Heliyon 8 (2022) e08727

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Minimum dietary diversity and its associated factors among infants and young children in Ethiopia: evidence from Ethiopian Demographic and Health Survey (2016)

Temesgen Muche [a,*], Sewitemariam Desalegn [a], Helen Ali [a], Moges Mareg [b], Daniel Sisay [c], Mahlet Birhane [a], Robel Hussen Kabthymer [a]

[a] Department of Human Nutrition, School of Public Health, College of Health Science and Medicine, Dilla University, Ethiopia
[b] Department of Reproductive Health, School of Public Health, College of Health Science and Medicine, Dilla University, Ethiopia
[c] School of Public Health, College of Health Science and Medicine, Dilla University, Ethiopia

ARTICLE INFO

Keywords:
Infant feeding
Child feeding
Diet
Children
Multilevel analysis
Ethiopia demographic and health survey

ABSTRACT

Background: Adequate infant and young child feeding during the first 1000 days of life is very essential to improve child health, survival, growth, and development through minimum dietary diversity (MDD). Hence, this study aimed to assess MDD and its multi-level factors among infants and young children aged 6–23 months in Ethiopia.
Methods: Ethiopian Demographic and Health Survey (EDHS-2016) data was used to identify both individual and community-level factors of dietary diversity. Weighted samples of 2,962 children were eligible and a multi-level regression model was used for the analysis. Finally, factors with a P-value of <0.05 were considered statistically significant.
Results: The prevalence of MDD among children in Ethiopia was 12.09%. According to this study, factors such as having a mother who attended higher education (AOR = 3.09, (95% CI; _1.67–5.71)), being a female household head (AOR = 0.62, (95% CI; _0.40–0.95)), having a mother's agricultural occupation (AOR = 1.89, (95% CI; _1.10–3.23)) and living in the household in the richest wealth index were significantly associated at the individual level. At the community level, children living in rural areas (AOR = 0.62, 95% CI; 0.39–0.98) were significant risk factors for MDD (AOR = 0.62, 95% CI; 0.39–0.98).
Conclusion: The educational and occupational status of the mother, wealth index, and region were significantly associated with MDD. Hence, strengthening of the existing nutritional intervention is helpful to increase diversified food consumption among children.

1. Introduction

Appropriate infant and young child feeding practices are very essential for the improvement of child health and development (UNICEF, 2011; WHO, 2007, 2010). Hence, it directly affects the nutritional status of children under two years of age ultimately, impacting child survival. Improving infant and young child feeding practices is therefore critical to improved nutrition, health, and development of children (WHO, 2007).

The first two years of life are considered as a “critical window of opportunity” for the prevention of growth faltering and micronutrient deficiency through optimal feeding (UNICEF, 2011). Adequate nutrition during the first 100 days is known to be crucial to ensure optimal growth, and health of children, which ultimately helps them to reach their full growth potential. In low-income countries where early childhood under-nutrition is common investing in the first two years of life is not only helpful for healthy child growth, but also has the potential to break the cycle of intergenerational malnutrition (Ali et al., 2018; Blackstone and Sanghvi, 2018; Khamis et al., 2019; SD., L., & M., 2017).

Minimum dietary diversity is one of the key recommendations to prevent micronutrient deficiency among children from the eight core infant and young child feeding (IYCF) recommendations to prevent child growth faltering (WHO, 2007). Globally, a small proportion of children received nutritionally adequate complementary foods. In many countries, less than one-fourth of infants aged 6–23 months meet the criteria of minimum dietary diversity that is appropriate for their age. After 6 months of age, children become prone to malnutrition if they did not get

* Corresponding author.
E-mail address: temesgenmuche5270@gmail.com (T. Muche).

https://doi.org/10.1016/j.heliyon.2022.e08727
Received 21 July 2021; Received in revised form 5 September 2021; Accepted 5 January 2022

an appropriately diversified diet (Roba et al., 2016). To assess feeding practice precisely and to compare within and across the nations, Minimum Dietary Diversity (MDD) is a widely used indicator, which is recommended by WHO, for assessing the adequacy of dietary micronutrient density for children 6–23 months old (Beckerman-Hsu et al., 2020; Mya et al., 2019). Even though Ethiopia has established National Strategy on infant and young child practices since 2004, the level of low dietary diversity is still high (MOH, 2004). Moreover, even if there are few studies covering the small geographical areas, country-level evidence on minimum dietary diversity among infants and young children (children aged 6–23 months) is lacking. Therefore, this study was conducted to assess the minimum dietary diversity and its association with multi-level factors among infants and young children in Ethiopia by using the EDHS-2016 data.

2. Materials and methods

2.1. Study setting

A detailed analysis was carried out using Ethiopian Demography and Health Survey (EDHS-2016) data. The EDHS-2016, a cross-sectional study of design, was conducted from January 18 to June 27, 2016, in Ethiopia. Ethiopia is located in the eastern horn of Africa (3°–14° N longitude, and 33°-48°E latitude). Ethiopia covers 1.1 million square kilometers with tremendous geographical diversity, which ranges from 4550 m above sea level down to the Afar depression to 110 m below sea level. Administratively, Ethiopia is divided into nine regional states and two city administrations, further subdivided into 68 zones, which are in turn divided into 817 districts and 16,253 kebeles (the lowest local administrative units in the country) (Central Statistical Agency - CSA/Ethiopia & ICF, 2017).

2.2. Source population

All children aged 6–23 months in Ethiopia.

2.3. Study population

All eligible children aged 6–23 months, in the selected clusters, in Ethiopia.

2.4. Study variables

2.4.1. Dependent variable

The dependent variable of this study is minimum dietary diversity (met/did not meet). Based on the updated criteria, this outcome variable was categorized as meeting MDD if the children received foods from ≥5 food groups from a total of 8 food groups and did not meet if>=5 food groups were consumed during the previous day of the survey (WHO, 2017), then coded if the child did not fulfill the minimum dietary diversity score, coded as 0; and 1 for those who fulfilled the criteria. The eight food groups used to compute this outcome variable were breast milk; dairy products; cereals, roots and tubers; legumes and nuts; meat products; eggs; vitamin A-rich fruits and vegetables; and other fruits and vegetables (WHO, 2017).

2.4.2. Independent variables

Individual-level/household factors:- Maternal education, father's occupation, mother's occupation, media exposure, sex of household head, antenatal care (ANC) follow-up, nutrition counseling exposure by the health workers, family size, place of delivery and wealth index.

Community-level factors:- Place of residence, region and community poverty. The community level poverty was obtained by aggregating household wealth indexes at the cluster (community) level and categorized as high if the proportion of households with the poorest and poorer wealth index in one cluster was >50.25% and as low if the proportion was 0–50.25%.

2.5. Data management, quality control and analysis

After receiving permission from the Demographic and Health Survey (EDHS) Program, the EDHS-2016 dataset was downloaded electronically by logging at, https://www.dhsprogram.com/data/dataset_admin/login_main.cfm. Then data extraction, cleaning, selecting variables, and computing variables that are crucial for the outcome variable were performed. Moreover, coding and categorization for both continuous and categorical variables were done based on the previous literatures and their public health importance.

For this study, we used the “kid's” data set. To restore the data representatives of the survey and adjust for non-allocation of the sample strata, sample weight (V005/1000000) was used throughout the analysis. Firstly, cross-tabulation and bi-variable logistic regression were conducted, and those variables with a p-value < 0.25 were included in the multivariable logistic regression analysis. Since the EDHS data has a hierarchical structure in nature, a multi-level logistic regression analysis was performed to estimate the adjusted odds ratio.

2.6. Model constructing and fitness

After model comparison, four models containing the study variables were fitted using the melogit command in STATA version 14.0. Model 1 (null model) was fitted without independent variables to test random variability in the intercept and estimate the intra-class correlation coefficient (ICC) that evaluates the extent of variations based on minimum dietary diversity. Model 2 was developed to test the effects of individual-level variables, Model 3 was used to examine the effects of community-level variables, and then Model 4 was performed to examine the effects of both individual-level and community-level factors at the same time. The model was constructed with individuals (level 1) nested within the community (level 2). Since the models were nested, the log likelihood-ratio and Akaike's information criterion (AIC) test were used to estimate the goodness of fit of the adjusted final model in comparison to the preceding models, and the model with the lowest value was considered as the best-fit model (Akaike, 1974).

The fixed effect sizes of both individual-and community-level factors on minimum dietary diversity among children aged 6–23 months were expressed using the adjusted odds ratios (AOR) with a 95% confidence interval (CI) and a p-value of <0.05 was considered as statistically significant. Predictors were checked for multi-collinearity using the variance inflation factor (VIF) and the mean VIF was 2.16, which showed that there was no significant multi-collinearity among predictors.

2.7. Parameter estimation methods

In the multilevel logistic regression models, the random effects which are the measures of variation of minimum dietary diversity among clusters, were measured and expressed in terms of the Intra Class Correlation (ICC), Median Odds Ratio (MOR), and Proportional Change in variance (PCV) (Austin and Merlo, 2017; Merlo et al., 2005a; Merlo et al., 2005b; Weinmayr et al., 2016). The ICC was calculated to examine the degree of variation of minimum dietary diversity within clusters or among communities, MOR was the degree of variation of minimum dietary diversity among clusters in terms of odds ratio scale, and PCV was the proportion of variance verified by subsequent models.

2.8. Ethical clearance

To conduct this study, an ethical approval letter for the use of the EDHS data set gained from the Measure DHS (ORC MACRO). No information was obtained from the data set disclosed to any third person.

3. Results

In this study, weighted samples of 2,962 children aged 6–23 months old were nested into 620 clusters and included in the analysis. The mean age of the participants was 14(SD ± 5) months of age and the prevalence of minimum dietary diversity among children in Ethiopia was 12.09%. Moreover, the individual and community-level background characteristics of the study participants and the bi-variable analysis were described in Table 1.

3.1. Associated factors of minimum dietary diversity among children

Model-4 was the final model that included both individual and community-level variables simultaneously. Children whose mothers had higher educational status were 3.09 (AOR = 3.09, (95%CI; _1.67–5.71)), times more likely to have the minimum dietary diversity than those children with mothers who had uneducated. The odds of fulfilling the minimum dietary diversity among children whose mother's occupation was agricultural activity were 1.89 (AOR = 1.89, (95% CI; _ 1.10–3.23)) times higher than children whose mothers had no work. The odds of having minimum dietary diversity among children from the richest households were 5.93 times (AOR = 5.93, (95%CI; _2.69–13.08)), from richer households were 3.98 times (AOR = 3.98, (95%CI; _ 2.04–7.76)) higher as compared with those children from the poorest households. Children residing in agrarian areas 38% (AOR = 0.62, (95%CI; _ 0.39–0.98)) times less likely than children living in pastoralist areas to meet minimum dietary diversity (Table 2).

3.2. Random effect analysis

Model 1 (null-model) showed that 2.25 of total variance on minimum dietary diversity occurred at the cluster level and also had the highest median odds ratio value, which was 4.18. That means when randomly selecting an individual from the cluster with the highest odds ratio of having minimum dietary diversity had 4.18 times higher than not fulfilling the minimum dietary diversity. Variability among clusters decreased from the null model (ICC = 41%) to model four (final model) (ICC = 22%). In addition, the highest proportional change in variance (PCV = 56.62%) was seen in model-4, which describes 56.62% of the community-level variation on fulfilling minimum dietary diversity as indicated by mixed factors at the individual and community levels. So, the effect of clustering is statistically significant in model 4 (Table 3).

3.3. Dietary diversity

Of the total children who consumed dairy products, 24 h prior to the data collection period, 36.39% of them were between the ages of 12–17 months (Table 4).

Table 1. Weighted proportion and bi-variable analysis of associated factors of minimum dietary diversity among infants and young children in Ethiopia, EDHS-2016.

Variables	Minimum Dietary Diversity		P-value
	Didn't meet N (%)	Met N (%)	
Maternal education			
No education	1625 (90.29)	175 (9.71)	1
Primary	795 (86.72)	122 (13.28)	0.00
Secondary	123 (78.76)	33 (21.24)	
Higher	50 (55.63)	40 (44.37)	
Sex of household head			
Male	2226 (87.44)	320 (12.56)	1
Female	366 (88.02)	50 (11.98)	0.08
Maternal occupation			
No work	1545 (89.40)	183 (10.60)	0.00
Non-agricultural	486 (80.47)	118 (19.53)	1
Agricultural	562 (89.13)	68 (10.87)	0.01
Father's occupation			
No work	410 (85.91)	67 (14.09)	0.00
Non-agricultural	575 (83.53)	113 (16.47)	1
Agricultural	1609 (89.48)	189 (10.52)	0.00
Antenatal care follow-up			
No visit	906 (88.60)	117 (11.40)	1
1-2 visits	813 (89.98)	90 (10.02)	0.00
4 and above visits	873 (84.32)	162 (15.68)	0.00
Nutrition counseling's			
No	1449 (87.51)	207 (12.49)	1
Yes	1143 (87.54)	263 (12.46)	0.00
Media exposure			
No	2585 (88.10)	349 (11.90)	1
Yes	8 (28.08)	20 (71.92)	0.00
Family size			
<5	786 (85.48)	134 (14.3)	1
5–9	1656 (88.54)	214 (11.46)	0.02
10 and above	150 (87.39)	22 (12.61)	0.50
Place of delivery			
Home	1696 (90.28)	182 (9.72)	1
Health facility	897 (82.74)	187 (17.26)	0.00
Wealth index			
Poorest	641 (93.53)	44 (6.47)	1
Poorer	559 (89.85)	63 (10.15)	0.00
Middle	576 (88.21)	77 (11.79)	
Richer	473 (87.44)	68 (12.56)	
Richest	344 (74.57)	117 (25.43)	
Place of residence			
Urban	262 (72.11)	101 (27.89)	1
Rural	2330 (89.68)	268 (10.32)	0.00
Region			
Pastoralist	174 (93.97)	11 (6.03)	1
City	69 (68.44)	32 (31.46)	0.00
Agrarian	2350 (87.80)	327 (12.20)	0.03
Community poverty			
Low	1392 (84.16)	262 (15.84)	1
High	1201 (91.78)	107 (8.22)	0.000

4. Discussion

Our study revealed the prevalence and individual and community-level factors of minimum dietary diversity among children aged 6–23 months in Ethiopia. The prevalence of children who met the minimum dietary diversity was 12.09 %. This finding is similar with studies conducted in northwest Ethiopia (Beyene et al., 2015) and the EDHS-2016 report (Central Statistical Agency - CSA/Ethiopia & ICF, 2017), but lower than different studies done in Wolyita (Mekonnen et al., 2017), Addis Ababa (Solomon et al., 2017), Myanmar (Mya et al., 2019), Bangladesh (Blackstone and Sanghvi, 2017) and Ghana (Issaka et al., 2015). These discrepancies might be due to the small sample size of studies conducted in Ethiopia and the socio-economic and cultural differences with Bangladesh and Ghana. In this study, the minimum dietary diversity among children was associated with both individual and community-level factors.

In the present study, children whose mothers' had secondary and higher educational status were more likely to meet the minimum dietary diversity which compliments with the findings of studies conducted in northwest Ethiopia (Beyene et al., 2015) and Bangladesh (Blackstone and Sanghvi, 2018), this association might be because of the levels of

Table 2. Multivariable analysis of individual and community level factors associated with minimum dietary diversity in Ethiopia, EDHS 2016

Variables	Model 1	Model 2	Model 3	Model 4
Individual level factors	AOR(95%CI)	AOR(95%CI)	AOR(95%CI)	P-Value
Sex of household head				
Male	1		1	
Female	0.66 (0.43–1.01)		0.62 (0.40–0.95)	0.03
Maternal education				
No education	1		1	
Primary	1.30 (0.89–1.91)		1.31 (0.89–1.93)	0.15
Secondary	1.71 (1.01–2.89)		1.68 (0.99–2.83)	0.05
Higher	3.29 (1.78–6.07)		3.09 (1.67–5.71)	0.00
Mother's occupation				
No work	1.01 (0.69–1.48)		0.98 (0.67–1.43)	0.92
Non-agricultural	1		1	
Agricultural	1.87 (1.10–3.19)		1.89 (1.10–3.23)	0.01
Wealth index				
Poorest	1		1	
Poorer	2.15 (1.11–4.15)		2.27 (1.17–4.40)	0.01
Middle	2.72 (1.42–5.23)		2.99 (1.54–5.79)	0.00
Richer	3.58 (1.85–6.92)		3.98 (2.04–7.76)	0.00
Richest	6.97 (3.59–3.51)		5.93 (2.69–13.08)	0.00
Community-level factors				
Region				
Pastoralist		1	1	
City		1.61 (0.97–2.66)	0.98 (0.98–1.65)	0.940
Agrarian		1.17 (0.78–1.77)	0.62 (0.39–0.98)	0.045

Notice; - P-value <0.05, statistically significant.

Table 3. Results from random intercept model (measure of variation) for Minimum Dietary Diversity at cluster level.

Measure of variation	Model 1	Model 2	Model 3	Model 4
Variance	2.25	1.02	1.3	0.98
ICC (95%CI)	0.41 (0.32–0.50)	0.23 (0.14–0.35)	0.28 (0.20–0.38)	0.22 (0.14–0.34)
PCV %	Reference	54.50	42.21	56.62
MOR (95%CI)	4.18 (3.09–5.28)	2.63 (1.90–3.35)	2.97 (2.26–3.68)	2.57 (1.86–3.27)
Model-fitness				
Log likelihood	-971.06	-694.64	-924.73	-691.46
AIC	1946.12	1431.29	1861.47	1430.92

Abbreviations: ICC; Intra-class correlation coefficient, PCV; Proportional change in variance; MOR; Median odds ratio: AIC; Akaike's information criterion.

understanding regarding to the importance of dietary diversity for children among educated women are relatively good.

Regarding maternal occupation, children whose mother's occupation was agricultural activity were positively associated with minimum dietary diversity, which is supported by a study done in Bangladesh (Blackstone and Sanghvi, 2018). Since the majority of study participants were from rural areas, the association can be explained by the fact that mothers participating in agricultural activities may have better access to different agricultural products, which are crucial to feeding their children. In addition, mothers who are involved in agricultural activities might have enough time to follow the feeding patterns of their children than their counterparts. Regarding the sex of the household head, those children who lived with a female household head were negatively associated with the fulfillment of minimum dietary diversity. This may be due to low economic status of the female household head.

Moreover, this study revealed that the infants and young children in the middle, richer, and richest wealth indexes were positively associated with the minimum dietary diversity. This finding is consistent with the existing studies conducted in Addis Ababa, Ethiopia (Solomon et al., 2017) and Ghana (Issaka et al., 2015). The existing association may be due to the economic advantage of children living in households with enough resources to have good access, availability, and utilization of diversified foods.

In this study, we found that region, a community-level factor, was found to be significantly associated with minimum dietary diversity among children. Children residing in agrarian areas were less likely to get diversified foods than children living in pastoralist areas. This might be due to low consumption of diversified foods in agrarian areas.

The strength of this study is that we used the required statistical analysis because of the hierarchical nature of the data, and the data is nationally representative. The study is not free of limitations; it is prone to recall bias due to participant self-report and a one-day 24-hour recall that did not identify the children's usual dietary habits.

Table 4. Proportion of study participants who consumed a variety of food groups in Ethiopia.

Food groups		Children's age in month		
		6–11 months	12–17 months	18–23 months
		Frequency (%)	Frequency (%)	Frequency (%)
Breast milk	Yes	1002 (38.29)	993 (37.98)	621 (23.73)
	No	56 (16.10)	97 (27.95)	194 (55.95)
Dairy products	Yes	397 (34.80)	415 (36.39)	329 (28.80)
	No	660 (36.26)	675 (37.06)	486 (26.68)
Grains, Roots, Tubers	Yes	523 (27.90)	747 (39.67)	609 (32.43)
	No	535 (49.14)	347 (31.87)	207 (18.99)
Eggs	Yes	150 (29.57)	200 (39.32)	158 (31.11)
	No	907 (36.96)	891 (36.28)	656 (26.75)
Meats	Yes	47 (18.14)	124 (48.30)	86 (33.56)
	No	1011 (37.37)	966 (35.71)	728 (26.92)
Legumes and nuts	Yes	190 (30.12)	239 (37.87)	202 (32.00)
	No	867 (37.21)	851 (36.52)	612 (26.28)
Vitamin A fruits and vegetables	Yes	206 (24.90)	353 (42.58)	269 (32.52)
	No	851 (39.89)	738 (34.56)	645 (25.55)
Other fruits and vegetables	Yes	82 (27.15)	117 (38.72)	103 (34.13)
	No	975 (36.66)	974 (36.59)	712 (26.75)
MDD	Met	95 (25.85)	184 (49.86)	90 (24.29)
Did not meet		962 (37.10)	906 (34.94)	725 (27.96)

5. Conclusions

This study identified that the prevalence of the minimum dietary diversity was very low among children aged 6–23 months. Both individual and community-level factors determine the magnitude of minimum dietary diversity. Individual/household factors like maternal education, sex of the household head, maternal occupation, and household wealth index were the significant determinants of minimum dietary diversity. From community-level factors, the region was significantly associated with minimum dietary diversity. Therefore, multi-sectorial collaboration is highly recommended to strengthen the existing interventions that increase agricultural productivity, behavioral change communication on nutritional activities, intensive nutrition education, and involvement of women in different income-generating activities to increase the consumption of diversified foods. Also, giving special attention to children whose mothers have no formal education, female household heads, and women with no work. Moreover, a strong commitment by the government, stakeholders, and policymakers is needed to ensure the consumption of adequate diversified foods.

Declarations

Author contribution statement

Temesgen Muche: Conceived and Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Sewitemariam Desalegn, Helen Ali, Moges Mareg, Daniel Sisay, Mahlet Birhane, Robel Hussen Kabthymer: Performed the experiments; Wrote the paper.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability statement

Data will be made available on reasonable request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Acknowledgements

We authors gratefully thank the DHS program for permitting us to use the Ethiopian Demography and Health Survey (EDHS) data set for conducting this study. And our gratitude goes to Dr.Tadesse Alemu Zerfu for his contribution in conceptualization, writing, editing and approval of the final draft of this manuscript.

References

Akaike, H., 1974. A new look at the statistical model identification. IEEE Trans. Automat. Control 19 (6), 716–723.
Ali, Z., Abu, N., Ankamah, I.A., Gyinde, E.A., Seidu, A.S., Abizari, A.R., 2018. Nutritional status and dietary diversity of orphan and non - orphan children under five years: a comparative study in the Brong Ahafo region of Ghana. BMC Nutr. 4, 32.
Austin, P.C., Merlo, J., 2017. Intermediate and advanced topics in multilevel logistic regression analysis. Stat. Med. 36 (20), 3257–3277.
Beckerman-Hsu, J.P., Kim, R., Sharma, S., Subramanian, S.V., 2020. Dietary variation among children meeting and not meeting minimum dietary diversity: an empirical investigation of food group consumption patterns among 73,036 children in India. J. Nutr.
Beyene, M., Worku, A.G., Wassie, M.M., 2015. Dietary diversity, meal frequency and associated factors among infant and young children in Northwest Ethiopia: a cross-sectional study. BMC Publ. Health 15, 1007.
Blackstone, S., Sanghvi, T., 2017. A comparison of minimum dietary diversity in Bangladesh in 2011 and 2014. Matern. Child Nutr. 14.
Blackstone, S., Sanghvi, T., 2018. A comparison of minimum dietary diversity in Bangladesh in 2011 and 2014. Matern. Child Nutr. 14 (4), e12609.
Central Statistical Agency - CSA/Ethiopia, & ICF, 2017. Ethiopia Demographic and Health Survey 2016. Retrieved from Addis Ababa, Ethiopia: http://dhsprogram.com/pubs/pdf/FR328/FR328.pdf.
Issaka, A.I., Agho, K.E., Burns, P., Page, A., Dibley, M.J., 2015. Determinants of inadequate complementary feeding practices among children aged 6-23 months in Ghana. Publ. Health Nutr. 18 (4), 669–678.
Khamis, A.G., Mwanri, A.W., Ntwenya, J.E., Kreppel, K., 2019. The influence of dietary diversity on the nutritional status of children between 6 and 23monthsof age in Tanzania. BMC Pediatr. 19 (1), 518.
Mekonnen, T.C., Workie, S.B., Yimer, T.M., Mersha, W.F., 2017. Meal frequency and dietary diversity feeding practices among children 6-23 months of age in Wolaita Sodo town, Southern Ethiopia. J. Health Popul. Nutr. 36 (1), 18.
Merlo, J., Chaix, B., Yang, M., Lynch, J., Råstam, L., 2005a. A brief conceptual tutorial of multilevel analysis in social epidemiology: linking the statistical concept of clustering to the idea of contextual phenomenon. J. Epidemiol. Community Health 59 (6), 443–449.
Merlo, J., Yang, M., Chaix, B., Lynch, J., Råstam, L., 2005b. A brief conceptual tutorial on multilevel analysis in social epidemiology: investigating contextual phenomena in different groups of people. J. Epidemiol. Community Health 59 (9), 729–736.
MOH, 2004. National Infant and Young Child Feeding Strategy. Ministry of Health Ethiopia.
Mya, K.S., Kyaw, A.T., Tun, T., 2019. Feeding practices and nutritional status of children age 6-23 months in Myanmar: a secondary analysis of the 2015-16 Demographic and Health Survey. PLoS One 14 (1), e0209044.
Roba, K., connor, T., Belachew, T., brien, N., Kedir, T., Roba, T., O, B., 2016. Infant and young child feeding (IYCF) practices among mothers of children aged 6–23 Months in two agro-ecological zones of rural Ethiopia. Int. J. Nutr. Food Sci. 5, 185–194.
SD., S., L., O., M., D., 2017. Infant and young child feeding practice and associated factors among mothers/caretakers of children aged 0-23 Months in Asella town, south east Ethiopia. J. Fam. Med. 4 (5), 1122.
Solomon, D., Aderaw, Z., Tegegne, T.K., 2017. Minimum dietary diversity and associated factors among children aged 6–23 months in Addis Ababa, Ethiopia. Int. J. Equity Health 16 (1), 181.
UNICEF, 2011. Nutrition Section, Programmes. UNICEF, New York.
Weinmayr, G., Dreyhaupt, J., Jaensch, A., Forastiere, F., Strachan, D., 2016. Multilevel regression modelling to investigate variation in disease prevalence across locations. Int. J. Epidemiol. 46.
WHO, 2007. Indicators for Assessing Infant and Young Child Feeding Practices : Conclusions of a Consensus Meeting Held. Washington D.C., USA.
WHO, 2010. Indicators for Assessing Infant and Young Child Feeding Practices.
WHO, 2017. World Health Organization, United Nations Children's Fund. Global Nutrition Monitoring Framework: Operational Guidance for Tracking Progress in Meeting Targets for 2025 [cited August, 2021]. Available: https://www.who.int/nutrition/publications/operational-guidance-GNMF-indicators/en/.