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DIETARY DIVERSITY, EATING HABITS, FOOD GROUP CONSUMPTION PATTERN, FOOD CHOICE AND ASSOCIATED FACTORS AMONG ADOLESCENT GIRLS: A MIXED-METHOD STUDY IN THE MION DISTRICT OF GHANA

AL-HASSAN RAIHANA

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BY

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(MPHIL PUBLIC HEALTH NUTRITION)

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OCTOBER, 2024

DECLARATION

I Al-Hassan Raihana, hereby declare that this dissertation is my own work done under supervision and to the best of my knowledge, contains no materials previously presented for the award of any degree in the University or anywhere else apart from the references cited to other people's works and opinions which has been duly acknowledged.

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ABSTRACT

Understanding adolescents' diet and eating behaviours is crucial for informing public health strategies and policies, allowing interventions to be tailored effectively to enhance dietary patterns and improve overall health and quality of life. This study explored the dietary diversity, eating habits, food group consumption pattern, and food choices among adolescent girls in Northern Ghana. A mixed-method design employing secondary data from in-depth interviews (*n*=30), two focus group discussions (5 in each group) and survey data from 882 mother-daughter pairs was used. Key findings indicate that approximately 90% of girls achieved the minimum dietary diversity for women of reproductive age (MDD-W), with most consuming three meals daily. Staples were eaten daily, while fruits and unhealthy foods were less frequently eaten. Moderate/severe food insecurity reduced the odds of achieving the MDD-W (AOR= 0.32; 95% CI (0.14, 0.72); P = 0.006), whereas larger household size was positively correlated with the MDD-W (AOR 1.08; 95% CI (1.02, 1.13); P = 0.005). Older girls were less likely to eat breakfast (AOR 0.77; 95 % C.I (0.65, 0.90); (P< 0.001), while household crop farm diversity increased the odds of eating supper on weekends (AOR 1.63; 95 % C.I (1.34, 1.97); P< 0.001). Moderate/severe food insecurity (P< 0.001) was inversely associated with intake of animal-sourced foods (ASFs), fruits, and unhealthy foods but positively correlated with vegetable consumption in the past month. Maternal non-literacy (P< 0.001) was linked to a lower intake of unhealthy foods, while specific ethnic backgrounds (P = 0.037) negatively influenced ASFs intake. Wealthier households (P = 0.008, 0.004) demonstrated higher consumption of staples. Qualitatively, health considerations, availability, taste, and cravings were major influencers of food choices. In conclusion, the findings underscore the significant impact of food security, household size, and socio-economic factors on the DD and meal patterns of adolescent girls in Ghana. Implementing school-based nutrition programs, educational campaigns, food security and

livelihood improvement as well as empowerment interventions could help improve the diet and overall health of adolescents.

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ACKNOWLEDGEMENTS

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DEDICATION

I humbly dedicate this work with much affection to my kids; Fawaz Nasara and Naqiyat Kasi.

This one is for you, from me, your loving mother.

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LIST OF ACRONYMS AND ABREVIATIONS

ANGELO   **-**   Analysis Grid for Elements Linked to Obesity

ASFs   -   Animal Source Foods

DD   -   Dietary Diversity

DDS   -   Dietary Diversity Score

DHS   -   Demographic and Health Survey

FAO   -   Food and Agriculture Organization

FDS   -   Farm Diversity Score

FIES   -   Food Insecurity Experience Scale

FSS   -   Food Security Status

GES   -   Ghana Education Service

GIFTS   -   Girl Iron Folic Tablet Supplementation

GSS   -   Ghana Statistical Service

HDDS   -   Household Dietary Diversity Score

HICs   -   High Income Countries

IDDS   -   Individual Dietary Diversity Score

IWI   -   International Wealth Index

KAP   -   Knowledge, Attitude and Practices

LMICs	-	Low- and Middle-Income Countries
MDD-W	-	Minimum Dietary Diversity for Women
NCDs	-	Non-Communicable Diseases
NHANES	-	National Health and Nutrition Examination Survey
NHRCIRB	-	Navrongo Health Research Centre Institutional Review Board
P VALUE	-	Probability Value
SD	-	Standard Deviation
SES	-	Socio-economic Status
SPSS	-	Statistical Package for Social Sciences
SSBs	-	Sugar-Sweetened Beverages
STP	-	Sweet Tooth Pattern
TP	-	Traditional pattern
WHO	-	World Health Organization

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CHAPTER ONE

INTRODUCTION

1.1 Background

According to the World Health Organization (WHO), adolescence is the transition from childhood to adulthood, and it occurs between the ages of 10 and 19 years old (Hadush et al., 2021). The last growth spurt takes place during this time, and early adolescence which is next to the infantile period is a crucial time for significant physical growth and changes in body composition, physiology, and endocrine (Kebede et al., 2021). Globally, about 1.2 billion of the population is made up of adolescents and 90% of them reside in LMICs and approximately 600 million are females (Gonete et al., 2020). One of the most active developmental phases of a person's life is adolescence. According to Burgess-Champoux et al. (2009), the greatest amounts of total energy and nutrients are needed during this time to support both physical and mental development. Due to their rapid pubertal growth, menarche and associated health hazards, adolescent females in particular need a sufficient supply of high-quality nutrients to meet their increased nutritional needs (Kahssay et al., 2020). However, adolescents often fail to meet these elevated dietary requirements (Burgess-Champoux et al., 2009). For growth and development as well as to lay a solid basis for a healthy weight and overall health in adulthood, adolescent diet quality, based on the intake of foods rich in the obligatory nutrients is essential (Golper et al., 2021).

One strategy for improving the nutrient adequacy of the diet and healthy eating habits is dietary diversification. A household's or an individual's consumption of different food groups over a given period of time is known as dietary diversity. However, in LMICs, many teenagers are

poorly nourished and consume food that lacks variety. For instance, previous research has found that adolescents' diets are monotonous and comprised primarily of cereal-based diets (Gonete et al., 2020). Prevalence of undernutrition among schooled teenage girls age 10-17 years in Ghana showed that 19.0% and 9.0% were stunted and thin respectively (Agaba et al., 2022) and among 12-18 years female student in Delta State Nigeria, 46.80% were underweight (Agofure et al., 2021).

Compared to childhood, early adolescence is a nutritionally susceptible stage of life characterized by a more personal control over dietary behaviours and a stronger impact of the socio-environmental influences on consumption patterns (Moitra & Madan, 2022). Adolescence is a crucial time to develop good dietary habits because this is when eating behaviours that lead to overweight/obesity and diet-related cardiovascular diseases are developed (Pearson et al., 2011). Research shows that poor eating habits, like consuming more calorie-dense, low-nutrient snacks instead of fruits and vegetables, are mostly developed and maintained during adolescence (Moitra & Madan, 2022). For instance, a study conducted in Ghana's Northern region among teenagers, indicated an increase of about 32.5% in the sweet tooth pattern (STP) characterized by the intake of foods high in fat, milk and milk products, energy and soft drinks, sugar-sweetened snacks, sweets (such as chewing gum and toffees), coffee, and tea compared to 17.2% of the traditional pattern (TP) marked by the intake of cereals and grains, local beverages, nuts, seeds and legumes, vegetables, fish and seafood.

Females typically have a healthier diet than men do, with more fruit and vegetables, whole grains, and fish, according to a systematic evaluation of gender variations in diet quality across different nations (Stea et al., 2021). For instance, adolescent girls in Australia consumed more

fruits on average each day compared to males, who preferred SSBs than females (Rathi et al., 2017)

According to Burgess-Champoux et al. (2009), data from the National Health and Nutrition Examination Survey (NHANES, 1999–2002) revealed that both male and female adolescents consume low dietary fibre, low potassium, magnesium and low intakes of vitamins A and E have all been recognized as potential issues for this age bracket. These unhealthy eating habits are not only common but could also be a result of the adjustment to new life circumstances, adult duties, and time demands during this period (Laska et al., 2015).

Although many environmental elements can affect an adolescent's eating habits and food intake, research indicates that family influences are the most significant in the food consumption pattern of adolescents (Moitra & Madan, 2022). Adolescent eating behaviour is influenced by the arrangement of meals or the meal structure, parental intake, attitudes, modelling, socialization practices and the availability and accessibility of food in the home (Burgess-Champoux et al., 2009).

Evidence suggests that adolescents' attitudes and views regarding healthy eating can influence their eating behaviours in addition to the food environmental determinants of consumption patterns. A cross-sectional study revealed perceived barriers and self-efficacy as important factors influencing teenagers' dietary behaviour. For instance, an investigation of teenagers aged 12 to 17 years old found positive connections between adolescents' autonomous motivation and eating behaviours (Moitra & Madan, 2022).

1.2 Problem Statement

Undernutrition and micronutrient deficiencies is a major public health problem among adolescent girls in Sub-Saharan Africa including Ghana (Azupogo et al., 2018; Kubuga et al., 2023). Inadequate dietary intake and the consumption of monotonous plant-based diets that lacks variety, partly explains why adolescents in low-and-middle income countries have insufficient micronutrient intake and, consequently, increased rates of iron deficiency and anaemia (Wemakor et al., 2023; Azupogo et al., 2023).

A priori data shows a high prevalence of iron deficiency anaemia among rural adolescent girls (64.6%), especially from the northern savannah agro-ecological zone of Ghana (Azupogo et al., 2018). Emerging data from other contexts also shows that food consumption patterns are changing among adolescents in LMICs, as inadequate dietary diversity, unhealthy eating patterns and meals skipping have been recorded especially among those in urban areas (Abizari & Ali, 2019; Abubakar et al., 2023; Afriyie et al., 2021; Agofure et al., 2021; Tariku et al., 2019; Wiafe et al., 2023; Worku et al., 2017).

According to Abizari & Ali (2019), teenagers' dietary intake in developing nations is alarming since traditional diets, which are mostly focused on cereal and tubers, fresh fruits and vegetables, and low-fat foods, are increasingly losing way to more Westernized diets that lack variety and are heavy in processed foods with lots of calories. Yet little is known about rural adolescents' dietary behaviours and practices in Ghana.

Thus, it may be necessary to address the nutritional needs of adolescents, as undernourished adolescents often grow up to be undernourished adults who give birth to small babies and pass undernutrition on to subsequent generations (Kahssay et al., 2020).

Moreso, Mion district is predominantly rural, and not much is known about it since it was only recently carved out of Yendi. Consequently, data on the nutrition and health of the Mion district is sparse and recently emerging. This study was therefore conducted to examine dietary diversity, eating habits, food consumption patterns and food choices of adolescent girls in the Mion district of Ghana.

1.3. Justification

There have been interventions for young infants, pregnant, and lactating mothers such as complementary feeding, optimal breastfeeding, and micronutrient supplementation. Adolescents have historically been overlooked as a group at low risk for poor nutrition and health (Hadush et al., 2021). Although there has been the recent micronutrient supplementation program (GIFTS) in Ghana for strengthening the nutrition and health of female adolescents; however, there has been poor compliance (Dubik et al., 2019; Gosdin et al., 2020) and little is known with regards to the effectiveness of the program as higher prevalences are continuously been reported.

Additionally, teenagers are considered the least in terms of intervention and policy priority (Das et al., 2018) and this contributes to a lack of information about adolescents' nutritional status, particularly in underdeveloped countries (Hadush et al., 2021). Intervening at this stage is important for enhancing nutrition status and obtaining overall health. It is against this backdrop that this research sought to fill this knowledge gap and contribute to evidence base nutrition and dietary interventions targeted towards adolescent females.

1.4 Significance of the Study

The findings from this study will help inform decisions and policies targeted towards adolescent female nutrition.

1.5. Main Research Question

What is the dietary diversity, eating habits, food group consumption patterns, and food choices of adolescent girls in the Mion district?

1.5.1. Specific Research Questions

1. What is the dietary diversity of adolescent girls in the Mion District?

2. What are the eating habits and food group consumption patterns of adolescent girls in the Mion District?

3. What are the factors associated with dietary diversity, eating habits and food group consumption patterns of adolescent girls in the Moin district?

4. What reasons do adolescent girls have for eating the foods they eat?

1.6. Main Research Objective

To assess the dietary diversity, eating habits, food group consumption patterns and food choices of adolescent girls in the Mion district

1.6.1. Specific objectives

1. To assess the dietary diversity of adolescent girls in the Mion District

2. To assess the eating habits and food group consumption patterns of adolescent girls in the Mion District

3. To examine the factors associated with dietary diversity, eating habits and food group consumption patterns of adolescent girls in the Moin district

4. To assess the reasons adolescent girls, eat the foods they eat

CHAPTER TWO

LITERATURE REVIEW

2.1. Dietary Diversity and Dietary Diversity Score

Dietary diversity (DD) is the number of foods consumed across and within food groups over a given period. It is commonly acknowledged as an important aspect of good nutrition. It reflects the belief that expanding the variety of foods and food types in the diet help ensures that essential nutrients are ingested in the proper amounts, and promote the general health (Olumakaiye, 2013). DD has proved to be a useful tool for assessing the appropriateness of an individual's nutritional consumption, including that of teenagers, and for reflecting the adequacy of particular nutrients. Micronutrient malnutrition caused by inadequate dietary diversity (monotonous, cereal-based diets) remains a public health problem in many developing nations, and may cause physical, emotional, and psychological modifications among teenagers (Worku et al., 2022). According to Wiafe et al. (2023), high DD and nutritious dietary routine is a sign of good nutrition since they improve teenagers' nutritional status.

One of the accurate measures of macronutrient and micronutrient consumption is the dietary diversity score (Worku et al., 2017). Rather than counting the number of foods consumed, DDS is measured by counting the number of food groupings. The period of reference is often the day or week prior, however it might vary (Gonete et al., 2020).

Developed as well as developing nations have produced numerous proof demonstrating the strong correlation between dietary diversity and nutrient sufficiency, making it a crucial component of a high-quality diet (Olumakaiye, 2013). In an attempt to evaluate the nutritional

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status and DD of teenagers residing in Ghanaian rural communities, Wiafe et al. (2023) discovered that teenagers had low DD and that the main predictors of insufficient DD were snacking, meal skipping, and the consumption of starchy staples.

2.2. Farm Diversity and Diet Quality

Several research have examined the connection between agricultural output and DD. Increased crop diversity could lead to farmer households having access to a greater variety of food items produced on their farm, as well as giving them the chance to grow cash crops, which could have an indirect impact on DD by generating more revenue (Singh et al., 2020). To investigate the relationship between crop and income diversity with intra-household DD among farmer households, Singh et al. (2020) revealed that crop diversity had a positive relationship with individual DD among adults, adolescents, and children.

Some studies however find farm diversity to have an inconsequential impact on diet quality. Evidence from Sibhatu et al. (2015) and Madzorera et al. (2020) imply that increasing farm output diversification may not always be as important for ensuring diet quality as income and market access.

2.3. Factors Associated with Dietary Diversity

Several studies have investigated the factors leading to DD, among which include parental education and occupation, household income, food security status (FSS), socioeconomic status (SES), social norms, and cultural values or beliefs about food (Ali & Abizari, 2018; Grammer et al., 2022; Laskar & Rakib, 2019; Worku et al., 2022; Xu et al., 2022; Yee et al., 2017).

2.3.1. Parental education and occupation

According to findings by Worku et al. (2022), maternal occupation and education were related to dietary diversification. Teens raised by illiterate moms had a greater probability of having poor DD than adolescents raised by mothers with at least an elementary education. This could be as a result of mothers with little education not knowing how important it is to vary the types of foods that are reasonably priced and locally available in their community.

Again, teenagers from housewife mothers had a stronger chance of inadequate DD compared to mothers who were not housewives, which could be reinforced by the possibility that housewife moms are less knowledgeable about DD than working mothers. Additionally, findings from Bancha et al. (2021) indicated that teenage females having employee fathers had a higher chance of consuming a varied diet compared to others.

2.3.2. Household Income

Income is an important predictor of the overall economic well-being of a household and therefore assumes a positive link with household dietary diversity. Higher-income increases dietary diversity at the household level and empowers a household to buy more food with better nutritional value (Laskar & Rakib, 2019). Results from Worku et al. (2017) showed a noticeable connection between the dietary diversity score of adolescent girls and the monthly earnings of the family. Households with reduced monthly earnings had a higher chance of inadequate DD compared with families with higher monthly income. This supports the evidence that food diversity is more expensive, and the poor sometimes do not have sufficient access to a variety of foods.

2.3.3. Food Security Status

When all people at all times has physical and financial access to enough, safe, and nutritious food that satisfies their dietary needs and tastes while maintaining an active and healthy lifestyle, then there is food security (Hussein et al., 2018). According to Athauda et al. (2022), DD is seen as an important indicator for evaluating the availability, quality, and accessibility of food and a stand-in for an individual's diet's adequacy in terms of nutrients, hence individuals and households lacking the capacity to obtain or consume safe, secure, nutritious, and sufficient foods to satisfy their nutritional requirements may have a poor dietary diversity (Hussein et al., 2018) .

Adolescent girls' dietary variety score and related factors studied by Worku et al. (2022) revealed that adolescents from food in-secured households had a greater chance of lower DDS than adolescents from food-secured households.

2.3.4. Socio-economic Status

The price of food is a significant factor in what foods are obtained among families living in poverty (Beheshti et al., 2016). Research by Codjoe et al. (2016) in Accra Ghana, showed that households in the low and highest wealth quintiles have adequate dietary diversity than households in the lowest wealth quintiles. Again, findings by Bi et al. (2019) in central China, revealed that children tend to have a more diverse diet when their families have more household possessions, a proxy of household SES which translate into more purchasing power, and thus, stated that food variety and SES are positively correlated.

2.3.5. Social norms, cultural values or beliefs about food

According to Das (2022), food and eating behaviours help meet humans' nutritional requirements and again an expression of social and cultural identity. The socio-cultural beliefs of people define the foods that are acceptable for consumption and those that are not. Culture, traditions, customs, religion, and taboos influence dietary patterns significantly. For instance, eating okro, snails, or ripe plantains while pregnant is prohibited among the Ewe tribe in Ghana due to the risk of miscarriage. Giving children protein products like eggs and meat is frowned upon in some Northern Ghanaian tribes because it can encourage them to steal. All these could have an impact on limiting the food variety of household members', hence poor DD (Codjoe et al., 2016).

Religious ideologies play a crucial role in determining what meals are deemed consumable and non-consumable, and as a result, they may affect the variety of diets found in homes. For example, some Christians use olive oil primarily for religious purposes, and Muslims avoid eating pork (Codjoe et al., 2016). Additionally, certain religious practices also tend to have a significant effect on DD. For instance, the study of Ali and Abizari (2018) among adolescents in Northern Ghana revealed that there were notable shifts in the quantity and variety of foods consumed during Ramadan, leading to a considerable increase in dietary diversity.

2.4: Dietary habit and Food Consumption patterns of Adolescents

Over the past few decades, it has been observed that young people's lifestyles have changed globally, which has affected their eating pattern (McEachern et al., 2022). According to Abizari and Ali (2019), the availability of fast food and globalization have caused a shift in Ghana's eating patterns from consuming wholegrain, unrefined carbohydrates to consuming a large number of highly processed foods , like pizza, pastries, and SSBs. Other eating patterns among

Ghanaian teenagers include skipping breakfast, snacking frequently, and consuming inadequate amounts of dietary fibre (Abizari & Ali, 2019).

2.5. Factors that Influence the Eating Habits and Food Consumption Patterns of Adolescents

Empirical evidence has been provided on factors that influence adolescent eating patterns and habits including, food environment, food availability and mealtimes, parenting patterns and behaviour modelling.

2.5.1. Family meals and Food Availability

Food availability and the family environment have been shown to have a significant impact on consumption patterns (Gordon-Larsen, 2014). Children's eating behaviour typically takes place at home or together with family members, making the family the most fundamental and closest setting for them. Early food and eating experiences in children are shaped by the family's physical, and sociocultural environmental factors (Zhang et al., 2022). Evidence demonstrates that frequent family mealtimes are positively correlated with improved nutrition quality for teenagers despite changes in the social context and form of family meals. Consumption of fruits, vegetables, grains, calcium-rich foods, folate, iron, and vitamins B_6, B_{12}, C, and E have all been significantly correlated with family meal frequency, while consumption of sugar as well as saturated fat has been negatively correlated with family meal frequency (Burgess-Champoux et al., 2009).

Again, Larson et al. (2012) in a study that aimed at describing young adults' eating habits and ascertaining if the frequency of family meals throughout adolescence is associated with food quality, meal frequency, social eating, and meal structure during the early stages of adulthood,

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found that adolescent family dinners may have a positive effect on the quality of diet and eating behaviours in young adulthood.

2.5.2. Parental Modelling and Food Restriction

Children tend to modify their dietary behaviour based on their parent's eating patterns, hence parents play a crucial part in the formation of children's eating habits (Faught et al., 2016). Research indicates that parental modelling and active guidance have the highest correlation with healthy eating behaviours, whilst other behaviours, like being forced to consume or restrictive feeding techniques, may limit children of their drive as well as their capacity to self-control concerning eating and a greater probability of been correlated with picky eating and eating disorders (Grammer et al., 2022; Yee et al., 2017). According to findings by (Monroe-lord et al., 2022; Reicks et al., 2015) parental behaviours that promote fruit and vegetable eating in children and teenagers are positively correlated, but parental restrictions on the intake of poor snacks are favourably connected to adolescents' consumption of these foods through autonomous motivation and perceived parental attitudes.

2.5.3. Food environment

According to Zhang et al. (2022), food environments influence the possibilities for healthy eating by interacting with personal factors, shown to be beneficial in enhancing children's food quality and the risk of chronic disease. According to the framework for the Analysis Grid for Elements Linked to Obesity (ANGELO), food environments exist on two scales—micro settings (home, school, and neighbourhood) and macro sectors (government, industry and society).

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The results from Zhang et al. (2022) indicates a stronger connection between family food environment and food consumption; the healthier family food environment was, the higher the intake of fruits and vegetables and the lesser the intake of SSBs among students.

Additionally, meal sources and locations are external influences connected with teenage diet quality and health outcomes. A study of teenagers from Seattle and the Baltimore-Washington DC areas found that dietary intake was nutritionally unfavourable when meals were consumed away from home or school. Overall, meals cooked and eaten at home had a chance to be healthier compared to meals cooked and eaten away from home (Golper et al., 2021).

Neighbourhoods with easy access to and availability of fast food may have a detrimental effect on adolescents' dietary choices. Hilmers et al. (2012) found that low-income neighbourhoods with significant minority groups had easy access to foods that encourage poor eating behaviours (e.g., convenience and fast food). According to a different study, adolescents from low SES households who reside in areas with fast food restaurants have a higher chance of poor dietary behaviours compared to their counterparts from better SES homes (Virtanen et al., 2015).

2.5. 4. Does the sex of the adolescent influence Food Consumption patterns?

Adolescents' dietary intake tends to vary according to gender (Rathi et al., 2017). Gender variations were noted concerning inadequate water intake, irregular mealtimes, skipping meals, and inadequate seafood consumption. A substantial correlation was found between female gender and inadequate hydration and meals skipping more than male gender. However, male students reported irregular meal times and insufficient seafood consumption more frequently compared to female students (AlJohani et al., 2019). Similarly, gender differences in food choices were also noticeable, particularly with regard to meat consumption in a study conducted by Sprake et al.

(2018) to assess the consumption patterns of university students in the UK. Girls preferred a 'vegetarian' diet, whereas boys favoured the 'convenience, red meat & alcohol' pattern.

Additionally, findings from Xu et al. (2022) indicated that male adolescents consumed convenience/fast food more than their female counterparts (fried potatoes, fried chicken, pizza, and burgers), and reported higher sugary food intake (frozen dessert, cookies/cake, and candy chocolates), regardless of their age.

2.6 Why adolescents eat what they eat

Dietary habit is impacted by ones' personal, social and cultural experiences and the environment (Penafiel et al., 2014). Previous findings from higher-income countries (HICs), identified taste, availability and accessibility, self-efficacy, financial constraints, time and convenience as significant factors in teenagers' dietary intake (Penafiel et al., 2014; Mama Chabi et al., 2022).

According to qualitative findings on factors influencing the eating behaviours of adolescent girls, Sondari et al. (2019) reported that the taste of food was the most significant factor that determined the adolescent girls' food choice. Overall, the girls were enthusiastic when talking about savoury, sweet or spicy foods. Also, price of the food was another factor that was identified. The majority of the girls revealed they mostly favoured foods that were less expensive and easy to buy, though they were not healthy.

Ziegler et al. (2021)   indicated that different environmental influences (family, school, restaurants, and stores) influence adolescents' food choices. Within the home environment, convenience, availability, and time priorities and schedule were factors identified to influence adolescents' food choices. The majority of teenagers admitted to basing decisions on when they

get home from school and when mealtime is due. Others indicated that, depending on how hungry they were, they would settle for less-preferred but more accessible or convenient foods.

Additionally, family meals were recognized by adolescents as significantly impacting their dietary intake. Others stated that their options for food choices were restricted during family mealtimes because they had to eat what was served at meals time (Fitzgerald et al., 2010).

Furthermore, adolescents' opinions and decisions about food are also influenced by age-related traits, such as greater vulnerability to peer pressure, especially in the school setting (Ziegler et al., 2021), which can result in the intake of high-calorie or unhealthy foods (Cohen et al., 2012; A. B. Gandhi, 2022). Adolescents' dietary choices were impacted by their peers through collective actions like splitting the cost of meals and sharing things (Ziegler et al., 2021).

2.7 Guideline for this Study

Why adolescent girls eat what they eat: a mixed method study in the Mion district of Ghana is the main topic of discussion. The examined parameters were based on earlier studies conducted by others on dietary diversity, dietary habits and patterns, and the reasons why adolescents eat the foods they eat. The following issues which served as a guide for this present study were reviewed; DD and DDS, farm diversity and diet quality, factors correlated with DD, dietary habits and dietary patterns of adolescents, factors that influence dietary patterns and dietary habits of adolescents and why adolescent eat what they eat.

CHAPTER THREE

METHODOLOGY

3.0. Introduction

The study's methodology is described in this chapter. It contains an overview of the study research design, and selection of study participants, data analysis, and study limitations.

3.1. Study Design

The current study utilizes a mixed method approach with cross-sectional quantitative data, and a qualitative data from the in-depth interviews and focus group discussions of the Ten2twenty-Ghana study. Data for the present study was extracted from the Ten2Twenty-Ghana study (Azupogo et al., 2021), which began with a thorough cross-sectional survey ($n = 1057$) and 2 months later, a follow-up double-blind, placebo-randomized control trial ($n = 621$). The study included information on adolescent girls' dietary intake, time use, aspirations, socioeconomic status, and nutritional status as well as information on mothers' nutritional status, involvement in household decision-making, mothers' fertility, education, and occupation. Qualitative in-depth interviews and focus groups were also conducted as part of the Ten2Twenty study at baseline on several topics regarding dietary intake, reproductive and sexual health, and psychosocial health.

3.2. Sample Size Determination and Study Participants

The details of the sample size estimate and sampling have previously been described elsewhere (Azupogo et al., 2021). However, a sample of 882 mother-daughter pair were drawn from the extensive cross-sectional baseline survey of the Ten2Twenty study (n=1057) because of missing data on mothers' decision-making (n= 136) and maternal literacy (n=39) (Figure 1).

In order to ensure how well powered the current study was, the number of participants (n) needed for the study's DDS (low/high) was calculated using the Cochran's sample size formula for categorical data.

Taking 56% as the prevalence of low dietary diversity practices from a study conducted in Ghana's Ashanti region (Gyimah et al, 2021).

n = t² × p(1-p) / m²

Where:

n= required sample size

t= the z score associated with the confidence level require (1.96) for 95% confidence level

p= estimated prevalence of DDS in the study area (88.1%)

m= margin of error (0.05)

1.96² × 0.56(1- 0.56) / 0.05²

n = 375

With 5% non-response rate **(18.85),** the sample size for the DDS of the girls was **394** which was rounded to **400**. This shows that with a population for analysis consisting of 882 mother-daughter pairs, the study was well powered.

Qualitatively, a sample of 30 females were utilized for the in-depth interviews. Out of four clusters in the Ten2Twenty-Ghana study, two were randomly selected, and 1 school was randomly chosen from each cluster for a focus group discussion consisting of 5 members in each group.

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┌─────────────────────────────────┐
│  Extensive cross-sectional       │
│  baseline survey of Ten2Twenty   │
│  n = 1057                        │
└─────────────────────────────────┘
                 │
                 ▼
┌─────────────────────────────────┐
│  n = 136 girls excluded due to   │
│  missing data on mothers'         │
│  decision-making                 │
│                                  │
│  n = 39 mothers excluded with    │
│  no data on maternal literacy    │
└─────────────────────────────────┘
       │                    │
       ▼                    ▼
┌──────────────┐   ┌──────────────────────┐
│ n = 882      │   │ Qualitative in-depth  │
│ mother-      │   │ interviews n = 30     │
│ daughter     │   │                       │
│ pair         │   │ 2 focus group         │
│              │   │ discussion = 5 in     │
│              │   │ each group            │
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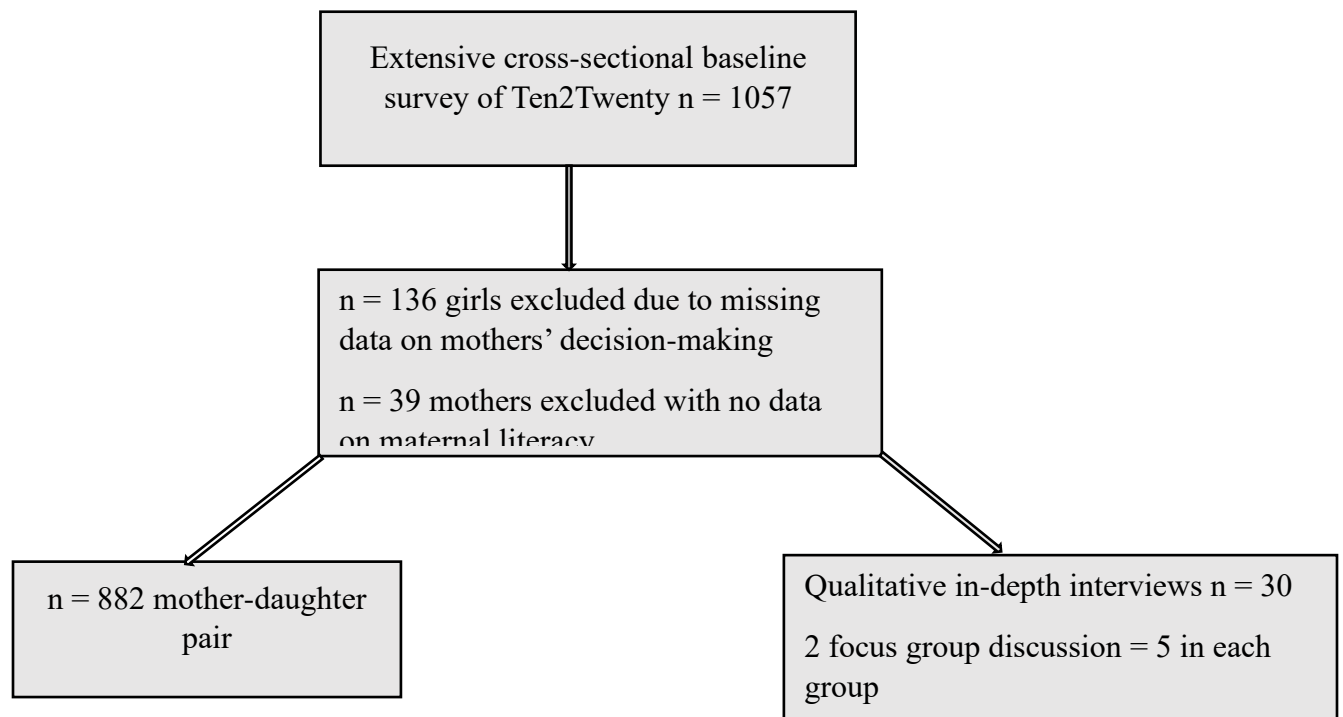
Figure 1 Flowchart for the selection of study population

3.3. Variables Of the Study

3.3.1. Outcome variables

The dietary diversity score, a dependent variable for this study, was evaluated by a qualitative 24hR, utilizing a 10-food indicator (FAO, 2021). The 10-food-group indicator used included: staples (grains, white roots, tubers, and plantains) (1), pulses (beans, peas and lentils) (2), nuts and seeds (3), diary (4), meat, poultry and fish (5), eggs (6), dark green leafy vegetables (7), other vitamin A-rich fruits and vegetables (8), other vegetables (9), and other fruits (10). The girl received a score of "1," if she consumed at least one food item from the food category, and a score of "0" if she did not. The dietary diversity score was established by adding the scores for each food group, with a minimum achievable score of 0 and a maximum score of 10. Girls who had a DDS of 5 and more met the MDD-W and girls who had a DDS less than 5 failed to meet the MDD-W (FAO, 2021).

Additionally, an adapted version of the 10-food group indicator (FAO, 2021) was employed to examine the girls' food consumption pattern, including staples (grains, white roots, tubers, and plantains) (1), pulses (beans, peas and lentils), nuts and seeds (2), diary (3), meat, poultry and fish (4), eggs (5), vegetables (6), fruits (7), Sweets (8), Sugar-sweetened drinks/beverages (9), Savoury and fried snacks (10). The girls were asked how frequently they ate food items from each of the food groups in the last month with frequency options ranging from "never", "once per month", "once per week", "2-4 times weekly", "5-6 times weekly", to "once daily". Each frequency was assigned a continuous score based on the number of days: "never" was scored as 0, "once per month" as 1, "once per week" as 4, "2-4 times weekly" as 12, "5-6 times weekly" as 22, and "once daily" as 30. The average frequency of consuming fruits, vegetables, animal-

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source foods (including dairy, meat, eggs, and fish), and unhealthy foods (such as sweets, sugar-sweetened drinks, and savoury fried snacks) was calculated by grouping these categories as classified by the (FAO, 2021).

Lastly, dietary habit of the girls was assessed using 8 questions which ranged from how often girls had: (1) breakfast during weekdays, (2) breakfast during weekends, (3) lunch during weekdays, (4) lunch during weekends, (5) supper during weekdays, (6) supper during weekends, (7) ate all 3 meals on weekdays, (8) ate all 3 meals on weekends. The responses were group into two; < 3 days and ≥ 3 days for all the dietary habits including both weekdays and weekend days (breakfast, lunch, and supper). Adolescent girls that consumed < 3 were given a score of '0' and ≥ 3 were given a score of '1'. Also, responses for girls who ate all 3 meals for both weekdays and weekends were group into two: yes/ no. So, girls that ate all 3 meals received a score of '1' for yes and '0' for no.

3.3.2. Demographic and socio-economic related covariates

3.3.2.1. Girl level variables

Individual attributes of the girls

The girls' characteristics included their ethnicity, and religion which were categorized as categorical variables, age, entered as a continuous variable, as well as their menarche status, which was dichotomous.

3.3.2.2. Maternal-related variables

Maternal factors included, literacy (dichotomous), and decision-making autonomy. Maternal decision-making autonomy was based on the Demographic and Health Survey 8-item final decision-making index (DHS, 2013).

3.3.2.3. Household-related variables

Household wealth index

The International Wealth Index (IWI), which ranges from a minimum score of 25 to a maximum possible score of 100 (Smits & Steendijk, 2014) was employed to determine the household's SES. The IWI rates households according to their possession of durable goods like a TV, refrigerator, phone, bicycle, car, and household items categorized as inexpensive (under $300), as well as the availability of sanitary facilities, the quality of water, and electricity, and the type of flooring they have.

Household Food Security

The Food Insecurity Experience Scale (FIES) (Ballard et al., 2014) was employed to determine the household FSS of the girls. The scale consists of eight yes/no questions, from moderate food insecurity (question 1) to severe food insecurity (question 8). A yes response earns a score of 1, while a no response receives a score of 0. The eight items' scores were summed to create the FIES score, which ranged between 0 to 8. The FIES score was then divided into four groups: 0 to 2 represented food security, 3 to 4 represented mild food insecurity, 4 to 6 represented moderate food insecurity, and 7 to 8 represented severe food insecurity.

Household Rooster

A household rooster included data on parental education (categorical), occupation (categorical), sex (categorical), and literacy (dichotomous). Further, household size, female-to-male ratio, and literacy ratios were computed from the household rooster and explored in the analysis.

3.3.2.4. Agriculture Biodiversity of Household

Farm diversity of household captured data on the different crop's households cultivated in the last farming season and the different types of animals and poultry/birds that households owned for the past year. The crop species included: cereals and grains (1), root tubers (2), legumes, nuts, and seeds (3), vegetables (4), fruits (5), cash crops (crops cultivated for only monetary gain and not for food in the household) (6). Animal species included ruminants (1), poultry and birds (2), and other animals (e.g., donkeys and horses) (3) (Sibhatu et al., 2015; Jones et al., 2014). If the household cultivated or owned at least one of the crops or animals, they received a score of "1," otherwise a score of "0". The farm diversity score (FDS), which has a minimum attainable score of 0 and a maximum score of 7, was established by summing the scores for the different crops cultivated and animals owned.

3.4. Statistical Analysis

Data from the current study were cleaned, coded, and analysed using SPSS V.21.0 (IBM). Descriptive statistics of the sampled population were presented as frequencies and percentages for categorical variables, while means and standard deviation (means ± SDs) were calculated for continuous data. Q-Q plots and normality histogram curves were employed to test for data normality.

Binary logistic regression was employed to examine the covariates correlated with the attainment of minimum DD using the binary variable for MDD-W(Low/High). Again, binary logistic regression was employed to assess the factors correlated with the dietary habits of the girls, that is, the consumption of breakfast, lunch, as well as supper ($\leq$ 3 days, and >3 days for weekdays and either one of the weekend days, or both weekend days). A bivariate analysis was carried out to determine the factors correlated with MDD-W (Low/High) and dietary habits ($\leq$ 3 days, and >3days for weekdays and either one of the weekend days, or both days for weekend). Stepwise backward elimination was specified and factors with p-value $\leq$ 0.10 at the bivariate level were included in a multivariable logistic regression model and a new p-value was set at 0.05. The school was included as a random intercept in the linear mixed-effect methods employed to analyze the covariates correlated with the frequency of the consumption of the different food groups in the last month among the girls, (mean consumption of cereals, grains, and tubers, pulse, nuts/seeds, animal source foods, fruits and vegetables, and unhealthy foods),

Multicollinearity between independent factors was examine using tolerance values of < 0.1 and a variance inflation factor of <10 in the linear regression step. A 95% confidence interval with a two-tailed P-value less than 0.05 was deemed statistically significant in all analyses.

Concerning the qualitative analysis, data from the focus group discussions and in-depth interviews were analysed using an inductive thematic analysis technique. Digital recordings, field notes, and worksheets from the girls were transcribed verbatim. The transcripts were intensively read, codes were generated, and emergent themes and factors influencing adolescent girls' food choices were identified. Factors were included based on how frequently, precisely, and comprehensively the quotes pertaining to the factor appeared. All the themes were

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systematically listed in a theme-count table, and quotations that act as inferences for the themes found were used to organize the data.

CHAPTER FOUR

RESULTS

4.0. Introduction

This chapter deals with the results and findings from the data analysis. The findings are presented according to the objectives of the study, and it is divided into four headings; Socio-demographic characteristics, DD, food habits and food consumption pattern of adolescent girls in the Mion district, covariates that correlated with DD, food habits and food consumption patterns of adolescent girls in the Mion district and the reasons adolescent girls have for eating the foods they eat.

4.1. Socio-demographic characteristics of the study population

The descriptive statistics of the 882 adolescent girls from Table 4.1 show that the average age of the teenage girls were 12.3 ± 1.9 years old. Almost 80% of the girls were pre-menarche. Most girls (61.2%) belonged to the Dagomba tribe and about 62.7% were Muslims. Additionally, 92.4% of mothers were non-literate whereas maternal decision-making index was 5.3 ± 1.4 out of a possible maximum score of 8. Table 4.1 again shows that the average household size was 12.1±5.1, with a 1.6 ± 1.2 female-to-male sex ratio and 0.5 ± 0.8 household literacy ratios. One-fifth of the girls were from severely food insecure households and the mean scores for crop farm diversity, animal farm diversity and farm diversity were 3.9 ± 1.1, 1.6 ± 0.6, and 5.5 ± 1.5 respectively. Finally, with the quintiles of wealth index, 18.1 % was classified as quintile 1(poorest) and 19.3% as quintile 5(richest).

Table 4.1: Socio-demographic Characteristics of the adolescent girls (n=882)

Variables	Mean ± SD / n (%)
Girl-level factors	
Age of girls (years)	12.3 ± 1.9
Ethnicity (%)	
Dagomba	540 (61.2)
Konkomba	326 (37.0)
Other	16 (1.8)
Religion (%)	
Muslim	553 (62.7)
Christian	316 (35.8)
Africa Traditional	13 (1.5)
Menarche status (%)	
Pre-menarche	705 (79.9)
Post-menarche	177 (20.1)
Maternal-related factors	
Maternal literacy (%)	
Non-literate	815 (92.4)
Literate	67 (7.6)
Maternal decision index	5.3 ± 1.4
Household-related factors	
Household size	12.1 ± 5.1
Female-to-male ratio	1.6 ± 1.2
Literacy ratio	0.5 ± 0.8
Household food security status (%)	
Food secured	165 (18.7)
Mildly food insecure	237 (26.9)
Moderately food insecure	311 (35.3)
Severely food insecure	169 (19.2)
Quintile of the international wealth index (%)	
Quintile 1	160 (18.1)
Quintile 2	187 (21.2)
Quintile 3	193 (21.9)
Quintile 4	172 (19.5)
Quintile 5	170 (19.3)
Household crop farm diversity	3.9 ± 1.1
Household animal farm diversity	1.6 ± 0.6
Household Farm Diversity	5.5 ± 1.5

4.2. Dietary diversity and Food groups consumed on the previous day by the girls

The DDS of the girls was 5.9 ± 1.2, with about 90.6% meeting the minimum dietary diversity for MDD-W of reproductive age. Figure 4.1 indicates that the most consumed food groups included staples (99.8%), meat, poultry, and fish (95%) and other vegetables (95.7%). The least consumed food groups were dairy products (15.2%) and eggs (6.6%).
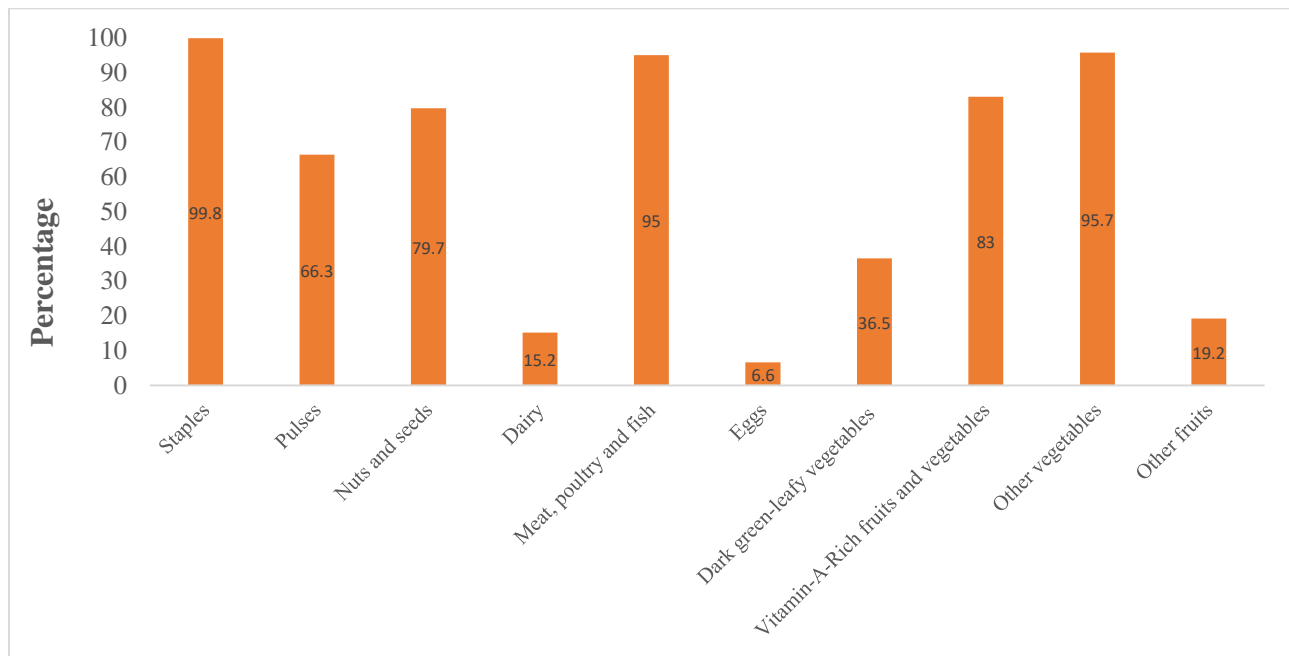
Figure 4.1: Percentage of girls who consumed each food group in the previous day

4.3. Food Habits of the Adolescent Girls

Table 4.2 shows that 90.6% of the girls had breakfast on both weekend days (Saturday and Sunday) whereas 95.6% had breakfast for more than 3 days during weekdays (Monday-Friday). Again, during the weekend, 92% ate lunch on both weekend days and 96.5% had lunch more than 3 days during weekdays. Table 4.2 again demonstrates dinner was a meal commonly consumed by nearly all the girls on both weekend days, as well as by almost all the girls on more

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than three weekdays. Lastly, nearly all the girls consumed all 3 meals (breakfast, lunch, and supper) on weekdays. A similar finding was observed for all 3 meals on weekends.

Table 4.2: Food Habits of the Adolescent Girls

Variables	n (%)
Breakfast (Weekend)	
Either one of the weekend days	83 (9.4)
Both days	799 (90.6)
Breakfast (Weekdays)	
< = 3 days	39 (4.4)
>3 days	843 (95.6)
Lunch (Weekend)	
Either one of the weekend days	71 (8.0)
Both days	811 (92.0)
Lunch (Weekdays)	
< = 3 days	31 (3.5)
>3 days	851 (96.5)
Supper (Weekend)	
Either one of the weekend days	56 (6.3)
Both days	826 (93.7)
Supper (Weekdays)	
< = 3 days	9 (1.0)
>3 days	873 (99.0)
The girl ate all 3 meals on weekdays	
Yes	874(99.1)
No	8(0.9)
The girl ate all 3 meals during the weekend	
Yes	869(98.5)
No	13(1.5)

4.4. Frequency of the consumption of food groups in the last month by the girls

The mean frequency of consuming staples (cereals, grains, tubers and plantain) in the last 30 days was 29.4 ± 3.5 and the mean frequency of consuming pulses (beans, peas lentils) and nuts/seeds over the last 30 days was 15.2 ± 7.4 (Table 4.3). Furthermore, the mean frequency of consuming ASFs (dairy, eggs, meat, and fish), fruits and vegetables, and unhealthy items (sweets, sugar-sweetened drinks, savoury and fried snacks), were 8.6 ± 3.9, 11.7 ± 6.0, and 6.9 ± 4.4 days, respectively.

Table 4.3: Frequency of the consumption of food groups in the last month by the girls

Variables	Number of days in the last month (Mean ± SD)
Staples (cereals, grains, and tubers)	29.4 ± 3.5
Pulses (beans, peas, lentils) and nuts/seeds	15.2 ± 7.4
Animal-source foods (dairy, eggs, meat, and fish)	8.6 ± 3.9
Fruits and vegetables	11.7 ± 6.0
Vegetables	17.1 ± 10.4
Fruits	6.2 ± 5.8
Unhealthy foods (sweets, SSBs, savoury and fried snacks)	6.9 ± 4.4

4.5. Factors associated with dietary diversity (Low/High) among 10-17 yrs. adolescent girls in the Mion District of Ghana

The bivariate logistic regression results showed that independent variables such as ethnicity (p-value = 0.014), religion (p-value = 0.002), menarche status (p-value = 0.070), household food security status (p-value = 0.005), and household size (p-value = 0.007) were significantly associated with DDS, having specified a stepwise backward elimination with a P-value ≤ 0.10, **(**Table 4.4**).**

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Table 4.4: Bivariate logistic regression of the factors associated with dietary diversity (low/high) among 10-17 years adolescent girls in the Mion District of Ghana

Variables	OR (95 % C.I)	P-value
Age of girls (years)	0.91 (0.81, 1.02)	0.109
Ethnicity		0.014
Dagomba	Ref	
Konkomba	0.52 (0.32, 0.81)	0.004
Other	1.17 (0.15, 9.07)	0.882
Religion		0.002
Muslim	Ref	
Christian	0.50 (0.31, 0.78)	0.003
Other	0.42 (0.09, 1.94)	0.266
Menarche Status		
Pre-menarche	Ref	
Post-menarche	0.62 (0.37, 1.04)	0.070
Maternal literacy		0.571
Non-literate	Ref	
Literate	0.76 (0.30, 1.95)	0.571
Maternal decision index	0.98 (0.83, 1.16)	0.828
Female-to-male (Sex) ratio	0.93 (0.78, 1.12)	0.409
Household size	1.07 (1.02, 1.13)	0.007
Literacy ratio	1.04 (0.78, 1.38)	0.799
Farm diversity	1.01 (0.87, 1.17)	0.909
Crop diversity	0.98 (0.79, 1.21)	0.846
Animal Diversity	1.22 (0.88, 1.70)	0.231
Household food security status		0.005
Food secured	Ref	
Mildly food insecure	0.46 (0.19, 1.10)	0.080
Moderately food insecure	0.37 (0.16, 0.86)	0.021
Severely food insecure	0.30 (0.12, 0.71)	0.007
Quintile of the international wealth index		0.227
Quintile 1	Ref	
Quintile 2	0.66 (0.32, 1.36)	0.264
Quintile 3	0.62 (0.31, 1.27)	0.191
Quintile 4	0.10 (0.45, 2.19)	0.996
Quintile 5	1.42 (0.60, 3.33)	0.426

The multivariable logistic regression analyses (Table 4.5) showed that household size and household FSS were correlated with DD. Girls from moderately/severe food insecure households were 68% less likely to have a higher DDS (AOR= 0.32; 95% CI (0.14, 0.72)). Those from mildly food insecure households were 58% less likely to have an increased DDS (AOR= 0.42; 95% CI (0.17, 1.01)). Finally, there was a positive association between the household size of the girl and an increased DD (AOR 1.08; 95% CI (1.02, 1.13).

Table 4.5: Multivariate logistic regression analysis of the factors associated with dietary diversity (Low/High) among 10-17 yrs. adolescent girls in the Mion District of Ghana

Variables	OR (95 % C.I)	P-value
Household size	1.08 (1.02, 1.13)	0.005
Household food security status		
Food secured	Ref	
Mildly food insecure	0.42(0.17, 1.01)	0.054
Moderately/ Severely food insecure	0.32(0.14, 0.72)	0.006
Model fit statistics		
Nagelkerke R Square	0.043	
-2 Log-likelihood ratio	532.598	
Wald test	24.962	< 0.001

4.6. Factors associated with dietary habits during weekdays and weekend days among 10-17 yrs. adolescent girls in the Mion District of Ghana

Significant predictors of breakfast consumption more than 3 days weekly included the age of the girl, religion, and household food security (Table 4.6). Mild as well as moderate food insecurity was also positively correlated with higher odds of consuming lunch at least 3 days weekly and the international wealth index was associated with consuming supper more than 3 days weekly.

Except for the age of the girl which was negatively correlated with reduced odds of eating breakfast, no other factors were identified for breakfast, and none were identified for lunch and supper (Table 4.7) at the multivariate level.

Table 4.8 shows that Konkomba ethnicity compared to other ethnicities was strongly correlated with an increased odds of eating lunch and supper on both weekend days. Likewise, Christian religion when compared to other religions correlated with an increased odds of consuming lunch and supper on both weekend days. Further, farm diversity and crop diversity were positively correlated with an increased odds of consuming breakfast, lunch, and supper on both weekend days. Animal farm diversity also correlated with a higher odds of eating breakfast on both weekend days. Finally, severe food insecurity correlated with an increased odds of eating supper on both weekend days.

In the multivariate analysis, only crop diversity was associated with an increased odds of consuming supper on both weekend days and no significant factor were identified for breakfast and lunch (Table 4.9)

Table 4.6: Bivariate logistic regression analysis of the factors associated with dietary habits during weekdays among 10-17 yrs. adolescent girls in the Mion District of Ghana

Variables	Breakfast		Lunch		Supper	
	OR (95 % C.I)	P-value	OR (95 % C.I)	P-value	OR (95 % C.I)	P-value
Age of girls (years)	0.77 (0.66, 0.91)	< 0.001	1.01 (0.83, 1.23)	0.904	0.88 (0.64, 1.23)	0.463
Ethnicity						
Dagomba	Ref.	0.206	Ref.	0.390	Ref.	1.000
Konkomba	0.56 (0.29, 1.06)	0.076	1.69 (0.74, 3.84)	0.211	Unreliable	
Other	Unreliable		0.64 (0.08, 5.04)	0.669	Unreliable	
Religion						
Muslim	Ref.	0.063	Ref.	0.248	Ref.	1.000
Christian	0.59 (0.30, 1.14)	0.116	1.92 (0.81, 4.52)	0.137	Unreliable	
Other	0.20 (0.04, 0.95)	0.042	0.52 (0.07, 4.18)	0.539	Unreliable	
Menarche Status						
Pre-menarche	Ref.		Ref.		Ref.	
Post-menarche	0.72 (0.34, 1.49)	0.376	1.05 (0.42, 2.59)	0.920	2.02 (0.25, 16.26)	0.509
Maternal literacy						
Non-literate	Ref.		Ref.		Ref.	
Literate	1.85 (0.70, 4.91)	0.215	0.54 (0.18, 1.59)	0.263	0.65 (0.08, 5.31)	0.691
Maternal decision index	0.98 (0.78, 1.24)	0.856	1.00 (0.78, 1.30)	0.989	1.16 (0.74, 1.81)	0.525
Female-to-male (Sex) ratio	0.89 (0.71, 1.09)	0.268	0.98 (0.74, 1.31)	0.900	1.01 (0.59, 1.73)	0.985
Household size	1.01 (0.95, 1.08)	0.781	0.99 (0.93, 1.07)	0.947	0.94 (0.84, 1.05)	0.286
Literacy ratio	1.09 (0.70, 1.71)	0.699	1.14 (0.67, 1.95)	0.625	1.05 (0.44, 2.50)	0.905
Farm diversity	1.12 (0.92, 1.35)	0.254	1.09 (0.88, 1.35)	0.446	0.74 (0.40, 1.37)	0.337
Crop diversity	1.11 (0.84, 1.46)	0.466	1.15 (0.85, 1.55)	0.372	0.61 (0.25, 1.47)	0.265
Animal Diversity	1.50 (0.97, 2.32)	0.066	1.19 (0.71, 2.01)	0.513	0.89 (0.30, 2.63)	0.835
Household food security status		< 0.001		0.583		0.723
Food secured	Ref.		Ref.		Ref.	
Mildly food insecure	0.15 (0.02, 1.23)	0.078	2.48 (0.89, 6.97)	0.084	0.72 (0.06, 7.97)	0.786
Moderately food insecure	0.14 (0.02, 1.08)	0.059	3.28 (1.17, 9.19)	0.024	0.37 (0.04, 3.22)	0.370
Severely food insecure	0.06 (0.01, 0.45)	0.006	1.15 (0.45, 2.90)	0.772	1.02 (0.06, 16.52)	0.986
International wealth index	0.99 (0.96, 1.02)	0.550	1.01 (0.98, 1.04)	0.620	0.95 (0.89, 1.00)	0.056

Table 4.7: Multivariate logistic regression analysis of the factors associated with weekday dietary habits among 10-17 yrs. adolescent girls in the Mion District of Ghana

Variables	Breakfast[1]	
	OR (95 % C.I)	P-value
Age of girls (years)	0.77 (0.65, 0.90)	<0.001
Model fit statistics		
Nagelkerke R Square	0.081	
-2 Log-likelihood ratio	297.569	
Wald test	10.541	

[1]No significant explanatory factors were found in the multivariate analysis for weekdays lunch and dinner, hence they were dropped from the table

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Table 4.8: Bivariate logistic regression analysis of the factors associated with dietary habits during weekend days among 10-17 yrs. adolescent girls in the Mion District, Ghana

Variables	Breakfast		Lunch		Supper	
	OR (95 % C.I)	P-value	OR (95 % C.I)	P-value	OR (95 % C.I)	P-value
Age of girls (years)	0.99 (0.88, 1.12)	0.914	0.99 (0.88, 1.14)	0.992	0.01 (0.87, 1.17)	0.890
Ethnicity		0.144		0.012		<0.001
Dagomba	Ref.		Ref.		Ref.	
Konkomba	1.42(0.87, 2.32)	0.161	2.53 (1.38, 4.62)	0.003	3.79 (1.77, 8.13)	<0.001
Other	1.77 (0.23, 13.65)	0.584	0.79 (0.18, 3.59)	0.764	1.43 (0.19,11.07)	0.732
Religion		0.169		0.003		<0.001
Muslim	Ref.		Ref.		Ref.	
Christian	1.43 (0.87, 2.34)	0.162	2.68 (1.44, 4.98)	0.002	4.20 (1.88, 9.39)	<0.001
Other	1.41 (0.18, 11.01)	0.746	1.38 (0.18, 10.80)	0.760	1.14 (0.15, 8.96)	0.900
Menarche Status						
Pre-menarche -	Ref.		Ref.		Ref.	
Post-menarche	0.90 (0.52, 1.56)	0.699	1.26 (0.66, 2.39)	0.488	1.33 (0.64, 2.78)	0.442
Maternal literacy		0.894		0.455		0.158
Non-literate	Ref.		Ref.		Ref.	
Literate	1.06 (0.44, 2.53)	0.894	0.73 (0.32, 1.66)	0.455	0.55 (0.24, 1.26)	0.158
Maternal decision index	0.85 (0.72, 1.01)	0.061	0.87 (0.72, 1.04)	0.128	0.86 (0.70, 1.05)	0.149
Female-to-male (Sex) ratio	0.93 (0.78, 1.09)	0.358	0.90 (0.76, 1.06)	0.209	0.87 (0.73, 1.04)	0.121
Household size	1.00 (0.96, 1.05)	0.879	0.99 (0.95, 1.04)	0.845	1.00 (0.95, 1.05)	0.938
Literacy ratio	0.87 (0.70, 1.09)	0.230	0.86 (0.68, 1.08)	0.187	0.87 (0.68, 1.13)	0.301
Farm diversity	1.31 (1.16, 1.48)	<0.001	1.25 (1.10, 1.43)	<0.001	1.35 (1.18, 1.55)	<0.001
Crop diversity	1.39 (1.17, 1.66)	<0.001	1.43 (1.19, 1.72)	<0.001	1.63 (1.34, 1.97)	<0.001
Animal Diversity	1.79 (1.33, 2.42)	<0.001	1.40 (0.99, 1.97)	0.051	1.38 (0.95, 2.01)	0.093
Household food security status		0.531		0.540		0.016
Food secured	Ref.		Ref.		Ref.	

Mildly food insecure	0.80 (0.39, 1.62)	0.529	1.23 (0.61, 2.47)	0.557	1.01 (0.49, 2.05)	0.987
Moderately food insecure	0.80 (0.41, 1.58)	0.523	1.41 (0.72, 2.77)	0.317	1.60 (0.77, 3.34)	0.207
Severely food insecure	0.77 (0.36, 1.63)	0.487	1.19 (0.56, 2.52)	0.652	3.04 (1.07, 8.65)	0.037
Quintile of the international wealth index		0.902		0.971		0.866
Quintile 1	Ref.		Ref.		Ref.	
Quintile 2	0.72 (0.36, 1.46)	0.360	1.19 (0.55, 2.57)	0.667	1.18 (0.50, 2.80)	0.706
Quintile 3	1.14 (0.53, 2.43)	0.739	1.14 (0.53, 2.43)	0.739	1.22 (0.52, 2.90)	0.650
Quintile 4	1.00 (0.47, 2.15)	0.993	1.08 (0.50, 2.35)	0.842	1.08 (0.46, 2.57)	0.861
Quintile 5	0.86 (0.41, 1.81)	0.697	1.07 (0.49, 2.32)	0.867	0.97 (0.42, 2.27)	0.948

Table 4.9: Multivariate logistic regression analysis of the factors associated with weekend dietary habits among 10-17 yrs. adolescent girls in the Mion District of Ghana

Variables	Breakfast		Lunch		Supper	
	OR (95 % C.I)	P-value	OR (95 % C.I)	P-value	OR (95 % C.I)	P-value
Crop diversity					1.63 (1.34, 1.97)	<0.001
Model fit statistics						
Nagelkerke R Square					0.065	
-2 Log-likelihood ratio					395.410	
Wald test					24.935	

4.7. Factors associated with frequency of consumption of some food groups among 10-17 years adolescent girls in the Mion District, Ghana

Table 4.10 indicates that maternal decision-making index was significantly correlated with fruit and vegetable consumption. Ethnicity, farm diversity, animal farm diversity, moderately/severely food insecure, and quintile 5 of the wealth index were factors correlated with animal-source foods intake. Muslim religion, maternal non-literacy, household size, household FSS, quintiles 2,4, and 5 of the wealth indexes, and farm, crop and animal diversity were factors significantly correlated with the consumption of unhealthy items. Factors such as quintiles 3,4,5 of the wealth index as well as farm diversity, crop diversity, and animal diversity were significantly associated with pulses/nuts and seeds consumption. Mildly food insecure, maternal decision-making index, farm diversity, crop diversity, animal diversity, and quintiles 3,4, and 5 were predictors of the consumption of cereals, grains, and tubers (Table 4.10).

At the multivariate level, moderately/severely food insecure, likewise the Konkomba ethnicity was negatively and significantly associated with the intake of animal source foods. Also, maternal non-literacy and household FSS were factors negatively correlated with the consumption of unhealthy foods. Lastly, only quintiles 3 and 5 of the wealth index had a statistically significant correlation with the consumption of cereals, grains and tubers and no association was found between the factors and the consumption of fruits and vegetables and pulses/nuts and seeds (Table 4.11).

Table 4.10: Bivariate Linear Mixed effect model analysis of the factors associated with frequency of consumption of the following food groups among 10-17 yrs. Adolescent girls in the Mion District, Ghana

Variables	Fruits and Vegetables		Animal source foods		Unhealthy foods		Pulses and Nuts/Seeds		Cereals, grains, and tubers	
	Estimate (95 % C.I)	P-value	Estimate (95 % C.I)	P-value	Estimate (95 % C.I)	P-value	Estimate (95 % C.I)	P-value	Estimate (95 % C.I)	P-value
Age of girls (years)	0.08(-0.13,0.29)	0.461	0.09(-0.04,0.23)	0.178	0.06(-0.09,0.22)	0.417	-0.17(-0.44,0.09)	0.191	0.07(-0.05,0.19)	0.273
Ethnicity										
Dagomba	-0.62(-3.61,2.36)	0.683	-1.69(-3.60,0.22)	0.083	0.64(-1.50, 2.78)	0.557	2.49(-1.19, 6.16)	0.184	-0.48(-2.23,1.27)	0.592
Konkomba	-0.57(-3.59,2.44)	0.709	-2.29(-4.22,0.36)	0.020	-1.53(-3.69,0.63)	0.165	1.58(-2.13, 5.29)	0.402	-0.86(-2.63,0.91)	0.340
Other	Ref		Ref		Ref		Ref		Ref	
Religion										
Muslim	-2.61 (-5.91,0.69)	0.121	0.46(-1.65, 2.58)	0.667	2.03(-0.34,4.40)	0.093	0.52(-3.55, 4.59)	0.801	-0.47(-2.40,1.47)	0.636
Christian	-2.72 (-6.05,0.60)	0.109	-0.15(-2.29,1.99)	0.890	-0.09(-2.48,2.29)	0.939	-0.26(-4.37,3.84)	0.900	-0.89(-2.84,1.07)	0.373
Other	Ref		Ref		Ref		Ref		Ref	
Menarche Status										
Pre-menarche	-0.18(-1.17, 0.81)	0.724	-0.35(-0.98,0.29)	0.287	0.01(-0.72, 0.74)	0.977	0.16(-1.05, 1.39)	0.791	0.07(-0.51, 0.65)	0.811
Post-menarche	Ref		Ref		Ref		Ref		Ref	
Maternal literacy										
Non-literate	-0.39(-1.88, 1.11)	0.611	-0.31(-1.27,0.65)	0.528	-1.95(-3.04, -0.85)	<.001	0.01(-1.83, 1.86)	0.991	-0.43(-1.31,0.44)	0.332
Literate	Ref		Ref		Ref		Ref		Ref	
Maternal decision index	-0.25(-0.53,0.04)	0.087	-0.15(-0.33,0.03)	0.104	0.12(-0.09, 0.33)	0.261	0.20(-0.15, 0.55)	0.267	0.14(-0.03, 0.31)	0.098
Female-to-male (Sex) ratio	-0.16(-0.49,0.17)	0.335	0.04(-0.17,0.25)	0.698	0.12(-0.13, 0.36)	0.351	-0.08(-0.48,0.33)	0.711	0.07(-0.12, 0.27)	0.476
Household size	0.03(-0.05, 0.10)	0.518	0.01(-0.38,0.61)	0.654	0.11(0.05, 0.17)	<.001	-0.03(-0.13,0.07)	0.542	0.02(-0.02, 0.07)	0.324
Literacy ratio	-0.01(-0.48, 0.47	0.982	-0.10(-0.41,0.20)	0.516	-0.09(-0.44, 0.25)	0.597	-0.11(-0.70,0.47)	0.701	-0.10(-0.38,0.18)	0.489
Farm diversity	-0.06(-0.33,0.20)	0.638	0.15(-0.02, 0.32)	0.077	0.34(0.15, 0.53)	<.001	0.53(0.21, 0.86)	0.001	0.23(0.07, 0.38)	0.004
Crop diversity	-0.09(-0.47,0.28)	0.613	0.14(-0.09, 0.38)	0.249	0.35(0.07, 0.62)	0.013	0.71(0.25, 1.16)	0.002	0.31(0.10, 0.53)	0.005
Animal Diversity	-0.08(-070, 0.54)	0.794	0.45(0.05,0.85)	0.027	0.74(0.29, 1.20)	<.001	0.82(0.05, 1.58)	0.036	0.36(-0.00, 0.73)	0.050
Household food security										

status										
Food secured	Ref		Ref		Ref		Ref		Ref	
Mildly food insecure	0.46(-0.74,1.65)	0.453	-0.45(-1.20,0.31)	0.243	-1.18(-2.05, -0.31)	0.008	-0.99(-2.46,0.48)	0.186	-0.72(-1.42, -0.02)	0.043
Moderately/ Severely food insecure	-1.40(-0.66,1.46)	0.463	-1.65(-2.33,0.99)	<.001	-1.93(-2.70, -1.15)	<.001	-0.69(-2.00,0.61)	0.298	-0.45(-1.08,0.17)	0.153
Quintiles of wealth index										
Quintile 1	Ref		Ref		Ref		Ref		Ref	
Quintile 2	0.32(-0.94, 1.59)	0.618	0.47(-0.34, 1.29)	0.254	0.83(-0.09, 1.76)	0.078	0.99(-0.57,2.55)	0.213	0.55(-0.19,1.29)	0.148
Quintile 3	-0.13(-1.39, 1.13)	0.838	0.55(-0.26, 1.36)	0.182	0.44(-0.48, 1.36)	0.347	1.43(-0.12, 2.98)	0.071	0.100(0.26, 1.73)	0.008
Quintile 4	0.52(-0.77, 1.81)	0.429	0.60(-0.23, 1.43)	0.155	1.36(0.42, 2.31)	0.005	1.35(-0.24, 2.95)	0.096	0.73(-0.02, 1.49)	0.058
Quintile 5	0.99(-0.31, 2.29)	0.134	0.94(0.10, 1.77)	0.028	1.79(0.83, 2.73)	<.001	1.41(-0.18, 3.01)	0.083	1.14(0.38, 1.90)	0.003

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Bivariate Linear Mixed effect model analysis of the factors associated with frequency of consumption of Fruits, and Vegetables

	Fruits		Vegetables	
Variables	**Estimate (95 % C.I)**	**P-value**	**Estimate (95 % C.I)**	**P-value**
Age of girls (years)	0.08(-0.13, 0.28)	0.461	0.07(-0.29, 0.44)	0.700
Ethnicity				
Dagomba	-0.74(-3.61, 2.12)	0.609	-0.62(-3.61, 2.36)	0.683
Konkomba	-1.23(-4.12, 1.67)	0.406	-0.57(-3.59, 2.44)	0.709
Other	Ref		Ref	
Religion				
Muslim	-1.06(-4.23, 2.11)	0.513	-4.23(-9.96, 1.50)	0.148
Christian	-1.63(-4.83, 1.57)	0.318	-3.83(-9.61, 1.95)	0.194
Other	Ref		Ref	
Menarche Status				
Pre-menarche	0.08(-0.87, 1.03)	0.873	-0.41(-2.13, 1.31)	0.641
Post-menarche	Ref		Ref	
Maternal literacy				
Non-literate	-1.22(-2.66, 0.21)	0.095	0.65(-1.94, 3.25)	0.621
Literate	Ref		Ref	
Maternal decision index	-0.01(-0.28, 0.27)	0.962	-0.45(-0.94, 0.04)	0.074
Female-to-male (Sex) ratio	-0.14(-0.46, 0.17)	0.382	-0.20(-0.77, 0.37)	0.491
Household size	0.03(-0.04, 0.10)	0.369	0.01(-0.13, 0.14)	0.902
Literacy ratio	0.07(-0.38. 0.53)	0.754	-0.08(-0.91, 0.74)	0.844
Farm diversity	0.19(-0.06, 0.45)	0.140	-0.33(-0.79, 0.13)	0.158
Crop diversity	0.19(-0.16, 0.55)	0.280	-0.40(-1.05, 0.25)	0.225
Animal Diversity	0.49(-0.10, 1.08)	0.107	-0.69(-1.76, 0.39)	0.211

Household food security status				
Food secured	Ref		Ref	
Mildly food insecure	-2.02(-3.16, -0.89)	<0.001	2.93(0.87, 4.99)	0.005
Moderately/ Severely food insecure	-2.40(-3.41, -1.39)	<0.001	3.16(1.33, 4.99)	<0.001
Quintiles of wealth index				
Quintile 1	Ref		Ref	
Quintile 2	0.24(-0.97, 1.46)	0.694	0.43(-1.77, 2.64)	0.698
Quintile 3	-0.19(-1.40, 1.02)	0.758	-0.02(-2.20, 2.17)	0.989
Quintile 4	0.50(-0.74, 1.75)	0.423	0.54(-1.70, 2.79)	0.635
Quintile 5	0.29(-0.96, 1.53)	0.653	1.63(-0.62, 3.88)	0.157

criteria									
-2 Restricted Log Likelihood	4848.84		5086.65		4712.07		5569.21		6619.75	
AIC	4850.84		5088.65		4714.07		5571.21		6621.75	

Fruits and Vegetables combined, and Pulses and Nuts/Seeds were excluded from the table due to the lack of statistically significant factors influencing their consumption

4.8. Qualitative findings

4.8.1. Dietary habits and patterns of adolescent girls

Several themes emerged regarding the eating behaviours and patterns of teenage girls from the analysis of the in-depth interview and focused group discussion. The number of participants who raised a certain theme is shown in Table 4.12.

Table 4.12: Prominent themes on dietary habits from qualitative in-depth interviews(n=30)

Breakfast	Theme Frequency	Percentage (%)
Porridge	26	86.7
Tea with bread	16	53.3
"Tuo Zaafi"	15	50
Rice dishes	9	30
Others	8	26.7
Lunch		
"Tuo Zaafi"	30	100
Rice dishes	18	60
Pigeon pea	5	16.7
Yam	4	13.3
Corn meal ("yoroyoro")	3	10
Others	7	23.3
Supper		
"Tuo Zaafi"	28	93.3
Rice dishes	15	50
"Fufu"	5	16.6
Yam	4	13.3
Banku	3	10
Pigeon pea	3	10
Others	3	10
Snack		
Biscuits /Pastries	19	63.3
Sweets	23	76.7
Fruits	15	50
Ice cream/Yoghurt	11	36.7
Soft drinks	8	26.7

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Locak beverages	8	26.7	
Others	4	13.3	

Table 4.13: Prominent themes on dietary habits from Focus group Discussion

Breakfast	Lunch	Supper	Snack
"Tuo Zaafi"	Pigeon pea	"Tuo Zaafi"	Local beverages
Porridge	Corn meal		Sweets
Tea with bread	Rice		Fruits
	Porridge		Pastries
	"Tuo Zaafi"		Icecream

The most dominant narratives on the choice of meals for breakfast were porridge and tea with bread, with some of the adolescent girls also recalling that they occasionally ate "tuo zaafi" and rice for breakfast.

I usually drink tea and bread in the morning

Source: [(Pupil) – Sang]

I drink porridge with sugar and sometimes groundnuts

Source: [(Pupil) – Sambu]

I take T.Z or "koko" in the morning

Source: [(Pupil) – Sanzee]

I take tea with bread and sometimes too I eat rice

Source: [(Pupil) – Nanundoo]

The dominant narrative on the choice of meal for lunch were "tuo zaafi", rice with stew, and pigeon pea (adwoa), some adolescent girls also recalled taking yam, and "yoroyoro" for lunch.

I usually eat "tuo zaafi in the afternoons, sometimes too I eat "adwoa".

Source: [(Pupil) – Zakpalsi]

Sometimes I buy yam in the afternoon

Source: [(Pupil) – Sambu]

I buy rice and mix it with adwoa in the afternoon

Source: [(Pupil) – Kpabia Nabatia]

I take "yoroyoro" for lunch

Source: [(Pupil) – Gunsi AME]

"Tuo zaafi" was the most dominant choice of meal for supper, but some adolescent girls also recalled consuming banku, rice meals and fufu for supper.

I always eat "Tou zaafi with dry okro/ayoyo soup in the house in the evening because my mother always coos it.

Source: [(Pupil) – Sang]

I sometimes eat fufu with bra soup in the evening

Source: [(Pupil) – Sakpe]

I eat "Tuo zaafi" most times but sometimes we cook rice or fufu in the evening

Source: [(Pupil) – Nanundoo]

Other times too, my mother cooks banku with dry okro soup

Source: [(Pupil) – Mbatinga]

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The most preferred snacks for the respondents were ice cream, fruits, local beverages, and sweets. Some also recalled usually consuming carbonated drinks.

I like biscuits, toffees and ice cream

Source: [(Pupil) – Mbatinga]

I take shea fruits, oranges, mango, and banana

Source: [(Pupil) – Sang]

I buy poha / sobolobo and drink

Source: [(Pupil) – Kpabia Nabatia]

I drink soft/ energy drinks

Source: [(Pupil) – Kanimo]

4.8.2. Reasons why adolescent girls eat what they eat

Two prominent themes emerged regarding the reasons why adolescent girls eat what they eat from the analysis of the in-depth interview and focused group discussion. All the themes are systematically presented in Table 4.14 and illustrative quotations that act as inference for the themes found were used to organize the data.

Table 4.14: Prominent themes on reasons for food choices

In-depth interview Themes	Theme Frequency	Focus group discussion
Health	14 (46.7%)	Health
Easily available	7 (23.3%)	
Cravings	5 (16.7%)	
Taste	4(13.3%)	

The analyses revealed that most of the adolescent girls are conscious of the self-perceived health implications of their diets; this was evident from the focus group discussion. Factors that underpin

Health

We eat them to be healthy and not be falling sick

Source: [(Pupil)—Sang]

I eat it because I want to be healthy

Source: [(Pupil) – Kulinkpegu]

Easily available

My mother and others cook it

Source: [(Pupil) – Kpabia]

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That's what we have

<div align="right">

Source: [(Pupil) – Kanimo]

</div>

Cravings

when we crave for them then we serve and eat

<div align="right">

Source: [(Pupil) – Sang]

</div>

My heart desires them

<div align="right">

Source: [(Pupil) – St Anthony]

</div>

Taste

I eat them a lot because I like them

<div align="right">

Source: [(Pupil) – Sambu]

</div>

They are sweet

<div align="right">

Source: [(Pupil) – Kpabia]

</div>

4.8.3. Food likes and dislikes of adolescent girls and reasons for likes and dislikes.

The study further explored the foods likes and dislikes of the teenage girls. The main themes that emerged are presented in a Table 4.15 and 4.16. Quotations that act as inferences for the themes found were used to organize the data. Notably, the percentage of adolescent who disliked "TZ" recipe were more than twice the percentage whole like it (26. 7% vs 10.0%). Likewise, more adolescents disliked fruits/vegetables compared to those who liked them (20.0% vs 13.3%).

Table 4.15: Prominent themes on type of food liked and disliked by the adolescent girls (In-depth interviews)

Food likes	Theme Frequency	Food dislikes	Theme Frequency
Sweets	4(13.3%)	"Tuo Zaafi"	8(26.7%)
Fruits/Vegetables	4(13.3%)	Fruits/Vegetables	6(20%)
"Tuo Zaafi"	3(10%)	Beans/ Pigeon pea	4(13.3%)
"Fufu"	2(6.7%)	"Yoroyoro"	3(10%)
Rice	2(6.7%)	"Yema"	3(10%)
Groundnuts	2(6.7%)	Others	6(20%)
Others	13(43.3%)		

Focus group discussions	
Food likes	**Food dislikes**
Sweets	"Tuo Zaafi" with kuuka (baobab leaves)
Local beverage	

Food dislikes

I don't like "T.Z"

Source: [(Pupil) – Barchaborido]

"Yoroyoro", I don't like it

<div align="center">

Source: [(Pupil) – Gunsi]

</div>

Food likes

"Fufu" I like it so much

<div align="center">

Source: [(Pupil) – Naloogni]

</div>

Watermelon and orange because they are healthy

<div align="center">

Source: [(Pupil) – Sambu]

</div>

Table 4.16: Prominent themes on reasons for food choices (In-depth interviews)

Food likes Themes	Theme Frequency	Food dislikes Themes	Theme Frequency
Food intolerance	11(36.7%)	Food intolerance	7(23.3%)
Unhealthy	6(20%)	Fed up	6(20%)
Taste	2(6.7%)	Taste	4(13.3%)
		Food texture/appearance	3(10%)
		Lack of appetite	1(3.3%)

Focus group discussions

Food likes themes	Food dislike themes
Taste	Fed up
Satiety	Food texture
Food intolerance	

Food intolerance

Beans, am allergic to it. My stomach pains when I eat it

<div align="center">

Source: [(Pupil) – Kulinkpegu]

</div>

I like fufu but when I eat it my stomach pains

<div align="center">

Source: [(Pupil) – Nanundo]

</div>

Unhealthy

Alewa and other sweets are not good for me, I can fall sick

Taste

I don't like foods that taste bitter. Yellow melon and Knontomire, Shiwaka(bitterleaf), I don't like them because they are bitter. But the yellow melon is too sweet that's why I don't like it

Source: *[(Pupil) -- Sanzee]*

Yoroyoro, it is not delicious to me

Source: *[(Pupil) -- Kanimo]*

Fed up

Tz, I'm fed up of it because we eat it everyday

Source: *[(Pupil) – St Anthony]*

Food texture and appearance

Tukari/kuuka (baobab leaves), the soup they always prepare and I don't like how it is

Source: *[(Pupil) – Zapalsi]*

Yema, I don't like its nature

Source: *[(Pupil) – Sang]*

Satiety

I like toffees but it is a sweet, it can't satisfy me

Source: *[(Pupil) – Sambu]*

Shea fruits, when we go to the bush and I'm hungry and there is no food I eat them

Source: *[(Pupil) – Zapalsi]*

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CHAPTER FIVE

DISCUSSION

5.0. Introduction

This study's goals were to evaluate DD, food group consumption pattern, food habits and associated factors, and the reasons why adolescent girls eat the foods they eat in the Mion district of Northern Ghana. Using data from the Ten2Twenty Ghana study, the main findings were that the household size of the girls had a positive association with a higher DDS and girls from moderately/severely food insecure households had a lower odd of having a higher DDS. Older age of the girl correlated with reduced chance of eating breakfast more than 3 days weekly whereas crop diversity correlated with a higher odds of eating supper on both weekend days. Moderate/severe food insecurity was inversely associated with intake of animal-sourced foods (ASFs), fruits, and unhealthy foods but positively correlated with vegetable consumption in the past month. Maternal non-literacy was linked to a lower intake of unhealthy foods, while specific ethnic backgrounds negatively influenced ASFs intake. Lastly, the middle and upper quintiles of wealth demonstrated higher consumption of staples

5.1. Factors associated with dietary diversity among the 10-17 years adolescent girls in the Mion District of Ghana

The average DDS of the girls was 5.9 ± 1.2, which is in line with the 5.7 ± 1.1 found by Azupogo et al. (2023) in Northern Ghana but higher than the 4.9 ± 1.47 that was found in a previous study in Addis Ababa in Ethiopia (Worku et al., 2022). Also, about 90.6% of the girls met the MDD-W. Consistent with the findings of the present study, Worku et al. (2022) in their study on DD

among high school teenage females found that DD was high (56.7%) but the prevalence of high DDS in their study was less than the current findings (90.6%) The variation could be the result of both cultural and socio-demographic differences across the research environments (Akter et al., 2021; Worku et al., 2022).

The high attainment of the MDD-W among the girls (~90%) was largely due to their consumption of staples, ASF (meat, poultry, and fish) besides other vegetables, as revealed by the FFQ data. Notably, anchovies, often used in soups and sauces, was a common ASF in their diet, accounting for the high consumption of ASFs. However, despite anchovies being rich in micronutrients, their impact on micronutrient intake might be limited due to the small quantities typically consumed in these dishes, with studies suggesting a median intake of less than 5g/day. Additionally, the consumption of condiment vegetables like onions, garlic, and peppers was nearly daily, falling under the other vegetable food group. Given these observations, carrying out additional investigation to examine the connection between qualitative DDS and the micronutrient adequacy of the girls' diets would be beneficial.

Adolescents need a diverse diet because they require the vitality for both physical and mental development (Belachew et al., 2013). Research by Workicho et al. (2016) indicates that adequate DDS is linked to greater nutrient consumption and improved nutritional status in both high-income and LMICs. The findings from the present study show a positive correlation between the household size of the girls and an increased DDS. This finding was contrary to the literature which shows that a large family is a barrier affecting diet and food security (Codjoe et al., 2016; Powell et al., 2017). A larger family size results in higher demands on the adults in the household, increases their expenses on food, and decreases quantity, quality, and variety of foods consumed. Furthermore, there was a correlation found between inadequate dietary diversity and

a household size of five or more compared to adolescents in families smaller than five (Endalifer et al., 2021). Therefore, smaller households have a higher chance of an adequate DD than larger households.

However, from the results, 90.6% of the adolescent girls met the MDD-W and most of the girls belonged to larger family size. Household with most of their members employed could also be less poor, as a broader work force can participate in more agricultural practices, which can boost output or earnings from paid labour, thus enhancing their purchasing power and a higher DDS; this may explain the finding.

Household food insecurity puts family members' varied diets at risk. As the situation gets worse, it also impacts how food is distributed within households, usually with girls' diets being the first to be affected (Belachew et al., 2013). Food insecurity has been demonstrated to decrease individual-level intake of animal source food, fruits, and vegetables mostly because their total food expenditure is substantially lower than that of a food secure home (Abebe et al., 2023). Results from the current study showed that girls from moderately/severely food insecure homes were less likely to have a higher DDS. Consistent with the present results, earlier studies on dietary diversity and associated variables revealed that household food insecurity has an unfavourable impact on adolescent girls' DD, with girls from food-insecure households with a greater chance of lower DDS compared to girls from food-secure households (Tariku et al., 2019; Bancha et al., 2021; Worku et al, 2022). Again, Akter et al. (2021) found that teenagers from mild and moderate food insecured homes had a considerably increased chance of lower DDS than adolescents from food-secure households. This could be due to the fact that most rural communities' diets are predominantly starchy staples (cereals, grains, and tubers), as they cultivate these crops on subsistent basis to feed the family with little or no variety.

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5.2. Factors associated with dietary habits during weekdays and weekend days among the 10-17 years adolescent girls in the Mion District of Ghana

Breakfast refers to the first meal of the day, or a meal that is typically consumed in the early morning. Breakfast consumption is favourably correlated with children's and adolescents' nutrient adequacy (Nardone et al., 2020). The findings of multiple studies indicate that children and adolescents who regularly eat a healthy breakfast have better cognitive health, better nutritional status, and lower plasma cholesterol levels (Mahmood et al., 2021; Mathews & Nadorff, 2022). Interestingly, older age of the girl correlated with reduced odds of eating breakfast more than 3 days weekly in the current study. In conformity with the results of this study, Onyiriuka et al. (2013) revealed that breakfast was the most commonly skipped meal and 30% below 14 years 50% 14-16 years and 60% over 16 years adolescent girls skipped their meals. Also, results from Nardone et al. (2020) among Italian adolescents and Ostachowska-gasior et al. (2016) in Southern Poland indicated that growing older substantially increased the likelihood of skipping breakfast on school days. This could be because some adolescents no longer receive the same level of attention and care as children, which could explain their autonomous motivation and sense of control over their eating habits. Conversely, Ostachowska-gasior et al. (2016) reported that in high school, the proportion of teenagers who ate lunch declined drastically in relation to their age, with girls showing this trend the most. Mahmood et al. (2021) reported that children and adolescents do not take their breakfast because of unavailability and inaccessibility of food at home in the morning. The current research, found a correlation between food insecurity and a lower odd of consuming breakfast but a higher odd of eating lunch 3 or more days during the week; however, the association did not remain after including other possible explanatory variables.

Again, there was a correlation between crop diversification and a higher likelihood of having dinner on both weekends in the present study. Generally, supper or the evening meal is one of the most important and nutritious meals (Myhre et al., 2021). Adolescents' eating choices at home in the evening are influenced by a variety of circumstances. Adolescents' food consumption at home is primarily influenced by what adults provide and expect them to eat (Overcash et al., 2020).The positive correlation between crop diversity and the intake of supper on both weekend days is consistent with the general view that farm household's daily intake reflect the variety of crops they cultivate (Sibhatu et al., 2015). Currently, there is no research on the relationship between crop diversity and adolescent girls' consumption of supper on both weekend days, and it is unclear what mechanism underlies the association. Meanwhile, the crops cultivated by majority in Mion are cereals, and most rural homes also consume T.Z (made from either maize, millet or sorghum) for supper as confirmed by the study's qualitative results. This could explain the association between the different crops they cultivate and the consumption of supper as what is cultivated is expected to reflect in one's diet (Sibhatu et al., 2015).

5.3. Factors associated with frequency of consumption of some food groups among the 10-17 years adolescent girls in the Mion District, Ghana

ASFs consumption is known to provide the body with protein as well as small levels of vital micronutrients like iron, zinc, and vitamins, despite social, economic, and cultural barriers to its consumption. It has been demonstrated that insufficient or poor ASF intake throughout life is substantially linked to morbidity and mortality, poor physical growth, and reduced cognitive function (Workicho et al., 2016). Belonging to the Konkomba ethnic group was negatively correlated with consuming ASFs in the present study. Ethnicity plays a major role in the food choice and habits of populations. In Ghana, pregnant Ewe women for instance, detest consuming

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snails, okro, and ripe plantains. Among the Dagaare in northern Ghana, pregnant women are not allowed to eat baobab leaves, and offering protein products to their children, such as eggs and meat raises concerns that it could encourage theft (Codjoe et al., 2016). In contrast, Drewnowski et al. (2020) discovered that ethnicity was related to the consumption of animal protein, with Indians consuming more dairy products and eggs, Malaysians consuming more seafood, and Chinese people consuming more meat. ASF is typically consumed during extra-special family or public occasions in settings that are predominately rural since it is viewed as an enjoyable food rather than an essential component of the regular family diet (Penafiel et al., 2014); this could explain why the Konkomba ethnic group was inversely associated with consuming ASFs.

Household diets in developing nations typically consist of starchy staples with limited animal products and seasonal fruits and vegetables (Melaku et al., 2018). Food insecurity correlated with reduced intake of ASFs, as well as fruit intake but correlated with increased vegetable intake in the present study. Food insecurity has been demonstrated to decrease individual-level intake of ASFs, fruits, and vegetables mostly because of poor overall food expenditure compared to food secure homes (Abebe et al., 2023). Similar to the present finding, one study observed that households experiencing food insecurity had lower odds of consuming poultry, meat, eggs, milk, and milk products compared to those experiencing food security (Daba et al., 2021b). Also, among pregnant adolescent females, food insecurity status was found to be correlated with reduced consumption of products derived from animal sources (Akter et al., 2021). Moreso, ASFs and fruits are known to be more expensive in Ghana, which explains why ASFs and fruits are less likely to be purchased for household consumption, with vegetables preferred over fruits, because vegetables are common in soups and sauces which is eaten alongside staple foods (Meng et al., 2014; Colecraft et al., 2006).

Furthermore, members of low-income households prioritize meeting their fundamental energy needs from staple foods to end hunger within their food budget because they are unable to purchase foods derived from animals in the first place (Akter et al., 2021). Hence, lower SES serves as a risk factor for inadequate ASFs and fruits consumption among adolescents.

Maternal non-literacy was negatively correlated with eating of unhealthy items. In contrast with the findings from the present study, Moitra & Madan (2022), and Vicente-rodrı et al. (2011) discovered that girls whose moms were not well educated had a higher chance of consuming high-fat, energy-dense drinks, added sugar, and salty foods. Evidence indicates that children who have healthy lifestyles and make appropriate dietary choices are more likely to have mothers with high educational levels. Perhaps, higher maternal educational level predicts better nutritional awareness, dietary intake, and parenting behaviours (Ciardullo et al., 2023). However, the association between maternal non-literacy and the lower consumption of unhealthy foods could be explained by the fact from the study qualitative findings that most girls eat what is cooked at home mostly for breakfast and supper which is mainly cereal based and monotonous and only get to consume unhealthy foods out of home especially in school as they choose what to eat at lunch.

Furthermore, mild food insecure as well as moderately/severely food insecure correlated with a reduced consumption of unhealthy foods in the present investigation. Generally, teenagers that are food insecure have a higher probability of having inadequate nutrition, poor health, and issues with development, behaviours, school attendance, and bullying (Fram et al., 2022). Contrary to the present results, Facina et al. (2023) found household food insecurity to be correlated with reduced compliance to healthy eating patterns among teenagers, leading to worse dietary choices and a preference for unhealthy, energy-dense foods with low nutrient content.

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Additionally, people who are food insecure are more inclined to buy less nutrient-dense foods that are heavy in fat, sugar, and salt (Norasma et al., 2023). This is because individuals who are extremely hungry may choose foods high in energy to make up for periods when food is unavailable (Kelly et al., 2022). The correlation of food insecurity with reduced consumption of unhealthy foods could be explained by the general opinion that severely food insecure household are likely to be poor and may not have enough purchasing power to consume unhealthy foods.

Household socioeconomic status is a major predictor of poverty and is typically expressed in relation to income and consumer spending (Xie et al., 2023). The study area which falls within the rural setting has agriculture as their main source of livelihood with a low SES reflected in the low mean household wealth index. The main crops they cultivated included cereals, grains and tubers which is expected to reflect in their diets as they cultivate mostly on subsistence basis for consumption and sometimes for income. However, in this study, only girls in households in the middle and highest quintile (quintiles 3 and 5) were more likely to consume cereals, grains, and tubers; suggesting that the availability and accessibility of even staple foods were poor in the household. This also explains the rising incidence of household food insecurity.

The study was carried out during the beginning of the agricultural crop harvest; the peak harvest season typically occurs in October and November, suggesting that the majority of farm produce was still unavailable (Azupogo et al., 2023); hence, only households that had the purchasing power could consume cereals, grains and tubers. This may explain the findings of the current study. Additionally, the effects of low socioeconomic status on children's dietary intake of various food groups and nutrients have been extensively studied. In contrast to this study, a report by Angeles-agdeppa et al. (2019) on the variations in food group consumption by SES in adolescents aged 13 to 18 years revealed that teenagers from lowest socioeconomic backgrounds

ate more rice, pasta, and other grain products than adolescents from wealthier socioeconomic backgrounds.

5.4. Why adolescent girls eat the foods they eat

Adolescents may be inspired to adopt healthy eating habits if they believe that eating well would have immediate and noticeable health benefits, such as better skin, stronger muscles, and enhanced gut health (Liu et al., 2022). The study found that the dietary choice of most of the adolescent girls (46.7%) was influenced by self-perceived health considerations. Similarly, Jezewska-Zychowicz et al. (2017) found that Polish females who showed a high level of health concerns were more likely to consume healthier diets. Similarly, Sedibe et al. (2014) found that the consumption behaviour of adolescent girls was impacted by their perceptions of what constituted healthy diets, Witmer et al. (2011) in the United States of America revealed that females perceived health to be important in preventing future disease and thus developed dietary habits that they perceived would keep them healthy. Overall, health issues have a significant influence on teenage girls' dietary habits, which in turn affects their long-term health and wellbeing.

Food habits among adolescent girls can also be influenced by food availability (23.3%) as was found in the present study. The availability of healthy food options can significantly impact the eating habits of adolescent girls. Healthy home food availability has been strongly correlated with fruit/vegetable consumption and negatively correlated with soda and snack food consumption in adolescents (Loth et al., 2016). Similarly, Onyiriuka et al. (2013) found availability to significantly influence food habits of adolescent girls in Nigeria, with similar findings also made by Mama Chabi et al. (2022) in Benin republic, and Razzak et al. (2020) in

Bangladesh. However, limited access to nutritious food due to living in areas with poor food availability or poverty can lead to inadequate vital nutrients and a higher chance of malnutrition. Therefore, access to healthy food options is crucial in shaping the dietary habits of teenage girls and promoting their overall health and well-being (Brown et al., 2021; Setiawan et al., 2023).

Additionally, the present study found that cravings (16.7%) can significantly influence food habits among adolescent girls. Hoseini et al. (2023) found that the connection between food cravings and body image is closely tied to healthy dietary behaviours in teenage girls. Moreover, food addiction can exacerbate insane food cravings, making healthy eating a challenge for teens, especially for those who did not experience a food addiction prior to weight gain (J. Gandhi & Battalwar, 2019). Similarly, Le et al. (2023) found that increased trait food craving have been linked to the intake of harmful foods among teenage girls. Also, Abouchacra et al. (2021) found that what adolescent girls consumed was mainly based on what appeared appetizing, followed by availability and cravings. Therefore, it is important to address food cravings and their influence on food habits to promote healthy eating behaviours among adolescent girls.

Furthermore, taste (13.3%) was found to be a significant factor that influenced the food choices of adolescent girls. Adolescents' preference for sweet foods and snacks, as well as their taste liking, influence their consumption pattern. This is consistent with findings from Bawajeeh et al. (2022) in the United Kingdom, Mama Chabi et al. (2022) in Benin republic, Onyiriuka et al. (2013) in Nigeria and Kowalkowska et al. (2018) in Poland. Adolescents consider taste a significant factor when choosing foods. Personal differences in taste sensation may contribute to variations in food consumption, which in turn can impact health (A. B. Gandhi, 2022). Therefore, promoting healthy eating that considers taste preferences is essential for improving the dietary habits of adolescent girls (Mama Chabi et al., 2022).

Additionally, the findings showed that most adolescent girls eat what is cooked at home, hence the household food environment contribute in shaping adolescents' food choices. Adolescent nutrition quality and health indicators have been linked to external factors, including the sources and places of meals (Golper et al., 2021). Similar to the findings, results from Zhang et al. (2022) indicates a strong correlation between family food environment and food consumption; the healthier family food environment was, the higher the intake of fruits and vegetables and the lower the intake of SSBs among students. Meals cooked and eaten at home were overall, likely to be healthier than meals cooked and eaten away from home (Golper et al., 2021).

Adolescent girls also indicated being "fed-up" as a reason for food dislikes as they consume this foods almost all the time especially with "T.Z", because foods that are made available at meals are what adolescents are expected to eat (Fitzgerald et al., 2010). For instance, previous research has found that adolescents' diets are monotonous and comprised primarily of cereal-based diets (Gonete et al., 2020). This could explain the current finding, as most foods lack variety with food insecurity been a factor.

According to the Global School-based Student Health Survey, most teenagers globally eat less fruit and vegetables than the required amount, despite the WHO recommendation that they eat at least 5 servings per day (Salwa et al., 2021). As observed in this study, fruits and vegetable consumption were low as most girls disliked its consumption. It is suggested that healthy family meals are crucial in increasing F&V intake among teenagers and forming their dietary habits (Zhang et al., 2022). The cultural dietary patterns and affordability mentioned earlier may also explain why fruit intake and preference for fruits were lower than vegetable intake and preference in our study.

It is therefore essential to encourage adolescents to consume three balanced meals a day, with fruits or vegetables as snacks, and to provide them with access to nutritious snack foods. Additionally, increasing fibre in their diet, decreasing the use of salt, and avoiding high-sugar drinks can contribute to healthier eating habits. Parents and caregivers can also play a role in promoting healthy eating by involving adolescents in meal preparation, experimenting with foods from different cultures, and avoiding keeping unhealthy food options at home (A. B. Gandhi, 2022).

5.5. Strengths and Limitations of the Study

The present study has several strengths over earlier research of this kind. Firstly, the study employed a mixed methods approach (both quantitative and qualitative) including girl-level, maternal-level, and household-level explanatory variables.

Secondly, the study included several variables that could have influenced the association under investigation, such as demographic and girl-level characteristics (age, ethnicity, religion and menarche status), maternal-level factors (education, occupation, literacy, age, and decision-making index), household-level factors (wealth index, food security status, female-to-male ratio, Dependency ratio, literacy ratio and household size) and agriculture biodiversity of the household (crop farm diversity and animal farm diversity)

The study has some limitations as well. Firstly, the dietary intake data used were taken during the farm crop harvest period and food consumption can change during festivities and lean or bumper seasons hence, no seasonal variation in dietary intake was considered.

Secondly, there is a chance that some of the data such as meal habits, DD, and food insecurity in the home may be influenced by short-term memory bias. But when it came to food insecurity in

the home and food intake, the mother helped the girls when it was needed. Also, it must be noted that because the cross-sectional survey design was used, associations were estimated, and causality could not be inferred from the results.

Thirdly, among the covariates associated to mothers (education, occupation, literacy, age, and decision-making index), only literacy and decision- making index was included in the analysis as there were a lot of missing data for maternal education, age and occupation which were excluded thus, reducing the sample size from 1057 to 882. The missing data was occasioned by some of the interviewed girls not living with their biological mothers. Nevertheless, based on our sample size estimation, out study was well powered.

Again, the study considered only the cultural and socioeconomic aspects; however, there are numerous other sets of explanatory variables, such as behavioural and environmental ones, that may have predictive potential on dietary diversity, dietary habits, and consumption pattern among adolescent girls; this may explain the proportion of variance explained in most of our statistical models were less than 10%.

Finally, because only females from one district were sampled, the findings of this study might not be applied to males or to Ghana as a whole. Although female adolescents enrolled in school were chosen for the study, over 80% of adolescent girls in Ghana are now enrolled in school (UNESCO-Ghana, 2022) ; therefore, the study population may be broadly applied to all rural teenage females in northern Ghana and comparable environments.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1. Conclusions

The study revealed that almost all of the girls had adequate dietary diversity. Also, nearly all of the girls consumed all 3 meals (breakfast, lunch, and supper) for both weekends and weekdays and the mean consumption of cereals, grains, and tubers was the highest and the least consumed were fruits and unhealthy foods.

The findings further revealed that, dietary diversity, dietary habits and food group consumption pattern of adolescents girls are impacted by a number of factors including; the girls age, ethnicity, household food security status, SES of household, household size, maternal-non literacy and the different crops cultivated by households. Also, the focus group discussions and in-depth interviews provided a clear insight into why adolescents'girls eat what they eat including; health reasons, taste, cravings, availability and the satisfaction of hunger. Further research is necessary to gain a deeper understanding of how these factors affect the dietary intake of adolescent girls in LMICs.

6.2. Recommendations

Our observations indicate that implementing school-based nutrition programs, educational campaigns, food security and livelihood improvement as well as empowerment interventions could help improve the diet and overall health of adolescents. Thus, conducting further investigation to examine the correlation between qualitative DDS and the micronutrient adequacy of the girls' diets would be beneficial.

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