ENSIGN GLOBAL UNIVERSITY, KPONG

EASTERN REGION, GHANA

FACULTY OF PUBLIC HEALTH

DEPARTMENT OF COMMUNITY HEALTH

DIETARY INTAKE ON OBESITY RISK AMONG RESIDENTS IN GA MASHIE, ACCRA, GHANA

BY

AVORGBEDOR SEDINAM

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JUNE, 2025

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A THESIS SUBMITTED TO THE FACULTY OF PUBLIC HEALTH, DEPARTMENT OF COMMUNITY HEALTH, ENSIGN GLOBAL UNIVERSITY, KPONG IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF PUBLIC HEALTH

JUNE, 2025

DECLARATION

I solemnly declare that this work is my own, submitted in fulfilment of the requirements for the Master of Public Health degree. To the best of my knowledge, it contains no material previously published or submitted for the award of any degree at any college or university, except where due acknowledgement is made within the text.

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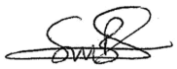
Dr. Sandra Boatemaa Kushitor 

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DEDICATION

This thesis is dedicated to those who supported and inspired me throughout this journey. To my family, your unwavering encouragement, patience, and belief in me have been my foundation.

I also dedicate this work to my dearest friends, whose words of encouragement and practical support carried me through long days and late nights. Your presence made this journey lighter and more meaningful.

And to anyone who has ever chased an idea late into the night, may your perseverance be rewarded.

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ABBREVIATIONS

BMI	Body Mass Index
CARE	Contextual Awareness, Response, and Evaluation
DQQ	Diet Quality Questionnaire
DE	Dietary Energy
EA	Enumeration Area
GAMADA	Ga Mashie Developmental Agency
GDRs	Global Dietary Recommendations
GSS	Ghana Statistical Service
HIC	High-Income Countries
LE	Life Expectancy
LMIC	Low-and Middle-Income Countries
MoFA	Ministry of Food and Agriculture
MoH	Ministry of Health
NCDs	Non-communicable Diseases
NHIS	National Health Insurance Scheme
OBS	Obesity
QALYs	Quality-Adjusted Life Years
RBS	Random Blood Sugar
WHO	World Health Organization

ABSTRACT

Background: With more than 890 million people living with obesity and 2 to 5 billion adults expected to be overweight in 2022, OBS (obesity) is becoming one of the main health determinants in the world. This shows a significant increase since 1990, although there are regional variations in prevalence rates. Few studies have investigated the potential protective effects of traditional diets in communities such as Ga Mashie in Ghana against this condition.

Methodology: This study employed a cross-sectional analysis of data from the Contextual Awareness, Response, and Evaluation (CARE) diabetes survey. The tool used in obtaining data for dietary intake was the Diet Quality Questionnaire (DQQ) for Ghanaians. Demographic characteristics were summed up using descriptive statistics. Regression analysis was used see how independent variables interact with dependent variables. STATA software was used to conduct a bivariate and multivariate analysis to investigate the relationship between variables and outcomes.

Results: Dietary habits revealed a strong tendency to include grains and whole grains in the diet. However, intake of protective food groups, which include pulses, nuts, fruits and vegetables, was found to be significantly lower. The NCD-Protect index showed that only 34.31% of the subjects had a high intake of protective foods, while the NCD-Risk index showed a staggering 87.70% displayed a low intake of detrimental foods. In total, more than 60% of the participants were classified as overweight or obese.

Conclusion: This research revealed significant nutritional deficiency among Ga Mashie residents, as their diets primarily consist of grain-based stables with little intake of protective food categories like fruits, vegetables, pulses, and nuts. Although the intake of ultra-processed foods is relatively low, the majority of participants exhibit low NCD-Protect scores, indicating a diet lacking in crucial nutrients that support the prevention of obesity and other NCDs.

Keywords: Obesity, dietary intake, food environment, Contextual awareness, response and evaluation (CARE), diet quality questionnaire (DQQ).

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CHAPTER 1

1.0 INTRODUCTION

1.1 Background

Obesity (OBS) is a multi-factorial metabolic disorder caused by a range of factors, including genetic, physiological, metabolic, socio-economic, and lifestyle factors particularly physical activity and diet (Ziba *et al.*, 2025). According to studies, overweight and obesity represent two of the most significant health challenges across all stages of life (WHO, 2025). The World Health Organization (WHO) has documented a dramatic increase in the global prevalence of overweight and obesity in recent decades (WHO, 2025). Globally, the situation has reached epidemic proportions, with projections estimating that by 2030, 1.12 billion people will be obese and 2.16 billion will be overweight (Behboudi-Gandevani *et al.*, 2016; Ziba *et al.*, 2025).

The pervasive impact of obesity as a global epidemic manifests with substantial variation across world regions, nations, and specific population subsets (Segun *et al.*, 2024). Over the past two decades, the surge in overweight and obesity rates has been particularly notable in regions undergoing rapid economic development (Segun *et al.*, 2024; WHO, 2025). In 2008, over 1.4 billion adults aged 20 years and older were classified as overweight, with over 200 million men and nearly 300 million women living with obesity (Afshin *et al.*, 2019; Segun *et al.*, 2024). This upward trend intensified by 2016, when more than 1.9 billion adults aged 18 and older were overweight, and 650 million were obese accounting for 13% of the global adult population (11% of men and 15% of women) (World Health Organization, 2016; Segun *et al.*, 2024).

The rise in obesity is closely associated with unhealthy dietary habits, particularly the increased consumption of processed foods high in sugars, unhealthy fats, and refined carbohydrates. Such

diets often lack essential nutrients while delivering excessive calories, contributing significantly to the onset of obesity and related health conditions (Mozaffarian, 2016; Cordova *et al.*, 2021). As such, the obesity epidemic is a stark indicator of the global health risks associated with NCDs, with developing nations shouldering an increasingly significant portion of this burden (Islam *et al.*, 2014). NCDs have become the leading causes of morbidity and mortality worldwide, responsible for an estimated 36 million deaths annually (Segun *et al.*, 2024).

The rapid shift toward high-fat, high-energy food consumption and sedentary behaviour is intrinsically linked to broader social changes, including globalization, urbanization, and mechanization (Troesch *et al.*, 2015). These dynamics have accelerated dietary transitions across numerous nations, fostering a marked increase in obesity rates among both children and adults (Troesch *et al.*, 2015; Segun *et al.*, 2024). In most low- and middle-income countries (LMICs), this nutritional shift is marked by increased intake of refined grains, animal-source foods, sugars, and fats, often accompanied by inadequate consumption of fruits and vegetables (Popkin, 2015; Kang, Kang and Lim, 2021). These trends have contributed significantly to the growing burden of nutrition-related NCDs (Osei-Kwasi *et al.*, 2020; Segun *et al.*, 2024).

The situation in West Africa reflects this global trend, with obesity prevalence estimates across the region averaging around 10.0% (Ofori-Asenso *et al.*, 2016). Within sub-Saharan Africa (SSA), the disparity is considerable, ranging from 3.5% in Eritrea to nearly 64% in Seychelles (Segun *et al.*, 2024). Ghana, in particular, demonstrates a concerning trajectory. A previous review identified an alarming 43% prevalence of overweight and obesity among Ghanaian adults (Ofori-Asenso *et al.*, 2016; Suara *et al.*, 2020).

Poor dietary behaviours in Ghana, combined with socio-economic challenges including poverty, limited access to healthcare, and a growing population, are intensifying the national burden of obesity and associated diseases (Yussif, Morrison and Annan, 2024). Addressing this trajectory necessitates urgent public health strategies focused on promoting healthy eating behaviours and balanced, nutrient-rich diets. This study, therefore, sought to investigate the role of dietary patterns in reducing the risk and prevalence of obesity among residents of Ga Mashie, Accra, Ghana.

1.2 Problem Statement

By 2022, the global burden of obesity had become increasingly alarming. One in eight individuals worldwide was living with obesity. Since 1990, adult obesity has more than doubled, and adolescent obesity has quadrupled (WHO, 2025). That year alone, 2.5 billion adults aged 18 and over were overweight, of whom 890 million were living with obesity. Additionally, 43% of adults aged 18 years and older were overweight, while 16% were obese (WHO, 2025). A previous review revealed an alarming prevalence (43%) of overweight and obesity in Ghanaian adults (Ofori-Asenso *et al.*, 2016).

The national prevalence of overweight and obesity were estimated as 25.4% (95% CI 22.2–28.7%) and 17.1% (95% CI = 14.7–19.5%), respectively (Ofori-Asenso *et al.*, 2016). However, it was further highlighted that the prevalence of overweight (27.8% vs 21.8%) and obesity (21.9% vs 6.0%) was also significantly higher in women than men (Ofori-Asenso *et al.*, 2016; Suara *et al.*, 2020). Additionally, the Ghana Demographic and Health Surveys (GDHS) from 1993 to 2014 reported an increasing prevalence of obesity among Ghanaian women (15–49 years) from 3.4% to 15.3% (GSS, 2015; Ofori-Asenso *et al.*, 2016).

Despite the evident link between diet and obesity, there remains a gap in localized, community-level research that explores the specific dietary patterns contributing to this health burden in urban Ghanaian settings. In areas such as Ga Mashie, residents face heightened exposure to obesogenic environments, marked by widespread availability of processed foods, limited access to healthy alternatives, and socio-economic constraints that hinder adoption of healthy lifestyles (Grijalva-Eternod *et al.*, 2024; Adjaye-Gbewonyo *et al.*, 2025).

The absence of such data creates a critical gap in addressing the rising burden of obesity in urban Ghanaian communities. Without this localized evidence, policymakers, public health practitioners, and nutrition stakeholders may lack the necessary information to design targeted, culturally appropriate interventions that promote healthy dietary habits and reduce the prevalence of obesity in vulnerable populations.

1.3 Rationale of Study

NCDs such as type 2 diabetes mellitus, hypertension and obesity have emerged as primary contributors to illness and death in LMICs, including Ghana. Ga Mashie, a crowded and economically disadvantaged urban area in Accra, confronts considerable health issues stemming from unhealthy eating habits, inadequate health-seeking behaviours, and a rapidly increasing rate of NCDs (Grijalva-Eternod *et al.*, 2024; Adjaye-Gbewonyo *et al.*, 2025).

Understanding the protective effects of diets in preventing NCDs is crucial for addressing this health burden. Dietary patterns in many urban poor settings, including Ga Mashie, are often marked by high intake of processed foods, refined sugars, and alcohol consumption among many others, contributing to the increasing rates of obesity in this populations.

The rationale of this study is therefore grounded in the urgent need to generate localized, context-specific evidence on the role of dietary patterns in influencing obesity among residents of Ga

Mashie. Such insights are critical to informing the development of targeted, culturally appropriate, and community-responsive interventions to improve nutritional behaviours and reduce obesity-related health risks. This study will benefit multiple stakeholders by providing evidence-based findings to guide municipal health authorities, urban planners, and public health advocates in designing interventions tailored to the lived realities of urban Ghanaian communities.

Additionally, findings will contribute to the implementation of Ghana's policy on reduction of NCDs through primary prevention strategies such as health promotion, and diet and nutrition and also tertiary prevention strategies like clinical care, screening and early detection. This policy aligns with the Astana Declaration on Primary Public Health Care and the WHO Global Action Plan for prevention and control of NCDs 2013–2030 (Jungo, Anker and Wildisen, 2020; Banatvala *et al.*, 2023). This study is both timely and relevant, as it aligns directly with the United Nations Sustainable Development Goal (SDG) 3, which aims to ensure healthy lives and promote well-being for all at all ages. Specifically, Target 3.4 seeks to reduce premature mortality from non-communicable diseases through prevention and treatment by 2030 (Howden-Chapman *et al.*, 2017).

1.4 Conceptual Framework

The conceptual framework of this study illustrates the interrelated variables influencing the incidence of obesity, with a particular focus on dietary intake, socio-demographic factors, and behavioural factors. These elements are examined to understand their collective and individual roles in shaping obesity risk among residents of Ga Mashie, Accra.

Behavioural factors include lifestyle choices such as levels of physical activity, alcohol consumption, and other health-related habits that may contribute to energy imbalance and weight

gain. Dietary intake focuses on the consumption patterns of key food groups particularly fruits, vegetables, and healthy fats to assess overall dietary quality and its association with obesity. Socio-demographic factors, such as income, are considered to evaluate how economic conditions influence food choices and access to nutritious foods.

This framework guides the study in analyzing how these variables interact and contribute to the risk and prevalence of obesity, offering a structured approach to identify key areas for intervention.

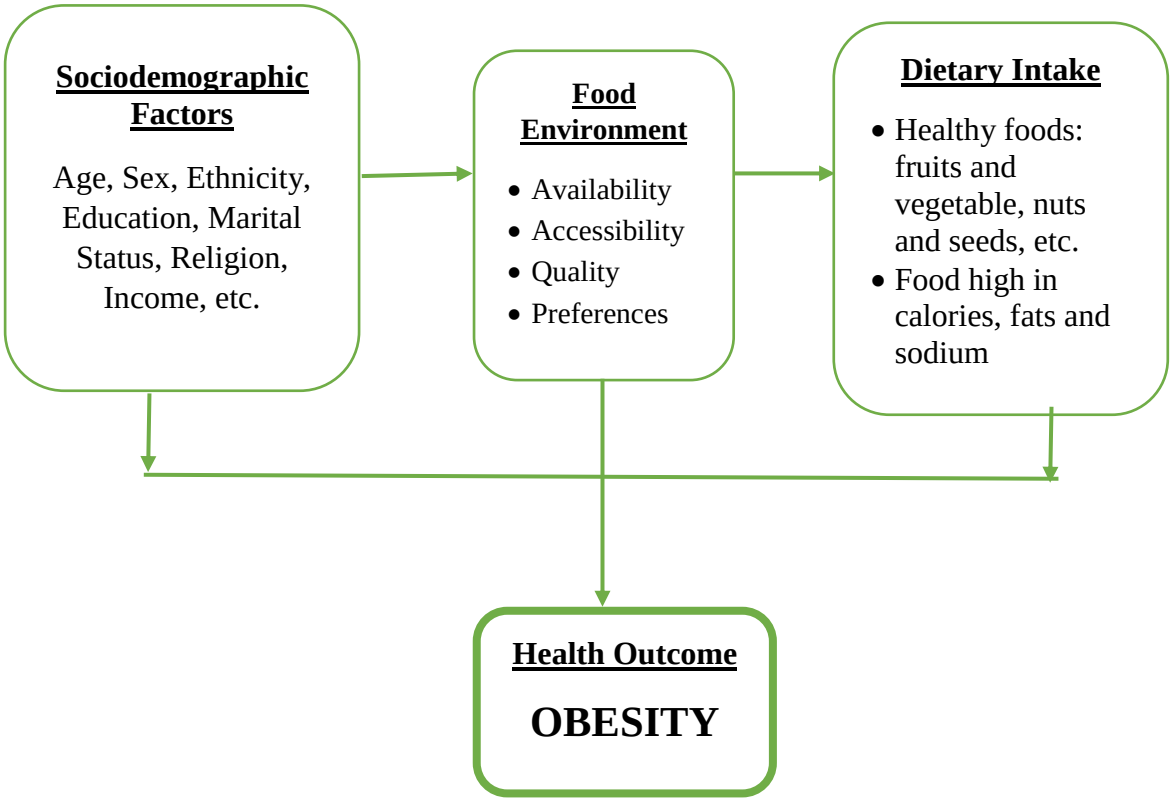

Figure 1.0: Conceptual Framework of Study

Source: *Arthur's Own Construct*

1.5 Research Questions

1. What are the dietary patterns among Ga Mashie residents?
2. How does dietary patterns protect against non-communicable diseases in Ga Mashie, Accra?

3. What is the prevalence of obesity in Ga Mashie, Accra?

1.6 General Objective

To investigate the role of dietary patterns in reducing the risk and prevalence of obesity among residents in Ga Mashie, Accra, Ghana.

1.7 Specific Objectives

1. To identify the dietary intake among Ga Mashie residents.
2. To identify how dietary intake, protect against non-communicable diseases in Ga Mashie, Accra.
3. To estimate the prevalence of overweight and obesity among Ga Mashie residents.

1.8 Profile of Study Area

Ga Mashie is a low-income urban community with a population of about 120,000 and known for low literacy rates, unhygienic conditions, and outdated housing structures. This community is known as an obesogenic community (Kushitor *et al.,* 2023) and marked by affordable energy dense street food, convenience foods, and fast food options, high availability of convenience shops, alcohol vendors, and limited fruits and vegetables (de-Graft Aikins *et al.,* 2020). This community also has a prevalence of NCDs with people living with these NCDs often experiencing complications due to poor management of their conditions (de-Graft Aikins *et al.,* 2020). This has been associated with unhealthy eating habits and a lack of awareness regarding dietary behaviours connected to NCDs (Codjoe, Okutu and Abu, 2016).

Figure 1.1: View of Ga Mashie

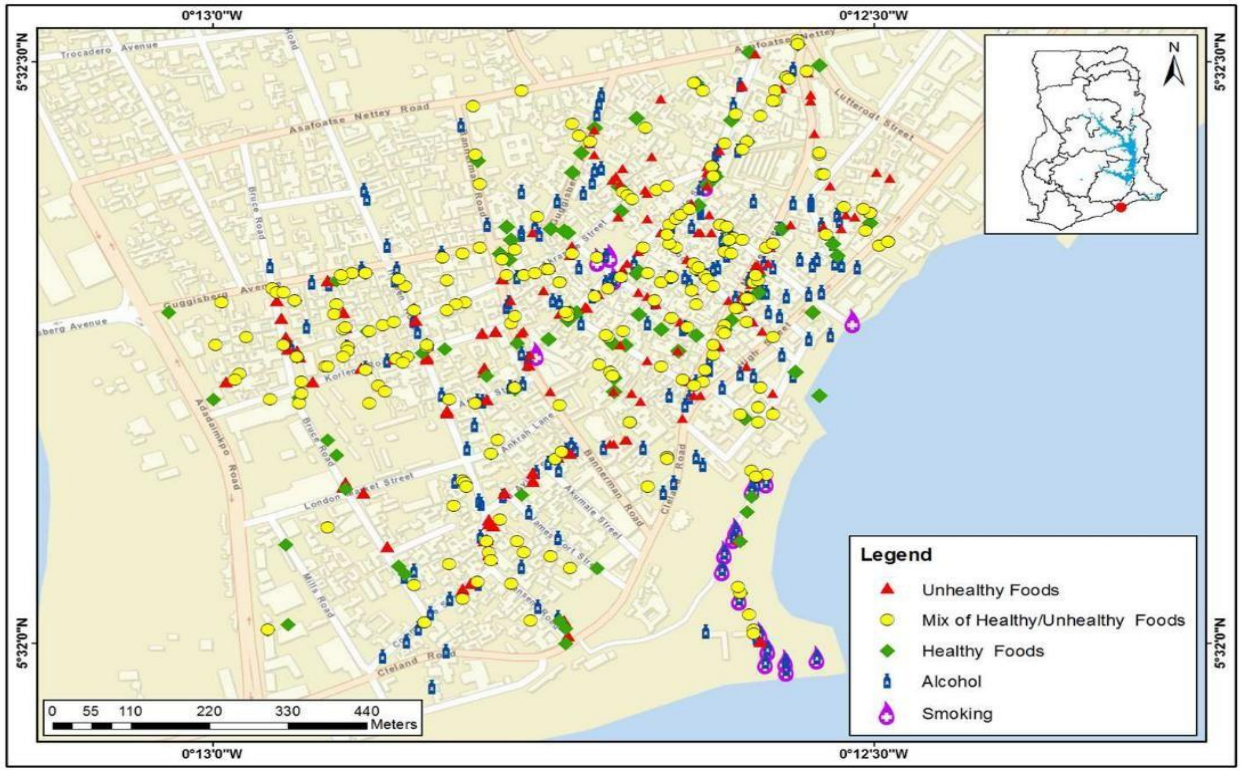

Figure 1.2 Map Showing Food Vending Sites and Alcohol Vendors in Ga Mashie
Source: (de-Graft Aikins *et al.*, 2020)

1.9 Scope of Study

This study focuses on adult residents of Ga Mashie, a densely populated urban community within the Greater Accra Region of Ghana. The research specifically examines the dietary patterns, socio-demographic characteristics, and behavioural factors that contribute to the risk and prevalence of obesity among this population. It does not include rural areas or populations outside of Ga Mashie. The scope is limited to assessing how local food choices, income levels, and lifestyle behaviours such as physical activity influence obesity, with the aim of generating data to inform targeted nutrition and public health interventions in similar urban Ghanaian settings.

1.10 Organization of Report

This thesis is organized into six chapters. Chapter One introduces the study by providing background information on the global and local burden of obesity, particularly in urban Ghana. It presents the problem statement, rationale, objectives, and the conceptual framework guiding the research. Chapter Two reviews relevant literature on obesity, its risk factors, and the influence of dietary patterns, with a particular focus on trends in sub-Saharan Africa and Ghana.

Chapter Three outlines the methodology used in the study, including the research design, sampling techniques, data collection tools, and analysis procedures. Chapter Four presents the findings of the study, detailing the socio-demographic profile of participants, their dietary patterns, and the relationship between these patterns and obesity prevalence.

Chapter Five discusses the key findings in the context of existing literature and highlights their implications for public health and nutrition policy. Finally, Chapter Six summarizes the study's conclusions and provides recommendations for improving dietary behaviours and addressing obesity through targeted interventions in urban communities like Ga Mashie.

2.0 LITERATURE REVIEW

2.1 Introduction

Overweight and OBS continue to pose significant public health challenges globally, particularly in LMICs undergoing rapid nutritional and lifestyle transitions. These conditions are the major risk factors for a range of NCDs. In recent years, increasing attention has been directed toward the role of diet in either exacerbating or mitigating these health outcomes. The protective capacity of specific dietary patterns, food groups, and nutrient profiles has emerged as a critical area of research in understanding how nutrition can serve as a preventive tool against obesity and its associated complication.

This chapter examines the current literature regarding nutritional knowledge and literacy, dietary habits and their links to obesity, challenges to healthy eating in low-income urban areas, public health strategies for NCD prevention in Ghana, and obstacles to healthy eating within low-income urban neighbourhoods.

2.2 Overview of NCDs and Obesity

NCDs are health issues characterized by extended durations and gradual advancement with very devastating outcomes with most being non-infectious, resulting from several factors which include environmental, genetic, behavioural, and physiological (Konda and Biswal, 2024). They contribute significantly to mortality rates, accounting for 38 million out of 57 million deaths each year, with 85% of these fatalities happening in LMIC (Akseer *et al.*, 2020). Throughout the years, the acronym NCDs has been applied to a diverse array of illnesses including liver, kidney, and gastrointestinal diseases, as well as endocrine, blood-related, and neurological conditions, skin diseases, genetic anomalies, injuries, and disabilities such as deafness and blindness (Budreviciute

et al., 2020). The primary risk factors associated with NCDs include physical activity, poor dietary habits, excessive alcohol consumption, and tobacco usage (Noor *et al.*, 2014). The rise of globalization and urbanization, particularly in LMICs, has greatly contributed to the increase in NCDs (Dowling and Yap, 2014) and have become a barrier to development (Beaglehole *et al.*, 2011).

OBS, a precursor for other NCDs such as hypertension, osteoporosis, arthritis, heart disease, and many others and has significantly increased since the WHO described it as an epidemic hazard worldwide (Mohamed *et al.*, 2014). Obesity significantly increases the risk of numerous diseases and health conditions associated with higher mortality rates (WHO, 2025). These include Type 2 diabetes mellitus (T2DM), cardiovascular disease (CVD), metabolic syndrome (MetS), chronic kidney disease (CKD), hyperlipidemia, hypertension, non-alcoholic fatty liver disease (NAFLD), certain cancers, obstructive sleep apnea, osteoarthritis, and depression (Lin and Li, 2021). Managing these conditions adds substantial pressure on healthcare systems; for instance, individuals with obesity incur approximately 30% higher medical expenses compared to those with a normal BMI (Lin and Li, 2021). With total healthcare costs doubling every decade, addressing obesity-related complications presents a growing and costly burden for both patients and healthcare providers (Bray *et al.*, 2017).

There have been many strategies proposed to manage the condition which include dieting, surgery, and medication with dieting and dietary components being the most proposed strategies (Huei *et al.*, 2020). This is because fruits and vegetables make up most of our foods, and are a great source of vitamins, minerals, dietary fiber, and non-nutrient substances such as plant steroids, flavonoids, and antioxidants (Azlan *et al.*, 2022).

2.3 Nutrition Knowledge and Food Literacy

To make nutritious choices, individuals need to acquire knowledge about nutrition and develop food literacy skills (Silva *et al.*, 2023). Nutrition knowledge refers to an understanding of the processes linked to nutrition and health. This encompasses awareness of the relationship between diet and health, diet and disease, key foods that provide essential nutrients, as well as dietary guidelines and recommendations (Mohebi *et al.*, 2018).

Food literacy, conversely, pertains to the understanding, abilities, and perspectives required to make educated choices about food and its effects on health (Silva *et al.*, 2023). It includes the capability to make choices regarding health, and contributing to sustainable food systems while taking into consideration social, cultural, economic, and environmental variables (Krause *et al.*, 2016). These are very essential concepts that serve a crucial function in producing positive and/or negative health outcomes, but even with the plethora of information available, it is difficult to settle for one thing due to individuals believing researchers often hold differing opinions and constantly have a change of mind (Silva *et al.*, 2023).

The link between health literacy and dietary behaviours is well-documented. Research has shown that higher levels of food literacy have a strong impact on dietary choices and eating habits, promoting greater consumption of fruits and vegetables while reducing the intake of fast food and processed snacks (Vaitkeviciute, Ball and Harris, 2015; Koca and Arkan, 2021; Murad, Alford and Davis, 2021).

2.4 Dietary Patterns and Their Association with Obesity

Dietary patterns refer to the amount, variety, and regularity of various foods and beverages consumed by a population, along with the behaviours linked to these dietary traits (Kushitor *et*

al., 2023). These behaviours stem from personal decisions shaped by various factors, including an understanding of nutrition, social connections, and environmental elements like the availability of food, food processing and preparation technologies, and the cost of food (Libman *et al.,* 2015). Obesity in low socioeconomic neighbourhoods is attributed to the excessive consumption of calorie dense foods, with fast food restaurants and convenient shops being overrepresented and health food stores being scarce (Micha, 2017).

A cohort study predicated on Yazd Healthy Heart Project has highlighted those specific dietary behaviours including high consumption of fat, sugar, fast foods, low consumption of fiber, and shunning breakfast are associated with overweight and obesity (Sarebanhassanabadi *et al.,* 2020). High consumption of ultra-processed foods, often energy-dense but nutrient-poor, disrupts normal appetite regulation and promote overeating due to their hyperpalatable nature (Monteiro *et al.*, 2019).

Additionally, frequent intake of sugar-sweetened beverages (SSBs), including sodas and sweetened fruit drinks, is associated with increased total energy intake and poor satiety, contributing significantly to positive energy balance and weight gain (Malik *et al.*, 2013). Skipping meals, irregular eating patterns, and night-time snacking have also been shown to influence metabolic health and are positively correlated with increased BMI (Gill and Panda, 2015).

In Ghana, excessive weight and obesity have been identified to significantly impact health and economic factors related to Life Expectancy (LE), QALYs, and the financial burden of the population (Yussif, Morrison and Annan, 2024). During a 50-year period, overweight and obesity caused 267,859 years of lives to be lost, 247,799 QALYs recorded, and an extra expenditure of US$82 million for all Ghanaians aged 50 and over, with the government's National Health

Insurance Scheme (NHIS) bearing 64% of those expenses (Lartey *et al.*, 2020). Currently, Ghana has experienced a spike in obesity and overweight rates with females in urban areas with the most prevalence compared to males. The percentage of overweight is among females and males is at (27.6% vs. 18.2%) and obesity at (17.3% vs. 11.0%) (Yussif, Morrison and Annan, 2024).

2.5 Barriers to Healthy Eating in Low-Income Urban Communities

Urban impoverished communities are characterized by insufficient income and resources essential for proper wellbeing, along with restricted access to fundamental services, job opportunities, and avenues for social advancement (Vilar-Compte *et al.*, 2021). Research shows that the cost of nutritious food tends to be high, resulting in a correlation between socio-economic status and food selection (Vilar-Compte *et al.*, 2021).

In Accra, Ghana, for instance, residents report choosing staple foods like kenkey over fruits due to cost considerations and the perception that such staples are more satiating (Afrifa-Anane *et al.*, 2022). Similarly, in Cape Town, South Africa, financial limitations are a primary barrier to consuming a diverse diet, with many individuals unable to afford healthier food options (Madlala *et al.*, 2024).

Additionally, urban communities with low income often have restricted availability of nutritious food choices, which connects the financial limitations of the residents and their environment to a broader issue of inadequate access to healthy foods (Taylor *et al.*, 2024). Also, personal and social ideals play an imperative role in food choices or dietary behaviour, with irregular food availability contributing to poor dietary habits through binge eating (P. W. F. Wilson, 2016).

Moreover, exposure to ultra-processed food advertisements have also shown to be responsible for overconsumption of energy and weight gain (Hall *et al.*, 2019). Nonetheless, cultural beliefs and a lack of nutrition education can influence dietary choices. In some communities, fruits and vegetables are considered non-essential or are perceived as snacks rather than integral components of a meal (Boatemaa, Badasu and de-Graft Aikins, 2018). This perception, combined with limited knowledge about the benefits of a balanced diet, hinders the adoption of healthier eating habits (Boatemaa, Badasu and de-Graft Aikins, 2018).

2.6 Public health policies for NCD prevention in Ghana

The burden of NCDs can be considerably decreased by cost-effective therapeutic and preventive measures in addition to currently offered NCD management and preventive measures (Schrag, 2019). However, the health system cannot handle NCDs and their problems on its own. To develop approaches for the control and prevention of NCDs, new health policies are needed (WHO, 2015). There are several documents on the prevention and strategic management of NCDs across continents. The key documents are the WHO Global Action Plan for NCD Prevention and control (Schrag, 2019) and the Action Plan for the Prevention and Control of NCDs in the WHO European Region 2016-2025 (Griebler Robert *et al.*, 2020).

Like other countries, Ghana also has policies that are implemented and aimed at the prevention of NCDs. Some of which include building healthy public policies (Ghana Ministry of Health, 2022), creating a supportive environment for NCD prevention (Owusu *et al.*, 2023), and mass media campaign (Konkor *et al.*, 2024).

2.6.1 Building Healthy Public Policies

The NCD policy developed in March, 2022 currently in use in Ghana brings to light three different categories of NCD policies namely international policies and resolutions, national policies, and specific NCD policies (Ghana Ministry of Health, 2022). Table 2.1 provides a brief summary of the policy document.

Table 2.1 Framework for NCD prevention

International Resolutions	National Health Policies	NCD specific policies
WHA Request for a Global Strategy for NCD Prevention and Control Reaffirmation	Ghana Shared Growth and Development Agenda (GSGDA), 2010–2013	National NCD Policy, 2012; 2022
Reaffirmation of Global Strategy of NCD Prevention and Control Transparency	National Health Policy 2007	National Strategy for the Prevention and Control of Non-communicable Diseases 2012
Transparency in Tobacco Control Process	Health Sector Medium Term Development Plan 2010–2013	Ghana National Nutrition Policy 2014–2017
Development of a Global Strategy on Diet, Physical Activity and Health (DPAS)	Health Promotion Policy 2005	Ghana Tobacco Control Regulations 2016 (L.I. 2247)
Adoption of WHO Framework Convention on Tobacco Control (FCTC)	Child Health Policy 2007–2015 Regenerative	National Alcohol Policy, 2016
Endorsement of DPAS	Regenerative Health and Nutrition Programme Strategic Plan 2007– 2011	
Health Promotion and Healthy Lifestyles	Disease Control Strategy 2010–2014	
Public Health Problems caused by Harmful Use of Alcohol		

Prevention and Control of NCDs: Implementation of the Global Strategy. Call to Prepare an Action Plan Endorsement	
Endorsement of a six-year Global Action Plan 2008–2013	
Strategy for the African Region on NCDs, WHO AFRO 2000	
WHO Framework Convention on Tobacco Control, 2003	
Global Strategy for Diet, Health and Physical Activity, 2004	
Action Plan for the Global Strategy for the Prevention and Control of NCDs, 2008	

Source: (Owusu *et al.*, 2023)

2.7.2 Creating a Supportive Environment for NCD Prevention

A study carried out by Owusu *et al.* (2023), examining health promotion efforts for NCDs through key informant interviews and documentary analysis indicated that various initiatives had been implemented in the past to foster an environment conducive to the prevention and management of NCDs- including advocacy, research, and risk factor control initiatives (Owusu *et al.*, 2023). These measures are currently still being undertaken for the management and prevention of NCDs. Table 2.2 indicates the interventions aimed at creating a supportive environment for NCD prevention and control in Ghana.

Table 2.2 *Measures Aimed at Creating a Supportive Environment for NCD Prevention In Ghana*

Intervention	Document Source
Celebration of International days	GHS Annual Report, 2012
Fiscal levers for healthy foods and drinks	National NCD Policy, 2022
Advocacy for physical education sessions in schools	National NCD Policy, 2012; 2022
Raising revenue for advocacy organizations by increasing taxes on tobacco and alcohol products (sin taxes)	National NCD Policy, 2012
Advocacy for healthy eating in curricular schools	National NCD Strategy, 2012
Advocacy for national stakeholder support on nutrition	National Nutrition Policy, 2013

Source: (Owusu *et al.*, 2023)

2.7.3 Mass Media Campaign

Since the huge success of the *Stop AIDS, love life* HIV/AIDS prevention mass media campaign, it has been established that the media plays an essential role in promoting health and producing positive health outcomes (Prilutski, 2010). The Ghana Demographic and Health Survey (GDHS) has consistently seen the relevance of media in health education (Konkor *et al.*, 2024), with recent evidence indicating approximately 82% of adults in Ghana listen to the radio, while around 70% watch television, both once a week (Kansanga *et al.*, 2018).

A study by Konkor *et al.* (2024), examining the connection between being exposed to mass media campaign communications and the adoption of NCD screening services showed a significant number of individuals are more likely to screen and adhere to preventive measures.

CHAPTER 3

3.0 METHODOLOGY

3.1 Introduction

This chapter outlines the methodological approach utilized in this research, specifying the study design, criteria for inclusion and exclusion, and the statistical methods applied to investigate the impact of dietary habits on obesity risk within the Ga, Mashie community. The methodology was designed to guarantee that the research effectively captured the different components necessary to examine dietary intake in the community.

3.2 Study Design and Source of Data

This study is a cross-sectional quantitative study using data from the CARE project. This study aimed to obtain data in order to better understand the burden, narratives, socio-ecological drivers, consequences, and response to diabetes mellitus in Ga Mashie and pinpoint interventions that would help the whole community in the control and prevention of diabetes mellitus. The researchers involved in this project estimated the prevalence of multimorbidity that is, diabetes, hypertension or obesity in Ga Mashie at the individual and household level. The prevalence of other NCDs, the risk factors, and their associated multimorbidity was also estimated. In addition, they also estimated the associations between contextual factors and the risk of diabetes.

3.2.1 Household Survey

Households of permanent residents in Ga Mashie met the criteria for this survey. In this context, permanent residents were described as those who had resided in a chosen household for the previous 12 months. A household was characterized as an individual or a collective of individuals, related to or not, who occupy the same address and share cooking facilities, as well as a living area, or dining space (Lule *et al.*, 2024).

3.3 CARE-Diabetes Sampling and Data Collection

The population of interest for this study was all individuals aged >25 years of age within selected households in Ga, Mashie. The Population and Household Census conducted in 2021 by the GSS was used to provide a sample of 12 households within the EAs used for the study. This gave a final sample of 920 households. It was further assumed that 40% of the households may either be empty or untraceable, therefore the sample size of the households was further increased to 958. A survey was then conducted in the 80 EAs of Ga Mashie so as to ensure a broad geographical representation by including households for the EAs (Figure 3).

To find the number of households needed for the study, it was estimated that there would be at least two eligible adults in each household, with a refusal rate of 10%. This resulted in a household sample of 684.

Figure 3.1: Enumeration Area of Ga Mashie

Source: (Lule *et al.*, 2024)

3.4 Data Collection Methods and Tools

Data was collected by forty enumerators who went through training to collect the data and procedures involved in data collection such as maintaining confidentiality, obtaining informed consent, conducting participant interviews, and conducting anthropometric measurements.

Household and individual data was captured using electronic questionnaires preloaded into the Open Data Kit (ODK) Collect app on an Android mobile device which were password protected and encrypted. Information was collected on sociodemographic characteristics, psychosocial well-being, physical activity, dietary intake, alcohol use, tobacco use, physical activity and exercise, and health service utilization among study participants. Blood pressure, blood glucose, and anthropometric measurements such as height, weight, and waist circumference were measure. Random blood glucose (RBS) concentration was taken from the middle finger by a prick. This was done using the One Touch select plus LifeScan Europe GmbH 6300 Zug, Switzerland. Their blood pressure measurements were obtained from the left arm using the OMRON–M7 intelli IT HEM-7361T-EBK, Vietnam BP monitor. It was done with the participants seated quietly for at least five minutes. Weight was measured in kilogram (kg) recorded to the nearest 0.1 kg using the GLC-D-200 KG digital body scale, GreenLife Canada digital scale. Height was measured in centimeters (cm) with a stadiometer to the nearest completed 0.1 cm, with the participant standing with the feet together, without shoes, and the heels, buttocks and upper part of the back projected on the same vertical plane, with the head oriented on the Frankfurt plane. The measurement in cm was then converted to meters (m). Waist circumference was taken at the navel using a measuring tape to the nearest complete 0.1 cm with the participant instructed to breathe normally, and

measurement taken after kg exhalation. BMI was calculated by using the formulae kg/m^2 to determine obesity.

3.5 Study Variable

The study variables for this study were focused on assessing the relationship between dietary intake and the risk of OBS among residents of Ga Mashie, Accra, Ghana. The variables were selected to capture dietary behaviour, socio-demographic characteristics, and health outcomes related to NCDs, with emphasis on obesity. Table 3.1 presents the variables used in this study.

3.5.1 Outcome Variable

The outcome variable is obesity, which was measured objectively through calculating the BMI, calculated as kg/m^2. Participants were classified into four categories according to the WHO standard; underweight (BMI< 18.5 kg/m^2), normal (18.5-24.9 kg/m^2), overweight (25.0-29.9kg/m^2), obese ($\geq$ 30.0 kg/m^2). The BMI categories allow for the estimation of the prevalence of obesity among the participants and the main outcome indicator for assessing health impact from dietary intake.

3.5.2 Explanatory Variable

The explanatory or independent variables comprised of dietary intake, which was assessed using the DQQ for Ghanaians with two derived indices: NCD-Protect score and NCD-Risk score. Higher NCD-Protect scores indicate a greater adherence to a protective diet aligned with WHO GDRs. Higher NCD-Risk scores reflect greater intake of risky foods linked to NCDs. The second explanatory variable is socio-demographic characteristics. It comprises of age, sex, ethnicity, marital status, education, and religion.

Table 3.1 Table on Study Variables

Variable	Coding/categories	Description
Dependent		
Overweight and OBS	0=No (Normal BMI), 1=Yes (overweight/OBS)	Overweight or obese based on BMI calculations
Independent		
Socio-demographic factors		
Sex	0= male, 1= female	Gender of respondent/ participant
Age (in years)	1= 25-44, 2= 45-64, 3= 65+	Age of respondent/ participant
Marriage	1=currently married, 2= divorced/separated, 3= widowed, 4= never married	Marital status of participants
Religion	1= no religion, 2= Christian, 3= Islam, 4= other	Belief system or object of worship
Education	1 = no education, 2 = basic, 3 = secondary, 4 = tertiary	Highest level of education
Ethnicity	1= Akan, 2= Ga-Dangme, 3= Ewe, 4=Mole Dagbani/Grussi/Gruma/Mande, 5= other	Ethnic group of participants
NCD score		
NCD-Protect score	Higher score = higher protective diet intake	Intake of foods protecting against NCDs
NCD-Risk score	Higher score = higher risk diet intake	Intake of foods increasing risk of NCDs

3.6 Inclusion/Exclusion Criteria

Individuals aged ≥25 years who are permanent residents within selected households and are deemed mentally sound and can provide informed consent were considered eligible for this research. The exclusion criteria covered pregnant women or women who gave birth within the last six months prior to the survey. Also, individuals deemed unable to provide informed consent, such

as those with impaired hearing or mental capacity. Women breastfeeding children under six months were also excluded.

3.7 Data Handling

Data were handled solely by the principal investigator in softcopy format. The electronic data were securely stored on a password-protected computer accessible only to the principal investigator and her supervisor. To ensure confidentiality and future reference, the data will be retained for a period of ten years following the completion of the study.

3.8 Data Analysis

Data analysis was conducted using STATA version 18 and Microsoft Excel 2021. Descriptive statistics were used to summarize participants' socio-demographic characteristics and responses related to dietary intake, behavioural factors, and obesity status. Frequencies and percentages were calculated for categorical variables, while means, medians, and standard deviations were computed for continuous variables. Bivariate analysis was used to explore associations between key variables. Chi-square tests were employed to examine relationships between categorical variables, particularly: Dietary patterns (healthy and unhealthy) and NCD scores (NCD-Protect and NCD-Risk), Sociodemographic variables (age, sex, education, marital status, religion) and NCD scores, as well as Individual dietary behaviours (e.g., consumption of sugar-sweetened beverages, deep-fried foods, processed meats) and overweight/obesity status.

Dietary patterns were derived from the Diet Quality Questionnaire (DQQ). A healthy dietary pattern score was calculated from the consumption of eight protective food groups: whole grains, pulses, nuts and seeds, vitamin A-rich vegetables and fruits, citrus fruits, other vegetables, and fish. Participants were categorized into Low (0–2 foods), Moderate (3–5 foods), and High (6–8

foods) consumption groups. An unhealthy dietary pattern score was created from the consumption of seven risk-associated food groups: processed meats, salty snacks, instant noodles, deep-fried foods, soft drinks, sweets, and fast food. Participants were similarly grouped into Low (0–1 foods), Moderate (2–4 foods), and High (5–7 foods) consumption groups.

These dietary pattern variables were cross-tabulated with both NCD-Protect and NCD-Risk score categories using chi-square tests. Additionally, logistic regression analysis was performed to identify significant predictors of obesity at a 95% confidence level. A p-value < 0.05 was considered statistically significant. Results were presented using tables and charts to enhance clarity and facilitate interpretation.

3.9 Ethical Consideration

Ethical Clearance was sought from the Ensign Global University Institutional Research Board (IRB); Ethical Approval reference: ENSIGN/IRB/EL/SN-279/01 (Appendix 1). Ethical approval for the CARE project was granted by the Ghana Health Service (GHS–ERC: 017/02/22), the Institutional Review Board at the Noguchi Memorial Institute for Medical Research, University of Ghana (NMIMR- IRB CP 060/21-22), and the Research Ethics Committee at University College London (ID: 21541/001). Participants gave their written informed consent.

3.10 Limitations of Study

Dietary intake was assessed using the DQQ, which relies participants' self-reported recall of foods consumed the previous day. This method was subject to recall bias and social desirability bias, potentially affecting the accuracy and eligibility of the dietary intake data.

3.11 Dissemination of Results

The findings of this study were disseminated through a formal presentation at the Ensign Global University Library. The results were shared with academic staff, students, and other stakeholders to inform future research, public health planning, and community-level interventions related to dietary habits and obesity prevention.

3.12 Assumptions

This study was based on several key assumptions. First, it assumes that participants will provide honest and accurate responses regarding their dietary habits, lifestyle behaviours, and socio-demographic information. Second, it assumes that the dietary patterns reported by the residents of Ga Mashie are reflective of their usual eating behaviours and are sufficiently stable to establish meaningful associations with obesity risk. Third, it is assumed that the tools and methods used for data collection, including dietary assessments and anthropometric measurements, are valid and reliable for the study population. Finally, the study assumes that external factors influencing obesity, such as genetic predisposition and environmental variables, remain relatively constant or have minimal impact on the observed relationships within the scope of this research.

CHAPTER 4

4.0 RESULTS

4.1 Introduction

This chapter presents the findings of the study based on the data collected from residents of Ga Mashie. The results of this study are presented based on the specific objectives: (i) To identify the dietary intake among Ga Mashie residents (ii) To identify how dietary intake, protect against noncommunicable diseases (iii) To estimate the prevalence of overweight and obesity among Ga Mashie residents.

4.2 Socio-Demographic Characteristics of Participants

Table 4.1 shows data from the CARE project with a total sample of 854 with majority of the participants between 25-44 years with a frequency of 397 (46.49%). The participants were widely distributed across various regions, with the highest respondents being Ga Dangme 654 (76.58%), followed by Akan 113 (13.23%), Ewe 36 (4.22%), other 33 (3.86%), and finally Mole-Dagbani/ Grussi/ Gruma/ Mande 18 (2.11%).

A greater majority of participants 535 (62.65%) attained basic education, 183 (21.43%) had secondary education, 84 (9.84%) had no education, and 52 (6.09%) had tertiary education. The predominant religion identified among the participants was Christianity 570 (66.74%), followed by others 132 (15.46%) which constitutes participants who refused to answer and agnostic individuals. Islam is the third common religion 109 (12.76%), and finally those with no religion 43 (5.04%).

Table 4.1 Socio-Demographic Characteristics

Variables	Frequency (n=854)	Percentage (%)
Sex		
Male	305	35.71
Female	549	64.29
Age		
25-44 yrs	397	46.49
45-64 yrs	328	38.41
65+ yrs	129	15.11
Marriage		
Currently married	409	47.89
Divorced/separated	158	18.50
Widowed	131	15.34
Never married	156	18.27
Religion		
No religion	43	5.04
Christian	570	66.74
Islam	109	12.76
Other	132	15.46
Education		
No education	84	9.84
Basic	535	62.65
Secondary	183	21.43
Tertiary	52	6.09
Ethnic group		
Akan	113	13.23
Ga-Dangme	654	76.58
Ewe	36	4.22
Mole-Dagbani/Grussi/Gruma/Mande	18	2.11
Other	33	3.86

4.3 DQQ Food Groups

The DQQ is a quick dietary evaluation tool aimed at facilitating the measurement and monitoring of diet quality within a population through 29 distinct food items. It comprises yes or no questions regarding food consumption during the previous day or night, aligning with the 29 different food groups. The categories include: 1) foods made from grains; 2) whole grains; 3) white roots, tubers, and plantains; 4) pulses; 5) vitamin A-rich orange vegetables; 6) dark leafy green vegetables; 7) other vegetables; 8) vitamin A-rich fruits; 9) citrus ; 10) other fruits; 11) baked/ grain-based sweets; 12) other sweets; 13) eggs; 14) cheese; 15) yogurt; 16) processed meat; 17) unprocessed red meat (ruminant); 18) unprocessed red meat (non-ruminant); 19) poultry; 20) fish and seafood; 21) nuts and seeds; 22) packaged ultra-processed salty snacks; 23) instant noodles; 24) deep fried foods; 25) fluid milk; 26) sweet tea/ coffee/ cocoa; 27) fruit juice and fruit-flavoured drinks; 28) soft drinks; 29) fast food.

Majority of participants being 66.63% reported consuming food made from grains, while 33.37% did not. Whole grain consumption was slightly lower, with 62.76% of participants including them in their diet. White roots, tubers, and plantains were consumed by 33.37% of the participants, while 66.63% did not include them in their diet. Consumption of pulses was notably low, with only 10.07% taking them. Similarly, vitamin A-rich orange vegetables were consumed by 8.43% of participants. Dark green leafy vegetables were consumed by 9.48% of participants, whereas 90.52% did not. Other vegetables had a higher consumption rate, with 68.03% of participants including them in their diet. Vitamin A-rich fruits had the lowest intake, with only 6.09% of participants consuming them. Citrus fruits were consumed by 11.01% of participants, while other fruits were included in the diet by 13.23% of participants. Baked/ grain-based sweets were

consumed by 14.52% of participants, while other sweets had a lower intake at 5.15%. Eggs were consumed by 28.69% of participants, while dairy consumption was also low, with cheese (1.41%), and yogurt (3.04%).

Processed red meat had a lower intake of 4.68%. Unprocessed red meat (ruminant) was consumed by 19.20% of participants whereas red meat (non-ruminant) consumption was only 4.57%. Poultry consumption was reported by 18.15% of participants. Fish and seafood had a relatively high intake, with 64.64% of participants including them in their diet. Nuts and seeds were consumed by 23.07% of participants. Ultra-processed salty snacks were consumed by 3.86% of participants, while instant noodles had a slightly higher intake at 5.62%. Deep-fried food consumption was reported by 22.72% of participants, and fluid milk intake was at 18.97%). Sweet tea/coffee/cocoa was taken by 21.34% of participants, while fruit juices and fruit-flavoured drinks were consumed by 6.32%. Soft drinks were taken by 20.61% of participants. Fast food consumption was the lowest among all food categories, with only 0.70% of participants reporting intake. Table 4.2 shows the various DQQ food groups.

Table 4.2 DQQ Food Groups

Food Item	**No (%)**	**Yes (%)**
Food made from grains	285 (33.37)	569 (66.63)
Whole grains	318 (37.24)	536 (62.76)
White roots, tubers, and plantains	569 (66.63)	285 (33.37)
Pulses	768 (89.93)	86 (10.07)
Vitamin A-rich orange vegetables	782 (91.57)	72 (8.43)
Dark green leafy vegetables	773 (90.52)	81 (9.48)

Other vegetables	273 (31.97)	581 (68.03)
Vitamin A-rich fruits	802 (93.91)	52 (6.09)
Citrus	760 (88.99)	94 (11.01)
Other fruits	714 (86.77)	113 (13.23)
Baked/grain-based sweets	730 (85.48)	124 (14.52)
Other sweets	810 (94.85)	44 (5.15)
Eggs	609 (71.31)	245 (28.69)
Cheese	842 (98.59)	12 (1.41)
Yogurt	828 (96.96)	26 (3.04)
Processed meat	814 (95.32)	40 (4.68)
Unprocessed red meat (ruminant)	690 (80.80)	164 (19.20)
Unprocessed red meat (nonruminant)	815 (95.43)	39 (4.57)
Poultry	699 (81.85)	155 (18.15)
Fish and seafood	302 (35.36)	552 (64.64)
Nuts and seeds	657 (76.93)	197 (23.07)
Packaged ultra-processed salty snacks	821 (96.14)	33 (3.86)
Instant noodles	806 (94.38)	48 (5.62)
Deep fried foods	660 (77.28)	194 (22.72)
Fluid milk	692 (81.03)	162 (18.97)
Sweet tea/coffee/cocoa	671 (78.57)	183 (21.43)
Fruit juice and fruit-flavored drinks	800 (93.68)	54 (6.32)
Soft drinks	678 (79.39)	176 (20.61)
Fast foods	848 (99.30)	6 (0.70)

4.4 NCD Protect Score

The NCD-Protect score varies between 0 and 9 and is based on 9 different food categories: 1) whole grains; 2) pulses; 3) nuts and seeds; 4) vitamin-A rich orange vegetables; 5) dark green leafy vegetables; 6) other vegetables; 7) vitamin-A rich fruits; 8) citrus; and 9) other fruits. It also signifies the compliance with GDRs concerning dietary components that safeguard against diet-related NCDs. A higher score indicates a greater inclusion of health-promoting foods within the diet and shows a positive correlation with adhering to WHO GRDs, such as ≥400 g of fruits and vegetables daily, incorporating legumes, whole grains, nuts, and consuming ≥25 g of fibre each day. The scoring for each group is binary (0: not consumed, 1: consumed), and the NCD-Protect score is derived by totalling the scores from all food groups.

From analysis, all nine (9) food groups show a low protect score with a frequency of 561 (65.69%), and a high protect score of 293 (34.31%). NCD-Protect foods consumed are: other vegetables 591 (69.20%), whole grains 536 (62.76%), nuts and seeds 197 (23.07%), other fruits 146 (17.10%), citrus 94 (11.01%), pulses 86 (10.07%), dark green leafy vegetables 81 (9.48%), vitamin-A rich orange vegetables 72 (8.43%), and vitamin-A rich fruits 52 (6.09%). Table 4.3 presents the NCD-Protect scores for each food item.

Table 4.3: NCD-Protect Score

Food Item	**No (%)**	**Yes (%)**
Whole grains	318 (37.24)	536 (62.76)
Pulses	768 (89.93)	86 (10.07)
Nuts and seeds	657 (76.93)	197 (23.07)
Vitamin-A rich orange vegetables	782 (91.57)	72 (8.43)

Dark green leafy vegetables	773 (90.52)	81 (9.48)
Other vegetables	263 (30.80)	591 (69.20)
Vitamin A-rich fruits	802 (93.91)	52 (6.09)
Citrus	760 (88.99)	94 (11.01)
Other fruits	708 (82.90)	146 (17.10)
NCD – Protect score		
Low protect	561 (65.69)	
High protect	293 (34.31)	

4.5 NCD Risk Score

NCD-Risk comprises of eight (8) food groups: 1) soft drinks; 2) baked/grain-based sweets; 3) other sweets; 4) processed meat; 5) unprocessed red meat; 6) deep fried foods; 7) fast food and noodles; and 8) packaged ultra-processed salty snacks. The NCD-Risk score reflects adherence to GDRs on components of the diet to limit or avoid. A higher score reflects a decreased chance of achieving the GRDs related to dietary risk factors for NCDs, which includes limiting free sugars to n more than 10% of dietary energy (DE), total fat to under 30% DE, saturated fat to below 10% DE, salt to no more than 5 g per day, red meat intake to less than 350 g per week, and steering clear of processed meat. Furthermore, the NCD-Risk score serves as a proxy for intake of ultra-processed foods, indicating that a higher NCD-Risk score correlates with greater consumption of such foods. Each food group's score is assigned a value of 0 if not consumed and 1 if consumed, with the NCD risk determined by adding the scores of all food groups.

The results obtained from analysis revealed a low risk of 749 (87.70%), and a high risk of 105 (12.30%). Deep fried foods are consumed the most with a frequency of 194 (22.72%), with

unprocessed red meat following at a frequency of 192 (22.48%), followed by soft drinks 176 (20.61%), baked/grain-based sweets 124 (14.52%), fast foods and instant noodles 52 (6.09%), other sweets 44 (5.15%), processed meat 40 (4.68%), and packaged ultra-processed salty snacks 33 (3.86%). Table 4.4 shows the NCD-Risk score for the various food items.

Table 4.4: NCD-Risk Score

Food Item	**No (%)**	**Yes (%)**
Soft drinks (soda)	79.39	20.61
Baked/grain-based sweets	85.48	14.52
Other sweets	94.85	5.15
Processed meat	95.32	4.68
Unprocessed red meat (ruminant)	77.52	22.48
Deep-fried foods	77.28	22.72
Fast foods and instant noodles	93.91	6.09
Packaged ultra-processed salty snacks	96.14	3.86
NCD risk score		
Low risk	749 (87.70)	
High risk	105 (12.30)	

4.6 Bivariate Analysis: Findings

4.6.1 Association Between Healthy Dietary Pattern and NCD-Protect Score

The analysis of the association between healthy dietary patterns and the NCD-Protect score revealed a significant relationship, as evidenced by a Pearson chi-square statistic of 249.1482 ($p < 0.001$) (refer to Table 4.5). Participants classified under the "Low Healthy Diet" category (consumed 0–2 protective food groups) accounted for 445 individuals, with the majority (89.89%) exhibiting a low NCD-Protect score, while only 10.11% demonstrated a high NCD-Protect score. Similarly, those in the "Moderate Healthy Diet" category (consumed 3–5 protective food groups)

showed a contrasting distribution, with 40.45% having a low NCD-Protect score and 59.55% having a high NCD-Protect score. Interestingly, participants in the "High Healthy Diet" category (consumed 6–9 protective food groups) exclusively exhibited high NCD-Protect scores (100%).

Individuals with moderate and high healthy dietary patterns demonstrated significantly higher proportions of high NCD-Protect scores, indicating better adherence to protective dietary behaviours. Conversely, participants with low healthy dietary patterns were predominantly associated with low NCD-Protect scores, reflecting limited consumption of protective food groups.

Table 4.5: Association Between Healthy Dietary Pattern and NCD-Protect Score (N=854)

Variables	**Low Protect**		**High Protect**		**χ^2 (p-Value)**
	N	**(%)**	**N**	**(%)**	
Healthy Dietary Pattern					
Low Healthy	400	89.89	45	10.11	
Moderate Healthy	161	40.45	237	59.55	
High Healthy	0	0.00	11	100.00	
Total	**561**	**65.69**	**293**	**34.31**	**249.1482 (0.000)**

Note: χ^2 = Chi-square test statistic; p-values less than 0.05 indicate statistical significance

4.6.2 Association Between Unhealthy Dietary Pattern and NCD-Risk Score

The analysis revealed a significant association between unhealthy dietary patterns and NCD-Risk Scores ($\chi^2 = 463.67$, $p < 0.001$) as shown in Table 4.6. Participants with a low unhealthy dietary pattern, characterized by the consumption of 0–1 risky food group, demonstrated a predominantly low NCD-Risk Score, with 97.93% falling into the low-risk category and only 2.07% classified as high risk. Similarly, those with moderate unhealthy dietary patterns (consuming 2–4 risky food

groups) exhibited a different distribution, with 31.50% categorized as low risk and 68.50% as high risk. In contrast, participants classified as having a high unhealthy dietary pattern (consuming 5–8 risky food groups) were exclusively in the high-risk category (100.00%).

There was a strong positive correlation between the number of risky foods consumed and the likelihood of being classified in the high NCD-risk group. Notably, the proportion of participants with high NCD-risk scores increased dramatically as the level of unhealthy dietary behaviour escalated from low to high.

Table 4.6: Association Between Unhealthy Dietary Pattern and NCD-Risk Score (N=854)

Variables	**Low Risk**	**High Risk**		**χ^2 (p-Value)**
	N	**%**	**N**	
Unhealthy Dietary Pattern				
Low Unhealthy	709	97.93	15	
Moderate Unhealthy	40	31.50	87	
High Unhealthy	0	0.00	3	
Total	**749**	**87.70**	**105**	**463.67 (0.000)**

Note: χ^2 = Chi-square test statistic; p-values less than 0.05 indicate statistical significance.

4.7 Bivariate Analysis: Sociodemographic Factors and NCD-Protect Score

Table 4.7 presents the socio-demographic characteristics of the participants categorized based on their NCD-Protect score into low and high protect groups. The statistical significance of differences between these groups was assessed using p-values. For sex, males made up 35.47% of the low protect group and 36.18% of the high protect group, while females constituted 64.53% and 63.82% of the respective groups. Statistical significance obtained from this group is 0.228

which indicates no strong association between sex and the consumption of foods that protect against NCDs.

The distribution of age groups across both categories showed that individuals aged 25-44 years constituted a large population in both low (45.99%) and high (47.44%) protection groups. The 45-64year group had 37.25% in the low protect category and 40.61% in the high protect category. Meanwhile, participants aged 65 years and above have smaller proportions in both low and high categories being 16.76% and 11.95% respectively. The p-values 0.344 and 0.135 for these ages suggest no association between age and NCD-protect scores.

Participants who were currently married constituted 47.06% of the low protect group and 49.99% of the high protect group. Those divorced or separated accounted for 19.07% in the low protect group and 17.41% in the high protect group. Widowed individuals made up 15.33% and 15.36%, while those who had never married accounted for 18.54% and 17.75% of the low and high protect groups, respectively. The p-values ranging from 0.306 to 0.798 indicate marital status has no significant influence on foods that protect against NCDs.

Individuals with no religious affiliation accounted for 4.81% and 5.46% in the low and high protect groups, respectively. Majority of participants identified as Christians, representing 64.71% of the low protect group and 70.65% of the high protect group. Muslims constituted 13.55% in the low protect group and 11.26% in the high protect group, while those belonging to other religious groups comprised 16.93% and 12.63% of the respective groups. The p-values 0.787, 0.386, and 0.248 also indicate no significant relationship between religious affiliation and NCD protection status. Among the participants, 10.52% of the low protect group had no education, compared to 8.53% in the high protect group. Those with basic education comprised of 64.35% and 59.39%, respectively. Secondary education was attained by 19.79% in the low protect group

and 24.57% in the high protect group. Tertiary education was the least common, with 5.35% in the low protect group and 7.51% in the high protect group. The p-values 0.929, 0.189, and 0.171 indicate no association between education level and NCD protection status. The Akan ethnic group constituted 12.30% in the low protection category and 15.02% in the high protect group. The Ga-Dangme ethnic group, making up 79.68% of the low protect category and 70.65% of the high protect category. The Ewes accounted for 2.85% in the low protect category and 6.83% in the high protect category, while Mole Dagbani/Grussi/Gruma/Mande individuals comprised 1.06% and 3.07% of the respective categories. The p-values 0.128, 0.082, 0.377, and 0.962% suggest no significant association between ethnicity and NCD protection status.

Table 4.7 NCD-Protect for Socio-Demographic Characteristics

Variables	**Low Protect**	**High Protect**	**χ^2 (p-Value)**
	N (%)	**N** (%)	
Age groups (years)			**3.60 (0.165)**
25–44	258 (64.99)	139 (35.01)	
45–64	209 (63.72)	119 (36.28)	
65+	94 (72.87)	35 (27.13)	
Gender			**0.04 (0.838)**
Male	199 (35.47)	106 (36.18)	
Female	362 (64.53)	187 (63.82)	
Marital Status			**0.59 (0.898)**
Currently married	264 (47.06)	145 (49.49)	
Divorced/separated	107 (19.07)	51 (17.41)	
Widowed	86 (15.33)	45 (15.36)	
Never married	104 (18.54)	52 (17.75)	
Religious Group			**4.27 (0.233)**
No religion	27 (4.81)	16 (5.46)	

Christian	363 (64.71)	207 (70.65)	
Islam	76 (13.55)	33 (11.26)	
Other	95 (16.93)	37 (12.63)	
Education Level			**5.06 (0.167)**
No education	59 (10.52)	25 (8.53)	
Basic	361 (64.35)	174 (59.39)	
Secondary	111 (19.79)	72 (24.57)	
Tertiary	30 (5.35)	22 (7.51)	
Ethnic Group			**12.68 (0.013)**
Akan	69 (12.30)	44 (15.02)	
Ga-Dangme	447 (79.68)	207 (70.65)	
Ewe	16 (2.85)	20 (6.83)	
Mole-Dagbani/Grussi/Ga	9 (1.60)	9 (3.07)	
Other	20 (3.57)	13 (4.44)	

4.8 Bivariate Analysis: Sociodemographic Factors and NCD-Risk Score

Table 4.8 displays the socio-demographic traits of participants divided into low and high-risk categories according to their NCD-Risk score. The statistical significance of differences between these groups was assessed using p-values. Among the participants, males constituted 35.51% of the low-risk group and 37.14% of the high-risk group, while females made up 64.49% and 62.86% of the respective groups. The statistical difference, 0.256 indicates no strong association between sex and NCD risk levels. Participants aged 25-44 years constituted the largest proportion in the both risk categories, representing 43.26% of the low-risk group and 69.52% of the high-risk group. The 45-64 age group comprised of 40.45% in the low-risk category and 23.81% in the high-risk category, showing a significant difference with a p-value of 0.021. Additionally, participants aged

65 years and above accounted for 16.29% of the low-risk group but only 6.67% of the high-risk group, with a statistically significant difference of 0.028. these results suggest that younger individuals are more likely to have a higher NCD score or are at a higher risk of suffering from NCDs, while older adults are at a low-risk of suffering from NCDs.

For the marriage variable, currently married individuals represented 47.66% of the low-risk group and 49.52% of the high-risk group. Those who were divorced/ separated accounted for 19.63% in the low-risk group and 10.48% in the high-risk group. Widowed individuals comprised 16.29% and 8.57% in the low and high-risk groups, respectively. However, the differences in p-values ranging from 0.328 to 0.723 suggest that marital status does not have a notable impact on NCD risk levels.

For religious affiliation, those with no religious affiliation accounted for 5.07% in the lowrisk category and 4.76% in the high-risk category. Christians constituted the majority in both groups, making up 65.95% of the low-risk group and 72.38% of the high-risk group. Muslims comprised 13.08% and 10.48% 0f the respective groups, while other religious groups accounted for 15.89% and 12.38%. The p-values ranging from 0.386 to 0.939 indicate no significant association between religious affiliation and NCD risk. Among participants in the education category, 10.81% of the low-risk group had no formal education, compared to 2.86% in the high-risk group. Those with basic education comprised 64.22% of the low-risk group and 51.43% of the high-risk group. Secondary education was attained by 19.76% in the low-risk group and 33.33% in the high-risk group, with a statistically significant p-value of 0.021. Tertiary education was the least common, with 5.21% in the low-risk category and 12.38% in the high-risk category, also with a statistically significant p-value 0f 0.018. These findings suggest that higher levels of education are associated with a higher NCD risk score.

For ethnicity, Akans constituted 12.95% in the low-risk group and 15.24% in the high-risk category. The majority of participants being Ga-Dangme made up 76.64% of the low-risk group and 76.19% of the high-risk group. Ewes represented 4.27% of the low-risk group and 3.81% of the high-risk group. The Mole-Dagbani/Grussi/Gruma/Mande category comprised 2.27% of the low risk group and 0.95% of the high-risk group. Other ethnic groups accounted for 3.87% of the low-risk group and 3.81% of the high-risk group. The p-values ranging from 0.332 to 0.765 indicate no significant association between ethnicity and NCD risk.

Table 4.8 Socio-Demographic Characteristics for NCD-Risk score

Variables	**Low Risk (N=749)**		**High Risk (N=105)**		**χ^2 (p-Value)**
	N	**(%)**	**N**	**(%)**	
Age Categories					25.95 (0.000)
25–44 years	324	43.26	73	69.52	
45–64 years	303	40.45	25	23.81	
65+ years	122	16.29	7	6.67	
Gender					0.11 (0.744)
Male	266	35.51	39	37.14	
Female	483	64.49	66	62.86	
Marital Status					19.16 (0.000)
Currently Married	357	47.66	52	49.52	
Divorced/Separated	147	19.63	11	10.48	
Widowed	122	16.29	9	8.57	
Never Married	123	16.42	33	31.43	
Religious Group					1.81 (0.613)
No Religion	38	5.07	5	4.76	
Christian	494	65.95	76	72.38	

Islam	98	13.08	11	10.48	
Other	119	15.89	13	12.38	
Education Level					24.03 (0.000)
No Education	81	10.81	3	2.86	
Basic	481	64.22	54	51.43	
Secondary	148	19.76	35	33.33	
Tertiary	39	5.21	13	12.38	
Ethnic Group					1.17 (0.883)
Akan	97	12.95	16	15.24	
Ga-Dangme	574	76.64	80	76.19	
Ewe	32	4.27	4	3.81	
Mole-Dagbani/Grussi/Ga	17	2.27	1	0.95	
Other	29	3.87	4	3.81	

4.9 Prevalence of Overweight and Obesity

Figure 4.1 presents the distribution of body weight status among the study participants. The results indicate that 3.04% of the population were underweight, while 33.37% had normal weight. Overweight individuals accounted for 29.04% of the population, and 34.54% were classified as obese.

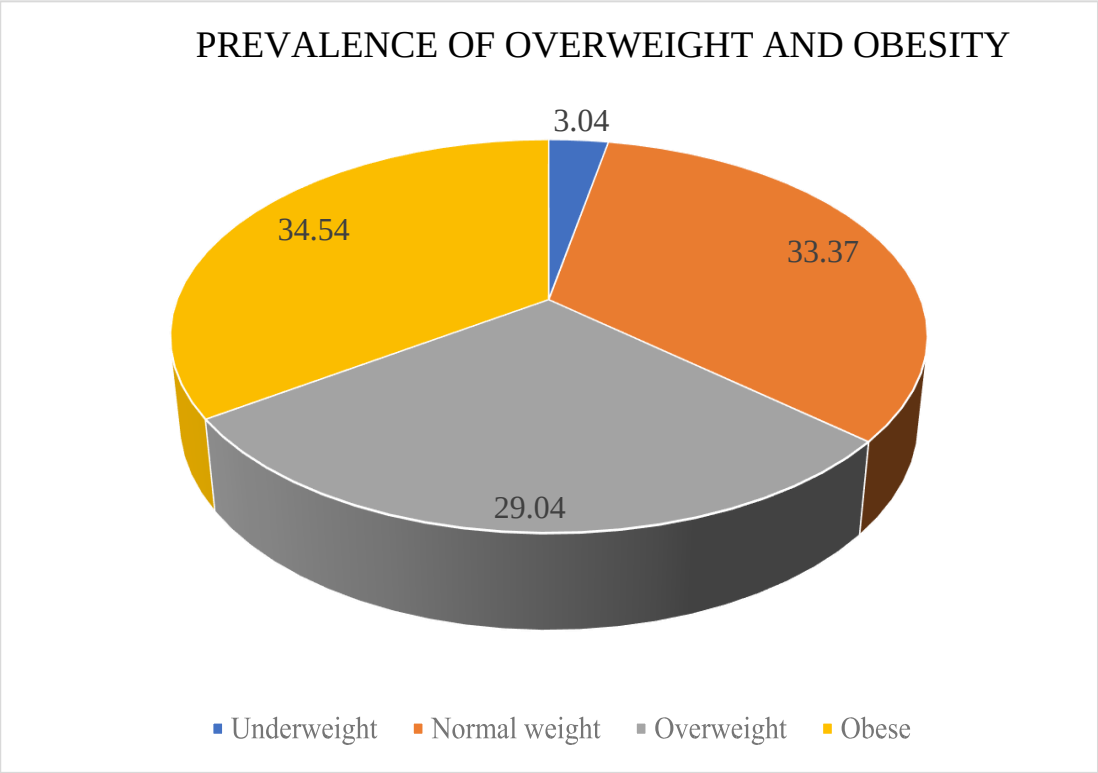

Figure 4.1: Prevalence of Overweight and Obesity

CHAPTER FIVE

5.0 DISCUSSION

5.1 Introduction

This chapter interprets and discusses the key findings of the study in relation to the research objectives and existing literature. It explores how dietary intake patterns among residents of Ga Mashie relate to NCD-Protect and NCD-Risk scores, and examines their implications for obesity prevalence in the community. The findings are analyzed in the context of public health concerns, socio-demographic influences, and nutrition-related risk factors.

5.2 Dietary Intake Patterns Among Ga Mashie Residents

Staple food consumption remains predominant, with 66.63% of participants consuming foods made from grains, while 62.76% included whole grains in their diet. This aligns with dietary trends observed in urban LMIC, where cereals and grains form majority of the diet due to affordability and accessibility (Peters *et al.*, 2019).

However, consumption of key food groups associated with improved diet quality was relatively low. This is alarming, as fruits, vegetables, and legumes are vital sources of dietary fibre, vitamins, and phytochemicals that lower the risk of NCDs (Ülger *et al.*, 2018). The findings are in line with the inconsistent availability of fruits and vegetables in Ghanaian households contributing to suboptimal consumption (Janice *et al.*, 2024).

The minimal intake of dairy products and eggs reflect economic status, as only 1.41% consumed cheese and 3.04% consumed yogurt. Furthermore, low consumption of animal-based protein like poultry (18.15%) and red meat (19.20%) could suggest either dietary preference shifts, and cost-related limitations (Cotter *et al.*, 2017).

The study also found a relatively high intake of ultra-processed food from a smaller percentage of the population. Soft drinks were found to be consumed by 20.61%, and deep-fried foods consumed by 22.72%. This trend mirrors dietary transitions driven by urbanization and global food marketing (de Bruin, Dengerink and van Vliet, 2021), raising concerns about the growing presence of processed foods in urban Ghanaian diets.

5.3 NCD-Protect and NCD-risk food scores

The NCD-Protect score provides an indication of the participants' adherence to dietary patterns that reduce the risk of chronic illnesses. The results revealed that only 34.31% of participants had a high NCD-Protect score, meaning two-thirds of the population are not consuming sufficient protective foods. This reflects inadequate intake of dietary fibre, insufficient fruits and vegetables consumption, and low legume and whole grain inclusion – all of which are essential for mitigating the risk of NCDs (Jayedi *et al.*, 2020). It also reinforces the narrative that urban diets are shifting away from plant-based traditional foods towards more processed and energy-dense alternatives (Cyr-Scully *et al.*, 2022).

In contrast, the NCD-Risk score showed that majority (87.70%) had a low-risk score. However, this does not necessarily indicate a healthy diet, as even low-risk scores were accompanied by poor protective scores. Deep fried food (22.72%), unprocessed red meat (22.48%), and soft drinks (20.61%) were the most frequently consumed NCD-Risk items. While these frequencies may seem moderate, their cumulative effect on NCD development can be significant, particularly when protective food consumption is low (Daba, Atsbeha and Debiso, 2025).

5.4 Socio-Demographic Associations Between Age, Education, And NCD-Risk Score

Interestingly, the study found no statistically significant association between sex, marital status, religion, or ethnicity and NCD-Protect or Risk scores. However, age and education level did show significance in relation to NCD-Risk scores. This reinforces the research indicating that nearly all working-class adults possess at least one risk factor for NCDs (Motuma *et al.*, 2022). Younger individuals (25-44 years) were more likely to fall into the high-risk category, possibly due to increased consumption of processed foods and beverages. This indicates a wider epidemiological pattern in which younger demographics are increasingly embracing "Westernized" diets rich in sugar, salt, and fat (Dicken, Qamar and Batterham, 2023).

5.5 Prevalence of Overweight and Obesity

The prevalence of overweight (29.04%) and obesity (34.54%) among Ga Mashie residents is alarming. Together, this accounts for more than 60% of the population, pointing out a public health issue. This is consistent with national trends, where the urban Ghanaian population continues to experience a rise in overweight and obesity due to sedentary lifestyle and dietary transitions (Yussif, Morrison and Annan, 2024). The low NCD-Protect score, combined with rising consumption of high-calorie, ultra-processed foods and sugary beverages, likely contributes to the high prevalence of overweight and obesity.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 Introduction

This chapter summarizes the key findings of the study and suggests evidence-based recommendations for enhancing dietary habits and reducing the impact of diet on obesity among the people of Ga Mashie. The conclusions made are derived from the information provided in chapter four and elaborated upon in chapter five. The recommendations are intended to guide public health initiatives, policy frameworks, and subsequent research endeavours.

6.2 Conclusion

The study revealed significant dietary imbalance among Ga Mashie residents, characterized by high consumption of grains and low intake of protective foods such as fruits, vegetables, pulses, and nuts. The NCD-Protect score showed that only about one third (34.31%) of participants had diets rich in foods that guard against NCDs, indicating that the majority are at nutritional risk. While the majority of NCD-Risk scores were low (87.70%), reflecting a lesser consumption of ultra-processed foods, the inadequate intake of protective foods continues to endanger long-term health results.

An analysis of socio-demographic characteristics indicated that both age and education level were significantly linked to elevated NCD-Risk scores. Individuals in the younger age group (25-44 years) and those with higher education tend to have a greater consumption of unhealthy foods, possibly due to lifestyle changes, increased exposure to fast food, and urban dietary patterns.

The prevalence of overweight (29.04%) and obesity (34.54%) together affect over 60% of the population. This brings to light the impact of inadequate protective dietary intake and the influence of energy-dense, processed foods.

6.2 Recommendations

1. The Ga Mashie Developmental Agency (GAMADA) in collaboration with local health facilities should work together to develop and implement targeted nutrition education programs emphasizing the importance of fruits, vegetables, whole grains, and legume consumption. Incorporate culturally tailored messages to resonate with the Ga Mashie population, particularly younger adults and those with higher education levels who show higher dietary risks.
2. MoFA, local farmers' groups, and market associations should collaborate with local farmers, markets, and food distributors to improve availability and affordability of nutrient-dense protective foods like fruits, vegetables, and pulses. Also, consideration of urban agriculture initiatives to promote self-sufficiency in fresh produce.
3. On the front of community-based interventions, leveraging of community leaders, faith-based groups, and health volunteers to inculcate behaviour change at the grassroots level. Initiating local cooking demonstrations, food fairs, and peer-led education to showcase affordable, healthy traditional meals.

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APPENDIX

APPENDIX I: ETHICAL CLEARANCE

ENSIGN GLOBAL
COLLEGE

OUR REF: ENSIGN/IRB/EL/SN-279/01
YOUR REF:

January 3, 2025

INSTITUTIONAL REVIEW BOARD SECRETARIAT

Sedinam Avorgbedor
Ensign Global College
Kpong.

Dear Sedinam,

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 Friday, January 3, 2025, your research proposal entitled **"Protective Effect of Diet against Non-Communicable Diseases among Residents in Ga Mashie, Accra, Ghana"** was considered.

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

We wish you all the best.

Sincerely,

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

P.O. Box AK 136 | Tema-Akosombo Highway, Kpong, Eastern Region, Ghana|
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