# Minimum dietary diversity and associated factors among children aged 6-23 months in Ghana: a cross-sectional study

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# Abstract

**Background:** The golden period in the first 1000 days of life is between the ages of 6 and 23 months. This period is referred to as a critical window because it promotes the optimal growth and development of the child. However, the nutritional status of children in this critical period is strongly influenced by their feeding patterns, which in turn has an impact on their survival. Inappropriate supplementary feeding techniques put children under the age of two at danger of malnutrition, illness, and death. This study therefore, assesses the minimum dietary diversity and its associated factors among children between the age 6-23 months in the Hohoe Municipality, in the Volta Region of Ghana.

**Methods:** A health facility-based cross-sectional study was conducted from April to July 2021. A multi-stage sampling technique was used to sample 422 study participants. Data were collected with a paper-based questionnaire, coded and entered into Epi-Data version 3.1. Data extraction was carried out in Excel Sheet for cleaning and then later exported into STATA V.16.0 for analysis. Logistic regression was fitted to identify significant factors associated with high MDD at 95% CI and a p-value < 0.05.

**Results:**Out of the 422 participants, majority of them 343 (81.0%) had good dietary practices. The prevalence of MDD among the children was 17.1%. On the other hand, the educational level of mothers [cOR=3.12 (95% CI: 1.57-6.19), p=0.001], their ethnicity [cOR=4.69 (95% CI: 1.55-14.19), p=0.006], their occupation [cOR=2.18 (95% CI: 1.15-4.11), p=0.017] and their dietary practices [cOR= 0.72 (95% CI: 0.13-3.92), p=0.008] were found to be significantly associated with children's MDD. After controlling for other co-variates, only educational level [aOR=3.16 (95% CI: 0.75-13.29), p=0.001] and ethnicity [aOR=24.72 (1.43-15.64), p=0.011] were statistically associated with children's high MDD.

**Conclusion:** The study concludes that while MDD was low among the children, breastfeeding was common but gaps existed in providing essential food groups, with significant influences from maternal education and ethnicity, highlighting the need for targeted interventions to enhance dietary practices for children aged 6-23 months.


# Background

The golden period in the first 1000 days of life is between the ages of 6 and 23 months (1) This period is referred to as a critical window because it promotes the optimal growth and development of the child (2). However, the nutritional status of children in this critical period is strongly influenced by their feeding patterns, which in turn has an impact on their survival (3). The World Health Organization (WHO) has developed recommendations for Infant and Young Child Feeding (IYCF) practices for children aged 6–23 months, including Minimum Dietary Diversity (MDD) as one of the core eight indicators (4). The WHO defined MDD "*as the consumption of four or more food groups from the seven food groups for higher dietary quality and to meet daily energy and nutrient requirements of the seven recommended food groups for children aged 6–23 months. These seven food groups were: grains, roots, and tubers; legumes and nuts; dairy products (milk, yogurt, cheese); flesh foods (meat, fish, poultry, and liver/organ meats); eggs; vitamin-A rich fruits and vegetables; other fruits and vegetables"* (5). This cut-off point was chosen because it has been linked to a higher quality diet in both children who are breastfed and non-breastfed children (6).

Globally, only a few children receive nutritionally appropriate and diversified diets. In many countries, fewer than one-fourth of infants aged 6–23 months meet the nutritional diversity and feeding frequency standards (7). Inappropriate supplementary feeding techniques put children under the age of two at danger of malnutrition, illness, and death (8). It is noteworthy that achieving MDD plays a pivotal role in the attainment of Sustainable Development Goals (SDG) (2, 3, and 4). The double burden of malnutrition is demonstrated, both by nutritional deficiencies (related to higher risk of infectious diseases) and overweight/obesity (associated with increased risk for non-communicable diseases), as a pandemic of gigantic proportions affecting a total of 4 billion people living in both developing and developed

countries (9, 10). According to WHO in 2020, 149 million children under 5 were estimated to be stunted (too short for age), 45 million were estimated to be wasted (too thin for height), and 38.9 million were overweight or obese worldwide (11).

Globally, around 5.9 million under-five age children die annually, majority of which reside in Africa, especially in sub-Saharan Africa including Ghana. Shockingly, undernutrition has been attributed to about 45% of child mortality globally (2, 11). In Ethiopia, according to the 2019 Ethiopia mini demographic and health survey (EMDHS) report, it was revealed that 7% of children under 5 years were wasted, 37% were stunted and 21% of all children were underweight (12). Similarly, to the data from the Ghana Demographic Health Survey (GDHS) in 2014, malnutrition has seen an overall increase across all age groups of children under the age of five in the past decade. The highest rate of malnutrition was observed in the 18–23 months age group in the year 2014. The malnutrition rate among children aged 0–11 months stood at 30.4%, which represents a significant surge from 4.9% in 2006. For children aged 12–23 months, the malnutrition rate escalated to 44.7% in 2014 compared to 10.1% in 2007. When analyzing regional variations, the Northern Region had the highest malnutrition rate at 43.8%, while the lowest rate of 11.9% was recorded in Greater Accra (13). A recent study conducted in Ghana found that MDD consumption was 35.3% (14).

However, several studies have investigated the factors linked to achieving MDD among children aged 6 to 23 months. Previous research has indicated that certain factors play a role in this context, such as maternal education (15, 16), the age of the child in months (17–19), child's sex (20), socioeconomic status of mother (15, 21) education status of mother (22, 23), and place of residence (24). These factors have been associated with the achievement of MDD in this age group, based on findings from previous studies. In the current study, we aimed to assess the minimum dietary diversity and its associated factors among children between the age 6–23 months in the study area.

# METHODS

## Study setting

The study was conducted in the Hohoe Municipality of the Volta Region of Ghana. The Municipality is one of the eighteen (18) districts in the Volta Region. The city of Hohoe, of which the district was named, serves as the capital and the administrative or local government centre. It shares borders with the Republic of Togo on the east; on the southeast by the Afadzato district and southwest by Kpando Municipality; on the north with Jasikan district; and on the northwest with the Biakoye districts. Its capital, Hohoe, is about 78 kilometers from Ho, the regional capital and 220km from Accra, the national capital. The Municipality consists of one hundred and two (102) communities with a population of 167,016 projected from the 2010 National Population Census.

## Study design and period

A health facility-based cross-sectional study design was carried out from April to July 2021 to assess the minimum dietary diversity and its associated factors among children between the age 6–23 months.

## Study population and participants

The study included all mothers of children aged 6 months to 23 months who were residents of the Hohoe Municipality and had come for immunization (Expanded Program on Immunization-EPI) at the Maternal and Child Health (MCH) clinic at the major health facilities of the two sub-districts randomly selected.

## Inclusion Criteria

Mothers with children aged 6–23 months who were residents of the Hohoe municipality and have given their informed consents to participate in the study were included. Additionally, the mothers should come for EPI at the MCH to be recruited to perticipate.

# Exclusion Criteria

Non-resident mothers, mothers seriously-ill on the day of data collection, and non-consenting mothers were excluded from the study. Mothers who did not come purposely for EPI at the MCH were also excluded.

# Variables of the study

# Outcome variable

The outcome variable of the current study was MDD. According to the WHO, MDD "*refers to the number of food groups consumed over a reference period; which is a proportion of infants and young children who consumed four or more food groups from the seven food groups in the previous 24 hours. Cereals, roots, and tubers; legumes and nuts; dairy products (milk, yogurt, and cheese); flesh items (meat, fish, poultry, and liver/organ meats); eggs; vitamin A-rich fruit and vegetables; and other fruits and vegetables were the seven dietary groups utilized to tabulate this indicato*r". Children were regarded to have met MDD if they obtained at least four food groups from the WHO's standard food categories without a minimum intake limitation during the reference period. On the other hand, children who received less than four food groups from the recommended groups of food categories were considered to have not met MDD (5).

# Explanatory variables

Ten (10) explanatory variables were considered in our estimations. The explanatory variables of the study included factors such as mothers' age (years), educational level, marital status, ethnicity, occupational status, religion, place of residence, sex of the child, age of the child (in months), and dietary practice.

# Sample size determination

The sample size for this study was calculated using a single proportion population formula by Cochran, (1997);
$n = \frac{z^2 p(1-p)}{d^2}$,

Parameters in the formula include;

n = Sample size to be determined

z = Z-score (95% confidence interval)

P = a proportion of 50% was used because no previous study had been conducted in the study area to provide an informed estimate.

d = precision or margin of error (0.05)

The reliability co-efficient used was 1.96 since the confidence interval is 95%.

Hence, sample size, $n$ = 384.16

Adjusting for an anticipated 10% non-response rate, an approximate minimum total of 422 mothers who met the inclusion criteria were included in this study.

# Sampling procedure

Multistage sampling technique was used to select the participants for the study. The first stage employed a simple random sampling to select two (2) sub-districts from the four (4) sub-districts in the Hohoe municipality (Lottery method). From the two sub-districts randomly selected, data was collected at their various major health facilities. At the second stage, for each health facility, the sample size was allocated proportionally to the total number of children aged 6–23 month who came for immunization at the MCH clinic; during the time period from 2nd April to 24th July, 2021. Finally, mothers who met the inclusion were randomly selected until the whole sample size was exhausted.

# Data collection procedure

Data were collected with a paper-based questionnaire by using a 24-hour recall method. This basically allowed the mothers to recall the type of food items they fed their child within the previous 24 hours. The questionnaire was designed in the official language (English) but the questions were explained in both English and the local dialects (Ewe, and Akan) without changing the context. This was to give the participants a better understanding. The questionnaire was in sections A, B, C and D. The section A contained items used to collect socio-demographic information of the participants. The section B of the questionnaire included questions that measured participants' dietary practices. The questions were adopted from the WHO indicators for assessing IYCF practices (5). The sections C and D assessed the dietary diversity using a 24hour dietary recall. In determining the overall MDD among the children, children who had eaten from at least 4 food groups of the 7 MDD food groups within the past 24 hours were classified as having "high minimum dietary diversity" and children who ate from less than 4 food groups of the 7 MDD food groups were classified to have "low minimum dietary diversity" (25, 26).

# Statistical analysis

The collected data were coded and entered into Epi-Data version 3.1. Data extraction was carried out in Excel Sheet for cleaning and then later exported into STATA V.16.0 (Stata Corp. 2019. Stata Statistical Software: Release 16. College Station, TX: Stata Corp LLC.) for analysis. To ensure the quality of the data extracted, double entry was done in Epi-Data to address discrepancies which may have occurred during extraction. A confidence interval of 95% was used in the Pearson's Chi-Square test. Normality tests was done to ensure that all the quantitative data were normally distributed. Descriptive statistical analysis, which included frequency, mean, standard deviation (SD) and percentages, was used to characterize the data. Findings were presented in tables, graphs and charts. A bivariate logistic regression was then performed to examine the association between each independent and dependent variable. Variables that showed significant associations based on the assumptions were considered for multivariate logistic regression. Finally, in multivariate logistic regression, significant variables were identified at a $p$-value < 0.05.

# RESULTS

In this study, a total of 422 mothers were interviewed. The ages of the mothers were categorized into mothers aged 24 years and below, 25–29 years, and 30 or more years. Out of the 422 mothers, majority of them 153 (36.3%) were 30 or more years. A large proportion 177 (41.9%) of them indicated to have had JHS as their highest level of education and most 257 (60.9%) of the mothers belonged to the Ewe ethnic group. A large proportion 272 (64.5%) of the mothers were self-employed and a significant majority 293 (69.4%) were Christians. Furthermore, prominent 322 (76.3%) among them were married. The majority 113 (26.8%) of the mothers were residents of Zongo (Table 1).

Table 1
Distribution of the socio-demographic characteristics of respondents.

| Characteristics | Frequency (n = 422) | Percentage (%) |
|---|---|---|
| **Age SD (27.79± 5.95)** | | |
| ≤ 24 | 125 | 29.6 |
| 25–29 | 144 | 34.1 |
| ≥ 30 | 153 | 36.3 |
| **Educational Level** | | |
| None | 18 | 4.3 |
| Primary | 42 | 10.0 |
| JHS | 177 | 41.9 |
| SHS | 126 | 29.9 |
| Tertiary | 59 | 14.0 |
| SHS | 126 | 29.9 |
| Tertiary | 59 | 14.0 |
| **Ethnicity** | | |
| Ewe | 257 | 60.9 |
| Akan | 49 | 11.6 |
| Guan | 42 | 10.0 |
| Ga-Adamgbe | 28 | 6.6 |
| Other[1] | 46 | 10.9 |
| **Marital Status** | | |
| Never married | 68 | 16.1 |
| Married | 322 | 76.3 |
| Divorced/separated | 2 | 0.5 |
| Other[2] | 30 | 7.1 |
| **Occupation** | | |
| Student | 19 | 4.5 |
| Unemployed | 65 | 15.4 |
| Government employed | 66 | 15.6 |
| Self employed | 272 | 64.5 |
| **Religion** | | |

| Characteristics | Frequency (n = 422) | Percentage (%) |
|---|---|---|
| Christian | 293 | 69.4 |
| Muslim | 110 | 26.1 |
| Traditionalist | 14 | 3.3 |
| No religion | 5 | 1.2 |
| **Residence** | | |
| Ahado | 75 | 17.7 |
| Blave | 43 | 10.2 |
| Gbi-Abansi | 34 | 8.1 |
| Gboxome | 76 | 18.0 |
| Kitikpa | 13 | 3.1 |
| Oklahoma | 12 | 2.8 |
| Segbedeme | 32 | 7.6 |
| Zongo | 113 | 26.8 |
| Kpoeta | 24 | 5.7 |
| **Size of household** | | |
| 1–5 | 313 | 74.2 |
| 6–10 | 103 | 24.4 |
| 11–15 | 4 | 1.0 |
| 16–20 | 2 | 0.5 |
| [1]Krobo, Kusasi, [2]Widowed/Cohabiting | | |

# Characteristics of children aged 6–23 months

The distribution of characteristics of the children were shown in Table 2 below. In addition to the 422 mothers who participated in the study, the child of each of the mothers was considered in the study. Of these 422 children, 239 (56.6%) were males and most 209 (49.5%) of the children were 6–11 months old.

Table 2
Characteristics of children aged 6–23 months.

| Characteristics | Frequency (n = 422) | Percentage (%) |
|---|---|---|
| *Sex of current child* | | |
| Male | 239 | 56.6 |
| Female | 183 | 43.4 |
| **Age in months (mean 12.50; Sd 4.90)** | | |
| 6–11 months | 209 | 49.5 |
| 12–17 months | 114 | 27.0 |
| 18–23 months | 99 | 23.5 |

# Type of minimum dietary diversity foods given to child

The table below presented the type of minimum dietary diversity foods mothers fed their children. To determine the MDD among the children, mothers were asked to briefly recall the seven MDD food groups from which their child had eaten from in the past 24 hours. A significant majority 374 (88.6%) of the mothers agreed to have given their children breastmilk in the last 24 hours against 48 mothers (11.4%) who did not. It was reported that most 295 (69.9%) of the mothers did not give their children an egg in the previous 24 hours. A large proportion 250 (59.2%) of them gave their children either grain, root or tubers in the last 24 hours. Mothers who indicated to have given their children legumes and nut were about 94 (22.3%) and a comparative majority of them gave their children flesh food thus; 267 (63.3%). Predominant among the mothers indicated to have not given their children any dairy product, vitamin-A rich fruits or vegetables, and any other fruit nor vegetable thus 339 (80.3%), 387 (91.7%), and 274 (64.9%) respectively (Table 3).

Table 3
Type of minimum dietary diversity foods given to child.

| Food groups | Frequency (n = 422) | Percentage (%) |
|---|---|---|
| ***Breastmilk*** | | |
| Yes | 374 | 88.6 |
| No | 48 | 11.4 |
| **Eggs** | | |
| Yes | 127 | 30.1 |
| No | 295 | 69.9 |
| **Grains, roots and tubers** | | |
| Yes | 250 | 59.2 |
| No | 172 | 40.8 |
| **Legumes and Nuts** | | |
| Yes | 94 | 22.3 |
| No | 328 | 77.7 |
| **Flesh foods** | | |
| Yes | 267 | 63.3 |
| No | 155 | 36.7 |
| **Dairy Products** | | |
| Yes | 83 | 19.7 |
| No | 339 | 80.3 |
| **Vitamin-A rich Fruits and Vegetables** | | |
| Yes | 35 | 8.3 |
| No | 387 | 91.7 |
| **Other fruits and vegetables** | | |
| Yes | 148 | 35.1 |
| No | 274 | 64.9 |

The figure below showed the MDD among children 6–23 months in the Hohoe municipality. In determining the overall MDD among the children, children who had eaten from at least 4 food groups of the 7 MDD food groups within the past 24 hours were classified as having “high minimum dietary diversity” and children who ate from less than 4 food groups of the 7 MDD food groups were classified to have “low minimum dietary diversity” (25, 26). Of the 422 children, 72 (17.1%) of them had “high minimum dietary diversity” as compared to the 350 (82.9%) others who had “low minimum dietary diversity score”.

The prevalence of MDD of the children was calculated using the formulae;

$$= \frac{Numberofchildren6-23monthsofagewhoatefoodsfrom5ormorefoodgroupinthepast24hours}{children6-23monthsofageforwhomdataonbreastfeedinganddietwerecollected} x100\%$$

Thus: Prevalence of MDD$= \frac{72}{422} x100\%$. (5).

Therefore, the prevalence of MDD among children aged 6–23 months was 17.1% (Fig. 1).

**Fig 1**

Minimum dietary diversity among children 6-23 months.

# Dietary practices of mothers

Regarding the dietary practices of the mothers as presented in Table 4 below, they were assessed based on series of questions asked. Of all the 422 mothers, more than ninety percent 410 (97.2%) of them agreed to have introduced other foods apart from breastmilk to the child where almost all 421 (99.76%) of them indicated to have started this practice when the child was 6-11months old. A significant majority 377 (89.3%) of the mothers said they still breastfeed their children and almost all 387 (91.71%) of them said they will stop breastfeeding their children when they are 18-23months old. The most common complementary food introduced by the mothers was porridge 275 (65.2%) and a large portion 303 (71.8%) of them indicated they introduced complementary foods because their child was 6 months old. Furthermore, mothers who agreed to have given their children any food apart from breastmilk the previous day were 391 (92.7%).

Table 4
Dietary practice of respondents

| Variable | Frequency (n = 422) | Percentage (%) |
|---|---|---|
| ***Have you introduced any food part from breast milk to your child?*** | | |
| Yes | 410 | 97.2 |
| No | 12 | 2.8 |
| **What age did you introduce other foods apart from breastmilk to your child?** | | |
| 6–11 months | 421 | 99.8 |
| 12–17 months | 0 | 0.0 |
| 18–23 months | 1 | 0.2 |
| **Is your still child breastfeeding?** | | |
| Yes | 377 | 89.3 |
| No | 45 | 10.7 |
| **At what age do you intend to stop breastfeeding your child?** | | |
| 6–11 months | 6 | 1.4 |
| 12–17 months | 29 | 6.9 |
| 18–23 months | 387 | 91.7 |
| **What food did you give to the child at the start of complementary foods?** | | |
| Is your still child breastfeeding? | | |
| Yes | 377 | 89.3 |
| No | 45 | 10.7 |
| **What was your reason for introducing food to your child?** | | |
| Breast milk was no longer sufficient | 73 | 17.3 |
| Because child was 6 months old | 303 | 71.8 |
| Others | 46 | 10.9 |
| **Did your child receive any food apart from milk yesterday?** | | |
| Yes | 391 | 92.7 |
| No | 31 | 7.3 |

The figure below showed the overall dietary practice of the respondents. The overall dietary practice was categorized into three groups: thus “poor dietary practices”, “average dietary practices”, and “good dietary practices”. These categories were determined based on the summation of the responses to the questions; “*have you introduced any food part from breast milk to your child?”, “is your still child breastfeeding?”, and “did your child receive any food apart from milk yesterday?”.* The summation of the responses to the question was scored over 3 points. Mothers who

scored 1 out of the 3 points were categorized under “poor dietary practices”. Similarly, mothers who scored 2 out of 3 and 3 out of 3 were categorized as “average dietary practices” and “good dietary practices” respectively. Among the 422 mothers, 9 (2.0%) of the mothers had poor dietary practices, 70 (17.7%) had average dietary practices and the majority 343 (80.3%) had good dietary practices (Fig. 2).

**Figure 2**

Dietary practices among mothers.

# Factors associated with MDD among children aged 6–23 months

In an association test using Pearson’s Chi-square, the educational level of mothers, their ethnicity, their occupation and their dietary practices were found to be significantly associated with children’s MDD with χ2/p-value of 14.0396/0.007, 14.7567/0.005, 7.5546/0.050 and 0.1753/0.006 respectively.

Furthermore, a bivariate analysis using logistic regression was performed. It was found that there was a significant association between educational level of mothers and MDD among children [cOR = 3.12 (95% CI: 1.57–6.19), p = 0.001]. However, when other characteristics were adjusted for in a multivariate analysis, it was further revealed that children whose mothers had obtained tertiary education were 3 times more likely to have acquired a high MDD thus consuming 4 or more food items from the 7 MDD food groups compared to the children of mothers with low level of education [aOR = 3.16 (95% CI: 0.75–13.29), p = 0.001]. The study also found a significant association between Ethnicity and MDD [cOR = 4.69 (95% CI: 1.55–14.19), p = 0.006]. The odds of a child whose mother belong to other ethnic groups (*Krobo, Kusasi*) obtaining a high MDD was 25 times more likely compared to mothers that belong to Ewe, Akan, Guan or Ga-Adamgbe ethnic groups [aOR = 24.72 (1.43–15.64), p = 0.011].

Similarly, mothers’ occupation was also significantly associated with their child’s MDD. The probability of a child obtaining a high MDD by mothers who were government employed was 2 times more likely as compared to mothers who are not government workers [cOR = 2.18 (95% CI: 1.15–4.11), p = 0.017]. However, after adjusting for all other characteristics in a multivariate regression, mothers’ occupation was no more significantly associated with high MDD. Furthermore, children whose mothers scored average dietary practices [cOR = 0.72 (95% CI: 0.13–3.92), p = 0.008] were significantly less likely to have obtained a high MDD score compared to their counterparts. But after adjusting for all other co-variates, dietary practice was no more significantly associated with high MDD. (Table 5).

Table 5
Factors associated with minimum dietary diversity among children aged 6–23 months

| Variable | Minimum dietary diversity | | χ2 /p-value | cOR (95% C.I), p-value | aOR (95% C.I), p-value |
|---|---|---|---|---|---|
| | Low MDD n (%) | High MDD n (%) | | | |
| **Age SD (27.79± 5.95)** | | | 3.8177/0.148 | | |
| ≤ 24 | 105 (84.0%) | 20 (16.0%) | | **Ref** | **-** |
| 25–29 | 125 (66.8%) | 19 (13.2%) | | 0.80 (0.40–1.57), 0.515 | - |
| ≥ 30 | 120 (78.4%) | 33 (21.6%) | | 1.44 (0.78–2.67), 0.241 | - |
| **Educational Level** | | | **14.0396/0.007*** | | |
| None | 15 (83.3%) | 3 (16.7%) | | 1.22 (0.33–4.51), 0.770 | - |
| Primary | 35 (83.3%) | 7 (16.7%) | | 1.22 (0.49–3.04), 0.675 | - |
| JHS | 152 (85.9%) | 25 (14.1%) | | **Ref** | **-** |
| SHS | 109 (86.5%) | 17 (13.5%) | | 0.95 (0.49–1.84), 0.875 | - |
| Tertiary | 39 (66.1%) | 20 (33.9%) | | **3.12 (1.57–6.19), 0.001*** ** | **3.16 (0.75–13.29), 0.001*** ** |
| **Marital Status** | | | 4.4824/0.214 | | |
| Never married | 6 (8.8%) | 62 (91.2%) | | 0.48 (0.14–1.73), 0.264 | - |
| Married | 61 (18.9%) | 261 (81.1%) | | 1.17 (0.43–3.18), 0.760 | - |
| Divorced/separated | 0 (00.0%) | 2 (100%) | | 1 | - |
| Other (*Widowed/Co-habiting*) | 5 (16.7%) | 25 (83.3%) | | **Ref** | **-** |
| **Ethnicity** | | | **14.7567/0.005*** | | |
| Ewe | 217 (84.4%) | 40 (15.6%) | | 1.62 (0.61–4.34), 0.336 | - |
| Akan | 44 (89.8%) | 5 (10.2%) | | **Ref** | **-** |
| Guan | 33 (78.6%) | 9 (21.3%) | | 2.40 (0.74–7.83), 0.147 | - |

| Variable | Minimum dietary diversity | | χ2 /p-value | cOR (95% C.I), p-value | aOR (95% C.I), p-value |
|---|---|---|---|---|---|
| | Low MDD n (%) | High MDD n (%) | | | |
| Ga-Adamgbe | 26 (92.9%) | 2 (7.1%) | | 0.68 (0.12–3.74), 0.655 | - |
| Other (*Krobo, Kusasi*) | 30 (65.2%) | 16 (34.8%) | | **4.69 (1.55–14.19), 0.006*** | **4.72 (1.43–15.64), 0.011*** |
| **Occupation** | | | **7.5546/0.050*** | | |
| Student | 14 (73.7%) | 5 (26.3%) | | 2.07 (0.71–6.07), 0.184 | - |
| Unemployed | 56 (85.2%) | 9 (13.8%) | | 0.93 (0.43–2.03), 0.860 | - |
| Government employed | 48 (72.7%) | 18 (27.3%) | | **2.18 (1.15–4.11), 0.017*** | - |
| Self employed | 232 (85.3%) | 40 (14.7%) | | **Ref** | **-** |
| **Religion** | | | 3.5431/0.315 | | |
| Christian | 240 (81.9%) | 53 (18.1%) | | 2.87 (0.37–22.43), 0.315 | - |
| Muslim | 94 (85.5%) | 16 (14.5%) | | 2.21 (0.27–18.10), 0.459 | - |
| Traditionalist | 13 (92.9%) | 1 (7.1%) | | **Ref** | **-** |
| No religion | 3 (60.0%) | 2 (40.0%) | | 8.67 (0.57-130.11), 0.118 | - |
| **Residence** | | | 9.4313/0.307 | | |
| Ahado | 59 (78.7%) | 16 (21.3%) | | **Ref** | **-** |
| Blave | 37 (86.1%) | 6 (13.9%) | | 0.60 (0.21–1.67), 0.325 | - |
| Gbi-Abansi | 29 (85.3%) | 5 (14.7%) | | 0.64 (0.21–1.91), 0.419 | - |
| Gboxome | 60 (78.9%) | 16 (21.1%) | | 0.98 (0.45–2.15), 0.966 | - |
| Kitikpa | 9 (69.3%) | 4 (30.7%) | | 1.64 (0.45–6.02), 0.457 | - |
| Oklahoma | 12 (100%) | 0 (00.0) | | 1 | - |
| Segbedeme | 30 (93.7%) | 2 (6.3%) | | 0.25 (0.05–1.14), 0.073 | - |

| Variable | Minimum dietary diversity | | χ2 /p-value | cOR (95% C.I), p-value | aOR (95% C.I), p-value |
|---|---|---|---|---|---|
| | Low MDD n (%) | High MDD n (%) | | | |
| Zongo | 95 (84.1%) | 18 (15.9%) | | 0.70 (0.33–1.48), 0.347 | - |
| Kpoeta | 19 (79.2%) | 5 (20.8%) | | 0.97 (0.31-3.00), 0.958 | - |
| **Sex of current child** | | | 0.9728/0.324 | | |
| Male | 202 (84.5%) | 37 (15.5%) | | 0.77 (0.47–1.29), 0.325 | - |
| Female | 148 (80.9%) | 35 (19.1%) | | **Ref** | **-** |
| **Age of child in months** | | | 0.9190/0.632 | | |
| 6–11 months | 177 (84.7%) | 32 (15.1%) | | **Ref** | **-** |
| 12–17 months | 93 (81.6%) | 21 (18.4%) | | 1.25 (0.68–2.29), 0.471 | - |
| 18–23 months | 80 (80.8%) | 19 (19.2%) | | 1.31 (0.70–2.46), 0.393 | - |
| **Dietary practices** | | | **0.1753/0.006*** | | |
| Poor dietary practices | 7 (77.8%) | 2 (22.2%) | | **Ref** | **-** |
| Average dietary practices | 58 (82.9%) | 12 (17.1%) | | **0.72 (0.13–3.92), 0.008*** | - |
| Good dietary practices | 285 (83.1%) | 58 (16.9%) | | 0.71 (0.14–3.52), 0.677 | - |

**χ2**: chi-square, **aOR**: adjusted odds ratio, **CI**: confidence interval, **cOR**: crude odds ratio, **Ref**: Reference point; ***p < 0.05; ***p ≤ 0.001**

# Discussion

Inappropriate supplementary feeding techniques put children under the age of two at danger of malnutrition, illness, and death (8). To avert the dire consequences this might have on young children, the WHO has developed recommendations for Infant and Young Child Feeding practices for children aged 6–23 months, including MDD as one of the core eight indicators (4). In our study, we assessed the MDD and associated factors among children aged 6–23 months in the Hohoe Municipality, in the Volta Region of Ghana. Finding from the study revealed that only 17.1% (72 children) had achieved minimal dietary diversity within 24 hours preceding the study. This proportion contrasts with earlier studies in India and Ethiopia (7, 17, 18, 27), as well as Burkina Faso (28), where higher percentages were reported. However, in comparison to studies in Pakistan (29), India (30), (Sri Lanka, Nepal, and Bangladesh) (18), Ethiopia (31), Nigeria (32), Tanzania (33), and Ghana (14, 34), the current study's findings indicate a relatively lower prevalence of MDD. The observed variations in MDD rates among children could be attributed to a

complex interplay of cultural, socioeconomic, geographical, and healthcare-related factors, as well as differences in data collection methods across the different studies in these regions.

This study revealed that a substantial majority of mothers, specifically 374 (88.6%), reported providing breast milk to their children within the past 24 hours. Conversely, the consumption of eggs in the previous 24 hours was reported by only 127 (30.1%) mothers. Notably, a significant proportion of 250 (59.2%) mothers offered their children foods such as grains, roots, or tubers within the same timeframe. In comparison, a study carried out in Ethiopia documented a comparatively elevated percentage (35). The difference in feeding practices among mothers can be attributed to a combination of cultural, economic, knowledge-based, and contextual factors that shape dietary choices for their children which could have contributed to the observed variations in these populations.

Additionally, the study reported a low consumption of Vitamin-A rich vegetables and fruits 387 (91.7%) among children aged 6–23 months. This could potentially be attributed to the prohibitively high cost, rendering them inaccessible to individuals residing in economically challenged households in Ghana. Additionally, caregivers might lack the necessary knowledge on effectively incorporating these essential dietary components into meals, highlighting the need for educational interventions, as emphasized in a study by (36). When contrasted with earlier studies conducted in Central America (37), Uttar Pradesh (38), Ethiopia (39), and Ghana (34), the pattern of diminished consumption of vegetables and fruits remained consistent.

An additional finding from this study revealed that a substantial majority 343 (80.3%) of mothers exhibited a good dietary practice for their children. In comparison to earlier research, this particular finding outperformed the results of a study conducted in Ethiopia (35). The disparity observed between the two different regions can be attributed to cultural and dietary distinctions, varying economic conditions, differences in nutritional awareness and education, government policies, food availability, sample characteristics, and methodological variations.

According to our study, educational level of mothers had a significant association with MDD of children. Children whose mothers had obtained tertiary education were 3 times more likely to have acquired a high MDD thus consuming 4 or more food items from the 7 MDD food groups compared to the children of mothers with low level of education [aOR = 3.16 (95% CI: 0.75–13.29), p = 0.001]. This aligns with similar findings from researches conducted in Uttar Pradesh (38), Nepal (40), Sri Lanka (41), and Ethiopia (7, 18). This correlation can be explained by the fact that mothers with higher education levels often have better access to information about nutrition and child care, enabling them to make informed decisions about their children's diets. Additionally, higher education may enhance mothers' ability to understand the nutritional needs of their infants and incorporate a wider variety of foods into their diets. Educated mothers are more likely to engage in health-seeking behaviors and adhere to recommended feeding practices, contributing to the observed positive outcomes in MDD. The consistency of these findings across the different regions and cultures underscores the universal importance of maternal education in fostering optimal infant feeding practices and ultimately promoting child health and development.

Furthermore, our study uncovered a noteworthy correlation between ethnicity and high MDD. The likelihood of a child, whose mother identified with different ethnic groups *(such as Krobo or Kusasi)*, achieving a high MDD was found to be 25 times greater in comparison to mothers from Ewe, Akan, Guan, or Ga-Adamgbe ethnic backgrounds [aOR = 24.72 (1.43–15.64), p = 0.011]. This finding aligns with a prior study conducted in Nepal, which demonstrated that children from *(Dalits and Janajati)* ethnic groups had a higher odds ratio of not meeting the MDD compared to those from the *(Brahmin/Chhetri)* ethnic group (42). Similarly, another study in Nepal indicated that children from the *(Brahmin/Chhetri)* ethnic group were more likely to receive a variety of food groups compared to those from other caste/ethnic groups (40). The reason for the correlation across these studies can be attributed to the distinct cultural

and dietary practices among different ethnic groups, varying levels of access to nutritional resources, traditional knowledge of locally available nutritious foods, socioeconomic influences, differences in healthcare access and education, geographical availability of diverse foods, as well as the impact of public health interventions.

# Implications for policy and practice

The current study highlights the need for the integration of nutrition counseling and guidance within routine antenatal (ANC) and postnatal (PNC) care visits. This approach will ensure that mothers receive timely and accurate information on optimal feeding practices, starting from pregnancy through the early childhood years. The strong association between maternal education, ethnicity and children's dietary diversity highlights the need for educational interventions targeting mothers, especially those with lower levels of education as well as culturally sensitive interventions. Comprehensive public awareness campaigns can raise awareness about the importance of dietary diversity for child health and development. These campaigns can leverage various communication channels, including mass media, social media, community events, and local networks, to reach caregivers and influence positive behavior change. These interventions can be integrated into existing maternal and child health services to reach a wider audience. The implications drawn from this study emphasize the need for multifaceted and context-specific approaches to improve infant and young child feeding practices. By addressing them we can work together to promote optimal nutrition for children aged 6–23 months, contributing to better health outcomes and overall well-being.

# Strengths and limitations of the study

The strength of the study lies in the utilization of the standardized tools and methodologies as well as the rigorous statistical analysis employed in the study. However, the study identified some limitations which must be acknowledged. The study's reliance on maternal recall of dietary practices over the past 24 hours introduces potential recall bias, as memory may not accurately capture all details, leading to underreporting or overestimation of certain food groups. Additionally, respondents may have provided answers that they perceived as socially desirable, potentially leading to an overestimation of positive feeding practices. Despite multivariate regression analysis, there may be unmeasured confounding factors not accounted for in the study that could influence the observed associations.

# Conclusion

In conclusion, the study found that only 17.1% children achieved MDD within the past 24 hours, which is relatively lower compared to some other regions. Breastfeeding was prevalent, but there were gaps in providing other essential food groups such as eggs, vegetables, and fruits. Notably, maternal education and ethnicity had a significant impact on children's MDD. These findings underscore the importance of maternal education and ethnic background in influencing children's dietary diversity. The results also highlight the need for targeted interventions to improve dietary practices among children aged 6–23 months, considering cultural, economic, and educational factors. These findings contribute to the broader understanding of factors affecting child nutrition and can guide future public health efforts to enhance infant feeding practices and overall child well-being.

# Abbreviations

**ANC**
Antenatal Care
**EPI**

Expanded Program on Immunization

**EMDHS**

Ethiopia Mini Demographic and Health Survey

**GDHS**

Ghana Demographic and Health Survey

**IYCF**

Infant and Young Child Feeding

**MCH**

Maternal and Child Health care

**MDD**

Minimum Dietary Diversity

**PNC**

Postnatal Care

**SDGs**

Sustainable Development Goals

**UNICEF**

United Nations International Children's Emergency Fund

**WHO**

World Health Organization

# Declarations

### Ethics approval and consent to participate

All methods were in accordance with the Declaration of Helsinki. The University of Health and Allied Sciences Research Ethics Committee (UHAS-REC) reviewed the study and approved it with a reference [ID: **UHAS-REC A.12 [112] 20-21**]. Permission was also obtained from the Hohoe Municipal Health Directorate before the commencement of the study. During data collection, permission was also sought from all the in-charges of the facilities where data was collected. The study did not directly involve the children therefore, a written informed consent was obtained from all mothers before the administration of the questionnaire.

### Consent for publication

Not applicable.

### Availability of data and materials

All data generated or analyzed during the current study are available from the corresponding author on reasonable request.

### Competing interests

The authors declare no conflict of interest as defined by BMC, or other interests that might be perceived to influence the results and/or discussion reported in this paper.


### Funding

No funding

### Authors' contributions

PSA and SS conceived and designed the study. PSA conducted the entire research work. SS wrote the initial and the final drafts of the manuscript. All authors read and approved the final manuscript.

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## Figures

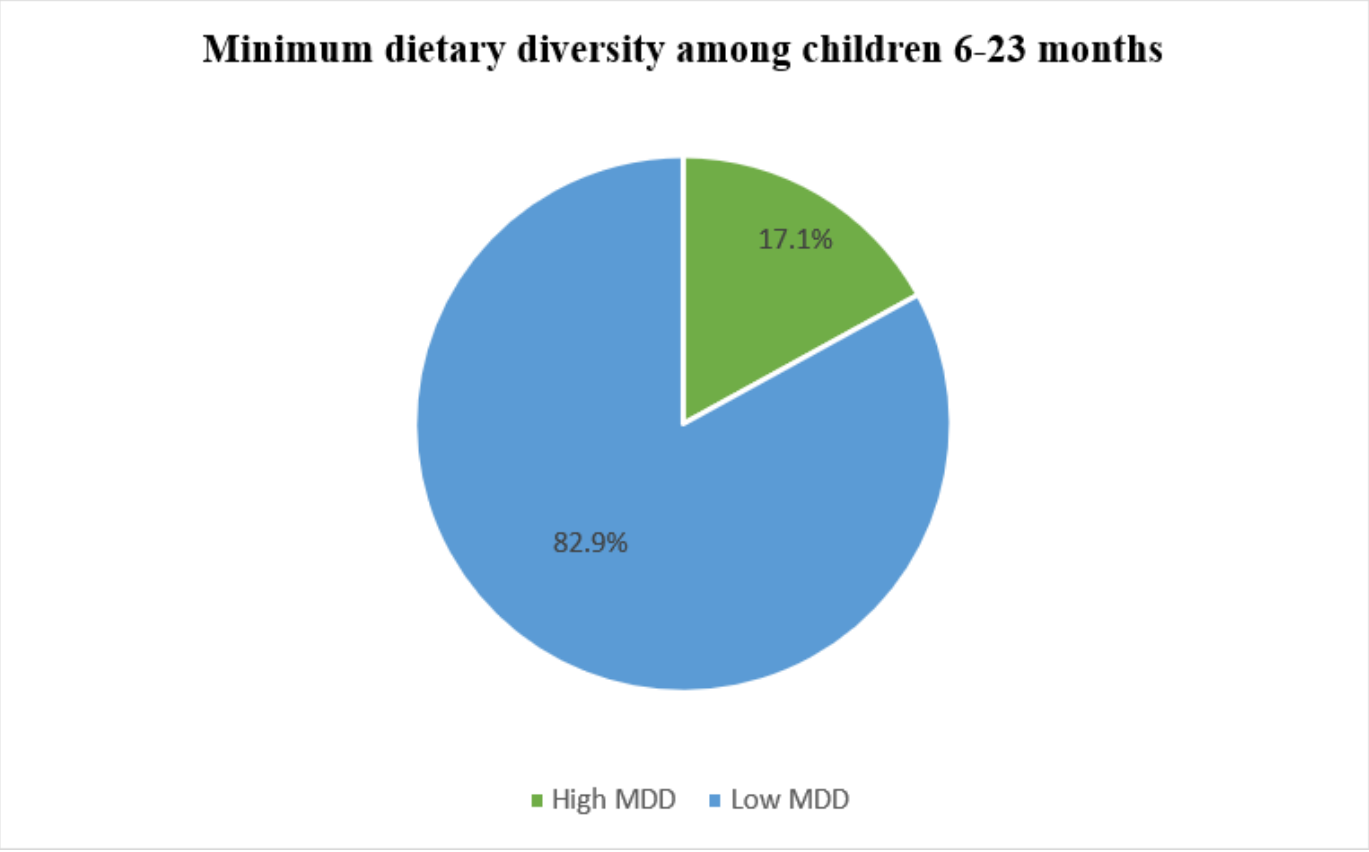

**Figure 1**

Minimum dietary diversity among children 6-23 months.

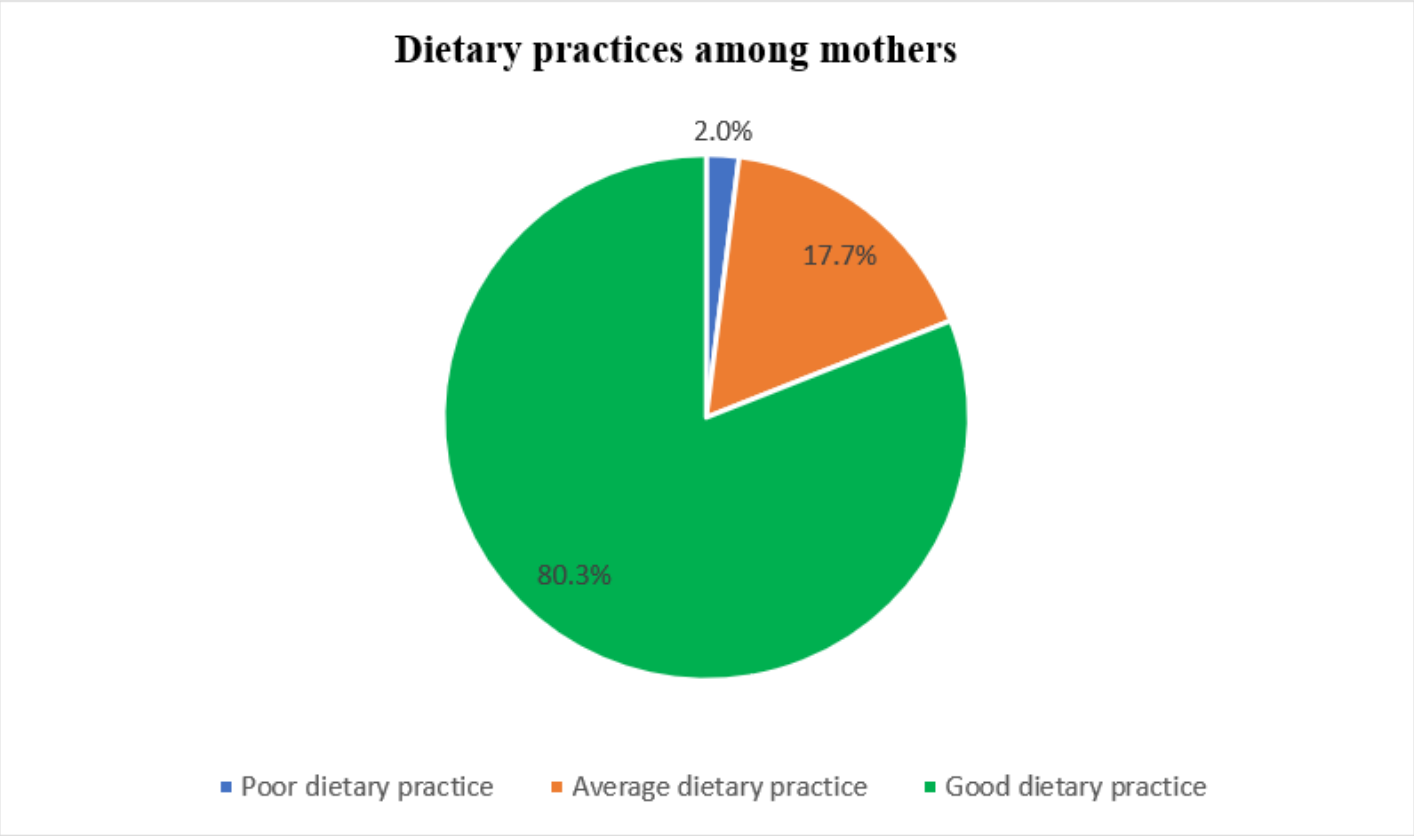


**Figure 2**

Dietary practices among mothers.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Additionalfile1Datacollectionquestionnaire.pdf