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Trends and inequalities of minimum dietary diversity among children aged 6–23 months in Sierra Leone, 2013–2019

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Abstract

Background Ensuring a healthy and diverse diet for young children is crucial for their proper growth and development. This study examined the trends and inequalities in minimum dietary diversity in Sierra Leone between 2013 and 2019, focusing on children aged 6–23 months.

Methods The study employed a time-trend ecological study design utilising the Sierra Leone Demographic Health Survey data rounds (2013 and 2019). The World Health Organization health equity assessment toolkit software was used to calculate both simple difference (D) and ratio (R) and complex measures of inequality: population attributable risk (PAR) and population attributable fraction (PAF). The inequality assessment was done for six stratifiers: child's age, household wealth quintile, maternal level of education, place of residence, sex of the child, and sub-national province.

Results Minimum dietary diversity among children aged 6–23 months in Sierra Leone increased from 13.4% in 2013 to 25.1% in 2019. Household economic inequality between children from richest households and those from poorest households decreased from 16.2% in 2013 to 8.3% in 2019. Inequality for place of residence between children of mothers in urban areas, and those from rural areas decreased from 8.8% in 2013 to 3.7% in 2019. For child's sex, the inequality between male and female children decreased from − 2.1% in 2013 to -3.7% in 2019. However, inequalities in child's age, maternal education and sub-national province increased over time, the absolute differences between the groups increased, from 12.6% in 2013 to 20.3% in 2019 between children aged 18–23 months and those aged 6-8 months. Also, from 12.4% in 2013 to 20.6% in 2019 between children of mothers with higher and those with no education and from 18.2% in 2013 to 21.3% in 2019 between children of mothers residing in Western area and those in the Eastern province.

Conclusion While the trend in minimum dietary diversity among children aged 6–23 months has shown an encouraging increase between 2013 and 2019, the proportion in 2019 indicates that further efforts are needed to improve minimum dietary diversity. Decreasing inequalities related to economic status, place of residence, and sex is promising, reflecting the country's progress toward achieving universal health coverage by 2030. However, the rise in age-related, educational and provincial inequalities, with children aged 6–8 months, those from less educated households and those in the eastern province disproportionately affected, is concerning. This highlights the need for targeted interventions to improve minimum dietary diversity among these groups. The government and

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policymakers in Sierra Leone should continue efforts to ensure all families, regardless of age, economic, educational or provincial background, have access to resources and information for child nutrition.

Keywords Children, Dietary, Diversity, Nutrition, Sierra Leone

Introduction

Minimum dietary diversity (MDD) assess whether children aged 6–23 months have consumed foods from at least five out of eight predefined food groups within 24 h [1]. According to the World Health Organization (WHO), a child meeting MDD criteria consumes foods from at least four out of seven food groups: (1) grains, roots, and tubers; (2) legumes and nuts; (3) dairy products (including breast milk); (4) flesh foods (meat, poultry, fish); (5) eggs; (6) vitamin A-rich fruits and vegetables; and (7) other fruits and vegetables [1]. Adequate dietary diversity is the proportion of children aged 6–23 months who consume foods from at least five out of eight predefined food groups within 24 h. This is essential for optimal physical and cognitive development, reducing the risk of malnutrition, stunting, and micronutrient deficiencies [2–6]. On the contrary, the lack of adequate dietary diversityis associated with a higher risk of stunting, being underweight, and iron deficiency anaemia, which can have lasting negative consequences for children's health and well-being [7].

While MDD is widely acknowledged as a crucial factor, only 29% of children between the ages of 6 and 23 months meet the requirements for MDD globally [8]. In 2021, approximately 149 million children under five years old were affected by stunting. Additionally, 45 million children suffer from wasting, while 39 million children were overweight [9, 10]. Sub-Saharan Africa accounted for the highest percentage of these statistics [11, 12]. This situation is even worse for countries with fragile health systems like Sierra Leone. Sierra Leone, located in West Africa, is ranked among the countries with the highest maternal and child mortality globally. In 2019, 9% of Sierra Leonean children aged 6–23 months had a MDD in 24 hours. This highlights the need to continue improving the country's infant and young child feeding practices.

Several international organizations, including WHO and UNICEF, advocate for implementation of interventions that promote optimal infant and young child feeding practices. These interventions often involve promoting breastfeeding, timely introducing complementary foods, dietary diversity counselling, and behaviour change communication strategies [1]. The government of Sierra Leone and partner organizations have implemented various programs to promote MDD such as nutrition education campaigns, community mobilization efforts, and promoting locally available, diverse foods [13]. However, evidence shows that inequalities in MDD persist, disproportionately affecting populations nationwide [14].

Previous studies have examined women's empowerment, innovative grandmother-inclusive approaches, inequality of complementary suboptimal feeding, and comparison of complementary feeding regarding MDD among children 6–23 months in Sierra Leone and sub-Saharan Africa [15–19]. Prior to this research, no study has examined the trends and inequalities of MDD among children aged 6–23 months in Sierra Leone. This study aims to address this gap by investigating national data from 2013 to 2019 to identify trends in MDD proportion and explore the potential inequalities associated with these trends. Understanding the factors influencing MDD practices is crucial for informing targeted interventions and improving child nutrition outcomes in Sierra Leone. This study contributes valuable insights for policymakers, program implementers, and healthcare professionals working to improve the health and well-being of young children in the country.

Methods

Study design and source

This study employed a time-trend ecological study design, utilising data from the 2013 and 2019 Sierra Leone Demographic Health Survey (SLDHS). The SLDHS is a nationwide survey that aims to identify consistent trends and changes in demographic indicators, health indicators, and social issues among individuals of all genders and age groups. The SLDHS is a cross-sectional design in which participants were chosen using a stratified multi-stage cluster sampling method. A detailed description of the sampling methodology can be found in the SLDHS report [20]. This study covered children aged 6–23 months in the corresponding SLDHS cycles. The 2013 and 2019 SLDHS data were available for direct use using the WHO HEAT online platform [21]. This study was done, considering the guidelines specified in the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) [22].

Variables

The study's outcome variable was MDD. The variable was assigned "Yes" if the child, aged 6–23 months, consumed food from at least 5 out of 8 food groups on the day before the survey. Otherwise, the variable was assigned "No". The eight dietary groups include (1) breastfeeding, (2) grains, roots, and tubers, (3) legumes and nuts, (4) dairy products (milk, yoghurt, cheese),5.

flesh foods (meat, fish, fowl, and liver/organ meats), 6. eggs, and 7. fruits and vegetables rich in vitamin A. 8. Additional types of fruits and vegetables. The assessment of inequality in MDD utilised six stratifiers: child's age (6–8 months, 9–11 months, 12–17 months and 18–23 months), household wealth quintile measured by (quintile 1, 2, 3, 4, 5), maternal level of education (no education, primary, secondary, and higher education), place of residence (rural, urban), sex of the child(male, female) and sub-national province (Eastern, Northern, Northwestern, Southern, Western).

Data analysis

The analysis was performed utilising the online version of the WHO HEAT software [21]. HEAT is a web-based statistical software that examines health inequalities within and among countries across several health indicators and socioeconomic factors, such as child, maternal, and reproductive health. This study analysed four inequality measures. The measures comprised difference (D), ratio (R), population-attributable fraction (PAF), and population-attributable risk (PAR). R and PAF are relative summary measures, whereas D and PAR are absolute summary measures. D and R are simple measurements, whereas PAR and PAF are more complex. Six equity stratifiers were employed to examine the MDD among children aged 6–23 months in Sierra Leone. The factors are child's age, household wealth quintile, maternal level of education, place of residence, the sex of the child, and sub-national province. Estimates and confidence intervals (CIs) were calculated to assess MDD among children aged 6–23 months, considering the specified stratifiers. The D was defined as the variation in outcome between different demographic groups such as socioeconomic and geographic factors. A ratio, the relationship between two quantities was used to illustrate disparities between demographic groups. PAF is the percentage of a health outcome in the entire population that can be attributed to a particular exposure or risk factor. PAR was defined as the excess risk of a health outcome associated with a particular exposure or risk factor. Two simple measurements, D and R, are not affected by weight, while the two complex measures,PAR and PAF, are influenced by weight. R and PAF are relative metrics. However, D and PAR are absolute measures. While D and R are more commonly used and easier to interpret, PAR and PAF offer additional insights by quantifying absolute and relative contributions of inequality to the overall prevalence of MDD. These measures are for understanding the potential impact of eliminating inequalities on improving MDD. Their inclusion ensures a more nuanced understanding of the observed disparities and strengthens the interpretation of the findings. Considering summary measures is grounded in the WHO's recognition that absolute and relative summary measurements are essential for deriving policy-driven findings. In contrast to simple measurements, complex measures consider the magnitude of categories within a specific population subset. The literature has comprehensively elucidated the World Health Organization's summary metrics and calculations [23, 24]. To summarise, a D value of zero (0) signifies a complete lack of inequality, while higher values suggest a greater degree of difference in MDD. Higher values of R indicate the disadvantaged group had high MDD. Without inequality, the value of R is equal to 1. Inequality increases as the value of R moves away from 1. PAF and PAR exhibit positive values for indicators that signify favourable conditions and negative values for indicators that signify unfavourable conditions. Higher degrees of inequality are associated with greater magnitudes of PAF and PAR. If no further improvement can be achieved, the values of PAF and PAR will be 0. This indicates that all subgroups have already reached the same indicator level as the reference subgroup.

$$D = \text{MDD } in\ most\ advantaged - \text{MDD } in\ most\ disadvantaged$$

$$R = \frac{\text{MDD } in\ most\ advantaged}{\text{MDD } in\ most\ disadvantaged}$$

$$PAR = \text{MDD } in\ most\ advantaged - \mu$$

$$PAF = \frac{PAR}{\mu} * 100$$

Where μ is Sierra Leone's national average estimate for MDD coverage.

Results

Proportion of minimum dietary diversity among children aged 6–23 months in Sierra Leone, 2013–2019

Table 1 presents the proportion of MDD among children aged 6–23 months in Sierra Leone from 2013 to 2019. At the national level, the proportion of MDD increased from 13.4% in 2013 to 25.1% in 2019, with improvements observed across all subgroups analyzed. Among children aged 6–8 months, the proportion of MDD rose from 5.0% in 2013 to 8.1% in 2019, while children aged 18–23 months showed an increase from 17.6 to 28.5% over the same period.

In terms of household wealth index, children of mothers in the poorest quintile (Quintile 1) experienced an increased in MDD from 8.8% in 2013 to 19.7% in 2019, while those in the richest quintile (Quintile 5) saw a rise from 25.1 to 28.1%. Among children whose mothers had no education, MDD proportion increased from 11.8% in 2013 to 23.8% in 2019. For mothers with primary education, the proportion rose from 16.7% to 22.3%, while for

Table 1 Trends in minimum dietary diversity proportion among children aged 6–23 months by different dimensions in Sierra Leone, 2013–2019

	2013 (13.4%)		2019 (25.1%)	
Dimension	**Estimate**	***NSample***	**Estimate**	***NSample***
Age				
6–8 months	5.0	606	8.1	482
9–11 months	10.6	513	21.2	425
12–17 months	16.1	1238	32.2	1026
18–23 months	17.6	788	28.5	689
Household wealth quintile				
Quintile 1 (poorest)	8.8	746	19.7	616
Quintile 2	11.3	672	25.3	573
Quintile 3	11.1	673	24.8	533
Quintile 4	15.0	601	29.1	489
Quintile 5 (richest)	25.1	454	28.1	411
Education				
No education	11.8	2052	23.8	1374
Primary education	16.7	459	22.3	430
Secondary education	15.8	598	26.7	742
Higher education	24.2	35	44.5	76
Place of residence				
Rural	11.1	2352	23.7	1719
Urban	20.0	794	27.5	903
Sex of child				
Female	14.5	1596	27	1303
Male	12.3	1549	23.2	1319
Province				
Eastern	8.5	746	11.1	573
Northern	11.3	1845	24.7	517
Northwestern	NA	NA	29.2	491
Southern	26.7	554	29.6	557
Western	NA	NA	32.5	483

NA-Not available; N-Sample; Est- Estimate

those with secondary education, it increased from 15.8% to 26.7%. The highest proportion was among children whose mothers had higher education, rising from 24.2% in 2013 to 44.5% in 2019.

In rural areas, the proportion of MDD increased from 11.1% in 2013 to 23.7% in 2019, while urban areas saw an increase from 20.0 to 27.5%. Sex differences were noted, with females showing an increase in MDD from 14.5% in 2013 to 27.0% in 2019 and males increasing from 12.3% to 23.2%.

In the Eastern province, the proportion of MDD increased from 8.5% in 2013 to 11.1% in 2019, while the Northern province saw a rise from 11.3% to 24.7%. Data for the Northwestern province were unavailable in 2013, but the proportion was 29.2% in 2019. The Southern province experienced an increase from 26.7% in 2013 to 29.6% in 2019, while the Western area, for which data was also unavailable in 2013, recorded the highest proportion at 32.5% in 2019.

Provincial proportion of minimum dietary diversity among children aged 6–23 months in Sierra Leone in 2019

Figure 1 shows the provincial distribution of MDD among children aged 6–23 months in Sierra Leone in 2019. MDD was highest in the Western area at 32.5%, while the Eastern province recorded the lowest proportion, at 11.1%, among children within the same age group.

Inequality in minimum dietary diversity among children aged 6–23 months in Sierra Leone, 2013–2019

Table 2 shows inequality measures for MDD among children aged 6–23 months in Sierra Leone from 2013 to 2019. There was an increase in age-related inequality among children aged 18–23 months and those aged 6–8 months, from 12.6% in 2013 to 20.3% in 2019. The ratio between the two groups decreased from 3.5% in 2013 to 3.4% in 2019, yet there remains an inequality disproportionately affecting children 6–8 months old.

The difference in the proportion of economic inequality among children of mothers in the richest households compared with those in the poorest households decreased from 16.2% in 2013 to 8.3% in 2019. The ratio between the two groups also decreased from 2.8% in 2013 to 1.4% in 2019, yet, inequality existed disproportionately affecting children in the poorest quintile.

The difference in proportion of education inequality among mothers of children aged 6–23 months increased from 12.4% in 2013 to 20.6% in 2019. The ratio between the two slight decrease from 2% in 2013 to 1.8% in 2019, however, there remains an inequality disproportionately affecting children of mothers with no education.

For the child's sex, the difference in proportion among male and female children aged 6–23 months decreased from – 2.1% in 2013 to -3.7 in 2019. However, there was no change in ratio between the two groups remaining stable at 0.8% indicating no inequality.

The notation "NA," which stands for "not available," indicates that these values were missing from the dataset generated from the WHO HEAT database.

Discussion

This study investigated the MDD among children aged 6–23 months in Sierra Leone, between 2013 and 2019. Nationally, MDD among children aged 6–23 months increased from 13.4% in 2013 to 25.1% in 2019. Inequalities in dietary diversity regarding household wealth quintile, place of residence, and child's sex decreased over time. However, the proportion gap widened for child's age, educational attainment, and provinces.

The finding that MDD among children aged 6–23 months increased between 2013 and 2019 indicates a positive trend. This increase could be attributed to stakeholders' investment in public education campaigns

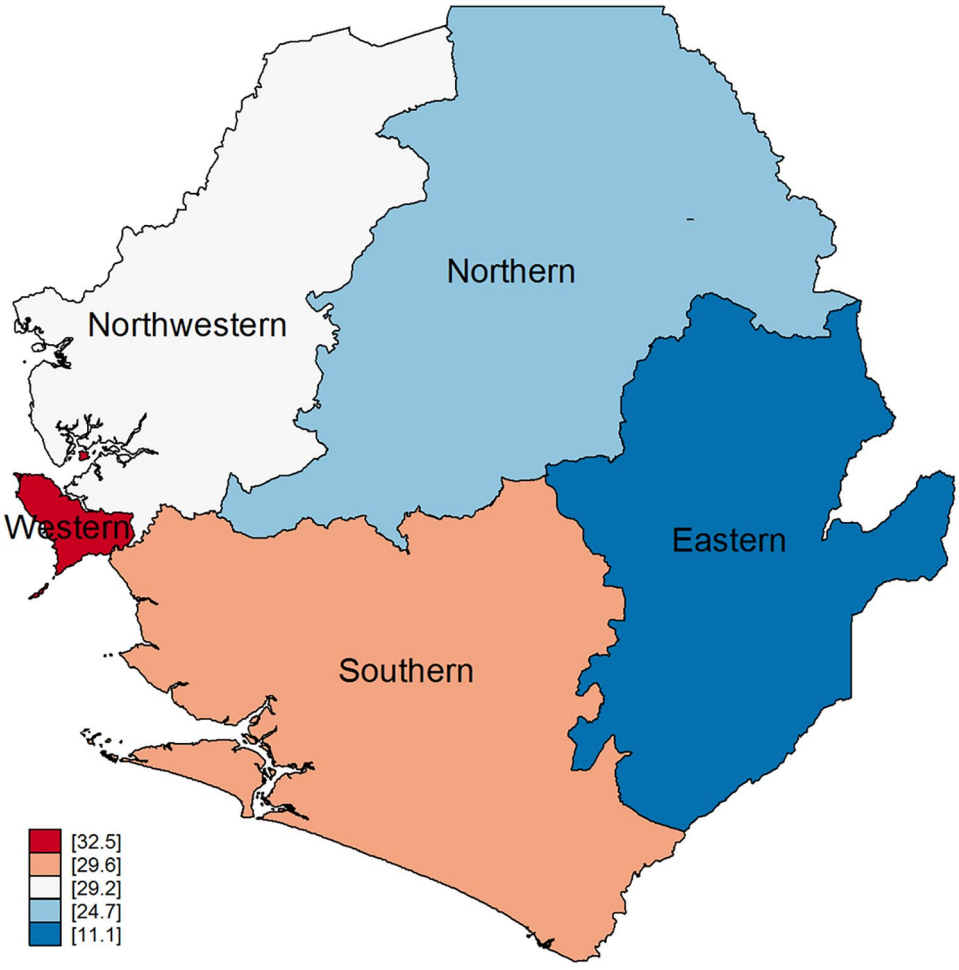

Fig. 1 Provincial proportion of minimum dietary diversity among children aged 6–23 months in Sierra Leone in 2019

promoting infant and young child feeding practices among caregivers [13]. Despite the increased MDD observed in this study, the highest percentage, 25.1% in 2019, is way below the global target of 50% set by the WHO, implying that most children still lack access to adequate varieties of food needed for optimal growth. This finding is similar to a study conducted in Ethiopia, where the authors reported an increase in MDD proportion from 2% in 2011 to 7% in 2019 [25].

The differences in MDD for age were consistent across all age groups, with children aged 6–8 months showing the least MDD and those aged 18–23 months showing the most MDD. Various factors might explain the lower MDD observed in the 6–8 month age group. This period marks a critical transition where children move from exclusive breastfeeding to complementary feeding, during which parents or caregivers are often exploring and deciding on the appropriate foods to introduce [26]. Such a transition likely led to the reduced MDD recorded in this study. Additional factors may include the difficulties some children experience with chewing or swallowing a variety of foods, as well as the continued reliance on breastfeeding, driven by concerns about potential health risks associated with complementary feeding. This observation is consistent with findings from a study conducted in Uganda, where the authors reported that, despite an overall low MDD, children aged 18–23 months achieved a relatively higher MDD compared to those aged 6–11 months, who exhibited the lowest MDD [27]. The authors reported similar factors as the likely reasons for the observed disparity in favor of older children, aged 18–23 months.

While economic inequality in MDD among mothers of children aged 6–23 months in Sierra Leone has lessened over time, the proportion of MDD has intensified, disproportionately affecting those in the poorest quintile. This gap can largely be attributed to the greater financial strength of children from wealthier parents, who can get a variety of foods, whereas their counterparts in the poorest quintile struggle to get it due to minimal financial resources [13]. This imbalance particularly impacts children in the poorest households, raising concerns,

Table 2 Inequality in factors associated with minimum dietary diversity among children aged 6–23 months in Sierra Leone, 2013–2019

	2013			2019		
Dimension	**Estimate**	**Lower Bound**	**Upper Bound**	**Estimate**	**Lower Bound**	**Upper Bound**
Age						
D	12.6	NA	NA	20.3	NA	NA
PAF	30.9	NA	NA	13.6	13.5	13.7
PAR	4.1	NA	NA	3.4	0.5	6.2
R	3.5	NA	NA	3.4	NA	NA
Household wealth quintile						
D	16.2	NA	NA	8.3	NA	NA
PAF	86.9	86.6	87.1	12.0	11.9	12.2
PAR	11.6	8.1	15.1	3.0	-0.9	6.9
R	2.8	NA	NA	1.4	NA	NA
Education						
D	12.4	NA	NA	20.6	NA	NA
PAF	80.2	79.1	81.2	78.0	77.6	78.5
PAR	10.7	-3.2	24.8	19.5	8.5	30.5
R	2.0	NA	NA	1.8	NA	NA
Place of residence						
D	8.8	NA	NA	3.7	NA	NA
PAF	49.0	48.8	49.1	9.6	9.5	9.7
PAR	6.5	4.3	8.8	2.4	0.1	4.7
R	1.7	NA	NA	1.1	NA	NA
Sex of child						
D	-2.1	NA	NA	-3.7	NA	NA
PAF	0	-0.0	0.0	0	-0.0	0.0
PAR	0	-1.2	1.2	0	-1.6	1.6
R	0.8	NA	NA	0.8	NA	NA
Province						
D	18.2	NA	NA	21.3	NA	NA
PAF	99.1	98.9	99.3	29.6	29.4	29.7
PAR	13.2	10.1	16.4	7.4	3.7	11.1
R	3.1	NA	NA	2.9	NA	NA

D- difference; PAF- population attributable fraction; PAR-Population attributable risk; R- ratio; NA- not available

given that over 50% of Sierra Leone's population survives on less than $1 per day [13]. Accordingly, the study recommends swift action from stakeholders to minimize the MDD inequalities between the wealthiest and poorest children. Programs in the form of government-led initiatives or NGO-supported interventions targeting low-income families are highly recommended. Some potential actions include providing financial aid to enable families in need to access diverse, nutritious foods, thus making healthy diets more attainable for disadvantaged households [28]. Targeted education campaigns focused on low-income communities, delivered through accessible channels (e.g., community radio, mobile phone messaging), could have increased awareness about MDD and its importance [29]. Continued focus on ensuring equitable access to nutritious foods and promoting knowledge about MDD across all economic backgrounds is crucial for sustained improvement. This finding is consistent with a study conducted in Ethiopia, where the authors reported a statistically significant disparity in MDD in favor of children in the wealthiest households [30].

Consistent with a multicountry study conducted among 31 Sub-Saharan African countries [31], this study also found that the education inequality of MDD among children aged 6–23 months increased over time, disproportionately affecting children of parents with no education. The lower MDD among children of parents or caregivers with no education is concerning, as 60% of Sierra Leone's population lacks formal education. This finding implies that most children are at increased risk of nutritional deficiencies potentially resulting in weakened immune function, poor growth and developmental issues, and digestive problems. It is, therefore, imperative to implement urgent measures to heighten and diversify food intake among children irrespective of parents or caregivers education level. Public education campaigns promoting MDD should be implemented, focusing on parents or caregivers with no education [32]. Redesigning

interventions to be more accessible and culturally appropriate for mothers with lower education, addressing time constraints and resource limitations, and providing ongoing support throughout the critical feeding period are potential strategies to bridge the gap.

The inequality in MDD disproportionately affecting children in rural areas highlights a critical issue. Remote areas have limited access to healthcare facilities, qualified personnel offering MDD counselling, and support services like nutrition education programs [33]. This can leave mothers with fewer resources and guidance to ensure MDD for their children. Inadequate transportation networks or storage facilities in certain regions could limit the availability and affordability of nutritious foods, particularly perishable items like fruits and vegetables [34]. It is therefore recommened for MDD interventions like public awareness programs to focus on rural areas to reduce disparity. This finding is consistent with a multicountry study conducted among three West African countries: Ivory Coast, Niger, and Senegal, where the authors reported children residing in urban areas hd a higher MDD prevalence than their counterparts in the rural areas [35]. Similar reasons were reported by the authors as the likely reason for the higher prevalence of MDD among children in urban areas than those in rural area.

Conversely, the notable increase in MDD in the Northwestern province, compared to the Eastern and Northern province, was unexpected. This province (Northwestern), which was originally part of the Northern province established in 2017, is the most deprived province in terms of healthcare resources in Sierra Leone. Access to healthcare resources for children in the Northwestern province is challenging; however, the rise in MDD may be influenced by factors that are not yet fully understood, potentially rooted in cultural and traditional practices. We recommend conducting a qualitative study to explore the drivers behind the increased MDD in this province. Moreover, the highest MDD observed among children residing in the Western Area was anticipated. This region, which encompasses the national capital city, hosts the primary administrative centers for healthcare resources, including health facilities and healthcare workers. Additionally, it benefits from extensive information dissemination regarding the advantages of food diversity through various media channels, including electronic, print, and social media. The interplay of these factors likely contributed to the increased MDD among children in this area, in contrast to other provinces with more limited access, as noted in the study.

Policy and practice implications

The overall increase in MDD represents a positive trend as Sierra Leone works toward achieving sustainable development goal 3 by 2030. However, the observed disparities disproportionately affecting disadvantaged groups raise concerns about the country's ability to achieve universal health coverage soon. Addressing these inequalities requires comprehensive and targeted interventions.

The government and policymakers should focus on developing programs targeting caregivers of young children (6–8 months) to improve their understanding and implementation of proper infant and young child feeding practices. Policies that advance economic opportunities and create robust social safety nets are vital for addressing the financial challenges in accessing varied and nutritious diets. Additionally, awareness campaigns highlighting the significance of MDD for children, especially in rural communities and among families with limited education, should be prioritized. Incorporating nutrition education into school curriculums can also help strengthen awareness and understanding of MDD.

Investments in infrastructure and support systems are essential for improving access to diverse and nutritious foods in rural areas. In addition, investigating the underlying causes behind provincial disparities such as food security challenges, cultural practices, or limited healthcare access is crucial. In light of these findings, it is essential to design customized programs and allocate resources strategically to address the specific needs of each province effectively.

Regular monitoring of trends in dietary diversity is critical for identifying emerging disparities and ensuring that policies and programs remain responsive to evolving challenges. By adopting a multifaceted approach that addresses social, economic, and provincial inequalities, Sierra Leone can make meaningful progress toward achieving universal health coverage and improving child nutrition outcomes.

Strengths and limitations

This study has two main strengths. First, the 2013 and 2019 SLDHS provide nationally representative data, allowing for generalizable conclusions about dietary diversity trends nationwide. Using the same survey tool (SLDHS) in 2013 and 2019 provides a more robust comparison of dietary diversity trends over time. Second, the WHO HEAT is a validated software designed to analyse health inequality data. This strengthens the credibility of the findings on how inequalities affect dietary diversity. Despite these strengths, this study has several limitations. First, the dietary intake data in SLDHS relies on mothers' recall, which can be prone to bias and inaccuracies. Second, the SLDHS MDD score is a basic measure and doesn't capture the quality or quantity of food consumed. Third, the SLDHS data is cross-sectional, providing a snapshot at a specific time, and cannot definitively

determine cause-and-effect relationships between factors and dietary diversity. Finally, a significant limitation of this study is the inability to conduct statistical testing for differences, as the WHO HEAT database does not support such analyses. Although confidence intervals were provided for some estimates to indicate precision, the absence of formal statistical testing necessitates cautious interpretation of the findings.

Conclusion

Although MDD for children aged 6–23 months significantly improved in Sierra Leone over time, the highest increase in 2019 is below the global target suggests additional efforts are needed to foster progress in optimizing children's growth. The decrease in MDD inequalities in the respective indicators: child's sex, household wealth quintile, and place of residence is encouraging for Sierra Leone, a nation struggling with meeting key sustainable development goal indicators like reducing child mortality to 25 per 1000 live births. However, the increase in MDD proportion in education is worrying. This suggests children from less educated caregivers have lower dietary diversity, thereby increasing their risk of contracting childhood illness. With the fragility of Sierra Leone's healthcare system, an increase in childhood illnesses resulting from a poorly balanced diet will overwhelm the healthcare system likely resulting in increased mortality. Similarly, the increase in MDD inequaliity especially for children residing Eastern province having lower dietary diversity, calls for targeted nutrition programs to address the specific needs of younger children (6–8 months) to improve their dietary diversity. Continue efforts to ensure all families, regardless of economic background, have access to resources and information for child nutrition. Implement education campaigns, mainly focused on rural areas and less educated households, to raise awareness about the importance of a diverse diet for children. Investigate the reasons behind the increase in provincial inequality and develop programs to improve dietary diversity in those areas. Furthermore, future studies should incorporate additional statistical analyses to strengthen the robustness of conclusions.

Abbreviations

D	Difference
HEAT	Health Equity Assessment Toolkit
DHS	Demographic Health Survey
MDD	Minimum Dietary Diversity
PAF	Population Attributable Fraction
PAR	Population Attributable Risk
R	Ratio
SDG	Sustainable Development Goal
WHO	World Health Organization

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Author contributions

AO and CB contributed to the study design and conceptualisation. AO and CB performed the analysis. AO and CB developed the initial draft. All the authors critically reviewed the manuscript for its intellectual content. US provided valuable feedback on the data interpretation, methodological approach, and manuscript clarity. All authors read and amended drafts of the paper and approved the final version. AO had the final responsibility of submitting it for publication.

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Data availability

The dataset used can be accessed at https://whoequity.shinyapps.io/heat/

Declarations

Ethics approval and consent to participate

This study did not seek ethical clearance since the WHO HEAT software and the dataset are freely available in the public domain.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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