UNIVERSITY OF EDUCATION, WINNEBA

ASSESSING THE ACCESSIBILITY OF KETOGENIC DIET-COMPATIBLE LOCAL FOOD COMMODITIES FOR OBESITY MANAGEMENT IN THE GREATER ACCRA REGION OF GHANA

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A thesis in the Department of Food and Nutrition, Faculty of Heath, Allied Sciences and Home Economics Education, submitted to the School of Graduate Studies, in partial fulfillment of the requirements for the award of the degree of Master of Philosophy (Food and Nutrition Education) in the University of Education, Winneba

AUGUST, 2025

DECLARATION

Student's Declaration

I**, Gloria Emefah Cudjoe**, hereby declare that this thesis with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is the result of my original research and that it has not been submitted, either in part or whole for another degree in this university or elsewhere.

Signature: ………………………………….

Date: ………………………….…………

Supervisor's Declaration

I hereby declare that the preparation and presentation of this thesis was supervised in accordance with the guidelines on supervision of thesis laid down by the University of Education, Winneba.

Name of Supervisor: DR. THERESA ALEXANDRA AMU

Signature: ………………………………….

Date: ………………………….…………

DEDICATION

I dedicate this thesis to my lovely husband, children and father.

ACKNOWLEDGEMENT

I give thanks to the Almighty God for the strength, divine protection, and wisdom to complete this thesis and the MPhil programme.

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I cannot close this chapter without a special mention of Kris Hilton who assisted me during the data collection and analysis phase. Ayekoo to my colleagues who played diverse roles from the beginning to the end of this MPhil programme.

God bless everyone!

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LIST OF ACRONYMS

WHO	World Health Organization
SKD	Standard ketogenic diet
CKD	Cyclical ketogenic diet
TKD	Targeted ketogenic diet
HKD	High protein ketogenic diet (HKD).
BMI	Body mass index (BMI
NCDs	Non-communicable diseases (NCDs).
MMDAs	Metropolitan, Municipal and District Assemblies

ABSTRACT

The adoption of ketogenic dietary system as a therapeutic intervention for obesity management, and the use of Ghanaian local food commodities to support ketogenic lifestyle remain underexplored. This study assessed the accessibility and nutritional suitability of ketogenic diet-compatible local food commodities in Ghana and examined the effects of ketogenic lifestyle practices on obesity management. A quantitative approach and a cross-sectional survey design were used to collect data from 120 obese individuals in the Accra Metropolis. Data were analysed using descriptive statistics, correlation, and multiple regression techniques.The findings indicate that ketogenic diet-compatible local food commodities are generally available and perceived to be of acceptable nutritional quality, aligning with high-fat, moderate-protein, and low-carbohydrate dietary requirements. However, challenges such as affordability, seasonality, and supply inconsistency affect access. Regression results show that moderate protein consumption (β=0.206, $p < 0.05$), hydration and electrolyte balance ((β=0.374, $p < 0.05$), physical activity ((β=0.371, $p < 0.05$) have significant positive effects on obesity management. High fat consumption (β=0.043, $p < 0.05$), low carbohydrate intake ((β=0.114, $p < 0.05$), and whole foods focus ((β=0.135, $p < 0.05$) show no significant effect. Overall. The study demonstrates that while ketogenic dietary practices are feasible within the Ghanaian context, their effectiveness for obesity management depends on specific lifestyle components and improved access to suitable local food commodities.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Obesity has become a major public health concern globally, with the World Health Organization (WHO, 2018) reporting that over 39% of adults worldwide are overweight or obese.In Ghana, approximately 2.5 billion adults were overweight, including nearly 900 million living with obesity (World Health Organization, Obesity and overweight fact sheet, 2025). This increasing burden contributes significantly to non-communicable diseases and premature mortality, with estimates suggesting that overweight and obesity account for about 1.6 million premature deaths each year Obesity Federation (2025). Projections further indicate that, if no effective interventions are implemented, more than half of adults and a third of children could be overweight or obese by 2050 (GBD BMI Collaborations, 2025), with obesity-related deaths potentially exceeding 5 million annually (Ahmed & Mohammed, 2025).

In Ghana, obesity prevalence has risen considerably over the past decade, with systematic reviews and meta-analyses estimating that approximately 13.3% to 17.1% of adults in the country are obese (Ofori-Asenso et al., 2016; Yussif et al., 2024). Poor management of obesity increases the risk of severe health complications, highlighting the need for effective and context-specif dietary interventions. One dietary approach that has gained considerable attention for weight management is ketogenic diet. The ketogenic diet is characterized by high fat, moderate protein, and very low carbohydrate intake, designed to induce nutritional ketosis (Paoli et al., 2013; Phinney, 2004). Evidence suggests that ketogenic diets are effective for weight loss and improvement of metabolic health outcomes. Including blood gloucose control and cardiovascular risk factors (Bueno et al., 2013; Dashti et al., 2014; Yancy et al., 2010).

Comparative studies further indicate that ketogenic diets may be more effective for weight loss than low-fat diets (Buenoet al., 2013; Saslow et al., 2014; Goldenberg et al., 2021).

Although carbohydrates typically contribute 45-60% of daily energy intake, they are not physiologically essential, as the body can synthesize glucose through alternative metabolic pathways (Gropper & Smith, 2020). However, excessive carbohydrate intake has been associated with increased risks of overweight, obesity, and related metabolic disorders (Yancy et al., 2004).

Despite the documented benefits of ketogenic diets, their implementation in Ghana presents signicant challenges. Traditional Ghanaian diets are predominantly high in carbohydrates and lowin fat, limiting compatibility with ketogenic dietary requirements (Otoo et al., 2019). Additionally, the reliance on imported ketogenic-fiendly foods increases cost and reduces accessibility. Thereby exacerbating health inequality (Otoo et al., 2019;Yancy et al., 2010).

Therefore, there is a need to explore the availability, affordability, accessibility and nutritional suitabiliy of local food commodities that can support ketogenic dietary practices in Ghana. This study addresses this gap by assessing the accessibility of ketogenic diet-compatible local foods, with the aim of informing sustainable dietary strategies for obesity management in the Ghanaian context.

1.2 Statement of the Problem

Obesity has become a significant public health concern in Ghana, with national survey data showing a steady increase in prevelance over time. According to the Ghana Demographic and Health Survey (GDHS), approximately 40% of women and 16% of men aged 15-49 were classified as overweight or obese by 2014, with (Ghana Statistical Service & Ghana Health Service, 2015). Further analysis of GDHS data show that obesity prevalence (BMI $\geq$ 30kg/m^2) among women increased from about 8% in 2003 to over 15% in 2014 (Tembo et al., 2025). This increasing trend has been associated with changes in dietary habits, reduced physical activity, and urbanization. Obesity is associated with a higher risk of non-communicable diseases, including type 2 diabetes, hypertension, and cardiovascular disease (WHO, n.d.).

Dietary interventions remain central to obesity management. The ketogenic diet has been identified as an effective dietary approach for weight loss and metabolic health improvement (Bueno et al., 2013; Paoli et al., 2013). However, its application in the Ghanaian context presents notable challenges. Traditional Ghanaian diets are predominantly high in carbohydrates and relatively low in fat, which may limit compatibility with ketogenic dietary requirements (Assmus et al., 2021; Rousham et al., 2020). In addition, the reliance on imported ketogenic-compatible food commodities increases cost and reduces accesibility, particularly among low-income populations (Dake et al., 2016; Yancy et al., 2010).

Despite the presence of local food commodities that may support ketogenic dietary practices, there is limited empirical evidence on their availability, affordability, and accessibility within the Ghanaian food system. This lack of evidence constraints the ability of healthcare providers and nutritionists to recommend context-appropriate dietary startegies for obesity management. Consequenly, the potential for utilizing locally available foods to support ketogenic dietary practices remains unerd explored in Ghana.

1.3 Purpose of the Study

The purpose of the study is to assess the accessibility and nutritional quality of local food commodities in Ghana that are compatible with ketogenic diet, to support obesity management and to promote healthy dietary practices. Specifically, it examines the availability, accessibility, affordability, and challenges associated with accessing ketogernic diet-compatible foods in Ghana, to inform evidence-based strategies for improving diet quqlity and reducing the burden of obesity in the country.

1.4 Objectives of the Study

Given the purpose of this study, the following specific objectives are set to be achieved:

1. To assess the availability and affordability of ketogenic diet-compatible local food commodities in Ghana.
2. To determine the nutritional quality of ketogenic diet-compatible local food commodities in Ghana.
3. To identify the challenges and opportunities for accessing ketogenic diet-compatible local food commodities in Ghana.
4. To explore the tenets of ketogenic lifestyle and their impact on obesity management in Ghana.

1.5 Research Questions

Given the research objectives aforementioned, the following research questions are formulated to be answered, and also guide the data collection.

1. What are the available and affordable means of ketogenic diet-compatible local food commodities in Ghana?
2. What is the nutritional quality of ketogenic diet-compatible local food commodities in Ghana?
3. What are the challenges and opportunities for accessing ketogenic diet-compatible local food commodities in Ghana?
4. What are the tenets of ketogenic lifestyle and their impact on obesity management in Ghana?

1.6 Hypothesis

The following hypothesis are formulated to test the effects or outcomes of applying the tenets of ketogenic lifestyle in managing obesity in the Ghanaian context.

H_0: There is no significant effect of the tenets of ketogenic lifestyle on obesity management.

H_1: There is significant effect of the tenets of ketogenic lifestyle on obesity management.

1.7 Significance of the Study

The study is significance for obesity management, healthcare practice, food policy in knowledge development in Ghana and similar contexts.

Regarding obesity management, the study provides evidence on the accessibility of ketogenic diet-compatible local food commodities in Ghana, thereby informing context-specific dietary strategies and reducing reliance on imported foods. For health care practice, the findings offer practical insights for healthcare providers, dietitians, and nutritionists to recommend and implement ketogenic dietary interventionms using locally available food commodities, thereby improving dietary counselling and management of obesity.

The study also contributes to addressing health disparities by examining access to ketogenic-compatible foods, particularly among low-income populatios. In addition, the findings have implications for food policy and nutrion programming by supporting the developmemt of interventions that promote healthy dietary practices and address obesity in Ghana.

At a broader level, the study contributes to global knowledge on the role of local food systems in obesity management, with relevance for other low-income and middle-income countries. It also aligns with the United Nations' Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-being).

Finally, the study adds to existing litterature on obesity management in sub-saharanAfrica by providing empirical evidence that can inform future research in similat and divers socio-economic contexts.

1.8 Limitations of the Study

Although, some attempts have been made by previous researchers to address the adoption of ketogenic dietary systems as a therapeutic intervention for managing obesity, the use of Ghanaian local food commodities to support ketogenic lifestyle towards managing obesity remains unexplored. This makes it a bit challenging to gather directly related literature on the current study. Consequently, the discussion of the findings in relation to previous literature is less exhaustive.

As a common limitation with descriptive survey research, it is envisaged that the study will be affected by the non-response syndrome, as some of the participants may not respond to the questionnaire that will be given to them. This may reduce the number of final questionnaire used in the analysis thereby affecting the extent of generalization of the study to the population. Moreover, the study may suffer from response bias in that some participants may not feel confortable divulging detail information about their obesity status and other health complications that made them adopt a ketogenic lifestyle.

In addition, the study is constrained by the use of a non-probability snowball sampling technique, which was necessitated by the absence of a formal sampling frame for obese individuals practicing ketogenic diets in the Accra Metropolis. This implies that findings may not be fully generalisable to the wider population of obese individuals, as participants were recruited through referral networks rather than random selection. Furthermore, although a sample size of 120 was deemed practically achievable under field conditions, it is lower than the statistically recommended sample size of approximately 384 derived from Cochran's formula for unknown populations, which may limit the statistical power of the study to some extent.

Notwithstanding these limitations, the methodology employed for the study provides a significant degree of confidence in the validity and reliability of the findings and conclusions of the study.

1.9 Delimitation of the Study

This study was delimited to adult obese individuals aged 20 to 60 years who are engaged in ketogenicdietary practices within the Accra Metropolis. Respondents were selected mainly from ketogenic-focused social media platforms and communities within this geographical area. The study also focused on selected major market dentres in Accra that trade in local food commodities with potential compatibility for ketogenic dietary requirments.

The study did not cover individuals outside the Accra Metropolis, including rural populations and other regions of Ghana. It excluded non-obese individuals, as well as individuals not practicing ketogenic diets. The study was further limited to local food commodities and did not examine imported ketogenic food products or supplements.

In addition, the study did not assess clinical or biochemical outcomes of ketogenic diet use, such as weight loss measurements, blood glucose levles, or other metabolic indicators. Instead, it focused specifically on the accessibility of ketogenic diet-compatible local food commodities.

1.10 Operational definition of Terms

Obesity Management: Obesity is an abnormal or excessive fat accumulation that presents a risk to human health. Obesity management refers to strategies and interventions aimed at preventing and treating obesity, including dietary approaches like the ketogenic diet (Yancy et al., 2010).

Ketogenic Diet: It refers to a high-fat, low-carbohydrate, moderate-protein diet that induces a metabolic state called ketosis, in which the body burns fat for fuel instead of carbohydrates (Dashti et al., 2014; Paoli et al., 2013). Ketosis is a metabolic process whereby fat stores are broken down to produce energy, releasing ketones in the process. Ketones are by-products of ketosis coming in the form of acids that build up in the blood and which are mostly eliminated in urine. Ketoacidosis is a condition where the levels of ketones in the body are abnormally high, poisoning the body.

Local Food Commodities: These are food products that are produced, processed, and distributed within a specific geographic area and intended primarily for consumption in that area (FAO, 2018; HLPE, 2017; MoFA, 2016). In the context of (Ghana), this refers specically to foods produced domestically and consumed by the local population.

Nutritional Quality: Nutritional quality refers to the extent to which a food or diet provides essential nutrients required for growth, maintenance, and overall health, with particular emphasis on the balance of macronutrients such as proteins, healthy fats, dietary fibre, vitamins, and minerals. In the context of this study, nutritional quality further refers to the suitability of local food commodities in meeting ketogenic dietary requirements, particularly their alignment with high-fat, moderate-protein, and low-carbohydrate nutritional composition.

Accessibility: The ease with which individuals and households are able to obtain local food commodities, including physical access (such as proximity to markets or food outlets and availability of transportation) and economic access (such as the finacial and social/cultural resources required to reach and acquire food). Accessibility captures the capacity of people to secure food within local environment without undue barriers (Okpala et al., 2024; O'Meara et al., 2025). In addition, availability refres to the presence and consistent supply of local food commodities in markets or distribution outlets in a given area, considering factors such as local production, distribution systems, and the overall supply of foods that meet nutritional needs (Okpala et al., 2014). Finally, affordability reflects the ecomnomic capacity of individuals and households to purchase local food commodities at prevailing prices, given their income and other financial obligations, and whether the cost of foods permits the acquisition of a nutritious diet (Kuri et al., 2024; O'Meara et al., 2025). These three components are key dimensions of food access and food security (ketogenic diet) because they jointly influence whether people can secure and use sufficient healthy foods in their daily lives (Okpala et al., 2024; Kuri etal., 2024; O'Meara et al., 2025).

1.11 Organization of the Study

This study has been organized into in five chapters. Chapter one focused on the background to the study and covered statement of the problem, the purpose of the study, objectives of the study, research questions, significance of the study, limitations of the study, delimitation of the study and operational definition of terms. Chapter Two covered the literature reviewed for the study and focused on the tenets of ketogenic lifestyle in managing obesity, available and access to local food commodities to support ketogenic lifestyle, and explore whether those with obesity use local ketogenic foodstuffs to improve on their management of obesity. Chapter three presented the methodology adopted for the study. Chapter four presented the analysis of results and discussion of findings. Lastly, chapter fiver comprised the summary of findings, conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature reviewed for the study. It is dividied into three main parts. The first part covers the theoretical foundations of ketogenic lifestyle and obesity management, including an overview of relevant theories, models, and frameworks (such as nutrition, physiology, and behavior change). It also provides a critical perspective on the extent to which these theoretical approaches explain obesity management within ketogenic dietary contexts, particularly in realtion to their applicability in low-income and middle-income settings such as Ghana.

The second part examines key concepts and definitions related to ketogenic lifestyle and obesity management (such as ketosis, macronutrient balance, whole foods). It further analyses the relationships between these concepts and their application in Ghanaian contexts,while considering the influence of cultural, socioeconomic, and environmental factors.This section also highlights the conceptual inconsistencies and gaps in the literature regarding the adaptation of ketogenic dietary principles to local food systems.

The third part ireviews empirical studies on ketogenic lifestyle and obesity management, focusing on themes such as the effectiveness of ketogenic diets for weight loss, the availability and affordability of compatible local food commodities, and the experiences and outcomes of individuals adopting ketogenic lifestyle approaches in Ghanaian and similar contexts. It critically evaluates the methodological quality, limitations, and gaps in existing studies, particularly the limited evidence on locally adaptable ketogenic food systems.

Subsequently, the conceptual framework for the study is developed based on insights from the empirical review, illustrating the relationships between accessibility of local food commodities and ketogenic dietary practices in obesity management. The chapter conludes with a syhthesis of key findings from the theoretical, conceptual, and empirical reviews and identifies of areas for further research within the Ghanaian contexts.

2.2 Theoretical Review

This section captures the theoretical foundation of the study by critically analysing the underpinning theory (i.e., theory of health promotion) and theoretical framework. It also captures relevant models such as carbohydrate-insulin model, ketogenic diet model, energy balance model, nutrient partitioning model, and metabolic flexibility model, with emphasis on their explanatory relevance to obesity management and dietary behaviour. While these models offer complementary perspectives, they differ in their assumptions regarding the primary drivers of obesity, thereby necessitating critical comparison to establissh their applicability within the Ghanaian context.

2.2.1 Theoretical framework

The study is underpinned by Pender's Health Promotion model, which is based on the premise that individuals can achieve higher levels of well-being by adopting some specific behavioural changes (Pender, 1987). This foundational concept is strengthened by contemporary research demonstrating its ongoing relavance and application in health promotion intervention. Naidoo and Wills (2003; 2021) emphsis health promotion may include a range of interventions such as those which foster healthy lifestyle, improves access to services and involvement in health decisions, those which seek to promote an environment in which the healthy choice becomes attainable. Recent empirical studies by Rojas-Torres et al. (2025) and Koulouvari et al. (2025) further support the effectiveness of behaviourally grounded interventions in improving health outcomes.

However, while Pender's model provides a strong behavioural framework, it has limitations in explaininig structural constraints such as food availability and affordability, which are particularly relevant in low-income and middle-income contexts like Ghana. This limitations suggests the need to integrate insights from complmentary models that account for metabolic and environmental influence on obesity. There are three tenets of Health Promotion Model, individual experiences, behaviour-specific knowledge and affect, and behavioural outcomes. These constructs are relevant in explaining the motivation of obese individuals to adopt ketogenic dietary practices as a health-promotion behaviour. For instance, individual experiences (such as prior dietary habits and health status) may influence willingness to adopt dietary change, while behaviour specific knowledge (such as awareness of ketogenic diets) shapes decision making. Behavioural outcomes reflect the extent to which individuals successfully adopt and sustain ketogenic lifestyle.

In cmparison with other models, the Energy Balance Model conceptualises obesity as a result of an imbalance between energy intake and expenditure, emphasing caloric control. In contrast, the Carbohydrate Insulin Model argues that obesity is driven by hormonal responses to carbohydrate intake, particularly insulin regulation, thereby supporting low-carbohydrate dietary approaches such as the ketogenic diet. While the Energy Balance Model is wildly accepted, it has been criticised for overssimplifying metabolic processes, whereas the Carbohydrate Insulin Model provides a more diet specific explanation but remains debated in the literature. Similarly, the Nutrition Pratitioning Model explains how macronutrients are metabolised and stored differently in the body, as it influences fat accumulation and energy use. The Metabolic Flexibility Model further expands this by describing the body's ability to switch between carbohydrates and fat metabolsm, a process centarl to ketogenic dietary adaptation. However, these physiological models largely overlook behavioural and environmental determinants of dietary choices.

Therefore, Pender's Health Promotion Model is particularly appropriate for this study because it integrates behavioural motivation with environmental influences, although it must be considered alongside metabolic models to provide a more comprehensive understanding of obesity management through ketogenic dietary practices. These tenets are illustrated in the theoretical framework below (Figure 2.1)

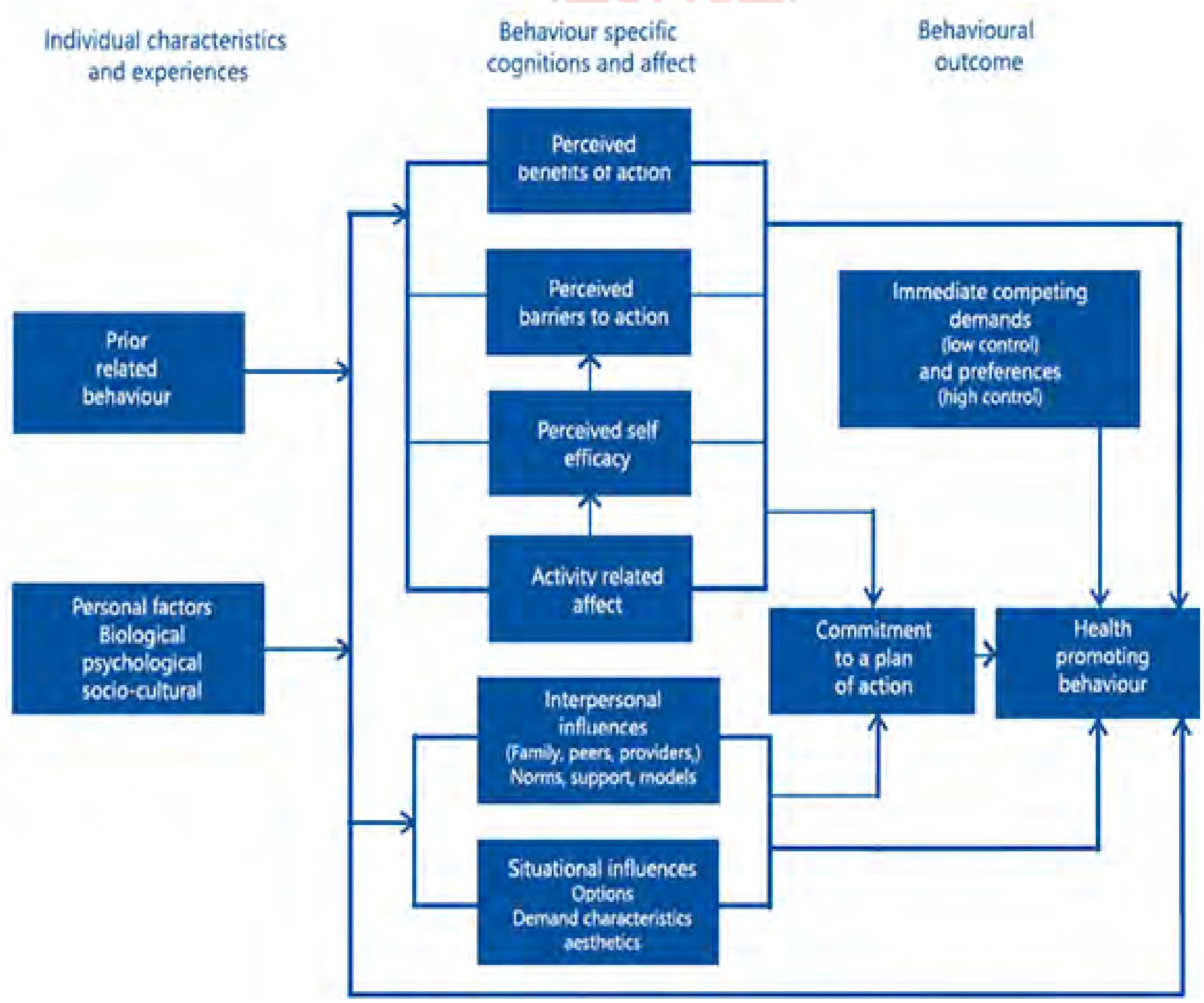

Figure 2.1: Pender's Health Promotion Model

2.2.2 Carbohydrate-Insulin Model

The carbohydrate-insulin model proposes that carbohydrate intake drives insulin resistance, leading to weight gain and metabolic disease (Ludwig et al., 2018). According to this model, reducing carbohydrate intake can improve insulin sensitivity, leading to weight loss and improved metabolic health (Ludwig et al., 2018). The effectiveness of this model is often discussed in relation to obesity. So, it is also called carbohydrate-insulin model of obesity. It posits that diets high in carbohydrate are particularly fattening due to their propensity to elevate insulin secretion. Insulin directs the partitioning of energy toward storage as fat in adipose tissue and away from oxidation by metabolically active tissues and purportedly results in a perceived state of cellular internal starvation. In response, hunger and appetite increases and metabolism is suppressed, thereby promoting the positive energy balance associated with the development of obesity.

Even though many factors affect fat cells, the hormone insulin exerts dominant anabolic control. Insulin decreases the circulating concentration of all major metabolic fuels by stimulating glucose uptake into tissues, suppressing release of fatty acids from adipose tissue, inhibiting production of ketones in the liver, and promoting fat and glycogen deposition (Ludwig et al., 2018). Consistent with these effects, states of increased insulin action are associated with weight gain, while reduced insulin activityin linked to weight loss (Carlson & Campbell, Hansen et al., 2004; 1993; Ludwig et al., 2018). However, despite itsstrong physiological basis, the carbohydrate insulin model remains highly contested in the literature. Carefully controlled inpatient feeding studies have failed to support some of its predictions, particularly regarding the extent to which insulin alone drives fat accumulation (Hall, 2017). These findings suggest that the model may oversimplify the complex interactions between diet, metabolism, and energy balance.

In contrast, the Energy Balance Model attributes obesity primarily to an imbalance between caloric intake and expenditure, regardless of micronutrient composition. While the carbohydrate–insulin model emphasises hormonal regulation, the energy balance approach highlights total energy intake, leading to ongoing debate regarding the relative importance of diet composition versus calorie quantity.

Furthermore, the carbohydrate–insulin model does not adequately account for behavioural, environmental, and socioeconomic factors that influence dietary choices, particularly in low- and middle-income contexts such as Ghana. For instance, high-carbohydrate dietary patterns in Ghana are often shaped by food availability, affordability, and cultural preferences, rather than physiological drivers alone. This limits the direct applicability of the model in explaining obesity within such contexts.

Therefore, while the carbohydrate–insulin model provides a useful framework for understanding the metabolic rationale behind ketogenic diets, it is insufficient as a standalone explanation of obesity. Its relevance to this study lies in its support for carbohydrate restriction as a mechanism for weight management; however, it must be considered alongside behavioural and environmental models to fully explain the accessibility and adoption of ketogenic diet-compatible local food commodities in Ghana.

Thus, important aspects of carbohydrate-insulin model have been experimentally falsified suggesting that the model is too simplistic (Hall, 2017). This model is applied in this study to describe the current state of the carbohydrate-insulin model and its implications in managing obesity in Ghana using ketogenic diet-compatible local food commodites.

2.2.3 Ketogenic Diet Model

Ketogenic diet model is a theoretical framework that explains how a ketogenic diet induces weight loss and improves metabolic health (Cahill et al., 1966). This model is based on the principle of ketosis, a metabolic state in which the body burns fat for fuel instead of carbohydrates. (Cahill et al., 1966). This model suggests that by restricting carbohydrate intake and increasing fat consumption, the body can enter a state of ketosis, leading to weight loss and improved metabolic health. While this model provides a strong physiological basis for ketogenic dietary interventions, its effectiveness is often debated in relation to other models of obesity, particularly those that emphasise total energy balance rather than macronutrient composition.

The main components of ketogenic diet model include: macronutrient restriction (the ketogenic diet restricts carbohydrate intake to 20-50 grams per day, replacing it with fat as the primary source of energy (Westman et al., 2014), ketosis (the diet induces ketosis, a metabolic state characterized by elevated levels of ketone bodies (acetoacetate, β-hydroxybutyrate, and acetone) in the blood (Cahill et al., 1966), and fat oxidation (the body adapts to burn fat for fuel, increasing fat oxidation and reducing glucose metabolism (Veech et al., 2001). These components demonstrate the metabolic processes through which the model operates. The mechanisms of this model involve reduced insulin resistance and increased fat oxidation. ketogenic diets have been shown to decrease insulin resistance, improve glucose metabolism, and reduce inflamation (Ludwig et al., 2018), while simultaneously promoting fat utilizationfor energy (Veech et al., 2001). However, although these mechanisms support weight loss, they do not fully account for behavioural and environmental determinants of dietary adherence. In contrast to the Energy Balance Model, which emphasises caloric intake and expenditure, the ketogenic model prioritises metabolic adaptation, thereby contributing to ongoing debate regarding the relative importance of calorie restriction versus macronutrient composition in obesity management. This model can be applied clinically in areas such as type 2 diabetes management, weight loss, epilepsy management, alzheimer's disease management, and as an adjunct in cancer treatment. Howeve, its application in obesity management, particularly in low-income and middle-income contexts, presents practical challenges. For instance, the strict carbohydrate restriction required to maintain ketosis may be difficult to sustain in settings where staple diets are predominantly carbohydrate-based, such as in Ghana. Additionally, the model does not explicitly address issues of food availability, affordability, and cultural dietary patterns, which are critical determinants of dietary behaviour.

Therefore, while the ketogenic diet model provides a strong metabolic explanation for weight loss and supports the use of low-carbohydrate dietary approaches, it is limited in its ability to explain real-world adoption and sustainability. Its relevance to this study lies in its role in identifying the nutritional characteristics of ketogenic diet-compatible foods; however, it must be integrated with behavioural and environmental frameworks to fully understand the accessibility and use of such foods in the Ghanaian context.

2.2.4 Energy Balance Model

The energy balance model proposes that weight loss occurs when energy expenditure exceeds energy intake (Hall et al., 2019). This model is based on the principle that body weight is regulated by the balance between calories consumed and calories expended through basal metabolic processes, physical activity, and thermogenesis. Within this framework, any dietary approach, including ketogenic diets, can promote weight loss if it results in a sustained negative energy balance. Accordingly, ketogenic diets may contribute to weight loss by reducing overall energy intake, increasing satiety, and, in some cases, modestly increasing energy expenditure through fat oxidation (Hall et al., 2019).

However, the energy balance model has been subject to critique for its limited consideration of hormonal and metabolic processes that influence energy storage and utilisation. In contrast, the carbohydrate–insulin model of obesity suggests that high consumption of processed, high-glycaemic load carbohydrates induces hormonal changes, particularly increased insulin secretion, which promote fat storage, increase hunger, and potentially reduce energy expenditure (Ludwig et al., 2018). While the energy balance model emphasises total caloric intake, the carbohydrate–insulin model highlights the role of macronutrient composition in regulating metabolism.

Although there is some conceptual overlap between the two models, particularly in their recognition that energy imbalance contributes to weight gain, they differ fundamentally in their explanatory focus. The energy balance model is widely accepted due to its simplicity and strong empirical support, but it has been criticised for oversimplifying obesity by neglecting biological and behavioural complexities. Conversely, the carbohydrate–insulin model provides a more mechanistic explanation of fat accumulation but remains contested due to inconsistent empirical evidence.

In the context of this study, the energy balance model provides a useful baseline for understanding weight regulation; however, it does not fully explain dietary behaviours or the challenges associated with adopting specific dietary patterns such as the ketogenic diet. In settings such as Ghana, where dietary choices are influenced by food availability, affordability, and cultural practices, the assumptions of the energy balance model may be insufficient. Therefore, while the model contributes to understanding obesity as a function of energy imbalance, it must be integrated with metabolic and behavioural frameworks to provide a more comprehensive explanation of obesity management through ketogenic diet-compatible local food commodities

2.2.5 Nutrient Partitioning Model

The Nutrient Partitioning Model proposes that the body's response to diet depends on how nutrients are distributed between different tissues such as muscle and adipose tissue (Krieger et al., 2018). This model suggests that ketogenic diets may promote weight loss by favouring the partitioning of nutrients toward lean tissue and away from fat storage. In this regard, the model provides a useful perspective for understanding how dietary composition influences body composition beyond total energy intake. However, unlike the Energy Balance Model, which focuses on the quantity of energy consumed and expended, the Nutrient Partitioning Model emphasises the destination of energy within the body. Similarly, while the Carbohydrate–Insulin Model highlights hormonal regulation, particularly insulin, the Nutrient Partitioning Model extends this by considering how multiple physiological processes determine whether nutrients are stored or utilised.

The main components of this model include macronutrient partitioning, hormonal regulation, and tissue-specific effects. The body partitions macronutrients (carbohydrates, protein, and fat) between tissues depending on metabolic conditions (Krieger et al., 2018). Hormones such as insulin, glucagon, and cortisol play a central role in regulating this process (Kraegen et al., 2006), while ketogenic diets may exert tissue-specific effects by influencing metabolism in muscle and adipose tissue (Volek et al., 2016). These components illustrate how nutrient distribution is regulated within the body.

The mechanisms of this model involve increased muscle protein synthesis, reduced fat storage, and improved insulin sensitivity. Ketogenic diets may enhance muscle protein synthesis and promote nutrient allocation toward lean tissue (Schoenfeld et al., 2018), while simultaneously increasing fat oxidation and reducing lipogenesis (Volek et al., 2016). Improvements in insulin sensitivity may further support favourable nutrient partitioning (Ludwig et al., 2018). However, despite these proposed mechanisms, empirical evidence on the extent to which ketogenic diets significantly alter nutrient partitioning in free-living populations remains limited and sometimes inconsistent.

Furthermore, the Nutrient Partitioning Model has limitations in explaining real-world dietary behaviour. It assumes that individuals can maintain dietary conditions necessary for optimal nutrient partitioning, which may not be feasible in contexts where food choices are constrained by availability, affordability, and cultural dietary patterns, such as in Ghana. In contrast to behavioural models like Pender's Health Promotion Model, which account for motivation and environmental influences, the Nutrient Partitioning Model focuses primarily on physiological processes and therefore provides an incomplete explanation of obesity management.

Therefore, while the Nutrient Partitioning Model contributes to understanding how ketogenic diets may influence body composition, it is insufficient as a standalone framework. Its relevance to this study lies in its ability to explain the metabolic effects of ketogenic diet-compatible foods; however, it must be integrated with behavioural and environmental models to adequately explain the accessibility and adoption of such foods in the Ghanaian context.

2.2.6 Metabolic Flexibility Model

The metabolic flexibility model proposes that the body's ability to adapt to different metabolic states (e.g., glucose, ketones, and fatty acids) is crucial for maintaining metabolic health (Taub et al., 2018). Metabolic flexibility refers to the capacity of the body to efficiently switch between fuel sources depending on energy availability and demand. In metabolically healthy individuals, the body can readily transition from glucose oxidation in the fed state to fat oxidation during fasting. In contrast, metabolic inflexibility, commonly observed in obesity and insulin resistance, is characterised by an impaired ability to switch between these fuel sources, leading to inefficient energy utilisation and increased fat storage.

This model suggests that ketogenic diets may improve metabolic flexibility by promoting adaptation to fat and ketone metabolism. By restricting carbohydrate intake, ketogenic diets encourage the body to rely more on fat oxidation and ketone utilisation, thereby enhancing the capacity to switch between metabolic states. While this provides a strong physiological rationale for ketogenic dietary interventions, the extent to which metabolic flexibility can be sustainably improved in diverse populations remains an area of ongoing research.

The vital components of this model comprise metabolic adaptability, fuel substrate switching, and hormonal regulation. Metabolic adaptability refers to the body's ability to adjust to varying energy conditions (Taub et al., 2018), while fuel substrate switching describes the transition between glucose and alternative fuels such as fatty acids and ketones (Veech et al., 2001). Hormonal regulation, particularly involving insulin, glucagon, and cortisol, plays a central role in coordinating these processes (Kraegen et al., 2006). These components collectively explain how the body regulates energy utilisation under different dietary conditions.

Regarding the mechanisms of the model, improved insulin sensitivity, increased fat oxidation, and enhanced ketone metabolism are central. Metabolic flexibility is associated with improved insulin sensitivity, which reduces insulin resistance (Ludwig et al., 2018). It also promotes greater reliance on fat as an energy source (Veech et al., 2001) and enhances the body's capacity to utilise ketones efficiently (Volek et al., 2016). However, despite these proposed mechanisms, empirical evidence on the long-term effects of ketogenic diets on metabolic flexibility remains mixed, with some studies suggesting variability based on individual metabolic status and adherence.

In comparison with other models, the metabolic flexibility model provides a more dynamic understanding of metabolism than the Energy Balance Model, which focuses primarily on caloric intake and expenditure. It also complements the Nutrient Partitioning Model by explaining how the body adapts to different fuel sources, while the Carbohydrate–Insulin Model focuses more narrowly on hormonal regulation. However, like other physiological models, it does not adequately account for behavioural, environmental, and socioeconomic factors that influence dietary practices. In the context of this study, the metabolic flexibility model is relevant for understanding how ketogenic diets may enhance the body's ability to utilise locally available food commodities that support fat-based metabolism. However, its practical application may be limited in settings such as Ghana, where dietary patterns are predominantly carbohydrate-based and influenced by food availability and affordability. Therefore, while the model provides important physiological insights, it must be integrated with behavioural and environmental frameworks to fully explain the adoption and sustainability of ketogenic dietary practices

2.3 Conceptual Review

This section of the chapter discusses key concepts and definitions related to ketogenic lifestyle and obesity management (such as ketosis, tenets of ketogenic lifestyle, macronutrient balance, and local food commodities). It also examines the relationships between these concepts and their application in Ghanaian contexts, with particular attention to cultural, socioeconomic, and environmental factors influencing the adoption of ketogenic dietary practices. While existing literature provides substantial conceptual explanations, there remain gaps regarding the contextual applicability of these concepts in low- and middle-income settings such as Ghana.

2.3.1 The Concept of Ketosis

Generally, carbohydrates are the primary source of energy for the human body. However, the concept of a ketogenic diet is based on the premise that fat stores, rather than glucose from carbohydrates, are used as the primary fuel source (Masood et al., 2023). When carbohydrate intake is reduced to less than 50g per day and fat consumption is increased, insulin levels decline and glycogen stores become depleted, prompting the body to rely more on fat metabolism for energy production (Masood et al., 2023; Paoli et al., 2013). This metabolic state is referred to as ketosis.

Ketosis is characterised by the production of ketone bodies (β-hydroxybutyrate, acetoacetate, and acetone) through the breakdown of fatty acids in the liver, which serve as alternative energy substrates, including for the brain (Masood et al., 2023; Evans et al., 2017). While gluconeogenesis continues to occur during this process to maintain essential glucose levels, the body increasingly relies on ketone bodies as a major energy source. This metabolic adaptation underpins the physiological basis of ketogenic diets in weight management.

Moreover, the macronutrient composition of the diet is a critical determinant of ketosis. Sumithran and Proietto (2008) posit that low-carbohydrate diets high in protein may not necessarily induce ketosis, as significant amounts of glucose can be synthesised from dietary protein (Jungas, Halperin, & Brosnan, 1992). This highlights the importance of maintaining a specific macronutrient balance to achieve and sustain ketosis.

However, despite its well-established biochemical basis, the concept of ketosis is not without debate. While some studies emphasise its role in enhancing fat oxidation and supporting weight loss, others question its long-term sustainability and practical applicability outside controlled settings. In comparison with general calorie-restriction approaches, ketosis represents a more restrictive metabolic strategy, which may limit adherence in real-world contexts.

Furthermore, the application of ketosis within the Ghanaian context presents additional challenges. Traditional dietary patterns are predominantly carbohydrate-based, which may make the induction and maintenance of ketosis difficult without significant dietary modification. In addition, access to appropriate ketogenic diet-compatible foods may be constrained by availability and affordability, thereby limiting the practical adoption of ketosis as a strategy for obesity management.

Therefore, while ketosis provides a strong physiological foundation for ketogenic dietary interventions, its effectiveness in obesity management depends not only on metabolic processes but also on contextual factors that influence dietary behaviour. This highlights the need to examine ketosis within broader environmental and socioeconomic frameworks.

2.3.2 Ketolysis and Ketoacidosis

Ketolysis occurs in the mitochondria of extrahepatic tissues and refers to the process by which ketone bodies are converted into acetyl CoA for energy production (Masood et al., 2023). This process involves the conversion of acetoacetate (AcAc) to acetoacetyl CoA by the enzyme succinyl CoA-oxoacid transferase (SCOT), followed by the production of acetyl CoA through the action of methylacetoacetyl CoA thiolase (MAT) (Masood et al., 2023; Evans et al., 2017). Ketolysis is therefore a critical component of energy metabolism during ketosis, as it enables peripheral tissues to utilise ketone bodies as an alternative fuel source. In the context of ketogenic diets, efficient ketolysis supports sustained energy production and contributes to fat utilisation, which is central to obesity management.

On the other hand, ketoacidosis is a pathological condition characterised by the excessive accumulation of ketone bodies, leading to a dangerous reduction in blood pH (Masood et al., 2023). Unlike nutritional ketosis, which is a controlled and safe metabolic state, ketoacidosis occurs when ketone production exceeds the body's capacity for utilisation, often in conditions such as uncontrolled diabetes. This distinction is critical, as the conflation of ketosis with ketoacidosis remains a common misconception in both academic and public discourse.

A key conceptual difference between ketosis and ketoacidosis lies in the regulation of ketone production and blood pH. In nutritional ketosis, ketone levels are moderately elevated and tightly regulated, while blood pH remains within normal physiological limits. In contrast, ketoacidosis involves extremely high ketone concentrations and significant metabolic acidosis, posing serious health risks. This distinction highlights that ketogenic diets, when properly managed, do not inherently lead to ketoacidosis in healthy individuals.

However, despite this clear physiological distinction, concerns about ketoacidosis may influence the acceptance and adoption of ketogenic diets, particularly in contexts where clinical guidance and nutritional education are limited. In the Ghanaian context, limited awareness and potential misconceptions about ketogenic diets may affect their uptake, especially among individuals with underlying health conditions.

Therefore, while ketolysis plays a fundamental role in enabling the metabolic benefits of ketogenic diets, the risk of ketoacidosis, although generally low in non-diabetic individuals, underscores the importance of proper dietary supervision and clinical monitoring. This highlights the need to consider both physiological mechanisms and contextual factors when evaluating the applicability of ketogenic dietary practices in obesity management.

2.3.3 The Concept of Ketogenic Diet

The term 'ketogenic diet' was first used to describe a dietary approach that serves as an alternative to fasting and involves the intake of a high-fat, low-carbohydrate diet that induces ketonemia. Historically, it was primarily used as a therapeutic intervention for managing childhood epilepsy (Hartman et al., 2007; Masood et al., 2023). The concept dates back to the early 1900s when Dr. Russell Wilder introduced it at the Mayo Clinic in 1921 as a starvation-mimicking diet for the treatment of epileptic seizures, based on earlier observations that fasting exhibited antiepileptic effects (Hartman et al., 2007). While this historical foundation highlights its clinical origins, the adaptation of the ketogenic diet for weight loss and obesity management represents a relatively recent development, which has expanded its application beyond therapeutic contexts.

A ketogenic diet is defined as a dietary pattern in which net carbohydrate intake is restricted to approximately 20–50 g/day (less than 10% of total energy intake), with a variable proportion of fats and proteins (Paoli et al., 2013; Masood et al., 2023). In this dietary state, fat becomes the primary energy substrate, replacing glucose as the dominant fuel source. Technically, the ketogenic diet is characterised by elevated levels of β-hydroxybutyrate (βOHB) above 0.6 mmol/L or a reduced glucose-to-ketone ratio (Meidenbauer et al., 2015). However, despite these biochemical thresholds, there is no universally accepted standard for defining a ketogenic diet, which introduces variability in its implementation across studies and populations.

As a high-fat, low-carbohydrate dietary approach, the appropriate macronutrient composition of ketogenic diets remains a subject of debate. Masood et al. (2023) recommend a composition of approximately 55–60% fat, 30–35% protein, and 5–10% carbohydrates, while other studies emphasise carbohydrate restriction within the range of 20–50 g/day as the primary determinant of ketosis (Paoli et al., 2013; Masood et al., 2023). This lack of standardisation reflects differences in individual metabolic responses, weight loss goals, and clinical objectives. In contrast to conventional dietary approaches that emphasise balanced macronutrient distribution, ketogenic diets require a substantial shift in dietary patterns, which may present challenges in adherence.

Furthermore, while ketogenic diets have been widely associated with weight loss and improved metabolic outcomes, their long-term sustainability and general applicability remain contested. Some studies highlight benefits such as improved glycaemic control and fat loss, whereas others point to difficulties in adherence and potential nutritional imbalances. Compared to less restrictive dietary approaches, ketogenic diets may be more effective in inducing rapid metabolic changes but may be harder to maintain over time.

In the context of this study, the concept of the ketogenic diet is particularly relevant in relation to the availability and accessibility of compatible food commodities. The requirement for high fat and low carbohydrate intake may pose challenges in settings such as Ghana, where traditional diets are predominantly carbohydrate-based. Additionally, the absence of a standardised macronutrient composition complicates the identification of locally available foods that meet ketogenic criteria. Therefore, while the ketogenic diet provides a strong conceptual and physiological framework for obesity management, its practical implementation is influenced by contextual factors such as food availability, affordability, and cultural dietary practices.

2.3.3.1 Macronutrients Composition of Ketogenic Diet

The ketogenic diet is generally regarded as a low-carbohydrate and high-fat dietary approach. A commonly cited rule of thumb postulated by Stock and Yudkin (as cited in Sumithran & Proietto, 2008) suggests that ketosis occurs when the proportion of fat in a diet is approximately twice that of carbohydrates, with a moderate contribution from protein. However, there is no clear consensus in the literature regarding the exact macronutrient composition required to achieve and sustain ketosis. This lack of standardisation reflects variations in individual metabolic responses, dietary objectives, and clinical applications.

Moreover, the macronutrient composition of a ketogenic diet largely depends on the purpose for which it is adopted, whether for therapeutic use in paediatric epilepsy, weight loss, or general obesity management. For instance, in the clinical management of childhood epilepsy, Hartman et al. (2007) indicate that the ratio of fat to combined carbohydrates and protein is typically maintained at 3:1 or 4:1. In contrast, Sumithran and Proietto (2008) argue that ketogenic diets used for weight loss do not adhere to such rigid ratios and may vary depending on caloric restriction and food sources. This distinction highlights a fundamental difference between therapeutic ketogenic diets, which require strict metabolic control, and lifestyle-based ketogenic diets, which allow greater flexibility but may yield variable outcomes.

Masood et al. (2023) propose that a well-formulated ketogenic diet should consist of approximately 55–60% fat, 30–35% protein, and 5–10% carbohydrates. While these proportions provide a general guideline, they are not universally applicable, as individual requirements may differ based on metabolic status, physical activity levels, and weight loss goals. For example, increased protein intake may be recommended for individuals engaged in resistance training to support muscle maintenance, although excessive protein consumption may reduce the depth of ketosis due to increased gluconeogenesis (Masood et al., 2023; Paoli et al., 2013).

Despite these guidelines, the variability in macronutrient composition presents practical challenges. Unlike standard dietary recommendations, ketogenic diets require careful balancing of macronutrients, which may be difficult to achieve consistently in real-world settings. In comparison with conventional balanced diets, ketogenic diets demand a significant reduction in carbohydrate intake, which can limit food choices and affect adherence.

In the context of this study, the macronutrient composition of ketogenic diets is particularly important for determining the suitability of local food commodities. The requirement for high fat and low carbohydrate intake may not align with the composition of commonly consumed Ghanaian foods, which are typically carbohydrate-based. Additionally, variations in recommended macronutrient ratios complicate the identification of locally available foods that meet ketogenic criteria. Therefore, while macronutrient composition provides a theoretical basis for ketogenic diets, its practical implementation is influenced by factors such as food availability, affordability, and cultural dietary patterns.

2.3.3.2 Forms of Ketogenic Diets

There are various forms of ketogenic diets, depending on the underlying objectives for adopting this dietary approach. The main types of ketogenic diets include the standard ketogenic diet (SKD), cyclical ketogenic diet (CKD), targeted ketogenic diet (TKD), and high-protein ketogenic diet (HKD). While these forms share the common principle of carbohydrate restriction to induce ketosis, they differ in macronutrient composition, timing of carbohydrate intake, and intended use.

The standard ketogenic diet (SKD) is characterised by very low carbohydrate intake, moderate protein consumption, and high fat intake, typically comprising approximately 75% fat, 20% protein, and 5% carbohydrates. This form is the most widely studied and is commonly associated with weight loss and obesity management. In contrast, the cyclical ketogenic diet (CKD) incorporates periodic carbohydrate refeeding, such as five days of strict ketogenic intake followed by two days of higher carbohydrate consumption. The targeted ketogenic diet (TKD) allows for the strategic intake of carbohydrates around periods of physical activity, while the high-protein ketogenic diet (HKD) modifies the standard approach by increasing protein intake, often to around 35%, with a corresponding reduction in fat.

Despite these classifications, not all forms of ketogenic diets are equally supported by empirical evidence. The standard ketogenic diet and, to some extent, the high-protein ketogenic diet have been more extensively studied, particularly in relation to weight loss and metabolic health. In contrast, the cyclical and targeted ketogenic diets are less frequently examined in clinical populations and are often applied in athletic or bodybuilding contexts, where performance and muscle preservation are prioritised. This suggests that these latter forms may be less suitable for general obesity management due to their complexity and the need for careful dietary timing.

Furthermore, the practical applicability of these ketogenic diet forms varies significantly. While SKD provides a relatively straightforward framework for inducing and maintaining ketosis, CKD and TKD require a higher level of dietary planning and adherence, which may limit their feasibility in real-world settings. In comparison with more flexible dietary approaches, the structured nature of ketogenic diets can pose challenges for long-term adherence.

In the context of this study, the different forms of ketogenic diets have important implications for the identification and use of local food commodities. For instance, the strict carbohydrate restriction required in SKD may limit the range of locally available foods that can be consumed, particularly in Ghana, where diets are predominantly carbohydrate-based. Additionally, more complex forms such as CKD and TKD may be difficult to implement in environments where access to diverse food options is constrained. Therefore, while multiple forms of ketogenic diets exist, their practical relevance for obesity management in Ghana may be largely limited to those that are simpler, more adaptable, and compatible with locally available food resources.

2.3.3.3 Benefits of Ketogenic Diets

The ketogenic diet has been associated with several metabolic and clinical benefits, particularly in the short term. Evidence indicates that, alongside weight loss, key health parameters linked to excess weight—such as insulin resistance, hypertension, and dyslipidaemia—may improve following adherence to ketogenic dietary patterns (Paoli, 2013; Schwingshackl & Hoffmann, 2013). However, while these benefits are widely reported, the extent and sustainability of such outcomes remain subjects of ongoing scientific debate.

One of the most consistently reported benefits of ketogenic diets is their role in weight loss and obesity management. Since the 1960s, numerous clinical studies have examined ketogenic diets as a dietary intervention for reducing body weight (Paoli et al., 2013). Masood et al. (2019) argue that ketogenic diets facilitate fat loss through mechanisms such as increased fat oxidation and reduced appetite. Similarly, Volek et al. (2015) and Biesiekierska et al. (2025) suggest that ketogenic diets may enhance satiety and reduce hunger, potentially improving adherence compared to conventional balanced diets.

However, these findings are not universally consistent, as some studies indicate that weight loss outcomes may depend more on overall caloric intake than macronutrient composition alone. This creates an ongoing debate between ketogenic models and energy balance perspectives, suggesting that the mechanisms underlying weight loss are multifactorial rather than exclusively driven by carbohydrate restriction.

There is growing interest in the use of ketogenic diets for improving glycaemic control in individuals with type 2 diabetes. Masood et al. (2023) report that carbohydrate restriction can reduce blood glucose levels and improve insulin sensitivity. This has positioned ketogenic diets as a potential lifestyle-based intervention for diabetes management.

Nevertheless, Masood et al. (2023) caution that the complexity of these mechanisms and the limited availability of long-term evidence make it premature to recommend ketogenic diets universally for the prevention of type 2 diabetes or cardiovascular disease. Thus, while short-term improvements are evident, long-term safety and sustainability remain uncertain.

Ketogenic diets have a well-established role in the management of refractory paediatric epilepsy, with extensive evidence supporting their clinical effectiveness (Freeman et al., 2006). Beyond epilepsy, emerging research suggests potential benefits in neurological conditions such as Alzheimer's disease and traumatic brain injury (Koppel & Swerdlow, 2018; Masood et al., 2023).

However, these applications are still under investigation, and the evidence base is less robust compared to epilepsy treatment. Similarly, studies exploring ketogenic diets in cancer therapy indicate possible roles in slowing tumour growth, but such findings remain preliminary and require further clinical validation (Klement & Champ, 2014).

Ketogenic diets have also been conceptualised as a lifestyle intervention that promotes dietary discipline and self-regulation (Kalra et al., 2018). Some studies suggest that reduced carbohydrate intake may help control food cravings and improve adherence to dietary regimens. However, the restrictive nature of ketogenic diets may also pose challenges for long-term sustainability, particularly in environments where carbohydrate-rich foods are culturally dominant.

Other reported benefits include improved cognitive function, enhanced energy levels, and potential improvements in skin health. While these claims are supported by some physiological explanations—such as the brain's ability to utilise ketone bodies as an alternative energy source—the empirical evidence remains limited or inconsistent. As such, these benefits should be interpreted cautiously and not generalised across populations.

In the context of obesity management, the most relevant benefits of ketogenic diets relate to weight loss, appetite regulation, and glycaemic control. However, the effectiveness of these benefits depends not only on physiological mechanisms but also on practical factors such as dietary adherence, food availability, and affordability. In Ghana, where staple diets are predominantly carbohydrate-based, the ability to achieve and sustain these benefits may be constrained. Therefore, while ketogenic diets offer potential advantages, their real-world applicability is influenced by contextual factors that this study seeks to explore.

2.3.3.4 Effects of Ketogenic

Studies have identified a range of physiological and practical effects associated with the ketogenic diet, which may influence its adoption and sustainability. These effects can be broadly categorised into short-term adaptation effects, long-term health risks, nutritional considerations, and adherence-related challenges.

During the initial phase of adopting a ketogenic diet (short-Term**)** , individuals often experience a cluster of symptoms commonly referred to as the “keto flu.” These symptoms include fatigue, low mood, irritability, constipation, headaches, and cognitive difficulties (Masood et al., 2023; Skartun et al., 2025). Although these effects are generally transient and manageable through adequate hydration and electrolyte intake, they may discourage adherence, particularly among first-time users. This highlights a key behavioural limitation of ketogenic diets when compared to less restrictive dietary approaches.

Prolonged adherence to ketogenic diets has been associated with several potential health risks. Studies suggest increased likelihood of kidney stones, elevated uric acid levels, and reduced bone mineral density (Acharya et al., 2021; Garofalo et al., 2023). Additionally, long-term ketosis has been linked to conditions such as hepatic steatosis, hypoproteinaemia, and micronutrient deficiencies (Masood et al., 2019).

However, it is important to note that some of these risks are context-dependent. For instance, concerns regarding renal impairment are often associated with high protein intake rather than ketogenic diets per se, as classical ketogenic diets are typically moderate in protein (Jhee et al., 2020). This distinction suggests that adverse effects may vary depending on the specific formulation of the diet.

Given that ketogenic diets are high in fat, there are concerns regarding potential cardiovascular risks, particularly if unhealthy fat sources are consumed. Some studies indicate that while triglycerides and HDL cholesterol may improve, LDL cholesterol levels may increase in certain individuals (Paoli et al., 2013; Santos et al., 2012). This variability suggests that individual metabolic responses and diet quality play a critical role in determining health outcomes.

In contrast, other evidence highlights improvements in metabolic markers such as insulin sensitivity, indicating that ketogenic diets may have both beneficial and adverse effects depending on implementation and individual characteristics.

The restrictive nature of ketogenic diets may increase the risk of nutrient deficiencies if dietary diversity is not maintained. Limiting carbohydrate-rich foods such as whole grains, fruits, and certain vegetables may reduce intake of fibre and essential micronutrients, including iron, magnesium, and zinc (Paoli et al., 2013). This necessitates careful dietary planning or supplementation to ensure nutritional adequacy.

Ketogenic diets are not suitable for all populations. They are contraindicated in individuals with conditions such as pancreatitis, liver dysfunction, disorders of fat metabolism, and certain genetic conditions including carnitine deficiency and porphyrias. This limits their universal applicability as a public health intervention.

Beyond physiological effects, ketogenic diets present practical challenges. Li et al. (2023) highlight that maintaining a ketogenic lifestyle can be difficult due to its restrictive nature, high cost, and the need for social and family support. These challenges may reduce long-term adherence, particularly in low-resource settings.

In the context of Ghana, where staple diets are predominantly carbohydrate-based, these constraints may be further amplified. The need for specific food types and potential reliance on supplements may increase the financial burden, thereby limiting accessibility for many individuals.

While ketogenic diets offer potential benefits for obesity management, their associated effects, particularly side effects, nutritional risks, and adherence challenges, highlight important limitations. These factors underscore the need to examine not only the physiological effectiveness of ketogenic diets but also their practical feasibility, especially in relation to the availability and affordability of compatible local food commodities in Ghana.

2.3.3.5 Ketogenic Diet-compatible Local

Ketogenic diet-compatible local food commodities refer to food products that are both locally available within a specific context and consistent with the macronutrient requirements of a ketogenic diet. Specifically, such foods are characterised by high fat content, low carbohydrate levels, and moderate protein composition, thereby supporting the induction and maintenance of nutritional ketosis. This definition distinguishes between general local foods and those that are nutritionally aligned with ketogenic dietary principles.

In the Ghanaian context, examples of ketogenic diet-compatible local food commodities include fatty meats (such as beef, goat meat, and chicken thighs), fatty fish (e.g., tilapia and catfish), eggs, full-fat dairy products (including milk, cheese, and yoghurt), oils and fats (such as coconut oil, palm oil, and shea butter), low-carbohydrate vegetables (e.g., leafy greens, broccoli, and cauliflower), and nuts and seeds (e.g., almonds, walnuts, and chia seeds). These food commodities have been identified in previous studies as nutritionally suitable for supporting low-carbohydrate dietary patterns (Osei-Kwasi et al., 2018).

However, the identification of such foods does not necessarily imply their widespread accessibility or utilisation. A key issue emerging in the literature is the contrast between the macronutrient composition of ketogenic diets and the structure of traditional Ghanaian diets, which are predominantly carbohydrate-based. Staple foods such as cereals, roots, and tubers form the foundation of daily consumption patterns, potentially limiting the integration of ketogenic dietary practices. This creates a fundamental tension between theoretical dietary recommendations and practical dietary realities.

Furthermore, the concept of accessibility, particularly in terms of availability and affordability, plays a critical role in determining the feasibility of ketogenic diets in Ghana. While some ketogenic-compatible foods may be locally produced, their distribution, seasonal availability, and market pricing may vary significantly. For instance, animal-based protein sources and high-fat foods may be less affordable for low-income populations, thereby constraining their dietary choices. This suggests that the adoption of ketogenic diets is not solely a matter of nutritional knowledge but is also shaped by economic and structural factors.

In addition to availability and affordability, the nutritional quality of these food commodities is an important consideration. Nutritional quality encompasses factors such as macronutrient composition, micronutrient density, fibre content, glycaemic index, and their effects on satiety and metabolic regulation. While ketogenic-compatible foods are typically evaluated based on their macronutrient profile, their broader nutritional value is essential for ensuring a balanced and sustainable dietary pattern. For example, an overreliance on high-fat foods without adequate micronutrient diversity may compromise overall health outcomes.

Critically, existing literature has largely focused on the physiological effects of ketogenic diets, with limited attention to the identification and evaluation of locally available foods that can support such diets in specific contexts. This represents a significant gap, particularly in low- and middle-income countries such as Ghana, where food systems, cultural practices, and economic constraints differ substantially from high-income settings where most ketogenic research is conducted.

In the context of this study, ketogenic diet-compatible local food commodities are examined not only in terms of their nutritional suitability but also in relation to their availability and affordability within the Ghanaian market. This approach provides a more comprehensive understanding of the practical feasibility of ketogenic diets as a

2.3.4 Tenets of Ketogenic Lifestyle

A ketogenic lifestyle refers to a structured behavioural and dietary approach designed to sustain a state of nutritional ketosis, in which the body primarily utilises fat-derived ketones as its main energy source rather than glucose. While the ketogenic diet forms the core physiological foundation of this approach, the broader lifestyle extends beyond dietary intake to include behavioural, physiological, and psychosocial factors that collectively influence metabolic adaptation and long-term adherence (Westman et al., 2014).

Nutrition remains the central determinant of a ketogenic lifestyle, as it directly regulates the metabolic state of ketosis. This involves a high-fat, low-carbohydrate, and moderate-protein dietary pattern that shifts energy metabolism from glucose dependence to fat oxidation (Westman et al., 2014). Although this macronutrient structure is widely accepted in literature, studies differ in the degree of restriction required to maintain ketosis, indicating variability in individual metabolic responses. This suggests that ketogenic nutrition is not a uniform prescription but a flexible metabolic strategy influenced by physiological differences.

Physical activity is often presented as a supportive component of ketogenic lifestyle. However, evidence suggests a complex relationship between exercise and ketosis, as high-intensity training may temporarily increase glucose demand, potentially affecting ketone production (Jabekk et al., 2018; Schoenfeld, 2018). Despite this, regular exercise is associated with improved insulin sensitivity and metabolic flexibility, reinforcing its complementary role rather than a primary driver of ketosis.

Stress management is included in ketogenic lifestyle frameworks due to its influence on cortisol levels and glucose metabolism. Elevated stress hormones may increase blood glucose availability, potentially interfering with sustained ketosis (Sharma et al., 2017). However, empirical evidence in this area remains limited and largely indirect, suggesting a need for further research into the neuroendocrine interactions between stress and ketogenic metabolism.

Adequate sleep and recovery are critical for maintaining hormonal balance and metabolic efficiency. Research indicates that poor sleep quality can impair insulin sensitivity and increase appetite-regulating hormones, potentially undermining ketogenic adaptation (Patel et al., 2018). However, most studies are observational, and causal pathways remain insufficiently established.

Hydration and electrolyte regulation are particularly important during the initial stages of ketogenic adaptation due to increased water and sodium excretion. Studies highlight that sodium, potassium, and magnesium depletion may contribute to early symptoms commonly referred to as “keto flu” (Volek et al., 2016). Nonetheless, long-term electrolyte requirements in ketogenic diets remain under-researched, indicating a significant gap in the literature.

Psychological and social factors such as motivation, self-efficacy, and community support are increasingly recognised as determinants of dietary adherence. While some studies suggest that social support improves long-term compliance (Sharma et al., 2017), the evidence is largely derived from general dietary behaviour research rather than ketogenic-specific populations. This represents a limitation in the current literature.

Additional behavioural practices such as intermittent fasting, meal planning, and structured eating patterns are often integrated into ketogenic lifestyle. However, these practices are not exclusive to ketogenic diets and may function as independent behavioural strategies for weight management (Westman et al., 2014; Schoenfeld, 2018). This raises conceptual ambiguity regarding whether these habits are intrinsic components of ketosis or complementary lifestyle interventions.

Integrative Evaluation and Theoretical Linkage

From a theoretical perspective, ketogenic lifestyle adherence can be interpreted through the Energy Balance Model and Carbohydrate-Insulin Model, which respectively emphasise caloric regulation and hormonal responses to carbohydrate intake. However, neither model fully captures the behavioural and psychosocial dimensions highlighted in ketogenic lifestyle frameworks. This indicates a theoretical gap between physiological models and real-world lifestyle implementation.

In the Ghanaian context, the adoption of a ketogenic lifestyle is influenced not only by biological principles but also by structural and socioeconomic factors. Food affordability, cultural dietary patterns dominated by carbohydrate-rich staples, and limited awareness of ketogenic principles may constrain adoption (Osei-Kwasi et al., 2018). However, existing literature provides limited empirical evidence on how these factors specifically affect ketogenic lifestyle adherence in Ghana, indicating a contextual research gap.

For the purpose of this study, the ketogenic lifestyle is operationalised through five key tenets: high fat consumption, low carbohydrate intake, moderate protein intake, whole food emphasis, and hydration/electrolyte balance. These were selected due to their direct relevance to maintaining nutritional ketosis and their measurable dietary implications within the Ghanaian food environment. Other lifestyle components such as mindset and exercise, while important, are treated as supportive rather than core determinants in this study's analytical framework.

2.3.4.5 Hydration and Electrolyte Balance

Hydration and electrolyte balance constitute a critical but often under-emphasised component of ketogenic dietary practice. Within ketogenic physiology, this tenet is essential due to increased renal excretion of sodium and water during the early stages of carbohydrate restriction, which can disrupt fluid and electrolyte homeostasis. This may contribute to symptoms such as fatigue, muscle cramps, dizziness, and reduced cognitive performance (Institute of Medicine, 2004).

From a biochemical perspective, electrolyte intake, particularly sodium, potassium, and magnesium, plays a key role in neuromuscular function and metabolic stability. While global recommendations generally emphasise adequate water intake and the inclusion of electrolyte-rich foods such as avocados, nuts, and leafy vegetables, these recommendations are often based on high-income dietary contexts where supplementation is readily accessible (Veech et al., 2001). This raises questions about the transferability of such guidelines to low- and middle-income countries.

In the Ghanaian context, hydration strategies are more closely linked to naturally available food sources and climatic conditions. Foods such as coconut water, baobab fruit, kontomire (cocoyam leaves), and spinach are locally recognised sources of electrolytes and may offer culturally appropriate alternatives to commercial supplements. However, despite their availability, seasonal variation, affordability, and market accessibility may limit consistent intake among certain population groups. This suggests that while local food systems provide potential support for ketogenic hydration needs, structural constraints may affect their reliability as sustained dietary solutions.

Critically, existing literature tends to focus on the physiological importance of hydration in isolation, with limited attention to socio-economic determinants of electrolyte intake in dietary interventions. This represents a gap, particularly in African dietary research, where food systems are highly dependent on informal markets and seasonal agriculture.

2.3.4.6 Incorporation of Physical Activity

Physical activity is widely recognised as a complementary component of ketogenic lifestyle frameworks, although it is not directly involved in inducing nutritional ketosis. Globally, regular engagement in aerobic and resistance exercises such as walking, cycling, swimming, and strength training is associated with improved insulin sensitivity, enhanced fat oxidation, and overall metabolic health (Jabekk et al., 2018). However, evidence also suggests that exercise intensity and type may influence substrate utilisation, with high-intensity activity temporarily increasing glucose demand, potentially affecting ketone levels in some individuals.

In contrast to Western sedentary lifestyle, physical activity in Ghana often incorporates culturally embedded forms of movement such as traditional dance styles (e.g., azonto, agbadza, kpalogo), occupational physical labour, and active transportation modes like walking and cycling. These culturally embedded activities may provide a more sustainable and context-appropriate means of integrating physical activity into daily life compared to structured gym-based exercise programmes.

Nevertheless, the literature remains divided on whether physical activity should be considered a core component of ketogenic lifestyle frameworks or a supportive behavioural modifier. While ketogenic dietary models such as the Carbohydrate-Insulin Model primarily emphasise dietary composition, the Energy Balance Model highlights the importance of total energy expenditure, thereby providing theoretical justification for including physical activity as a moderating factor in obesity outcomes.

In this study, physical activity is therefore conceptualised as a control variable rather than a primary tenet of ketogenic dietary intervention. This is because its influence is not specific to ketogenic metabolism but rather affects energy expenditure across all dietary patterns. Treating it as a control variable allows for a more accurate estimation of the relationship between ketogenic dietary tenets and obesity management outcomes in the Ghanaian context.

2.3.5 The Concept of Obesity

Obesity is widely recognised as a complex and multifactorial public health condition characterised by excessive or abnormal fat accumulation that poses significant risks to health. The World Health Organisation defines obesity as abnormal or excessive fat accumulation that presents a risk to health (World Health Organisation, 2025). While this definition provides a useful clinical benchmark, it has been critiqued for its reliance on simplified anthropometric indicators that may not fully capture variations in body composition, fat distribution, and metabolic health.

Obesity has become a major global health concern due to its strong association with non-communicable diseases such as type 2 diabetes, cardiovascular diseases, and certain cancers (World Health Organisation, 2020). Although historically associated with high-income countries, recent evidence shows a significant epidemiological shift, with rising prevalence in low- and middle-income countries, particularly in urban populations (Swinburn et al., 2011). This shift has been attributed to dietary transitions, increased consumption of energy-dense processed foods, reduced physical activity, and rapid urbanisation. However, the literature indicates that the pace and drivers of obesity in LMICs differ from those in high-income countries, suggesting the need for context-specific interventions.

From a theoretical perspective, obesity has traditionally been explained using the Energy Balance Model, which attributes weight gain to sustained caloric intake exceeding energy expenditure. While this model remains widely used, emerging perspectives such as the Carbohydrate-Insulin Model argue that hormonal responses, particularly insulin dynamics triggered by carbohydrate intake, play a significant role in fat storage and hunger regulation. The coexistence of these models reflects ongoing scientific debate, indicating that obesity cannot be fully explained by a single linear framework.

In terms of measurement, several methods are used to assess obesity, including Body Mass Index (BMI), skinfold thickness (plicometry), and bioelectrical impedance analysis (BIA) (Heydari et al., 2011; World Health Organisation, 2020). Among these, BMI remains the most widely used due to its simplicity and cost-effectiveness. BMI is calculated as weight in kilograms divided by height in metres squared. A BMI of 30 kg/m^2 or above is classified as obesity, while a BMI between 25 and 29.9 kg/m^2 indicates overweight.

However, despite its widespread use, BMI has important limitations. It does not differentiate between fat mass and lean muscle mass and does not capture fat distribution, particularly visceral fat, which is more strongly associated with metabolic risk. This limitation is particularly relevant in diverse populations, including African populations, where body composition patterns may differ from the populations in which

BMI thresholds were originally developed. Consequently, reliance on BMI alone may lead to misclassification of obesity status in some individuals.

Table 2.1: Level of Body Mass and Weight Status

Body Mass Index (BMI)	Weight Status
Below 18.5	Underweight
18.5-24.9	Normal
25.0-29.9	Overweight
30.0 and higher	Obesity

Source: Adapted from World Health Organisation (WHO, 2000).

While this classification provides a useful public health screening tool, its clinical interpretation should be complemented with other measures such as waist circumference or body fat percentage to improve accuracy.

In the Ghanaian context, rising obesity rates have been linked to changing dietary patterns, increased consumption of processed foods, and reduced physical activity, particularly in urban areas. However, empirical evidence specific to Ghana remains limited in terms of longitudinal dietary tracking and metabolic profiling, indicating a gap in locally grounded obesity research.

Overall, the concept of obesity is no longer viewed as a simple caloric imbalance but as a multifactorial condition influenced by biological, behavioural, environmental, and socioeconomic factors. This complexity supports the need for dietary approaches, such as ketogenic interventions, to be evaluated not only for effectiveness but also for feasibility within specific contexts such as Ghana.

2.3.5.1 Epidemiology of Obesity

Globally, the prevalence of overweight and obesity continues to increase, with significant variations across regions and socioeconomic groups. In Ghana, studies have reported a consistent upward trend in obesity between 1998 and 2016, with urban populations experiencing significantly higher rates compared to rural populations (Ofori-Asenso et al., 2016; Kushitor, 2017). National estimates indicate an obesity prevalence of 17.1% (95% CI: 14.7–19.5%) and overweight prevalence of 25.4% (95% CI: 22.2–28.7%). Urban prevalence rates are notably higher, with obesity at 21% compared to 8% in rural areas.

This urban–rural disparity suggests that environmental and lifestyle factors, rather than biological factors alone, are significant drivers of obesity in Ghana. Urbanisation is associated with increased consumption of processed foods, reduced physical activity, and greater exposure to obesogenic environments. However, existing studies in Ghana largely provide cross-sectional prevalence data, with limited longitudinal analysis of dietary and behavioural transitions, indicating a gap in understanding temporal trends.

Beyond physical health, obesity is associated with substantial psychosocial consequences. Affected individuals often experience reduced quality of life, social stigma, and psychological distress, including depression, shame, and social isolation. While these impacts are widely reported in global literature, fewer Ghana-specific studies have systematically examined the mental health burden of obesity, suggesting another contextual research gap.

2.3.5.2 Causes and Risk Factors of Obesity

Obesity is commonly explained through the Energy Balance Model, which attributes weight gain to sustained caloric intake exceeding energy expenditure. While this model remains widely accepted, it does not fully explain inter-individual variation in weight gain, particularly under similar caloric conditions. This limitation has led to alternative explanations such as hormonal and metabolic models, including the Carbohydrate-Insulin Model, which emphasises insulin-driven fat storage.

In Ghana, dietary transitions have been strongly associated with increased obesity risk. The rising availability of energy-dense processed foods, particularly in urban areas, has contributed to higher caloric intake. Studies indicate that low-cost processed foods are often calorie-dense and nutrient-poor, increasing the likelihood of excessive energy intake (Drewnowski & Darmon, 2005; Kushitor, 2021). However, affordability rather than availability alone appears to be a key driver, as lower-income populations tend to rely more heavily on inexpensive, highly processed foods.

Food manufacturing practices also contribute to obesity risk. The use of added sugars, fats, and flavour enhancers increases palatability and promotes overconsumption (Malik et al., 2010; Poti et al., 2017). While Ghana has regulatory measures such as import restrictions on certain fatty foods, the continued presence of fast-food outlets and informal food vendors suggests limited effectiveness of such policies in controlling dietary exposure to obesogenic foods.

Sugar consumption trends further complicate the obesity landscape. Evidence from Ghana indicates a growing presence of sugars and sweeteners in the food supply (Kushitor, 2021), consistent with global findings linking high sugar intake to metabolic disorders (Popkin et al., 2012; Malik et al., 2013). However, most studies do not differentiate between naturally occurring sugars and added sugars, limiting precision in dietary assessments.

From a biological perspective, genetic predisposition also contributes to obesity risk. Genome-wide association studies have identified more than 50 loci associated with obesity, although most exert polygenic effects (Locke et al., 2015; Berndt et al., 2013). While monogenic obesity exists, it represents a small proportion of cases and is typically associated with severe early-onset obesity. However, the interaction between genetic predisposition and environmental factors (epigenetics) is increasingly recognised as a key determinant of obesity risk.

Despite these advances, genetic studies are predominantly based on non-African populations, limiting their generalisability to Ghanaian populations. This represents a significant gap in obesity genomics research in African contexts.

Behavioural factors, including physical inactivity and sedentary lifestyle, also contribute significantly to obesity. The WHO recommends at least 150 minutes of moderate physical activity per week; however, compliance rates remain low globally. Sedentary behaviours such as prolonged sitting, television viewing, and frequent snacking further exacerbate energy imbalance. In Ghana, urban lifestyle increasingly reflect these sedentary patterns, although traditional forms of physical activity such as walking and dance may still offer protective effects.

Medication-induced weight gain is another contributing factor, particularly among individuals undergoing long-term treatment for chronic conditions. Certain drugs influence appetite regulation, hormonal balance, and metabolic rate, thereby increasing obesity risk. However, this pathway is often under-researched in Ghana, where pharmacovigilance studies on weight-related side effects remain limited.

Table 2.2: Selected Obesity Associated Gene Variants identified in Genetic Studies

Gene	Gene Name	Role of Gene products in Energy Balance
ADIPOQ	Adipocyte-, C1q-, and collagen domain-containing	Produced by fat cells, adiponectin promotes energy expenditure
FTO	Fat mass- and obesity-associated gene	Promotes food intake
LEP	Leptin	Produced by fat cells
LEPR	Leptin receptor	When bound by leptin, inhibits appetite
INSIG2	Insulin-induced gene 2	Regulation of cholesterol and fatty acid synthesis
MC4R	Melanocortin 4 receptor	When bound by alpha-melanocyte stimulating hormone, stimulates appetite
PCSK1	Proprotein convertase subtilisin/kexin type 1	Regulates insulin biosynthesis
PPARG	Peroxisome proliferator-activated receptor gamma	Stimulates lipid uptake and development of fat tissue

Source: *Based on genetic association and GWAS literature*

2.3.5.3 Causes and Effects of Obesity

Hruby and Hu (2015) identify unhealthy lifestyle and poor eating habits as significant causes of obesity, reinforcing the widely accepted energy imbalance framework. However, this explanation is increasingly considered reductionist in the literature, as it does not fully account for metabolic, hormonal, and environmental interactions highlighted in more recent studies.

Higher intake of sugar-rich foods and sugar-sweetened beverages has been linked to a significantly higher risk of developing metabolic syndrome and a 26% greater risk of developing type 2 diabetes compared with those with the lowest consumption (Malik et al., 2010). Similarly, individuals with the greatest intake of added sugar and sugar-rich foods had a 44% higher risk of developing metabolic syndrome compared with those with the lowest intake (Wang et al., 2024). While both studies consistently associate sugar intake with metabolic risk, the magnitude of reported effects differs, which may reflect differences in population characteristics, dietary measurement approaches, and study design. This variation highlights the lack of uniformity in quantifying dietary risk exposure across studies.

Beyond dietary intake, obesity effects extend beyond physiological outcomes to psychosocial consequences. Evidence consistently shows that obesity negatively affects quality of life through reduced participation in daily activities and avoidance of public spaces due to stigma. Individuals may experience discrimination, depression, shame, guilt, and social isolation, which further reinforces sedentary behaviour and worsens weight outcomes. However, most studies emphasize psychological consequences in general terms without sufficiently distinguishing between cultural contexts, particularly in low- and middle-income settings where stigma dynamics may differ.

2.3.5.4 Health-related Complications

The issue of health complications associated with obesity has received considerable attention in the literature, although much of the evidence is heavily concentrated in high-income country populations. According to the World Health Organisation (2021), at least 2.8 million adults worldwide die each year as a result of being overweight or obese, underscoring its global public health significance.

Obesity is strongly associated with chronic diseases such as hypertension, diabetes, and cardiovascular disorders. Specifically, it increases the likelihood of elevated blood pressure and abnormal cholesterol levels, which are key risk factors for heart disease and stroke. However, while the causal pathway between obesity and non-communicable diseases is well established, much of the literature tends to treat obesity as a uniform risk factor without adequately accounting for variations in fat distribution, metabolic health status, and lifestyle heterogeneity among individuals.

A key gap in the literature is the limited integration of context-specific evidence from Ghana and similar developing economies, where dietary transitions, urbanisation, and affordability of food may significantly alter disease progression patterns compared to high-income countries.

2.3.5.5 Obesity Management

Lifestyle changes, including dietary modifications, increased physical activity, and behavioural counselling, remain the cornerstone of obesity prevention and management (Apovian et al., 2015). However, although widely recommended, the effectiveness of lifestyle interventions varies significantly across individuals, particularly in relation to adherence levels, socioeconomic status, and environmental constraints. These interventions are sometimes implemented alone or in combination with pharmacotherapy or bariatric surgery, depending on the severity of obesity and the presence of comorbid conditions.

Individuals who do not achieve adequate weight loss through lifestyle intervention alone are often advised to use pharmacotherapy, while some patients with severe obesity or obesity-related complications undergo bariatric surgery (Apovian et al., 2015). This stepped approach reflects clinical consensus, although the literature shows ongoing debate regarding long-term sustainability, particularly for pharmacological interventions where weight regain is commonly reported after discontinuation.

Dietary approaches that create an energy deficit are central to weight reduction strategies. Various dietary patterns, including low-carbohydrate and higher-fat diets, have demonstrated short-term effectiveness in reducing body weight. However, comparative studies suggest that while such diets may produce faster initial weight loss, long-term outcomes are largely determined by adherence, metabolic adaptation, and behavioural consistency rather than macronutrient composition alone. This highlights a key gap in obesity management literature, where short-term efficacy is often overemphasised relative to long-term sustainability.

Regular physical exercise, including fast or slow walking, swimming, and cycling, contributes significantly to reducing body fat mass by increasing energy expenditure and improving metabolic health. The recommendation of at least 150 minutes of moderate-intensity physical activity or 75 minutes of vigorous activity per week is widely supported in the literature. However, empirical studies consistently report low compliance rates, particularly in urban populations where sedentary lifestyles are increasing, suggesting a disconnect between public health guidelines and real-world implementation.

Healthy eating patterns also play a central role in obesity management. Evidence supports diets rich in low-calorie, nutrient-dense foods such as fruits, vegetables, and whole grains, while limiting saturated fats and energy-dense processed foods. Nevertheless, access and affordability remain critical constraints, particularly in low- and middle-income contexts where healthier food options may be more expensive or less available than energy-dense alternatives. This structural limitation is often underemphasised in clinical recommendations.

Behavioural strategies such as self-monitoring, dietary awareness, and identification of triggers for overeating are widely recognised as supportive tools for weight management. However, the effectiveness of behavioural interventions varies across individuals and is often influenced by psychological factors, food environment, and cultural eating practices. Compared to pharmacological and surgical interventions, behavioural strategies are less invasive but require sustained motivation and long-term behavioural change, which remains a major challenge in obesity management.

Adequate sleep, consistency, and regular weight monitoring are also associated with improved weight management outcomes. Evidence suggests that sleep deprivation may influence appetite regulation and energy balance, although this relationship is still being explored in different population contexts. Regular self-monitoring of weight has been associated with improved weight maintenance, but findings are mixed regarding its effectiveness as a standalone strategy, indicating that it is most effective when integrated with broader lifestyle interventions.

2.4 Empirical Review

This section of the chapter discusses empirical studies on ketogenic lifestyle and obesity management, including effectiveness of ketogenic diets for weight loss and obesity management, nutritional quality and availability of local food commodities in Ghana that align with ketogenic lifestyle principles, experiences and outcomes of individuals adopting ketogenic lifestyle approaches in Ghanaian contexts, and critical analysis of the methodological quality, limitations, and gaps in existing empirical research. While these areas are widely researched globally, the evidence base remains uneven, particularly in low- and middle-income country settings where dietary patterns and food accessibility differ significantly from high-income contexts.

2.4.1 Ketogenic Lifestyle and Obesity Management

Over the years, there has been growing interest in low-carbohydrate and high-fat diets as interventions for achieving weight loss and improving metabolic health (Bueno et al., 2013; Paoli et al., 2013). However, despite increasing popularity, the empirical literature shows mixed emphasis on short-term metabolic outcomes versus long-term sustainability, which remains a central limitation in ketogenic diet research.

Historically, carbohydrate-restricted diets can be traced to the 19th century when William Banting reported weight loss following reduced intake of bread, sugar, and starchy foods (Paoli et al., 2013). While this anecdotal evidence influenced early dietary thinking, modern research has shifted toward controlled clinical trials. The ketogenic diet itself was initially developed in the 1920s as a therapeutic intervention for epilepsy and has since been extended to metabolic disorders such as obesity and type 2 diabetes (Paoli et al., 2013). This evolution highlights a shift from clinical treatment to broader lifestyle application, although the strength of evidence differs across these contexts.

Evidence suggests that ketogenic diets may promote weight loss and improve glycaemic control by inducing ketosis and altering metabolic pathways related to fat and carbohydrate metabolism (Bueno et al., 2013; Hallberg et al., 2018; Volek and Phinney, 2012). However, while these mechanisms are widely accepted, there is ongoing debate regarding whether observed benefits are due to carbohydrate restriction itself or overall caloric reduction, indicating a theoretical disagreement between metabolic and energy balance interpretations.

A review by Paoli et al. (2013) on the principles, safety, and efficacy of ketogenic diet as a therapy for weight loss concluded that ketogenic diets are beneficial in achieving weight loss and improving triglyceride and high-density lipoprotein levels. Nevertheless, the review also reflects a broader limitation in the literature, as many studies included are short-term and do not sufficiently address long-term adherence or metabolic adaptation.

People on a ketogenic diet initially experience rapid weight loss largely due to glycogen depletion and associated water loss, followed by progressive fat loss as ketosis is maintained (Volek and Phinney, 2012; Hallberg et al., 2018). However, this initial rapid reduction can sometimes be misinterpreted in studies as fat loss alone, which creates inconsistencies in evaluating true long-term effectiveness. While proponents argue that ketogenic diets may produce sustained weight loss over time, comparative studies often show that long-term outcomes are similar to other dietary approaches when adherence is controlled, suggesting that compliance rather than macronutrient composition may be the key determinant.

Masood et al. (2023) note that ketogenic diets may be followed for a minimum of 2 to 3 weeks up to 6 to 12 months, with recommendations for monitoring renal function and gradual dietary transition. This indicates clinical caution in long-term application, highlighting uncertainty about extended use safety and sustainability, particularly outside controlled medical settings.

Castro (2018) examined the effects of a very-low-calorie ketogenic diet on weight loss and body composition among obese adults and reported significant reductions in body weight and body fat, along with improvements in cardiometabolic risk factors. However, the study is primarily short-term in design, limiting its ability to assess whether these improvements persist after dietary intervention ends.

Building on short-term evidence, Shai et al. (2008) conducted a two-year randomized controlled trial comparing low-fat, Mediterranean, and low-carbohydrate diets. The study found that low-carbohydrate diets produced greater weight loss than low-fat diets, while the Mediterranean diet also produced favourable outcomes. Importantly, the differences between diets were modest at long-term follow-up, suggesting that multiple dietary patterns can be effective when adherence is sustained. This contrasts with earlier short-term ketogenic studies, indicating that initial superiority in weight loss may not translate into significantly different long-term outcomes.

2.4.2 Local Food Commodities in Ghana

Ghana’s food system includes a wide range of indigenous and non-indigenous crops grown across different ecological zones, from the northern savannah to the humid forest areas in the south. Although food preferences differ among ethnic groups, the national diet is generally built around a few staple food groups. These include tubers and root crops, cereals, legumes, fruits, vegetables, and animal-source foods.

A closer look at the dietary pattern, however, shows a strong dominance of carbohydrate-rich staples, especially tubers and root crops. This means that while the diet provides sufficient energy, it is not always balanced in terms of macronutrients. This becomes more noticeable when compared with dietary approaches such as ketogenic or low-carbohydrate diets. Table 2.3 helps to illustrate this pattern more clearly.

The data shows that tubers and root crops alone contribute 43 percent of the total dietary energy supply, making them the most dominant food group in Ghana. Cereals and grains add another 29 percent. Together, these two groups account for over 70 percent of total energy intake, which shows a heavy reliance on carbohydrate-based foods.

Other food groups contribute much less. Legumes and oil crops account for 9 percent, while fruits and vegetables contribute 10 percent. Animal-source foods, including livestock and fish, make up only 4 percent combined. Sweeteners also contribute a smaller share of about 3 percent.

This distribution shows that the Ghanaian food system is largely centred on carbohydrates. While tubers and cereals provide affordable and accessible sources of energy, their dominance suggests limited diversity in sources of protein and healthy fats. From a broader nutrition perspective, this pattern is important. When combined with reduced physical activity and more sedentary lifestyles, it may increase the risk of energy imbalance and related health conditions.

The strong reliance on foods such as cassava, yam, maize, and rice also suggests that much of the dietary energy comes from high glycaemic index foods. This has implications for insulin response and overall metabolic health. When this structure is compared with ketogenic dietary principles, which require high fat, moderate protein, and very low carbohydrate intake, a clear mismatch is observed. This does not mean that local foods are unhealthy. Rather, it shows that the current dietary pattern would need significant adjustment to support ketogenic goals.

In addition, the low contribution of animal-source foods points to possible limitations in protein variety and micronutrient intake. This imbalance may help to explain some of the patterns seen in obesity and diet-related non-communicable diseases in Ghana. Most existing studies, including FAO food balance data, focus mainly on food availability and consumption levels. They often do not go further to examine how these patterns affect metabolic health or relate to modern dietary approaches such as ketogenic nutrition. There is also limited research on how affordability and cultural food preferences influence what people actually eat. This creates an important gap in understanding how the Ghanaian food system shapes dietary behaviour and health outcomes.

Table 2.3: Dietary Energy of Major food groups consumed in Ghana from 2001-2003

Major Food Groups	Common Food Representatives	Supply for human Consumption in g/day	Dietary Energy Supply by Food Group
Tubers & Root Crops	Cassava, Yam, Cocoyam	1107	43%
Cereals & Grains (excluding beer)	Maize, Rice, Millet, Guinea corn, Sorghum	249	29%
Legumes, Nuts & Oil crops	Soyabean, Groundnuts	55	9%
Fruits & Vegetables	Plantain, Pineapple, Mango, Orange, Tomatoes, Pepper, Onion, Okro, Taro leaves	407	10%
Livestock (Meat, Offal, Milk, Eggs & Animal fats)	Cattle, Sheep, Goats, Poultry, Grasscutter, Snail, Guinea Pigs, Rabbits	53	2%
Fish and Sea food	Tilapia, Cat fish	80	2%
Sweeteners	Sugar, Chocolates, Honey, Syrups	19	3%

Source: Author construct from Food and Agriculture Organization of the United Nation (2009) Food Balance Sheets, FAOSTAT database.

2.4.3 Ketogenic Diet-compatible Local Food Commodities that support Ketogenic Lifestyle

The ketogenic diet is a high-fat, moderate-protein, and very low-carbohydrate dietary pattern that induces a metabolic state known as ketosis, where the body shifts from glucose-based energy production to fat-derived ketone bodies. This metabolic shift is the central mechanism underlying ketogenic dietary interventions in weight management and metabolic health improvement (Paoli et al., 2013; Masood et al., 2023; Ashtary-Larky et al., 2022).

In Ghana, carbohydrate-rich food groups such as cereals, grains, roots, and tubers dominate dietary energy intake (Food and Agriculture Organisation of the United Nations, 2009). As a result, most commonly consumed staples are not naturally aligned with ketogenic macronutrient requirements. However, certain locally available food commodities can be adapted or selected to partially support ketogenic dietary patterns. It is important to note that while several food lists exist in literature and informal sources, including online and social media recommendations, their scientific validation within Ghanaian dietary contexts remains limited. Therefore, the classification below is based primarily on peer-reviewed ketogenic dietary principles and existing food composition knowledge, rather than informal dietary claims.

Table 2.4: Local Ghanaian food commodities for a ketogenic diet plan

Food groups	To be Eaten	To be Avoided
Fats & Oil	Avocado oil, Cocoa butter, Coconut oil, Egg yolk, Grass-fed butter, Chicken fat, Duck fat & Nut oils, Palm kernel oil, shea butter, and palm oil.	Peanut oil, Soya oil, Margarine and Sunflower Oil, Groundnut Oil
Proteins	Colostrum, Sausage, Offal/organ, (Organic, pasture-raised and grass-fed: whey milk, cow meat & chicken meat), Pasture raised eggs, Seafood, Bush meat (Grasscutter, Antelope, Anteater, Deer among others), Salmon, Sardines, Cat fish, Herrings, Tuna, Shrimp, pork, Mutton, Game, beef, snails, and crab	Proteins from grain fed animals and Soya proteins
Vegetables	Kontomire, Alefu, Ayoyo, Gboma, Eggplant, Onions, Okro, Peppers, Garlic, Green Beans, Mushrooms, Lettuce, Cabbages, Spinach, Cucumber	Corn, Pea, Potatoes
Fruits	Avocado, Coconut, Lemon, Lime, Tomatoes, Bush Mango, Apples	Bannas, Grapes, Plantain, Mango, Oranges, Pineapple, Water melon
Legumes, Nuts & Seeds	Coconut, Almonds, Cashew nuts, Neri seeds, bread nutseeds (artocarapus camansi)	Most beans, Peanut, Groundnut

Beverage & Sweeteners	Coffee, Coconut milk, Lemon grass tea, Mineral water, High-quality dark chocolate, Coconut water, vegetable juice, Green tea, monk sweetener, Sobolodrink with no sugar, natural sugars found in whole foods like tamatoes.	Beer, drinks made with artificial Sweeteners, Zonkomi, Elewonyo/Asaana, Sweetened energy drinks, Direct sugar, Fructose, honey, high-fructose corn syrups
Spices, seasonings & condiment	Bitter cocoa powder, Coconut aminos, black pepper, Ginger, Sea salt, Momoni, Koobi, Garlic, Shallots, Onion.	Artificial flavours, Artificial Sweeteners, Soy products.

2.4.5 The Use of Ketogenic Diet-Compatible Local Food Commodities in Managing Obesity

The ketogenic diet has a long history as a therapeutic dietary approach, especially in the management of drug resistant epilepsy since the early 1920s. Its main principle is to shift the body into a metabolic state known as ketosis, where energy is derived from fat rather than glucose. In this state, the body produces ketone bodies through fat oxidation. This process is also linked to weight reduction. In the early stages, weight loss is often due to water loss as glycogen stores are depleted, while continued adherence leads to actual fat loss over time.

In clinical practice, ketogenic diets have been studied mainly in relation to neurological conditions such as epilepsy. For instance, Cao et al. (2015) showed how ketogenic dietary therapy can be used in the management of childhood epilepsy. However, the types of foods used in these interventions are often commercially prepared and not based on indigenous food systems. This makes it difficult to directly apply such findings to the Ghanaian context, where dietary habits and available food options differ significantly.

When used for obesity management, the ketogenic diet is often associated with short term weight loss. At the same time, research findings on its long term effectiveness are not consistent. Some studies report significant weight reduction in the early stages, while others point to challenges with maintaining the diet over time. Issues such as difficulty in adherence, changes in metabolism, and possible side effects have been noted. As a result, some nutrition experts consider it less sustainable compared to more balanced dietary approaches.

In Ghana and similar settings, health professionals tend to be cautious in recommending ketogenic diets for general weight loss. This is partly due to reported side effects such as fatigue, headaches, and nausea, which are often described as keto flu. These symptoms usually occur as the body adjusts to a lower intake of carbohydrates. For this reason, ketogenic diets are more commonly accepted in clinical settings for specific medical conditions rather than for widespread use in obesity management. However, outside the clinical setting, more people are beginning to adopt ketogenic eating patterns for weight control. This shows a growing difference between formal medical advice and everyday dietary practices.

The structure of the Ghanaian diet presents an important challenge to ketogenic dieting. Many commonly consumed foods such as cassava, yam, maize, and rice are high in carbohydrates. This makes it difficult to maintain a strict low carbohydrate diet without making major changes to traditional eating patterns. Despite this, some individuals have started to adapt ketogenic principles using locally available foods. These adaptations are often influenced by information obtained from the internet and social media. Reports suggest that a large number of individuals rely on online recipes, while others use commercial dietary supplements such as Herbalife and Forever Living products. However, such information is mostly self reported and may not always be supported by clinical evidence.

This growing reliance on online sources points to a lack of structured nutritional guidance and locally relevant ketogenic dietary frameworks in Ghana. It also highlights the need for more context specific research and education. Another major issue is dietary compliance. Following a ketogenic diet over time can be difficult due to food cravings, cultural food preferences, and limited access to suitable alternatives. In Ghana, food is closely tied to culture and social life, which makes it harder for individuals to move away from traditional high carbohydrate meals.

In response to these challenges, some local food innovations have been introduced. These include alternatives such as cabbage based fufu and garden egg based banku substitutes. These efforts aim to adapt ketogenic principles to fit within the Ghanaian food culture. Even though they appear promising, there is limited scientific evidence to confirm their nutritional value and long term effectiveness.

A major gap in the literature is the lack of empirical studies that examine ketogenic diets within Ghanaian populations using locally available foods. Much of the existing research comes from Western clinical settings or from informal online sources. These do not fully reflect the realities of Ghanaian dietary patterns, food availability, and affordability. In addition, there is limited research comparing medically supervised ketogenic diets with self directed practices in Ghana. This makes it difficult to fully understand how effective and sustainable ketogenic diets are within the local context.

2.5 Conceptual Framework

The conceptual framework for this study is developed from the integration of theoretical and empirical literature on ketogenic dietary patterns, the food environment, and obesity management. It explains how knowledge, the food environment, dietary adoption behaviour, and obesity outcomes are related within the Ghanaian context. The framework is based on the understanding that obesity management is influenced not only by biological energy imbalance but also by behavioural, environmental, and informational factors. It aligns with broader perspectives from the Energy Balance Model and the Health Promotion Model, which highlight the interaction between individual behaviour and environmental conditions in shaping health outcomes.

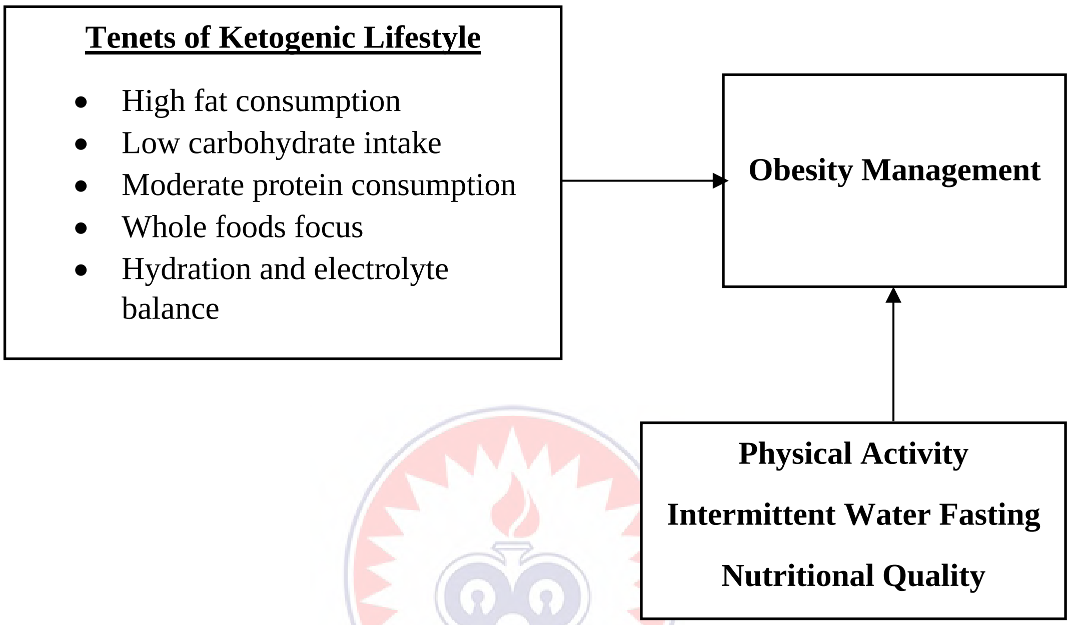

Figure 2.2: Conceptual Framework

Source: Researcher's Construct (2024)

Within this framework, knowledge of ketogenic diet principles refers to an individual's understanding of key aspects of the ketogenic lifestyle. This includes low carbohydrate intake, high fat consumption, moderate protein intake, and the metabolic shift into ketosis. From a behavioural point of view, knowledge serves as an important factor that shapes decision making. Individuals who have better understanding are more likely to assess dietary options carefully and make deliberate efforts to adopt structured dietary changes.

The framework also considers the availability and accessibility of local food commodities. This refers to how easily individuals can obtain foods that are compatible with ketogenic dietary requirements within the Ghanaian food environment. It includes the presence of low carbohydrate food options, the affordability of such foods, and their cultural acceptability. In Ghana, where carbohydrate rich staple foods are dominant, these conditions can create limitations that make strict adherence to ketogenic diets more difficult.

Another important element in the framework is the adoption of the ketogenic lifestyle. This represents the actual practice of ketogenic dietary principles. It involves reducing carbohydrate intake and increasing the consumption of fats and appropriate protein sources over time. This behaviour is not influenced by knowledge alone. It is also shaped by environmental conditions, cultural food habits, and economic factors. For this reason, adoption is seen as a behavioural outcome that results from both individual choices and external constraints.

Obesity management outcomes form the final part of the framework. These outcomes include changes such as reduction in body weight, improvement in body fat composition, and better metabolic health. Existing literature on ketogenic diets suggests that these outcomes are linked to reduced insulin levels, increased fat burning, and improved energy use. However, there is still debate about how sustainable these effects are over a long period.

The framework assumes that there is a sequence in how these elements are related. Knowledge of ketogenic dietary principles influences whether an individual is likely to adopt the diet. This is consistent with the Health Promotion Model, which explains that behaviour is shaped by what individuals know, believe, and feel capable of doing. At the same time, the availability and accessibility of appropriate foods affect this relationship. Even when individuals have good knowledge, they may struggle to adopt the diet if suitable foods are not available, are too expensive, or do not fit within cultural food practices. This reflects the role of environmental constraints as highlighted in the Energy Balance Model.

When individuals are able to adopt the ketogenic lifestyle successfully, it is expected to influence obesity management outcomes. This is supported by the Carbohydrate Insulin Model, which suggests that reducing carbohydrate intake lowers insulin levels and promotes fat loss. However, this process is not always straightforward. Challenges with adherence, long term sustainability, and socio cultural influences may reduce the effectiveness of the diet over time.

Overall, the framework presents obesity management as the result of interacting behavioural and environmental factors rather than a purely biological process. It shows that while ketogenic diets may provide metabolic benefits, their success in the Ghanaian context depends largely on knowledge, the food environment, and the ability of individuals to maintain the diet.

A key gap identified in the literature is the limited evidence on how these factors interact within the Ghanaian food system. Most existing studies on ketogenic diets focus on clinical settings or Western populations, with little attention to local food availability, cultural dietary patterns, and affordability. This study addresses this gap by examining how ketogenic compatible local food commodities can be integrated into obesity management strategies in Ghana.

2.6 Lessons Learnt from Literature

The literature reviewed presents several important insights regarding the physiological, dietary, and contextual dimensions of ketogenic diets and their relevance to obesity management. A key theme emerging from the literature is metabolic flexibility, which refers to the body’s ability to switch between glucose and fat-derived ketones as energy sources depending on dietary intake and energy availability. This metabolic adaptability is central to the theoretical justification of ketogenic diets, particularly in conditions of carbohydrate restriction and fasting states.

However, while this physiological mechanism is well established, the literature also suggests that its practical effectiveness depends on individual adherence, dietary composition, and metabolic health status. This indicates that metabolic flexibility alone does not guarantee sustained weight loss outcomes, particularly in real-world dietary environments.

Another consistent finding is the brain's high dependence on glucose under normal physiological conditions. The literature indicates that the brain requires a continuous glucose supply; however, during prolonged carbohydrate restriction, ketone bodies can partially substitute as an alternative energy source. While this adaptation supports survival during fasting or low-carbohydrate intake, some studies caution that full reliance on ketones may not fully replicate all glucose-dependent neurological functions, particularly during early adaptation phases.

In relation to weight management, existing studies generally agree that ketogenic diets can induce short-term weight loss, primarily due to glycogen depletion, water loss, and increased fat oxidation. However, the literature is divided on long-term sustainability, with some studies reporting weight regain after discontinuation and others highlighting adherence challenges as a key limitation. This suggests that ketogenic diets may be effective as short-term interventions but less stable as long-term population-level strategies.

A critical theme emerging from the literature is the importance of food environment and cultural context. While ketogenic diets are well documented in clinical and Western dietary settings, there is limited evidence on their feasibility in non-Western food systems such as Ghana, where carbohydrate-based staples dominate dietary patterns.

This raises important questions about accessibility, affordability, and cultural acceptability of ketogenic dietary patterns in such contexts.

Furthermore, the literature highlights the need for adaptation of ketogenic diets using locally available food commodities. However, there is limited empirical validation of locally adapted ketogenic dietary models, particularly in Ghana. Most existing recommendations are derived from international guidelines or informal online sources, which may not fully reflect local dietary realities or nutritional composition.

Finally, the role of healthcare professionals is emphasised as critical in guiding safe and effective dietary interventions. However, literature indicates variability in professional knowledge and acceptance of ketogenic diets, particularly in contexts where long-term safety and sustainability remain debated.

Overall, the literature reveals a significant gap in context-specific research examining how ketogenic diets can be practically implemented using local food systems in Ghana. There is also limited comparative evidence between medically supervised ketogenic interventions and informal self-directed dietary practices, particularly in relation to obesity outcomes.

2.7 Chapter Summary

This chapter has reviewed literature on ketogenic dietary patterns, obesity management, and the role of local food commodities in dietary interventions. The review indicates that ketogenic diets operate through a metabolic shift from glucose dependence to fat-derived ketone utilisation, a process that has been widely studied in clinical and nutritional science literature.

Evidence suggests that ketogenic diets may support short-term weight loss through mechanisms such as glycogen depletion, reduced insulin levels, and increased fat oxidation. However, the literature also indicates that long-term effectiveness remains uncertain due to challenges related to dietary adherence, cultural food preferences, and metabolic adaptation.

The review further highlights that while ketogenic diets have been extensively studied in clinical and Western contexts, there is limited empirical evidence regarding their application within Ghanaian dietary systems. In particular, the integration of locally available food commodities into ketogenic dietary patterns remains underexplored.

In addition, the chapter identifies a gap in understanding how knowledge, food availability, and affordability influence the adoption of ketogenic lifestyle in non-clinical populations. This gap is particularly relevant in Ghana, where carbohydrate-dense staples dominate dietary intake and where dietary transitions are increasingly linked to rising obesity prevalence. Overall, the literature suggests that while ketogenic diets present potential benefits for obesity management, their effectiveness in Ghana is dependent on contextual adaptation, behavioural adherence, and food system compatibility.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The chapter presents the research methodology adopted for the study.The following areas were covered; research paradigm, research design, research approach, study area, population, sample and sampling technique, data collection instruments and procedure, data analysis, validity and reliability of research instruments, and ethical considerations. The summary of the chapter was provided.

3.2 Research Paradigm

A research paradigm refers to a researcher's philosophical assumptions about the nature of reality and knowledge are that crucial to understanding the overall perspective from which a scientific inquiry is carried out. These philosophical assumptions consist of the beliefs and values that a researcher holds about the nature of reality and how it can be known, as well as what should count as knowledge (Saunders et al., 2019). Thus, research paradigms shape a researcher's perspective of the social world and inform the choice of the approach for investigating a research problem in terms of what kind of data to collect, how the data will be collected and analysed, and how the results will be presented. Saunders et al. (2019) postulate four most common philosophical assumptions (interpretivism, realism, pragmatism and positivism). These assumptions can broadly be grouped under three paradigms: epistemology, ontology, and axiology. Given the purpose of this study, the researcher adopted a positivist ontological worldview to the study. It is premised on the philosophical assumption that experiment, observation, and reason based on experience ought to be the basis for understanding human behaviour, and therefore constitute the only legitimate means of extending knowledge and human understanding (Kivunja & Kuyini, 2017). They contend that positivism is generally deductive and encourages scientific enquiry that involves observation and experiments to arrive at an objective conclusion. Thus, positivist researchers construe social reality of being objective and argue that reality is independent of the researcher and can only be discovered through observation and experiments using one's senses (Saunders et al., 2019). The positivist philosophical assumption was adopted on the basis that it allowed the researcher to perform an objective analysis of how local food commodities on the Ghanaian market can be used to promote ketogenic lifestyle towards managing obesity using a quantitative method such that the researcher has no influence over the data collected but can only make inferences from the results produced from statistical analysis.

3.3 Research Approach

Researchers may draw on three major research approaches to analyze a specific research problem. The three approaches comprise a quantitative approach, qualitative approach, and mixed-methods approach. Creswell & Creswell (2017) describes these approaches as consisting of a continuum and that researchers mostly align themselves to either a quantitative approach or qualitative approach; with the mixed-methods approach residing in the middle. Mauch & Park (2003) posits that the choice of a particular research approach is mostly influenced by one's philosophical assumption underpinning the study. The differences in the selection of research approaches do not make one selected approach or a study better than the other but to a large extent only reflects its suitability to the particular research problem (Mauch & Park, 2003). It follows that the selection of a specific research approach for a study is mostly influenced by the research objective underlying the study, along with the kind of data required and the methods deployed in that data collection and analysis (Kothari, 2004; Saunders & Thornhill, 2019). Qualitative and quantitative approaches are typically selected depending on whether the research seeks to explore subjective meanings or measure objective phenomena (Creswell & Cresswell, 2017). Therefore, given that the researcher aimed at performing an empirical analysis of the research problem by collecting numerical data which can be subjected to statistical analysis to arrive at observable results from which valid conclusions could be drawn, the quantitative approach to research was considered most fitting and suitable for the study.

Furthermore, the positivist paradigm advocates the use of quantitative methods to investigate a research problem by collecting mesurable numerical data which can be subjected to rigorous statistical analysis to test a hypothesis or answer research questions and arrive at justifiable conclusions that can help test hypothesis , answer research questions and support the conceptual framework for the research, **(**Fisher, 2010). Additionally, the quantitative approach was adopted because it takes a deductive and analytical view of social reality and examines a phenomenon or analyze the relationship between different aspects and variables using statistical methods that rely on numerical data to produce objective results (Fellows & Liu, 2021; Kothari, 2004; Creswell & Creswell, 2017; Saunders et al., 2019).

3.4 Research Design

A research design refers to a master plan specifying the methods and procedure for collecting data for research in social science and analyzing the needed information (Creswell & Creswell, 2017). It establishes what the study is about and shows what type of data will be required. It can be classified into three: purpose (exploratory, explanatory and descriptive), approach (quantitative, qualitative and mixed-method), and strategy or method (survey, case study, quasi study, observation, etc.) (Saunders et al., 2016). Given the purpose of this study, the researcher employed a descriptive research and a cross-sectional survey designs.

A descriptive research describes a given phenomenon or the relationship that exist between variables (such as independent and dependent variables) in broader or specific terms (Saunders et al., 2016). It is mostly suitable for answering research questions such as“what”, which seeks to describe characteristics or relationship within a population (Saunders et al., 2016; Creswell & Cresswell, 2018). Therefore, considering the research questions of this study, the researcher employed descriptive design. Furthermore, this study investigates the tenets of ketogenic lifestyle and their impact on obesity management, including the control effect of physical activity, hence descriptive design is most appropriate compared to exploratory and explanatory designs. Additionally, since the data would be collected in a single moment of time, a cross-sectional survey design is suitably chosen. A cross-sectional study is a research whereby various segment of a population are sampled and data are collected at a single moment in time (Zikmund et al., 2010). The use of the cross-sectional design supports quantitative research approach and offers the researcher the opportunity to collect cross-sectional data using a survey method.

3.5 Study Area

This study was conducted in the Accra Metropolitan Assembly. This Metropolis is one of the 261 Metropolitan, Municipal and District Assemblies (MMDAs) in Ghana, and forms part of the 29 MMDAs in the Greater Accra Region. With its administrative capital as Accra and located at the southern part of Ghana, it was established by Legislative Instrument (L.I) 2034 and covers an area of 173 sq km. It shares common boundaries with La-Dade Kotokpon Municipal from the east and Ga West Municipal, Ga Central Municipal and Ga South Municipal Assemblies from the west. The Metropolitan Assembly also share common boundary with the Gulf of Guinea. The population of the Metropolitan according to 2021 population and housing census stands at 284,124 with 134,045 males and 150,079 females.

Accra is a city that offers something for everyone, from its rich cultural heritage to its modern attractions and landmarks. Whether you are interested in history, culture, or entertainment, Accra is a city that is sure to captivate and inspire you. Notable landmarks and attractions include Independence Square (a large public square that hosts national events and celebrations); Kwame Nkrumah Memorial Park (a memorial park dedicated to Ghana's first president, Kwame Nkrumah); National Museum (a museum that showcases Ghana's history, culture, and art); Makola Market (a bustling marketplace that sells everything from fresh produce to traditional crafts); Osu Castle (a 17th-century castle that served as a trading post and later as a presidential palace); Accra Sports Stadium (a stadium that hosts national and international sports events); National Theatre (a theater that hosts cultural performances and events); and Accra Mall (a shopping mall that offers a wide range of retail and entertainment options).

3.6 Population

The population for this study comprised all obese individuals residing in the Accra Metropolis who are managing their obesity through the adoption of a ketogenic lifestyle.

The target population specifically consisted of obese adults aged 20 to 60 years within the Accra Metropolis who are actively practicing a ketogenic diet as a deliberate strategy for obesity management. These individuals were identified through keto dieters' social media platforms and relevant reference groups, including nutritionists and market sellers who are familiar with individuals adopting ketogenic dietary practices. This target population is characterised by individuals following a low-carbohydrate, high-fat dietary pattern with the primary objective of weight reduction or obesity control.

3.7 Sample Size

The sample size for this study comprised 120 obese individuals practicing ketogenic diets within the Accra Metropolis. This sample size was guided by methodological recommendations for quantitative descriptive and correlational studies, which suggest that a minimum of about 100 respondents is generally adequate for statistical analysis of relationships between variables, particularly where non-probability sampling is used (Hair et al., 2010; Saunders et al., 2019).

The choice of 120 participants was also informed by the absence of a clear sampling frame for obese individuals practicing ketogenic diets in the Accra Metropolis. In such contexts, sample size determination is often guided by feasibility, accessibility of the population, and the need to capture sufficient variation in responses for meaningful analysis. Therefore, the sample size of 120 was considered adequate to examine the availability and affordability of ketogenic-compatible local food commodities, as well as the relationship between ketogenic lifestyle practices and obesity management outcomes.

In addition, the sample size can be supported using Cochran's formula for determining sample size for an unknown or large population. The formula is expressed as:

$$n_0 = (Z^2pq) / e^2$$

where n_0 represents the sample size, Z is the z-score corresponding to the desired confidence level (1.96 for 95% confidence), p is the estimated proportion of the population (0.5 used where the population proportion is unknown), $q = 1 - p$, and e is the margin of error (0.05).

Substituting these values gives:

$n_0 = (1.96^2 \times 0.5 \times 0.5) / (0.05^2) \approx 384$

However, due to the absence of a defined sampling frame, the specific and hard-to-reach nature of the study population, and logistical constraints, a reduced but practically attainable sample size of 120 respondents was used. This is consistent with studies involving specialized populations where access is limited.

3.7.1 Sampling Technique

The study used a snowball sampling technique to recruit participants. This approach was considered appropriate because there is no formal database of obese individuals practicing ketogenic diets in the Accra Metropolis, and such individuals are not easy to identify directly. In addition, ketogenic dietary practices for obesity management are often informal and not always publicly disclosed, which makes the population relatively hidden.

Participants were required to meet specific inclusion criteria. They had to be between 20 and 60 years of age, reside within the Accra Metropolis, and be classified as obese with a Body Mass Index of 30 or above. This classification was based on self-reported height and weight or a confirmed clinical diagnosis where available. Participants also had to be actively practicing a ketogenic diet for the purpose of managing obesity and must have followed this dietary pattern consistently for at least six months.

Eligibility was verified through a structured screening process at the point of initial contact. Participants were first asked questions about their dietary pattern to confirm that they followed a low-carbohydrate, high-fat ketogenic diet. They were then asked to state how long they had been following the diet to ensure that the minimum duration requirement was met. Information on height and weight was collected and used to calculate Body Mass Index to confirm obesity status. Where possible, participants were also asked to indicate any prior clinical diagnosis. Residency within the Accra Metropolis was confirmed during this process. Only those who met all the inclusion criteria were selected for the study.

The sampling process began with a small number of initial participants identified through informal networks within the Accra Metropolis. These individuals were screened and confirmed to be eligible before they were included in the study. Each participant was then asked to refer other individuals within their social or dietary networks who also met the study criteria. All referred individuals went through the same screening and verification process before being included. This process continued until the required sample size of 120 participants was reached.

This sample size selection is further supported by methodological considerations for hard-to-reach populations, where no sampling frame exists and participants are not easily identifiable. In such contexts, probability-based sample size requirements, such as those derived from Cochran's formula for unknown populations, may not be fully attainable in practice. Although the statistically recommended sample size for an unknown population at 95% confidence level and 5% margin of error is approximately 384 respondents, as derived from Cochran's formula, the study adopted a smaller sample size of 120 due to the specific challenges associated with accessing obese individuals actively practicing ketogenic diets within the Accra Metropolis. These challenges include the informal nature of ketogenic dietary practices, limited disclosure of dietary behaviour, and the reliance on referral-based recruitment inherent in snowball sampling. Despite this reduction, the sample size remains adequate for detecting relationships between variables in correlational and regression analysis, particularly in studies involving specialized or hidden populations.

3.8 Data Collection Instruments

Creswell & Creswell (2017) contends that survey researchers collect numerical data using a questionnaire and analyze the data using statistical techniques to describe trends about responses to questions. Therefore, based on the research design for this study, a questionnaire was deemed the most appropriate tool for data collection. A questionnaire is a data collection tool consisting of a series of questions that are either closed-ended, open-ended or both and requires the respondent to provide brief answers to describe current events, conditions or attributes of a population at a given point in time (Saunders et al., 2019; Creswell & Creswell. 2018). The questionnaire was employed on the premise that it is a handy instrument for collecting numerical data from a geographically dispersed sample within a relatively short time and at a lesser cost (Johnson & Christensen, 2014; Saunders et al., 2019). Moreover, in line with the descriptive survey design adopted for the study, the use of a questionnaire was deemed to be consistent with the chosen research design based on the assertion of (Saunders et al., 2019; Creswell & Creswell. 2018) that questionnaire is the widely used data collection tool in survey research.

The study relied on one set of the questionnaire designed by the researcher based on the objectives of the research and literature on the concepts of the study variables. The questionnaire involved closed-ended questions under six major sections. The closed-end structure of questions or statements was adopted because such questions are easy to ask and easy to answer, require no lengthy writing by the respondent, and the results are straightforward to analyze (Naoum, 2019; Saunders et al., 2019). Also, the questionnaire was designed in simple language to enhance readability taking into consideration the fact that some of the respondents may not be highly educated. Section I comprised of statements on the demographic characteristics of the respondents.

Section II collected data on the availability and affordability of ketogenic diet-compatible local food commodities. Section III collected data on the nutritional quality of ketogenic diet-compatible local food commodities. Section IV obstained data on the challenges and opportunities of ketogenic diet-compatible local food commodities.

Nutritional quality in this section was measured using respondents' assessment of the perceived dietary suitability of local food commodities for a ketogenic diet. Specifically, items focused on the perceived adequacy of macronutrient composition (high fat, moderate protein, and low carbohydrate content) as well as the perceived presence of essential nutrients such as fibre, vitamins, and minerals, in relation to ketogenic dietary requirements.

Section V solicited data on the five tenets of ketogenic lifestyle, which were measured with four items per each tenant on likert's scale responses. Section V collectd on obesity management, which was measured with 10 items on likert's scale responses.

3.9 Operationalisation of Variables

The key constructs in this study were operationalised to allow for quantitative measurement. The tenets of the ketogenic lifestyle were measured using a structured questionnaire based on core dietary and behavioural principles of ketogenic practice. These constructs included high fat consumption, low carbohydrate intake, moderate protein consumption, whole foods focus, and hydration and electrolyte balance.

Each construct was measured using multiple items on a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Respondents were asked to indicate their level of agreement with statements relating to their dietary practices.

High fat consumption was measured through items assessing the regular intake of high-fat foods such as oils, eggs, and fatty food sources. Low carbohydrate intake was assessed through reduced consumption of carbohydrate-rich foods such as rice, yam, cassava, and bread. Moderate protein consumption was measured based on balanced intake of protein sources such as fish, meat, and legumes.

Whole foods focus was assessed by respondents' preference for natural and minimally processed foods. Hydration and electrolyte balance was measured through regular water intake and attention to mineral balance during dieting. Intermittent water fasting and physical activity were also measured as control variables using similar Likert-scale items. For each construct, responses from multiple items were aggregated by computing the mean score to form composite variables. These composite scores were treated as continuous variables and used in the correlation and regression analysis.

3.10 Validity and Reliability of Instrument

It is necessary to ensure that a questionnaire is fit for purpose in terms of its content validity and internal consistency when using the self-constructed questionnaire for the first time. The validity of a research instrument refers to the assurance that a research instrument has been designed based on the study objectives and that it is capable of achieving relevant and accurate results (Mugenda & Mugenda, 2003; Creswell & Creswell, 2018). On the other hand, reliability refers to the ability of a research instrument to generate the same results upon repeated trials using the same respondents on the same conditions (Neuman, 2014). Taking cognizance of the essence of ensuring the validity and reliability of a self-constructed questionnaire in survey research, the researcher took steps to address these two major issues.

Firstly, in terms of validity of the questionnaire, it was designed based on the specific objectives of the study making sure that the response items concerning each section contained constructs that adequately measured the particular purpose it was meant to measure. This was aimed at enhancing the content validity of the questionnaire. Also, a draft of the questionnaire was submitted to the thesis supervisor for her reading, comments and suggestions. The questionnaire was modified based on the feedback from the thesis supervisor. Furthermore, the questionnaire was sent to one dietitian from a hospital in Accra for her expert advice. Again, the quality of the instrument was improved based on the suggestions from the experts. With these, the instrument was adjudged content valid and therefore the researcher proceeded to carry out the pre-test which helped to conduct the predictive validity. The predict validity is also tested to confirm whether the instrument validly predicts the outcomes (Thomas, 2006). The predict validity test was done using inter-construct correlation and the results depicted that the instrument is valid. The result has been presented in the chapter four of this study.

The pre-test also helps to ascertain instrument's reliability and fine-tune it or make necessary corrections based on the results (Neuman, 2014). Therefore, in ensuring that the questionnaire was consistent in producing the same results upon repeated trials, it was pre-tested with 15 respondents outside the original sample. The results from the pre-test were analyzed using Cronbach's alpha reliability coefficient test in Statistical Package for Social Science (SPSS version 26) to determine the reliability of the questionnaire. By far, Cronbach's alpha test has been the widely used measure of internal consistency of the Likert scale type of questionnaire. The test produced an alpha coefficient of 0.78, which was above the threshold of 0.70 for the instrument to be deemed reliable (Nunnally & Bernstein, 1994; Hair et al., 2010; Saunders et al; 2019). The result has been presented in the chapter four of this study.

3.11 Data Collection Procedures

The process of data collection commenced with the administration of the questionnaire to the identified respondents at their various locations. The researcher recruited and trained five people to assist her in the data collection. The research assistants were given guidelines and instructions to ensure that they maintained high ethical research standards; did not interfere with the data collected; and collected the accurate and reliable data from the respondents. The administration of the questionnaire and retrieval of such, lasted for one month.

3.12 Ethical Considerations

Before the commencement of data collection process, various ethical issues relating to research were taken into consideration. Firstly, the issue of informed consent was given critical attention. Informed consent implies that the respondents are competent; are involved voluntarily; are aware of their right to discontinue; are not coerced and not induced to participate in the study (Creswell & Poth, 2017). The researcher sought the consent of prospective respondents by sending a notice to the ketogenic dieters WhatApp platform, which was used as a major source of respondents for the study. The instruction spelt out the purpose of the research and essence of the study. Members of the group were encouraged to voluntarily participate in the study as respondents by sending a private message to the researcher or texting “Yes” on the group page. Other respondents identified through reference groups and informants were also contacted, briefed about the study, and asked to participate in the study voluntarily. Those who accepted to take part in the study were noted.

In terms of anonymity of respondents, it must be noted that privacy is an individual’s right and researchers must bear in mind the importance of safeguarding the privacy and identity of respondents and act with the necessary sensitivity where the privacy of respondents is relevant. Therefore, in ensuring anonymity of the respondents, a statement in the introductory section of the questionnaire made it clear that respondents were not required to write their names on the questionnaire or identify themselves in any form when answering the questionnaire. This was to ensure that the identity of the respondents was hidden. With this, it is believed that respondents will be confident and open when answering the questionnaire without any fear or doubts whatsoever about their identity been exposed.

Another major ethical issue that was taken into consideration was the confidentiality of the information provided by the respondents. Protection of confidentiality may among other things include ensuring that respondents do not identify themselves by their real names in the study and ensuring that the publication of the research findings is done in a manner that does not allow for quick identification of respondents. In preserving the confidentiality of information provided voluntarily by respondents, they were assured through a statement in the introduction section of the questionnaire that information they provided was to use for only academic purposes and that under no circumstance will such information be released to a third party with the prior consent of the respondents.

3.13 Data Analysis

Data analysis was carried out using the Statistical Package for Social Sciences (SPSS) version 26. After data collection, questionnaires were checked for completeness and consistency. Only fully completed questionnaires were coded and entered into SPSS for analysis.

The data were analysed using both descriptive and inferential statistics. Descriptive statistics such as mean, standard deviation, skewness, and kurtosis were used to summarise the data and describe the characteristics of respondents. These were used to address the first, second, and third research objectives.

Normality of the data was assessed using skewness and kurtosis values, based on the rule of thumb that values should fall within ±1 as recommended by Tabachnick et al.

(2007). This was done to determine whether parametric tests were appropriate for further analysis.

Inferential statistics were then applied. Pearson correlation analysis was used to examine the relationship between the tenets of ketogenic lifestyle and obesity management. Multiple regression analysis was also used to determine the predictive influence of the independent variables on obesity management and to test the study hypotheses.

All statistical tests were conducted at a 0.05 level of significance. This means that results were considered statistically significant when the p-value was less than 0.05.

Before performing regression analysis, key assumptions were checked. These included normality of data distribution, linearity, and multicollinearity among independent variables to ensure the reliability of the regression model.

For the purpose of analysis, nutritional quality was computed as a composite index derived from respondents' ratings on perceived macronutrient adequacy, including high fat, moderate protein, and low carbohydrate composition, as well as micronutrient presence such as fibre, vitamins, and minerals in ketogenic-compatible local food commodities. The composite score was treated as a continuous variable in both descriptive and inferential analysis.

The following regression models were estimated:

$$OM = \alpha + \beta 1HFC + \beta 2LCI + \beta 3MPC + \beta 4WFF + \beta 5HEB + \mu$$

$$OM = \alpha + \beta 1HFC + \beta 2LCI + \beta 3MPC + \beta 4WFF + \beta 5HEB + \beta 6PA + \beta 7IWF + \beta 8NQ + \mu$$

Where OM represents obesity management, HFC represents high fat consumption, LCI represents low carbohydrate intake, MPC represents moderate protein consumption, WFF represents whole foods focus, HEB represents hydration and electrolyte balance, PA represents physical activity, IWF represents intermittent water fasting, and NQ represents nutritional quality. Alpha is the intercept, beta represents coefficients, and mu represents the error term.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This chapter presents the results of the various analyses and interprets same. The results are presented in the order of the research objectives and carefully discussed. The study aim to: assess the availability and affordability of ketogenic diet-compatible local food commodities in Ghana, determine the nutritional quality of ketogenic diet-compatible local food commodities in Ghana, identify the challenges and opportunities for accessing ketogenic diet-compatible local food commodities in Ghana, and explore the tenets of ketogenic lifestyle and their impact on obesity management in Ghana. Research questions were framed out of these objectives to guide the data collection.

A structured questionnaire was used to collect cross-sectional data from sampled obese people within the Accra Metropolis. In total, 120 questionnaires were administered to the respondents via face-to-face engagments. All were validly retrieved for the analysis. The researcher utilized SPSS to analyze the data by carrying out descriptive analysis, correlation and regression analyses to test each research question. Microsoft Excel was used to edit the charts and graphs that were generated from the SPSS. This presents the demographic characteristics of the respondents. The rest of the results are presented in tables and clearly interpreted. The subsequent sections and subsections of this chapter present in details the results, including discussions of the findings in line with the previous findings reviewed in the chapter two of this thesis.

4.1 Demographic Characteristics of Respondents

4.1.1 Gender of Respondents

The Figure 4.1 below shows the gender of the respondents. It has recorded 45.8 percent of the respondents to be males and 54.2 percent of the respondents to be female. It implies that more females participated in the survey than males. It also means obesity is more prevalent among Ghanaian women than men. However, given the sample size, it might be that more females were accessible than males.

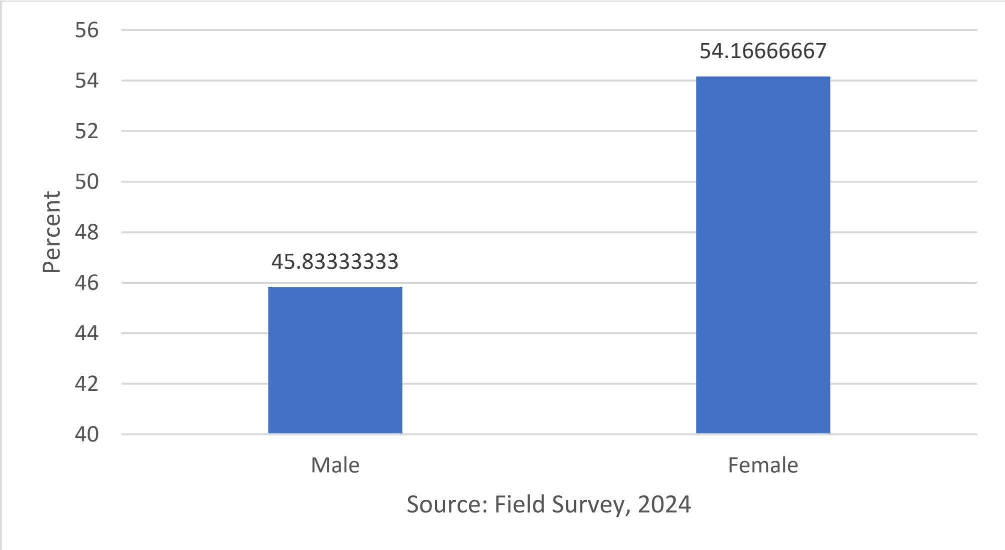

Figure 4.1 Gender of Respondents

4.1.2 Age of Respondents

Figure 4.2 below shows the age groups of the respondents. The age groups are divided into four: 20-30, 31-40, 41-50, and 51-60. It can be observed from Figure 4.2 that 5.8 percent of the respondents (representing 7) fall within the age group (20-30). Again, 30 percent of the respondents (representing 36) are within the age group (31-40), 52.5 percent of the respondents (representing 63) are aged between 41 and 50 years, and 11.7 percent of them (representing 14) fall within the age bracket (51-60). It follows that majority of the respondents are in the age bracket of 41-50, and the second largest age group is in the age bracket of 31-40. This suggests that most of the obessed people are between 31 and 50 years, which constitute a youth and nearly older population. This suggests that such population normally suffers from obesity than other age categories within the Accra metropolis.

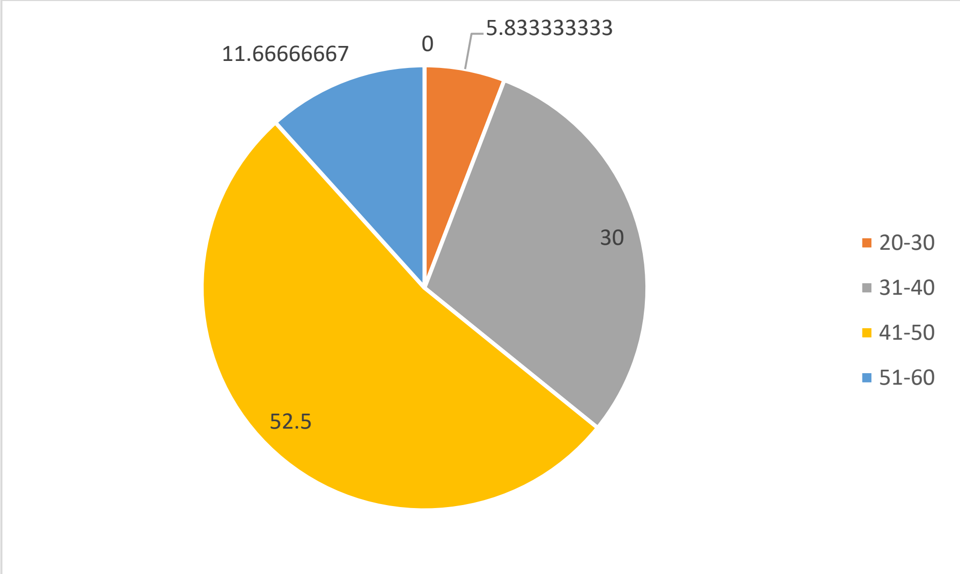

Figure 4.2 Age of Respodents

4.1.3 Marital Status of Respondents

Figure 4.3 above presents the marital status of the respondents. It shows that 39.2 percent of the respondents (representing 47) are single while 50.8 percent of the respondents (representing 61) are married. Next, 10 percent of the respondents (representing 12). This means that about half of the respondents are married and only 10 percent are divorced. It can be concluded that obesity is more prevalent among married people, followed by unmarried or divorced people within the Accra metropolis.

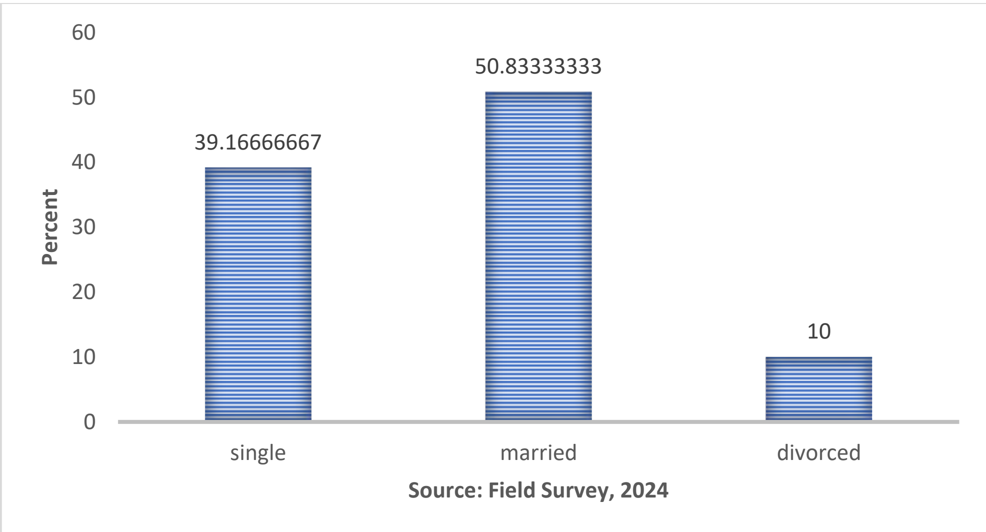

Figure 4.3 Marital Status

4.1.4 Highest Level of Education

The educational level of the respondents is shown in Figure 4.4. It can be observed that 10 percent of the respondents (representing 12) attained primary education (JHS/SHS) level. It can also be seen that 28.3 percent of the respondents (representing 34) hold diploma certificate. Also, 45 percent of the respondents (representing 54) obtained bachelor's degree. Additionally, 16.7 percent of the respondents (representing 20) hold masters' degree. It follows that most of the respondents are first degree holders followed by diploma holders, then masters' degree holders, and so they could give fair response to the questionnaires. Regardless, one's educational level, he or she is likely to be obessed.

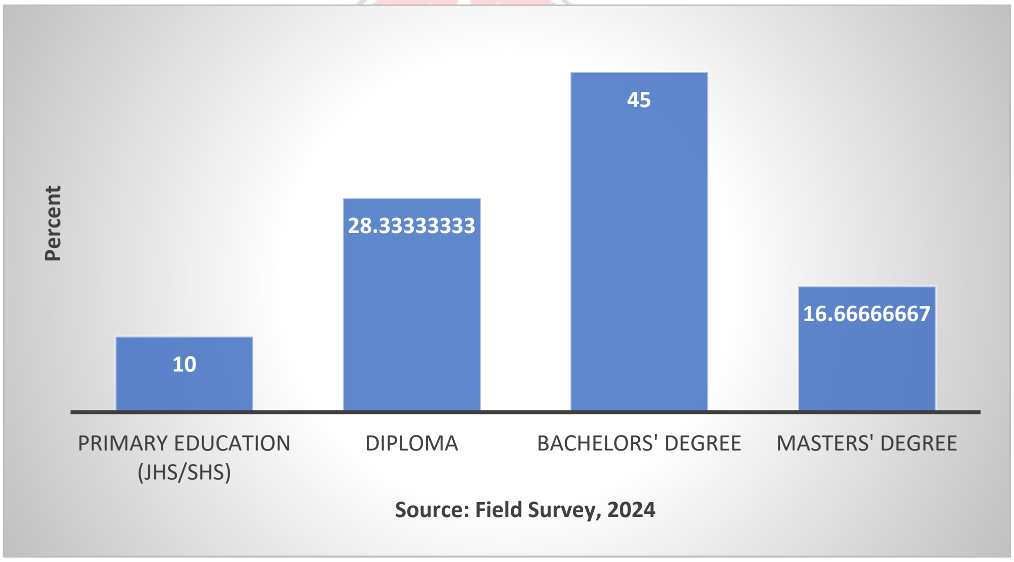

Figure 4.4 Educational level

4.1.5 Respondents' number of years living with obesity

The respondents' numbers of years living with obesity are presented in Figure 4.5 above. 33.3 percent of the respondents (representing 40) have been living with obesity for 1-5 years. Again, 43.3 percent of them (representing 52) have been living with obesity between 6 and 9 years. Additionally, 23.3 percent of them (representing 28) have been living with obesity for more than 10 years. These results show that all the respondents have been living with obesity long enough to comment on their ketogenic lifestyle and obesity management. It further suggests that these respondents are more likely to provide accurate and reliable information.

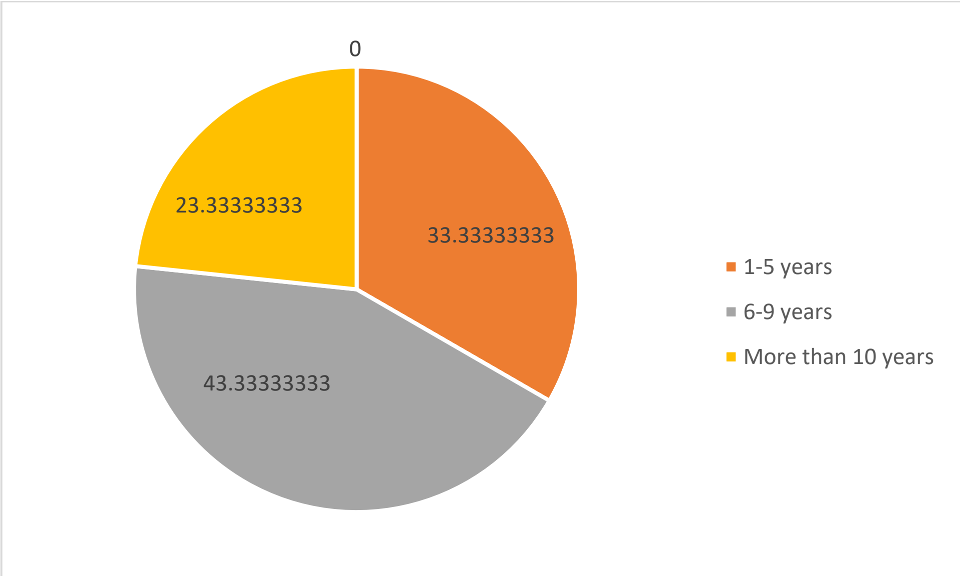

Figure 4.5 How long have you been living with obesity?

4.2 Reliability, Validity and Normality Results

4.2.1 Content Validity

Content validity test was carried out on the questionnaires to determine inappropriate statements or items and ensure that the items validly measured the objectives of the study. The questionnaires were given to the supervisor and some nutritionists to confirm the face validity. Their initial feedback was used to refine the instrument by deleting confusing and ambiguous statements or items. The assessment team approved the instrument after the correction, confiming the content validity of the instrument.

4.2.2 Predictive Validity

To test the predictive validity of the instrument, inter-item correlation analysis was run on the study variables (tenets of ketogenic lifestyle and obesity management). The result reveals that the instrument is predictively valid as the independent variables (high fat consumption, low carbohydrate intake, moderate protein consumption, whole foods focus, and hydration and electrolyte balance) and control variables (physical activity, intermittent water fasting, and nutrition quality) significantly correlated with the dependent variable (obesity management) (see Table 4.8). Hence, the independent variable has a significant positive correlation with the dependent variables.

4.2.3 Reliability

The researcher tested the reliability of the instrument by calculating the Cronbach's alpha. This test allows to affirm the internal consistency of the measuring items or statements. The value of the alpha coefficient ranges from 0.1 and is used to describe reliability of factors extracted at 5% level of significance from dichotomous and or multi-point formatted scales. Mugenda and Mugenda (2008) suggests that a Cronbach's alpha of 0.70 or above means a more reliable generated scale, and that offers a reasonable reliability for research purposes. The result of the Cronbach's alpha test is reported in Table 4.1 below. It can be observed that all the measuring items for the study variables are reliable as they record Cronbach's alpha above the prescribed threshold of 0.70.

Table 4.1 Reliability Results

Scale	Cronbach's Alpha
High Fat Consumption	0.79
Low Cabohydrate Intake	0.73
Moderate Protein Consumption	0.74
Whole Food Focus	0.92
Hydration and Electrolyte Balance	0.74
Incorporate Physical Activity	0.87
Intermittent Water Fasting	0.89
Obesity Management	0.82

Source: Field Survey, 2024

4.2.4 Normality and Multicollinearity Tests

Before proceeding with the analysis, it is important to know whether the data is normally distributed to inform the type of statistical test (parametric or non-parametric) to carry out. Tabachnick et al. (2007) provide a rule of thumb for normality test that the skewness and kurtosis of the study variables should fall within +1 and –1. Applying the rule of thumb by Tabachnick et al. (2007), it can be concluded that the data is normally distributed given that the skewness and kurtosis for all the variables are within +1 and –1 (Table 4.2). Hence, parametric statistical tests could be carried out. Additionally, applying the rule of thumb by Kennedy (2008) that the independent variables should not correlate above 0.80, there is no issue of multicollinearity since the independent variables are not highly correlated (Table 4.5).

Table 4.2 Normality Test Results

Variables	N	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
HFC	120	1	5	3.36	0.82	-0.299	-0.781
LCI	120	1	5	3.60	0.64	-0.704	-0.055
MPC	120	1	5	3.58	0.68	-0.107	0.617
WFF	120	1	5	3.84	0.89	-0.400	0.506
HEB	120	1	5	3.74	0.66	-0.864	-0.233
IPA	120	1	5	3.91	0.77	-0.616	0.959
IWF	120	1	5	3.77	0.71	-0.846	0.822
OM	120	1	5	3.64	0.62	-0.499	0.026
NQ	120	-	-	2.65	0.47	-0.637	-0.622

Notes (Variables and Interpretation):

1.**Variable Abbreviations:**

HFC = High-Fat Consumption

LCI = Low-Carbohydrate Intake

MPC = Moderate Protein Consumption

WFF = Whole Food Focus

HEB = Hydration and Electrolytes Balance

IPA = Incorporate Physical Activity

IWF = Intermittent Water Fasting

OM = Obesity Management

NQ = Nutritional Quality

2. Normality interpretation

Skewness and kurtosis values indicate that most variables are proximately normally distributed.In line with statistical convention, skewness and kurtosis values within ±2 are considered acceptable for assuming approximate normality for paramatric analysis.

Variables HEB, IWF, and IPA show slight deviations from perfect normality, however, their skewness and kurtosis values remain within acceptable thresholds. Indicating that the assumption of normality is not violated.

3. Nutritional Quality (NQ) Variable:

The minimum and maximum values for NQ are not reported because it is a composite index derived from multiple questionnaire items rather than a single-item 1-5 Likert scale variable. The index reflects aggregated responses, which are analysed as a composite score in the study.

Source: Field Survey, 2024

4.3 Main Results

This section of the chapter presents the main results of the study. It reports the findings based on each objective to answer the research questions of the study following the analysis of the data collected. There are four specific objectives (the availability and affordability of ketogenic diet-compatible local food commodities in Ghana, the nutritional quality of ketogenic diet-compatible local food commodities in Ghana, the challenges and opportunities for accessing ketogenic diet-compatible local food commodities in Ghana, and the effects of tenets of ketogenic lifestyle and on obesity management in Ghana) whose achievement would address the main objective (the accessibility of ketogenic diet-compatible local food commodities for obesity management in Ghana) of the study. The proceeding sub-headings, therefore, capture each objective of the study and their respective results.

4.3.1 Availability and Affordability of Ketogenic diet-compatible Local Food Commodities

The first objective of the study is to assess the availability and affordability of ketogenic diet-compatible local food commodities in Ghana. Respondents were expected to confirm whether diet-compatible local food commodities were available and affordable in their areas. The results of the descriptive statistical analysis are shown in Table 4.3.

Table 4.3 shows the descriptive statistics for the item: Are the following ketogenic diet-compatible local food commodities [Vegetables (kontomire, spinach, tomatoes); Fruits (avocado, coconut, citrus); Proteins (tilapia, chicken, beans); Healthy fats (coconut oil, shea butter, palm oil); Whole grains (millet, sorghum, rice)] available in your area?. The result depicts that 35 percent of the respondents (representing 42) indicated that some of the local food commodities were available, while 65 percent of them (representing 78) indicated that all the local food commmodities were available. The mean score mean of 2.65 with a standard deviation of 0.47. It follows that the suggested ketogenic diet-compatible local food commodities were physically available in the areas surveyed. Next, the researcher inquired whether the commodities are available throughout the year or only during specific seasons. 53.3 percent of the respondents (representing 64) submitted that they are available throughout the year, whereas 46.7 percent of them (representing 56) indicated that they are available during specific seasons. Though more than half of the respondents indicated that the local food commodities are available throughout the year, it may be the case that some of these commodities may not be found in some areas as suggested in the first question. Regarding the difficulty in locating ketogenic local food in their areas, 11.7 percent of the respondents (representing 14) said they are very difficult to locate, 28.3 percent (representing 34) said they are somewhat difficult to locate, 35 percent (representing 42) indicated that they are not very difficult to locate, and 25 percent (representing 30) said they are not at all difficult to locate. The mean score of 3.73 with a standard deviation of 0.96 shows that averagely the respondents (about 60 percent) indicated that the diet-compatible local food commodities are not difficult to locate, suggesting these commodities are generally available in various markets for obese people to access.

With regards to affordability, the researcher inquired about how often do they purchase the local food commodities. 32.5 percent of the respondents (representing 39) said they purchase these commodities daily, 43.3 percent (representing 52) submitted that they purchase these commodities weekly, 14.2 percent (representing 17) purchase these commodities monthly, and 10 percent (representing 12) rarely purchase these commodities. Furthermore, in terms of average monthly expenditure on these commodities, 1.7 percent of the respondents (representing 2) spend less than GH¢ 50, 5.8 percent (representing 7) spend GH¢ 50-100, 7.5 percent (representing 9) spend GH¢ 101-200, and 85 percent (representing 102) spend more than GH¢ 200. It follows that majority of the respondents spend more on these foods monthly. Additionally, 56.7 percent of the respondents (representing 68) indicated that the prices of these commodities are not reasonable, whereas 43.3 percent (representing 52) said the prices are reasonable. More than half of the respondents confirmed that the prices are not reasonable, affirming the fact that they spend more than GH¢ 200 monthly on these commodities. This may affect their ability to purchase these foods frequently.

Table 4.3 Descriptive Statistical Analysis of Availability and Affordability of Ketogenic Local Food Commodities

Availability	Expected Response	N	Percent	Mean	SD
Are the following ketogenic diet-compatible local food commodities available in your area? Vegetables (kontomire, spinach, tomatoes); Fruits (avocado, coconut, citrus); Proteins (tilapia, chicken, beans); Healthy fats (coconut oil, shea butter, palm oil); Whole grains (millet, sorghum, rice)	Not at all	0	0%	2.65	0.47
	Some available	42	35%		
	All available	78	65%		
Are these commodities available throughout the year or only during specific seasons?	Available throughout the year	64	53.3%	1.47	0.50
	Only during specific seasons	56	46.7%		
How difficult is it to locate ketogenic local food in your area?	Very difficult	14	11.7%	3.73	0.96
	Somewhat difficult	34	28.3%		
	Not very difficult	42	35%		
	Not at all difficult	30	25%		
Affordability					
How often do you purchase these commodities?	Daily	39	32.5%	2.02	0.93
	Weekly	52	43.3%		
	Monthly	17	14.2%		
	Raraly	12	10%		
What is your average monthly expenditure on these commodities?	Less than GH¢ 50	2	1.7%	3.76	0.63
	GH¢ 50-100	7	5.8%		
	GH¢ 101-200	9	7.5%		
	More than GH¢ 200	102	85%		
Do you think the prices of these commodities are reasonable?	No	68	56.7%	0.43	0.49
	Yes	52	43.3%		

Source: Field Survey, 2024

4.3.2 Nutritional Quality of Ketogenic Diet-compatible Local Food Commodities

This is the second objective of the study, and it focuses on the nutritional quality of the available local food commodities. Table 4.4 details out the result of the analysis of the data collected. The proceeding paragraphs highlight the result for each assessment item or question, and brief interpretations.

First, the respondents were asked to rate the nutritional quality of the ketogenic diet-compatible local food commodities in their area. 1.7 percent of them (representing 2) rated the nutritional quality poor, 8.3 percent (representing 10) rated it fair, 38.3 percent (representing 46) rated it good, and 51.7 percent (representing 62) rated it excellent. The mean score is 3.40 and standard deviation is 0.71. While the mean score shows the average response, the standard deviation shows a less variation in the responses, making the result more acceptable and reliable. It follows that the respondents rated the nutritional quality of the ketogenic diet-compatible local food commodities in their area very high. In other words, the local food commodities are of high quality.

Furthermore, the respondents were asked whether they think the nutritional quality of these commodities meets their dietary needs. 92.5 percent of them (representing 111) said yes, while 7.5 percent (representing 9) said no. The mean score is 0.93 with a standard deviation of 0.26, indicating that about 93 percent of the respondents think that the nutritional quality of the ketogenic local food commodities meets their dietary needs. The relatively low standard deviation suggests that responses are closely clustered around the mean, reflecting minimal variation among respondents.

Next, the respondents were asked whether they have you noticed any variations in the nutritional quality of these commodities depending on the season or source. 43.3 percent of them (representing 52) responded no, but 56.7 percent (representing 68) said yes. The mean score is 0.57 and standard deviation is 0.49. The mean affirms that 57 percent of the respondents say yes, with a less variation in the responses obtained.

Additionally, the respondents were asked whether they are aware of any initiatives to improve the nutritional quality of these commodities. 75 percent of them (representing 90) said no, while 25 percent (representing 30) said yes. This means that there were no initiatives, perhaps by government or local authorities to improve the nutritional qualities of the local food commodies that they are aware of.

Lastly, the respondents were asked the importance of nutritional quality when selecting ketogenic local food commodities. 2.5 percent of them (representing 3) indicated that it is not important at all, 8.3 percent (representing 10) submitted that it is not very important, 20 percent (representing 24) noted that it is somewhat important, and 69.2 percent (representing 83) mentioned that it is very important. The mean score is 3.56 with a standard deviation of 0.75. The mean score affirms the percentages that the respondents approximately indicated that nutritional quality is very important in selecting ketogenic local food commodities.

Table 4.4 Descriptive Statistical Analysis of Nutritional Quality of Ketogenic Diet-Compatible Local Food Commodities

Items/Indicators	Expected Response	N	Percent	Mean	SD
How would you rate the nutritional quality of the ketogenic diet-compatible local food commodities in your area?	Poor	2	1.7%	3.40	0.71
	Fair	10	8.3%		
	Good	46	38.3%		
	Excellent	62	51.7%		
Have you noticed any variations in the nutritional quality of these commodites depending on the season or source?	No	52	43.3%	0.57	0.49
	Yes	68	56.7%		
Are you aware of any initiatives to improve the nutritional quality of these commodities?	No	90	75%	0.25	0.43
	Yes	30	25%		
Do you think the nutritional quality of these commodities meets your dietary needs?	No	9	7.5%	0.93	0.26
	Yes	111	92.5%		
How important is nutritional quality when selecting ketogenic local food commodities?	Not important at all	3	2.5%	3.56	0.75
	Not very important	10	8.3%		
	Somewhat important	24	20%		
	Very important	83	69.2%		

Source: Field Survey, 2024

4.3.3 Challenges and Measures for Accessing Ketogenic Local Food Commodities

In order to understand the challenges and measures of accessing ketogenic diet-compatible local food commodities, the researcher asked the respondents the following questions (see Table 4.5). Regarding the challenges, the respondents were asked about the challenges they face in accessing ketogenic diet-compatible local food commodities. 21.7 percent (representing 26) identified availability, 40.8 percent (representing 49) said affordability, 26.7 percent (representing 32) ticked quality, and 10.8 percent (representing 13) indicated seasonality. Thus, availability, aforadability, quality and seasonality are the challenges of accessing the local food commodities.

Additionally, 7.5 percent of the respondents (representing 9) said they never experience stockouts or shortage of ketogenic local food commodities, 41.7 percent (representing 50) said they rarely experience stockouts, 35 percent (representing 42) indicated that they sometimes experience stockouts, and 15.8 percent (representing 19) ticked that they often experience stockouts (Table 4.5). Given the mean score of 2.59 with a standard deviation of 0.85, it can be concluded that approximately they sometimes experience stockouts of the local food commodities. This implies that stockouts or shortage is another challenge that they face.

In terms of strategies, the respondents were asked about the measures they will consider for improving access to ketogenic diet-compatible local food commodities. 25 perccent of them (representing 30) indicated increased production, 17.5 percent (representing 21) ticked enhanced marketing, 38.3 percent (representing 46) said support for local farmers, and 19.2 percent (representing 23) suggested improved distribution (Table 4.5). It follows that increased production, enhanced marketing, support for local farmers, and improved distribution can be measures to improve access to ketogenic local food commodities in Ghana, but support for local farmers is paramount.

Furthermore, the respondents were asked whether they are willing to pay a premium for high-quality ketogenic local food commodities. 5.8 percent of them (representing 7) are not willing at all, 15.8 percent (representing 19) are not very willing, 32.5 percent (representing 39) are somewhat willing, and 45.8 percent (representing 55) are very willing (Table 4.5). Given the mean score of 3.18 (which lies between somewhat willing and very willing) with a standard deviation of 90, it can be concluded that the respondents are approximately willing to pay premium for high-quality ketogenic local food commodities, making this another measure to improve accessibility.

Lastly, the respondents were asked whether they think ketogenic local food commodities should be subsidized to make them more affordable. 80 percent of them (represent 96) said yes, but 20 percent (representing 24) ticked no (Table 4.5). The overall effect is that the respondents overwhelming affirm that ketogenic local food commodities should be subsidized to improve accessibility.

Table 4.5 Descriptive Statistical Analysis of Challenges and Measures for Accessing Ketogenic Local Foods

Items/Indicators	Expected Response	N	Percent	Mean	SD
What challenges do you face in accessing ketogenic diet-compatible local food commodities?	Availability	26	21.7%	2.27	0.87
	Affordability	49	40.8%		
	Quality	32	26.7%		
	Seasonality	13	10.8%		
How often do you experience stockouts or shortages of ketogenic local food commodities?	Never	9	7.5%	2.59	0.85
	Rarely	50	41.7%		
	Sometimes	42	35%		
	Often	19	15.8%		
Opportunities					
What opportunities do you see for improving access to ketogenic diet-compatible local food commodities?	Increased production	30	25%	2.52	1.06
	Enhanced marketing	21	17.5%		
	Support for local farmers	46	38.3%		
	Improved distribution	23	19.2%		
How willing are you to pay a premium for high-quality ketogenic local food commodities?	Not at all willing	7	5.8%	3.18	0.90
	Not very willing	19	15.8%		
	Somewhat willing	39	32.5%		
	Very willing	55	45.8%		
Do you think ketogenic local food commodities should be subsidized to make them more affordable?	No	24	20%	0.80	0.40
	Yes	96	85%		

Source: Field Survey, 2024

4.3.4 Tenets of Ketogenic Lifestyle and their Effect on Obesity Management

The fourth objective is about tenets of ketogenic lifestyle and their effect on obesity management. First, the researcher investigated the tenets of ketogenic lifestyle using a likerts' scale statements or items. Respondents were expected to indicate the extent to which they agree or disagree with the statements on a scale of 1 (strongly disagree) to 5 (strongly agree). Five main tenets of ketogenic lifestyle in terms of food commodities were identified in literature and tested. Two additional tenets were also identified and tested as control variables because they are not directly related to food commodities. Table 4.6 below presents the mean and standard deviation for both individual items measuring each tenet and each overall tenet. It is important to note that each tenet is measured with four items.

For high fat consumption, the analysis records a mean value of 3.67, and a standard deviation of 0.60. Whereas the standard deviation value depicts low spread of the values in the distribution around the mean, the mean value shows that high fat consumption as a ketogenic lifestyle is relatively high since the mean is above the midpoint of 2.5 on the scale of 1 to 5. It can be concluded that high fat consumption is quite or somewhat high among the participants.

Next, the assessment of low carbohydrate intake shows a mean value 3.61, and a standard deviation value of 0.64. The mean depicts that approximately the respondents agreed that low carbohydrate intake as a ketogenic lifestyle is quite high among the participants if we consider the scale of 1 to 5. Meanwhile, the standard deviation depicts less spread of the values in the distribution around the mean, making the mean score more acceptable and reliable.

Regarding moderate protein consumption, the analysis records a mean value of 3.58, and a standard deviation of 0.68. Whereas the standard deviation value depicts low spread of the values in the distribution around the mean, the mean value shows that moderate protein consumption as a ketogenic lifestyle is fairly high since the mean is above the midpoint of 2.5 on the scale of 1 to 5. It can be concluded that moderate protein consumption is quite high among the participants in the Accra Metropolis.

Again, the assessment of whole foods focus shows a mean value of 3.84, and a standard deviation value of 0.89. The mean depicts that approximately the respondents agreed that whole foods focus as a tenet of ketogenic lifestyle is quite high among the participants if we consider the scale of 1 to 5. Meanwhile, the standard deviation depicts less spread of the values in the distribution around the mean, making the mean score more acceptable and reliable.

Furthermore, Table 4.6 displays a mean score of 3.74 and a standard deviation of 0.66 for hydration and electrolyte balance. The mean score indicates that the respondents approximately agreed that they practice hydration and electrolyte balance as a ketogenic lifestyle since the value lies between point 3 (somewhat agree) and point 4 (agree). It is important to note that there is no much variation in the responses obtained based the value of the standard deviation.

Regarding physical activity, the analysis records a mean value of 3.91, and a standard deviation of 0.77. While the standard deviation value indicates a low spread of the values in the distribution around the mean or less variations in the responses, the mean value shows that physical activity as a tenet of ketogenic lifestyle is approximately high given that the mean is nearly 4 on the scale of 1 to 5. It can be concluded that physical activity is high among the participants in the Accra Metropolis.

Finally, the assessment of intermittent water fasting reveals a mean value of 3.77, and a standard deviation value of 0.71. The mean result shows that approximately the respondents confirmed that intermittent water fasting is a tenet of ketogenic lifestyle that is being practiced by the participants in the Accra Metropolis. The standard deviation result shows a close spread of the values in the distribution around the mean, indicating less variation in the responses, making the mean score more acceptable and reliable.

Table 4.6 Tenets of Ketogenic Lifestyle

Items/Indicators	N	Min	Max	Mean	Std. Deviation
I consume healthy fats like coconut oil and avocado daily.	120	2	5	3.78	0.85
I prioritize fat-rich foods in my diet.	120	2	5	3.74	0.87
I make sure to include sources of saturated fat in my meals.	120	2	5	3.63	0.81
I choose full-fat dairy products over low-fat options.	120	1	5	3.87	0.75
High Fat Consumption	**120**	**2.00**	**5.00**	**3.67**	**0.60**
I limit my carbohydrate intake to 20-50 grams per day.	120	2	5	3.56	0.87
I avoid sugary foods and drinks.	120	2	5	3.62	0.88
I choose vegetables and whole grains over refined carbohydrates.	120	1	5	3.68	0.98
I monitor my carbohydrate intake to maintain a state of ketosis.	120	1	5	3.58	0.99
Low Carbohydrate Intake	**120**	**2.00**	**4.75**	**3.61**	**0.64**
I consume protein-rich foods like meat and fish in moderation.	120	1	5	3.02	0.93
I prioritize whole food sources of protein over supplements.	120	1	5	3.75	0.91
I aim for 0.8-1.2 grams of protein per kilogram of body weight daily.	120	2	5	3.88	0.87
I balance my protein intake with fat and carbohydrate consumption.	120	1	5	3.69	0.87
Moderate Protein Consumption	**120**	**1.25**	**5.00**	**3.58**	**0.68**
I prioritize whole, unprocessed foods in my diet.	120	1	5	3.63	.91
I choose organic and locally sourced foods when possible.	120	1	5	3.59	0.90
I avoid foods with artificial additives and preservatives.	120	1	5	4.10	0.99
I cook meals from scratch using whole food ingredients.	120	1	5	4.02	1.12
Whole Foods Focus	**120**	**1.50**	**5.00**	**3.84**	**0.89**
I drink at least eight glasses of water per day.	120	2	5	3.77	0.72
I consume electrolyte-rich foods like avocados and nuts.	120	1	5	3.86	1.21
I monitor my urine output to ensure proper hydration.	120	1	5	3.58	0.92

I adjust my electrolyte intake based on my physical activity level.	120	1	5	3.73	0.89
Hydration and Electrolyte Balance	**120**	**2.00**	**4.75**	**3.74**	**0.66**
I engage in regular physical activity, such as walking or jogging.	120	1	5	3.71	0.89
I incorporate strength training into my exercise routine.	120	1	5	3.78	0.95
I aim for at least 150 minutes of moderate-intensity exercise per week.	120	1	5	4.02	0.95
I adjust my physical activity level based on my dietary intake.	120	1	5	4.13	0.88
Incorporate Physical Activity	**120**	**1.00**	**4.75**	**3.91**	**0.77**
I regularly practice intermittent water fasting as part of my lifestyle.	120	1	5	3.68	0.84
I find it easy to stick to my intermittent water fasting schedule.	120	1	5	3.83	0.86
Intermittent water fasting has improved my overall physical health.	120	1	5	3.78	0.79
I experience increased mental clarity and focus when practicing intermittent water fasting.	120	1	5	3.78	0.78
Intermittent Water Fasting	**120**	**1.00**	**4.75**	**3.77**	**0.71**

Source: Field Survey, 2024

Obesity Management Assessment

Before proceeding to examine the effect of the tenets of ketogenic lifestyle on obesity management, the researcher assessed obesitiy management using likerts' scale items as in the case of assessing the tenets of ketogenic lifestyle. Obesity management is assessed as single construct or variable but measured with ten items as reported in Table 4.7 below. The items were assessed using the likerts' scale: 1 (strongly disagree) to 5 (strongly agree).

It can be observed from the Table 4.7 that the overall assessment of the obesity management recorded a mean score of 3.64 and a standard deviation of 0.61. Whereas the standard deviation value depicts low spread of the values in the distribution around the mean indicating a less variations in the responses, the mean score depicts that obesity management among the participants is relatively high since the mean is above point 3 on the scale of 1 to 5. It can be concluded that obesity management in the Accra Metropolis is approximately high.

Table 4.7 Obesity Management

Items/indicators	N	Min	Max	Mean	Std. Deviation
I am committed to maintaining a healthy weight.	120	1	5	3.95	0.91
I monitor my food intake to manage my weight.	120	1	5	4.00	0.93
I engage in regular physical activity to support weight loss.	120	1	5	3.33	0.93
I seek support from healthcare professionals or registered dietitians for weight management.	120	1	5	3.58	0.80
I set realistic weight loss goals and track my progress.	120	1	5	3.87	0.92
I understand the health risks associated with obesity.	120	2	5	3.93	1.09
I have tried various weight loss strategies in the past.	120	2	5	3.59	1.06
I am motivated to make lifestyle changes to manage my weight.	120	2	5	3.10	1.11
I have a support system in place to help me manage my weight.	120	1	5	3.03	1.10
I am willing to make long-term changes to maintain weight loss.	120	1	5	4.05	1.11
Obesity Management	**120**	**2.10**	**4.90**	**3.64**	**0.61**

Source: Field Survey, 2024

Effect of Tenets of Ketogenic Lifestyle on Obesity Management

To examine the effect of the tenets of ketogenic lifestyle on obesity management in Ghana, a regression analysis was conducted using multi-learn regression modeling. However, a correlation analysis was conducted to show the correlation matrix, which depicts the potential direction of the relationship between the tenets of ketogenic lifestyle and obesity managment. The two models are considered because correlation analysis only demonstrates the mere relationship between variables, without the predictive effects. Thus, to test the predictive effects or the regression models under section 3.11, the multi-linear regression analysis was run in SPSS. Since the data is a parametric data, a regression analysis could be conducted to establish the association effects (Field, 2015; Hilton et al., 2024).

Correlation Matrix

Table 4.8 below presents the bivariate correlation result for high fat consumption, low carbohydrate intake, moderate protein consumption, whole foods focus, hydrate and electrolyte balance, physical activity, interminent water fasting, nutritional quality, and obesity mangemnt. The correlation is 2-tailed and significant at 1 or 5 percent significance level. This analysis establishes the inter-construct correlation between the study variables.

Table 4.8 Correlation Matrix of Dietary Factors and Obesity Management

Variables	1	2	3	4	5	6	7	8
1. High Fat Consumption	1							
2. Low Carbohydrate Intake	.538**	1						
3. Moderate Protein Consumption	.107	.229*	1					
4. Whole Foods Focus	-.139	.058	.257**	1				
5. Hydration and Electrolyte Balance	-.189*	0.081	.054	.780**	1			
6. Physical Activity	-.277**	-.181*	-.049	.698**	.731**	1		
7. Intermittent Water Fasting	-.355**	-.234*	-.062	.749**	.750**	.828**	1	
8. Obesity Management	-.218*	-.122*	.153*	.571**	.657**	.680**	.654**	1

*****Correlation is significant at the 0.01 level or *Correlation is significant at the 0.05 level (2-tailed); Source: Field Survey, 2024***

Table 4.8 records a correlation of -0.218 between high fat consumption and obesity management, indicating a fairly moderate negative correlation which is significant at 0.05. This result shows an inverse relationship between high fat consumption and obesity management, and the relationship is significant. It illustrates that high fat consumption and obesity management move in the opposite direction, and therefore high fat consumption could negatively influence obesity management or a unit change in high fat consumption may lead to a corresponding significant negative change in obesity management, other factors held constant.

Again, Table 4.8 depicts a correlation of -0.122 between low carbohydrate intake and obesity management, indicating a fairly modest negative correlation which is significant at 0.05. This result shows a negative link between low carbohydrate intake and obesity management, and the relationship is significant. It means that low carbohydrate intake and obesity management move in the opposite direction, and so low carbohydrate intake could negatively influence obesity management. In other words, a unit change in low carbohydrate intake may lead to a corresponding significant negative change or reduction in obesity management, other factors held constant.

Furthermore, a correlation of 0.153 is recorded for correlation between moderate protein consumption and obesity management, illustrating a fairly modest negative correlation which is significant at 0.05. It indicates that moderate protein consumption and obesity management are moving in the same direction, therefore, moderate protein consumption could positively influence obesity management. Put differently, a positive change in moderate protein consumption may lead to a corresponding significant positive change in obesity management, other factors held constant.

Next, a correlation of 0.571 is recorded for correlation between whole foods focus and obesity management, demonstrating a fairly strong positive correlation which is significant at 0.01. It implies that whole foods focus and obesity management are moving in the same direction, therefore, whole foods focus could positively influence obesity management. In other words, a positive change in whole foods focus may lead to a corresponding significant positive change in obesity management, other factors held constant.

Moreover, a correlation of 0.657 is recorded for correlation between hydration and electrolyte balance and obesity management, suggesting a strong positive correlation which is significant at 0.01. It implies that hydration and electrolyte balance and obesity management are moving in the same direction. Thus, hydration and electrolyte balance could positively influence obesity management. Put differently, a positive change in hydration and electrolyte balance may lead to a corresponding significant positive change in obesity management, all other things being equal.

Table 4.8 also presents a correlation of 0.680 between physical activity and obesity management, indicating a strong positive correlation which is significant at 0.05. This result shows a positive connection between physical activity and obesity management, and the relationship is significant. It means that physical activity and obesity management move in the same direction, and so physical activity could positively influence obesity management. In other words, a unit change in physical activity may lead to a corresponding significant positive change in obesity management, other factors held constant.

Once more, a correlation result of 0.654 is recorded for intermittent water fasting and obesity management, indicating a strong positive correlation which is significant at 0.01. It means that intermittent water fasting and obesity management are moving in the same direction, and thus intermittent water fasting is likely to influence obesity management positively. This further suggests that a positive change in intermittent water fasting may lead to a corresponding significant positive change in obesity management, all other things being equal.

In conclusion, the correlation matrix depicts that the tenets of ketogenic lifestyle and obesity management are significantly correlated. Thus, all the study variables (independent variables and control variables) show tendency of influencing obesity management. Hence, a regression analysis is necessary to establish the predictive effects.

Regression Analysis

It is important to note from Table 4.9 model 1* which relates to the initial entry of the control variables assuming in model 1. The analyses are in line with the two regression models estimated under the chapter 3. The unstandardized beta coefficients, t-statistics, R-square, adjusted R-square, F-statistics and p-value are recorded for each model. The R-square, adjusted R-square, and F-statistics indicate that the independent variable contributes significantly to explain variations in the dependent variable by about 49 percent in the case of model 1 and 59 percent in the case of model 2. This suggests that the inclusion of the control variables has increased the regression model's efficiency and the amount of variations in obesity management that can be attributed to the tenets of ketogenic lifestyle.

From Table 4.9, it can be observed that in Model 1, the coefficient for high fat consumption is (0.008, t = 0.09), but it is not significant. This indicates that high fat consumption has a positive insignificant relationship with obesity management. It suggests that a unit change in high fat consumption will likely result in a corresponding insignificant positive change in obesity management by the magnitude of the coefficient (0.008), other factors held constant. Next, the coefficient for low carbohydrate intake is (-0.207, t = -2.58) and it is significant at 0.01. This means that low carbohydrate intake has significant negative relationship with obesity management. It implies that a unit change in low carbohydrate intake may lead to a negative or inverse change in obesity management, holding other factors constant. Furthermore, the coefficient for moderate protein consumption is (0.139, t = 2.07), and it is significant at 0.01. This shows that moderate protein consumption and obesity management are positively and significantly related, such that a unit change in moderate protein consumption will likely lead to corresponding positive change in obesity management by the magnitude of 0.139, all other things being equal.

Again, the coefficient for whole foods focus is (0.044, t = 0.55), but it is insignificant. This indicates that whole foods focus has insignificant positive association with obesity management. Given that the coefficient is not significant, a unit change in whole foods focus will likely not affect obesity management because the corresponding change will be insignificant. Lastly, the coefficient for hydration and electrolyte balance is (0.580, t = 5.48) and it is significant at 0.01. This demonstrates that hydration and electrolyte balance has a strong positive relationship with obesity management such that a unit change in hydration and electrolyte balance may lead to corresponding significant positive change in obesity management by the magnitude of 0.580, holding other factors constant. It can be observed that among the tenets, hydration and electrolyte balance has the highest predictive effect while high fat consumption has the lowest predictive effect.

Under Model 2, the coefficients for all the control variables (physical activity = 0.280, intermittent water fasting = 0.196, and nutritional quality = 371) are positive and significant at 0.01. This illustrates that these control variables have positive significant relationship with obesity management. It implies that a unit change in these variables may lead to a corresponding positive change in obesity management by the magnitude of their coefficients, other factors held constant. In the case of the independent variables, only moderate protein consumption and hydration and electrolyte balance have significant positive effect on obesity management with coefficients of 0.206 and 0.374 respectively. Whole foods focus now shows negative but insignificant effect on obesity management. It is important to note that under model 1*, the initial entry of the control variables resulted in positive significant coefficients, affirming their potential effect on obesity management in both models.

Table 4.9 Regression Results

		Unstandardized betas		Model Summary			
Model	Predictors	*B*	*t*	R^2	ΔR^2	*F*	*P*
1	Constant	1.531	3.59**	0.491	0.468	21.97	0.000
	HFC	0.008	0.09	0.491	0.468	21.97	0.000
	LCI	-0.207	-2.58**	0.491	0.468	21.97	0.000
	MPC	0.139	2.07**	0.491	0.468	21.97	0.000
	WFF	0.044	0.55	0.491	0.468	21.97	0.000
	HEB	0.580	5.48**	0.491	0.468	21.97	0.000
2	Constant	-0.198	-0.36	0.590	0.560	19.93	0.000
	HFC	0.043	0.55	0.590	0.560	19.93	0.000
	LCI	-0.114	-1.46	0.590	0.560	19.93	0.000
	MPC	0.206	3.26**	0.590	0.560	19.93	0.000
	WFF	-0.135	-1.61	0.590	0.560	19.93	0.000
	HEB	0.374	3.46**	0.590	0.560	19.93	0.000
	IPA	0.280	3.06**	0.590	0.560	19.93	0.000
	IWF	0.196	1.66*	0.590	0.560	19.93	0.000
	NQ	0.371	2.45**				
1*	IPA	0.436	4.15**	0.491	0.468	21.97	0.000
	IWF	0.404	3.19**	0.491	0.468	21.97	0.000
	NQ	0.143	2.15*	0.491	0.468	21.97	0.000

Note: ***Excluded Variables from Model 1 = Model 1****

****p*<0.01 and **p*<0.05; Field Survey, 2024**

4.4 Discussion of Findings

This study investigated the accessibility of ketogenic diet-compatible local food commodities for obesity management in Ghana. The analysis focused on availability and affordability, nutritional quality, access constraints, and the effects of ketogenic lifestyle tenets on obesity management. The findings are interpreted in relation to existing literature, with attention to statistical evidence, contradictions, and implications.

The first objective assessed availability and affordability. The findings show that ketogenic-compatible foods such as vegetables, fruits, proteins, healthy fats, and selected grains are widely available in the Accra Metropolis. Specifically, 65 percent of respondents confirmed full availability, while 35 percent reported partial availability. The mean score of 3.73 further indicates general agreement that these foods are not difficult to locate. This supports food environment studies in Ghana which report broad availability of minimally processed foods in markets and retail systems (Adjei et al., 2022; Mockshell et al., 2022).

However, a more critical interpretation shows that availability is not uniform across locations and seasons. About 46.7 percent indicated seasonal variation. This introduces an important limitation to food stability that is often underreported in similar studies. While foods exist in the system, consistent year-round access is not guaranteed for all consumers.

Affordability presents a more complex pattern. Although 43.3 percent reported weekly purchases and 32.5 percent reported daily purchases, 56.7 percent considered prices unreasonable. Additionally, 85 percent spend more than GH¢200 monthly. This creates an important contradiction. High purchase frequency suggests functional affordability, while perceived price burden suggests economic pressure. This inconsistency is an important unexpected finding. It shows that affordability is not only about ability to buy, but also about financial strain experienced during purchase. This finding partly contradicts assumptions in food access literature that availability and affordability always move together. Instead, it supports broader food systems research which shows that dietary transition foods often impose hidden economic pressure even when accessible.

The implication is that ketogenic-compatible diets may be economically accessible in principle but not sustainable for all households in practice. Policy measures such as targeted subsidies or price stabilisation may therefore be required.

The second objective examined nutritional quality. The results show that 51.7 percent rated nutritional quality as excellent and only 1.7 percent rated it poor. The mean score of 3.40 with a standard deviation of 0.71 indicates consistent positive perception. This aligns with Asante et al. (2021), who argue that locally available foods in Ghana contribute to dietary diversity and nutrient adequacy. It also aligns with Bueno et al. (2013), who associate nutrient-dense diets with improved metabolic outcomes.

However, a key analytical limitation must be acknowledged. The assessment is based on perception rather than laboratory nutrient profiling. This creates a gap between perceived and actual ketogenic suitability. While respondents believe foods meet dietary needs, this does not confirm macronutrient alignment with ketogenic thresholds. This distinction is important and weakens any assumption of direct ketogenic equivalence.

An important insight is that 92.5 percent believe nutritional quality meets dietary needs, and 69.2 percent consider it a key purchase factor. This shows that perception of quality strongly influences dietary behaviour. The implication is that nutrition education, not just food availability, is central to improving obesity management outcomes.

The third objective identified key barriers to access. Affordability emerged as the most important constraint, followed by quality concerns, availability gaps, and seasonality. Stockouts were also reported. These findings are consistent with the earlier results and reinforce the instability of food access despite market presence.

Quality perception is particularly important. Findings show that when consumers suspect quality variation, they avoid purchase. This introduces behavioural sensitivity into food access models that is often overlooked in literature. It means access is not only structural but also psychological.

The study also identified interventions such as increased production, improved distribution, farmer support, premium pricing for quality foods, and subsidies. The strong emphasis on farmer support reflects a supply-side solution rather than only consumer-focused interventions. This strengthens the policy relevance of the study.

A cautious interpretation is needed regarding novelty claims. While literature on ketogenic-specific food access in Ghana is limited, broader food access constraints are well documented. The contribution of this study is therefore contextual application rather than absolute novelty. It extends existing food systems literature into a ketogenic dietary framework.

The fourth objective examined ketogenic lifestyle tenets. The results show generally high adoption, with physical activity recording the highest mean (3.91), followed by whole foods focus (3.84), intermittent fasting (3.77), hydration and electrolyte balance (3.74), high fat intake (3.67), moderate protein intake (3.58), and low carbohydrate intake (3.61).

These results broadly align with global ketogenic guidelines (Westman et al., 2014; Volek et al., 2016). However, an important contextual contradiction emerges. Ghanaian diets are typically carbohydrate-dense, centred on staples such as fufu, banku, kenkey, and plantain. Therefore, the relatively high reported low carbohydrate intake is unexpected. This may reflect partial adherence, recall bias, or substitution rather than true dietary restriction. It suggests that ketogenic adherence in this population may be behavioural rather than strict metabolic ketosis.

The regression results provide stronger analytical insight. Not all ketogenic tenets significantly predict obesity management. High fat consumption shows an insignificant positive effect (0.008). Whole foods focus is also insignificant. In contrast, moderate protein consumption is significant and positive (0.139), while hydration and electrolyte balance has the strongest positive effect (0.580). Low carbohydrate intake shows a significant negative relationship (-0.207).

This is the most critical finding of the study and represents a clear contradiction with established ketogenic literature. Studies such as Shai et al. (2008), Westman et al. (2008), and Masood et al. (2023) consistently report that low carbohydrate intake improves weight loss and metabolic outcomes. The opposite finding in this study suggests strong contextual variation. Possible explanations include inconsistent adherence, substitution with energy-dense foods, or misclassification of carbohydrate intake levels. It may also reflect short-term behavioural change rather than sustained dietary modification.

This divergence is important. It suggests that ketogenic principles may not be universally transferable without adaptation to local food systems and dietary culture. It also raises questions about the operationalisation of “low carbohydrate intake” in survey-based dietary research.

Moderate protein consumption aligns with previous studies (Layman et al., 2003; de Carvalho et al., 2020; Stein et al., 2024; Zhang et al., 2025), which show that protein improves satiety, preserves lean mass, and supports weight management. This is consistent with Ghana's food environment where protein sources such as fish, chicken, and legumes are widely available (Amoah et al., 2018).

Hydration and electrolyte balance emerges as the strongest predictor. This is a notable and somewhat underexplored finding in ketogenic literature. In the Ghanaian tropical climate, hydration may play a more central role in metabolic regulation than typically reported in temperate settings. This represents an important contextual contribution of the study.

Control variables including physical activity, intermittent fasting, and nutritional quality show significant positive effects on obesity management. This is consistent with global obesity management literature and reinforces the robustness of the model (Jabekk et al., 2018). It confirms that lifestyle factors beyond diet remain central to obesity control.

Overall, the findings suggest that obesity management in Ghana is not driven by strict ketogenic adherence but by a hybrid model combining moderate protein intake, hydration practices, physical activity, and partial dietary modification. High fat intake and whole foods focus alone are insufficient predictors.

In conclusion, the study makes three key contributions. First, it shows that ketogenic-compatible foods are available but not consistently affordable or stable. Second, it reveals a gap between perceived and actual nutritional adequacy. Third, it demonstrates that key ketogenic principles do not uniformly predict obesity management in the Ghanaian context, with low carbohydrate intake showing an unexpected inverse effect. This challenges dominant assumptions in ketogenic literature and highlights the need for context-specific dietary models in obesity management in developing countries such as Ghana.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the summary of the results, conclusion of the study based on the findings, and recommendations that will aid the policy decisions of health professionals, governmental agencies, and other relevant stakeholders such as obese people in the Ghanaian health sector. The chapter finally provides the limitations of the study and directions for future research.

5.1 Summary of findings

Obesity has become a significant public health concern in Ghana, with the prevalence of obesity increasing from 5.5% in 2003 to 10.9% in 2014. This growing trend is attributed to changes in dietary habits, reduced physical activity, and urbanization. The consequences of obesity are far-reaching, including increased risk of chronic diseases like diabetes, hypertension, and cardiovascular disease. Given these dreadful consequences of obesity, its management is indispensible. Despite the growing prevalence of obesity in Ghana, there is a lack of research on effective weight loss strategies, particularly those that incorporate local food commodities. The ketogenic diet has been shown to be an effective approach to weight loss and improving metabolic health. However, its implementation in Ghana is limited by the availability and affordability of compatible local food commodities. Without access to compatible local food commodities, healthcare providers and nutritionists are unable to effectively recommend and implement ketogenic diets for their patients, limiting the effectiveness of obesity management strategies. Hence, this study investigated the accessibility of ketogenic diet-compatible local food commodities in Ghana, providing insights into the challenges and opportunities for obesity management in the country.

Regarding the first objective, the results showed that ketogenic diet-compatible local food commodities: vegetables (kontomire, spinach, tomatoes); Fruits (avocado, coconut, citrus); proteins (tilapia, chicken, beans); healthy fats (coconut oil, shea butter, palm oil); and whole grains (millet, sorghum, rice) were available within the Accra Metropolis. The results further showed that these commodities are available throughout, and at times during specific seasons. These diet-compatible local food commodities are not difficult to locate, suggesting that they are generally available in various markets for obese people to access. Furthermore, the findings revealed that these commodities are largely affordable based on the frequency of purchase and the amount spent by the participants on daily, weekly or monthly basis. It can be concluded that the commodities are accessible, achieving objective one.

For objective two, the results indicated that the commodities have nutritional quality. In other words, the local food commodities are of high quality and meet the dietary needs of consumers. It is further confirmed that nutritional quality is very important in selecting ketogenic local food commodities Any variation in the quality of these commodities will likely affect demand for these commodities.

The results for objective three indicated the challenges of accessing ketogenic diet-compatible local food commodities in the Ghanaian market to include affordability, quality, availability, seasonality, and stockouts or shortage. Conversely, the results depicted that increased production, enhanced marketing, support for local farmers, and improved distribution can be measures to improve access to ketogenic local food commodities in Ghana, with support for local farmers being paramount. Premium payment for high-quality ketogenic local food commodities is another measure to improve accessibility. Additionally, the respondents overwhelming affirmed that ketogenic local food commodities should be subsidized to improve accessibility. Lastly, in terms of the fourth objective, seven tenets of ketogenic lifestyle were identified to include: high fat consumption, low carbohydrate intake, moderate protein consumption, whole foods focus, hydration and electrolyte balance, physical activity and intermittent water fasting. Alongside, obesity management was found to be approximately high. Furthermore, the findings revealed that not all the tenets of ketogenic lifestyle has significant effect on obesity management. High fat consumption and whole foods focus have insignificant positive effect on obesity management. Moderate protein consumption, hydration and electrolyte balance, physical activity and intermittent water fasting have significant positive effect on obesity management, whereas low carbohydrate intake has significant negative effect on obesity management. Hydration and electrolyte balance has the highest predictive effect while high fat consumption has the lowest predictive effect. Interestingly, low carbohydrate intake has inverse relationship with obesity management.

5.2 Conclusion

The study provides empirical evidence that ketogenic diet-compatible local food commodities are structurally embedded within the Accra Metropolis food system. However, their practical accessibility is constrained by systemic inefficiencies rather than mere physical absence. Although availability is generally high, the evidence shows that access is uneven. It is shaped by affordability pressures, seasonal fluctuations, and inconsistent supply chains. This indicates that in the Ghanaian context, food accessibility is a function of both market presence and household purchasing power, rather than availability alone. This challenges simplified assumptions in food access frameworks.

The study further demonstrates that nutritional quality is largely perceived as adequate and supportive of dietary needs. Importantly, 69.2 percent of respondents consider nutritional quality a key factor influencing food purchase, highlighting the role of perception in dietary behaviour. However, this perceived adequacy does not automatically translate into verified ketogenic suitability or standardized dietary compliance. This exposes a conceptual gap between consumer perception of "healthy food" and the technical nutritional requirements of ketogenic dietary practice. It also highlights a methodological limitation in obesity-related dietary studies. These often rely on subjective nutritional assessment rather than biochemical or macronutrient verification.

In terms of obesity management, the findings show that ketogenic lifestyle tenets exert differentiated and context-sensitive effects rather than uniform influence. Moderate protein intake, as well as hydration and electrolyte balance, emerge as the most consistent and statistically meaningful predictors of improved obesity management outcomes. This suggests that metabolic stability and satiety-related mechanisms may be more influential in this setting than strict macronutrient restriction alone. In contrast, high fat intake and whole foods focus show limited explanatory power. This indicates that their effects may be indirect, context-dependent, or mediated by other behavioural factors. Most notably, low carbohydrate intake demonstrates an inverse relationship with obesity management. This contradicts established ketogenic literature and signals a potential breakdown in dietary adherence, misclassification of intake, or contextual dietary substitution patterns that are not fully captured in conventional ketogenic models.

Overall, the evidence suggests that ketogenic dietary practice in Ghana is not a direct replication of the classical ketogenic framework documented in international literature. Rather, it is a hybridised and locally adapted behavioural pattern shaped by cultural dietary norms, economic constraints, and lifestyle realities. This hybrid model is primarily driven by moderate protein intake, hydration practices, physical activity engagement, and partial dietary modification. The findings therefore challenge the universality of ketogenic dietary effectiveness and reinforce the need for context-specific nutritional models in non-Western populations.

Therefore, the study concludes that while ketogenic-compatible food systems and lifestyle components are present within Ghana's urban food environment, their effectiveness in obesity management is conditional. It is mediated by structural, behavioural, and contextual factors. Sustainable obesity interventions in Ghana will therefore require integrated strategies that go beyond dietary prescription. These should include food system strengthening, behavioural adherence support, and locally grounded nutritional adaptation.

5.3 Recommendations

Based on the findings of the study, the following recommendations are made for key stakeholders in obesity management in Ghana, particularly within the Accra Metropolis.

For policymakers, including the Ministry of Health and the Ghana Health Service, the recommendations stem directly from the finding that ketogenic-compatible foods are generally available in the Accra Metropolis but access is uneven due to seasonal fluctuations, affordability constraints, and systemic inefficiencies in supply. The conclusion further established that food accessibility is shaped not only by market presence but also by household purchasing power and structural conditions. In response, it is recommended that a structured national obesity management framework be developed that integrates locally available ketogenic-compatible foods with lifestyle-based interventions, while ensuring that ketogenic principles are applied as flexible and context-adapted rather than rigid dietary prescriptions. Additionally, strengthening food system efficiency through improved production, distribution, and year-round availability of nutrient-dense foods is necessary to address seasonal variability and supply inconsistencies. Given the persistent affordability challenges identified in the findings, targeted subsidies and price stabilization mechanisms are also recommended to reduce financial strain and improve equitable access. Furthermore, strengthening routine population-level obesity screening is essential for early identification and timely intervention, aligning with the study's emphasis on structural determinants of obesity management outcomes.

For nutritionists, dieticians, and other health professionals, the recommendations are grounded in the finding that nutritional quality is largely perceived as adequate, with perception strongly influencing dietary behaviour, as 69.2 percent of respondents identified nutritional quality as a key purchase factor. However, the findings also show that perceived adequacy does not necessarily reflect actual ketogenic suitability, creating a gap between perception and nutritional reality. In addition, regression results indicate that moderate protein intake and hydration and electrolyte balance are the most significant predictors of improved obesity management outcomes, while high fat intake and whole foods focus are not sufficient on their own, and low carbohydrate intake shows an unexpected inverse relationship. Based on this, health professionals are recommended to move beyond generic dietary counselling and adopt context-specific obesity management approaches that incorporate locally available foods such as fish, legumes, vegetables, and healthy fats while carefully interpreting ketogenic principles in relation to Ghanaian dietary patterns. They should prioritize balanced lifestyle interventions that emphasize moderate protein intake, hydration, and overall behavioural modification rather than strict low-carbohydrate prescriptions. Continuous patient education is also necessary to bridge knowledge gaps and improve adherence to evidence-based dietary practices.

For obese individuals and the general population, the recommendations reflect the finding that obesity management in this context is driven more by behavioural and lifestyle factors than strict ketogenic adherence. Moderate protein intake, hydration and electrolyte balance, and physical activity were identified as the strongest contributors to improved outcomes, whereas low carbohydrate intake did not consistently align with better obesity management results. In addition, the study highlights that consumer perception of nutritional quality significantly influences food choices. In this regard, individuals are recommended to improve dietary awareness and engage consistently in evidence-based lifestyle practices that prioritize moderate protein consumption, adequate hydration, and regular physical activity. They should also make informed food choices using locally available commodities rather than relying on restrictive or incomplete interpretations of ketogenic diets. Sustained behavioural consistency, rather than short-term dietary experimentation, is essential for effective obesity management.

For food producers, marketers, and agricultural stakeholders, the recommendations are based on findings that highlight seasonal variability, stockouts, quality concerns, and inconsistent supply as key barriers to access. The conclusion further confirms that structural inefficiencies in production and distribution systems contribute significantly to uneven food accessibility. Therefore, it is recommended that production of ketogenic-compatible local food commodities be increased while supply chain coordination is strengthened to reduce disruptions. Improvements in post-harvest handling, storage systems, and distribution networks are necessary to minimize seasonal shortages and stockouts. Investment in market infrastructure and value chain efficiency is also essential to ensure consistent availability and improved affordability.

In addition, expanding farmer support programmes will help enhance production capacity and improve overall food quality consistency.

Overall, the recommendations collectively reflect the study's central conclusion that effective obesity management in Ghana is not determined by strict ketogenic adherence alone but by a combination of structural food system conditions, behavioural practices, and contextual realities. This necessitates coordinated action across policy, clinical practice, individual behaviour, and food system governance to ensure sustainable and context-appropriate obesity interventions.

5.4 Limitations and Suggestions for Future Study

Despite the relevance of this study in examining ketogenic dietary adoption using Ghanaian local food commodities for obesity management, several methodological and contextual limitations should be acknowledged.

First, the study was affected by item non-response and partial questionnaire completion among some respondents in the Accra Metropolis. Although questionnaires were distributed and retrieved, not all items were fully completed by every participant, particularly those relating to detailed dietary adherence and obesity history. This may have reduced the completeness of some variable measurements and introduced minor inconsistencies in dataset responses used for analysis.

Second, the study relied on self-reported data on dietary practices, obesity status, and lifestyle behaviours, which introduces the possibility of social desirability bias and recall bias. Some respondents were hesitant to provide precise information regarding their eating patterns, weight history, and adherence to ketogenic principles, which may have led to underreporting or overreporting of certain behaviours. This limitation is particularly relevant in obesity-related studies where stigma may influence reporting accuracy.

Third, the study was geographically restricted to the Accra Metropolis, which represents a highly urbanised and economically diverse setting. This means that findings may reflect urban dietary access patterns, food market structures, and lifestyle behaviours that are not fully representative of rural or peri-urban regions in Ghana. As such, the external validity of the findings is limited to similar urban contexts with comparable food system structures.

Fourth, the study focused on adult obese individuals aged 20 to 60 years, thereby excluding adolescents and older adults above 60 years. This age restriction limits the applicability of the findings to broader population groups, particularly given that obesity patterns and metabolic responses may differ across age categories.

Finally, because ketogenic dietary practice is still an emerging concept within the Ghanaian context, the study population of identified keto-adopting individuals may not fully capture the broader spectrum of partial adopters or individuals attempting similar dietary patterns without formal adherence. This may have resulted in a more selective sample of respondents who are more informed or economically capable of sustaining such dietary practices.

Notwithstanding these limitations, efforts were made to ensure methodological rigour through structured data collection procedures and careful sampling. However, future studies should expand the geographical scope to include multiple regions of Ghana, incorporate objective dietary and anthropometric measurements where possible, and consider longitudinal designs to better capture adherence patterns and long-term obesity outcomes.

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APPENDICES

APPENDIX A

INTRODUCTORY LETTER

APPENDIX B

QUESTIONNAIRE

Dear Respondent,

Kindly provide your views on the following statements which seek to ASSESS THE ACCESSIBILITY OF KETOGENIC DIET-COMPATIBLE LOCAL FOOD COMMODITIES FOR OBESITY MANAGEMENT IN GHANA.

Purpose

The information gathered through this questionnaire will be used as an empirical study on Ketogenic Lifestyle and Obesity Management, focusing on people with obesity. The research is conducted as a prerequisite requirement for the completion of an MPhil programme at the University of Education, Winneba.

Anonymity and Confidentiality

Please note that the respond you will provide are completely anonymous and confidential. The research outcomes and reports will not include reference to any individual. The researcher will take sole ownership of the completed questionnaire and destroy them after work is done.

Thank you for your time!

SECTION I: Demographic Information

Kindly tick appropriately

1. Gender: [ ] Male [ ] Female
2. Age: [ ] 20-30 years [ ] 31-40 years [ ] 41-50 years [ ] 51-60
3. Marital status: [ ] Single [ ] Married [ ] Divorced
4. Education level:

   [ ] Primary education (JHS/SHS) [ ] Diploma

   [ ] First Degree [ ] Masters' Degree [ ] Doctorate

5. How long have you been living with obesity?

   (a) Less than 1 year [ ] (b)1 - 4 years [ ] (c) 5 - 9 years [ ] (d) Above 10 years [ ]

SECTION II: Availability and Affordability

Availability

1. Which of the following ketogenic diet-compatible local food commodities are available in your area? (Select all that apply)

Vegetables (kontomire, spinach, tomatoes)	
Fruits (avocado, coconut, citrus)	
Proteins (tilapia, chicken, beans)	
Healthy fats (coconut oil, shea butter, palm oil)	
Whole grains (millet, sorghum, rice)	

2. Are these commodities available throughout the year or only during specific seasons?

[ ] Available throughout the year [ ] Only during specific seasons

3. How difficult is it to locate ketogenic local food in your area?

[ ] Very difficult [ ] Somewhat difficult [ ] Not very difficult [ ] Not at all difficult

Affordability

1. How often do you purchase these commodities?

[ ] Daily [ ] Weekly [ ] Monthly [ ] Rarely

2. What is your average monthly expenditure on these commodities?

[ ] Less than GH¢50 [ ] GH¢ 50-100 [ ] GH¢ 101-200 [ ] More than GH¢ 200

3. Do you think the prices of these commodities are reasonable?

[ ] Yes [ ] No

SECTION III: Nutritional Quality

1. How would you rate the nutritional quality of the ketogenic diet-compatible local food commodities in your area?

[ ] Excellent [ ] Good [ ] Fair [ ] Poor

2. Have you noticed any variations in the nutritional quality of these commodities depending on the season or source?

[ ] Yes [ ] No

3. Are you aware of any initiatives to improve the nutritional quality of these commodities?

[ ] Yes [ ] No

4. Do you think the nutritional quality of these commodities meets your dietary needs?

[ ] Yes [ ] No

5. How important is nutritional quality when selecting ketogenic local food commodities?

[ ] Very important [ ] Somewhat important

[ ] Not very important [ ] Not at all important

SECTION IV: Challenges and Opportunities

Challenges

1. What challenges do you face in accessing ketogenic diet-compatible local food commodities? (Select all that apply)

[ ] Availability [ ] Quality [ ] Seasonality

[ ] Affordability [ ] Other (please specify)…………..

2. How difficult is it to locate ketogenic local food in your area?

[ ] Very difficult [ ] Somewhat difficult [ ] Not very difficult [ ] Not at all difficult

3. How often do you experience stockouts or shortages of ketogenic local food commodities? [ ] Often [ ] Sometimes [ ] Rarely [ ] Never

Opportunities

1. What opportunities do you see for improving access to ketogenic diet-compatible local food commodities? (Select all that apply)

[ ] Increased production [ ] Enhanced marketing [ ] Support for local farmers [ ] Improved distribution[ ] Other (please specify)…………..

2. How willing are you to pay a premium for high-quality ketogenic local food commodities?

[ ] Very willing [ ] Somewhat willing [ ] Not very willing [ ] Not at all willing

3. Do you think ketogenic local food commodities should be subsidized to make them more affordable? [ ] Yes [ ] No

SECTION V: Tenets of Ketogenic Lifestyle

Please rate your agreement with the following statements, using the scale:

1 = strongly disagree, 2 = disagree, 3 = somewhat agree, 4 = agree 5 = strongly agree

High Fat Consumption					
I consume healthy fats like coconut oil and avocado daily.	**1**[ ]	**2**[ ]	**3**[ ]	**4**[ ]	**5**[ ]
I prioritize fat-rich foods in my diet.	**1**[ ]	**2**[ ]	**3**[ ]	**4**[ ]	**5**[ ]
I make sure to include sources of saturated fat in my meals.	**1**[ ]	**2**[ ]	**3**[ ]	**4**[ ]	**5**[ ]
I choose full-fat dairy products over low-fat options.	**1**[ ]	**2**[ ]	**3**[ ]	**4**[ ]	**5**[ ]
Low Carbohydrate Intake					
I limit my carbohydrate intake to 20-50 grams per day.	**1**[ ]	**2**[ ]	**3**[ ]	**4**[ ]	**5**[ ]
I avoid sugary foods and drinks.	**1**[ ]	**2**[ ]	**3**[ ]	**4**[ ]	**5**[ ]
I choose vegetables and whole grains over refined carbohydrates.	**1**[ ]	**2**[ ]	**3**[ ]	**4**[ ]	**5**[ ]
I monitor my carbohydrate intake to maintain a state of ketosis.	**1**[ ]	**2**[ ]	**3**[ ]	**4**[ ]	**5**[ ]
Moderate Protein Consumption					
I consume protein-rich foods like meat and fish in moderation.	**1**[ ]	**2**[ ]	**3**[ ]	**4**[ ]	**5**[ ]
I prioritize whole food sources of protein over supplements.	**1**[ ]	**2**[ ]	**3**[ ]	**4**[ ]	**5**[ ]
I aim for 0.8-1.2 grams of protein per kilogram of body weight daily.	**1**[ ]	**2**[ ]	**3**[ ]	**4**[ ]	**5**[ ]
I balance my protein intake with fat and carbohydrate consumption.	**1**[ ]	**2**[ ]	**3**[ ]	**4**[ ]	**5**[ ]
Whole Foods Focus					
I prioritize whole, unprocessed foods in my diet.	**1**[ ]	**2**[ ]	**3**[ ]	**4**[ ]	**5**[ ]

I choose organic and locally sourced foods when possible.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I avoid foods with artificial additives and preservatives.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I cook meals from scratch using whole food ingredients.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
Hydration and Electrolyte Balance					
I drink at least eight glasses of water per day.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I consume electrolyte-rich foods like avocados and nuts.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I monitor my urine output to ensure proper hydration.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I adjust my electrolyte intake based on my physical activity level.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
Incorporate Physical Activity					
I engage in regular physical activity, such as walking or jogging.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I incorporate strength training into my exercise routine.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I aim for at least 150 minutes of moderate-intensity exercise per week.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I adjust my physical activity level based on my dietary intake.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]

SECTION VI: Obesity Management

Please rate your agreement with the following statements, using the scale:

1 = strongly disagree, 2 = disagree, 3 = somewhat agree, 4 = agree 5 = strongly agree

I am committed to maintaining a healthy weight.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I monitor my food intake to manage my weight.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I engage in regular physical activity to support weight loss.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I seek support from healthcare professionals or registered dietitians for weight management.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I set realistic weight loss goals and track my progress.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I understand the health risks associated with obesity.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I have tried various weight loss strategies in the past.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I am motivated to make lifestyle changes to manage my weight.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I have a support system in place to help me manage my weight.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]
I am willing to make long-term changes to maintain weight loss.	1[ ]	2[ ]	3[ ]	4[ ]	5[ ]