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DEPARTMENT OF COMMUNITY HEALTH

ASSESSING THE FOOD ENVIRONMENT IN URBAN POOR COMMUNITIES

BY

DEBORAH ESAA LARBI-SARPONG

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DECLARATION

I hereby declare that this submission is my work for the master of public health degree (MPH) and that, to the best of my knowledge, it does not contain any material previously published by any person or material accepted for the granting of any other degree from the college, except where proper attribution has been indicated in the text.

Deborah Esaa Larbi-Sarpong

(237100263)



28/08/2024

(Student's Name & ID)

Signature

Date

Certified by:

Dr Sandra Boatemaa Kushitor

(Supervisor's Name)

Signature

Date

Certified by:

Dr Stephen Manortey

.....

.....

(Head of Academics Program)

Signature

Date

DEDICATION

To my mother, Grace Adukwei Spong- your support, encouragement and love has brought me thus far.

To my wonderful supervisor for granting me audience whenever I needed it and guiding me through this journey.

To the most supportive friend group, thank you for listening to all my complaints and encouraging me whenever I needed a pep talk.

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DEFINITION OF TERMS

FOOD ENVIRONMENT

Food environment refers to 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

NON-COMMUNICABLE DISEASES

Non-communicable diseases are diseases that are not spread through infection or through other people, but are typically caused by unhealthy behaviours.

LIST OF ABBREVIATIONS

CARE-Diabetes	Contextual Awareness, Response and Evaluation; Diabetes
CoD	Cost of Diet
CoRD	Cost of Recommended Diet
FFR	Fast-food restaurants
GIS	Geographical Information Systems
GPS	Geographical Positioning System
GPS	Global Positioning System
HF	Heart Failure
NCDs	non-communicable diseases
NMIMR	Noguchi Memorial Institute for Medical Research
NR-NCDs	Nutrition-related non-communicable diseases
QGIS	Quantum Geographical Information Systems
SDGs	Sustainable Development Goals
WHO	World Health Organization

ABSTRACT

Background: The food environment represents the range of foods that can be accessed in the context where people live and can enable or restrict healthy dietary choices. This includes the availability, affordability, convenience, and desirability of food, as well as the sustainability properties of food and beverages. Understanding the environmental factors influencing dietary behaviors is crucial in addressing the rising prevalence of non-communicable diseases, particularly in low-resource settings like urban poor communities in Ghana. This study assessed the food environment in James Town and Ussher Town, in Accra, Ghana.

Research methodology: This study used data from the Contextual Awareness, Response and Evaluation; Diabetes (CARE Diabetes) project. Geographic information Systems was used to map food vendors and markets in the community during the data collection between November and December 2022. A combination of spatial and statistical analysis tools was used to analyse the characteristics of the food environment including heat maps

Results/Findings: The food environment in Ga-Mashie was characterized by a predominance of traditional staple foods, including banku, fufu, kenkey, and rice-based dishes. The mapping exercise identified 2,862 food items, with a significant portion categorized as green-labelled foods under the Traffic Light Food Labelling System, indicating high fibre content and nutritional value. The study also identified a presence of ultra-processed foods, though they were less common, posing potential risks for non-communicable diseases (NCDs).

Conclusion: This study aimed to assess the food environment in Ga-Mashie, with a focus on quantifying the various types of food vendors and classifying available foods using both the Traffic Light Labelling System and the NOVA Food Classification System. The findings revealed a predominantly informal food retail system, characterized by a rich variety of community staples that are high in fibre and integral to the local diet.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The food environment includes environmental elements that affect food choices and nutritional status (Vanderlee and L'Abbé, 2017). This encompasses the availability, cost, convenience, and appeal of food, as well as the sustainability of food and beverages (Downs *et al.*, 2020). Poor food choices in these settings have been directly connected to the rise in noncommunicable illnesses such as obesity, diabetes, and cardiovascular disease. Given the fast epidemiological and nutritional transitions, there is a need to encourage healthy dietary behaviors by developing healthier food environments (Hawkes *et al.*, 2020). For instance, a healthy food environment may promote access to fresh food products, offer affordable nutritious options, and prioritize sustainability practices in food production.

Chronic noncommunicable diseases (NCDs) are a serious worldwide health problem, accounting for a high share of global mortality, especially in low- and middle-income countries (Dugee *et al.*, 2018). According to estimates from 2023, non-communicable illnesses would account for 74% of all deaths worldwide, killing 41 million people year (World Health Organization, 2023). It is noteworthy that 77% of deaths attributable to NCDs occur in low- and middle-income nations (World Health Organization, 2023). This emphasizes the unequal distribution of the burden of NCD-related diseases in the world regions. Research suggests that the epidemiological and nutrition transition, characterized by a shift towards higher intake of simple carbohydrates and fat, and lower intake of complex carbohydrates, is a key driver of the increasing prevalence of non-communicable diseases (NCDs) worldwide (Gayathri, Ruchi and Mohan, 2017; Casari *et al.*, 2022; Popkin and Ng, 2022).

The rising incidence of nutrition-related non-communicable diseases has been linked to individual characteristics such as genetic susceptibility, high calorie intake, and sedentary lifestyles, according to previous study (NR-NCDs)(Imam and Ismail, 2017; Pradeilles *et al.*, 2021; Omotayo *et al.*, 2024). Recent data, however, indicates that the sharp increase in NR-NCDs observed globally may not be entirely explained by these proximal variables alone (Singhal, 2014). Emerging evidence suggests that distal factors, such as the food environment, significantly influence individuals' dietary behaviors and lifestyle choices, highlighting the need for a holistic approach to addressing the rising prevalence of NR-NCDs (Díez, Bilal and Franco, 2019). Understanding the environmental factors influencing dietary behaviors is crucial in addressing the rising prevalence of NCDs, particularly in low-resource settings like urban poor communities in Ghana.

In order to promote a healthy and active lifestyle, urban impoverished communities sometimes lack access to recreational facilities, social structures, and nutritious dietary options like fresh fruits and vegetables (Theuri, McCullough and Rennels, 2016). Food swamps and deserts multiply as a result of this. Food swamps are low socioeconomic level locations with high geographic access to non-nutritious food sources, while food deserts are defined as areas where vulnerable individuals have poor geographic access to nutritious food (Yang, Wang and Qiu, 2020). Although food swamps are thought to be more common than food deserts, in certain instances, their combined presence is a significant predictor of non-communicable diseases (NR-NCDs) (Cooksey-Stowers, Schwartz and Brownell, 2017; Luo, 2020).

In Ghana, like many other developing nations, the double burden of diseases persists alongside a rapid nutrition transition (Konkor and Kuuire, 2023). While infectious diseases such as malaria and tuberculosis remain prevalent, the country is also experiencing a rapid rise in nutrition related non-communicable diseases (NR-NCDs) such as diabetes, hypertension, and cardiovascular diseases (Amu *et al.*, 2021). In 2023, it was estimated that the prevalence of

NCDs in Ghana stood at 26.7% (Boakye *et al.*, 2023). Additionally, it is reported that NCDs accounted for about 43% of deaths within the country (World Health Organization, 2022).

Most of the research on the food environment has been conducted within more developed countries such as Canada. Although, there have been a few studies assessing the food environment in Ghana and other countries with similar demographic profiles (Dake *et al.*, 2016a; Osei-Kwasi *et al.*, 2021; Laar *et al.*, 2022), it is important to note that, the area of food environment research remains largely unexplored. Again, it was noticed that for the most part, non-communicable disease research in Africa is mostly focused on epidemiological research, focusing on prevalence and predictors and individual level characteristics amongst population subgroups (Mudie *et al.*, 2019). Landmark research on food environment in Africa, has demonstrated the need for more of such research (Laar *et al.*, 2022). Thus, the aim of this study is to assess the food environment within an urban poor community in Ghana's capital, to identify the primary sources of food, distinguish between healthy and unhealthy food options as well as determine the spatial distribution of healthy food sources within the community.

1.2 Problem Statement

The food environment in many urban areas of Ghana, such as Ga-Mashie, faces significant challenges that contribute to unhealthy dietary habits and, consequently, the rising burden of non-communicable diseases (NCDs) (Boatemaa, Badasu and de-Graft Aikins, 2018; Juma *et al.*, 2019). These challenges include the influence of extensive advertising for unhealthy foods, the widespread availability of these options, and the prevalence of convenience stores and street vendors offering low-nutrient, high-calorie foods (Adjei *et al.*, 2022; Amevinya *et al.*, 2022). These factors collectively create an obesogenic environment that encourages the consumption of energy-dense, nutrient-poor foods, leading to poor eating habits marked by a deficiency of fruits and vegetables and a significant degree of food insecurity (Dake *et al.*, 2016b).

The implications of these challenges are profound, as they contribute to the worsening NCD burden in Ghana. The prevalence of NCDs, including diabetes, hypertension, and cardiovascular diseases, continues to rise, placing a significant strain on healthcare systems and adversely affecting the quality of life of individuals (Amu *et al.*, 2021). For instance, by 2030, it is predicted that 18.6 million individuals in Africa will be affected by disease, a huge increase from the 7.1 million estimated in the early 2000s (Asamoah-Boaheng *et al.*, 2019). Specifically, Ghana's diabetes prevalence trends are similar to those of other sub-Saharan nations; previous research revealed a pitiful prevalence rate of less than 0.02% of adults, while more recent estimates range from 6.2% to 13.9% (Asamoah-Boaheng *et al.*, 2019). Moreover, the association between unhealthy diets and NCDs highlights the urgent need to address the root causes of poor dietary habits, including the detrimental influence of the food environment (Pradeilles *et al.*, 2021).

There is evidence linking the foods in a particular eating environment to an increased risk of NCDs. For example, a study conducted in Southeast Asia found that a higher percentage of fast-food restaurants (FFR) was connected with a 9.21 mg/dl blood glucose increase, while having at least one FFR in proximity was associated with a 2.14 mg/dl blood glucose increase.

Furthermore, a 1% increase in the proportion of FFR near a person's house was associated with an 8% increase in the likelihood of being clinically diagnosed with diabetes. Another study, which looked at the relationship between ready-to-eat food environments and the risk of heart failure (HF) in a large prospective cohort, discovered that the closeness and density of pubs, bars, and fast-food restaurants were related with an elevated risk of HF. The risk of HF increased as the distance to these food environments decreased and their density increased.

Despite the clear implications of the food environment on public health, there has been a notable policy neglect of this issue in Ghana. Government policies and regulations related to food advertising, food labelling, and the availability of healthy food options are lacking, exacerbating the challenges posed by the obesogenic environment (Laar *et al.*, 2020). Without adequate policy interventions to address these issues, the prevalence of NCDs is likely to continue escalating, further burdening the healthcare system and undermining efforts to promote public health.

Despite rising knowledge of the substantial impact of the food environment on dietary behaviors and non-communicable disease (NCD) prevalence, there remains a dearth of research focused on understanding how physical food environments drive dietary choices and behaviors, particularly within urban poor communities in African contexts (Green *et al.*, 2020; Osei-Kwasi *et al.*, 2021).

This gap in knowledge is particularly pronounced in urban poor communities, where the double burden of diseases persists alongside a rapid nutrition transition. Urban poor communities, characterized by limited access to healthy food options, face heightened risks of obesity and NCDs due to the proliferation of food deserts and food swamps.

Consequently, there is an urgent need to comprehensively assess the food environment within these communities to identify primary sources of food, distinguish between healthy and unhealthy options, and determine the spatial distribution of healthy food sources. This study intends to help create targeted treatments for generating healthier food environments and lowering the burden of NCDs among urban poor populations.

1.3 Rationale of the study

The study's significance stems from its potential to close crucial gaps in understanding the function of the food environment in affecting dietary choices and chronic disease prevalence,

particularly within urban poor communities in Ghana. By comprehensively assessing the food environment and identifying primary sources of food, distinguishing between healthy and unhealthy options, and determining the spatial distribution of healthy food sources, this research will inform targeted interventions aimed at creating healthier food environments. Healthy eating and favourable non-communicable disease (NCD) outcomes are critical for achieving Sustainable Development Goals (SDGs) 1 and 3, which focus on eradicating poverty and ensuring healthy lives for all. In communities like Ga-Mashie, where the food environment is dominated by informal markets offering predominantly ultra-processed, nutrient-poor foods, the risk of NCDs such as obesity, diabetes, and hypertension is significantly heightened. These health challenges not only burden individuals and families with medical costs but also limit economic productivity, perpetuating cycles of poverty. Ultimately, the findings have the potential to contribute to efforts to lessen the burden of noncommunicable diseases among vulnerable populations and advance public health initiatives in low-resource settings.

1.4 Conceptual framework

People's food choices and dietary practices are heavily influenced by their living settings, which contributes to the incidence of obesity and chronic diseases. Over the past decade, researchers have employed ecological models to construct conceptual frameworks for understanding the food environment and the dynamic interrelationships among elements that influence nutrition, obesity and NR-NCDs (Swinburn *et al.*, 2004; Glanz, 2009). Utilizing this past model and evidence, Li *et al.* (2016) developed a conceptual framework that describes how the food environment influences diet-related choices. In this concept, context refers to the government, industry actors, and other entities that have a macro-level impact on the food environment. Subsequently, community socio-demographic refers to the features of the community such as the culture, income, and other socioeconomic related elements that expose individuals to certain

food environments, dietary behaviors, and health conditions. In this context, rapid nutrition transition, overcrowding, urbanization etc are the characteristics of Ga-mashie that tend to influence the dietary behaviours of the inhabitants. It is believed that context, socio-demographic factors and the food environment interact to influence the dietary choices, which subsequently affect the health status of community members.

The food environment is contextualized along four dimensions: availability, accessibility, cost, and quality. The availability of food refers to the types and quantities of food options and food sources available to an individual (Figure 1). There are both healthy and harmful food options, such as fresh fruits and vegetables, as well as items heavy in sugar and sodium. Accessibility refers to the food supply's location and the ease with which it may be reached, such as distance and travel time. Affordability refers to the pricing, cost, and perceived value of food options. Finally, quality refers to people's views and standards toward food options and sources, such as food freshness, appearance, and safety.

This particular study focuses on the availability dimension of the food environment.

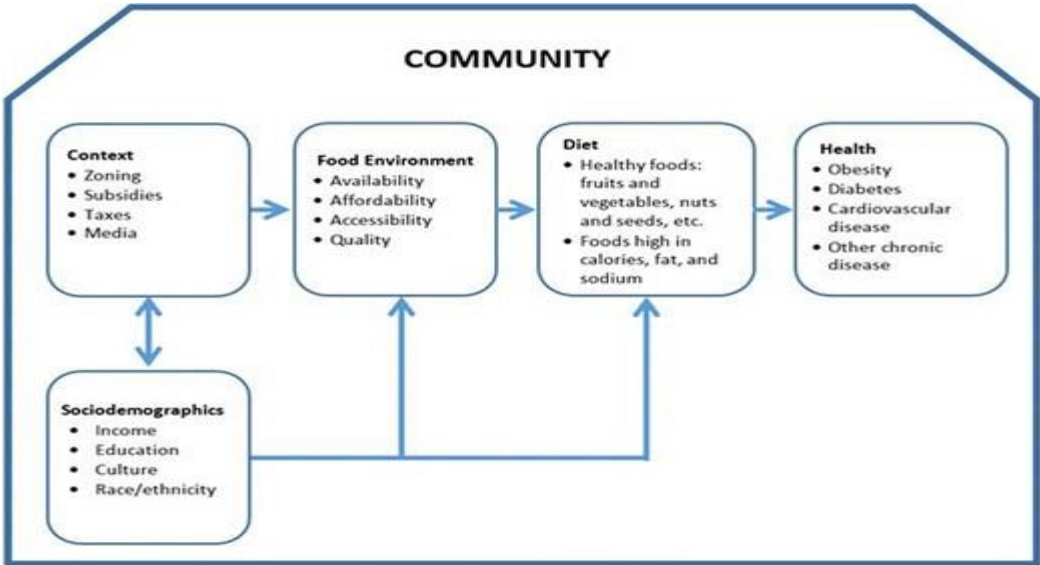


Figure 1.1 presents a conceptual framework for the food environment (Li *et al.*, 2016).

1.5 Research Questions

1. What are the main sources of food and food outlets operating within Ga-Mashie?
2. What is the composition of available food options in terms of their nutritional value, categorizing them as healthy or unhealthy using nutrition composition and NOVA classification?
3. How are healthy food sources distributed spatially within the Ga-Mashie community, and what factors influence their accessibility?

1.6 General Objectives

This study seeks to evaluate the food environment in Ga-Mashie.

1.7 Specific Objectives

Specifically, this study seeks to;

1. Identify the primary sources of food and food outlets within the Ga-Mashie community.
2. Assess the variety of food offerings available, distinguishing between healthy and unhealthy options using nutrition composition and NOVA classification.
3. Determine the spatial distribution and accessibility of healthy food sources within Ga-Mashie

1.8 Profile of study Area

Ga Mashie, which includes James Town and Ussher Town, covers approximately 100 hectares along the eastern bank of the Korle Lagoon on Accra's southwest coast. This densely populated metropolitan region, home to approximately 120,000 individuals, is characterized by poor socioeconomic level, inadequate literacy rates, substandard sanitary conditions, and largely old housing infrastructure.(Sanuade *et al.*, 2021). The housing landscape is predominantly composed of double-story compound homes made of sand-concrete blocks and bricks, with

roofing materials ranging from aluminum sheeting to slate or asbestos sheets. These structures are packed together and connected via passageways paved with blocks (Bloomberg, 2021). On average, each compound house accommodates over five families, with typically 10 to 15 rooms per property.

Ga Mashie has a mix of formal and informal healthcare providers, including the Ussher Town Polyclinic, a government-run facility. The village is primarily inhabited by the indigenous Ga people, with migrant groups from various places (de-Graft Aikins *et al.*, 2014). While fishing remains a key source of income, small-scale commerce and other economic ventures have gained popularity in the town. The London and Salaga markets are important trading hubs, selling a wide variety of local food and non-food items. Furthermore, street selling is a frequent practice among households, with popular staples like Kenkey being sold in front of many residences (Lule *et al.*, 2024).

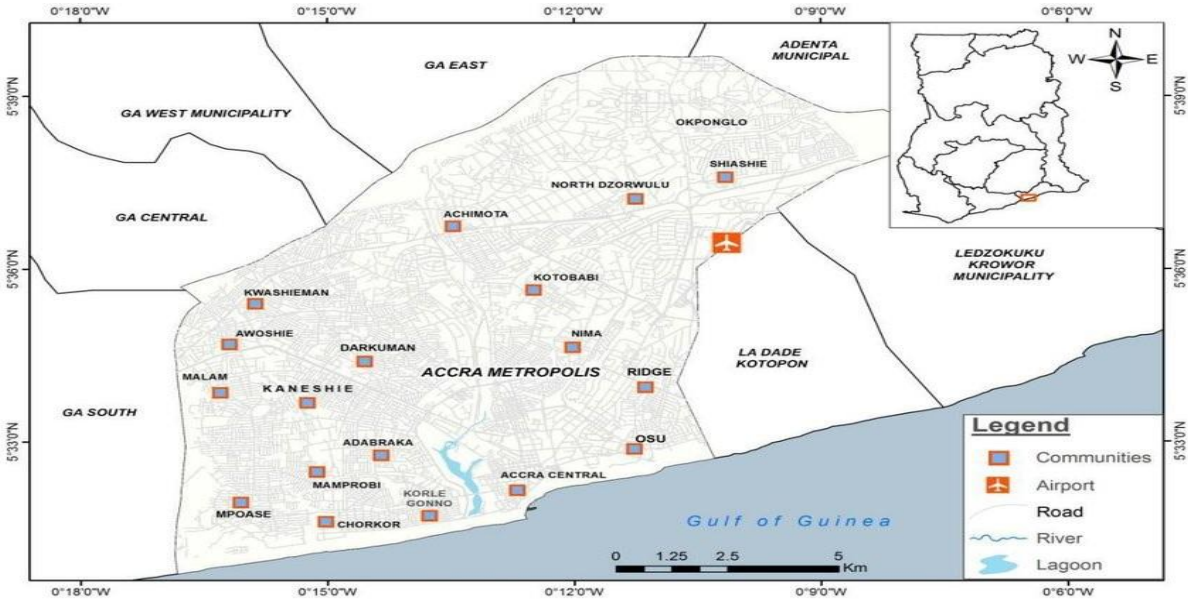


Figure 1.2 Map of Ga-Mashie

1.9 Organization of the report

This thesis is divided into five chapters, each of which contributes to a thorough knowledge of the research on the food environment in the Ga-Mashie community and its consequences for public health. The first chapter provides an overview of the study, including the background, problem statement, rationale, conceptual framework, research objectives, questions, study area profile, and research scope. The second chapter provides a review of pertinent literature on food environments, dietary patterns, and their impacts on non-communicable diseases, grounding the study in existing research. Chapter Three outlines the methodology employed, detailing the study design, data collection methods, inclusion and exclusion criteria, and the statistical analysis conducted. Chapter Four presents the results, offering insights into the geographic distribution of food outlets, the classification of food items, and the implications for dietary health. Chapter Five discusses the findings, contextualizing them within the broader literature and exploring their significance for public health policy and practice in similar urban poor communities. Finally, the thesis concludes with a summary of the findings, recommendations for future research

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter provides a comprehensive literature review on the food environment and its measurement, focusing on various dimensions and frameworks. Initially rooted in ecological research, the food environment has evolved to include human-built environments, such as neighbourhoods and institutional settings. This chapter examines the definitions, frameworks, and components of the food environment, emphasizing the shift from focusing on external factors to incorporating both external and personal influences on food choice. Furthermore, the chapter looks at the instruments used to measure various aspects of the food environment and reviews the present state of food environment research in Ghana, including major studies and their findings.

2.2 Definitions of the food environment

The concept of the food environment originated in ecological research, where it referred to the context and characteristics of food chains among various species, focusing on factors such as the nutritional quality and abundance of the food supply available to different herbivores within ecosystems.(Palo and Robbins, 1991). In the twenty-first century, the idea of the food environment was broadened to include the built environment in human and cultures (Hinkle and Loring, 1977), specifically, neighbourhoods (Morland, Wing Roux, 2002) and practices inside institutional settings, such as schools and workplaces in high income countries (French, 2005).

Increasingly, the linkages between the built food environment, diets and chronic diseases were explored from socio-ecological perspective to examine the factors that influenced the food choices of individuals (Downs *et al.*, 2020). The food environment can be distinguished into 2

main types (Ahmed and Herforth, 2017); Natural food habitats are sometimes referred to as subsistence and constructed food environments. The natural food environment consists of wild and cultivated habitats, whereas the built food environment, also known as the market or retail food environments.

The built food ecosystem includes both informal and formal markets. Informal food settings are those that are not formally governed through governance systems, such as wet markets, street vendors, kiosks, and mobile food sellers. On the other hand, formal markets food settings cover those that are regulated through formal governance structures, where sellers can openly advertise their locations and pricing, and include hypermarkets, supermarkets, merchants, farmer's markets, and restaurants (Ahmed and Herforth, 2017).

The food environment is referred to as an individual's interface with the food system that entails the availability, affordability, convenience, promotion and quality, as well as the longevity of foods and beverages in wild, cultivated, and built spaces that are affected by the socio-cultural, political, and ecosystems within which they are embedded (Downs, Ahmed and Herforth, 2020).

The food environment refers to the physical, economic, political, and socio-cultural framework in which consumers interact with the food system to make decisions. about procuring, preparing, and eating food(Drewnowski *et al.*, 2020); An interface between the wider food system and the individual through which decisions are made about food acquisition, preparation, and consumption behaviors (Constantinides *et al.*, 2021).

2.3 Frameworks of the food environment

Frameworks for the food environment have evolved over the years. Previous food environment frameworks predominantly focused on external factors, whilst more recent food environment frameworks seek to balance both external and personal factors (Toure *et al.*, 2021). The food environment framework proposed by Turner *et al.*, (2018) divides the food environment into 2

domains; External domain and Personal domain. The external domains include exogenous opportunities and constraints that influence food choice and features subdomains of availability, prices, vendor and product properties, marketing and regulations whereas the personal domains refer to individual-level influences on food choice and include accessibility, affordability, convenience and desirability. This framework contextualizes the food environment as an interface within the wider food environment (Turner *et al.*, 2018).

Scholars argue that most food environment frameworks are tailored to high income countries leading to the exclusion of the unique features of the food systems of most low- and middle-income countries (Turner *et al.*, 2020). To bridge this gap in the African context, a food environment framework composed of 103 factors which were peculiar to the African context was developed (Osei-Kwasi *et al.*, 2021). Out of the 103 factors identified, about half of them were individual level factors. This framework considered four different environmental levels i.e. individual, social environment. Physical environment and the macro environment. This framework builds on the socio-ecological framework to develop a context-sensitive food environment framework.

2.4 Elements of the food environment

2.4.1 Food availability and physical access

This refers to the quantity and diversity of the food options available in food outlets (markets, stores, restaurants) that can be physically accessed by people living in the surrounding area (Pradeilles *et al.*, 2021). This concept can also be extended to other settings where people spend most of their time, such as offices, schools, and universities, where food is often acquired through vending machines, canteens, nearby kiosks, and street food vendors

2.4.2 Food prices and affordability

This refers to the range of food options that constitute a healthy diet that are affordable to consumers (HLPE, 2017). This element is especially important in low- and middle-income country contexts where a huge proportion of income is spent on food.

Research indicates that food prices and affordability significantly influence dietary choices and health outcomes. Food prices and affordability are important determinants of food choices, obesity and non-communicable diseases (Russell, Whelan and Love, 2022). When healthier foods like fresh fruits, vegetables, and lean proteins are expensive or less accessible, individuals and families may be compelled to opt for cheaper, calorie-dense, and nutrient-poor alternatives (Lewis *et al.*, 2023). These options, often high in sugars, fats, and processed ingredients, are more affordable but contribute to the increased risk of non-communicable diseases (NCDs) such as obesity, diabetes, and hypertension.

Affordability influences not only the types of food people buy but also the quantity and quality of their diets. When the cost of living is high and incomes are low, people are more likely to prioritize quantity over quality, choosing foods that provide more calories for less money (French *et al.*, 2019). This economic constraint limits access to a balanced diet and reinforces unhealthy eating patterns, perpetuating health disparities.

2.4.3 Convenience and time savings

This encompasses vendor and product properties that reduce time or effort needed for acquiring, preparing, and consuming a food item. In addition to these factors, we recognize the time required for consumers to reach different typologies of food outlets (produce markets, convenience stores, supermarkets, etc.) available in the surrounding area as a key factor, as this can determine the kind of foods that be accessed (Herforth and Ahmed, 2015).

2.4.4 Promotion, advertising and information

This refers to the modalities through which food becomes attractive to consumers, such as promotional and advertising campaigns (discounts, product placement in stores,

advertisements, branding, etc.), including how the availability of nutrition information and messaging (food labels, food based dietary guidelines, health campaigns, etc.) can drive consumer food choices towards healthy eating (HLPE, 2017).

2.4.5 Food quality and safety

This refers to all the characteristics and attributes consumers value, and the perceived and actual safety associated with, food products (HLPE, 2017). Food quality also includes the nutrient density and the presence of unhealthy components (trans-fats, refined sugars, salt, additives, etc.

2.5 Measuring the food environment

Different tools have been developed to measure the different elements of the food environment.

Whilst some tools measure specific elements of the food environment, others can apply to multiple elements of the food environment. Measures and methodologies such as photovoice methodologies and geographic information system food environment reporting can apply to multiple elements of the food environment.

2.5.1 Photovoice

This is a participatory research methodology that has been widely applied in food environment research. It has been used in a variety of settings, including schools, low-income communities, and metropolitan neighborhoods. Participatory photography is a common tool for researching the food environment because it captures people's lived experiences with food acquisition and consumption. It argues that participants act as change agents for sustainable food systems and better health. The technique is useful for investigating various food environment typologies and scales, with an emphasis on consumers.

A study used photovoice to explore urban African American youth's perceptions of their food environments and diets, finding that youth had differing views on the availability of nutritious foods and frequently classified foods and people as either "healthy" or "unhealthy," suggesting

the need for tailored messaging strategies to improve diets in similar populations (Johnson et al,2017).

Another study which assessed the urban physical environments and how it drives dietary behaviours in both Ghana and Kenya (Pradeilles *et al.*, 2021). The use of photovoice methodologies allowed for a better understanding of food behaviors and associated issues from the participants' perspectives. This approach of participatory research is particularly significant for populations that face socioeconomic adversity and/or marginalization to ensure that their lived experiences are adequately captured.

2.5.2 Geographic Information System Food Environment Reporting (Geo-FERN)

This strategy employs geographic information systems to assess the retail food environment. It measures the spatial distribution of food outlets, calculates food outlet density, measures proximity to healthy food sources and estimates travel time to food outlets. It helps to identify areas with higher concentrations of food sources and assesses the physical accessibility of healthy options.

2.5.3 Metrics for food prices and affordability

2.5.3.1 The Cost of Recommended Diet (CoRD)

This is a measure of economic access to food, attempting to capture individuals' ability to afford the recommended diet. It is created by merging information on the recommended intake of each food category from the FBDGs with food costs (from primary or secondary sources). For each food group, the two least expensive food products are chosen, and their prices per unit are converted to prices per serving. Each food group is assigned a number of servings per day, allowing for the computation of the minimal cost that each individual must pay on a daily basis to afford the suggested diet (Cost of Nutritious Diet Consortium, 2018)

2.5.3.2 The Cost of Diet (CoD) tool

This tool investigates the effects of poverty on the purchase of healthful foods necessary to meet nutrient requirements. Based on linear programming, the tool combines price data over

time of a list of items that have been picked within a particular study area (60-200 foods) with data on household income and budget spending (Cost of Nutritious Diet Consortium, 2018). The selected foods are accompanied with information about their nutritious composition. The study of this data enables the determination of the lowest cost associated with four standardized diets, ranging from 'energy-only' to 'nutritious'. As a result, it is possible to estimate the population distribution across various diets.

2.5.4 Metrics for food quality and safety

2.5.4.1 The Produce Desirability (ProDes) tool

This tool using five observational measures (overall desirability, visual appeal, touch and firmness, aroma, and size), this study evaluates the extent to which fruit and vegetable qualities influence consumers' desire for those goods (Ahmed *et al.*, 2018).

2.6 Food Environment research in Ghana

Food environment research has gained traction in Africa and Ghana due to rapid nutrition transitions fuelled by globalization, rapid urbanization, and development across the context (Laar *et al.*, 2022) Over the years, one of the main drawbacks of food environment research in the African and Ghanaian context was its lack of context sensitivity (Mockshell *et al.*, 2022). Thus, Laar *et al.*, (2022) sought to identify priorities for food and environmental research in Africa. The study priorities listed were performing thorough research on the commercial determinants of nutrition and health, understanding the role of the informal retail sector, developing standardized instruments to profile food environments.

Additionally, they emphasized that research should focus on examining associations between food environment exposures and health outcomes, improving diet quality measurement, and capturing the consumption of ultra-processed foods. At the individual and community levels, it is essential to identify community priorities, develop strategies to promote healthier diets, and improve nutrition literacy (Laar *et al.*, 2022). At the macro level, priorities include evaluating existing interventions, mapping urban food environments, addressing the affordability of

healthy diets, and exploring innovative interventions and policies to improve food systems and nutrition (Laar *et al.*, 2022).

A research evaluating the availability of good and bad meals in current retail locations across two districts in Ghana's capital found that for every healthy food option, there were five ultra-processed options (Adjei *et al.*, 2022). This widespread availability of ultra-processed food options significantly threatens to increase the prevalence of nutrition-related non-communicable diseases. However, the study highlighted a notable limitation: while existing evidence strongly correlates ultra-processed foods with high levels of free/added sugars, sodium, and saturated fats, calorie density and the degree of processing are not foolproof indicators of a food's healthiness or lack thereof (Adjei *et al.*, 2022).

Another study investigated the prevalence and character of food and beverage advertising around elementary and junior high schools in Greater Accra, Ghana's most populous and urbanized district (Amevinya *et al.*, 2022). The study reported a proliferation of unhealthy food advertisements within the school food environment, posing a significant threat to the food acquisition and consumption patterns of school children in the region (Amevinya *et al.*, 2022). A notable limitation of this study was its inability to detect seasonal variations in marketing practices due to its cross-sectional design.

Furthermore, Dake *et al.*, (2016) who investigated the local food environment in an urban poor community concluded that it was suggestive of an obesogenic food environment defined by an abundance of out-of-home cooked foods, convenience stores, and a scarcity of fruits and vegetables options. After controlling for individual socio-demographic characteristics, lifestyle behaviors, and community characteristics, they hypothesized that every additional convenience store resulted in a 0.2 kg/m² increase in BMI and every out-of-home cooked food place resulted in a 0.1 kg/m² decrease in BMI. One stated drawback was that the distance from all respondents

to various food resource and physical activity venues could not be established since their exact position in the enumeration area (EA) was unknown, even though the EA in which they resided was known (Dake *et al.*, 2016b).

Furthermore, a photovoice study found that elements in the physical food environment influence dietary behaviors among low-income residents of three African cities. Purchasing power, food safety, and physical access to food were identified as major factors influencing participants' dietary behaviors (Pradeilles *et al.*, 2021).

2.7 Food environment, dietary intake and NCD risk

The food environment significantly influences dietary intake and obesity-related outcomes. Studies have shown that the presence of supermarkets in neighbourhoods is associated with increased fruit and vegetable consumption. Consumer food environment interventions, such as financial incentives and healthy food saliency, can improve dietary quality, while neighbourhood food environments impact fast-food consumption and BMI, especially in children and certain adult groups (Atanasova *et al.*, 2022). The modern food environment, characterized by increased consumption of refined carbohydrates and saturated fats, contributes to the development of noncommunicable diseases (Guleria, 2021). A complex adaptive system approach reveals that the food environment in low-income groups operates within a supply-and-demand economic paradigm, with five interconnected sub-systems influencing dietary intake (Sawyer *et al.*, 2021).

It is observed that due to determinants such as globalization, urbanization and commercialization, most sub-Saharan countries have experienced an increased availability of modern food items including sweetened carbonated soft drinks and fast foods, particularly in urban areas (Lin, Teymourian and Tursini, 2018). The increasing availability of calorie-dense foods within the food environment has constituted a built environment which has negative

connotations on dietary choices, obesity and physical activity especially within urban poor areas (Dixon et al., 2021).

2.8 Summary

The literature review has highlighted the complexity and multidimensional nature of the food environment. Definitions and frameworks have evolved to incorporate both external and personal factors that influence food choice. Measurement tools and methodologies have been developed to capture various elements of the food environment, such as availability, affordability, convenience, promotion, quality, and safety.

Despite the advancements in understanding and measuring the food environment, significant gaps remain, particularly in low- and middle-income countries like Ghana. Research priorities have been identified to address these gaps, emphasizing the need for context-sensitive studies that consider the unique features of African food systems. There is a pressing need to examine the informal retail sector's role, understand associations between food environment exposures and health outcomes, and develop interventions to improve diet quality and nutrition literacy.

In Ghana, studies have revealed a concerning prevalence of ultra-processed food options and unhealthy food advertising, particularly around schools. The local food environment in urban poor communities has been found to promote obesogenic behaviors, necessitating targeted interventions to promote healthier food choices. Future research should focus on addressing these challenges by evaluating existing interventions, mapping urban food environments, and exploring innovative policies to improve food systems and nutrition.

CHAPTER THREE

3.0 METHODOLOGY

3.0 Introduction

This chapter outlines the methodological approach employed in this study, detailing the design, inclusion and exclusion criteria, and the statistical analyses used to explore the food environment in the Ga-Mashie community. The methodology was meticulously structured to ensure that the study accurately captured the diversity and distribution of food outlets, as well as the availability and healthiness of food options within the community. By employing a comprehensive mapping exercise, coupled with rigorous classification systems such as the Traffic Light Food Labelling System and the NOVA Food Classification System, this chapter provides a clear framework for understanding how the data was collected, processed, and analysed.

3.1 Study design

The CARE Survey is a descriptive cross-sectional epidemiological study in which trained local enumerators gathered information from individuals and households in Ga Mashie, Accra, and used Global Positioning System (GPS) to map the retail and urban environment, including the precise positions of all food and beverage outlets, health facilities, and physical, religious, and social spaces. (Lule *et al.*, 2024). Field activities lasted six weeks. Individual-level data were collected from each agreeing and eligible individual in each home. In addition to supplying individual-level data, household heads (the primary earner or the person in charge of purchasing) as determined by household members submitted data on the household level. Diabetes, hypertension, and obesity were estimated using measurements of blood glucose, blood pressure, and human anthropometry (weight, height, and waist circumference).

(Lule *et al.*, 2024)

3.2 Source of data

The Contextual Awareness Response and Evaluation for Diabetes in Ghana (CARE-Diabetes) survey was a hybrid approach research (Lule *et al.*, 2024). It was a cross-sectional epidemiological study in which trained local enumerators surveyed houses and people in Ga Mashie, Accra. In addition, the Global Positioning System (GPS) was utilized to map the commercial and constructed surroundings, comprising the locations of every type of food and beverage outlets, health facilities, physical, religious, and social spaces (Lule *et al.*, 2024). This particular study will utilize the data from the household survey, in-depth interviews and mapping component of the broader study.

3.2.1 Household and individual survey

Individuals aged 25 and older who have been permanent residents of the selected households for the last 12 months meet the eligibility criteria for the household and individual surveys. A permanent resident is defined as someone who has resided in a specific household for a set period. Furthermore, a household is defined as either a single individual living alone or a group of people, regardless of relation, who reside at the same place and share shared amenities such as cooking, living, sitting, or eating rooms.

3.2.2 Sample size calculation and Sampling methods

The survey sample was calculated with an anticipated diabetes prevalence of 5.0%, a precision of 2.0%, and a design effect of 2.5. The anticipated prevalence of 5.0% was calculated using the lowest (therefore most cautious) prevalence found in a study of prior diabetes studies in Ghana. This calculation yielded a required sample size of 1,242 persons. The number of households required for the survey was calculated by assuming that each household would have an average of two eligible adults and a 10% refusal rate, yielding a sample size of 684 houses. However, based on some of the authors' past field experiences, it was expected that 40% of

residences would be empty or untraceable, resulting in a larger sample size of 958 households. To achieve broad geographical coverage, the survey was performed in Ga Mashie's 80 enumeration areas (EAs), with homes from all EAs included. The Ghana Statistical Service (GSS), which performed the 2021 Ghana Population and Housing Census (including enumeration of Ga Mashie), used simple random sampling to choose 12 homes from each EA for inclusion in this study. As a result, the total sample size rose to 960 families. The GSS randomly chose 50 families in the La municipal district of Accra to pre-test the survey tools and processes.

3.2.3 Food environment survey

The EAs served as the geographic scale at which the community level data were collected. Food sales point were the subjects of the food environment survey. All food sales point within the catchment area were mapped.

Data on food environment features were collected using geographical positioning system (GPS) technology. Geocoding will be used to determine the location of three categories of food resources in the selected EAs: (1) out-of-home cooked foods, (2) convenience stores, and (3) fruit/vegetable stands or sales locations. The variety of meals provided at every site was also documented. Out-of-home cooked foods are those that have previously been prepared and are ready to eat when sold by food sellers. Convenience stores are tiny neighborhood stores that sell processed and pre-packaged commodities such as polished rice, refined vegetable oil, and sweetened fizzy beverages. Perishable food goods, such as fruits and vegetables, are rarely available in convenience stores. These stores occasionally carry non-food items. Fruit and vegetable stands, also known as sales stations, are community areas where fresh produce can be acquired. Data on the location, number, and qualities of each of these three types of food resources were gathered as part of the local food environment.

3.2.4 Population

All sales vendors within the Ga-Mashie catchment areas were mapped for their study irrespective of their vending sites.

3.3 Inclusion/exclusion criteria

Participants in the study were eligible if they were permanent residents of the selected households and aged 25 or older. A permanent resident is someone who has lived in a specific household for the last 12 months. A household is either a single person living alone or a group of people who may or may not be related but reside at the same place and share kitchen facilities, a living room, a sitting room, or a dining room. Pregnancy has been shown to impact blood glucose and blood pressure (BP), hence pregnant women and those who had given birth within the previous six months were excluded from our study. Furthermore, anyone deemed incapable of providing informed permission or completing the survey, such as persons with low mental capacity or who are deaf and unassisted, was omitted. Enumerators embarked on a transect walk in the 2 communities and mapped food sales points using Kobocollect to map the various GPS coordinates.

3.4 Data handling

The data was entered straight into ODK on Android devices. The ODK form was created with restrictions, logic, and consistency checks to assure data accuracy and completeness. Field team leaders oversaw and supervised data gathering and quality assurance. Data cleaning will be place to guarantee that an appropriate dataset is available for analysis.

3.5 Data storage and ownership

The data from the broader study was securely stored on University College London servers. An email was sent to the principal investigator of the study to request access to the data. After the request was approved, the data was stored on a secure laptop to ensure confidentiality. Throughout the duration of the study, the principal investigator retained the softcopy of the

data. The information obtained was kept confidential by storing physical files in a locked cabinet, accessible only to the principal investigator. The softcopy of the data was stored on an encrypted computer, with the password known only to the PI and her supervisors.

3.6 Statistical analysis

A combination of spatial and statistical analysis tools was utilized in this study to analyse the characteristics of the food environment in Ga-Mashie. Spatial analysis techniques including geographic visualization and heat map analysis was employed for the analysis. Analysis was conducted in QGIS version 3.38.

To determine the spatial distribution and accessibility of healthy food sources, the geographic distribution of food outlets across Ga-Mashie was visualized. This visualization facilitated the identification of various food establishments, such as markets, convenience stores, and fruit/vegetable stands, and help identify areas with higher concentrations of food sources.

Moreover, the study utilized the traffic light food labelling system to classify foods into red, amber, and green categories. Green food items were identified as high in fibre but low in fat and calories, while amber food items will be low in fibre, fat, and calories. Red food items will be characterized as low in fibre but high in fat and calories. Furthermore, the nova food classification system was used to group the different food offerings based on the extent of processing.

3.7 Dissemination of results

The findings of this survey will be presented at a conference and published in a peer-reviewed journal.

3.8 Ethical issues

Ethical approval for this research was granted by University College London (UCL) (21541/001), the Noguchi Memorial Institute for Medical Research (NMIMR) Institutional

Review Board (NMIMR-IRB CP 060/21-22) and the Ghana Health Service (GHS-ERC 017/02/22). However, for the purposes of this study, ethical approval was obtained from Ensign Global College; Ethical approval number; ENSIGN/IRB/EL/SSN-263/01

This study posed no harms to the study population. Informed Consent was sought from food vendors before GPS coordinates were obtained. Names of food vending points were redacted to protect privacy of food vendors.

CHAPTER FOUR

4.0 RESULTS

4.1 Introduction

This chapter details the findings from the geographical mapping of food outlets in Ga-Mashie, focusing on three key research questions;

1. What are the main sources of food and food outlets operating within Ga-Mashie?
2. What is the composition of available food options, classified using the Traffic Light Labelling System and the NOVA Classification System?
3. How are foods within Ga-Mashie spatially distributed?

These research questions guided the data analysis and interpretation, shedding light on the variety, classification, and geographical distribution of food sources in the community.

4.2 Geographic Food Access: Main sources of food outlets in Ga Mashie

A total of 1,300 food outlets were mapped in the Ga-Mashie community using GPS technology. Among these, table-top vendors were the most prevalent, accounting for approximately 56.9% of the outlets, representing the dominant mode of food vending. Community shops were the second most common, comprising 18.5% of the outlets, followed by kiosks, which made up 10% of the food outlets. This distribution highlights the dominance of informal food vending in Ga-Mashie, which has implications for both food access and quality.



Images depicting the informal food markets

The distribution of vendors shown in Fig.1 shows an abundance of table top vendors (56.9%).

Table top vendors are informal retailers who sell a wide range of food items ranging from ready to eat meals such as waakye, fufu etc to non-food items such as water and other condiments. Community shops were the second most common type of food outlet (18.5%).

These are moderately sized stores that predominantly sell processed and packaged food items.

Common offerings include bottled water, biscuits, toffee, uncooked rice, and uncooked noodles. Community shops generally do not offer fresh produce or ready-to-eat meals. Kiosks are semi-permanent wooden structures situated at vantage community spaces serving out of home cooked foods to community members such as students, fisherfolk etc. These structures tend to provide both ready to eat foods as well as beverages such as chocolate drinks, fruit juice, bottled water etc.

The distribution of food outlets reveals that they are often clustered close together, with some locations featuring multiple outlets in proximity. However, it was interesting to note that no designated sites for selling fruits and vegetables were mapped

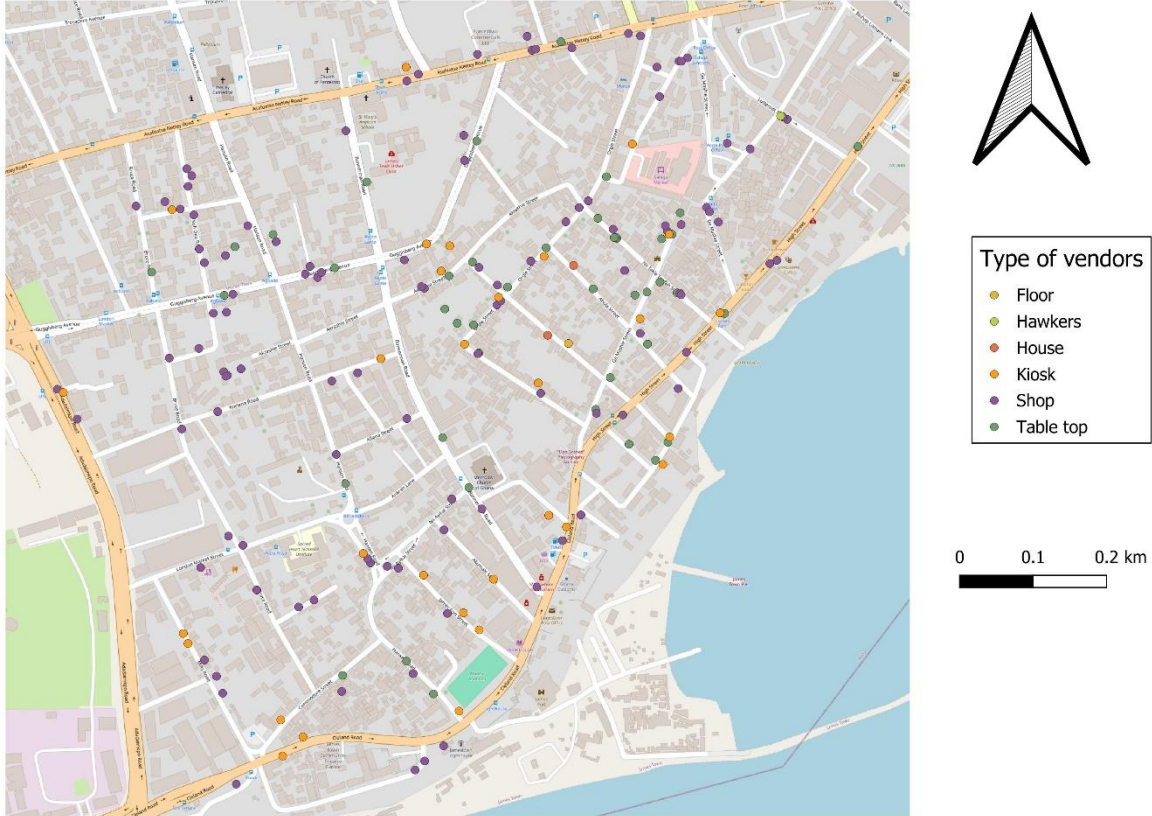


Figure 4.1. Map showing the distribution of vendors in Ga-Mashie

4.3 Food Availability in Ga-Mashie

The mapping exercise identified a total of 2,862 food items available within the Ga-Mashie community. These included staple foods such as *fufu*, *banku*, *kenkey*, *ampesie*, rice and stew, rice and beans, and *jollof*. Fufu is typically served with a variety of soups namely, a tomato-based soup also known as light soup, groundnut soup and palm nut soup. Staple foods such as banku and kenkey, both made from fermented maize, were typically accompanied with fried fish and a ground sauce composed of tomato, pepper, onion and salt. They were alternatively eaten with a stewed sauce, soup and okro. Ampesie which was either boiled yam or boiled plantain was either eaten with kontommire stew (a sauce made out of cocoyam leaves, tomato, pepper, onion and salt) or garden eggs stew. Rice dishes such as jollof rice and

waakye was typically served with animal products such as eggs, chicken, fish and beef. Plain rice was either paired with beans stew or a tomato-based sauce. Additionally, other items like bread, cereals (e.g., oats, corn flakes, *tom brown*), and snacks (e.g., *bofrot*, toffee, chips, cake, biscuits) were mapped. Additionally, there were beverages such as tea, coffee drinks, chocolate drinks.

4.3.1 Availability of healthy and unhealthy foods

4.3.1.1 Traffic Light Labelling System

The food items were categorized using the Traffic Light Food Labelling System, which assesses foods based on their nutritional content. **Green-labelled foods (52.5%)**, recognized for being high in fibre and low in fat and calories, included Ampesie, Banku, Beans and Gari, Kenkey, Tuo Zaafi, and Waakye. Common breakfast items such as oats, porridge, and tom brown were also classified as green due to their significant fibre content and overall nutritional value. **Green-labelled foods**, which were abundant, especially in staple dishes, highlight the nutritional value of traditional staple meals in Ga-Mashie.

Amber-labelled foods (37.0%), characterized by moderate levels of fibre, fat, and calories, encompassed items like bread, bread with egg, and tea. Snack foods such as cake, biscuits, chocolate drinks, coffee drinks were also placed in this category.

Finally, **red-labelled foods (10.5%)**, which were high in calories and low in fibre, included items such as noodles, toffee, and chips. The traffic light food labelling system is important because it can help consumers make healthier food choices.

Figure 2 shows the spatial distribution of foods using the traffic light labelling system. From the map, it is obvious that green foods such as fufu, ampesie, banku etc which are community staples are abundant in the Ga-mashie community. Whilst these foods are widely spread throughout the community, a source of concern is the portion sizes and times of day these foods are consumed. The next dominant foods were those of moderate nutritional value such

as bread, rice and stew, drinks such as coffee drinks, and chocolate drinks. These foods are readily accessible in kiosks and shops and are very convenient for when you want to eat something on the go. They are a preferred alternative to out of home cooked foods when one needs to get a snack. The least dominant foods were the red foods which are highly processed, have high fat content and low fibre content. Whilst these foods were sparsely distributed in the community, it is important to note that eating both amber and green foods without regard for the daily caloric limit has grave implications for obesity and non-communicable diseases in the Ga-Mashie community.

Food item	Colour Coding		
	Green	Amber	Red
Ampesie	✓		
Banku	✓		
Beans and Gari	✓		
Biscuit		✓	
Bofrot		✓	
Boiled egg and pepper	✓		
Bottled water	✓		
Bread		✓	
Bread and fried egg		✓	
Cake		✓	
Chips			✓
Chocolate drinks		✓	
Coffee drinks		✓	

Cooked egg	✓		
Cornflakes		✓	
Fruit juice	✓		
Fufu	✓		
Gari	✓		
Groundnut	✓		
Graphic and times (Roasted maize and groundnut)	✓		
Jollof rice		✓	
Kaaklo		✓	
Kenkey	✓		
Koose		✓	
Milk	✓		
Noodles			✓
Oats	✓		
Porridge	✓		
Rice and beans		✓	
Rice and stew		✓	
Rock buns		✓	
Sachet water	✓		
Salt		✓	
Sugar		✓	
Tea	✓		

Toffee			✓
Tom brown	✓		
Tuo Zaafi	✓		
Waakye	✓		
Yogurt	✓		

Table 4.1 Table depicting the classification of foods using traffic light labelling system

Figure 4 shows the spatial distribution of foods using the traffic light labelling system. From the map, it is obvious that green foods such as fufu, ampesie, banku etc which are community staples are abundant in the Ga-mashie community. Whilst these foods are widely spread throughout the community, a source of concern is the portion sizes and times of day these foods are consumed.

The next dominant foods were those of moderate nutritional value, such as bread, rice and stew, and drinks, coffee and chocolate drinks. These foods are readily accessible in kiosks and shops and are very convenient for when you want to eat something on the go. They are a preferred alternative to out-of-home cooked foods when one needs to get a snack. The least dominant foods were the red foods, which are highly processed, have high fat content and low fibre content. Whilst these foods were sparsely distributed in the community, it is important to note that eating both amber and green foods without regard for the daily caloric limit has grave implications for obesity and non-communicable diseases in the Ga-Mashie community

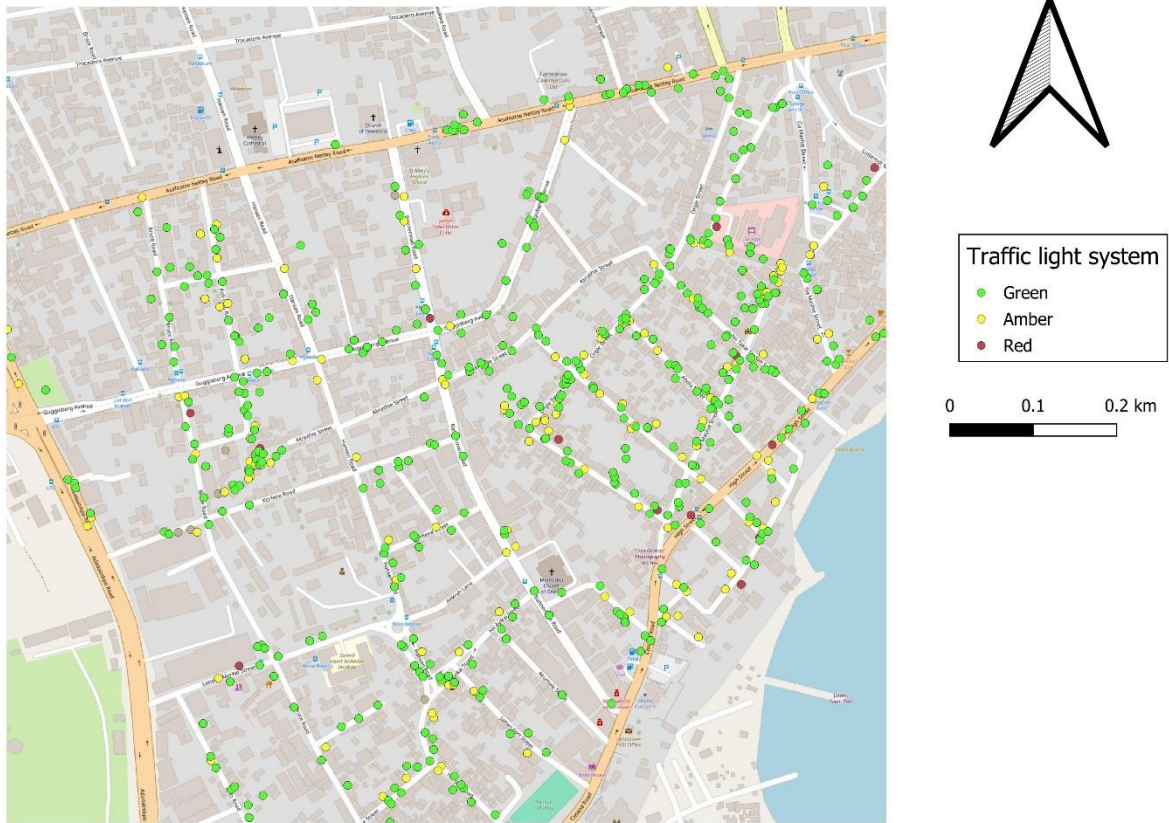


Figure 4.2 Map showing the distribution of colour-coded foods

4.3.2 Nova Food Classification system

The NOVA Classification System further categorizes foods based on processing levels, revealing a range from minimally processed staples to ultra-processed snack options within Ga-Mashie.

Food item	Nova Classification groups			
	Group 1	Group 2	Group 3	Group 4
Ampesie	✓			
Banku	✓			
Beans and Gari	✓		✓	
Biscuit				✓
Bofrot				✓

Boiled egg and pepper	✓		✓	
Bottled water	✓			
Bread				✓
Bread and egg				✓
Cake				✓
Chips				✓
Chocolate drinks				✓
Coffee drinks				✓
Cooked egg	✓			
Cornflakes				✓
Fruit juice				✓
Fufu	✓			
Gari	✓			
Groundnut	✓			
Graphic and times (Roasted maize and groundnut)	✓			
Jollof rice			✓	
Kaaklo				✓
Kenkey	✓			
Koose				✓

Milk		✓		
Noodles				✓
Oats	✓			
Porridge	✓			
Rice and beans			✓	
Rice and stew			✓	
Rock buns				✓
Sachet water	✓			
Salt		✓		
Sugar		✓		
Tea	✓			
Toffee				✓
Tom brown	✓			
Tuo Zaafi	✓			
Waakye	✓			
Yogurt				✓

Table 4.2 Table depicting the classification of foods using the NOVA food classification system

The nova classification system is used to classify food based on the extent and purpose of the processing they undergo. Group 1 foods are unprocessed or minimally processed foods.

Foods such as banku and kenkey which had been subjected to grinding and fermentation were grouped as group 1 foods. Ampesie, Waakye, cooked egg, tuo zaafi, groundnut, tom brown and other foods which had undergone different forms of processing such as boiling etc were also classified as group 1 foods. Most of these foods had been preserved in their natural states and had not been altered in any forms.

Group 2 foods included culinary ingredients that were used in cooking. These included sugar, salts and condiments which were used to enhance the taste of foods. These foods were colour coded as yellow on the graph and were very sparsely distributed across the Ga-Mashie community.

Group 3 foods are known as processed foods and involves the addition of oils, salt and sugars to naturally or minimally processed foods to either preserve them or make them more palatable. They included rice dishes such as jollof rice, rice and stew etc. It is also important to note that most staple dishes in the Ga-Mashie community are eaten with sauces which contains varying amounts of oil and salt.

Group 4 foods are ultra processed foods that are made from substances extracted from foods or through processes such as frying. These methods alter the natural state of the food items such that group 1 foods appear in very minute quantities in such foods. Some of the group 4 foods available in the Ga-mashie community included bread, biscuits, bofrot (fried dough usually taken with porridge), koose (fried bean cake), yogurt, chocolate drinks, coffee drinks, indomie, toffee etc. These foods are mostly the preferred snack options as they are very convenient and readily available.

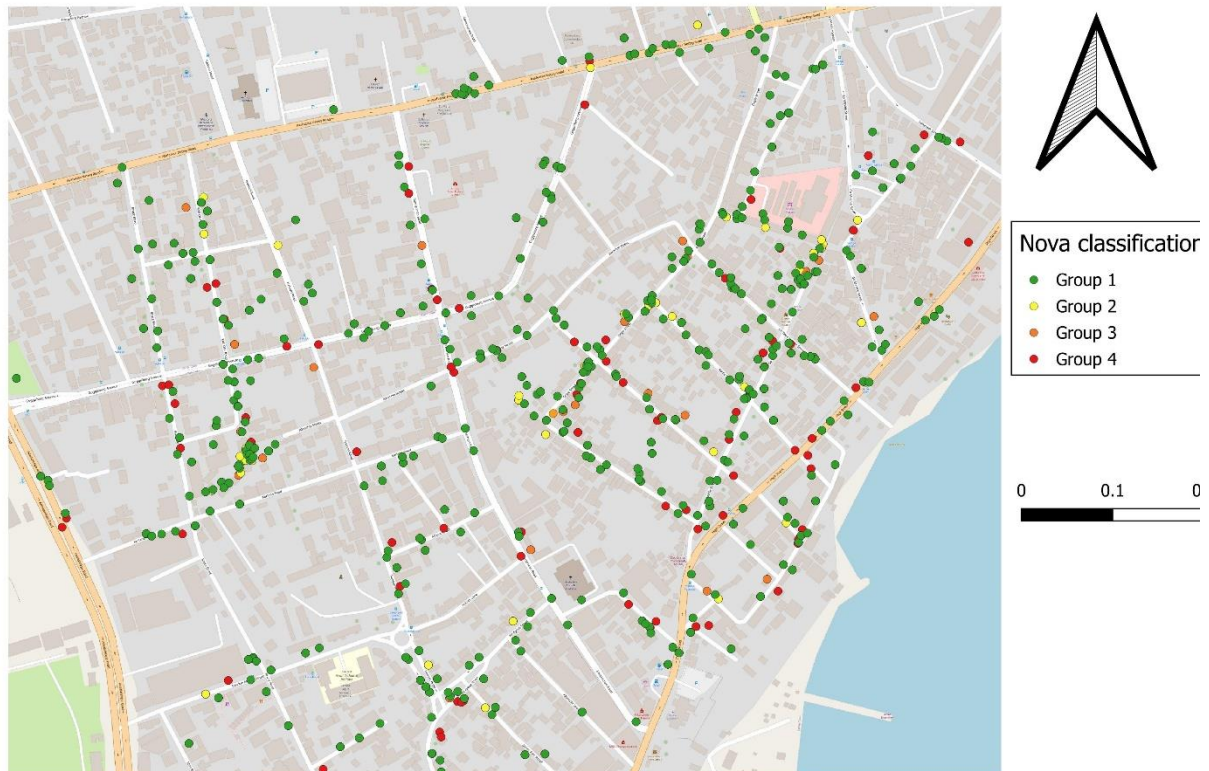


Figure 4.3; Map showing the distribution of foods that were classified using the nova classification system

4.3.3 Comparison between Traffic light labelling system and NOVA food classification system

Table 4.3 shows the distinctions between the food classification systems used. The ticks refer to instances where a particular food item reported similarities between the two classification systems whereas the noughts depict instances where a food item reported differences between the two classification systems.

Food item	Traffic light label	NoVA group	Difference between the two
Ampesie	Green	Group 1	✓
Banku	Green	Group 1	✓
Beans and Gari	Green	Group 3	○

Biscuit	Amber	Group 4	○
Bofrot	Amber	Group 4	○
Boiled egg and pepper	Green	Group 3	○
Bottled water	Green	Group 1	✓
Bread	Amber	Group 4	○
Bread and egg	Amber	Group 4	○
Cake	Amber	Group 4	○
Chips	Red	Group 4	✓
Chocolate drinks	Amber	Group 4	○
Coffee drinks	Amber	Group 4	○
Cooked egg	Green	Group 1	✓
Cornflakes	Amber	Group 4	○
Fruit juice	Green	Group 4	○
Fufu	Green	Group 1	✓
Gari	Green	Group 1	✓
Groundnut	Green	Group 1	✓
Graphic and times (Roasted maize and groundnut)	Green	Group 1	✓
Jollof rice	Amber	Group 3	✓
Kaaklo	Amber	Group 4	○

Kenkey	Green	Group 1	✓
Koose	Amber	Group 4	○
Milk	Green	Group 2	✓
Noodles	Red	Group 4	✓
Oats	Green	Group 1	✓
Porridge	Green	Group 1	✓
Rice and beans	Amber	Group 3	✓
Rice and stew	Amber	Group 3	✓
Rock buns	Amber	Group 4	○
Sachet water	Green	Group 1	✓
Salt	Amber	Group 2	✓
Sugar	Amber	Group 2	✓
Tea	Green	Group 3	○
Toffee	Red	Group 4	✓
Tom brown	Green	Group 1	✓
Tuo Zaafi	Green	Group 1	✓
Waakye	Green	Group 1	✓
Yogurt	Amber	Group 4	○

Table 4.3 Comparison between the 2 different classification systems

CHAPTER 5

5.0 DISCUSSION

5.1 Introduction

This study used three different objectives to assess the food environment in Ga Mashie. The first objective sought to identify the main sources of food within the Ga Mashie community. This objective was important for understanding geographical food access and how the types of food vendors in the community could affect dietary choices of community residents. The second objective was vital for identifying the different compositions of foods available within the community. Using classification systems such as traffic light labelling systems and the NOVA food classification system, foods were classified based on their nutritional value and the extent to which they have been processed. The third objective was essential for visualizing the spatial distribution of foods within the Ga Mashie community.

5.2 Geographic food access within the Ga Mashie community

This study presents a comprehensive analysis of geographic food access and the availability of healthy and unhealthy food options in the Ga-Mashie community. A total of 1,300 food outlets were mapped, revealing that informal table-top vendors were the most predominant, followed by community shops and kiosks. These findings align with the work of Chege *et al.*, (2021) and Dake *et al.*, (2016) who identified a similar variety of food vendors, including informal markets, kiosks, and street food vendors, in urban poor environments. However, unlike these studies, which reported the presence of modern retail outlets such as supermarkets, our study did not identify any supermarkets within Ga-Mashie. This absence of supermarkets, is characteristic of urban poor neighbourhoods where residents primarily rely on smaller, informal retail food outlets for their food purchases (Wanyama *et al.*, 2019). While supermarkets typically offer greater food diversity, they are often perceived as too expensive for the average resident in communities like Ga Mashie.

The scarcity of supermarkets, combined with the limited availability of fruit stalls, contributes to the creation of urban food deserts in Ga-Mashie. Urban food deserts, characterized by restricted access to fresh, affordable produce, disproportionately impact low-income neighbourhoods such as Ga-Mashie (Brace, Moore and Matthews, 2020). A study on informal food deserts in Namibia highlights the significant impact these environments have on household food insecurity—a concern that is highly relevant in Ga-Mashie (Crush, Nickanor and Kazembe, 2018). In these areas, food insecurity is not solely a matter of food availability but also stems from economic inaccessibility. Most households lack the necessary income to meet their basic needs, which limits their ability to purchase food in quantity and diversity, preventing them from ensuring a balanced and nutritious diet for all household members.

The proliferation of informal food markets in Ga-Mashie can be attributed to the less stringent capital and regulatory requirements needed to establish these markets in urban poor communities. Unlike formal markets, informal markets require minimal capital to start and can often be set up without the need for government authorization. While these markets play a crucial role in providing accessible food to resource-poor communities, they also pose significant public health risks due to inadequate hygiene practices and a lack of regulatory oversight (Giroux *et al.*, 2021).

Moreover, the affordability of informal markets ensures their continuous patronage by community members, even in the presence of formal markets (Wegerif, 2023; Kushitor, Alimohammadi and Currie, 2022). The convenience offered by these markets, with their widespread availability across the community, further solidifies their role in the daily lives of Ga-Mashie residents. These vendors offer a wide range of traditional meals, Western-style foods, and snack options, making them the preferred choice for a community where factors such as food sharing, limited cooking spaces, and time constraints make home meal preparation challenging (Adeosun, Greene and Oosterveer, 2022). However, the predominance of

unhealthy and ultra-processed foods in these markets raises concerns about their contribution to the rising prevalence of non-communicable diseases and obesity in such communities (Dake *et al.*, 2016b).

In conclusion, while informal food markets in Ga-Mashie offer a variety of both traditional and Western food options, the absence of outlets providing fresh produce, such as fruits and vegetables, is of grave concern. This lack of access contributes to the creation of urban food deserts, where healthy food choices are limited, and residents are disproportionately exposed to unhealthy, ultra-processed foods (Vilar-Compte *et al.*, 2021). The high prevalence of these foods in the community raises significant public health concerns, particularly regarding the potential for increased rates of obesity and non-communicable diseases, such as diabetes and hypertension.

5.3 Composition of available food options

This study provides a comprehensive analysis of the diverse food options available within the Ga-Mashie community, mapping a total of 2,862 food items. The food environment in Ga-Mashie can be described as a hybrid one, encompassing both traditional and Western food options (Annan *et al.*, 2022). However, traditional staple foods dominated the landscape, with items like banku, fufu, kenkey, ampesie, tuo zaafi, and various rice dishes, including jollof rice, rice and stew, rice and beans, and rice balls, being the most prevalent. These staples not only reflect the cultural dietary preferences of the community but also serve as the primary source of sustenance for its residents (Dake *et al.*, 2016b).

The application of the Traffic Light Food Labelling System provided valuable insights into the nutritional quality of the food offerings in Ga-Mashie. A significant proportion of the foods mapped in the community were green foods. This high representation of green-labelled foods is largely due to the prominence of community staples, which are inherently rich in fibre and nutritional value (Osei-Kwasi *et al.*, 2021). Foods like ampesie, banku, and waakye are

examples of traditional dishes that, by their nature, provide essential nutrients and contribute positively to the diet.

However, while these staple foods are generally healthy, the nutritional quality of meals in Ga-Mashie can be compromised by the accompaniments and portion sizes (Boatema, Badasu and de-Graft Aikins, 2018). Many of these traditional dishes are often served with high-calorie sauces and fried accompaniments, which can negate their inherent health benefits (Staatz and Hollinger, 2016). For instance, fufu, which is typically classified as a green food due to its fibre content, is often paired with high-fat soups and large portions, potentially leading to excessive calorie intake. This highlights the need for moderation and portion control, even with foods that are considered healthy.

In contrast, most snacks in the community, such as cake, rock buns, chocolate drinks, and coffee drinks, were classified as amber. This finding diverges from studies conducted in more affluent neighbourhoods in the United States, where similar food items and beverages were often labelled green (Olstad *et al.*, 2015). The amber classification indicates that these foods provide a balanced nutritional profile but should be consumed in moderation. Their presence in Ga-Mashie reflects the availability of convenient, moderately nutritious options that complement the traditional diet. However, their consumption should be monitored to prevent potential negative health outcomes.

Foods classified as red, such as toffee, chips, and noodles, which are high in calories and low in fibre, were relatively scarce in the community. Despite their limited availability, these foods pose a significant health risk due to their potential to contribute to higher caloric intake with minimal nutritional benefits. The consumption of such foods is associated with an increased risk of obesity and related non-communicable diseases, such as diabetes and hypertension.

Therefore, even their occasional presence in the diet warrants attention, especially in a community like Ga-Mashie, where health resources may be limited.

While the predominance of green-labelled foods is a positive finding, it is crucial to emphasize the importance of adhering to nutritional principles, such as moderation and portion control. Ensuring that diets are not calorie-dense, even when composed primarily of green-labelled foods, is vital for maintaining good health.

Furthermore, the analysis of food availability in the Ga-Mashie community, as categorized by the NOVA Classification System, reveals a diverse food environment that ranges from minimally processed staple foods to highly processed snack options. This classification system, which categorizes foods based on the extent and purpose of their processing, offers valuable insights into the dietary patterns and potential health implications for the residents of Ga-Mashie.

Group 1 foods, which include unprocessed or minimally processed items, form the foundation of the diet in Ga-Mashie. These foods have undergone minimal alteration from their natural state, preserving most of their original nutritional content (Monteiro *et al.*, 2018). Staples such as banku and kenkey, both of which involve processes like grinding and fermentation, are prime examples of Group 1 foods. These foods, central to the local diet, are culturally significant and nutritionally dense, providing essential nutrients like fibre, carbohydrates, and vitamins.

Other Group 1 foods in Ga-Mashie include ampesie (boiled yam or plantain), waakye (rice and beans), cooked eggs, tuo zaafi, groundnuts, and tom brown (a roasted cereal blend). These foods have undergone basic processing methods, such as boiling or roasting, that do not significantly alter their natural state. Their availability and consumption highlight a diet that is rooted in traditional culinary practices, emphasizing the use of whole, unrefined ingredients.

The predominance of Group 1 foods within the Ga-Mashie community suggests a dietary pattern that aligns with healthful eating principles (Osei-Kwasi *et al.*, 2021). These foods, being largely unprocessed, are less likely to contribute to the chronic diseases often associated with processed foods. However, the nutritional benefits of these foods can be compromised by the sauces and accompaniments typically consumed with them, which often contain high levels of oil, salt, and other additives.

Group 2 foods, which include processed culinary ingredients like sugar, salt, and condiments, are used primarily to enhance the flavour of other foods. These ingredients were sparsely distributed across the Ga-Mashie community, as indicated by their limited representation in the food mapping exercise. While these ingredients are essential in the preparation of many traditional dishes, their excessive use can contribute to health issues such as hypertension and other cardiovascular diseases.

The relatively low presence of Group 2 foods in the community suggests a potential for moderation in their use. However, given the significant role these ingredients play in local cuisine, particularly in the preparation of sauces and soups, it is crucial to monitor their consumption to avoid potential health risks.

Group 3 foods are those that have been processed by the addition of oils, salt, or sugars to enhance flavour or extend shelf life. In Ga-Mashie, this group includes various rice dishes such as jollof rice and rice and stew, as well as other staple dishes that are often served with rich, oil-based sauces. The processing of these foods, while making them more palatable and sometimes more convenient, introduces additional calories and fats that may not be present in their unprocessed counterparts (Sadler *et al.*, 2021).

The consumption of Group 3 foods reflects a dietary shift towards more processed options, which, while still rooted in traditional staples, involve added ingredients that can increase their

calorie density. This shift is indicative of broader nutritional transitions observed in urban poor communities, where economic and social factors drive the consumption of more processed, calorie-dense foods.

The presence of Group 4 foods, which are ultra-processed and often contain substances extracted from foods or created through extensive processing methods like frying, represents a significant shift in the dietary landscape of Ga-Mashie. These foods, such as bread, biscuits, bofrot (fried dough), koose (fried bean cake), yogurt, chocolate drinks, coffee drinks, instant noodles (e.g., Indomie), and toffees, are predominantly consumed as snacks and are favoured for their convenience and availability.

Group 4 foods are characterized by their high content of added sugars, fats, and artificial ingredients, which often displace the natural components of the original food items. The consumption of these ultra-processed foods poses serious health risks, particularly in low-income communities where access to healthier options may be limited (Albuquerque, Bragotto and Costa, 2022). The preference for these snacks in Ga-Mashie reflects broader global dietary trends where convenience and taste often outweigh nutritional considerations.

The increasing reliance on Group 4 foods in Ga-Mashie is concerning, as these ultra-processed items contribute to higher caloric intake without providing essential nutrients (Gramza-Michałowska, 2020). Their consumption is closely linked to the rising prevalence of non-communicable diseases, including obesity, diabetes, and cardiovascular diseases.

The NOVA classification of foods within the Ga-Mashie community reveals a complex food environment where traditional, minimally processed foods coexist with an increasing presence of processed and ultra-processed options. While the prevalence of Group 1 foods suggests a strong foundation of nutritious, traditional eating habits, the growing consumption of Group 3 and Group 4 foods indicates a shift towards more calorie-dense, less nutritious diets. This shift

highlights the need for targeted public health interventions that promote healthier eating habits within low resourced urban communities, where access to nutritious food options may be limited. By addressing the factors driving the consumption of processed and ultra-processed foods, it is possible to support the community in maintaining a balanced and healthful diet.

5.4 Conclusion

This study aimed to comprehensively assess the food environment in Ga-Mashie, with a focus on quantifying the various types of food vendors and classifying available foods using both the Traffic Light Labelling System and the NOVA Food Classification System. The findings revealed a predominantly informal food retail system, characterized by a rich variety of community staples that are high in fibre and integral to the local diet. However, while these staples offer nutritional benefits, it is crucial to emphasize the importance of consuming them in moderation to maintain appropriate caloric intake. Additionally, the sauces and accompaniments typically consumed with these staples should be nutrient-dense and low in fats and oils to preserve the overall nutritional quality of meals.

This study makes significant empirical contributions to food environment research in Africa. By employing spatial analysis, it provided a visual representation of the distribution of food vendors and the types of foods available in Ga-Mashie, offering insights into the local food landscape. Unlike previous studies, such as Dake et al. (2016), this study uniquely combines the use of both the Traffic Light Labelling System and the NOVA Food Classification System. This dual classification approach is vital for public health practice, as it provides a more nuanced understanding of the health implications of available foods, particularly in urban poor settings like Ga-Mashie.

The findings have important policy implications. The prevalence of calorie-dense, nutrient-poor foods, despite the availability of healthier options, underscores the need for public health interventions aimed at promoting healthier eating habits. Policies should focus on improving

the nutritional quality of foods offered by informal vendors and educating the community on the importance of portion control and the nutritional content of their meals. Such interventions are crucial for addressing the rising prevalence of non-communicable diseases (NCDs) like obesity, diabetes, and hypertension in the Jamestown community.

Moreover, the study's findings have broader implications for achieving Sustainable Development Goals (SDGs) 1 (No Poverty) and 3 (Good Health and Well-being). Ensuring access to affordable, nutritious food is essential for reducing poverty and improving health outcomes, particularly in vulnerable communities. By highlighting the need for a balanced, nutrient-rich diet, this research contributes to the global effort to combat NCDs and promote sustainable, healthy living conditions in urban poor communities.

5.5 Recommendations

Based on the findings of this study, we recommend the following;

1. Enhancing Nutritional Quality of Foods in Informal Markets:

- There is a need to improve the nutritional quality of foods offered by informal vendors in the Ga-Mashie community. The Ussher Polyclinic should work with local vendors to promote the use of healthier cooking methods, such as reducing the use of oils and fats in food preparation. Educational campaigns can also be implemented to raise awareness among vendors and consumers about the importance of nutrient-dense meals and the risks associated with calorie-dense, low-nutrient foods.

2. Promoting Portion Control and Dietary Balance:

- Given the predominance of high-fibre staple foods in the community, it is crucial to promote portion control to prevent excessive caloric intake. Public health initiatives should include community-based education programs that teach residents about portion sizes and the importance of balancing their diet with fruits, vegetables, and

protein-rich foods. These programs could be delivered through local health centres, schools, and Obonu Fm, a radio station within the community.

3. Incorporating Food Labelling Education:

- The Traffic Light Labelling System and NOVA Food Classification System should be incorporated into community education programs to help residents make more informed food choices. These systems can be simplified and adapted for local use, providing visual guides to help consumers quickly identify healthier food options. Collaborating with local vendors to display these labels on food items could further enhance the effectiveness of this strategy.

5.6 Limitations

This study has some limitations. First, the reliance on manual mapping of food outlets and food items might have introduced errors or inconsistencies, especially in densely populated areas with overlapping food vendor locations. Additionally, the informal nature of many food vendors might have led to underreporting or misclassification. Secondly, while the Traffic Light Labelling System and NOVA Food Classification System provide insights into the nutritional quality of available foods, the study does not include detailed nutrient analyses (e.g., caloric content, sodium levels) of the food items.

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APPENDIX
Appendix 1

ENSIGN GLOBAL
COLLEGE

OUR REF: ENSIGN/1RB/EL/SN-263/01

YOUR REF:

April 29, 2024.

INSTITUTIONAL REVIEW BOARD SECRETARIAT

Deborah Esaa Larbi Sarpong
Ensign Global College Kpong.

Dear Deborah,

ETHICAL CLEARANCE TO UNDERTAKE POSTGRADUATE RESEARCH

At the General Research Proposals Review Meeting of the INSTITUTIONAL REVIEW BOARD (IRB) of Ensign Global College held on Thursday, April 25, 2024, your research proposal entitled "**Assessing the Food Environment in JamesTown and UssherTown in the Accra Metropolis of the Greater Region of Ghana**" was considered.

You have been granted Ethical Clearance to collect data for the said research under academic supervision within the IRB's specified frameworks and guidelines.

We wish you all the best.

Sincerely,



Dr. (Mrs.) Rebecca Acquah-Arhin
IRB Chairperson

Appendix 2

Food item	Description
Ampesi	Boiled yam, plantain or cocoyam
Indomie	A brand of instant noodles
Fufu	Boiled pounded dough made from cassava and plantain/cocoyam
Jollof rice	Rice boiled in gravy
Kenkey	Cornmeal dumpling
Fried fish	Any type of fish that has been deep fried
Brukina	Fermented milk drink with millet
Hausa koko	Millet porridge
Tuo zaafi	Cornmeal and cassava flour dumpling
Gari	Dried cassava grits
Koko	Cornmeal porridge
Kulikuli	Groundnut snack
Kokonte	Cassava flour dumpling
Fante fate	Fresh fish stew
Sobolo	Hibbiscus leaves drink
Omotuo	Boiled rice dumpling
KFC	A brand of fast-food company known for serving fried chicken and French fries
Papaye	A brand of fast-food company known for serving fried rice and fried chicken

Description of food items in most Ghanaian communities