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Multinomial-Multilevel Analysis of the Duration of Breastfeeding Status in Ethiopia

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Abstract: One strategy for lowering infant mortality and morbidity is breastfeeding. It benefits communities, families, and the economy. This study assessed the variation in breastfeeding duration among the household and communities in Ethiopia based on the evidence from Ethiopia Mini Demographic and Health Survey (EMDHS), 2019. A total of 8414 women were considered in the final analysis of the study. Multinomial multilevel logistic regression was used to estimate the effects of the covariates on each breastfeeding status. Based on the results, the percentage of women who had breastfed was 3.7% for less than six months, 44.1% for six months or longer but less than twelve months, and 52.2% for twelve months or longer. Age of mother, preceding birth interval (in months), mother's and father's educational level, wealth quintile, sex of child, place of delivery, number of prenatal care visits, postnatal (women, infants, and children) participation, place of residence, and region were the significant factors to the duration of breast feeding. The duration of breastfeeding varies throughout family and community groups in Ethiopia. The amount of time of breastfeeding varies significantly within family and community clusters, as this study showed and offered substantial evidence of. Therefore, programs to educate and prepare healthcare professionals about women's health ought to be implemented. By raising awareness and strengthening the current community-based health extension program, the federal, regional, and other implementers should underscore the benefits of duration of breastfeeding to those pastoral communities. It is recommended that breastfeeding education be incorporated into follow-up visits for prenatal care and that postpartum care visits be made more widely available in order to promote breastfeeding practices in Ethiopia.

Keywords: Breastfeeding Duration, Community, Household, Ethiopia

1. Introduction

One of the best strategies to lower infant mortality and morbidity is by breastfeeding [1]. The introduction of solid and semisolid foods at age six months, exclusive breastfeeding for the first six months of life, continued breastfeeding until age two, and gradual increases in food intake and feeding frequency as the child gets older are all examples of appropriate feeding practices for infants and young children [2]. In order to meet their expanding needs for micronutrients, children must also consume a varied diet that includes items from many food groups [3].

Optimal feeding practices for newborns, infants, and children are required for nations in sub-Saharan Africa (SSA) to meet the third Sustainable Development Goal of ending needless deaths of newborns and children under five. In order to improve children's nutrition, health, and development, infant and child feeding behaviors must be encouraged [4]. The World Health Organization (WHO) recently released a set of indicators to evaluate child feeding habits and monitor the success of campaigns to promote breastfeeding. The newborn and child feeding structure, as well as what constitutes optimal nursing and supplementary feeding practices, have received a lot of attention [5]. It is recommended to breastfeed a child solely for the first six months of life, without supplementation with any other liquids or foods, and to continue breastfeeding until the child is two years old [6].

About 1.5 million infants could be saved each year through

improved breastfeeding practices [7]. Up to 61% and 63%, respectively, of admissions related to diarrheal and pneumonia infections can be avoided by exclusively breastfeeding. Furthermore, type 1 diabetes can be reduced [8]. Improvements in breastfeeding status were made through breastfeeding education and information provided at prenatal and postpartum visits [9]. Additionally, community-based promotion and support, campaigning, training, and the introduction of a global code of practice for the marketing of breast milk substitutes were all measures to improve breastfeeding practices [10].

In Ethiopia, 59% of infants less than six months are exclusively breastfed [11]. The most current Ethiopian Demographic and Health Survey (EDHS) report states that, in addition to breast milk, 17%, 5%, and 11% of infants aged 0 to 5 months received plain water, non-milk liquids, other milk, and complementary foods. In Ethiopia, where breastfeeding was formerly commonplace, it is currently only 76% at 23 months old. Only 58% of infants less than six months are nursed exclusively. The proportion of newborns exclusively breastfed dropped dramatically with age, from 74% at 0-1 month to 36% at 4-5 months [12]. Therefore, little is known about how to affect an Ethiopian woman's breastfeeding cycle. Similar to this, a private study did not examine any potential influences on how long women in our nation nurse their children. Therefore, a population-based study of Ethiopian women could shed light on the prevalence of breastfeeding times as well as potential determinants of this desire. Therefore, using data from the 2019 Ethiopia Mini Demographic and Health Survey, this study evaluated the factors that influence the variations in breastfeeding duration in Ethiopia.

2. Materials and Methods

2.1. Data Source

The 2019 Ethiopia Mini Demographic and Health Survey (EMDHS), which included a total of 8885 qualified women, provided the data for this study. Under the general direction of the Technical Working Group (TWG), the Ethiopian Public Health Institute (EPHI), in collaboration with the Federal Ministry of Health (FMoH) and the Central Statistical Agency (CSA), implemented the 2019 EDHS. It is Ethiopia's second EMDHS and fifth DHS to be put into place. The United Nations Children's Fund (UNICEF), the World Bank, and the United States Agency for International Development (USAID) all contributed funding to the 2019 EMDHS. It is intended to offer information for tracking the current state of health sector objectives such calculating early childhood mortality and evaluating the nutritional quality of children under five, as well as the duration of breastfeeding [13].

2.2. Study Population

The study's target population consisted of all the interviewed women between the ages of 15 and 49. There are 8885 eligible women in all. The final analysis of this study includes the total weight of 8418 women.

2.3. Study Variables

2.3.1. Outcome Variables

The response variables used were duration of breastfeeding status, which was categorized as follows: <6 months, 6 to <12 months, and ≥12 months.

2.3.2. Explanatory Variables

The explanatory variables considered were preceding birth interval, sex of child, size of child at birth, number of children under-five, woman's and husband's education, marital and occupational status, age of mothers, wealth index, pregnancy, antenatal care visits, place of delivery, postnatal (women, infants, and children) participation, place of residence and region.

2.4. Multinomial Logistic Regression

The technique of multinomial logistic regression is a substitute for least-squares regression that ensures the fitted probabilities between 0 and 1. The final group, group K, is arbitrary chosen to act as the baseline category. In the multinomial logit model;

$$logit\left(\frac{pr(y=k/x)}{pr(y=k/x)}\right) = {\beta_o}^{(k)} + {\beta_1}^{(k)}x_1 +, \ldots + {\beta_p}^{(k)}x_p \quad (1)$$

For k = 1…, K – 1. According to this model, the ratio of any two group membership probabilities is a log-linear function of x, since we have;

$$logit\left(\frac{pr(y=j/x)}{pr(y=k/x)}\right) = {\beta_o}^{(j)} - {\beta_o}^{(k)} + {\beta_1}^{(j)} - {\beta_1}^{(k)}x_1 +, \ldots + \beta_p^{(j)} - {\beta_p}^{(k)} \quad (2)$$

For any j and k, including the baseline category K if we take $\beta_i^{(K)} = 0$ for $i = 0, 1, \ldots, p$, a convenient choice to ensure model identification. The group membership probabilities can be solved for explicitly, and are given by;

$$pr(y\,k/x) = \frac{\exp({\beta_o}^{(k)} + {\beta_1}^{(k)}x_1 +, \ldots + {\beta_p}^{(j)}x_p}{\sum_{j=1}^{k}\exp(\exp({\beta_o}^{(k)} + {\beta_1}^{(k)}x_1 +, \ldots + {\beta_p}^{(j)}x_p)} \quad (3)$$

The approach of maximum likelihood is used to estimate the unknown parameters [14]. Maximum likelihood estimates can be determined using any statistical software program, though care must be made to ensure that the model parameterization is what the user intends. In the classification problem, a new observation x_o is classified as belonging to the group k for which $\widehat{pr}(y = k/x_o)$ is maximized.

2.5. Bivariate Analysis

To choose the candidate variables for the multilevel logistic regression analysis model with p-values less than 0.25, a bivariate logistic regression analysis (Crude analysis) was performed [15, 16] Variables with a p-value less than 0.05 with 95% confidence interval and adjusted odd ratio (AOR) were conducted.

2.6. Multilevel Logistic Regression Model

To acknowledge the existence of data hierarchies by allowing for residual components at each level in the hierarchy, multilevel models were preferred. Multilevel logistic regression was used in this work to demonstrate the analysis of data with a complicated structure of variability linked to nested sources of variability in Ethiopian households and communities.

2.7. Three-Level Multilevel Model

Community at level 3, household at level 2, and individuals at level 1 were utilized. This model only contains random groups and random variation within groups and between the groups.

$$\eta_{ijk} = \beta_0 + \varepsilon_{jk} + \varepsilon_k \quad (4)$$

Whereas, ε_{jk} denote the random effect for the j^{th} level cluster in the k^{th} cluster and ε_k denote the random effect for the k^{th} third level cluster.
for i=,…, number of individual, j=1,…, number of household within each community, k=1,…..number of community.

2.8. Random Intercept Multilevel Logistic Regression Model

The covariates were taken into account in this model, and the only random effect was the intercept, indicating that the groups varied in terms of the response variable's average value.

$$\eta_{ijk} = \beta_0 + \beta_{1h}\sum_{h=1}^{p} X_{hijk} + \beta_{2h}\sum_{h=1}^{q} X_{hjk} + \beta_{3h}\sum_{h=1}^{l} X_{hk} + \varepsilon_{jk} + \varepsilon_k \quad (5)$$

Whereas, X_{hijk} denote the vector of the first level variables, X_{hjk} denote the vector of the second level variables, and X_{hk} denote the vector of 3rd level predictor variables. In addition, β_{1h} denote the vector of regression parameters for the first-level variables, β_{2h} denote the vector of regression parameters for second-level variables, and β_{3h} denote the vector of regression parameters for the third-level variables. And ε_{jk} denote the random effect for the j[th] level cluster in the k[th] level cluster and ε_k denote the random effect for the k[th] 3rd level cluster.
for i=,…, number of individual, j=1,…, number of household within each community, k=1,…..number of community, h=1,…, p individual level variables, h=1,…, q household level variables, h=1,…, l community level variables.

2.9. Random Coefficient Multilevel Multinomial Logistic Regression Model

In this model, the coefficients of the explanatory variables are considered as random [17].

$$\eta_{ijk} = \beta_0 + \beta_{1h}\sum_{h=1}^{p} X_{hijk} + \beta_{2h}\sum_{h=1}^{q} X_{hjk} + \beta_{3h}\sum_{h=1}^{l} X_{hk} + \varepsilon_{jk} + \varepsilon_{ojk}\sum_{h=1}^{p} X_{hijk} + \varepsilon_k + \varepsilon_{ok}\sum_{h=1}^{p} X_{hijk} \quad (6)$$

Whereas, X_{hijk} denote the vector of the first level variables, X_{hjk} denote the vector of the second-level variables, and X_{hk} denotes the vector of third-level predictor variables. In addition, β_{1h} denotes the vector of regression parameters for the first-level variables, β_{2h} denote the vector of regression parameters for second-level variables, and β_{3h} denote the vector of regression parameters for the third-level variables. And ε_{jk} denote the random effect for the j[th] level cluster in the k[th] level cluster and ε_{ojk} denote the random effect for the k[th] 3rd level cluster, ε_{ojk} and ε_{ok} are the random slope. The parts $\beta_0 + \beta_{1h}\sum_{h=1}^{p} X_{hijk} + \beta_{2h}\sum_{h=1}^{q} X_{hjk} + \beta_{3h}\sum_{h=1}^{l} X_{hk}$ are the fixed part of the model and $\varepsilon_{jk} + \varepsilon_{ojk}\sum_{h=1}^{p} X_{hijk} + \varepsilon_k + \varepsilon_{ok}\sum_{h=1}^{p} X_{hijk}$ are the random part of the model.
for i=,…, number of individual, j=1,…, number of household within each community, k=1,…..number of community, h=1,…, p individual level variables, h=1,…, q household level variables, h=1,…, l community level variables.

2.10. Parameter Estimation Multilevel Logistic Regression Model

The maximum likelihood estimation method is the most popular approach utilized in this work to estimate multilevel models. A different strategy is to use numerical integration and likelihood maximization to approximate the integral of complete log-likelihood. A first- or second-order Taylor expansion of the link function is the foundation of the most often utilized techniques.

2.10.1. Model selection Criteria

To choose the optimal model using the Akaike information criterion (AIC), it was necessary to assess the model's sufficiency or goodness of fit before fitting it. The best model is one that has a low AIC value, which indicates that it is one that closely resembles reality [17] and has minimal parameters that need to be estimated.

AIC were defined as:

$$AIC = -2ln(likelihood) + 2k \quad (7)$$

Where, k is the model degrees of freedom calculated as the rank of a variance-covariance matrix of the parameters and N is the number of observations used in the estimation or, more precisely, the number of independent terms in the likelihood.

2.10.2. Measures of Variation (Random Effects)

The researcher purposively used ICC to measure the reliability of ratings for the clusters. To understand the variation of breastfeeding status among mothers, households and communities the researcher used Intra cluster correlation and determined as follows [18];

$$ICC_{household} = \frac{V_{household}}{V_{community} + V_{household} + \frac{\pi^2}{3}} \quad (8)$$

$$ICC_{community} = \frac{V_{community}}{V_{community} + V_{household} + \frac{\pi^2}{3}} \quad (9)$$

Where $\frac{\pi^2}{3} = 3.29$, denotes the variation of lower

(individual) level unit, $V_{community}$, $V_{household}$ are the variances of breastfeeding at the household and community levels, respectively.

3. Results

3.1. Descriptive Statistics of the Respondents

Table 1 shows the background characteristics of the 8418 women included in the study. The results showed that 2137 female children were breastfed for ≥12 months, 166 females were breastfed for <6 months, and 1841 females were breastfed for 6 to <12 months, but 2257 males were breastfed for <6 months, 148 males were breastfed for <6 months, and 1869 males were breastfed for 6 to <12 months. Similarly, among urban resided women, 1176 of them were breastfed for ≥12 months, 71 of them were breastfed for <6 months, and 764 of them were breastfed for 6 to <12 months, but from those rural resided women, 5228 of them were breastfed for ≥12 months, 243 of them were breastfed for <6 months, and 936 of them were breastfed for 6 to <12 months. Likewise, from the women who have no occupation, 3150 of them were breastfed for <6 months, 253 of them were breastfed for <6 months, 2698 of them were breastfed for 6 to <12 months, but from the women who have an occupation, 1244 of them were breastfed for ≥12 months, 61 of them were breastfed for <6 months, and 1012 were breastfed for 6 to <12 months.

3.2. Bivariate Analysis of Factors Associated with Breastfeeding Duration

Table 1 presents the results on the relationship between breastfeeding duration and explanatory variables. The results showed that with the exception of current marital status, birth order number, number of children under-five in household, and current pregnancy wanted, the remaining explanatory variables were statistically associated with breastfeeding duration status ($p<0.05$).

Table 1. *Descriptive statistics and bivariate analysis on explanatory variables and breastfeeding duration.*

Variables	Categories	Number of respondents (N) on the response categories				
		≥ 12	6 to <12	< 6	χ^2	P-value
Place of residence	Urban	1176	764	71	5.384	0.001*
	Rural	5228	936	243		
Mothers educational level	No education	2993	2299	216	48.655	0.000*
	Primary	1027	1024	59		
	Secondary	229	268	23		
	Higher	145	119	16		
Wealth index	Poorest	1709	1225	117	33.366	0.000*
	Poorer	1747	796	48		
	Middle	590	569	49		
	Richer	511	496	41		
	Richest	229	268	23		
Age of mothers	15-24	2251	1841	151	6.085	0.001*
	25-34	1880	1660	147		
	35 and above	263	209	16		
Current marital status	Never in union	5	1	1	7.528	0.782
	Married/living with partner	4228	3607	303		
	Separated	161	99	10		
Father educational level	No education	2271	1755	162	11.799	0.000*
	Primary	1369	1291	90		
	Secondary	406	370	37		
	Higher	348	294	25		
Region	Tigray	494	436	13	52.522	0.000*
	Afar	482	295	29		
	Amhara	353	480	12		
	Oromia	661	556	38		
	Somalia	688	327	56		
	Benishangul-gumuz	335	332	30		
	SNNPR	490	528	75		
	Gambela	238	263	29		
	Harari	248	172	8		
	Addis Ababa	189	163	15		
	Dire dawa	163	189	31		
Mothers occupational status	No	3150	2698	253	12.677	0.000*
	Yes	1244	1012	61		
Birth order number	1(First)	768	679	65	8.607	0.003*
	2-4	2006	1676	154		
	>4	1620	1355	95		
Sex of child	Male	2257	1869	148	12.513	0.000*
	Female	2137	1841	166		
Preceding birth interval (months)	<24 months	1307	781	85	79.663	0.000*
	>=24 months	3087	2929	229		

Variables	Categories	Number of respondents (N) on the response categories				
		≥ 12	6 to <12	< 6	χ^2	P-value
Size of child at birth	Very large	759	614	49	15.371	0.000*
	Larger than average	643	475	49		
	Average	1858	1554	136		
	Smaller than average	411	373	23		
	Very small	723	694	57		
Number of children under-five	<2	13	36	1	93.327	0.000*
	2-4	3353	3096	238		
	>=4	1024	578	75		
Current pregnancy wanted	No	1338	1090	85	7.228	0.012*
	Yes	3056	2620	229		
Number of ANC visits	0	2247	1829	146	17.195	0.000*
	1	1895	1669	152		
	2-3	233	201	14		
	>=4	19	11	2		
Place of delivery	Home	1472	1296	104	11.046	0.000*
	Private facility	639	480	47		
	Government health center	2283	194	163		
Postnatal women, infants, and children participation	No	2989	2389	221	22.778	0.000*
	Yes	1405	1321	93		

Note that: <6: respondent who had breastfed for <6 months, 6-12: respondent who had breastfed for 6 to <12 months, ≥12: respondent who had breastfed for ≥12 months, ANC: antenatal care and χ^2 denotes the chi-square test of association.

3.3. Model Comparison on Breastfeeding Duration Status

The AIC for breastfeeding duration status was least in the Model V (Individual, household and community level factors). Hence, Model V was chosen as the best-fitted model for comparison in the present study (Table 2).

Table 2. *Model comparison and measures of variations of breastfeeding status.*

Model Comparison Criteria	Null Model (Model I)	Individual-level factors (Model II)	Household level factors (Model III)	Community-level factors (Model IV)	Individual Household and Community-level factors (Model V)
AIC	11523.94	10268.11	9854.32	9435.12	8869.58
Random effect analysis					
Variance for level 3	.29 [.18-.77]	.64 [.21-.92]	.37 [.17-.68]	.12 [.02-.44]	.099 [.043-.16]
ICC for level 3	0.077	0.147	0.095	0.003	0.027
Variance for level 2	.18 [.09-.58]	.41 [.19-.68]	.20 [.15-.57]	.49 [.13-.76]	.24 [.058-.59]
ICC for level 2	0.047	0.094	0.052	0.125	0.066

Note: Community at level 3, household at level 2, and individuals at level 1, ICC: Intra cluster correlation and AIC: Akaike information criterion.

The variance of breastfeeding length was estimated from the model at ${\sigma_{ou}}^2$=0.29, which was significant at the 5% level of significance, demonstrating that there were variances in breastfeeding duration across the Ethiopian community. This was done without taking explanatory variables across groups into account. In line with this, the variance of breastfeeding duration was calculated at ${\sigma_{ou}}^2$=0.18 and was significant at the 5% level of significance, demonstrating that there were differences in breastfeeding duration among Ethiopian households (Table 2).

At the 5% level of significance, the intra-community coefficient (ICC) of duration of breastfeeding at Model V was calculated to be 0.027, which is statistically significant. This indicates that variations within the community accounted for around 2.7% of the overall variability in the length of breastfeeding. In Model V, the duration of breastfeeding was estimated to have an intra-household correlation coefficient (ICC) of 0.066, which is statistically significant at the 5% level of significance. This indicates that variations within the family accounted for 6.6% of the total variability in breastfeeding time (Table 2).

3.4. Determinants for Breastfeeding Greater Than 6 Months in Ethiopia

In multinomial multilevel logistic regressions, the factors related with breastfeeding status are shown in Table 3. The references for the three dependent variables were 'Ref'; as a result, an odds ratio (OR) over one denotes a relationship between a factor and whether a woman has breastfed for <6 months, 6 to <12 months, and ≥12 months. Women who gave birth in a medical facility had significantly greater odds of breastfeeding for 6 to <12 months, and ≥12 months (AOR = 1.48, 95% CI = 0.41-2.67 and AOR = 1.36, 95% CI = 0.93-2.75, respectively). The odds of a woman breastfeeding for 6 to <12 months were significantly higher for those who used postpartum care facilities (AOR = 1.36, 95% CI = 1.11-1.66) and significantly lower for those who resided in rural regions (AOR = 0.86, 95% CI =.75-98). AOR = 1.33, 95% CI = 1.16-1.52, and AOR = 1.73, 95% CI = 1.29-2.28, respectively, were also statistically significant higher for women with higher levels of education, who were in the

middle quintile of wealth, and who had received breastfeeding advice during prenatal care visits, respectively (Table 3).

3.5. Determinants for Breastfeeding Less Than 6 Months in Ethiopia

When compared to women who did not receive postpartum care, the odds of a woman breastfeeding for less than 6 months were considerably lower for those who did (AOR = 0.13, 95% CI = 0.09-0.29). Higher educated women are approximately 3 times less likely than uneducated mothers to breastfeeding for less than 6 months (AOR = 2.99, 95% CI = 2.39-3.30). In comparison to their counterparts, women in regions like Somali, Gambela, Afar, and Benishangul-Gumuz are 3.30 (AOR = 3.30, 95% CI = 2.54-4.25), 2.90 (AOR = 2.90, 95% CI = 2.54-3.25), 1.79 (AOR = 2.79, 95% CI = 2.58-3.04), and 2.77 (AOR = 2.77, 95% CI = 2.55-3.08) times more likely to breastfeeding for less than 6 months respectively (Table 3).

Table 3. *Factors associated with duration of breastfeeding status in multinomial multilevel logistic regressions.*

Factors	**≥12 months**		**6 to <12 months**		**<6 months**	
Fixed part	**AOR [95% Conf. Interval]**	**P-value**	**AOR [95% Conf. Interval]**	**P-value**	**AOR [95% Conf. Interval]**	**P-value**
Child-related factors						
Preceding birth interval (in months)						
<24 months	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
>=24 months	1.43 [1.29-1.58]	0.000*	1.55 [1.40-1.71]	0.000*	0.55 [0.40-0.71]	0.000*
Sex of child						
Male	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
Female	0.72 [0.59-0.89]	0.003*	0.65 [0.48-0.89]	0.008*	1.65 [1.49-1.79]	0.001*
Birth order number						
1(First)	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
2-4	1.12 [0.89–1.54]	0.259	1.15 [0.76–1.75]	0.561	1.03 [0.74–1.41]	0.874
>4	1.31 [0.83–1.51]	0.485	1.93 [1.23–2.98]	0.074	1.39 [0.98–1.95]	0.065
Size of child at birth						
Very large	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
Larger than average	0.98 [0.79-1.09]	0.394	0.97 [0.79-1.14]	0.383	0.83 [0.65-1.22]	0.411
Average	1.02 [0.90-1.16]	0.700	1.04 [0.92-1.17]	0.520	1.08 [0.95- 1.18]	0.429
Small than average	1.10 [.93-1.32]	0.248	1.15 [.87-1.13]	0.266	1.13 [.95- 1.35]	0.151
Very small	1.15 [1.07-1.45]	0.404	1.18 [1.02-1.37]	0.420	1.23 [1.06-1.42]	0.505
Number of children under-five						
<2	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
2-4	1.22 [0.86–1.72]	0.000*	1.09 [0.94–1.25]	0.000*	0.67[0.50-0.81]	0.000*
>=4	1.49 [0.99–2.26]	0.001*	1.04 [0.89–1.21]	0.000*	0.45[0.35-0.61]	0.003*
Maternal factors						
Age of mothers						
15-24	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
25-34	1.12 [0.82–1.51]	0.000*	1.13 [0.98–1.27]	0.000*	0.13 [0.05–0.27]	0.021*
35 and above	1.44 [0.87–2.35]	0.012*	1.37 [1.11–1.66]	0.001*	0.15 [0.12–0.33]	0.000*
Mothers educational level						
No education	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
Primary	1.16 [1.04-1.29]	0.006*	1.25 [1.13-1.38]	0.000*	0.51 [0.23-0.84]	0.000*
Secondary	1.38 [1.13-1.68]	0.000*	1.51 [1.26-1.81]	0.000*	0.33 [0.15–0.67]	0.040*
Higher	1.74 [1.60-2.36]	0.000*	1.55 [1.16-1.89]	0.001*	2.99 [2.39-3.30]	0.000*
Mothers occupational status						
No	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
Yes	0.85 [0.77-1.94]	0.223	0.91 [0.82-1.06]	0.067	0.89 [0.81-1.98]	0.527
Current pregnancy wanted						
No	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
Yes	1.25 [1.07-1.45]	0.604	1.19 [1.02-1.37]	0.520	1.24 [1.06-1.42]	0.705
Current marital status						
Never in union	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
Married	0.92 [0.79-1.08]	0.399	0.87 [0.79-1.14]	0.373	0.83 [0.65-1.22]	0.511
Separated	1.03 [0.90-1.56]	0.712	1.05 [0.92-1.17]	0.720	1.08 [0.95- 1.18]	0.320
Household-level factors						
Father's education						
No education	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
Primary	1.37 [0.92–2.00]	0.000*	1.04 [0.90–1.33]	0.000*	0.67 [0.25–1.05]	0.000*
Secondary	1.43 [0.91–1.91]	0.000*	1.15 [0.95–1.39]	0.000*	0.45 [0.19–1.12]	0.000*
Higher	1.62 [0.88–1.99]	0.000*	1.35 [0.25–1.45]	0.000*	0.33 [0.25–1.09]	0.000*
Wealth index						
Poorest	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
Poorer	1.22 [1.09-1.47]	0.000*	1.21 [1.06-1.37]	0.003*	1.18 [1.04- 1.34]	0.008*

Factors	≥12 months		6 to <12 months		<6 months	
Fixed part	**AOR [95% Conf. Interval]**	**P-value**	**AOR [95% Conf. Interval]**	**P-value**	**AOR [95% Conf. Interval]**	**P-value**
Middle	1.30 [1.10-1.47]	0.002*	1.33 [1.16-1.52]	0.000*	1.29 [1.13-1.48]	0.000*
Rich	1.07 [.92-1.25]	0.360	1.33 [1.16-1.54]	0.000*	1.26 [1.09-1.45]	0.001*
Richest	1.10 [.95-1.28]	0.166	1.24 [1.10-1.39]	0.092	1.10 [.96-1.26]	0.152
Community-level factors						
Place of residence						
Urban	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
Rural	.86 [.75-.98]	0.025*	.53 [.33-.94]	0.000*	.51 [.36-.98]	0.000*
Region						
Tigray	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
Afar	.73 [.61-.89]	0.002*	.74 [.61-.89]	0.002*	2.79 [2.58-3.04]	0.001*
Amhara	.53 [1.27- 1.84]	0.670	1.56 [1.27-1.85]	0.234	1.67 [1.34-1.99]	0.712
Oromia	.98 [.83- 1.17]	0.895	.99 [.84-1.18]	0.984	.74 [.56-1.05]	0.342
Somali	.61 [.51-0.73]	0.000*	.60 [.50-.72]	0.000*	3.30 [2.54-4.25]	0.000*
Benishangul	.18 [.07-0.44]	0.000*	.24 [.98-0.45]	0.000*	2.77 [2.55-3.08]	0.000*
SNNPR	.35 [.13-0.61]	0.001*	.46 [1.18- 0.62]	0.000*	1.51 [1.35-1.86]	0.000*
Gambela	.34 [.09-0.67]	0.006*	.33 [1.07- 0.65]	0.008*	2.90 [2.54-3.25]	0.000*
Harari	.79 [.63- 1.02]	0.056	.78 [.62-.99]	0.942	.56 [.41-.87]	0.764
Addis Ababa	1.03 [.81-1.31]	0.773	.96 [.72-1.26]	0.784	1.53 [1.04-1.79]	0.279
Diredawa	.85 [.66-1.08]	0.185	.82 [.64-1.05]	0.130	.96 [.69-1.24]	0.335
Healthcare -related factors						
Number of ANC visits						
0	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
1	1.11 [.95-1.28]	0.166	1.25 [1.10-1.39]	0.092	1.10 [.96-1.26]	0.521
2-3	1.45[1.29-1.58]	0.000*	1.55[1.40-1.71]	0.000*	0.55[0.40-0.71]	0.000*
>=4	1.73[1.29-2.28]	0.000*	1.60[1.40-1.81]	0.000*	0.45[0.36-0.71]	0.000*
Place of delivery						
Home	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
Private Facility	0.98 [0.51–1.96]	0.000*	1.25 [0.91–1.69]	0.000*	0.35 [0.09–0.59]	0.000*
Health center	1.48 [0.41–2.67]	0.000*	1.36 [0.93–1.75]	0.000*	0.23 [0.09–0.45]	0.000*
Postnatal women, infants, and children participation						
No	1.00 [Ref]		1.00 [Ref]		1.00 [Ref]	
Yes	1.75 [1.24–2.39]	0.000*	1.43 [0.99–1.79]	0.000*	0.13 [0.09–0.29]	0.000*

Note that: 1.00 [Ref] indicates the reference group, Ref, reference; AOR, adjusted odds ratio; Conf. Interval: confidence interval, ANC: antenatal care.

In summary, the final model (Model V) shows that age of mother, preceding birth interval (in months), mother's and father's educational level, wealth quintile, sex of child, place of delivery, number of ANC visits, postnatal (women, infants, and children) participation, place of residence, and region were the significant factors in the duration of breastfeeding (Table 3).

4. Discussion

This study assesses the variation of breastfeeding duration among households and communities in Ethiopia. The result showed that the proportion of women's breastfeeding status was 3.7% for less than 6 months, 44.1% for greater or equal to 6 months but less than 12 months, and 52.2% for greater or equal to 12 months.

Both mother's and father's educational level have significant effect on the duration of breastfeeding status. Our findings are contrary to the findings in previous studies [19-21] which suggest that there is a negative relationship between maternal education level and breastfeeding status. This inconsistency may be due to cultural beliefs regarding prelacteal feeding, that is, the practice of giving food to newborns before the initiation of breastfeeding. Relatedly, the wealth index of mothers was the significant factor in this study. The similar study conducted in Nigeria suggests that mothers in wealthy families often practice breastfeeding more than mothers in poor families, which may reflect that wealthy mothers have more access to health care [22].

The place of residence of women was another significant factor in the duration of breastfeeding in this study. A similar study conducted in Pakistan [23] suggests most medical utilization and public health practices for women in small towns were between those in large cities and rural areas. In comparison to large cities and rural areas, small towns have different characteristics that influence the utilization of medical facilities as a place of birth [24]. The factor ''region of mothers'' was a significant impact on the duration of breastfeeding with similar results were found in previous studies [25-27].

The sex of the child has a significant effect on the breastfeeding duration. In this study, female children were more likely to be exposed to the duration of breastfeeding status. This is due to the perception that breast milk alone does not meet nutritional needs, and the belief that infant men have a more greedy appetite than infant women and require additional nutrition, infant men start solids early. Additionally, female babies are considered good babies; breast milk alone may be able to meet their nutritional needs and may not be able to start feeding early. The finding was

consistent with studies conducted in Kenya [28], Cameroon [29], Angola [30], and Ghana [31].

When it came to the place of delivery, mothers who gave birth in medical facilities used breastfeeding more frequently than mothers who delivered at home. Similar investigations have been conducted in Ghana [32], Tanzania [33], and Nigeria [34]. The results of a Canadian study were the exact opposite, and the adverse impact of formula addition in their context was cited as the cause [35]. Our findings support the global advice to make healthcare facilities "baby-friendly" since parents and society value the information they receive from healthcare facilities.

Region of residence was also a key factor in the determinant of breastfeeding duration. Specifically, women who live in pastoralist regions were less likely to have a family with the breastfeeding duration as compared to women found in agrarian regions. The regional variation of breastfeeding duration was also observed in the previous studies conducted in Ghana [32] and Malawi [36]. The variation in breastfeeding periods may be due to herders not being fully informed about the importance of breastfeeding due to weak health care systems for women in the region and low self-determination of women. In addition, nomads have a mobile lifestyle and may start milking early rather than paying attention to the length of breastfeeding [37]. Furthermore, there may be regional differences in some background characteristics such as culture, religion, living conditions, availability, and accessibility of maternal and child health services.

5. Conclusions

Age of mother, preceding birth interval (in months), mother's and father's educational level, wealth quintile, sex of child, place of delivery, number of prenatal care visits, postnatal (women, infants, and children) participation, place of residence, and region were the significant factors to the duration of breastfeeding. As a result, we strongly advise healthcare professionals to emphasize the importance of encouraging mothers to attend prenatal and postnatal care, as our findings support, in order to promote breastfeeding duration and give women a chance to educate them about it. In addition to the institutional environment, health extension workers will offer newborns and early children community-based feeding guidance and counseling. Additionally, one of the most important ways to promote breastfeeding for a longer period of time is through the efforts of health extension workers, who can improve the utilization of prenatal care and institutional delivery.

Abbreviations

ANC: Antenatal care; AOR: Adjusted odds ratio; AIC: Akaike information criteria, CI: Confidence interval; CSA: Central Statistical Agency, EPHI: Ethiopian Public Health Institute, EMDHS: Ethiopia Mini Demographic and Health Survey; FMoH: Federal Ministry of Health, ICC: Intra cluster correlation, SNNPR: Southern Nations and Nationalities People's Regional State; TWG: Technical Working Group; UNICEF: United Nations Children's Fund, USAID: United States Agency for International Development WHO: World Health Organization.

Authors' Contributions

SYG designed the study, performed the statistical analysis and participated in drafting the manuscript. KAK participated in the study design, implementation of the study, and drafted the manuscript. Both authors contributed to the data analysis, read and approved the final manuscript.

Availability of Data and Materials

We have accessed the publically available data based on the available data access permission set by the agency under official web page (www.dhsprogram.com).

Declarations

Ethics Approval and Consent to Participate

Our data source was the Ethiopia Mini Demographic and Health Survey, 2019, which was collected at national level with written consents and ethical consideration during data collection by Ethiopian statistical Agency (CSA, https://www.statsethiopia.gov.et/). All methods were carried out in accordance with relevant guidelines and regulations.

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Conflicts of Interest

The authors declare that they have no competing interests.

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