ORIGINAL RESEARCH

CURRENT DEVELOPMENTS IN NUTRITION

Community and Global Nutrition

Trends and Determinants of Dietary Diversity in Children Aged 6–59 Months in Ethiopia: Analysis of 2005–2016 Demographic and Health Survey

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ABSTRACT

Background: Dietary diversity may be associated with health and optimum growth in children.

Objectives: In this study we analyzed the trends and determinants of minimum dietary diversity (MDD) among Ethiopian children aged 6 to 59 mo.

Methods: Ethiopian Demographic Health Survey (EDHS) data of 3 consecutive years (2005, 2011, and 2016) were analyzed. A total of $n = 2396$ (2005), $n = 3385$ (2011), and $n = 3723$ (2016) children aged 6 to 59 mo were included for measurement of trends and identification of the determinants of MDD. The associations between the study factors and MDD were investigated using multiple logistic regression analysis.

Results: The proportion of children who fulfilled the MDD decreased from 2.46% in 2005 to 1.57% in 2011 but sharply increased to 7.82% in 2016. Adjusted regression analysis revealed that exposure of mothers to media, particularly watching television, maternal education, and household wealth were associated with a greater likelihood of mothers providing diversified diets to their children across the 3 y of EDHS data.

Conclusions: A decrease in MDD was observed from the years 2005 to 2011, after which a sharp increase was noted in 2016. In all 3 y of the EDHS, media exposure, maternal education, and household wealth were the consistent factors positively affecting dietary diversity among children aged 6 to 59 mo. Future intervention programs to increase dietary diversity in children should emphasize improving access to media exposure, education, and antenatal care visits. *Curr Dev Nutr* 2022;6:nzac135.

Keywords: minimum dietary diversity, trend, Ethiopia, determinants, children younger than 5 years

Manuscript received February 23, 2022. Initial review completed July 23, 2022. Revision accepted August 25, 2022. Published online August 30, 2022.
The authors reported no funding received for this study.

Author disclosures: The authors reports no conflicts of interest.

Supplementary Tables 1 and 2 are available from the "Supplementary data" link in the online posting of the article and from the same link in the online table of contents at https://academic.oup.com/cdn/.

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Abbreviations used: ANC, antenatal care; AOR, adjusted OR; COR, crude OR; DHS, Demographic Health Survey; EDHS, Ethiopian Demographic Health Survey; ICF, Inner City Fund; MDD, minimum dietary diversity; NRERC, National Research Ethics Review Committee; SDG, Sustainable Development Goals; SSA, Sub-Saharan Africa

Introduction

Inadequate intake of energy and nutrients continues to be a serious public health challenge in developing countries (1–3). With the emergence of COVID-19, the global prevalence of undernutrition is getting worse, with a sharp increase to 9.9% in 2020 from 8.4% in the previous year (1). Recent WHO data on malnutrition included estimates that worldwide ~22% of children aged >5 y have stunted growth and 6.7% have wasting (3), with substantial prevalence in developing regions, particularly in Sub-Saharan Africa (SSA) (4, 5).

Several interventions have been applied to reduce the extensive rate of malnutrition in Ethiopia. Despite the tremendous efforts being employed, the rate of undernutrition in Ethiopia is still significant (6). According to a recent national survey performed in 2019, 37% of children aged >5 y had stunted growth, 7% had wasting, and 21% were underweight (7). Undernutrition in the first 2 y of life commonly causes impaired mental growth resulting in poor educational performance, reduced economic productivity, and increased illness and mortality during adulthood (8).

The WHO has strongly emphasized the need for adequate and safe foods for children aged ≥6 mo to stay healthy and achieve optimal growth. The type of food intake that best ensures nutrient adequacy is a diverse diet that delivers a variety of macro- and micronutrients from different food groups. However, ~43% of the global population cannot afford a healthy diverse diet, and this estimate increases to 87% for people in low-income countries. (9, 10).

Evidence has shown that globally only 29% of children aged 6 to 23 mo consume diets that fulfill the required minimum dietary diversity (MDD; ≥4 of 7 food groups). According to a WHO estimate ~12 million avoidable deaths in 2018 were attributable to poor diet in adults

(2). Data show a much lower magnitude of dietary diversity in Ethiopia (13% of children aged 6–23 mo), with children's diets among the least diverse in the world (4).

A few previous studies have been performed to investigate the determinants of dietary diversity in the Ethiopian setting (11–13). However, most of the findings were limited to 1-season EDHS data. Factors associated with MDD and their trends over time are key targets for investigations contributing to in-depth understanding of the progress of dietary diversity over time and clearing a path toward the design of appropriate programs and intervention.

In this study we aimed to explore factors affecting dietary diversity and their trends over 3 consecutive surveys (EDHS 2005, 2011, and 2016). The findings from the current research can serve as important evidence that is useful for policymakers and researchers.

Methods

Data source

The study used data from the Ethiopian Demographic Health Survey (EDHS) for the years 2005 ($n = 2396$), 2011 ($n = 3385$), and 2016 ($n = 3723$), which were collected by the Central Statistical Agency of Ethiopia in collaboration with the US Inner City Fund (ICF) and ORC Macro. The EDHS includes national data for infant and young child feeding practices. Our analysis was restricted to children aged 6–59 mo and their mothers. Selection of households from each numeration area were performed following a 2-stage stratified cluster-sampling technique. Ethiopian population housing census data were used to select clusters from a list of enumeration areas. Then random selection of households was conducted after complete listing of households from each enumeration area. Details of the methodology are described in the respective EDHS reports (14–16).

Outcome variable

The MDD is defined as the proportion of children aged 6–59 mo who consumed foods from ≥4 food groups out of 7 referenced food groups within a 24-h time period (17). The 7 food groups are the following: *1*) grains, roots, and tubers; *2*) legumes and nuts; *3*) dairy products (milk, yoghurt, and cheese); *4*) flesh foods (meat, fish, poultry, and liver/organ meats); *5*) eggs; *6*) vitamin A–rich fruits and vegetables; and *7*) other fruits and vegetables. In this study The updated version of MDD-8 was not used as an indicator (18), because more than half of the targeted children were >2 y old (23 mo) or beyond the optimum breastfeeding group. Minimum dietary diversity was calculated by summing all the food groups together, with scores ranging from 0 to 7. Consumption of any of the food groups was assigned a score of 1, and a score of 0 was assigned for not consuming a food group. For the purpose of this study in children aged 6–59 mo, during the previous 24 h before the interview, children who received foods from ≥4 food groups were considered to have achieved adequate MDD, and those who received foods from <4 food groups to have achieved inadequate MDD. Hence, the outcome variable was categorized as "<4 food groups" for inadequate MDD and "≥4 food groups" for adequate MDD.

Explanatory variables

Explanatory data were selected based on literature findings and categorized as demographic, socioeconomic, health service, or community-level factors (13, 19–22). These data provide information that is important in measuring diet or nutritional status in children.

Maternal age was categorized as 15–24, 25–34, or 35–49 y; child sex was categorized as male or female; family size was categorized as ≤3, 4–5, or ≥6 family members; and media exposure was categorized as reading newspapers, listening to radio, or watching television.

Mother or father education, maternal occupation, and household wealth were the socioeconomic factors analyzed during the study. Grouping of the socioeconomic factors was done according to Ahmed et al. 2020 (20). Educational status was grouped into 4 classes: no schooling or primary, secondary, or higher education. Mothers working in professional, technical, managerial, or clerical services were grouped to formal occupation; those working in agriculture and manual or any business work were grouped to informal occupation; and those working only in household activities such as preparing food, and raising children were grouped to household occupation (9, 20). The EDHS categorized household wealth index into 5 quintiles: poorest, poor, middle, rich, and richest. For our analyses, we regrouped the household wealth index into tertiles: low, middle, and high (19).

Data for frequency of antenatal care visits, place of birth, and postnatal checkups were included as health service factors. ANC visits have been grouped as none, 1–3, or ≥4 visits, whereas place of birth has been grouped as home or health facility delivery and the postnatal checkup data have been grouped as yes or no.

Factors included under the community level were place of residence, which has been categorized as either urban or rural, and region of residence, which has been grouped into large central, small peripheral, and metropolis regions depending on the geopolitical characteristics (20). The regions of Tigray, Amhara, Oromia, the and Southern Nations and Nationalities and Peoples have been included under the large central region category, whereas Afar, Somali, Benishangul, and Gambella have been grouped under the small peripheral region. Addis Ababa, the Dire Dawa city administration, and the Harari regions have been categorized under the metropolis regions.

Statistical analysis

Data analysis was conducted using sampling weight and Stata survey commands (Stata version 16.0, Stata Corp). Descriptive analyses by frequencies and percentages for the study factors from 2005 to 2016 were performed. For each data year, the prevalence of MDD was examined. Bivariate logistic regression analyses were applied to measure the impact of each explanatory variable on the outcomes. Only variables with a P value < 0.25 was entered into multiple logistic regression models to control possible confounders. In the final model, those variables with a P value < 0.05 were used to predict dietary diversity of children aged 6–59 mo. Both crude and adjusted ORs with 95% CIs were presented the results. All regression analyses were conducted separately for each of the 3 y of data collection, 2005, 2011, and 2016. The Hosmer–Lemeshow goodness-of-fit test was used to determine model fitness (23). Multicollinearity between explanatory variables was checked by using the variance inflation factor (VIF).

Ethical consideration

To conduct the EDHS, ethical approval was obtained from the National Research Ethics Review Committee (NRERC) of Ethiopia. Permissions from administrative offices and study participants were obtained before the actual data collection. For this study, the authors obtained permission from the DHS Program for the use of the EDHS data set after a proposal was submitted online.

Results

Characteristics of the study participants

From 2005 to 2016, the majority of mothers who participated in the study were aged between 15 and 24 y. Many mothers had no media exposure and no schooling from 2005 to 2016. Similarly, many mothers had no ANC visits from 2005 to 2016. Over the study period, a high percentage of children were from low-income families (**Table 1**).

Trends of MDD in children aged 6–59 mo

The proportion of children who achieved adequate MDD decreased from 2.46% in 2005 to 1.57% in 2011, but increased rapidly to 7.82% in 2016. Between 2005 and 2011, the prevalence of inadequate MDD among children was increased by 0.89%, whereas from 2011 to 2016 it was reduced by 6.25% (**Table 2**).

Trends of the food consumption group in children aged 6–59 mo

Grain, roots, and tubers were consumed by the majority of children across the 3 y of the surveys, whereas flesh foods, eggs, and other fruits and vegetables were consumed by a few children. Food consumption trends are presented in **Supplementary Table 1**.

Determinants of MDD

The 2005 study participant data revealed that watching television was positively associated [AOR: 2.36; 95% CI: 1.04, 5.34)] with MDD. For socioeconomic factors, children whose parents had a high household wealth index [AOR: 2.13; 95% CI: 1.02, 4.47] were more likely to meet the MDD than children whose parents had a low household wealth index. In the 2011 analysis, children whose mothers watched television [AOR: 2.63; 95% CI: 1.40, 4.93] and those who had a primary educational level [AOR: 2.42; 95% CI: 1.30, 4.48] were more likely to meet the MDD than mothers who did not watch television and did not attend formal schooling. Similarly, children whose mothers had ≥4 ANC visits were more likely to meet the MDD than children whose mothers had no ANC visits [AOR: 2.29; 95% CI: 1.12, 4.72]. In the 2016 analysis, children whose mothers were aged between 25 and 34 y [AOR: 1.39; 95% CI: 1.01, 1.93], those who read the newspaper [AOR: 1.49; 95% CI: 1.01, 2.22] or who listened to the radio [AOR: 1.55; 95% CI: 1.16, 2.08], those who attended higher education [AOR: 2.27; 95% CI: 1.32, 3.91], and those resided in middle-wealth households [AOR: 2.08; 95% CI: 1.39, 3.09] or wealthy households [AOR: 1.77; 95% CI: 1.19, 2.63] were more likely to achieve MDD than children whose mothers did not engage in these activities (**Table 3**).

Discussion

In this study we examined the trends and determinants of dietary diversity in children aged 6–59 mo in Ethiopia. Our results showed that the proportion of children who achieved an adequate MDD decreased between 2005 and 2011 (from 2.46% to 1.57%) but increased rapidly to 7.82% in 2016. Weak improvements in the number of children meeting the MDD has been observed over these trends. Possible reasons for this limited improvement are the slow economic growth during the last 2 decades and the low level of national nutrition efforts to improve child dietary diversity in Ethiopia (20, 24). Nutritional education is expected to broaden the knowledge of mothers, leading to improved child feeding practices (25, 26). Better understanding of educational messages delivered through different media outlets can improve nutritional outcomes of children (27). The source of information transmitted through mass media may affect behavior because it is considered to be trustworthy (28). In particular, television and radio have an impact on improving child dietary diversity through improving nutrition awareness among mothers and other or caregivers (29). In addition, limited income to purchase and consume more diversified animal and plant sources of food may result in a household's choice of prioritizing prices of foods (30, 31). Therefore, encouraging multisectoral nutrition coordination and integration program would be important to increase feeding practice for Ethiopian children and mothers.

In adjusted regression analysis, maternal age, reading of newspapers/magazines, listening to radio, watching television, and increased education; increased household wealth status; and ANC visits have shown positive associations with dietary diversity. However, among the mothers who watched television, maternal education and household wealth were among the predictors consistently associated with dietary diversity across the 3 EDHS.

Our findings for the year 2016 were similar to those for the study in southwest Ethiopia that showed a significant association between the maternal age of 25–34 y and dietary diversity, but statistically significant association were not observed in 2005 and 2011. Mothers aged 25–34 y were more likely to achieve adequate MDD than their counterparts. This finding could be due to mothers giving more attention to nutritional education at this age, which leads to efforts to have adequate dietary diversity during their pregnancy (24, 32).

The present study also revealed a significant relation between maternal exposure to media (i.e., television, radio, newspaper or magazine) and child dietary diversity, a finding that was consistent with the results of studies conducted in Indonesia and India (18, 33). Media exposure is considered one of the sources of information that could be influencing behavior. In recent years in Ethiopia, child feeding practices have received wide mass media coverage, which may explain the observed association with maternal exposure to media and dietary diversity in their children (18). Hence, our results encourage promotion of nationwide access to mass media.

Maternal education is one of the most important determinants that improves maternal and child health, including child nutrition (32). Educated mothers have better awareness of the importance of following scientifically proven feeding recommendations and are likely to have employment opportunities and household decision-making empowerment compared with mothers with no schooling (18, 34). In line with the findings of previous related studies performed in Timor-Leste and

TABLE 1 Demographic-, socioeconomic-, health service–, and community-level characteristics of Ethiopia children aged between 6 and 59 mo (2005–2016[1]

Variable	2005 (n = 2396)	2011 (n = 3385)	2016 (n = 3723)
Demographic characteristics			
Maternal age, y			
15–24	648 (27.05)	999 (29.51)	1140 (30.62)
25–34	1155 (48.21)	1699 (50.19)	1885 (50.63)
35–49	593 (24.75)	687 (20.30)	698 (18.75)
Sex of child			
Male	1246 (52.00)	1734 (51.23)	1850 (49.69)
Female	1150 (48.00)	1651 (48.77)	1873 (50.31)
Family size			
≤3	252 (10.52)	357 (10.55)	502 (13.48)
4–5	796 (33.22)	1096 (32.38)	1276 (34.27)
≥6	1348 (56.26)	1932 (57.07)	1945 (52.25)
Reading newspaper/magazines			
No	2295 (95.78)	3252 (96.07)	3420 (91.86)
Yes	101 (4.22)	133 (3.93)	303 (8.14)
Listening to radio			
No	1661 (69.32)	2022 (59.73)	2792 (74.99)
Yes	735 (30.68)	1363 (40.27)	931 (25.01)
Watching television			
No	2261 (94.37)	2610 (77.10)	2891 (77.65)
Yes	135 (5.63)	775 (22.90)	832 (22.35)
Socioeconomic characteristics			
Maternal education			
No schooling	1952 (81.47)	2503 (73.94)	2224 (59.74)
Primary	373 (15.57)	835 (24.67)	1025 (27.53)
Secondary	68 (2.84)	40 (1.18)	315 (8.46)
Higher	3 (0.13)	7 (0.21)	159 (4.27)
Maternal occupation			
Household occupation	16 (0.67)	67 (1.98)	364 (9.78)
Formal occupation	181 (7.55)	388 (11.46)	625 (16.79)
Informal occupation	2199 (91.78)	2930 (86.56)	2734 (73.43)
Household wealth status			
Low	1171 (48.87)	1874 (55.36)	1926 (51.73)
Middle	478 (19.95)	634 (18.73)	523 (14.05)
High	747 (31.18)	877 (25.91)	1274 (34.22)
Health service characteristics			
Antenatal visits			
None	1815 (75.75)	2133 (63.01)	1193 (32.04)
1–3	337 (14.07)	832 (24.58)	1152 (30.94)
≥4	244 (10.18)	420 (12.41)	1378 (37.02)
Birthplace			
Home	2360 (98.50)	3339 (98.64)	2152 (57.80)
Health facility	36 (1.50)	46 (1.36)	1571 (42.20)
Postnatal checkup			
No	2327 (97.12)	3224 (95.25)	3406 (91.49)
Yes	69 (2.88)	161 (4.75)	317 (8.51)
Community-level characteristics			
Place of residence			
Rural	2223 (92.78)	3142 (92.82)	2980 (80.04)
Urban	173 (7.22)	243 (7.18)	743 (19.96)
Region of residence			
Large central	1565 (65.32)	1850 (54.65)	1764 (47.38)
Small peripheral	627 (26.17)	1206 (35.63)	1365 (36.66)
Metropolis	204 (8.51)	329 (9.72)	594 (15.96)

[1]Values are presented as n (%) unless otherwise indicated. MDD, minimum dietary diversity.

TABLE 2 MDD trends of Ethiopian children aged between 6 and 59 mo (2005–2016)

MDD	2005 (n = 2396)	2011 (n = 3385)	2016 (3723)
Inadequate (<4 food groups)	2337 (97.54)	3332 (98.43)	3432 (92.18)
Adequate (≥4 food groups)	59 (2.46)	53 (1.57)	291 (7.82)

[1]Values are presented as n (%) unless otherwise indicated. MDD, minimum dietary diversity.

TABLE 3 Bivariate and multivariate logistic regression between different-level determinants and MDD of Ethiopian children aged 6–59 mo (2005–2016)[1]

Variables	2005				2011				2016			
	COR (95% CI)	*P* value	AOR (95% CI)	*P* value	COR (95% CI)	*P* value	AOR (95% CI)	*P* value	COR (95% CI)	*P* value	AOR (95% CI)	*P* value
Demographic factors												
Maternal age, y												
15–24	1				1		1		1		1	
25–34	1.16 (0.62, 2.17)	0.634			0.58 (0.32, 1.04)	0.069	0.78 (0.39, 1.54)	0.472	1.35 (1.02, 1.79)*	0.036	1.39 (1.01, 1.93)**	0.043
35–49	0.94 (0.44, 2.00)	0.885			0.44 (0.19, 1.02)	0.057	0.61 (0.23, 1.63)	0.325	0.97 (0.67, 1.42)	0.891	1.27 (0.81, 1.98)	0.293
Sex of child												
Male	1				1				1			
Female	1.20 (0.71, 2.02)	0.480			0.80 (0.46, 1.39)	0.431			1.04 (0.82, 1.32)	0.751		
Family size												
≤3	1				1				1		1	
4–5	0.95 (0.39, 2.26)	0.905			0.43 (0.20, 0.91)	0.027	0.53 (0.23, 1.19)	0.125	0.91 (0.64, 1.29)	0.603	0.85 (0.58, 1.25)	0.403
≥6	0.82 (0.36, 1.89)	0.648			0.38 (0.19, 0.76)	0.006	0.64 (0.28, 1.47)	0.297	0.68 (0.48, 0 .97)*	0.031	0.80 (0.53, 1.20)	0.284
Reading newspa-per/magazines												
No	1		1		1		1		1		1	
Yes	3.78 (1.75, 8.20)*	0.001	0.99 (0.37, 2.69)	0.988	2.03 (0.72, 5.70)	0.181	0.57 (0.18, 1.76)	0.327	3.77 (2.77, 5.12)*	0.000	1.49 (1.01, 2.22)**	0.042
Listening to radio												
No	1		1		1		1		1		1	
Yes	3.17 (1.88, 5.36)*	0.000	1.57 (0.84, 2.93)	0.158	2.48 (1.42, 4.35)*	0.001	1.47 (0.79, 2.72)	0.226	2.65 (2.08, 3.39)*	0.000	1.55 (1.16, 2.08)**	0.003
Watching television												
No	1		1		1		1		1		1	
Yes	6.29 (3.41, 11.64)*	0.000	2.36 (1.04, 5.34)**	0.040	3.59 (2.08, 6.18)*	0.000	2.63 (1.40, 4.93)**	0.003	2.72 (2.13, 3.49)*	0.000	0.78 (0.53, 1.16)	0.225
Socioeconomic factors												
Maternal education												
None	1		1		1		1		1		1	
Primary	3.03 (1.71, 5.37)*	0.000	1.79 (0.94, 3.44)	0.076	3.74 (2.14, 6.53)*	0.000	2.42 (1.30, 4.48)**	0.005	1.91 (1.44, 2.54)*	0.000	1.34 (0.96, 1.86)	0.084
Secondary	4.48 (1.69, 11.83)*	0.002	0.77 (0.22, 2.75)	0.691	5.68 (1.29, 24.93)*	0.021	2.29 (0.45, 11.79)	0.321	2.54 (1.72, 3.74)*	0.000	1.12 (0.69, 1.84)	0.640
Higher	28.21 (2.49,318.56)*	0.007	12.28 (0.46,324.05)	0.133	1				6.86 (4.61, 10.21)*	0.000	2.27 (1.32, 3.91)**	0.003
Maternal occupation												
Household occupation	1				1				1		1	
Formal occupation	0.69 (0.08, 5.92)	0.738			1.21 (0.1467894, 10.02)	0.858			2.51 (1.49, 4.23)*	0.001	1.17 (0.67, 2.04)	0.591
Informal occupation	0.34 (0.04, 2.66)	0.306			1.04 (0.14, 7.66)	0.969			1.38 (0.85, 2.24)	0.198	1.18 (0.72, 1.95)	0.511
Household wealth status												
Low	1		1		1		1		1		1	
Middle	1.41 (0.59, 3.38)	0.445	1.17 (0.48, 2.87)	0.727	1.99 (0.95, 4.15)	0.067	1.71 (0.79, 3.67)	0.169	2.35 (1.60, 3.43)*	0.000	2.08 (1.39, 3.09)**	0.000
High	4.31 (2.31, 8.02)*	0.000	2.13 (1.02, 4.47)**	0.044	2.78 (1.49, 5.17)*	0.001	1.61 (0.79, 3.29)	0.192	3.72 (2.81, 4.93)*	0.000	1.77 (1.19, 2.63)**	0.004

(*Continued*)

TABLE 3 (*Continued*)

Variables	2005				2011				2016			
	COR (95% CI)	*P* value	AOR (95% CI)	*P* value	COR (95% CI)	*P* value	AOR (95% CI)	*P* value	COR (95% CI)	*P* value	AOR (95% CI)	*P* value
Health service factors												
Antenatal visits												
None	1		1		1		1		1		1	
1–3	1.08 (0.48, 2.45)	0.856	0.65 (0.27, 1.55)	0.333	1.72 (0.87, 3.40)	0.118	1.17 (0.57, 2.38)	0.674	1.59 (1.13, 2.26)*	0.008	1.00 (0.68, 1.47)	0.998
≥4	3.93 (2.16, 7.13)*	0.000	1.56 (0.76, 3.19)	0.223	4.28 (2.24, 8.19)*	0.000	2.29 (1.12, 4.72)**	0.023	2.51 (1.83, 3.45)*	0.000	0.96 (0.64, 1.43)	0.829
Birth place												
Home	1				1				1		1	
Health facility	1.13 (0.15, 8.42)	0.902			1.40 (0.19, 10.38)	0.739			2.58 (2.01, 3.31)*	0.000	1.24 (0.88, 1.75)	0.215
Postnatal checkup												
No	1		1		1		1		1		1	
Yes	4.29 (1.78, 10.37) *	0.001	2.03 (0.73, 5.65)	0.174	2.94 (1.24, 6.99)*	0.015	1.77 (0.69, 4.53)	0.231	1.89 (1.33, 2.69)*	0.000	1.26 (0.87, 1.83)	0.228
Community-level factors												
Place of residence												
Rural	1		1		1		1		1		1	
Urban	5.66 (3.15, 10.17)*	0.000	1.69 (0.72, 3.96)	0.231	2.34 (1.09, 5.03)*	0.029	1.07 (0.44, 2.63)	0.882	3.22 (2.51, 4.12)*	0.000	1.48 (0.96, 2.28)	0.077
Region of residence												
Large central	1		1		1		1		1		1	
Small peripheral	0.94 (0.51, 1.76)	0.854	1.13 (0.58, 2.19)	0.719	1.17 (0.6671633, 2.04)	0.589	1.80 (0.98, 3.32)	0.058	0.71 (0.53, 0.96)*	0.025	0.98 (0.70, 1.36)	0.903
Metropolis	1.69 (0.77, 3.67)	0.189	1.08 (0.46, 2.55)	0.856	0.38 (0.09, 1.62)	0.192	0.30 (0.07, 1.35)	0.118	2.11 (1.58, 2.82)*	0.000	1.20 (0.85, 1.72)	0.302

[1]Values are presented as *n* (%) unless otherwise indicated. *$P < 0.25$, **$P < 0.05$. MDD, minimum dietary diversity.

other low- and middle-income countries (35–37), our findings show that mothers with schooling are better able to feed their children with a more diversified diet. In 2005 there was no observed trend showing an influence of maternal education on MDD in children. However, children of mothers with primary education in 2011and higher education in 2016 were more likely to achieve MDD than children of mothers without schooling. These improvements might be attributable to improvements in educational quality in Ethiopia (38).

In the present study high household wealth index was shown to be positively associated with adequate MDD in children during the years of 2005 and 2016. However, no statistically significant relation was seen in 2011. Adequate MDD decreased from 1.20% in 2005 to 0.96% in 2011, then slowly increased to 3.95% in 2016 for children from low-income families, whereas adequate MDD in children from high-income families decreased from 4.95% in 2005 to 2.62% in 2011, then increased to 13.27% in 2016 (**Supplementary Table 2**). Similarly, researchers in South East Asia and Indonesia have reported that children from the wealthiest families had more opportunity of consuming a diversified diet than children from low-income families (18, 39). Wealthy households have multiple affordable options for foods from animal and plant sources (40).

Maternal participation in ≥4 ANC visits significantly associated with dietary diversity in children. This finding is consistent with studies undertaken in Nigeria and India (19, 33). However, our results showed a significant relation of ANC visits with MDD in the 2011 survey but not in 2005 and 2016 surveys. Maternal nutritional counseling during ANC visits is one of the most effective factors for improving child feeding practices (22). Therefore, our findings suggest that strengthening maternal nutritional counseling and education during ANC visits may improve children's dietary diversity.

This study has certain limitations. First, the study was cross-sectional in design and thus might not show inferring causal directions. Second, the outcome variables were measured based on self-reported information, and thus the data were exposed to possible bias associated with recall and social desirability. Third, due to the nature of secondary data, our analysis was restricted to only variables that were in the dataset.

In conclusion, this study revealed that the proportion of Ethiopian children with adequate MDD decreased between 2005 and 2011, but rapidly increased in 2016. Common determinants of dietary diversity included maternal media exposure, maternal education, and household wealth. Based on our findings we recommend that policy and program interventions to increase MDD in Ethiopian children focus on improving maternal access to education, media exposure, and ANC visits.

Acknowledgments

We thank Dr. Kassaye Tolessa for facilitating the training on data analysis using STATA and Mr. Kibru Teshome for his editorial support on the draft manuscript. The authors' responsibilities were as follows—DDJ: designed the research, analyzed the data, wrote the paper, and contributed to review; BGA: designed the research, wrote the paper, contributed to review, and had primary responsibility for the final content; and all authors: read and approved the final manuscript.

Data Availability

Data described in the manuscript will be made available upon request.

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