets and nutrition in Zambia*. Lusaka, Zambia: Hivos and IIED. Available at: https://pubs.iied.org/sites/default/files/pdfs/migrate/G04163.pdf (Accessed: 19 September 2022).

Mzumara, B. *et al.* (2018) 'Factors associated with stunting among children below five years of age in Zambia: evidence from the 2014 Zambia demographic and health survey', *BMC Nutrition*, 4(1), p. 51. Available at: https://doi.org/10.1186/s40795-018-0260-9.

Namugumya, B.S. *et al.* (2021) 'The framing of malnutrition by parliamentarians in Uganda', *Health Policy and Planning*, 36(5), pp. 585–593. Available at: https://doi.org/10.1093/heapol/czab009.

National Food and Nutrition Commission (2011) 'NATIONAL FOOD AND NUTRITION STRATEGIC PLAN FOR ZAMBIA 2011-2015'. Government of the Republic of Zambia. Available at: http://www.nfnc.org.zm/download/file/fid/257 (Accessed: 28 October 2019).

NFNC (2018) 'Most Critical Days Programme II: "Zambia's Five Year Flagship Stunting Reduction Programme". 2018 – 2020'. National Food and Nutrition Commission. Available at: https://www.nfnc.org.zm/download/the-first-1000-most-critical-days-programme-mcdp-ii-zambias-five-year-flagship-stunting-reduction-programme-2017-2021/ (Accessed: 6 May 2021).

Nicklas, T.A. (1995) 'Dietary studies of children: the Bogalusa Heart Study experience', *Journal of the American Dietetic Association*, 95(10), pp. 1127–1133.

Nixon, L. *et al.* (2015) '"We're Part of the Solution": Evolution of the Food and Beverage Industry's Framing of Obesity Concerns Between 2000 and 2012', *American Journal of Public Health*, 105(11), pp. 2228–2236. Available at: https://doi.org/10.2105/AJPH.2015.302819.

Norman, J. *et al.* (2016) 'The Impact of Marketing and Advertising on Food Behaviours: Evaluating the Evidence for a Causal Relationship', *Current Nutrition Reports*, 5(3), pp. 139–149. Available at: https://doi.org/10.1007/s13668-016-0166-6.

Nugent, R. (2019) 'Rethinking systems to reverse the global syndemic', *The Lancet*, 393(10173), pp. 726–728. Available at: https://doi.org/10.1016/S0140-6736(18)33243-4.

Oelke, N.D. *et al.* (2016) 'Understanding Perceptions and Practices for Zambian Adults in Western Province at Risk for Hypertension: An Exploratory Descriptive Study', *Global Journal of Health Science*, 8(2), pp. 248–259. Available at: https://doi.org/10.5539/gjhs.v8n2p248.

Ohri-Vachaspati, P. *et al.* (2015) 'The relative contribution of layers of the Social Ecological Model to childhood obesity', *Public health nutrition*, 18(11), pp. 2055–2066.

Okop, K.J. *et al.* (2016) 'Perceptions of body size, obesity threat and the willingness to lose weight among black South African adults: a qualitative study', *BMC public health*, 16(1), p. 365.

Otterbach, S. *et al.* (2021) 'Using Google data to measure the role of Big Food and fast food in South Africa's obesity epidemic', *World Development*, 140, p. 105368. Available at: https://doi.org/10.1016/j.worlddev.2020.105368.

Patton, G.C. *et al.* (2022) 'Nourishing our future: the Lancet Series on adolescent nutrition', *The Lancet*, 399(10320), pp. 123–125. Available at: https://doi.org/10.1016/S0140-6736(21)02140-1.

Pell, D. *et al.* (2021) 'Changes in soft drinks purchased by British households associated with the UK soft drinks industry levy: controlled interrupted time series analysis', *BMJ*, 372, p. n254. Available at: https://doi.org/10.1136/bmj.n254.

Pengpid, S. and Peltzer, K. (2020) 'Prevalence and correlates of multiple non-communicable disease risk factors among adults in Zambia: results of the first national STEPS survey in 2017', *The Pan African Medical Journal*, 37, p. 265. Available at: https://doi.org/10.11604/pamj.2020.37.265.25038.

Phooko-Rabodiba, D. *et al.* (2019) 'Socioeconomic determinants influencing nutritional status of children in sekhukhune district of Limpopo province in South Africa'.

Pingali, P. and Sunder, N. (2017) 'Transitioning toward nutrition-sensitive food systems in developing countries', *Annual Review of Resource Economics*, 9, pp. 439–459.

PMRC (2021) 'Agriculture, Manufacturing, Mining and Tourism - four key economic sectors to drive Zambia's economic stabilization agenda'. Available at: https://pmrczambia.com/blog-agriculture-mining-manufacturing-and-tourism-four-key-economic-sectors-to-drive-zambias-economic-stabilisation-agenda/ (Accessed: 30 October 2022).

Popkin, B.M. (1994) 'The Nutrition Transition in Low-Income Countries: An Emerging Crisis', *Nutrition Reviews*, 52(9), pp. 285–298. Available at: https://doi.org/10.1111/j.1753-4887.1994.tb01460.x.

Popkin, B.M. (2014) 'Nutrition, Agriculture and the Global Food System in Low and Middle Income Countries', *Food policy*, 47, pp. 91–96. Available at: https://doi.org/10.1016/j.foodpol.2014.05.001.

Popkin, B.M. (2015) 'Nutrition Transition and the Global Diabetes Epidemic', *Current Diabetes Reports*, 15(9), p. 64. Available at: https://doi.org/10.1007/s11892-015-0631-4.

Popkin, B.M., Adair, L.S. and Ng, S.W. (2012) 'Global nutrition transition and the pandemic of obesity in developing countries', *Nutrition Reviews*, 70(1), pp. 3–21. Available at: https://doi.org/10.1111/j.1753-4887.2011.00456.x.

Popkin, B.M., Corvalan, C. and Grummer-Strawn, L.M. (2019) 'Dynamics of the double burden of malnutrition and the changing nutrition reality', *The Lancet*, 0(0). Available at: https://doi.org/10.1016/S0140-6736(19)32497-3.

Potvin Kent, M. *et al.* (2019) 'Children and adolescents' exposure to food and beverage marketing in social media apps', *Pediatric Obesity*, 14(6), p. e12508. Available at: https://doi.org/10.1111/ijpo.12508.

Prochaska, J.O. (2020) 'Transtheoretical model of behavior change', *Encyclopedia of behavioral medicine*, pp. 2266–2270.

Puoane, T., Tsolekile, L. and Steyn, N. (2010) 'Perceptions about body image and sizes among black African girls living in Cape Town'.

Qutteina, Y. *et al.* (2019) 'What Do Adolescents See on Social Media? A Diary Study of Food Marketing Images on Social Media', *Frontiers in Psychology*, 10, p. 2637. Available at: https://doi.org/10.3389/fpsyg.2019.02637.

Rakhra, V. *et al.* (2020) 'Obesity and the Western Diet: How We Got Here', *Missouri Medicine*, 117(6), pp. 536–538.

Rao, M. *et al.* (2013) 'Do healthier foods and diet patterns cost more than less healthy options? A systematic review and meta-analysis', *BMJ open*, 3(12), p. e004277. Available at: https://doi.org/10.1136/bmjopen-2013-004277.

Ravuvu, A. *et al.* (2017) 'Monitoring the impact of trade agreements on national food environments: trade imports and population nutrition risks in Fiji', *Globalization and Health*, 13(1), p. 33. Available at: https://doi.org/10.1186/s12992-017-0257-1.

Ravuvu, A. *et al.* (2021) 'Analysing the impact of trade agreements on national food environments: the case of Vanuatu', *Globalization and Health*, 17(1), p. 107. Available at: https://doi.org/10.1186/s12992-021-00748-7.

Reich, M.R. (1995) 'The politics of health sector reform in developing countries: three cases of pharmaceutical policy', *Health Policy (Amsterdam, Netherlands)*, 32(1–3), pp. 47–77. Available at: https://doi.org/10.1016/0168-8510(95)00728-b.

Republic of Zambia (2006) 'Vision 2030: A Prosperous Middle-Income Prosperous by 2030'. Ministry of Finance. Available at: http://unpan1.un.org/intradoc/groups/public/documents/cpsi/unpan040333.pdf (Accessed: 18 June 2019).

Riley, L. *et al.* (2016) 'The World Health Organization STEPwise Approach to Noncommunicable Disease Risk-Factor Surveillance: Methods, Challenges, and Opportunities', *American Journal of Public Health*, 106(1), pp. 74–78. Available at: https://doi.org/10.2105/AJPH.2015.302962.

Rischke, R. *et al.* (2015) 'Supermarkets and food consumption patterns: The case of small towns in Kenya', *Food Policy*, 52, pp. 9–21.

Roberto, C.A. *et al.* (2015) 'Patchy progress on obesity prevention: emerging examples, entrenched barriers, and new thinking', *The Lancet*, 385(9985), pp. 2400–2409.

Ronit, Karsten and Jensen, J.D. (2014) 'Obesity and industry self-regulation of food and beverage marketing: a literature review', *European journal of clinical nutrition*, 68(7), pp. 753–759.

Ronit, K. and Jensen, J.D. (2014) 'Obesity and industry self-regulation of food and beverage marketing: a literature review', *European Journal of Clinical Nutrition*, 68(7), pp. 753–759. Available at: https://doi.org/10.1038/ejcn.2014.60.

Rush, K.L. *et al.* (2018) 'Hypertension prevalence and risk factors in rural and urban Zambian adults in western province: a cross-sectional study', *The Pan African Medical Journal*, 30, p. 97. Available at: https://doi.org/10.11604/pamj.2018.30.97.14717.

Ryckman, T. *et al.* (2021) 'Affordability of nutritious foods for complementary feeding in Eastern and Southern Africa', *Nutrition Reviews*, 79(Suppl 1), pp. 35–51. Available at: https://doi.org/10.1093/nutrit/nuaa137.

Sabatier, P.A. (1988) 'An advocacy coalition framework of policy change and the role of policy-oriented learning therein', *Policy Sciences*, 21(2), pp. 129–168. Available at: https://doi.org/10.1007/BF00136406.

Sacks, G. and Looi, E.S.Y. (2020) 'The Advertising Policies of Major Social Media Platforms Overlook the Imperative to Restrict the Exposure of Children and Adolescents to the Promotion of Unhealthy Foods and Beverages', *International Journal of Environmental Research and Public Health*, 17(11), p. 4172.

Sainsbury, E. *et al.* (2020) 'Explaining resistance to regulatory interventions to prevent obesity and improve nutrition: A case-study of a sugar-sweetened beverages tax in Australia', *Food Policy*, 93, p. 101904. Available at: https://doi.org/10.1016/j.foodpol.2020.101904.

Schmitt, N.M., Wagner, N. and Kirch, W. (2007) 'Consumers' freedom of choice—advertising aimed at children, product placement, and food labeling', *Journal of Public Health*, 15, pp. 57–62.

Schram, A. *et al.* (2015) 'The role of trade and investment liberalization in the sugar-sweetened carbonated beverages market: a natural experiment contrasting Vietnam and the Philippines', *Globalization and Health*, 11(1), p. 41. Available at: https://doi.org/10.1186/s12992-015-0127-7.

Schram, A., Labonté, R. and Sanders, D. (2013) 'Urbanization and international trade and investment policies as determinants of noncommunicable diseases in Sub-Saharan Africa', *Progress in Cardiovascular Diseases*, 56(3), pp. 281–301. Available at: https://doi.org/10.1016/j.pcad.2013.09.016.

Seidenfeld, D. *et al.* (2014) 'The impact of an unconditional cash transfer on food security and nutrition: the Zambia Child Grant Programme'.

Seifu, C.N. *et al.* (2021) 'Dietary patterns associated with obesity outcomes in adults: an umbrella review of systematic reviews', *Public Health Nutrition*, 24(18), pp. 6390–6414. Available at: https://doi.org/10.1017/S1368980021000823.

Sharma, L.L., Teret, S.P. and Brownell, K.D. (2010) 'The Food Industry and Self-Regulation: Standards to Promote Success and to Avoid Public Health Failures', *American Journal of Public Health*, 100(2), pp. 240–246. Available at: https://doi.org/10.2105/AJPH.2009.160960.

Shearer, J.C. *et al.* (2016) 'Why do policies change? Institutions, interests, ideas and networks in three cases of policy reform', *Health Policy and Planning*, 31(9), pp. 1200–1211. Available at: https://doi.org/10.1093/heapol/czw052.

Shill, J. *et al.* (2012) 'Government regulation to promote healthy food environments–a view from inside state governments', *Obesity reviews*, 13(2), pp. 162–173.

Siegel, K.R. *et al.* (2016) 'The contribution of subsidized food commodities to total energy intake among US adults', *Public Health Nutrition*, 19(8), pp. 1348–1357. Available at: https://doi.org/10.1017/S1368980015002414.

Siervo, M. *et al.* (2006) 'A pilot study on body image, attractiveness and body size in Gambians living in an urban community', *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 11(2), pp. 100–109.

StataCorp (2017) 'Stata Statistical Software'. College Station, TX: StataCorp LLC.

Steenkamp, J.-B.E.M. (1993) 'Food consumption behavior', *ACR European Advances*, E-01. Available at: http://acrwebsite.org/volumes/11478/volumes/e01/E-01 (Accessed: 11 January 2020).

Story, M. and French, S. (2004) 'Food advertising and marketing directed at children and adolescents in the US', *International Journal of Behavioral Nutrition and Physical Activity*, 1, pp. 1–17.

Swinburn *et al.* (2019) 'The global syndemic of obesity, undernutrition, and climate change: The Lancet Commission report', *The Lancet*, 393(10173), pp. 791–846.

Swinburn, B. *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', *Obesity Reviews*, 14(S1), pp. 24–37. Available at: https://doi.org/10.1111/obr.12073.

Swinburn, B., Egger, G. and Raza, F. (1999) 'Dissecting obesogenic environments: the development and application of a framework for identifying and prioritizing environmental interventions for obesity', *Preventive medicine*, 29(6), pp. 563–570.

Swinburn, B.A. *et al.* (2019) 'The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission report', *The Lancet*, 393(10173), pp. 791–846. Available at: https://doi.org/10.1016/S0140-6736(18)32822-8.

Tateyama, Y. *et al.* (2018) 'Obesity matters but is not perceived: A cross-sectional study on cardiovascular disease risk factors among a population-based probability sample in rural Zambia', *PLOS ONE*, 13(11), p. e0208176. Available at: https://doi.org/10.1371/journal.pone.0208176.

Tateyama, Y. *et al.* (2019) 'Dietary habits, body image, and health service access related to cardiovascular diseases in rural Zambia: A qualitative study', *PLOS ONE*, 14(2), p. e0212739. Available at: https://doi.org/10.1371/journal.pone.0212739.

Thow, A.M. *et al.* (2016) 'Toward food policy for the dual burden of malnutrition: an exploratory policy space analysis in India', *Food and nutrition bulletin*, 37(3), pp. 261–274.

Thow, A.M. *et al.* (2018) 'Improving policy coherence for food security and nutrition in South Africa: a qualitative policy analysis', *Food Security*, 10(4), pp. 1105–1130. Available at: https://doi.org/10.1007/s12571-018-0813-4.

Thow, A.M. *et al.* (2021) 'Understanding the Impact of Historical Policy Legacies on Nutrition Policy Space: Economic Policy Agendas and Current Food Policy Paradigms in Ghana', *International Journal of Health Policy and Management*, 10(Special Issue on Political Economy of Food Systems), pp. 909–922. Available at: https://doi.org/10.34172/ijhpm.2020.203.

Thow, A.M. and McGrady, B. (2014) 'Protecting policy space for public health nutrition in an era of international investment agreements', *Bulletin of the World Health Organization*, 92, pp. 139–145.

Tillotson, J.E. (2004) 'America's obesity: conflicting public policies, industrial economic development, and unintended human consequences', *Annual review of nutrition*, 24, p. 617.

Tugendhaft, A. *et al.* (2016) 'Cost of inaction on sugar-sweetened beverage consumption: implications for obesity in South Africa', *Public Health Nutrition*, 19(13), pp. 2296–2304. Available at: https://doi.org/10.1017/S1368980015003006.

Turner, C. *et al.* (2018) 'Concepts and critical perspectives for food environment research: A global framework with implications for action in low-and middle-income countries', *Global food security*, 18, pp. 93–101.

Turner, C. *et al.* (2020) 'Food Environment Research in Low- and Middle-Income Countries: A Systematic Scoping Review', *Advances in Nutrition*, 11(2), pp. 387–397. Available at: https://doi.org/10.1093/advances/nmz031.

UN (2011) *Political declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases*. New York: United Nations.

UNICEF (2019) *State of the World's Children 2019. Children, Food and Nutrition: Growing well in a changing world*. New York: UNICEF. Available at: https://www.unicef.org/media/63016/file/SOWC-2019.pdf?_sm_au_=iVV2jPNrqtsmf03HCsHGjKsjFQJVc (Accessed: 12 December 2019).

United Nations (2016) *Transforming our world: the 2030 Agenda for Sustainable Development*. United Nations. Available at: https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf (Accessed: 6 May 2021).

United Nations (2017) 'UN Decade of Action on Nutrition 2016 to 2025'. United Nations. Available at: https://www.who.int/nutrition/decade-of-action/workprogramme-doa2016to2025-en.pdf?ua=1 (Accessed: 6 May 2021).

Ustjanauskas, A.E., Harris, J.L. and Schwartz, M.B. (2014) 'Food and beverage advertising on children's web sites', *Pediatric Obesity*, 9(5), pp. 362–372. Available at: https://doi.org/10.1111/j.2047-6310.2013.00185.x.

Verguet, S. *et al.* (2020) 'The Broader Economic Value of School Feeding Programs in Low- and Middle-Income Countries: Estimating the Multi-Sectoral Returns to Public Health, Human Capital, Social Protection, and the Local Economy', *Frontiers in Public Health*, 8. Available at: https://www.frontiersin.org/article/10.3389/fpubh.2020.587046 (Accessed: 27 February 2022).

Vogel, E.M., Burt, S.D. and Church, J. (2010) 'Case study on nutrition labelling policy-making in Canada', *Canadian Journal of Dietetic Practice and Research*, 71(2), pp. 85–92.

Wagenaar, B.H. *et al.* (2015) 'Using routine health information systems for well-designed health evaluations in low-and middle-income countries', *Health policy and planning*, 31(1), pp. 129–135.

Walt, G. and Gilson, L. (1994) 'Reforming the health sector in developing countries: the central role of policy analysis', *Health policy and planning*, 9(4), pp. 353–370.

Weber, K., Story, M. and Harnack, L. (2006) 'Internet food marketing strategies aimed at children and adolescents: a content analysis of food and beverage brand web sites', *Journal of the American Dietetic Association*, 106(9), pp. 1463–1466.

Wechsler, H. *et al.* (2000) 'Using the school environment to promote physical activity and healthy eating', *Preventive medicine*, 31(2), pp. S121–S137.

WHO (2004) 'Global Strategy for Diet and Physical Activity'. World Health Organization. Available at: https://www.who.int/dietphysicalactivity/strategy/eb11344/strategy_english_web.pdf (Accessed: 6 May 2021).

WHO (2010) 'Set of recommendations on the marketing of foods and non-alcoholic beverages to children'. World Health Organization. Available at: http://apps.who.int/iris/bitstream/handle/10665/44416/9789241500210_eng.pdf?sequence=1 (Accessed: 6 May 2021).

WHO (2013) *Global action plan for the prevention and control of noncommunicable diseases 2013-2020*. World Health Organization.

WHO (2014a) 'Comprehensive Implementation Plan for Maternal, Infant and Young Child Nutrition'. World Health Organization. Available at: https://apps.who.int/iris/bitstream/handle/10665/113048/WHO_NMH_NHD_14.1_eng.pdf.

WHO (2014b) 'Global school-based student health survey'. Available at: https://www.who.int/ncds/surveillance/gshs/methodology/en/ (Accessed: 15 January 2020).

WHO (2015) *Fiscal Policies for Diet and Prevention of Noncommunicable Diseases*. Geneva: World Health Organization. Available at: https://apps.who.int/iris/bitstream/handle/10665/250131/9789241511247-eng.pdf?sequence=1 (Accessed: 28 April 2019).

WHO (2016) *The double burden of malnutrition: policy brief*. World Health Organization.

WHO (2017) 'Tackling NCDs: "best buys" and other recommended interventions for the prevention and control of noncommunicable diseases'. World Health Organization.

WHO (2018) *Adolescents: health risks and solutions*. Available at: https://www.who.int/news-room/fact-sheets/detail/adolescents-health-risks-and-solutions (Accessed: 17 January 2020).

WHO (2019) *Healthy diet*. World Health Organization. Regional Office for the Eastern Mediterranean.

WHO (2020) *Malnutrition*. Available at: https://www.who.int/health-topics/malnutrition#tab=tab_1 (Accessed: 1 March 2023).

WHO and FAO (2014) 'Second International Conference on Nutrition: Framework of Action'. World Health Organization and Food and Agriculture Organization. Available at: http://www.fao.org/3/ml542e/ml542e.pdf (Accessed: 6 May 2021).

Willett, W. *et al.* (2019) 'Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems', *The Lancet*, 393(10170), pp. 447–492.

Williams, S.N. (2015) 'The incursion of "Big Food" in middle-income countries: a qualitative documentary case study analysis of the soft drinks industry in China and India', *Critical Public Health*, 25(4), pp. 455–473. Available at: https://doi.org/10.1080/09581596.2015.1005056.

World Food Programme (2021) *Fill the nutrient gap: Zambia summary report*. Lusaka, Zambia: World Food Programme, National Food and Nutrition Commisssion. Available at: https://docs.wfp.org/api/documents/WFP-0000131212/download/ (Accessed: 3 November 2022).

Wu, Y. *et al.* (2021) 'Growing fast food consumption and obesity in Asia: Challenges and implications', *Social Science & Medicine*, 269, p. 113601. Available at: https://doi.org/10.1016/j.socscimed.2020.113601.

Zezza, A. *et al.* (2017) 'Food counts. Measuring food consumption and expenditures in household consumption and expenditure surveys (HCES). Introduction to the special issue', *Food Policy*, 72, pp. 1–6.

Ziba, F. and Phiri, M. (2017) *The expansion of regional supermarket chains: Implications for local suppliers in Zambia*. WIDER Working Paper.

Zipar (2022) '2023 National Budget Analysis'. Zambia Institute for Policy Analysis and Research.

Zyambo, K. *et al.* (2022) 'Selenium status in adults and children in Lusaka, Zambia', *Heliyon*, 8(6), p. e09782. Available at: https://doi.org/10.1016/j.heliyon.2022.e09782.

Appendices

Appendix 1: Food frequency questionnaire

Instructions for completion.

1. First, fill out below the personal information

2. Mark with an 'X' the frequency with which you consumed the food recorded: never, seldom (less than once a month); number of times per month, week or day.

3. Mark with an 'X' the source from where you obtained the food item most of the time: Home, Street vendor, Katemba, Grocery, Supermarket,

4. If you have a question, please ask the research assistance for help.

3. Once complete, hand back this sheet to the research assistant.

Section A: PERSONAL INFORMATION

Name of school		
Age		
Gender	Male	
	Female	
Residence		
Amount of pocket money per week		
How many people do you live with at home		
Is your primary guardian employed	Yes	
	No	
On average you consider your household (Tick 0ne)	Poor	
	Non-poor	

Section B: DIETARY BEHAVIOURS (Adapted from Global School Health Survey(WHO, 2014b)**)**

During the past 30 days, how often did you eat breakfast?	a. Never
	b. Rarely
	c. Sometimes
	d. Most of the time
	e. Always
2. How do you describe your weight?	a. Very underweight
	b. Slightly underweight
	c. About the right weight
	d. Slightly overweight
	e. Very overweight
Which of the following are you trying to do about your weight?	a. I am not trying to do anything about my weight
	b. Lose weight
	c. Gain weight
	d. Stay the same weight

4. During the past 12 months, have you been weighed and measured?	a. Yes b. No
5. What is the main reason you do not eat breakfast?	a. I always eat breakfast b. I do not have time for breakfast c. I cannot eat early in the morning d. There is not always food in my home e. Some other reason
6. During the past 30 days, did you exercise to lose weight or to keep from gaining weight?	a. Yes b. No
During the past 30 days, did you take any diet pills, powders, or liquids without a doctor's advice to lose weight or to keep from gaining weight?	a. Yes b. No
8. During the past 30 days, did you eat less food, fewer calories, or foods low in fat to lose weight or to keep from gaining weight?	a. Yes b. No
9. During the past 30 days, did you go without eating for 24 hours or more (also called fasting) to lose weight or to keep from gaining weight?	a. Yes b. No
10. During the past 30 days, did you vomit or take laxatives to lose weight or to keep from gaining weight?	a. Yes b. No
11. During the past 30 days, did you exercise to gain weight?	a. Yes b. No
12. During the past 30 days, did you eat more food, more calories, or foods high in fat to gain weight?	a. Yes b. No
During the past 30 days, did you take any pills, powders, or liquids without a doctor's advice to gain weight?	a. Yes b. No
14. During the past 30 days, how often did you bring your lunch to school?	a. Never b. Rarely c. Sometimes d. Most of the time e. Always
15. During the past 30 days, how often was breakfast offered to you at school?	a. Never b. Rarely c. Sometimes d. Most of the time e. Always
16. During the past 30 days, how often was lunch offered to you at school?	a. Never b. Rarely c. Sometimes

	d. Most of the time e. Always
The next 7 questions ask about how carbonated soft drinks, such as Coca cola, Fanta, Appy Apple (Do not include diet soft drinks) and foods from fast food restaurants, such as Hungry lion, Steers, Debonairs, Pizza in are advertised and sold	
21. When you watch television, videos, or movies, how often do you see advertisements for carbonated soft drinks or fast foods?	a. I do not watch television, videos, or movies b. Never c. Rarely d. Sometimes e. Most of the time f. Always
22. During the past 30 days, how many advertisements for carbonated soft drinks or fast foods did you see when you watched television?	a. I did not watch television during the past 30 days b. A lot c. A few d. None
23. During the past 30 days, how many advertisements for carbonated soft drinks or fast foods did you see on the internet?	a. I did not use the internet during the past 30 days b. A lot c. A few d. None
24. During the past 30 days, how many text messages or mobile phone calls did you get that encouraged you to go to a carbonated soft drink or fast food company website?	a. I did not receive text messages or mobile phone calls during the past 30 days b. A lot c. A few d. None
25. Can you buy carbonated soft drinks or get them for free in your school?	a. Yes b. No
26. Can you buy fast foods or get them for free in your school?	a. Yes b. No
27. During the past 30 days, how many advertisements for carbonated soft drinks or fast foods did you see in your school?	a. I did not see any advertisements for carbonated soft drinks or fast foods in my school b. A lot c. A few d. None
Knowledge, Attitudes, Skills, and Sources of Information	
28. During this school year, were you taught in any of	a. Yes b. No

your classes the benefits of healthy eating?	c. I do not know
29. During this school year, were you taught in any of your classes the benefits of eating more fruits and vegetables?	a. Yes b. No c. I do not know
30. During this school year, were you taught in any of your classes how to safely prepare or store food?	a. Yes b. No c. I do not know
31. During this school year, were you taught in any of your classes healthy ways to gain weight?	a. Yes b. No c. I do not know
32. During this school year, were you taught in any of your classes healthy ways to lose weight?	a. Yes b. No c. I do not know

Section C: FOOD FREQUENCY QUESTIONNAIRE (Adapted from Food and Agriculture Organisation (Food and Agriculture Organisation, 2018))

	FREQUENCY ***(Select only 1 response)***						SOURCE *(Select all that applies)*			
FOOD ITEMS	**Never**	**Seldom (less than a month)**	**1 – 3 per month**	**1 – 2 per week**	**3 – 4 per week**	**Daily**	**Home**	**Street vendor**	**Katemba**	**Grocery**
Cereals										
Nshima (breakfast)										
Nshima (roller)										
Rice										
Wheat (bread, buns)										
Pasta (Spaghetti, macaroni)										
Samp										
Sorghum										
Millet										
Roots										
Busala										
Cassava (fresh)										
Cassava flour										
Potato (Irish)										

Potato (Sweet)										
Cassava roasted										
Chikanda										
Yam										
Pulses/nuts										
Dried beans										
Ground nuts dried or paste										
Cowpeas										
Green peas										
Soya										
Pumpkin seed										
Vegetables										
Cucumber										
Rape										
Cabbage										
Spinach										
Carrot										
Broccoli										
Green pepper										
Lettuce										
Green beans										
Kalembula										
Chibwabwa										
Bondwe										
Okra										
Beans leaves										
Indigenous										
Katapa										
Wild mushroom										
Cowpea leaves										
Impwa										
Lumanda										
Pumpkin										
Spinach										
Fruits										
Banana										
Orange										
Pawpaw										
Guava										
Pineapple										
Mango										
Apple										
Masuku										
Baobab (Chibuyu)										

Grapes										
Lemon										
Strawberry										
Masau										
Mulberry										
Tamarind										
Watermelon										
Tungai										
Meat										
Chicken										
Chicken fried										
Game meat										
Beef										
Pork										
Goat										
Rabbit										
Fish										
Dried Kapenta										
Fresh kapenta										
Dried fish										
Fresh fish										
Eggs										
Insects										
Caterpillars										
Crickets										
Grasshoppers										
Inswa										
Milk										
Fresh milk										
Powdered milk										
Condensed milk										
Goat milk										
Soy milk										
Sour milk										
Ice cream										
Yoghurt										
Cheese										
Oils										

Cooking oil										
Margarine (Blueband)										
Butter										
Palm oil										
Beverages										
Mango juice										
Orange juice										
Munkoyo										
Chibwantu										
Sugar										
Snacks										
Crisps										
Jiggies										
Chips										
Fritters										
Roasted groundnuts										
Freezit										
Cocacola/fanta/sprite										
Other carbonated (appy apple, mojo)										
Energy drink (wildcat, kungfu, red bull)										
Pure fruit juice										
Munkoyo/										
Chocolate										
Other sweets										
Cake										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Appendix 2: Adolescent focus group discussion guide

Length: 90 to 120 minutes

Study Summary

The main objective of this study is to understand the factors that influence consumer dietary decisions and analyse the potential for policies to shape food environments. In this discussion, we are going to ask questions to understand how you interact with the food environment to acquire and consume food and your understanding of healthy food.

Introduction

1. Which foods are mostly consumed by people your age? Why?
2. What kind of food do young people your age consider to be healthy? Why?
3. What kind of food do young people your age consider to be unhealthy? why?

Availability

4. Which types of foods and food sources are available in and around your school? Why?
5. Which types of foods and food sources would young people want to be available in and around your school and community? Why?
6. How has the availability of foods been affected during the Covid-19 crisis changed?

Prices

7. How is the price of different food types that are mainly consumed by young people like you?
8. How has the pricing of different food affected during the Covid-19 crisis?

Vendors and product property

9. What do young people like you consider when deciding on a place to source food from? Why are these factors important?
10. What do young people like you consider when deciding what kind of food to buy? Why are these factors important?
11. How was your decision on what to consider when deciding on a place to source food from impacted by the Covid-19 crisis?

Marketing and regulation

12. What kind of food marketing strategies have you been exposed to?

Accessibility

13. What are the challenges that you experience in buying healthy food?
14. How were these challenges impacted during the Covid-19 crisis?

Affordability

15. Which food types are you unable to purchase in your current status?
16. How do young people like you feel about their ability to buy foods that is healthy?
17. How was your ability to buy food that is healthy impacted during the Covid-19 crisis?

Convenience

18. What makes it easy or difficult to eat healthy food?
19. What do you feel are some of the challenges people have in preparing or eating healthy foods?
20. How was your ability to prepare health foods impacted during the Covid-19 crisis?

Desirability

21. Which types of food are young people like you likely to prepare/ consume? Why?
22. What are the factors that influence choice of foods young people like you eat?
23. What would make young people like you to buy or eat healthy foods more often?

Appendix 3: Food environment observation guide

Purpose:

This check list will be used to record information on various aspects of the school food environment. This information will contribute to understanding the factors that influence consumer dietary decisions and analyse the potential for policies to shape food environments.

Food vendors (please tick)

Food vendors within walking distance of school	Yes	
	No	
Types of food vendors within walking distance of school	Steet vendor	
	Kantemba	
	Grocery	
	Fast food chain store	
	Supermarket	

Types of food sold by vendors within walking distance of school (please tick)

	Fast foods (fried chicken and chips, sausage and chips, pizza)	Snacks (crisp, jiggies, cake, doughnuts, biscuits, sweets)	Nshima	Fruit, fruit juice, salad	Carbonated and sugar sweetened beverage	Milk, yorghurt	Water
Street vendor							
Katemba							
Grocery							
Fast food store/restaurant							
Supermarket							

Presence of marketing material within school premises (Please tick)

Food adverts present within school premises	Yes	
	No	

Types of foods advertised within school premises (Please tick)

Fast foods (fried chicken and chips, sausage and chips, pizza)	
Snacks (crisp, jiggies, cake, doughnuts, biscuits, sweets, ice cream)	
Nshima	
Fruit, fruit juice, salad	
Carbonated and sugar sweetened beverage	
Milk, yoghurt	
Water	
Other	

Appendix 4: Data extraction sheet

General information				Food environment related policy provisions and recommendation					Guiding principles	
Document title	Issuing organisation	Year	Primary purpose	Healthy food provisioning	Nutrition education	Regulatory/ legislative/ economic measures	Nutrition sensitive social protection	Production of nutritious food	Governance	Multisectoral collaboration

Appendix 5: Policymakers interview guide

Introduction: The purpose of this interview is to understand your perception of adolescent nutrition problems in Zambia and how these can be addressed at policy level, using a food environment approach.

1. Briefly introduce yourself and your role in this organisation? What has been your involvement in nutrition policy making in Zambia?

Part 1: Understanding of the problem (Ideas and framing)

2. In your opinion, what are the major nutrition problems currently affecting adolescents in Zambia?

Probes:

- *Is undernutrition a problem, why or why not?*
- *Is over-nutrition a problem, why or why not?*
- *What is causing these nutrition problems?*

3. Based on your observations, how is the government addressing nutrition problems in adolescents at policy level?

Probes:

- *Should governments play a role in addressing nutrition problems? Why or why not?*
- *If yes, what role should government play in addressing nutrition related problems?*

Part 2: Addressing the evidence

In the earlier stages of this study, we researched adolescent dietary patterns as well as the determinants of these patterns. We found that the snacking dietary pattern (characterized by consumption of processed food high in sugar, salt and fats) was prevalent among adolescents. Adolescents said that junk food is readily available affordable and desirable as compared to healthy foods. Our observations of food vendors in and around the school environment also found wide availability of junk food

4. Our findings show that school food environments are largely unhealthy, leading to unhealthy dietary patterns in adolescents. What are your thoughts on these findings? Do you think that adolescent diets should be an issue for policy intervention by governments?
5. What policy options might contribute to making school food environment healthier?

Probes:

- *Are there opportunities within existing policies or institutions that can be leveraged?*
- *Who has interests in this policy issue?*
- *Who should be leading this and why? Is there a particular government ministry? What role can your organisation play?*
- *What are the possible facilitators/barriers to policy development or implementation? Who are the stakeholders?*

Part 3: Case study of policy options

6. Regulating marketing of unhealthy foods to children is one of the recommended policy actions to address nutrition problems in children as it reduces the desirability of unhealthy food options. Is introduction of marketing regulation of unhealthy foods to children feasible for the Zambian context? What would be required to develop (and implement) such a policy measure?

Probes:

- *Who are the key stakeholders and what are their interests? Who might be supportive? Who might oppose? What role can your organisation play?*
- *How can the policy get on the agenda? Who would lead the policy development and implementation? What would be the potential facilitators and barrier to implementation?*
- *How would this policy compare with Zambia's statutory instrument restricting marketing of breast milk supplements?*

7. Healthy food provisioning including restriction of foods sold by vendors in and around the school environment has potential to improve availability of health food while limiting availability of unhealthy foods. Is introduction of healthy food provisioning policies feasible for the Zambian context? What would be required to develop (and implement) such a policy measure?

Probes:

- *Who are the key stakeholders and what are their interests? Who might be supportive? Who might oppose? What role can your organisation play?*
- *How can the policy get on the agenda? Who would lead the policy development and implementation? What would be the potential facilitators and barrier to implementation?*

8. As I've mentioned, one aim of our research is to identify opportunities to promote healthy school food environments in Zambia and support healthy diets in adolescents – is there anything else that we need to know or understand to achieve this aim?

Appendix 6: Ethics approval – University of the Western Cape

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50 YEARS *of hope, action & knowledge*

19 August 2020

Ms MM Mukanu
School of Public Health
Faculty of Community and Health Sciences

Ethics Reference Number:	HS20/6/19
Project Title:	Development of evidence-based context appropriate public policy reform models that coherently promote healthy food environments and food consumption patterns in Zambia.
Approval Period:	17 August 2020 – 17 August 2023

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report by 30 November each year for the duration of the project.

The permission to conduct the study must be submitted to HSSREC for record keeping purposes.

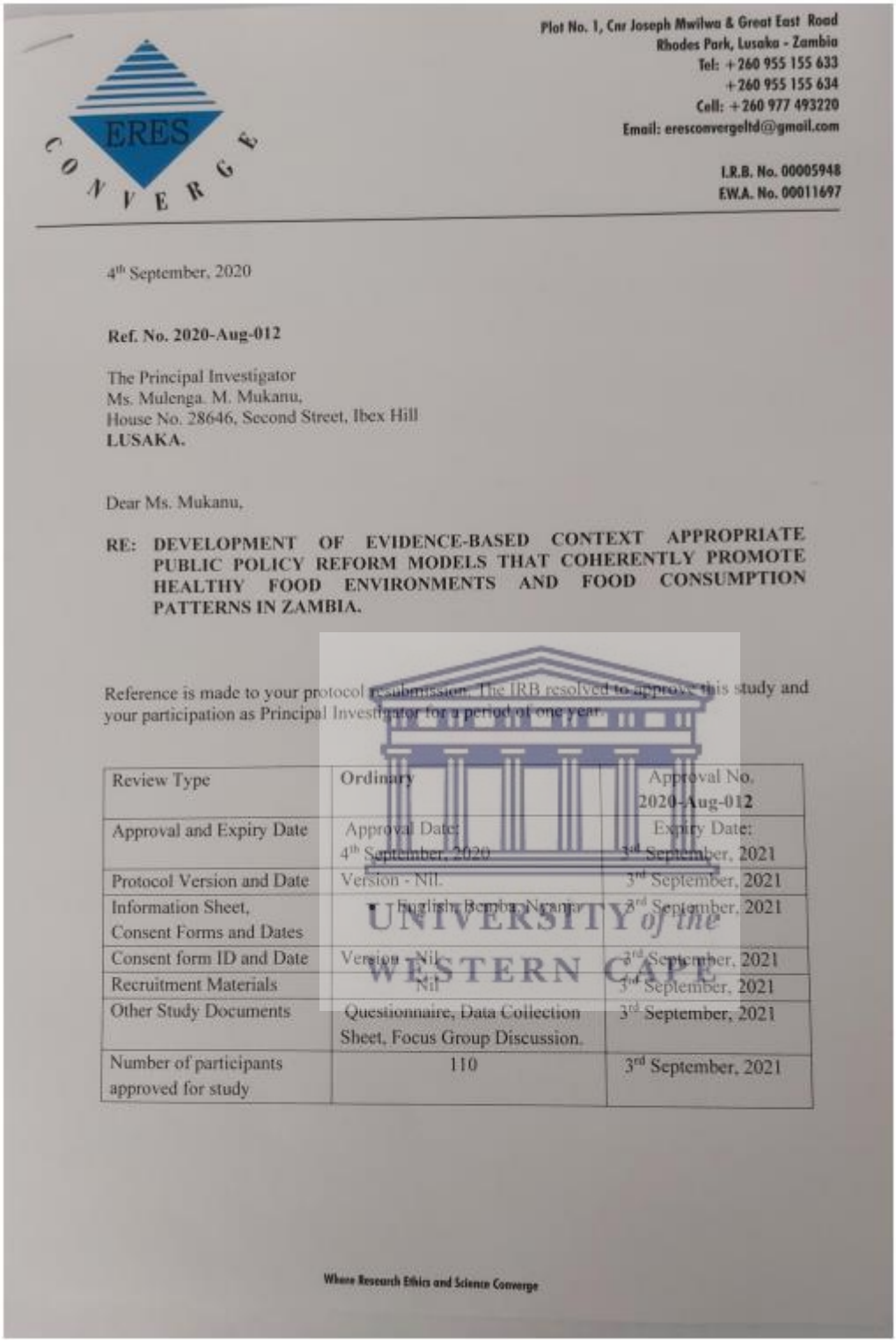
The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

Director: Research Development
University of the Western Cape
Private Bag X 17
Bellville 7535
Republic of South Africa
Tel: +27 21 959 4111
Email: research-ethics@uwc.ac.za

NHREC Registration Number: HSSREC-130416-049

Appendix 7: Ethics approval – Zambia



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Cell: +260 977 493220
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I.R.B. No. 00005948
F.W.A. No. 00011697

4th September, 2020

Ref. No. 2020-Aug-012

The Principal Investigator
Ms. Mulenga. M. Mukanu,
House No. 28646, Second Street, Ibex Hill
LUSAKA.

Dear Ms. Mukanu,

RE: DEVELOPMENT OF EVIDENCE-BASED CONTEXT APPROPRIATE PUBLIC POLICY REFORM MODELS THAT COHERENTLY PROMOTE HEALTHY FOOD ENVIRONMENTS AND FOOD CONSUMPTION PATTERNS IN ZAMBIA.

Reference is made to your protocol resubmission. The IRB resolved to approve this study and your participation as Principal Investigator for a period of one year.

Review Type	Ordinary	Approval No. 2020-Aug-012
Approval and Expiry Date	Approval Date: 4th September, 2020	Expiry Date: 3rd September, 2021
Protocol Version and Date	Version - Nil.	3rd September, 2021
Information Sheet, Consent Forms and Dates	• English, Bemba, Nyanja	3rd September, 2021
Consent form ID and Date	Version - Nil	3rd September, 2021
Recruitment Materials	Nil	3rd September, 2021
Other Study Documents	Questionnaire, Data Collection Sheet, Focus Group Discussion.	3rd September, 2021
Number of participants approved for study	110	3rd September, 2021

Where Research Ethics and Science Converge

Specific conditions will apply to this approval. As Principal Investigator it is your responsibility to ensure that the contents of this letter are adhered to. If these are not adhered to, the approval may be suspended. Should the study be suspended, study sponsors and other regulatory authorities will be informed.

Conditions of Approval

- No participant may be involved in any study procedure prior to the study approval or after the expiration date.
- All unanticipated or Serious Adverse Events (SAEs) must be reported to the IRB within 5 days.
- All protocol modifications must be IRB approved prior to implementation unless they are intended to reduce risk (but must still be reported for approval). Modifications will include any change of investigator/s or site address.
- All protocol deviations must be reported to the IRB within 5 working days.
- All recruitment materials must be approved by the IRB prior to being used.
- Principal investigators are responsible for initiating Continuing Review proceedings. Documents must be received by the IRB at least 30 days before the expiry date. This is for the purpose of facilitating the review process. Any documents received less than 30 days before expiry will be labelled "late submissions" and will incur a penalty.
- Every 6 (six) months a progress report form supplied by ERES IRB must be filled in and submitted to us.
- A reprint of this letter shall be done at a fee.

Should you have any questions regarding anything indicated in this letter, please do not hesitate to get in touch with us at the above indicated address.

On behalf of ERES Converge IRB, we would like to wish you all the success as you carry out your study.

Yours faithfully,
ERES CONVERGE IRB

Dr. Jason Mwanza
Dip. Clin. Med. Sc., BA., M.Soc., PhD
CHAIRPERSON

Appendix 8: National Health Research Authority approval

NATIONAL HEALTH RESEARCH AUTHORITY
Paediatric Centre of Excellence, University Teaching Hospital, P.O. Box 30075, LUSAKA
Tell: +260211 250309 | Email: znhrasec@gmail.com | www.nhra.org.zm

Ref No: NHRA00006/7/09/2020 **Date: 7th September, 2020**

The Principal Investigator
Ms. Mulenga M. Mukanu,
House No. 28646, Second Street, Ibex Hill
Lusaka, Zambia.

Dear Ms. Mukanu,

Re: Request for Authority to Conduct Research

The National Health Research Authority is in receipt of your request for authority to conduct research titled **"DEVELOPMENT OF EVIDENCE-BASED CONTEXT APPROPRIATE PUBLIC POLICY REFORM MODELS THAT COHERENTLY PROMOTE HEALTHY FOOD ENVIRONMENTS AND FOOD CONSUMPTION PATTERNS IN ZAMBIA."** I wish to inform you that following submission of your request to the Authority, our review of the same and in view of the ethical clearance, this study has been approved on condition that:

1. The relevant Provincial and District Medical Officers where the study is being conducted are fully appraised;
2. Progress updates are provided to NHRA quarterly from the date of commencement of the study;
3. The final study report is cleared by the NHRA before any publication or dissemination within or outside the country;
4. After clearance for publication or dissemination by the NHRA, the final study report is shared with all relevant Provincial and District Directors of Health where the study was being conducted, University leadership, and all key respondents.

Yours sincerely,

Prof. Godfrey Biemba
Director/CEO
National Health Research Authority

All correspondences should be addressed to the Director/CEO National Health Research Authority