FACTORS AFFECTING EXCLUSIVE BREASTFEEDING AMONG WOMEN WITH INFANTS UNDER SIX MONTHS IN ETHIOPIA: AN ANALYSIS OF THE 2019 ETHIOPIAN MINI DEMOGRAPHIC AND HEALTH SURVEY

Markos Abiso Erango[1], Gulilat Kurate Kutaye[1], Kabtamu Tolosie Gergiso[2]

ABSTRACT

BACKGROUND: Exclusive breastfeeding is a cost-effective intervention that reduces infant morbidity and mortality, supporting both physical and mental development. However, in Ethiopia, exclusive breastfeeding prevalence remains below WHO recommendations. This study aims to assess the prevalence of exclusive breastfeeding and identify the barriers hindering its practice among women with infants under six months of age in Ethiopia.

METHODS: This study utilized secondary data from the 2019 Ethiopian Mini Demographic and Health Survey, employing a cross-sectional design. A stratified, two-stage cluster sampling technique was used to select the study sample. In the first stage, 305 enumeration areas were selected, comprising 93 urban and 212 rural areas. In the second stage, households were randomly chosen, and a total of 573 women were included in the analysis. A multilevel logistic regression model was applied to identify the barriers significantly associated with exclusive breastfeeding practices.

RESULTS: The prevalence of exclusive breastfeeding was 59.86%, significantly below the World Health Organization's recommended threshold. A notable variation in exclusive breastfeeding prevalence was observed across Ethiopia's regional states, with an 8.30% difference. The random intercept binary logistic regression model was identified as the best fit for the data. Mothers aged 25–34 were 10.5% more likely to exclusively breastfeed than those aged 15–24 (OR = 1.105, P = 0.000). Mothers with secondary and higher education were 55.9% and 44.5% more likely to exclusively breastfeed compared to those with no formal education (OR = 2.559, P = 0.000; OR = 3.445, P = 0.000). Factors such as women's age, household wealth, education level, family size, place of delivery, antenatal care visits, residence, and delivery method were significantly linked to exclusive breastfeeding practices.

CONCLUSION: The findings highlight that exclusive breastfeeding rates are significantly below WHO recommendations. To address this, efforts should focus on educating mothers, especially those with no formal education, and encouraging breastfeeding among younger mothers. Increasing access to antenatal care, promoting facility-based deliveries, and providing breastfeeding support in healthcare settings are essential. Additionally, targeting regional disparities, supporting lower-income households, and encouraging family and community involvement will help improve exclusive breastfeeding practices.

KEYWORDS: Exclusive breastfeeding practice, barriers, multilevel model, EDHS, Ethiopia.

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1 Department of Statistics, College of natural and Computational science Arba Minch University, Arba Minch, Ethiopia
2 Department of Public Health, college of Health Science, Arsi University, Asella, Ethiopia

INTRODUCTION

1.1 Background of the Study

According to the World Health Organization (WHO), exclusive breastfeeding (EBF) is the practice in which an infant receives only breast milk from the mother or a wet nurse for the first six months, with no other solids or liquids, except for drops or syrups containing vitamins, minerals, supplements, or medicines[1]. Breastfeeding provides essential nutrition and immunological protection for infants in the first six months, supporting both their physical and mental development. It offers short- and long-term health benefits for both mother and child, while also reducing formula feeding costs. Timely initiation and exclusive breastfeeding for the first six months can save over 820,000 children's lives annually, with the majority under six months of age[2,1].

Exclusive breastfeeding for the first six months protects infants from infections, supports healthy growth and early development, and strengthens the immune system—improving child survival and preventing chronic diseases. It is associated with better cognitive performance in childhood and adolescence and reduces the risk of obesity, type 2 diabetes, and premature death in later life. Furthermore, it reduces risks for both infants and mothers, including infections and long-term health issues such as cancer and heart disease, while also benefiting society by lowering healthcare costs and absenteeism[1,3].

Breastfeeding, when started within the first hour of birth and continued exclusively for six months with appropriate complementary foods, is crucial for child survival and well-being. Improving global breastfeeding rates could save over 820,000 children under five annually, with 87% being infants under six months[4].

Infants should be exclusively breastfed for the first six months to promote optimal growth and health. Breastfeeding is a vital public health strategy that reduces infant mortality, enhances maternal health, and lowers healthcare costs, particularly in developing countries where malnutrition and infections are major causes of child death. Inadequate breastfeeding and complementary feeding contribute to malnutrition and illnesses, hindering children's cognitive and physical development and affecting their future potential[4, 5]. Studies indicate that promoting exclusive breastfeeding can notably reduce neonatal and infant mortality, preventing around 1.4 million child deaths globally each year. The 2030 Agenda for Sustainable Development highlights breastfeeding-related goals crucial for child health. In Ethiopia, the rate of exclusive breastfeeding rose from 49% in 2005 to 58% in 2016, but the practice decreases as infants age, with many being introduced to other foods and liquids before six months—contrary to WHO recommendations[4, 6, 7, 8].

Exclusive breastfeeding practices are shaped by factors such as geography, residence, social influences like religion and culture, and the age and education of mothers and their husbands. Antenatal care, delivery location, and household income also play a crucial role, particularly in rural areas with food scarcity[9]. This study aims to identify the barriers to exclusive breastfeeding and explore key research questions related to risk factors, associations with socioeconomic and healthcare characteristics, regional variations, and contributing obstacles in Ethiopia.

2. Methods

2.1. Data Source and Study Design

The data for this study were obtained from the 2019 Ethiopia Mini Demographic and Health Survey (EMDHS), conducted by the Central Statistical Agency from March 21 to June 28, 2019. The survey was designed to provide estimates for key indicators at the national level, as well as separately for urban and rural areas and for each of the nine regions and two administrative cities, as part of the global Demographic and Health Survey project.

The sample was selected using a stratified, two-stage cluster design. Enumeration areas (EAs) were the first stage of sampling, with 305 EAs selected—93 from urban areas and 212 from rural areas. In the second stage, households were randomly selected, and the resulting household lists served as the sampling frame for identifying eligible households to be interviewed.

2.2. Study Variables

The outcome variable of this study was exclusive breastfeeding status, a dichotomous variable categorized as either "exclusive" or "not exclusive." This variable was coded as 1 for exclusive breastfeeding and 0 for non-exclusive breastfeeding.

Yi={1, if the ith mother is exclusively breastfeeding 0, if the ith mother is not exclusively breastfeeding Y_i = \begin{cases} 1, & \text{if the} i^\text{th} \text{mother is exclusively breastfeeding} \\ 0, & \text{if the } i^\text{th} \text{ mother is not exclusively breastfeeding} \end{cases}

The independent variables included in this study were demographic and socioeconomic factors such as the child's sex, birth order, breastfeeding initiation, mother's age, maternal education level, marital status, religion, place of residence, region, household wealth index, and family size. Additionally, obstetric and healthcare-related variables were included, such as antenatal visits, place of delivery, cesarean delivery, postnatal checkup within two months, and breastfeeding counseling by a healthcare provider within the first two days after birth.

2.3. Multilevel Logistic Regression Model

Multilevel modeling is a statistical method used to analyze relationships between dependent and independent variables when observations within groups are correlated. These models account for parameters that vary across multiple levels within the data[10].

Let yijy_{ij} be a binary response variable (0 or 1), with level-one units (children) nested within level-two units (regions), and xijx_{ij} as explanatory variables. The probability of the response being one, πij=P(yij=1)\pi_{ij} = P(y_{ij} = 1), is modeled using a logit link function, assuming a Bernoulli distribution for YijY_{ij}. The empty two-level model for a binary outcome defines group-dependent outcomes without additional explanatory variables, focusing on the population of groups (e.g., regions)[11,12].

This model includes random effects for both group and within-group variation, decomposing total variance into between-region and within-region components. The intraclass correlation coefficient (ICC) measures the correlation between individuals within the same region, while the random intercept model captures group differences in the average response, assuming a constant relationship between explanatory and response variables across groups[11].

logit(πij)=log⁡(πij1−πij)=β0j+∑h=1kβhxhij\text{logit}(\pi_{ij}) = \log\left(\frac{\pi_{ij}}{1 - \pi_{ij}}\right) = \beta_{0j} + \sum_{h=1}{k} \beta_h x_{hij}

Where:

- i=1,2,...,ni = 1, 2, \dots, n represents the number of children nested in the 11 regions;
- j=1,2,...,11j = 1, 2, \dots, 11 represents the region;
- The intercept term β0j\beta_{0j} is assumed to vary randomly and is given by the sum of an average intercept β0\beta_0 and group-dependent deviations: β0j=β0+u0j\beta_{0j} = \beta_0 + u_{0j}.

In the random coefficient model, both intercepts and slopes vary across regions, with group-specific regression of the logit of success probability on a level-one explanatory variable. This model includes random effects for both intercepts and slopes, assuming the random effects are independently and identically distributed across groups. Variance components—such as the random intercept variance,

random slope variance, and their covariance—are estimated. Model selection is conducted using methods like Maximum Likelihood Estimation (MLE), Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC)[13].

Results

Descriptive Statistics

This study used a two-level hierarchical dataset, with 573 women nested within eleven geographical regions. The study aimed to examine barriers to exclusive breastfeeding (EBF) practices in relation to demographic, socioeconomic, obstetric, and healthcare-related factors. More than half of the women in the study, 337 (58.81%), lived in rural areas, with only 140 (24.23%) exclusively breastfeeding their infants. In contrast, 236 (41.87%) women resided in urban areas, and 203 (35.43%) of them practiced exclusive breastfeeding. Of the entire sample, 309 (53.93%) infants were female, while 264 (46.07%) were male. The prevalence of EBF practice was slightly higher in the 25–34 years age group, with 166 women (28.97%), and lower in the 35–49 years age group, with 21 women (3.64%). There were notable variations in the prevalence of EBF across the regional states of Ethiopia. The prevalence rates were 5.06% in Afar, 5.76% in Tigray, 6.29% in Amhara, 8.90% in Oromia, 4.88% in Somalia, 3.50% in Benishangul, 7.33% in SNNPR, 4.71% in Gambela, 4.36% in Harari, 3.83% in Addis Ababa, and 5.23% in Dire Dawa (Table 1).

Table 1, Distribution of Demographic, Socio-economic, Obstetric and health care related barriers on the prevalence of exclusive breastfeeding practice of mother's and infant's in the first 6 months of life in Ethiopia, EMDHS 2019 (n=573).

Variable	Categories	EBF status		x^2 (df)	P-value
		Yes (%)	No (%)		
Mother's age group in year	15-24	156(27.22)	70(12.22)	39.59 (2)	0.000
	25-34	166(28.97)	61(10.65)		
	35 and above	21(3.64)	99(17.27)		
Mother's Region	Tigray	23(4.01)	33(5.76)	43.32 (10)	0.000
	Afar	29(5.06)	35(6.10)		
	Amhara	36(6.29)	8(1.40)		
	Oromia	51(8.90)	24(4.18)		
	Somali	28(4.88)	32(5.58)		
	Benshangul	20(3.5)	31(5.41)		
	SNNPR	42(7.33)	18(3.14)		
	Gambela	27(4.71)	23(4.01)		
	Harari	25(4.36)	20(3.5)		
	Addis Ababa	22(3.83)	2(0.35)		
	Dire Dawa	30(5.23)	12(2.09)		
Place of residence	Urban	203(35.43)	33(5.76)	14.77 (1)	0.000
	Rural	140(24.43)	197(34.38)		
Educational level of mother's	No education	17(2.97)	133(23.21)	26.89 (3)	0.000
	Primary	108(18.85)	60(10.47)		
	Secondary	153(26.70)	35(6.11)		
	Higher	65(11.34)	2(0.35)		
Religion	Muslim	96(16.75)	63(10.10)	22.28 (3)	0.000
	Orthodox	134(23.38)	95(16.58)		
	Protestant	111(19.38)	67(11.70)		
	Others	2(0.35)	5(0.87)		
Marital status of mother's	Never in Union	2(0.35)	6(1.05)	7.11 (2)	0.000
	Currently in union	336(58.64)	210(36.65)		
	Widowed/Divorced	5(0.87)	14(2.44)		
Consultancy about EBF	No	123(21.46)	140(24.43)	2.30 (1)	0.000
	Yes	220(38.39)	90(15.71)		
Birth order of infant	1st	152(26.53)	46(8.03)	0.35 (2)	0.548
	2nd _ 3rd	100(17.45)	85(14.83)		
	4th and above	91(15.88)	99(17.28)		
Sex of infants	Female	180(31.41)	129(22.51)	1.49 (1)	0.000
	Male	163(28.45)	101(17.63)		
Place of delivery 0.000	other than health facility		153(26.70)	142(24.78)	12.74 (1)
	Health facility	190(33.16)	88(15.36)		
Antenatal visits	Not	42(7.33)	108(18.85)	135.45 (2)	0.000
	1-3	101(17.63)	73(12.74)		
	4th and above	200(34.90)	49(8.55)		
Initiation of breastfeeding	<1 Hour of Birth	238(41.53)	94(16.40)	20.79 (1)	0.000
	>1 Hour of Birth	105(18.32)	136(23.73)		
Postnatal check	No	131(22.86)	143(24.95)	31.20 (1)	0.000
within 2 months	Yes	212(37.00)	87(15.18)		
Caesarean delivery	No	259(45.20)	72(12.56)	123.59 (1)	0.000
	Yes	84(14.66)	158(27.57)		
Household family size	<= 5,	203(35.42)	97(16.93)	8.84 (1)	0.000
	>5,	140(24.43)	133(23.21)		
Household wealth index	Poor	52(9.07)	162(28.27)	34.31 (2)	0.000
	Middle	193(33.68)	57(9.95)		
	Rich	98(17.11)	11(1.92)		

Education is a significant predictor of exclusive breastfeeding (EBF) practices, as evidenced by numerous studies. The percentage of women practicing EBF varied by education level: 17 women (2.97%) with no education, 108 women (18.85%) with elementary education, 153 women (26.70%) with secondary education, and 65 women (11.34%) with higher education. Additionally, the frequency of EBF practice was influenced by the infant's birth order: 152 first-born children (26.53%), 100 second- or third-born children (17.45%), and 91 children of fourth-born or higher (15.88%) practiced EBF

Characteristics of Infants and Mothers

Regarding the timing of breastfeeding initiation, 105 babies (18.32%) began nursing more than an hour after birth, while 238 babies (41.53%) started within the first hour of delivery. These figures emphasize the prevalence of exclusive breastfeeding (EBF) practices. In terms of family size, 140 women (24.43%) with families of more than five members and 203 women (35.42%) with families of five or fewer reported practicing EBF. Additionally, antenatal care (ANC) visits were associated with the prevalence of EBF: 42 women (7.33%) had not attended any ANC visits, 101 women (17.63%) had attended one to three visits, and 200 women (34.90%) had attended three or more ANC visits.

The prevalence of exclusive breastfeeding (EBF) practices also varied based on the place of residence. Among women who gave birth at health facilities, 190 (33.16%) practiced EBF, whereas among those who gave birth outside health centers, 153 (26.70%) practiced EBF. Regarding postnatal care (PNC) visits, the prevalence of EBF was higher among women who had PNC visits within two months of childbirth (212 women, or 37.00%) compared to those who did not have PNC visits within two months (131 women, or 22.86%). Lastly, counseling about EBF also influenced its practice: 220 women (38.39%) who received counseling from healthcare providers during the first two days after birth practiced EBF, while only 123 women (21.46%) who did not receive counseling practiced EBF.

Test of Association

The Chi-square test of association was used to examine the relationship between exclusive breastfeeding (EBF) practice and various socio-economic, demographic, obstetric, and healthcare-related factors. The results in Table 1 show that factors such as the child's sex, breastfeeding initiation, mother's age, maternal education level, marital status, place of residence, region, household wealth index, family size, antenatal visits, place of delivery, Caesarean delivery, postnatal checkup within two months, and counseling about EBF from healthcare providers during the first two days after birth were all significantly associated with EBF practice at the 5% level of significance. The Chi-square test revealed variation in women's characteristics across Ethiopian regions, with a Chi-square value of $x^2 = 43.3$, degrees of freedom (df) = 10, and a p-value of 0.000. This indicates regional heterogeneity, suggesting that the multilevel binary logistic regression model is an appropriate choice to account for the variation in women's characteristics across regions in Ethiopia. Additionally, Figure 1 below shows the percentage distribution of exclusive breastfeeding in Ethiopia. The plot further highlights regional variations in the prevalence of exclusive breastfeeding practice among mothers (see Figure 1).

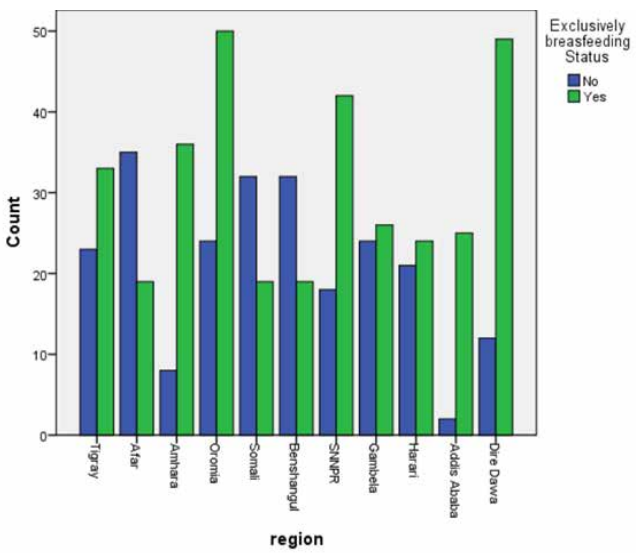

Figure 1: The plots of the percentage distribution of exclusive breastfeeding in Ethiopia Vs. region

Multilevel Logistic Regression analyses

A multilevel stepwise logistic regression was employed for this analysis. In the first stage, the null model was used to assess the overall probability of exclusive breastfeeding (EBF) practice without adjusting for any covariates. In the second stage, both multilevel and single-level analyses were conducted, focusing on fixed slopes and random intercepts. In the third stage, a multilevel logistic regression model with two levels random intercept and random slope (random coefficient) was applied. The empty model is considered as a parametric version of assessing heterogeneity of regions for EBF practice. The empty model estimates using Laplacian approximation, we can say that the log odds of EBF practice in an 'average' region (one with Uoj = 0) is estimated as $\beta o = -0.6104$. The intercept for region j is -0.6104 +Uoj, where the variance of Uoj is estimated as $\delta_{ou}^2 = 0.899$. The likelihood ratio statistic for testing the null hypothesis, that $\delta_{ou}^2 = 0$, can be calculated by comparing the two-level model, with the corresponding single-level model without the level 2 random effects. The LRT test statistic x^2 is 11.84, corresponding p-value (<0.001), with 1 degree of freedom, suggests that there is strong evidence that the between-region variance is non-zero.

The likelihood ratio test specifies the null and alternative hypothesis as follows; Ho: δ^2(region)= 0 (there is no regional variation in the EBF practice in Ethiopia, i. e single level logistic regression best fit the data) Versus Hl: δ^2(region)≠ 0 (there is regional variation in the EBF practice in Ethiopia, i. e multilevel logistic regression best fit the data). The likelihood ratio test statistics is 11.84, df = 1, with (P<0.001) hence, there is strong evidence to reject the null hypothesis and conclude there is regional variation in the EBF practice in Ethiopia at 5% of level of significance.

To create a random-intercept logistic regression model, we introduced a region-specific random intercept into the linear predictor, which relaxed the assumption of conditional independence among responses within the same region, given the covariates. The model's results indicated that factors such as the mother's age group, wealth index, education level, family size, place of delivery, antenatal care (ANC) visits, place of residence, and mode of delivery were all statistically significant. These findings suggest that these factors significantly influence exclusive breastfeeding (EBF) practices and contribute to the regional variations observed across Ethiopia.

The overall average odds of EBF are estimated to be -0.99 which is decreased by 0.38 as compared to an empty model (Table 2), indicating that many

Table 2: Result of Parameter Estimate of empty Model

Fixed part	Coef.	Std.Err.	Z-value	P-value|	95% CI
(βo) = Intercept	-0.6104	0.1863	-3.274	0.001	[-0.975, -0.245]
Random part	Variance		ICC (Rho (ρ)) = 0.2146		
(δuo^2) =Var (U_0j) level two variance	0.899				
Deviance-Based Chi-Square (($\chi 2$) = 11.84)) p-value(0.000)					
	Number of obs: 573, groups: region, 11				

variables that are included in this model has impacts on the EBF practice across the country. The result of intercept model displayed in (Table 3) also estimates that, the variance of random effect at the regional level Var (u_0j) = 0.8112, which is significant and indicating that there is a variation in the prevalence of EBF practice among regional state of Ethiopia.

There is reduction of variance between the empty multilevel model δ2_u0= 0.899 and the intercept variance of the random effect var (u_0j)= 0.8112. The reduction of the random effects of the intercept variance is due to the inclusion of fixed explanatory variables. That is, taking into account the fixed independent variables can provide extra predictive value on EBF practice in each region.

The results presented in Table 3 show that the intra-region correlation coefficient (ICC) was estimated at 0.2146, indicating that 21.46% of the total variability in exclusive breastfeeding (EBF) practices can be attributed to differences between regions. The remaining 78.54% of the variability is due to individual differences within regions.

The results revealed that mothers in the age group of 25–34 years were 10.5% more likely to exclusively breastfeed their infants compared to mothers in the 15–24 years age group (OR = 1.105, P = 0.000; 95% CI: 1.040, 1.173). Conversely, mothers in the 35–49 years age group were 74% less likely to exclusively breastfeed their infants compared to those in the 15–24 years age group (OR = 0.261, P = 0.000; 95% CI: 0.113, 0.605).

Regarding maternal education, mothers who completed secondary and higher education were 55.9% (OR = 2.559, P = 0.000; 95% CI: 0.891, 7.352) and 44.5% (OR = 3.445, P = 0.000; 95% CI: 2.584, 4.592) more likely to exclusively breastfeed their children compared to mothers with no formal education. Additionally, mothers who made antenatal care (ANC) visits of 1-3 times and 4 or more times were 64.5% (OR = 1.645, P = 0.000; 95% CI: 1.950, 2.532) and 67% (OR = 1.670, P = 0.000; 95% CI: 1.035, 2.699) more likely to exclusively breastfeed their child compared to those who did not make any ANC visits. In terms of place of delivery, mothers who delivered at a health center were 80% (OR = 1.20, P = 0.000; 95% CI: 1.014, 1.442) more likely to exclusively breastfeed their child compared to those who delivered elsewhere (see Table 3 below).

Table 3: Results of Multi level random intercept with fixed effects model

		Fixed effects(Measures of association)					
Variables	**Categories**	**β**	**Se(β)**	**Z value**	**P value**	**exp(β)**	**95%CI for exp(β)(β)**
Intercept		-0.99	0.286	-3.474	0.000	0.371	[0.212, 0.649]
Age group of mothers	19-24 (Ref)						
	25-34	0.102	0.031	3.290	0.000	1.105	[1.040, 1.173]
	35-49	-1.34	0.428	-3.139	0.000	0.261	[0.113, 0.605]
Educational level of mothers	No - edu (Ref)						
	Primary	0.628	0.154	4.069	0.000	1.874	[1.385,2.536]
	Secondary	0.738	0.162	4.566	0.000	2.091	[1.523,2.869]
	Higher	1.237	0.147	8.435	0.000	3.445	[2.584, 4.592]
Residence	Urban(Ref)						
	Rural	-1.68	0.363	-4.628	0.000	0.186	[0.091, 0.379]
Place of delivery	Home(Ref)						
	Health facility	.190	.090	2.111	0.000	1.20	[1.014, 1.442]
family size	<=5 (Ref)						
	>5	-0.62	0.113	-5.486	0.000	0.537	[0.431, 0.671]
Caesarean delivery	No (Ref)						
	Yes	-0.34	0.13	-2.615	0.000	0.711	[0.551,0.918]
Antenatal visits	Not (Ref)						
	1-3	0.498	0.220	2.263	0.024	1.645	[1.950, 2.532]
	4 and above	0.513	0.245	2.093	0.037	1.670	[1.035, 2.699]
Household wealth index	Poor(Ref)						
	Middle	0.098	0.031	3.161	0.002	1.103	[1.037, 1.172]
	Rich	0.565	0.149	3.791	0.000	1.759	[1.313, 2.356]
Random part (δ_{ou}^2)	Variance 0.8112			ICC (Rho (ρ))= 0.065			
Deviance-Based Chi-Square ((χ2) = 599.4804))				p-value (0.000)			
Number of obs: 573, groups: region, 11							

3.5 Results of Multi level random coefficient model

It is possible to extend the model such that the effect of level-1 covariates varies across regions. In the random intercept model, we allowed only the intercept to vary across regions while fixing the explanatory covariates. However, the relationship between the explanatory and dependent variables can differ between groups. In this extended model, we tested the variables that significantly impact exclusive breastfeeding (EBF) in the intercept model by observing their respective regional effects. Consequently, regional-level variables that are expected to vary by region, such as household wealth index and place of residence, were examined (see Table 4).

Table 4, Results of Multi level random coefficient model

Variables	Categories	Fixed effects(Measures of association) β	Se(β)	Z value	P value	exp(β)
Intercept		-0.612	0.256	-2.390	0.017	0.542
Age group of mothers	19-24(Ref)					
	25-34	0.102	0.024	4.250	0.000	1.107
	35-49	-1.569	0.232	-6.75	0.000	0.208
Educational level of mothers	No - edu (Ref)					
	Primary	0.521	0.177	2.940	0.003	1.683
	Secondary	0.675	0.191	3.536	0.000	1.964
	Higher	1.080	0.217	4.973	0.000	2.947
Residence	Urban (Ref)					
	Rural	-1.244	0.176	-7.055	0.000	0.288
Place of delivery	Home(Ref)					
	Health facility	0.312	0.132	2.360	0.018	1.366
family size	<=5 (Ref)					
	>5	-0.775	0.224	-3.467	0.000	0.461
Caesarean delivery	No (Ref)					
	Yes	-0.582	0.217	-2.679	0.007	0.559
Antenatal visits	Not (Ref)					
	1-3	0.666	0.116	5.729	0.000	1.946
	4 and above	0.233	0.115	2.026	0.043	1.262
Household wealth index	Poor(Ref)					
	Middle	0.098	0.031	3.161	0.002	1.103
	Rich	0.289	0.097	2.990	0.003	1.335
Random part		Variance Component		S.D		ICC (Rho (ρ))= 0.12
(σo2) =Var (U0j)	0.4430	0.6656				
(σ12) =Var (U1j)	0.7285	0.8535				
(σ22) =Var (U2j)	0.1161	0.3407				
σ10 = Cov(U1j,U_0j)	0.544	0.737				
σ02 = Cov(U0j,U_2j)	0.167	0.408				
σ12 = Cov(U1j,U_2j)	0.194	0.440				
Deviance-Based Chi-Square ((χ2) = 583.31))	p-value (0.000)					

Number of obs: 573, groups: region, 11

Comparison among Multilevel Logistic Regression Models

The model fit statistics (Deviance = 273.7, AIC = 337.9, and BIC = 446.5) for the random intercept model are considerably smaller than those of the other multilevel models, indicating that the random intercept model provides the best fit for the data. The deviance-based chi-square test for random effects in the random coefficient model was not statistically significant (p = 0.3708), and this model also had larger AIC and BIC values compared to the random intercept model. Therefore, the random intercept model with fixed effects is the best-fitting model for the dataset (see Table 5).

Table 5: Comparison of Multilevel Logistic Regression Model

Fitted Model	Empty Model	Random Intercept Model	Random Coefficient Model
-2*Log Likelihood	861.353	289.8906	273.8
Deviance-Based Chi-Squared Value	11.84	599.4804	583.31
P-value	0.000	0.000	0.3708
		Model Fit Diagnostics	
Deviance	861.4	273.7	289.9
AIC	865.4	337.9	351.7
BIC	874.4	446.5	528.2

Discussion

In this study, the prevalence of exclusive breastfeeding (EBF) practice was 59.86%. This finding is consistent with previous studies conducted in Ethiopia, which also reported a prevalence of 59.86%[14]. However, it is lower than findings from studies in Malawi, Zimbabwe, and Ghana, where the prevalence rates were 76%, 78%, and 68.6%, respectively[15,16]. On the other hand, the prevalence in this study was higher than figures reported in studies from India (48.5%)[17], Mexico (28%)[18], and China (29.5%)[19].

This discrepancy in the prevalence of EBF may be attributed to differences in study period, study design, age distribution of infants, socio-economic status, socio-cultural factors, and health service utilization across study areas. The current study found that place of residence was significantly associated with EBF practice, which aligns with previous studies conducted in Ethiopia[20], Saudi Arabia[21], and Cambodia[22]. This may be due to urban women—often engaged in permanent or temporary employment—spending a significant amount of time away from their children. However, this finding contrasts with a study from Indonesia[23] , which found that women residing in urban areas were more likely to practice EBF than those in rural areas.

Additionally, this study showed that maternal education level was significantly associated with EBF practice, with higher education positively linked to increased EBF rates. This result is consistent with findings from studies in Ethiopia[15,24] and Myanmar[25], which revealed that maternal education has a positive effect on EBF practice. A possible explanation is that more educated mothers are likely to be more aware of the benefits of EBF through reading informational materials and understanding counselling messages more effectively than mothers with lower or no education.

The current study also found a significant association between the household wealth index and EBF practice. This finding is consistent with studies in Ghana, India, and Maharashtra[16, 25, 26]. A possible explanation is that wealthier women may have greater access to breastfeeding-related information and improved negotiating power for flexible work hours, enabling them to stay at home and exclusively breastfeed. Conversely, the lower use of EBF among women in the poorest wealth index group may be due to lack of awareness and stressful living environments.

The study also revealed that women who attended antenatal care (ANC) visits during their most recent pregnancy were more likely to practice EBF than those who did not attend ANC. This finding is consistent with prior studies conducted in Ethiopia[27,28,29], Egypt[30], Malawi[13], Myanmar[24], and India[31]. ANC visits provide opportunities

for health professionals to educate mothers on the benefits of exclusive breastfeeding, which may encourage them to adopt this practice.

Additionally, this study found that family size was significantly associated with EBF practice. Women with larger families were less likely to practice EBF compared to those with smaller families. This finding is consistent with studies conducted in Ethiopia[32] and India[31]. A possible explanation is that mothers with larger families may be busier managing multiple family members, which can divert their attention from exclusively breastfeeding their infants.

Furthermore, our study revealed that the mode of delivery was a significant factor associated with EBF practice. Women who gave birth by cesarean section were less likely to practice EBF than those who delivered vaginally. This finding aligns with studies conducted in Ethiopia[31,32]. One possible explanation is that cesarean deliveries, which may result in postoperative pain and discomfort, could make it more difficult for mothers to engage in exclusive breastfeeding compared to those who had vaginal deliveries.

Additionally, place of delivery was found to be a significant factor associated with EBF practice. Women who gave birth in health facilities were more likely to exclusively breastfeed their infants than those who gave birth at home. This result is consistent with earlier studies in Ethiopia[19,31,27,32], as well as studies in Malawi13and Myanmar[24]. A possible explanation for this finding is that women delivering in health facilities are more likely to receive counselling from health professionals, who emphasize the importance of exclusive breastfeeding for the first six months of life[19].

Conclusions

This study highlights key factors influencing exclusive breastfeeding (EBF) in Ethiopia, including socio-economic, demographic, obstetric, and healthcare-related aspects. Urban women, those with higher education, and those with access to healthcare are more likely to practice EBF, while rural women, older mothers, those with no education, and lower-income households face more barriers. EBF rates remain below WHO recommendations, requiring efforts to educate mothers, increase antenatal care attendance, promote facility-based deliveries, and address regional disparities. Targeting these factors and involving families and communities will help improve EBF practices.

Availability of Data and Material

The dataset for this study was sourced from the publicly available 2019 Ethiopian Mini Demographic and Health Survey (EMDHS) at https://dhsprogram.com/data/available-datasets.cfm. The data used for the final analysis can be requested from the corresponding author upon reasonable request. Permission to use the publicly available EDHS data, which excludes personal identifiers, was granted by the Measure DHS International Program.

Consent for Publication

Not applicable.

Competing Interests

The authors declare that they have no conflicts of interest.

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Corresponding author:
Kabtamu Tolosie Gergiso (K.T):
kabtamuto@gmail.com
Markos Abiso (M.A): markos.erango73@gmail.com
Gulilat Kurate (G.K): gulilatkk892@gmail.com

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