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Minimum dietary diversity behaviour among children aged 6 to 24 months and their determinants: insights from 31 Sub-Saharan African (SSA) countries

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Abstract

Background Feeding practices during infancy have a significant impact on a child's cognitive development and long-term health outcomes. Dietary diversity guidelines from the WHO and UNICEF recommend a diverse range of foods for children aged below 24 months for their optimal growth and development. However, in sub-Saharan Africa (SSA), little is known about the extent to which dietary diversity behaviour in children aged 6 to 24 months aligns with the recommendations and the factors associated with the differentials in dietary behaviour. This study aimed to fill this gap.

Methods This study employed an analytical cross-sectional approach, drawing on recent Demographic and Health Survey (DHS) data from 31 SSA countries. The study included a weighted sample of 44,071 children aged between 6 and 24 months, and their respective mothers aged 15–49 years. The primary outcome was Minimum Dietary Diversity (MDD) categorised per WHO recommendation. Multivariable logistic regression was used to examine the association of MDD with demographic and socio-economic characteristics.

Results The pooled MDD intake among children aged 6–24 months in SSA was 11% ranging from as low as 1.3% in Burkina Faso to 32.9% in South Africa. Children of mothers aged 45–49 years had 52% significant higher likelihood of MDD compared to those aged 15–19 years (AOR = 1.52, 95% CI:1.03, 2.24). Higher maternal education levels also increased MDD odds in the children: 22% higher for mothers who had attained secondary education (AOR = 1.22, 95% CI:1.07, 1.39), and 36% higher for those with education beyond secondary level (AOR = 1.36, 95% CI:1.09, 1.71) compared to no education. Children of rich mothers had 44% higher odds of MDD than those with poor mothers (AOR = 1.44, 95% CI:1.27, 1.62). Increased antenatal visits, and urban residence also contributed to higher MDD odds.

Conclusion Based on the current global estimate of approximately 28% MDD rate, the reported 11% MDD intake among children in this study is relatively low. There is a positive association between MDD intake in children and several factors, including maternal education, antenatal visits, wealth index, and residency. These findings highlight the need for policymakers and other stakeholders to give urgent attention to empowering parents to ensure adequate nutrient intake among children for better child growth and development.

Keywords Minimum dietary diversity, Children, Sub-saharan Africa

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Introduction

Ensuring adequate dietary diversity is crucial for the optimal growth and development of infants and young children [1]. Dietary diversity refers to the consumption of a variety of foods from different food groups over a defined period, including breast milk, grains, roots and tubers, legumes and nuts, dairy products (e.g. milk and yoghurt), flesh foods (e.g. meat, fish, etc.), eggs, vitamin A-rich fruits and vegetables, and other fruits and vegetables [2]. This diversity plays a fundamental role in infants and young children's nutrition, as emphasized by the Dietary Diversity guidelines provided by the World Health Organization (WHO) and UNICEF [2, 3].

The WHO recommends a minimum dietary diversity (MDD) of at least five out of eight food groups for infants to ensure proper growth and development during this critical period [4]. These dietary diversity guidelines underscore the importance of consuming a variety of food groups globally, serving as a foundational framework for evaluating feeding practices among infants and young children [3]. A diverse diet ensures adequate nutrient intake and supports healthy growth and development. Evidence from both developed and developing countries indicates a correlation between dietary diversity and child stunting [5–8]. Additionally, dietary diversity has been reported to impact growth and development, influence overall health, affect school performance, and have implications for the economy [4]. Globally, only 28.2% of children aged 6–23 months meet the recommended level of dietary diversity, with lower rates in low- and middle-income countries (LMICs), particularly in South Asia, Eastern, West Southern, and Central Africa [1].

In Sub-Saharan Africa (SSA), where a significant proportion of the population faces food insecurity and limited access to diverse and nutritious foods, the issue of inadequate dietary diversity among children aged 6 to 24 months is particularly pertinent [9]. Nutrition statistics reveal alarming morbidity and mortality rates associated with malnutrition in this region [10, 11], highlighting the urgent need for interventions to improve dietary behaviours among young children [11, 12]. In comparison to other regions worldwide, SSA is disproportionately affected by child malnutrition with approximately 33.2% of children under the age of five in this region reported to be stunted, 7.1% experiencing wasting, and 16.3% being underweight [7, 13].

Social determinants play a significant role in shaping dietary behaviours among children, including factors such as household income, maternal education, cultural practices, and access to healthcare services, age of the child, maternal employment status, gender of the household head, mothers' age, family size, and place of residence [3, 6, 12, 13]. These factors are recognised to likely affect dietary diversity among children aged 6–23 months in LMICs [3, 6, 12, 13]. Key determinants such as the child and mother's age, alongside maternal education, have been primarily studied within East and Southern African contexts [13, 14]. However, extrapolating these findings to all of sub-Saharan Africa has been challenging partly due to limited data availability and the region's vast socio-cultural and economic diversity. Data from these studies underscore the significant variability within the region: for instance, only about 10% of children in Ethiopia and approximately 16% in Rwanda met the minimum dietary diversity standards [13]. This variability, with over half attributed to differences across communities, underscores the importance of considering multiple communities within this region to assess the determinants of dietary diversity in SSA [11, 13].

To address this knowledge gap, we utilised the comprehensive Demographic and Health Survey (DHS) data from 31 countries in SSA. Our analysis aimed to estimate the prevalence of MDD among children in the region. Additionally, we assessed the determinants of MDD, considering factors such as children's age, maternal age, maternal education, household wealth status, and other relevant socio-economic variables. By understanding regional and country-specific variations in dietary diversity and its associated factors, our research aims to guide regional initiatives and pinpoint priority intervention strategies for countries most in need. Moreover, our findings can assist stakeholders in identifying potential contributors to the low prevalence of dietary diversity in SSA, thus facilitating targeted interventions and policy decisions aimed at improving child nutrition outcomes in the region.

Methodology

Study design

This study adopts an analytical cross-sectional approach, drawing on recent Demographic and Health Survey data collected between 2010 and 2022 from 31 African countries. The countries included in the study are Angola, Benin, Burkina Faso, Burundi, Cameroon, Chad, Comoro, Congo Brazzaville, Congo DR, Gabon, Gambia, Ghana, Guinea, Ivory Coast, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Namibia, Niger, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Togo, Uganda, Zambia, and Zimbabwe (Table 1).

Study population and sample size

The study encompasses a weighted sample of 44,071 children aged between 6 and 24 months, accompanied by their mothers aged 15–49 years who are regular residents of the chosen households or have spent the night in the selected households. All individuals with missing dietary intake information were excluded from the study.

Table 1 Survey year for each country

Country	Year
Angola	2015/16
Benin	2017/18
Burkina Faso	2010
Burundi	2016/17
Cameroon	2018/19
Chad	2014/15
Comoro	2012
Congo BL	2011/12
Congo DR	2013/14
Gabon	2019/21
Gambia	2019/20
Ghana	2014
Guinea	2018
Ivory coast	2011/12
Kenya	2022
Lesotho	2014
Liberia	2019/20
Madagascar	2021
Malawi	2015/16
Mali	2018
Namibia	2013
Niger	2012
Nigeria	2018
Rwanda	2019/20
Senegal	2019
South Africa	2016
Tanzania	2022
Togo	2013/14
Uganda	2016
Zambia	2018/19
Zimbabwe	2015

Sampling technique

The DHS utilises a two-stage probability sampling procedure. The first stage involves selecting Primary Sampling Units (PSUs) with probability proportional to size within strata, where strata are defined by geographic region and urban/rural areas. The second stage includes a systematic sampling of households within the selected clusters. DHS collects standardised data through questionnaires, developed collaboratively with stakeholders and translated into national languages to address each nation's unique population and health needs [15, 16].

Ethical considerations

This study was based on publicly accessible survey data from the MEASURE DHS program. Ethical approval and participant consent were not required for this secondary analysis. Permission to download and use the data was obtained from http://www.dhsprogram.com. The datasets used in the analysis do not contain personally identifiable information or household addresses. Approval for this secondary analysis study was obtained from MEASURE DHS after the review of our submitted concept note.

Study variables and measurements

The 31 countries were selected based on the availability of the necessary variables required for the analysis in this study. The study focused on similar variables collected across all 31 countries which included demographic characteristics of children, caregivers/mothers, partners' demographic details, household wealth index, and children's dietary intake.

Outcome variable

The primary outcome of interest was MDD, categorised according to WHO recommendations and coded as 1 for those who consumed at least 5 food groups the previous day and 0 for otherwise [3]. The food groups considered were roots and tubers, grains, flesh foods (meat, fish, poultry, and organ meats), legumes and nuts, dairy products, vitamin A-rich fruits and vegetables, eggs, and other fruits and vegetables [3, 5, 17, 18].

Main independent variables

The main independent variables were selected based on empirical literature [3, 6, 12–14, 19]. These includes child's Age, and sex (male, female). Mother's characteristics include age (years), mother's age (5 years group: 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49), mother's education (no education, primary, secondary, Higher), and occupation. Occupation categories for mothers include not working, Prof., tech., manager (covering professionals, technical workers, and managers), clerical, sales, agric-self-employed (self-employed in agriculture), agric-employee (employed in agriculture by someone else), household & domestic, services, skilled manual, and unskilled manual. We also included antenatal visits defined as the number of antenatal visit a mother has attended. Husband characteristics include age (years), husband education level (no education, primary, secondary, higher), and occupation (not working, Prof., tech., manager, clerical, sales, agric-self-employed, agric-employee, household & domestic, services, skilled manual, unskilled manual). Household characteristics include the household head's sex (male, female), household size (0–5, 6–10, more than 10), wealth index (poor, middle, rich), number of under 5 children, and type of residence (urban, rural).

Data processing and analysis

Data were checked for possible errors, missing values, and duplicates before the analysis. Some variables were categorised based on previous literature for better interpretation and comparability between studies. Data were analysed using R Software. The complexity of the survey design and the nature of the dataset were considered. Weighting was done for each country's dataset, using sampling weights predefined within each dataset to adjust for survey design factors such as sample size and population distribution. In DHS datasets, these weights are typically scaled by a factor of 1,000,000, so each weight was divided by 1,000,000 before analysis and then combined into a single dataset.

Descriptive statistics were summarised using frequency and proportions for categorical variables and mean as well as standard deviations were computed for continuous variables. The study utilised Classical Pooled Weighted Logistic Regression to identify determinants of MDD. To control for confounding variables, a multivariable weighted logistic regression model was implemented. Akaike information Criteria (AIC) was used for selecting variables to be included in the final model, where the model with the lowest AIC was considered the best model. Before model construction, independent variables were assessed for multi-collinearity, employing Generalized Variance Inflation Factors (GVIF). Calibration of the model was assessed through the Hosmer-Lemeshow test, validating that the model aligns well with the data. Model discrimination was evaluated using C statistics. The associations were quantified using odds ratios along with their respective 95% Confidence Intervals. Statistical significance was determined at a p-value threshold of < 0.05.

Results

Respondent background characteristics

As shown in Table 2, the average age of the children was 15 months, with a nearly equal distribution for males (51%) and females (49%). The average age of the mothers was 29 years old, and their education levels varied, with the majority never been to school (38%) or attended primary education (32%). The occupational distribution of the mothers was diverse, with nearly one-third (30%) not working while the majority (28%) engaged in agricultural self-employment. The majority of households were headed by males (86%), and the average household size was 7 people. The wealth index shows varied economic statuses, with 43% classified as poor, 37% as rich, and 20% as middle-class. The majority of them were living in rural residence (68%).

Table 2 Population-weighted demographic characteristics ($N = 44071$)

Variable	Mean (SD)/Percent
Child's Age in months-Mean (SD)	15 (5)
Child's Sex	
Male	51%
Female	49%
Mother's Age in years-Mean (± SD)	**29 (7)**
Mother's Age (5 years group)	
15–19	6.7%
20–24	23%
25–29	28%
30–34	21%
35–39	14%
40–44	5.5%
45–49	1.1%
Mother's Education	
No education	38%
Primary	32%
Secondary	25%
Higher	4.8%
Mother's Occupation	
Not working	30%
Prof., tech., manager	4.4%
Clerical	0.6%
Sales	20%
Agric-self employed	28%
Agric-employee	3.4%
Household & domestic	1.2%
Services	4.6%
Skilled manual	3.7%
Unskilled manual	3.6%
Antenatal Visits-Mean (SD)	4 (2)
Husband Age in years-Mean (SD)	36 (9)
Husband Education	
No education	33%
Primary	29%
Secondary	29%
Higher	8.3%
Husband's Occupation	
Not working	4.1%
Prof., tech., manager	10%
Clerical	1.4%
Sales	10%
Agric-self employed	37%
Agric-employee	4.4%
Household & domestic	1.1%
Services	8.1%
Skilled manual	16%
Unskilled manual	7.8%

Table 2 (continued)

Variable	Mean (SD)/Percent
Household head's sex	
Male	86%
Female	14%
Household size	
0–5	45.0%
6–10	42%
More than 10	13%
Wealth Index	
Poor	43%
Middle	20%
Rich	37%
Number of under 5 children-Mean (SD)	2 (1)
Residence	
Urban	32%
Rural	68%

Minimum dietary diversity across 31 African countries

Overall, the prevalence of MDD in the 31 countries is 11% indicating that only 1 in 10 children had eaten the minimum required food varieties the previous day. Country specific MDD are presented in Table 3. Notably, South Africa had the highest MDD of 32.9%, indicating a substantial dietary diversity among children in the country. Namibia closely followed with a notable percentage of 24.5%, emphasizing the prevalence of diverse diets in this population. Angola (22.8%), Gabon (20.6%), and Nigeria (20.4%) also exhibited significant figures. Conversely, Burkina Faso had the lowest MDD at 1.3%, followed by Chad (3.7%), Niger (4.1%), Ivory Coast (5%), Burundi (7.6%), Kenya (7.7%), Gambia (7.7%), Congo DR (8.0%), Liberia (8.0%), and Congo BR (8.5%) (Table 3).

Distribution of food group consumption, number of food groups eaten, and MDD

Table 4. provides an overview of the dietary composition and diversity among children, focusing on the consumption of various food groups. Notably, the majority of children in the studied population had a significant intake of grains (67%), Vitamin A-rich fruits and vegetables (49%) and flesh foods (40%). Conversely, Dairy products and Eggs were less consumed (5.4% and 13% respectively). The findings on the number of food groups eaten revealed that a considerable proportion of children consumed 2 to 3 food groups, while more than one quarter (22%) did not consume any food group from the specified list.

Table 3 Weighted MDD proportional by countries (*N* = 44485)

Country	Weighted MDD (%)
Angola	22.82
Benin	16.61
Burkina Faso	1.31
Burundi	7.55
Cameroon	10.23
Chad	3.69
Comoro	15.16
Congo Brazzaville	8.5
Congo DR	7.95
Gabon	20.57
Gambia	7.7
Ghana	14.1
Guinea	8.42
Ivory coast	5.01
Kenya	7.7
Lesotho	9.62
Liberia	8.04
Madagascar	13.18
Malawi	10.53
Mali	9.01
Namibia	24.49
Niger	4.08
Nigeria	20.41
Rwanda	10.58
Senegal	10.67
South Africa	32.92
Tanzania	10.94
Togo	13.97
Uganda	15.48
Zambia	11.71
Zimbabwe	12.48

MDD by the respondent's background characteristics

Table 5. presents MDD by the respondent's background characteristics. Children who had MDD the previous day had an average age of 16 months, and the distribution was nearly equal between males (51%) and females (49%). Mothers of children who had MDD, on average, were 29 years old, with varying education levels, predominantly secondary education (38%) or primary education (25%). Among these mothers, 25% were not working, while 18% were engaged in agricultural self-employment. The households with children exhibiting MDD were mainly headed by males (87%). The wealth index reflects diverse economic statuses for those who met the MDD, with 28% classified as poor, 55% as rich, and 17% as middle-class.

Table 4 Child dietary composition and diversity: distribution of food group consumption, number of food groups eaten, and MDD

Variable	Percent
Food groups	
Roots and tubers	25%
Grains	67%
Flesh foods (meat, fish, poultry and organ meats)	40%
Legumes and nuts	22%
Dairy products	5.5%
Vitamin A-rich fruits and vegetables	49%
Eggs	13%
Other fruits and vegetables	21%
Number of food groups eaten	
0	22%
1	16%
2	20%
3	19%
4	12%
5	6.3%
6	2.6%
7	1.3%
8	0.6%
Minimum Child Dietary Diversity (> 4 food groups)	11%

Determinants of MDD

The determinants of MDD have been presented in Table 6. Children with mothers aged 45–49 exhibited a 52% higher likelihood of MDD compared to those aged 15–19 (AOR = 1.52, 95% CI: 1.03, 2.24). Similarly, the odds increased by 48% for mothers aged 40–44 (AOR = 1.48, 95% CI: 1.12, 1.97) and by 23% for those aged 25–29 (AOR = 1.23, 95% CI: 1.01, 1.51).

Education also played a significant role, with children of mothers having secondary education showing 22% higher odds of MDD (AOR = 1.22, 95% CI: 1.07, 1.39), while those with higher education showing increased odds by 36% (AOR = 1.36, 95% CI: 1.09, 1.71) compared to those with no education. Additionally, children(s) of actively employed mothers had higher odds of MDD compared to non-working mothers.

Other factors contributing to MDD included an increase in antenatal visits (AOR = 1.05, 95% CI: 1.03, 1.07), higher socioeconomic status (middle group AOR = 1.13, 95% CI: 1.27, 1.62; rich group AOR = 1.44, 95% CI: 1.27, 1.62), and residing in urban areas (AOR = 0.72, 95% CI: 0.63, 0.81.

Discussion

This study aimed to investigate the Minimum Dietary Diversity (MDD) behaviour among children aged 6 to 24 months in Sub-Saharan Africa (SSA) and to analyse the factors associated with the behaviour patterns. The study reveals a low MDD (11%) across the 31 countries with a significant variation between countries. The reported prevalence of MDD in this present study is significantly lower than the estimated global rate of approximately 28% [1], highlighting an urgent need for targeted interventions. South Africa and Namibia exhibited significantly higher rates of MDD compared to other nations, suggesting the presence of a good dietary practices and access to diverse food sources in these two countries. Conversely, countries such as Burkina Faso and Chad displayed an alarmingly lower levels of MDD, indicating potential nutritional deficiencies and challenges in ensuring MDD among children. Thus, unlike lower-income countries like Burkina Faso and Chad, higher income countries like South Africa and Namibia may have more economic resources, better food distribution systems, and well-established dietary guidelines and nutrition programs that promote diverse and balanced diets [20, 21] They may also have better infrastructure and more developed agricultural sectors, ensuring consistent access to a variety of foods, including fruits, vegetables, proteins, and grains [22, 23] Economic stability and lower poverty rates in higher income countries also enable households to afford a wider range of nutritious foods [24–27]. Additionally, the observed disparities in MDD across countries could be attributed to a multitude of factors, including climatic changes, regional conflicts, and food insecurity. The presence of non-state armed groups has been reported as a major contributor to food insecurity in Burkina Faso, with more than 3 million people facing food insecurity, according to the World Food Program [28]. Similarly, Chad has been named as having one of the highest hunger rates in the world in 2022, with regional conflicts exacerbating issues compounded by environmental degradation and rapid desertification. It has been reported that millions in Chad suffer from food insecurity due to these complex interplays of socio-economic, environmental, and political factors [29]. These findings imply that policy research and practice should prioritise improving agricultural infrastructure, economic stability, nutrition education, and health programs in countries with low MDD to address nutritional deficiencies and enhance dietary diversity.

Findings from this present study also show that children's age, mother's age, education, occupation, antenatal visits, husband's education, sex of the household head, wealth index, and residence may affect MDD in children aged 6 to 24 months in SSA. We found that a child's age was significantly associated with increased odds of dietary diversity, similar to findings reported by other studies conducted elsewhere [30, 31]. This could be because as children grow older, they are introduced to a wider

Table 5 Weighted population characteristics by MDD

Variable	Non-MDD (0), mean (SD), %	MDD (1), mean (SD)/ Percent
Child's Age	14 (5)	16 (5)
Child's Sex		
Male	51%	49%
Female	49%	51%
Mother's Age (years)	29 (7)	29 (6)
Mother's Age (5 years group)		
15–19	7.0%	4.7%
20–24	23%	21%
25–29	28%	30%
30–34	21%	23%
35–39	14%	13%
40–44	5.5%	6.1%
45–49	1.1%	1.1%
Mother's Education		
No education	39%	27%
Primary	33%	27%
Secondary	24%	35%
Higher	4.2%	10%
Mother's Occupation		
Not working	31%	25%
Prof., tech., manager	3.9%	8.8%
Clerical	0.5%	1.4%
Sales	19%	24%
Agric-self employed	30%	18%
Agric-employee	3.4%	3.4%
Household & domestic	1.1%	2.0%
Services	4.2%	8.1%
Skilled manual	3.6%	4.9%
Unskilled manual	3.4%	4.5%
Antenatal Visits	4 (2)	5 (3)
Husband Age (years)	36 (9)	36 (8)
Husband Education		
No education	35%	23%
Primary	29%	25%
Secondary	28%	38%
Higher	7.5%	15%
Partner's Occupation		
Not working	4.2%	3.6%
Prof., tech., manager	9.7%	17%
Clerical	1.4%	1.6%
Sales	9.8%	14%
Agric-self employed	38%	25%
Agric-employee	4.6%	2.8%
Household & domestic	1.1%	0.9%
Services	8.0%	9.5%
Skilled manual	16%	18%
Unskilled manual	7.8%	8.2%

Table 5 (continued)

Variable	Non-MDD (0), mean (SD), %	MDD (1), mean (SD)/Percent
Household head's sex		
Male	86%	87%
Female	14%	13%
Household size		
0–5	45%	48%
6–10	42%	40%
More than 10	13%	12%
Wealth Index		
Poor	45%	28%
Middle	20%	17%
Rich	35%	55%
Number of under 5 children	2 (1)	2 (1)
Residence		
Urban	30%	50%
Rural	70%	50%
Roots and tubers	18%	75%
Grains	63%	92%
Flesh foods (meat, fish, poultry and organ meats)	33%	88%
Legumes and nuts	16%	64%
Dairy products	2.7%	27%
Vitamin A-rich fruits and vegetables	43%	93%
Eggs	7.7%	55%
Other fruits and vegetables	14%	72%

variety of foods and their dietary patterns become more diverse [32]. For instance, children often transition from exclusive breastfeeding or formula feeding to the introduction of solid foods as they grow older, increasing the variety in their diet. Older children are also more capable of chewing and digesting a wider range of foods, including various textures and flavours, hence improving their dietary diversity compared to younger children [33]. This suggests that age-appropriate dietary interventions and education are important for ensuring nutritional adequacy and promoting healthy eating habits from an early age.

The significant association found between maternal education and MDD further underscores the role of maternal knowledge and empowerment in shaping dietary practices and nutritional outcomes among children. Higher maternal education levels were associated with increased odds of achieving MDD, with notable increases observed in children whose mothers have attained secondary education or beyond. Thus, educated mothers are more likely to have better knowledge and awareness about nutrition and the importance of a balanced diet, leading to more diverse food choices for their children [34]. Additionally, higher education is often associated with better job opportunities and higher income, allowing mothers to afford a wider variety of nutritious foods [35]. They are also more likely to utilise available resources, such as health clinics, nutrition programs, and community support services that promote dietary diversity [36]. The association of mother's education level to MDD have also been reported in other studies [3, 4, 31].

In line with previous studies [31, 37, 38], this present study shows that maternal engagement in active occupation is linked to higher odds of MDD, suggesting the importance of active caregiving in promoting healthy eating habits among children. Notably, maternal employment frequently increases household income, thereby augmenting financial resources available for the purchase of diverse and nutritious foods [39]. This supplementary income can enhance food security by facilitating sustained access to a broad spectrum of food groups [39]. Additionally, employed mothers may benefit from improved access to information and resources regarding child nutrition through workplace initiatives and employer-provided benefits [40].

Table 6 Determinant of MDD from weighted pooled- logistic regression

Characteristic	COR	95% CI	*p*-value	AOR	95% CI	*p*-value
Child's Age	1.05	1.04, 1.06	< 0.001	1.05	1.05, 1.06	< 0.001
Child's Sex						
Male	Ref	Ref		Ref	Ref	
Female	1.07	0.99, 1.16	0.091	1.06	0.98, 1.15	0.135
Mother's Age (5 years group)						
15–19	Ref	Ref		Ref	Ref	
20–24	1.36	1.13, 1.65	0.001	1.11	0.91, 1.35	0.300
25–29	1.63	1.35, 1.97	< 0.001	1.23	1.01, 1.51	0.040
30–34	1.63	1.35, 1.97	< 0.001	1.23	1.00, 1.51	0.054
35–39	1.39	1.13, 1.71	0.002	1.10	0.87, 1.38	0.433
40–44	1.66	1.30, 2.11	< 0.001	1.48	1.12, 1.97	0.006
45–49	1.44	1.02, 2.04	0.039	1.52	1.03, 2.24	0.037
Mother's Education						
No education	Ref	Ref		Ref	Ref	
Primary	1.20	1.07, 1.34	0.002	0.97	0.86, 1.09	0.623
Secondary	2.13	1.90, 2.38	< 0.001	1.22	1.07, 1.39	0.004
Higher	3.55	3.01, 4.19	< 0.001	1.36	1.09, 1.71	0.008
Mother's Occupation						
Not working	Ref	Ref		Ref	Ref	
Prof., tech., manager	2.84	2.40, 3.36	< 0.001	1.67	1.39, 2.01	< 0.001
Clerical	3.58	2.47, 5.18	< 0.001	2.06	1.41, 3.03	< 0.001
Sales	1.52	1.35, 1.71	< 0.001	1.29	1.14, 1.46	< 0.001
Agric-self employed	0.76	0.68, 0.85	< 0.001	1.01	0.89, 1.16	0.831
Agric-employee	1.25	0.96, 1.61	0.092	1.89	1.38, 2.59	< 0.001
Household & domestic	2.26	1.50, 3.42	< 0.001	1.92	1.26, 2.91	0.002
Services	2.39	2.00, 2.87	< 0.001	1.82	1.51, 2.19	< 0.001
Skilled manual	1.67	1.39, 2.02	< 0.001	1.55	1.28, 1.88	< 0.001
Unskilled manual	1.64	1.31, 2.05	< 0.001	1.64	1.30, 2.08	< 0.001
Antenatal Visits	1.13	1.11, 1.15	< 0.001	1.05	1.03, 1.07	< 0.001
Husband Age (years)	1.00	0.99, 1.00	0.401	0.99	0.99, 1.00	0.053
Husband Education						
No education	Ref	Ref		Ref	Ref	
Primary	1.28	1.14, 1.44	< 0.001	1.16	1.03, 1.30	0.015
Secondary	2.03	1.80, 2.28	< 0.001	1.28	1.12, 1.46	< 0.001
Higher	3.10	2.69, 3.56	< 0.001	1.24	1.02, 1.51	0.031
Partner's Occupation						
Not working	Ref	Ref		Ref	Ref	
Prof., tech., manager	2.06	1.63, 2.60	< 0.001	1.12	0.87, 1.43	0.379
Clerical	1.30	0.89, 1.90	0.180	0.74	0.50, 1.09	0.125
Sales	1.62	1.30, 2.04	< 0.001	1.20	0.95, 1.52	0.124
Agric-self employed	0.77	0.61, 0.96	0.018	1.00	0.79, 1.26	0.993
Agric-employee	0.70	0.52, 0.94	0.018	0.62	0.45, 0.86	0.004
Household & domestic	0.92	0.55, 1.55	0.758	0.71	0.43, 1.16	0.172
Services	1.39	1.10, 1.76	0.006	0.94	0.74, 1.20	0.612
Skilled manual	1.32	1.05, 1.67	0.018	0.92	0.72, 1.18	0.514
Unskilled manual	1.22	0.93, 1.61	0.144	0.94	0.71, 1.23	0.636
Household head's sex						
Male	Ref	Ref		Ref	Ref	
Female	0.92	0.82, 1.02	0.117	0.84	0.75, 0.94	0.003

Table 6 (continued)

Characteristic	COR	95% CI	*p*-value	AOR	95% CI	*p*-value
Household size						
0–5	Ref	Ref		Ref	Ref	
6–10	0.89	0.82, 0.97	0.006	1.06	0.97, 1.17	0.207
More than 10	0.86	0.75, 1.00	0.043	1.16	0.98, 1.37	0.084
Wealth Index						
Poor	Ref	Ref		Ref	Ref	
Middle	1.35	1.21, 1.51	< 0.001	1.13	1.01, 1.26	0.040
Rich	2.53	2.30, 2.79	< 0.001	1.44	1.27, 1.62	< 0.001
Number of under 5 children	0.91	0.87, 0.96	< 0.001	1.00	0.96, 1.04	0.978
Residence						
Urban	Ref	Ref		Ref	Ref	
Rural	0.43	0.39, 0.47	< 0.001	0.72	0.63, 0.81	< 0.001

COR Crude Odds Ratio, *AOR* Adjusted Odds Ratio, *95% CI* 95% Confidence Interval

Our analysis further reveals that households led by females are associated with lower MDD among children aged 6 to 24 months, aligning with similar studies in the literature [41]. This implies that MDD tends to decrease when females are the primary decision-makers, reflecting socioeconomic factors influencing food access within these households. Female-headed households often experience reduced income levels, which may limit their ability to purchase a wide variety of nutrient-rich foods, leading to a greater reliance on cheaper, less diverse staple foods. This finding underscores the need to address economic barriers that disproportionately affect female-led households in ensuring adequate dietary diversity for young children [42]. Additionally, the multiple caregiving and household responsibilities typically shouldered by women can constrain their capacity to procure and prepare a diverse range of foods [43]. Moreover, cultural norms and traditions may shape food preferences and preparation practices, often emphasising familiarity and economic feasibility at the expense of dietary diversity [44].

Additionally, the analysis highlights lower MDD in rural areas among children aged 6 to 24 months, consistent with prior research [8, 13, 45]. Rural settings frequently experience constraints such as limited access to markets and supermarkets that provide a broad selection of nutritious foods, thereby constraining the availability of diverse dietary choices [44]. Additionally, economic hardships prevalent in rural households often result in reduced purchasing power, making it less affordable to access a variety of foods compared to urban areas [46]. Moreover, inadequate infrastructure and transportation networks in rural regions can impede the distribution and availability of fresh and varied foods [47–49], thereby affecting dietary options for young children. Furthermore, traditional dietary practices within rural communities often prioritise staple foods over a diverse array of food groups, influencing the food options accessible and consumed by children [50]. These factors highlight the importance of access to healthcare services, economic resources, and urban infrastructure in facilitating optimal nutritional outcomes among children. However, disparities in MDD persist, indicating the need for targeted interventions that address socio-economic inequalities and promote equitable access to nutritious food options across diverse African contexts.

Similarly, our study found that the number of antenatal visits was associated with increased odds of dietary diversity among children, consistent with findings from studies in India, Bangladesh, Nepal and Pakistan [51–54]. This result is not surprising as antenatal visits provide opportunities for healthcare providers to educate expectant mothers about the importance of nutrition during pregnancy and early childhood, influencing their dietary choices for their children [55]. These results highlight the critical role of antenatal visits in providing nutritional education to mothers, emphasising the importance of feeding children a varied diet. This suggests that enhancing the quality and frequency of antenatal care could be an effective strategy for improving child nutrition and health outcomes [55].

Overall, our findings indicate that a higher socioeconomic status of the mother is associated with increased odds of dietary diversity among children. This observation is consistent with other similar studies [13, 31, 52, 56–60]. These results underscore the significant role of purchasing power in facilitating access to a variety of foods. This implies that socioeconomic interventions aimed at improving family income and economic stability could be crucial in enhancing dietary diversity and, consequently, the overall nutritional status of children. Similarly, the findings underscore the role of economic factors in shaping dietary diversity, with higher socioeconomic status facilitating access to a wider variety of food groups. Moreover, the analysis of the number of food groups eaten highlights the prevalence of suboptimal dietary diversity among children, with a considerable proportion consuming only 2 to 3 food groups. Alarmingly, more than one quarter of children in our sample do not include any food group from the specified list in their diets. Moreover, this may be partly explained by diverse cultural practices surrounding infant and young child feeding across SSA. In some cultures, exclusive breastfeeding may be encouraged beyond six months, while others may have traditional beliefs or economic constraints delaying the introduction of complementary foods [61]. These cultural norms can shape feeding practices and affect dietary diversity, highlighting the importance of culturally sensitive approaches in designing interventions to improve MDD and nutritional intake in young children [62]. The dietary patterns observed among children in the studied population reveal both strengths and areas for improvement in achieving MDD. The significant intake of grains, Vitamin A-rich fruits and vegetables, and flesh foods among the majority of children underscores the presence of staple foods and essential nutrients in their diets. However, the lower consumption rates of dairy products and eggs suggest potential gaps in accessing diverse sources of protein and essential micronutrients critical for healthy growth and development.

Strengths and limitations of the study

The strength of this study lies in its robust methodology, which includes a weighted large sample size including 31 countries in SSA. We also examined a diverse range of factors as potential determinants in MDD. By examining a diverse range of factors, the study provides comprehensive insights into the determinants of dietary diversity among children aged 6 to 24 months. However, the study's results should be interpreted with caution due to the following limitations. Firstly, the study's cross-sectional design provides a valuable snapshot of dietary diversity but lacks the ability to establish causal relationships, limiting the definitive attribution of causation to specific factors. This limitation is important as it affects the depth of understanding regarding the impact of various determinants on dietary diversity. Moreover, the accuracy of the study's findings may be affected by mothers' recall bias, where their ability to accurately remember and report their children's dietary diversity could affect the data's accuracy. Additionally, social desirability bias may play a role, as mothers might respond in ways they perceive as socially acceptable rather than reflecting their actual practices. These biases are important to consider in interpreting the results, despite efforts made to minimize them through structured questionnaires and confidentiality assurances during data collection. Another limitation is the age of the data for some countries. Data from Burkina Faso and Congo are from 2010, 2011, and 2012, making them considerably older than most other data sources. This variability in data collection years could influence the comparability of findings across countries and should be taken into account. Additionally, the absence of variables in the DHS dataset that specifically capture cultural influences poses a significant limitation. Cultural factors play a crucial role in shaping dietary practices [63], and their exclusion hinders a comprehensive understanding of the interplay between cultural influences and other determinants of dietary diversity. Furthermore, the focus on children aged 6 to 24 months, while appropriate for assessing early childhood nutrition, may not fully represent dietary diversity behaviours and determinants across all age groups. This narrow focus potentially restricts the generalisability of the findings to other age demographics. Moreover, limiting the study's scope to 31 sub-Saharan African countries may not adequately capture the full spectrum of dietary behaviours and determinants present across the entire region. This limitation could impact the applicability of the findings to a broader context, as dietary practices and determinants can vary significantly even within subregions of Africa.

Conclusion

In conclusion, MDD was low (11%) and uneven across the 31 countries. The disparity in food diversities among the SSA countries, with South Africa exhibiting the highest prevalence and countries like Burkina Faso, Chad, and Niger experiencing the lowest levels underscores the need for policy and practical interventions to address the problem. The results indicate that several factors are associated with MDD in the sample. These include the children's age, the mother's age, education, and occupation, as well as the number of antenatal visits. The husband's education level, the sex of the household head, the household's wealth index, and residence also play a role in determining MDD. These findings suggest that a holistic approach is needed to address dietary diversity, taking into account various demographic and socio-economic factors that influence food choices and access to diverse diets. In-depth qualitative studies are also warranted and essential for understanding the complex interplay of factors, including cultural influences, that contribute to these disparities. Understanding how these variables impact food diversities in specific countries is crucial for developing effective interventions and policies tailored to each context. Such initiatives are vital for addressing nutritional challenges and promoting food security in SSA.

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Authors' contributions
HP&JE conceptualization of the study, data curation, data analysis and interpretation of the findings, data analysis, data analysis, IA conceptualization of the study, technical assistance in data analysis and reviewing all the manuscripts, SC, HS, JM&PL manuscript review and editing. All authors reviewed and approved the final manuscript.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
The study analysed the collected data from the Demographic Health Survey (DHS) which had already obtained ethical clearance hence this study did not need another ethical clearance. However, permission to use the data was requested from the DHS custodian. Procedures and questionnaires for standard DHS surveys have been reviewed and approved by ICF Institutional Review Board (IRB). Additionally, country-specific DHS survey protocols are reviewed by the ICF IRB and typically by an IRB in the host country. ICF IRB ensures that the survey complies with the U.S. Department of Health and Human Services regulations for the protection of human subjects (45 CFR 46), while the host country IRB ensures that the survey complies with the laws and norms of the nation.
Not applicable.

Consent for publication
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Competing interests
The authors declare no competing interests.

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