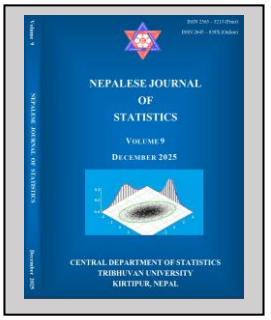
Knowledge, Attitude, Social Support and Determinants of Exclusive Breastfeeding Among the mothers of Child Below 6 Months: A Cross-Sectional Study of Damak Municipality

Diwas Rai[1*] and Pravat Uprety[2]

Submitted: 12 December 2025; Accepted: 23 December 2025
Published online: 31 December 2025
DOI: https://doi.org/10.3126/njs.v9i1.88704



ABSTRACT

Introduction: Exclusive breastfeeding during the first six months of life is critical for infant health. Despite the national and international promotions and guidelines, the rate remains subpar.

Objective: To estimate the prevalence of exclusive breastfeeding and determine the factors of exclusive breastfeeding in the Damak municipality of Jhapa.

Materials and Methods: A cross-sectional study was conducted among 388 mothers using a structured questionnaire. The sampling frame was constructed using vaccine records. Data were analyzed using the concept of descriptive statistics, chi-square, and Mann-Whitney U tests for bivariate analysis and binary logistic regression for multivariate analysis. Model diagnostics included Hosmer-Lemeshow test, Analysis of Deviance, Generalized Variance Inflation Factor, AUC and pseudo-R^2. Reasons for early cessation of breastfeeding were asked to non-EBF mothers.

Results: The EBF prevalence was 32.99% (95% CI: 28.31%-37.67%). Logistic regression identified initiation of breastfeeding (within an hour) (AOR=3.32, 95% CI: 1.8-6.88, p<0.001), maternal knowledge (AOR=1.95, 95% CI: 1.03-3.73, p=0.04), maternal age 35-44 years (AOR=0.37, 95% CI: 0.15-0.84, p=0.021), job/wage income (AOR=2.18, 95% CI: 1.17-4.06, p=0.014) and infant age 4 months (AOR=0.40, 95% CI: 0.17-0.91, p=0.033) and 5 months (AOR=0.29, 95% CI: 0.12-0.68, p=0.005) as significant predictors. Attitude and morbidity were not statistically significant. Perceived milk insufficiency (72.85%) and perceived infant thirst (28.05%) are major leading causes of early supplementation.

Conclusion: EBF in Damak is significantly below the national average. Key determinants include initiation of breastfeeding, knowledge, major income source, mother's age and infant age in months. While attitude and morbidity were positively related, but it was not statistically significant. Lastly, 76% of the mothers had poor knowledge which highlights the knowledge gaps that affecting exclusive breastfeeding practice.

Keywords: Attitude, determinants, exclusive breastfeeding, maternal knowledge, social support.

Address correspondence to the author: Central Department of Statistics, Institute of Science and Technology, Tribhuvan University, Kirtipur, Kathmandu, Nepal [1, 2].
Email: diwas.bantawa.rai@gmail.com[1] (Corresponding author email); pravatup@gmail.com[2]

INTRODUCTION

Exclusive breastfeeding refers to the infant consuming only breast milk except for oral rehydration solution and vitamins, minerals or medicinal drops/syrups, no other liquids or solids, including water (World Health Organization, 2023). Breastmilk provides all the essential nutrients and antibodies a baby needs to survive and thrive during their early days. However, many moms still find it difficult to follow the advice of health care providers. The World Health Organization (WHO) advises breastfeeding the child from birth to 6 months because it promotes general health, immune system development, and growth. Many babies are still not breastfed throughout these vital first few months of life, even though these guidelines are in effect worldwide. Breast milk acts as a vital source of nutrition and immunity buildup for babies. Moreover, it supplies essential nutrients and antibodies according to the needs of the baby. Apart from the baby, the mother also benefits from the practice of exclusively feeding the baby with milk of their own. Potentially lowering the risk of certain cancers and facilitating postpartum recovery are some perks. Mother's milk is an unparalleled source of nourishment for infants, as it adapts to their requirements over time as they develop. Breast milk consists of antibodies, which help newborns develop an effective immune system and protect them from diseases. Breastfeeding helps in preventing postpartum depression and also reduces a mother's risk of getting breast and ovarian cancer.

Breastfeeding rates are rising throughout the world from approximately 38% in 2013 to nearly 48% in 2023. This is because of improved assistance and safety measures. Additionally, the World Health Assembly (WHA) has set a goal to increase the global rate of exclusive breastfeeding to at least 50% by the year (World Health Organization, 2014), and a more optimistic target was established by the Global Breastfeeding Collective, which calls for a 70% prevalence rate by 2030 (World Health Organization & United Nations Children's Fund, 2023). In contrast to the global situation, Nepal is in a different direction. If we look at the data of Nepal Demographic and Health Survey (NDHS) 2022 rates have been declining since 2011, from 70% to 56% (Ministry of Health and Population et al., 2023). The scenario is not that there are not enough studies being conducted in Nepal, but rather that most are based either nationally or in large hospitals and cities such as Kathmandu. Damak has a diverse population, including residents originating from hill districts, the Terai region, and refugee communities. Despite this diversity, no prior study has been conducted focusing on the Damak Municipality. Hence, this research delves into the mother's knowledge, attitude and practice to shed light on gaps and opportunities for improving maternal and child health in Damak, Nepal.

METERIALS AND METHODS

Study area and design

A long-established town, Damak Municipality in the Jhapa district, located in Nepal's Koshi Province is the place where the study was conducted. The town covers a total area of about 70 km^2 with 107,227 people living, which means about 1,513 people are living in each square kilometer and there is a total of 27,569 households (National Statistics Office, 2023). This cross-sectional study was conducted among the mothers of Child Below 6 Months of Damak Municipality.

Sampling frame and size determination

The list of mothers with children not older than five months old wasn't readily available within the Damak Municipality. Therefore, decided to use a list compiled from vaccination records as our sampling frame. Ethical approval was obtained from Damak Municipality to access vaccination records from healthcare facilities within the Municipality which were conducting immunization programs. The sampling frame of 621 mothers was constructed by identifying Mothers from the immunization record with an infant born between 2081-06-01 B.S. and 2081-11-29 B.S. This approach is practical considering Damak Municipality's efforts to guarantee substantial immunization coverage among children residing in it.

The Cochran's sample size formula (Cochran, 1977):

$$\boldsymbol{n = \frac{z^2 \cdot p \cdot (1-p)}{d^2}},$$

where:

p = 54.9% prevalence of exclusively breastfeeding in Nepal (Department of Health Services, 2024), d = 5% margin of error. The sample size was determined using Cochran' sample size formula (Cochran, 1977) based on a 54.9% prevalence of exclusive breastfeeding in Nepal (Department of Health Services, 2024) with a 95% confidence interval (CI) and a 5% margin of error. The initial sample size was calculated at 381. After adjusting for a 10% expected non-response rate, the final sample size was estimated to be 418.51758 ≅ 419 mothers. Out of 419 sampled mothers, only 388 participated, resulting in an actual non-response rate of 7.4%.

Method of data collection and measurement tools

For this cross-sectional based study, primary data collected was cleaned and arranged using Excel and statistical analysis was done using R (version 4.5.0). From the list of 621 eligible mothers, 419 were randomly selected for participation. Every mother on the list has an equal chance of being included in the study by using a simple random sampling technique. Data were collected through structured interviews conducted during routine infant vaccination visits at designated vaccine centers, Primary Health Centers, Urban Health Centers and hospitals. For mothers who do not attend during the vaccine schedule, follow-up was executed via phone call with home visits. Mothers whose contact number was out of service or didn't pick up the phone call after multiple tries and a few selected mothers with missing contact information were considered non-responders.

Knowledge

The questionnaire of knowledge as well as the assessment of exclusive breastfeeding were adapted from the Module 1: Feeding infants (0–6 months) given in the Guidelines for assessing nutrition-related Knowledge, Attitudes and Practices – KAP Manual (Macías & Glasauer, 2014). This tool has been often used to measure the mothers' knowledge regarding exclusive breastfeeding including its definition, merits, recommended length and proper feeding techniques. The module includes multiple-choice questions with right answers scored as 1 and wrong ones as 0. A total knowledge score calculated with greater scores reflecting more knowledge on exclusive breastfeeding.

Iowa infant feeding attitude scale (IIFAS)

The Iowa Infant Feeding Attitude Scale (IIFAS), developed by De La Mora et al. (1999), predicts both planned and real-world infant nutrition practices through its validated framework. This study used the scale to evaluate mothers' perceptions on the baby feeding attitudes. This tool has 17 statements with a 5-point agreement scale ranging from 1 (strong disagreement) to 5 (strong agreement). Hence, scale's total score spans 17 to 85. Greater scores reflect favorable views toward breastfeeding, while lower values suggest a preference for formula use. The overall scores of 70-85, 49-69, and 17-48 indicate positive attitude for the practice of breastfeeding, neutral, and positive attitude for formula supplementation, respectively (De La Mora et al., 1999).

Social support

The Breastfeeding Support Scale (Nanishi et al., 2021) was used to assess the level of support mothers receive from both lay and professional persons. This 11-item scale measures three key dimensions: support from breastfeeding peers and healthcare professionals, practical assistance, and emotional support in addressing breastfeeding concerns.

Exclusive breastfeeding

A dichotomous variable that denotes whether the mother followed the exclusiveness in feeding breast-milk or not. It was identified using the adapted standardized module question from Guidelines for assessing nutrition-related knowledge, attitudes and practices - KAP Manual (Macías & Glasauer, 2014) in section Appendix 6, module 1, Practices. On the basis of the outcome of the question, the variable was marked with "0" and "1" for mothers who did not follow the exclusiveness in feeding breastmilk and mothers who followed the exclusiveness in feeding breastmilk, respectively.

Reliability and validity of instruments

In a pilot survey of 10% of the sample size, Cronbach's alpha created by Cronbach, L. J., (1951) was implied test the reliability of the scale in the context of the mothers of Damak Municipality. Cronbach's alpha measures the internal consistency of the scale i.e., the extent to which all items in a scale measure the same construct (Tavakol & Dennick, 2011). The Cronbach's alpha for Infant feeding attitude and social support scale were 0.74 and 0.79, respectively. It suggests that both the scale used are very much reliable in the context of Nepal and more specifically in Damak Municipality.

Content validity was ensured through expert review, as the questionnaire was developed and refined by the supervisor. The tools were adapted from previously validated instruments: Guidelines for assessing nutrition-related knowledge, attitudes and practices - KAP Manual (Macías & Glasauer, 2014) for knowledge questions, The Iowa Infant Feeding Attitude Scale (De La Mora et al. 1999) for assessing breastfeeding attitude, and The Breastfeeding Support Scale (Nanishi et al., 2021) for social support. These validated frameworks strengthen construct validity. The questionnaire was translated into Nepali and back translated to ensure linguistic accuracy.

Data analysis

To summarize characteristics of the primary data, frequency and percentage was calculated for categorical variables. Whereas Mean, Median, Standard Deviation, Minimum & Maximum were estimated for continuous variables. We used Chi-sq test to investigate the relationships between EBF and other categorical variables such as Caste, type of family, place of delivery, infant gender, and so on. In case, fail to maintain the assumption of Chi-sq test, i.e. expected cell counts less than 5, Fisher Exact test was used accordingly. The Shapiro-Wilk and Kolmogorov-Smirnov tests were used to assess the normality of continuous variables prior to assessing their relationship with EBF. Since, all the continuous variables concluded to be non-normal we performed non-parametric test i.e., Mann Whitney U test to test the difference in distributions between two groups. Logistic regression was fitted including independent variables which were significant variable from bivariate analysis at 0.05 level of significance and an exceptional variable 'age of the mother' was also included; which was significant at 0.1 level of significance and due to significant variable from past studies. All the significant variable were tested for multicollinearity by estimating adjusted Generalized Variance Inflation Factor (GVIF). Further, the Wald test was used to determine the statistical significance of the beta coefficients in the model.

Model adequacy tests

To evaluate model adequacy, Nagelkerke's pseudo-R^2 was obtained. Analysis of deviance was performed to compare the full model against the null model, testing whether the full model significantly improved fit. The Hosmer-Lemeshow test was implemented to measure goodness-of-fit. Lastly, ROC curve was also plotted to evaluate the diagnostic performance of the model.

RESULTS

Descriptive statistics

388 mothers of infants aged below six months participated in this research, out of which 28.4% were aged between15-24, 57.7% were aged between 25-34 and 13.9% were aged between 35-44. Meanwhile, the average age of the participant mothers was 28.01 years. In terms of education, the majority of the mothers have attained SEE/SLC and above education level. Out of which 32.99% of mothers have attained +2 level education followed by SEE/SLC (30.41%), Primary level (27.32%) and Bachelor above level (9.28%). 86.86% of the mothers were not working in a job. Only 13.14% of mothers were either currently enrolled in studies or working. In the context of family setting, 55.93% reported living in a joint family whereas 44.07% reported living in a nuclear family. In the context of ethnicity, 29.12% belong to Brahmin/Kshetri, 48.45% belong to Janjati and

the remaining 22.42% belong to other ethnic groups. Among all respondents, 37.9% of the husband's primary source of income was from Business, 35.1% husband's primary source of income was from job/wage and 27.06% husband's primary source of income was remittance from foreign employment. Only 18.04% of mothers had milk-producing animals in the household. Likewise, only 0.77% of mothers used to consume alcohol and 2.06% consumed tobacco products. 46.65% of mothers were first-time mothers (primiparous) whereas 53.35% had more than one child (multiparous). In the case of utilizing health services, 94.59% of mothers did receive counselling during pregnancy. 63.66% of mothers attended more than 8 Antenatal visits and the rest of the mothers (36.34%) visited less than 8 times. In contrast, only 1.55% of mothers were able to receive more than 4 postnatal contacts. 97.42% of mothers gave birth to their child at the hospital whereas 2.58% gave birth at home. The majority of mothers (72.42%) underwent c-sections while 27.58 had a normal vaginal delivery.

55.15% child were male whereas 44.85% were female. Among all the infants, 57.22% had no history of illness reported by the mothers. Out of 388 samples, 7%, 18.8%, 20.1%, 22.7%, 15.5% and 16% of infants were aged less than 1 month, 1 month, 2 months, 3 months, 4 months and 5 months old, respectively. Only 2.84% of mothers had a preceding birth interval of fewer than 24 months whereas 50.51% of mothers had more than 24 months gap between their current and previous child the remaining (46.65%) were primiparous mothers. The majority of infants (78.61%) infants were initiated breastfeeding within an hour of being born. Mothers' knowledge was poor for 76% of them, high for 14.9%, and moderate for just 9%. There was no proportion of mothers who had a positive attitude towards formula feeding. 55.4% of mothers were positive towards breastfeeding and 44.6% were neutral in infant feeding attitude. The mean weight of infants was 3.14 kilograms. Minimum report birth weight was 1 kg and maximum was 5.9 kgs.

Table 1. Association between independent variables and exclusive breastfeeding practice.

Variables	EBF			*p*-value
	Overall	Yes	No	
	n (%)	*n* (%)	*n* (%)	
Age of the mother				0.087
15-24	110(28.4)	41 (37.27)	69 (62.73)	
25-34	224(57.7)	76 (33.93)	148 (66.07)	
35-44	54(13.9)	11 (20.37)	43 (79.63)	
Maternal Education				0.87
Primary/BLE	106(27.32)	37 (34.91)	69 (65.09)	
SEE/SLC	118(30.41)	36 (30.51)	82 (69.49)	
2	128(32.99)	44 (34.38)	84 (65.62)	
Bachelors and above	36(9.28)	11 (30.56)	25 (69.44)	
Maternal Employment Status				0.792
Not working	337(86.86)	112 (33.23)	225 (66.77)	

working/student	51(13.14)	16 (31.37)	35 (68.63)	
Type of family				0.759
Nuclear family	171(44.07)	55 (32.16)	116 (67.84)	
Joint family	217(55.93)	73 (33.64)	144 (66.36)	
Caste/Ethnicity				0.472
Brahmin/Kshetri	113(29.12)	42 (37.17)	71 (62.83)	
Janjati	188(48.45)	57 (30.32)	131 (69.68)	
Others	87(22.42)	29 (33.33)	58 (66.67)	
Husband's primary source of income				0.021
Job/wage income	136(35.1)	54 (39.71)	82 (60.29)	
Business income	147(37.9)	50 (34.01)	97 (65.99)	
Remittance income	105(27.06)	24 (22.86)	81 (77.14)	
Milk producing animal				0.414
Yes	70(18.04)	26 (37.14)	44 (62.86)	
No	318(81.96)	102 (32.08)	216 (67.92)	
Alcohol use				0.554
Yes	3(0.77)	0 (0)	3 (100)	
No	385(99.23)	128 (33.25)	257 (66.75)	
Tobacco use				0.28
Yes	8(2.06)	1 (12.50)	7 (87.50)	
No	380(97.94)	127 (33.42)	253 (66.58)	
Parity				0.308
Primipara	181(46.65)	55 (30.39)	126 (69.61)	
Multipara	207(53.35)	73 (35.27)	134 (64.73)	
Counselling during pregnancy				0.323
Yes	367(94.59)	119 (32.43)	248 (67.57)	
No	21(5.41)	9 (42.86)	12 (57.14)	
ANC visit				0.115
>=8 ANC visit	247(63.66)	89 (36.03)	158 (63.97)	
<8 ANC visit	141(36.34)	39 (27.66)	102 (72.34)	
PNC contact				0.184
>=4 PNC contact	6(1.55)	0 (0)	6 (100)	
<4 PNC contact	382(98.45)	128 (33.51)	254 (66.49)	
Place of Delivery				
Home	10(2.58)	3 (30.00)	7 (70.00)	

Health facilities	378(97.42)	125 (33.07)	253 (66.93)	
Type of Delivery				0.105
Vaginal birth	107(27.58)	42 (39.25)	65 (60.75)	
Caesarean	281(72.42)	86 (30.60)	195 (69.40)	
Infant Gender				0.729
Male	214(55.15)	69 (32.24)	145 (67.76)	
Female	174(44.85)	59 (33.91)	115 (66.09)	
Morbidity				0.003
Yes	166(42.78)	41 (24.70)	125(75.30)	
No	222(57.22)	87 (39.19)	135(60.81)	
Infant age in months				0.025
Less than 1 month	27(7)	11 (40.74)	16 (59.26)	
1 months	73(18.8)	29 (39.73)	44 (60.27)	
2 months	78(20.1)	29 (37.18)	49 (62.82)	
3 months	88(22.7)	34 (38.64)	54 (61.36)	
4 months	60(15.5)	13 (21.67)	47 (78.33)	
5 months	62(16)	12 (19.35)	50 (80.65)	
Preceding Birth Interval				0.225
No Previous birth	181(46.65)	55 (30.39)	126 (69.61)	
Less than 2 years	11(2.84)	6 (54.55)	5 (45.45)	
More than two years	196(50.51)	67 (34.18)	129 (65.82)	
Initiation of Breastfeeding				<0.001
Within an hour	305(78.61)	115 (33.71)	190 (62.29)	
after more than an hour	83(21.39)	13 (15.66)	70 (84.34)	
Knowledge				0.033
Poor	295(76)	87 (29.49)	208 (70.51)	
Moderate	35(9)	15 (42.86)	20 (57.14)	
High	58(14.9)	26 (44.83)	32 (55.17)	
Infant feeding attitude				0.038
Positive towards formula feeding	0(0)	0 (0)	0 (0)	
Neutral	173(44.6)	47 (27.17)	126 (72.83)	
Positive towards Breastfeeding	215(55.4)	81 (37.67)	134 (62.33)	

Source: Field Survey, 2025.
**P*-value based on Chi-square tests and Fisher's exact test (count<5)

Knowledge, Attitude and Social Support scores on exclusive breastfeeding

The average knowledge score obtained by the mothers of Damak municipality was 6.304 with 95% CI (6.118-6.490). As the total score of knowledge ranges from 0-10, the average score can be reported as 63.04%. Since this score is below the 70% threshold, an urgent nutrition education intervention is required (Macías & Glasauer, 2014). Also, narrow CI indicates a very precise estimate of the average knowledge score. Overall Infant feeding attitude score of the mothers of Damak was found to be 70.72 (95% CI: 69.97-71.47) which indicates that the mothers are more positive towards breastfeeding (De La Mora et al., 1999). On a scale of 11 items and a score ranging from 11-55, the average social support score of mothers was 45.64 (95% CI: 45.11-46.17).

Prevalence of Exclusive Breastfeeding

Out of 419 randomly selected mothers, 388 were successfully contacted and agreed to participate in the study. From 388 mothers only 128 were found to be practicing breastfeeding exclusively in Damak municipality resulting 32.99% prevalence rate with 95% CI (28.31, 37.67), which is substantially lower than the national average 54.9% (Department of Health Services, 2024) and the global target of 50% by World Health Assembly (World Health Organization, 2014).

Bivariate analysis

The associations between various maternal, infant and health service characteristics and the practice of exclusive breastfeeding were examined using the Chi-square test of independence or Fisher's Exact test where appropriate. Several factors were significantly associated with EBF.

Test of Normality

The normality of distribution of continuous data was tested using the Shapiro-Wilk and Kolmogorov-Smirnov tests, p-values for all variables are less than <0.001, which means that there is no evidence for accepting the null hypothesis, i.e. the variable is normally distributed. Hence, it suggests to implementing the non-parametric test.

Mann-Whitney U test

The Mann-Whitney U test was used to compare groups for variables which failed to meet the normality assumption. From Table 2, the test indicated that there were no statistically significant differences in the distributions of birth weight and social support scores between the EBF and non-EBF groups at the 0.05 level of significance.

Table 2. Comparison of birth weight and social support scores by EBF status using Mann-Whitney U Test.

Variable	W Statistic	p-value
Birth weight	15811	0.424
Social support	15513.5	0.277

Source: Field Survey, 2025.

Logistic model summary

Factors associated with EBF among mothers of infants under six months in Damak Municipality were identified fitting a Multiple logistic regression model. The model incorporated all the factors that were statistically significant at the 0.05 level of significance in the bivariate analysis including the mother's age. From Table 3, mothers whose husband's primary source of income was Job/Wage income had significantly higher odds of EBF (AOR=2.17; 95% CI: 1.18-4.09) and mothers whose husband's primary source of income was business income also had higher odds of EBF but not statistically significant (AOR=1.72; 95% CI: 0.94-3.20) compared to the mothers whose husband's primary source of income was remittance. Mothers aged 25-34 have 24% lower odds of practicing EBF compared to mothers aged 15-24 (reference group) (AOR=0.76; 95% CI: 0.44-1.28) but this difference is not statistically significant. Mothers aged 35-44 have 63% lower odds of EBF compared to mothers aged 15-24 (AOR: 0.37, 95% CI: 0.15-0.84) and this difference is statistically significant. This indicates that both demographic factor such as mothers age and socioeconomic factors such as household income and maternal education achievement influence the likelihood of EBF.

High breastfeeding knowledge mothers were 1.95 times more likely to involve in EBF than poor breastfeeding knowledge mothers (CI: 1.03-3.37, p=0.04). Likewise, mothers with moderate levels of breastfeeding knowledge were 1.99 times more likely to implement EBF than mothers with a low level of knowledge, but this difference was not statistically significant at 0.05 level of significance. Mothers who had positive attitudes towards breastfeeding were 1.42 times more likely to practice EBF compared to Neutral attitudes but this result was not statistically significant (p=0.2). Mothers who initiated breastfeeding within an hour of birth had 3.32 times higher odds of EBF compared to those who initiated after an hour (95% CI: 1.8-6.88, p=<0.001). These findings indicate higher maternal knowledge about breastfeeding and early initiation of breastfeeding are significantly associated with exclusive breastfeeding practice. Infants who had no past illness were 1.51 times more likely to be exclusively breastfed than those who had a past illness history but this result was not statistically significant (95% CI:0.92-2.51, p=0.11). Infant aged less than 1 month showed no significant difference in EBF practice compared to 1 month old infants (AOR=0.80; 95% CI: 0.30-2.08). Similarly, 2 months old infants also showed no significant difference in EBF practice compared to 1 month old infants (AOR=0.75; 95% CI: 0.37-1.52). Likewise, no significant change in EBF was observed at 3 months (AOR=0.93; 95% CI: 0.46-1.88). In case of 4 months old infants, there was a significant 60% reduction in EBF odds compared to 1 month old infants (AOR=0.40; 95% CI: 0.17-0.91). Infants of 5 months old have 70% lower EBF odds than 1 month old infants (AOR=0.30; 95%

CI:0.12-0.68). Overall, there was no significant EBF practice decrease in 0-3 months but steep decline in 4 to 5 months old.

Table 3. Summary of multiple logistic regression between several independent variables and exclusive breastfeeding practice.

Variable	AOR	95% CI of AOR		*p*-value
		Lower	Upper	
(Intercept)	0	0.01	0.13	<0.001
Husband's primary source of income				
Remittance income ®				
Business income	1.72	0.94	3.32	0.082
Job/Wage income	2.18	1.17	4.06	0.014
Age of the mother				
15-24 ®				
25-34	0.76	0.44	1.28	0.3
35-44	0.37	0.15	0.84	0.021
Knowledge				
Poor ®				
High	1.95	1.03	3.73	0.04
Moderate	1.99	0.89	4.4	0.09
Infant feeding attitude				
Neutral ®				
Positive towards breastfeeding	1.42	0.88	2.28	0.2
Initiation of Breastfeeding				
After more than an hour ®				
Within an hour	3.32	1.80	6.88	<0.001
Infant age in months				
1 month ®				
Less than 1 month	0.80	0.30	2.08	0.7
2 months	0.75	0.37	1.52	0.4
3 months	0.93	0.46	1.88	0.8
4 months	0.40	0.17	0.91	0.033
5 months	0.30	0.12	0.68	0.005
Morbidity				
Yes ®				
No	1.51	0.92	2.51	0.11

Source: Field Survey, 2025 ; ® Reference

Analysis of deviance

In the analysis of deviance, the difference between the Null and Full model ($\chi^2_{(14)} = 57.41$, $p < 0.001$) was statistically significant, indicating that the inclusion of predictors significantly improves the fit compared to the null model.

Table 4. Analysis of deviance: Full vs null model comparison.

Model	Residual Deviance	Residual DF	Deviance difference	DF difference	p-value
Full model	434.66	373	57.41	14	<0.001
Null model	492.07	387			

Source: Field Survey, 2025

Hosmer-Lemeshow goodness of fit test

The Hosmer-Lemeshow test's $p = 0.4814$ suggests fail to reject the null hypothesis, implying that the model does fit the data well.

Pseudo R^2

The Cox & Snell R^2 value was 0.1375 and Nagelkerke R^2 which is the adjusted value of Cox & Snell R^2 to range between 0-1, was 0.1914 indicating that the predictors in the model explains the 19.14% variability in the EBF. In other words, predictors improve the fit of the model by 19.14% compared to a null model.

Multicollinearity test using GVIF

The Generalized Variance Inflation Factor (GVIF) was used to analyze multicollinearity among predictor variables (Fox & Monette, 1992). As shown in Table 5, there was no multicollinearity between these variables because all of the $GVIF^{(1/(2\times DF))}$ values were below 1.078, which is below the threshold value of 2.

Table 5. Multicollinearity test (GVIF).

Variable	GVIF	DF	$GVIF^{(1/(2\times DF))}$
Husband's primary source of income	1.107	2	1.026
Age of the mother	1.106	2	1.025
Knowledge	1.108	2	1.026
Infant feeding attitude	1.053	1	1.026
Initiation of breastfeeding	1.04	1	1.020
Infant age in months	1.332	5	1.029
Morbidity	1.162	1	1.078

Source: Field work, 2025

Cut-off value determination

The optimal cutoff value for classification was determined using Youden index (Max. value of Youden's J statistics). At cut-off value of 0.39 yielded the highest Youden's Index of 0.3825. At this threshold, the specificity was 77.31% and sensitivity was 60.94%.

Confusion matrix

Table 6 shows that the classification accuracy of the model at the optimal cut-off value 0.3825. The model correctly classified 77.31% of non-EBF and 60.94% of EBF cases. Overall, the model accuracy was 71.91%. In conclusion, the model demonstrates moderate overall predictive power, but it is more effective at correctly identifying non-EBF cases (specificity of 77.31%) than it is at identifying EBF cases (sensitivity of 60.94%).

Table 6. Classification table.

		Predicted		
		Non-EBF	EBF	Accuracy %
Observed	Non-EBF	201	59	77.31%
	EBF	50	78	60.94%
			Overall	71.91%

Source: Field Survey, 2025

Receiver operating characteristic (ROC) analysis

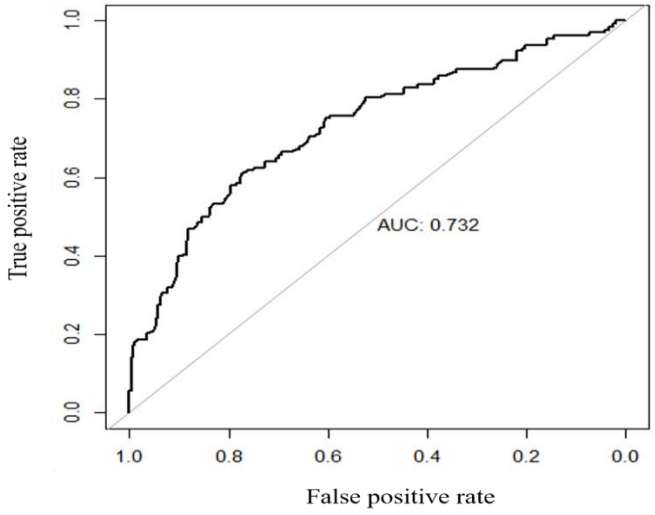


Fig. 1. ROC curve.

The ROC curve is a graphical plot that shows the performance of a binary classifier model at varying threshold values. The ROC curve is the plot of the true positive rate against the false positive rate at each threshold values. The estimated Area under the Curve (AUC) was 0.732 as displayed in Figure 1, suggesting an acceptable discriminatory ability of the model.

AUC is a way to summarize the overall diagnostic accuracy of the test. It takes values from 0 to 1, where a value of 0 indicates a perfectly inaccurate test and a value of 1 reflects a perfectly accurate test. An AUC of 0.5 suggests no, 0.7 to 0.8 is considered acceptable, 0.8 to 0.9 is considered excellent, and more than 0.9 is considered outstanding. A value of 0.5 for AUC indicates that the ROC curve will fall on the diagonal (i.e., 45-degree line) and hence suggests that the diagnostic test has no discriminatory ability. ROC curves above this diagonal line are considered to have reasonable discriminating ability to diagnose patients with and without the disease/condition (Mandrekar, 2010). An AUC of 0.732 indicates that the model has a 73.2% chance that it will distinguish between a random selected positive case and a randomly selected negative case (Hosmer & Lemeshow, 2000).

Patterns of non-exclusive breastfeeding

As shown in Table 7, among the 260 non-EBF mothers, highest proportion of 46.54% reported giving formula milk only, 22.69% reported giving plain water only, 20.77% reported giving a combination of plain water and formula milk only and lastly 10% reported giving a combination of two or more items (i.e. water, formula, animal milk, juice and porridge) as a supplementary food to their infants.

Table 7. Types of supplements food given to infants among non-EBF mothers.

Reported infant non-exclusive breastfeeding category	n	%
Formula milk (only)	121	46.54%
Plain water (only)	59	22.69%
Plain water & formula milk (only)	54	20.77%
Combination of two or more items (i.e. water, formula, animal milk, juice and porridge)	26	10.00%
Total non-EBF mothers	260	100%

Source: Field Survey, 2025

Reasons for non-exclusive breastfeeding

An additional open-ended question was asked during interviews to explore reasons why mothers did not exclusively breastfeed. Out of 260 non-EBF mothers, 221 responded to this question. Perceived insufficiency of breast milk was reported by 72.85% of these mothers. Followed by perceived infant thirst (28.05%), maternal or infant illness (13.12%), infant's refusal of breast milk (3.16%) and others (2.71%).

Table 8. Reasons reported by non-EBF mothers for not exclusively breastfeeding.

Reason reported by non-exclusive breastfeeding mothers	n	% (n=260[a])
Breast milk wasn't enough for the baby	161	72.85
Thought that baby is thirsty	62	28.05
Mother or baby illness	29	13.12
Infant's refusal of breast milk	7	3.16
Others (Due to work, cultural practice, family pressure, etc)	6	2.71

Source: Field Survey, 2025; [a] Reflects the number of mothers who did not practice EBF

DISCUSSION

This study was conducted to estimate the prevalence and determinants of exclusive breastfeeding among mothers of infants under six months in Damak municipality. The EBF rate was found to be 32.99%, significantly lower than National average (54.9%) (Department of Health Services, 2024) and the global target of 50% (World Health Organization, 2014). Also, rate of initiation of breastfeeding within an hour was 78.61% which is lower than the national rate of 84% (Department of Health Services, 2024). Among all the predictors, initiation of breastfeeding within an hour of birth came out as the strongest determinant. Mothers who initiated breastfeeding early were over three times more likely to exclusively breastfeed. This finding is consistent with the World Health Organization (WHO) recommendation and study by Shi et al. (2021). Maternal knowledge was significantly associated with EBF. Mothers with stronger breastfeeding knowledge were nearly twice more likely to follow EBF. This positive association between maternal knowledge and EBF aligns with findings from studies in Ethiopia, China, Bangladesh and Abu Dhabi (Gebretsadik et al, 2022; Shi et al., 2021; Hasan et al., 2021; Al Ketbi et al., 2018). Husband's primary source of income and the maternal age were significant predictors. Mothers whose husband's primary source of income was job based were more likely to continue EBF compare to whose husband's primary source of income was remittance. Older mothers (35-44) have 63% lower odds of EBF compared to younger mothers aged 15-24. Similar findings were reported in prior studies (Dhakal et al.,2022; Shi et al.,2021). The inverse relationship between infant age and EBF. Older infants were significantly less likely to be exclusively breastfed. This result matches with the finding by Hagos & Tadesse (2020) and Singh et al. (2024). This study also documented the types of food or fluids provide to infants in non-exclusive breastfeeding households. Either alone or in combination, formula milk and plain water were the most common substitutes. Among non-EBF mothers those who responded, the most cited reason for giving formula milk or water was the insufficient breastmilk production, followed by beliefs that the infant was thirsty. These reasons point to misconceptions and knowledge gaps regarding the adequacy of breastmilk. These findings are consistent with other studies by Ejie et al. (2021), Pradhan et al. (2022) and Parajuli (2025). Perceived milk insufficiency is one of the leading causes of early supplementation.

CONCLUSION

Exclusive breastfeeding practice among mothers in Damak Municipality is significantly below the global target and national average, regardless of the good reach of health facilities such as antenatal coverage and hospital delivery. Key determinants included initiation of breastfeeding (within an hour), maternal knowledge, maternal age, husband's primary source of income sourced from job/wage employment, and infant age. The early initiation of breastfeeding significantly increased the odds of EBF, reinforcing the World Health Organization (WHO) and national guidelines, and maternal knowledge about breastfeeding was the only significant determinant that is modifiable. This study further revealed that the average maternal knowledge score was 63.04%, which is below the acceptable threshold of 70% recommended for public health nutrition interventions (Macías & Glasauer, 2014). Despite high health facility reach, 76% of the mothers had poor knowledge with perceived insufficiency of breast milk (72.85%) and perceived infant thirst (28.05%) as the primary barrier to exclusivity. These findings highlight the prevalent misconceptions and the urgent need for nutrition education interventions.

ACKNOWLEDGEMENTS

Authors would like to express sincere gratitude to Prof. Srijan Lal Shrestha, Prof. Gauri Shrestha and Prof. Ram Prasad Khatiwada for invaluable and insightful feedback throughout the course of this research. Also, heartfelt appreciation to the health centers especially ANM Mina Baral and ANM Sobha Bhandari and municipal staff of Damak Municipality for their generous support and coordination at the local level during field survey.

CONFLICT OF INTEREST

The authors declared that there is no conflict of interest.

AUTHOR CONTRIBUTION

DR was responsible for study design, data collection, data analysis, and writing. PU provided overall supervision and review.

FUNDING

This research received no external funding.

DATA AVAILABILITY

Data are available upon reasonable request.

ETHICAL STATEMENT

This study was approved by the Department Research Committee of the Central Department of Statistics, Tribhuvan University. Formal permission for data collection was obtained from Damak Municipality. Written informed consent was obtained from all participants.

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Reference to this paper should be made as follows:
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