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Determinants of Exclusive Breastfeeding Among Mothers in Al-Kharj Governorate, Saudi Arabia: A Logistic Regression Analysis

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ABSTRACT: Exclusive breastfeeding (EBF) remains below the WHO target in many settings, including Saudi Arabia. This study aimed to identify modifiable determinants of EBF in Al-Kharj region and examine their broader public health implications in similar socio-cultural contexts. A cross-sectional study was conducted among 573 infants aged 6–12 months at the Maternity and Children's Hospital. Data were collected through structured interviews and analyzed using multivariable logistic regression to identify independent predictors across socio-demographic, breastfeeding practice, and cultural domains. The outcomes were presented as adjusted odds ratios (AOR). The prevalence of EBF was 38%. Factors associated with a higher probability of EBF in the domain-specific multivariable models included more than three antenatal care visits (AOR = 11.94), frequent breastfeeding (>8 times/day) (AOR = 7.44), and colostrum feeding (AOR = 4.99). Conversely, cultural traditions discouraging breastfeeding were associated with a lower probability of EBF (AOR = 0.07), along with perceived insufficient milk (AOR = 0.22) and work or study pressures (AOR = 0.30). A fully adjusted sensitivity analysis confirmed the stability of these key predictors. To improve EBF rates, public health policies should prioritize intensive prenatal counseling and community-based programs that specifically engage husbands and address deeply ingrained cultural misconceptions. Adopting Baby-Friendly Hospital Initiative (BFHI) practices across regional primary care centers is essential.

Keywords: Exclusive breastfeeding, Breastfeeding determinants, Maternal and child health, Logistic regression, Saudi Arabia.

I. INTRODUCTION

Exclusive breastfeeding (EBF) is a cornerstone of infant, maternal, and community health. It is recommended by the World Health Organization (WHO) [1, 2]. EBF is defined by the WHO as "giving only breast milk to infants from 0 to 6 months (24 weeks) of age, without feeding any food or liquid, even water, except syrups containing vitamins, mineral supplements, or medicine [1]. Recognizing the need for accelerated global action to address child malnutrition, the United Nations Children's Fund and the WHO established six global nutrition targets for 2025. One of these targets was to increase the rate of EBF to at least 50%. In addition, WHO recommends initiating breastfeeding within the first hour after birth and maintaining EBF for the first six months of life. This target highlights the importance of strengthening maternal counseling, health-system support, and workplace policies to help mothers initiate and sustain EBF. Countries that have already surpassed this target are encouraged to continue progressing towards higher rates [3].

In Saudi Arabia, EBF rates remain significantly below 9.44% WHO recommendations, with considerable variation across regions. A much older study indicated that the rate of EBF was only 1.7% [4], then increased to 17.1% in a later study [5]. Later evidence indicates that the prevalence of EBF in Saudi Arabia was low, ranging from 13.7% to 31.4% [4-7], while later evidence indicates that Saudi Arabia has high rates of breastfeeding initiation at delivery, followed by a declining trend [8].

In line with global efforts to promote breastfeeding, the Saudi government has made tremendous efforts by adopting the Baby-Friendly Hospital Initiative program (BFHI) [9]. The BFHI Unit at Al-Kharj Maternity and Children's Hospital (MCH), which is responsible for promoting, protecting, and supporting breastfeeding through antenatal education, postnatal counseling, and lactation support services, serves as a major provider of breastfeeding-related care in Al-Kharj Governorate. Despite the benefits of breastfeeding, still, the rate of EBF practice is below expectation [10]. National data further indicate that EBF under six months remains low across Saudi Arabia, with only 15.5% of infants exclusively breastfed to six months in a recent national survey [11]. Therefore, this study aims to identify factors associated with EBF in Al-Kharj region using logistic regression and to highlight modifiable factors associated with continuation up to six months, providing evidence to inform policies and interventions locally and nationally.

II. LITERATURE REVIEW

1 GLOBAL DETERMINANTS OF EBF

Evidence from global meta-analyses and systematic reviews suggests that EBF is influenced by a complex interplay of factors categorized into many primary domains: Many studies have been conducted worldwide on the role of maternal education, age and economic status as a sustained factor for EBF in various populations [12, 13] Health systems have a key role; the adoption of the BFHI has been associated with better EBF rates all over the world [14, 15] Moreover, it is internationally recognized that antenatal care visits and structured breastfeeding education are high impact interventions. Breastfeeding practices are heavily influenced by cultural norms and the support of the community. Those sociocultural barriers that often conflict with EBF practice are identified by systematic reviews such as traditional beliefs and lack of family support [16, 17].

2. SAUDI ARABIAN DETERMINANTS OF EBF

Many recent studies were conducted in Saudi Arabia that reported different prevalence rates of EBF and factors that influence breastfeeding practices. In a previous study in Hail, 50.7% of mothers of 6-24 months old infants practiced EBF, and mothers with good awareness, post-delivery counselling, attending antenatal care, prior history of breastfeeding and feeding colostrum experienced higher likelihood of practicing EBF [18]. Another study conducted in Jeddah city that only 5·3 % of mothers engaged in EBF, 44·9 % breast-fed their infants after an hour of birth, and showed that maternal age and mode of delivery were related to the introduction of complementary feeding early [19]. A study conducted at Maternal and Children's Hospital in Najran revealed a positive effect of maternal ideation on EBF practices with 40.9% of mothers continuing to breastfeed for 6 months. Important factors that were found to contribute were knowledge, beliefs, self-efficacy and social support [20]. Furthermore, another study was conducted in four primary healthcare centers in Riyadh, reported that the breastfeeding initiation rates were high, 86.6%. However, variations were observed in the initiation timing, with only 46.0% of the patients initiating breastfeeding within the first hour [21]. Similarly, a cross-sectional study was performed via structured interviews with mothers living in Eastern Province who had children aged 6–24 months. The results showed that the rate of EBF was 25% [22]. Only two prior studies have examined breastfeeding practices in the Al-Kharj area. The first, conducted during 2000–2001, the researchers in that study classified mothers into three distinct feeding categories: EBF (27.3%), partial breastfeeding (66.1%), and exclusive bottle feeding (6.7%) [23]. A later case control study in Al-Kharj and Riyadh identified risk factors for cessation of breastfeeding, but also did not estimate EBF rate [24].

The findings of previous studies conducted in Saudi Arabia indicate that socio-demographic, health-related, behavioral and cultural factors contribute to EBF in a complex way. There is a wide region-to-region

variation in the prevalence of EBF reported, with some areas having very low levels and others having high levels. Likewise, though maternal age, breastfeeding knowledge, antenatal counseling, social support and breastfeeding practices have been consistently shown to play significant roles, they have been reported differently among various studies. Inconsistencies could be due to variations in study populations, health services, culture, and analysis.

3. METHODOLOGICAL LIMITATIONS OF PREVIOUS STUDIES

There have been multiple studies focused on EBF in Saudi Arabia, but there are still some key methodological limitations. A number of previous studies examined only a handful of predictors, instead of socio-demographic, breastfeeding practice, knowledge, and cultural factors in a single analytic model. In addition, were a number of studies that mainly provided descriptive analysis or explored association without an appropriate control for potential confounding factors. Variations in study designs, target populations, and statistical methods could also be a source of variation in reported determinants of EBF. These limitations highlight the need for more comprehensive multivariable analyses.

4. RESEARCH GAP AND STUDY RATIONALE

Although breastfeeding practices have been documented in various regions of Saudi Arabia, Al-Kharj Governorate has not received sufficient attention in maternal and child health studies, particularly those concerning exclusive breastfeeding and its determinants. Most of the available data for this region is either outdated [23] or lacks an accurate estimate of EBF rates [24]. This study critically bridges this gap by providing updated epidemiological data, essential for understanding how socio-demographic, obstetric, breastfeeding practices, and knowledge and cultural changes have influenced maternal behaviors in EBF. Therefore, the significance of these domains when it comes to EBF is not fully understood and factors may have been unconsidered which could have confounded the effect(s) of the predictors. Hence, an overall evaluation of the determinants is required to better understand the determinants associated with mothers' EBF practices in this region. The aim of the present study was the estimation of the prevalence of EBF and the study of its determinants among mothers with 6–12-month-old infants in Al-Kharj using a multivariable logistic regression analysis.

III. METHODOLOGY

This study complies with the guidelines laid down in the Declaration of Helsinki [25]. Data obtained from the participants were kept confidential

1. STUDY SETTING

A cross-sectional study was conducted at the Maternity and Children's Hospital (MCH) in Al-Kharj, Saudi Arabia, between November 2024 and April 2025. The hospital serves as the main referral center in the region.

2. PARTICIPANTS AND SAMPLING STRATEGY

Mothers of infants aged 6–12 months were included. Infants less than 6 months of age were excluded because they had not attained the recommended EBF period. Children aged more than 12 months were excluded to minimize recall bias and mothers who had contraindications to breast feeding and infants who had congenital anomalies that impacted breastfeeding were also excluded. A total of 573 participants were selected using systematic random sampling from approximately 2,300 eligible mothers (N=2300), based on a 95% confidence level (Z=1.96), 5% margin of error (d=0.05), and assumed prevalence of 50% (P=0.5). The sample size was calculated by Cochran formula [26]:

$$n = (z^2 p(1-p))\backslash d^2 \quad (1)$$

The sample size needed for an infinite population was 384. A finite population correction was applied.

$$n_{adj} = n \setminus \left(1 + \frac{n-1}{N}\right) \quad (2)$$

We used a finite population correction to determine the number of participants required for the study, which was 329, but we recruited a larger sample of 573 participants. This method was used to increase the statistical power of the study to improve the reliability of the multivariable logistic regression model.

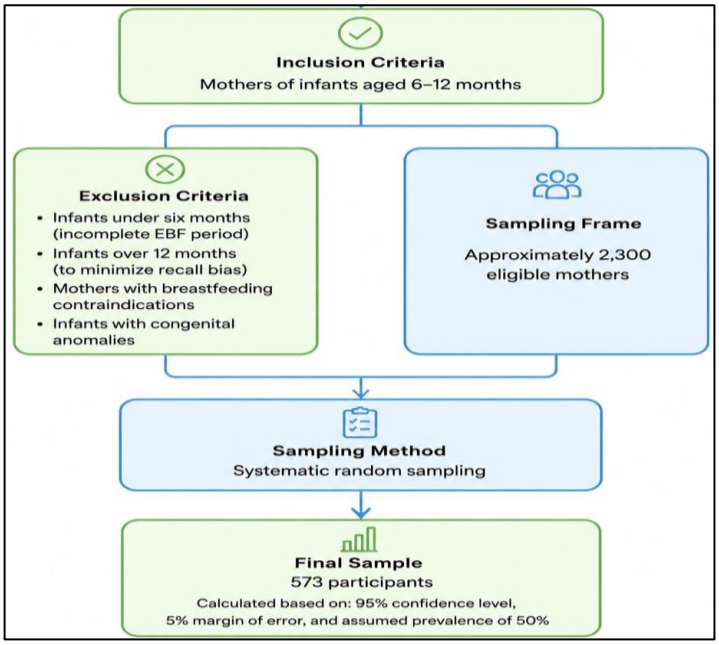

FIGURE 1. Flowchart of study sample design and participant selection process.

The study sample design and the process of selection of participants are presented in Figure 1. Out of a total pool of approximately 2,300 eligible mothers who visited the hospital during the study period, a final sample of 573 participants was successfully recruited and analyzed by selecting every third mother to apply the systematic random sampling and exclusion criteria.

3. DATA COLLECTION

Data were collected through structured face-to-face interviews using a questionnaire based on the BFHI [27]. The original version of the questionnaire was written in English and then translated into Arabic. For content validity, a panel of two maternal and child health experts reviewed the draft. A small pilot study (30 mothers not included in the main study) was carried out to validate and clarify questions. Cronbach's alpha coefficient was 0.78, indicating good reliability for the tool. EBF was the dependent variable (0 = no, 1 = yes). The independent variables were classified into three categories: socio-demographic and obstetric factors, actual breastfeeding practices, and knowledge and cultural factors. Data collection adhered to standardized protocols and was executed by a trained research assistant to mitigate bias. Whenever feasible, responses were corroborated with hospital records to improve data accuracy.

4. STATISTICAL METHODS AND LOGISTIC REGRESSION MODEL DIAGNOSTICS

Before the analysis, the data were checked for completeness, accuracy, and outliers. We used SPSS to do the statistical analyses. Descriptive statistics provided an overview of participant characteristics. Bivariate analyses were performed to evaluate the relationships between independent variables and EBF, with variables exhibiting $p < 0.05$ being incorporated into multivariable logistic regression models, specific to each domain [28, 29].

In addition, a fully adjusted multivariable logistic regression model was developed as a sensitivity analysis. The selection of variables was guided by a theoretical framework that categorizes EBF determinants into three primary domains: socio-demographic and obstetric characteristics, actual breastfeeding practices, and knowledge and cultural factors. This framework ensures that all theoretically relevant predictors are accounted for in the fully adjusted model, regardless of their bivariate significance, to minimize the risk of omitting important confounders. The outcomes were presented as Adjusted Odds Ratios (AORs) accompanied by 95% Confidence Intervals (CIs), with statistical significance established at $p < 0.05$. The AORs were derived from the domain-specific multivariable logistic regression models, which served as the primary analytical framework for identifying and interpreting the determinants of exclusive breastfeeding within each conceptual domain. whereas the fully adjusted model was conducted as a sensitivity analysis to assess the stability of the identified predictors after simultaneous adjustment for all theoretically relevant variables.

The goodness-of-fit and predictive performance of the logistic regression models were evaluated using the Hosmer–Lemeshow test and Area Under Curve (AUC). The logistic regression models demonstrated good predictive performance and adequate overall model fit. Overall classification accuracy ranged from 75.9% to 85.9%. The model including actual breastfeeding practice variables achieved the highest predictive accuracy (85.9%). All models showed non-significant Hosmer–Lemeshow test results ($p > 0.05$), indicating good agreement between observed and predicted EBF outcomes.

The socio-demographic model performed with an acceptable discrimination, the knowledge and cultural factors model performed with a good discrimination and the breastfeeding practices model performed with excellent discrimination (AUC = 0.75, 0.84 and 0.87, respectively) as revealed by the ROC curve analysis. The fully adjusted model had the best predictive capacity, with an AUC of 0.95, excellent predictive capacity to differentiate mothers who practiced EBF and those who did not. The Nagelkerke R^2 value for the fully adjusted model was 0.733, suggesting a substantial proportion of the variability in exclusive breastfeeding status was accounted for by the predictors included in the model (See Table.1).

Table 1. Prediction accuracy and goodness-of-fit of logistic regression models assessing determinants of EBF.

Model	Observed EBF	(%) Correct classification	(%) Overall accuracy	Hosmer–Lemeshow	P value	AUC (95% CI)
Sociodemographic variables and obstetric	No	(84.5)	(75.9)	8.390	0.396	0.75 (0.71–0.80)
	Yes	(61.9)				
Actual breastfeeding practices	No	(88.6)	(85.9)	7.202	0.515	0.87 (0.84–0.90)
	Yes	(81.2)				
Maternal knowledge and cultural factors	No	(89.3)	(82.7)	6.397	0.603	0.84 (0.81–0.87)
	Yes	(72.0)				
Fully adjusted model	No	(91.3)	(88.5)	2.771	0.950	0.95 (0.93–0.97)
	Yes	(83.9)				

AUC: Area Under Curve, the Receiver Operating Characteristic (ROC). Values closer to 1.0 indicate better discriminative ability of the model.

Nagelkerke R^2 for the fully adjusted model = 0.733

IV. DATA ANALYSIS

1. PARTICIPANTS CHARACTERISTICS

Participant characteristics are summarized in Table 2. There were 573 mothers in the study. Results show that the overall prevalence of EBF (Yes EBF) was 38.0%. Half of the mothers (52.2%) belonged to the age category of 21–34 years. The percentage of mothers with a university education or higher was 61.6%, while the percentage of fathers were 55.1%. More than half of the participants belonged to the middle-income

bracket. The obstetric data showed that 74.7% were full-term deliveries, and a significant majority of mothers had a vaginal delivery. For the infants, 79.1% were aged between 6 and 9 months with normal birth weight (59.3%), while 31.6% required incubator care. Based on the data in Table 2, father's education and child's age (months) were not significantly associated with EBF (p=0.700, 0.575, respectively), and were thus not included in the domain-specific models but included in the fully adjusted sensitivity analysis model.

Table 2. Demographic, socioeconomic and obstetric characteristics of the study participants according to EBF status and significance tests of independent variables (n = 573).

Variable	Total n=573) (%)	No EBF	355 (62.0)	Yes EBF	218 (38.0)	Chi-square	P- value
Mother's age (years)						20.906	0.001
<20	83 (14.5)	67 (11.7)		16 (2.8)			
21–34	299 (52.2)	189 (33.0)		110 (19.2)			
≥35	191 (33.3)	99 (17.3)		92 (16.1)			
Mother's education						16.130	0.001
Secondary and less	220 (38.4)	159 (27.7)		61 (10.6)			
University and more	353 (61.6)	196 (34.2)		157 (27.4)			
Father's education						0.148	0.700
Secondary and less	257 (44.9)	157 (27.4)		100 (17.5)			
University and more	316 (55.1)	198 (34.6)		118 (20.6)			
Family monthly income (SR)						68.408	0.001
<5000	105 (18.3)	73 (12.7)		32 (5.6)			
5000–10,000	309 (53.9)	146 (25.5)		163 (28.4)			
>10,000	159 (27.7)	136 (23.7)		23 (4.0)			
Gestation period (last baby)						40.528	0.001
Preterm	145 (25.3)	122 (21.3)		23 (4.0)			
Full-term	428 (74.7)	233 (40.7)		195 (34.0)			
Type of delivery						14.782	0.001
Cesarean section	175 (30.5)	129 (22.5)		46 (8.0)			
Vaginal delivery	398 (69.5)	226 (39.4)		172 (30.0)			
Child's age (months)						0.315	0.575
6–9	453 (79.1)	278 (48.5)		175 (30.5)			
10–12	120 (20.9)	77 (13.4)		43 (7.5)			
Birth weight (kg)						33.056	0.001
<2.5	115 (20.1)	94 (16.4)		21 (3.7)			
2.5–3.5	340 (59.3)	180 (31.4)		160 (27.9)			
>3.5	118 (20.6)	81 (14.1)		37 (6.5)			

2. BREASTFEEDING PRACTICE

69.1% of mothers had previous breastfeeding experience. 47.5% of mothers practiced early skin-to-skin contact, while 41.0% reported rooming-in. Only 36.6% of mothers reported feeding colostrum. More than half of the mothers (61.4%) reported giving prelacteal fluids. Also,41.2% of mothers-initiated breastfeeding within the first three days, only 27.1% breastfed their infants more than 8 times per 24 hours. The most common inter-birth interval was< 24 months (47.3%) and 51.7% reported experiencing problems with breastfeeding. A large portion of the mothers (59.9%) stopped EBF due to insufficient milk supply, 49.4% due to returning to work/study, and 45.9% due to new pregnancy. It is encouraging that a large percentage of mothers reported having a companion during childbirth (77.1%). Based on the data in Table 3, the variable " Accompanying during childbirth" was not included in the domain-specific multivariable models (p=0.108), but was included in the fully adjusted multivariable logistic

Table 3. Breastfeeding practices during the first six months of life stratified by EBF[a] (n = 573).

Variable	Total n=573 (%)	No EBF 355 (62.0)	Yes EBF 218 (38.0)	Chi-square	P-value
Previous breastfeeding experience				71.298	0.001
No	177 (30.9)	155 (27.1)	22 (3.8)		
Yes	396 (69.1)	200 (34.9)	196 (34.2)		
Skin-to-skin contact				53.674	0.001
No	301 (52.5)	229 (40.0)	72 (12.6)		
Yes	272 (47.5)	126 (22.0)	146 (25.5)		
Rooming-in (24 hours)				23.303	0.001
No	338 (59.0)	237 (41.4)	101 (17.6)		
Yes	235 (41.0)	118 (20.6)	117 (20.4)		
Colostrum feeding				103.99	0.001
No	363 (63.4)	282 (49.2)	81 (14.1)		
Yes	210 (36.6)	73 (12.7)	137 (23.9)		
Prelacteal feeding (fluids/formula)				33.865	0.001
No	221 (38.6)	104 (18.2)	117 (20.4)		
Yes	352 (61.4)	251 (43.8)	101 (17.6)		
Initiation of breastfeeding				23.977	0.001
Not breastfeeding	115 (20.1)	94 (16.4)	21 (3.7)		
After 3 days	222 (38.7)	125 (21.8)	97 (16.9)		
Within first 3 days	236 (41.2)	136 (23.7)	100 (17.5)		
Breastfeeding frequency (24 hours)				59.710	0.001
Not breastfeeding	219 (38.2)	171 (29.8)	48 (8.4)		
<8 times	199 (34.7)	124 (21.6)	75 (13.1)		
≥8 times	155 (27.1)	60 (10.5)	95 (16.6)		
Inter-birth interval				98.771	0.001
No previous birth	134 (23.4)	94 (16.4)	40 (7.0)		
<24 months	271 (47.3)	209 (36.5)	62 (10.8)		
≥24 months	168 (29.3)	52 (9.1)	116 (20.2)		
Nipple/breast problems				61.689	0.001
No	277 (48.3)	126 (22.0)	151 (26.4)		
Yes	296 (51.7)	229 (40.0)	67 (11.7)		
Insufficient milk				112.92	0.001
No	230 (40.1)	82 (14.3)	148 (25.8)		
Yes	343 (59.9)	273 (47.6)	70 (12.2)		
Return to work/study				79.076	0.001
No	290 (50.6)	128 (22.3)	162 (28.3)		
Yes	283 (49.4)	227 (39.6)	56 (9.8)		
New pregnancy				21.832	0.001
No	310 (54.1)	165 (28.8)	145 (25.3)		
Yes	263 (45.9)	190 (33.2)	73 (12.7)		
Accompanying during childbirth				2.580	0.108
No	131 (22.9)	89 (15.5)	42 (7.3)		
Yes	442 (77.1)	266 (46.4)	176 (30.7)		

[a]All feeding practices were assessed retrospectively for the first six months of the infant's life, regardless of the infant's age at the time of interview

3. KNOWLEDGE AND CULTURAL FACTORS

Based on the results in table 4, only 33.2% of the mothers reported receiving support from their husbands. A large majority of mothers (70.3%) reported that certain traditions hindered EBF. Despite 38.4% of mothers attending over three antenatal visits, antenatal and postnatal education were limited (40.5% and 37.0 %), respectively. Although 77.1% of mothers were aware of breastfeeding benefits, only 33.3% knew the correct definition of EBF and 34.0 % knew the recommended duration, and 33.3% had heard about BFHI. The most common source of information was non-health facilities (62.1%). The Source of EBF information (p=0.685) and EBF benefits awareness (p=0.142) variables were not included in the domain-specific multivariable models, but both were included in the fully adjusted multivariable logistic regression model.

Table 4: Cultural influences, and knowledge regarding EBF and significance tests of independent variables (n = 573).

Variable	Total n=573 (%)	No EBF 355 (62.0)	Yes EBF 218 (38.0)	Chi-square	P-value
Husband support				50.068	0.001
No	383 (66.8)	276 (48.2)	107 (18.7)		
Yes	190 (33.2)	79 (13.8)	111 (19.4)		
Traditions hindering EBF				72.889	0.001
No	170 (29.7)	60 (10.5)	110 (19.2)		
Yes	403 (70.3)	295 (51.5)	108 (18.8)		
Antenatal care visits				83.671	0.001
No visits	121 (21.1)	38 (6.6)	83 (14.5)		
1–3 visits	232 (40.5)	138 (24.1)	94 (16.4)		
>3 visits	220 (38.4)	179 (31.2)	41 (7.2)		
Received antenatal EBF education				32.927	0.001
No	341 (59.5)	244 (42.6)	97 (16.9)		
Yes	232 (40.5)	111 (19.4)	121 (21.1)		
Advice after delivery				14.470	0.001
No	361 (63.0)	245 (42.8)	116 (20.2)		
Yes	212 (37.0)	110 (19.2)	102 (17.8)		
Source of EBF information				0.757	0.685
No education	63 (11.0)	42 (7.3)	21 (3.7)		
Non-health facility	356 (62.1)	220 (38.4)	136 (23.7)		
Health facility	154 (26.9)	93 (16.2)	61 (10.6)		
Know EBF duration (6 months)				12.945	0.001
No	378 (66.0)	254 (44.3)	124 (21.6)		
Yes	195 (34.0)	101 (17.6)	94 (16.4)		
Know EBF definition				12.454	0.001
No	382 (66.7)	256 (44.7)	126 (22.0)		
Yes	191 (33.3)	99 (17.3)	92 (16.1)		
EBF benefits awareness				2.153	0.142
No	131 (22.9)	74 (12.9)	57 (9.9)		
Yes	442 (77.1)	281 (49.0)	161 (28.1)		
Heard about BFHI				48.959	0.001
No	382 (66.7)	275 (48.0)	107 (18.7)		
Yes	191 (33.3)	80 (14.0)	111 (19.4)		

4. LOGISTIC REGRESSION MODELS FOR EACH DOMAIN

According to the final modeling results of the multiple logistic regression analysis for each domain, in Table 5, it can be concluded that at a significance level of 5%, with corresponding 95% confidence intervals (CI) and adjusted odds ratios (AOR), the predictive variables included in the logistic model are as follows:

Among socio-demographic factors, several variables were associated with higher odds of EBF. The strongest positive association was observed for full-term gestation, where mothers were about 3.36 times more likely to practice EBF (AOR = 3.36; 95% CI: 1.97–5.74). Followed by normal birth weight (2.5–3.5 kg), advanced maternal age (>35 years), and middle-income status. Vaginal delivery, and university education were also significantly associated with EBF. In contrast, some factors showed negative associations with EBF. Mothers with higher income (>10,000 SR) had about 50% lower odds of practicing EBF (AOR=0.50; 95% CI: 0.26–0.96), and infants admitted to the nursery had 38% lower odds of EBF.

As for breastfeeding practices, mothers breastfeeding more than 8 times per day had the highest odds of EBF, had 7.44 times higher odds to practice EBF (AOR=7.44; 95% CI: 3.50–15.84), followed by colostrum feeding (AOR=4.99; 95% CI: 2.76–9.01). Previous breastfeeding experience and a longer interval between births (≥ 24 months) were associated with higher odds of EBF. Early initiation of breastfeeding within the first 3 days and early skin-to-skin contact were also associated with higher odds of EBF.

In contrast, several factors were negatively associated with EBF. Perceived insufficient breast milk was the strongest barrier and was associated with 78% lower odds of EBF (AOR=0.22; 95% CI: 0.12–0.38). Followed by return to work/study (AOR=0.30; 95% CI: 0.17–0.52), breast or nipple problems, and new pregnancy. Prelacteal feeding also was associated with lower odds of EBF.

Knowledge and cultural factors also played a significant role. The strongest positive association was observed among mothers with more than 3 antenatal care visits, who were 12 times more likely to practice EBF (AOR = 11.94; 95% CI: 6.04–23.60). This was followed by receiving antenatal EBF education (AOR=4.40; 95% CI: 2.74–7.08), and having 1–3 antenatal care visits. Furthermore, knowledge of EBF definition, awareness of BFHI, husband support, knowledge of EBF duration, and receiving postpartum advice all were positively associated with EBF practices. On the other hand, EBF-inhibiting traditions were associated with substantially lower odds of EBF by 93% (AOR=0.07; 95% CI: 0.04-0.13).

Table 5. Multiple logistic regression analysis of significant predictors of EBF (domain-specific).

Predictor	β	Wald	P value	AOR	95% CI
Model 1: Socio-demographic and obstetric factors					
Mother's age (21–34 vs<20)	0.73	4.61	0.032	2.07	1.07–4.03
(>35 vs<20)	1.09	9.40	0.002	2.97	1.48–5.97
Mother's education (≥University vs ≤Secondary)	0.71	10.80	0.001	2.03	1.33–3.09
Income (5000–10,000 vs<5000)	0.96	12.89	0.001	2.60	1.54–4.38
(>10,000 vs<5000)	-0.70	4.38	0.036	0.50	0.26–0.96
Gestation (full-term vs preterm)	1.21	19.79	0.001	3.36	1.97–5.74
Delivery (vaginal vs cesarean section)	0.77	11.00	0.001	2.15	1.37–3.39
Birth weight (2.5–3.5 vs<2.5)	1.10	13.99	0.001	3.01	1.69–5.36
(>3.5 vs<2.5)	0.89	6.59	0.010	2.45	1.24–4.84
Model 2: Breastfeeding actual practices					
Previous breastfeeding experience (yes vs no)	1.52	19.65	0.001	4.56	2.33–8.92
Skin-to-skin (yes vs no)	1.05	12.91	0.001	2.86	1.61–5.07
Rooming-in (yes vs no)	0.72	5.65	0.017	2.05	1.13–3.71
Colostrum feeding (yes vs no)	1.61	28.37	0.001	4.99	2.76–9.01
Prelacteal feeding (yes vs no)	-0.90	9.49	0.002	0.41	0.23–0.72
Breastfeeding initiation (after 3 days vs none)	0.88	4.43	0.035	2.41	1.06–5.46
(before 3 days vs none)	1.09	7.01	0.008	2.97	1.33–6.67
Breastfeeding frequency (<8 vs none)	0.86	6.45	0.011	2.36	1.22–4.58
(>8 vs none)	2.01	27.16	0.001	7.44	3.50–15.84

Inter-birth interval (<24-month vs first)	-0.05	1.55	0.214	0.63	0.31–1.30
(≥24-month vs first)	1.30	10.40	0.001	3.67	1.67–8.10
Breast/nipple problems (yes vs no)	-1.14	15.54	0.001	0.32	0.18–0.56
Insufficient milk (yes vs no)	-1.53	27.86	0.001	0.22	0.12–0.38
Return to work or study (yes vs no)	-1.21	17.94	0.001	0.30	0.17–0.52
New pregnancy (yes vs no)	-0.95	9.92	0.002	0.39	0.22–0.70
Model 3: Knowledge and cultural factors					
Husband support (yes vs no)	0.72	7.62	0.006	2.06	1.23–3.44
Traditions hindering EBF (yes vs no)	-2.65	82.89	0.001	0.07	0.04–0.13
Antenatal care visits (1–3 vs none)	1.13	17.15	0.001	3.09	1.81–5.26
(>3 vs none)	2.483	50.84	0.001	11.94	6.04–23.6
Antenatal EBF education (yes vs no)	1.483	37.25	0.001	4.40	2.74–7.08
Advice after delivery (yes vs no)	0.59	6.12	0.013	1.80	1.13–2.86
Knowledge of duration (yes vs no)	0.71	6.45	0.011	2.03	1.18–3.49
Knowledge of definition (yes vs no)	1.06	15.44	0.000	2.87	1.70–4.86
Awareness of BFHI (yes vs no)	0.796	8.45	0.004	2.21	1.29–3.77

5. MULTICOLLINEARITY DIAGNOSTICS

Prior to conducting the multivariable logistic regression analyses, multicollinearity diagnostics were performed before fitting the fully adjusted logistic regression model, using tolerance and variance inflation factor (VIF) statistics. The tolerance values ranged from 0.664 to 0.924 and all exceeded the recommended threshold of 0.10. Similarly, VIF values ranged from 1.082 to 1.505, which were substantially below the commonly accepted cut-off value of 5. These findings indicate that multicollinearity was not a concern and that the regression coefficients were estimated reliably (Table 6). Therefore, all theoretically relevant variables were retained in the fully adjusted model.

Table 6. Multicollinearity diagnostics for variables included in the fully adjusted model.

Predictor	**Tolerance**	**VIF**
Mother's age	0.909	1.100
Mother's education	0.801	1.248
Father's education	0.887	1.128
Family income	0.915	1.093
Gestation period	0.906	1.104
Type of delivery	0.732	1.366
Child's age	0.865	1.156
Birth weight	0.880	1.136
Previous breastfeeding experience	0.803	1.246
Skin-to-skin contact	0.875	1.143
Rooming-in	0.854	1.171
Colostrum feeding	0.793	1.262
Prelacteal feeding	0.726	1.378
Breastfeeding initiation time	0.922	1.085
Breastfeeding frequency	0.837	1.195
Inter-birth interval	0.891	1.122
Breast/nipple problems	0.887	1.128
Insufficient milk supply	0.811	1.232
Return to work or study	0.805	1.243
New pregnancy	0.895	1.117
Accompanying during childbirth	0.924	1.083

Husband support	0.740	1.351
Traditions hindering EBF	0.817	1.225
Antenatal care visits	0.924	1.082
Antenatal EBF education	0.835	1.197
Advice after delivery	0.891	1.122
Source of EBF information	0.835	1.197
Knowledge of EBF duration	0.664	1.505
Knowledge of EBF definition	0.805	1.242
Awareness of EBF benefits	0.807	1.239
Awareness of BFHI	0.672	1.489

6. FULLY ADJUSTED MULTIVARIABLE LOGISTIC REGRESSION MODEL (SENSITIVITY ANALYSIS)

To provide a more rigorous analytical framework and address potential confounding across domains, a final comprehensive multivariable model was constructed (Table 7), the primary predictors demonstrated remarkable stability. Most of the important predictors were still statistically significant after simultaneously adjusting for all predictors, thereby reinforcing the stability and reliability of the primary determinants that remained significant across both models

Specifically, attending more than three antenatal care visits emerged as the most significant predictive factor (AOR=6.976; 95% CI: 2.91–16.72), followed by breastfeeding frequency > 8 per day. These moderated values confirm that the multivariable framework effectively addressed potential overestimation and shared variance, reinforcing the reliability of these determinants. The other important predictive factors were husband support, advice after delivery, and antenatal EBF education. This was followed by breastfeeding initiation within 3 days of birth, knowledge of the definition of EBF, gestation reaching full term, middle-income families, colostrum feeding, awareness of the BFHI, and skin-to-skin contact.

On the other hand, the factors that hindered breastfeeding showed the highest negative association with exclusive breastfeeding, such as tradition hindering EBF (AOR=0.104; 95% CI: 0.05–0.22), prelacteal feeding, perceived insufficient milk supply, and return to work or study. The results of the comparisons showed that several variables that were identified as significant predictors within their respective domains lost their statistical significance in the final comprehensive model. Notably, among socio-demographic and obstetric factors, maternal age, maternal education, and birth weight were no longer independent predictors of EBF. The negative association observed for high family income (>10,000 SR) and the positive association for vaginal delivery were attenuated to non-significance in the fully adjusted framework. Within the breastfeeding practices domain, factors such as previous breastfeeding experience, 24-hour rooming-in, and a longer inter-birth interval became non-significant after adjustment. Furthermore, clinical challenges like breast or nipple problems and a new pregnancy, as well as the knowledge of the recommended EBF duration, did not maintain their independent predictive power in the final model. Conversely, the sensitivity analysis confirmed that no new variables gained statistical significance in the fully adjusted model.

Table 7. Fully adjusted multivariable logistic regression model for exclusive breastfeeding (Sensitivity Analysis) (n = 573).

Predictor	**β**	**Wald**	**P value**	**AOR**	**95% CI**
Mother's age (21–34 vs<20)	0.426	0.77	0.380	1.532	0.59–3.97
(>35 vs<20)	0.907	3.00	0.083	2.476	0.89–6.91
Mother's education (≥University vs ≤Secondary)	0.520	2.25	0.134	1.682	0.85–3.32
Father's education (≥University vs ≤Secondary)	0.256	0.63	0.428	1.291	0.69–2.43
Income (5000–10,000 vs<5000)	0.940	4.30	0.038	2.560	1.05–6.22
(>10,000 vs<5000)	-0.600	1.23	0.267	0.549	0.19–1.58
Gestation (full-term vs preterm)	0.949	5.82	0.016	2.582	1.19–5.58
Delivery (vaginal vs cesarean section)	0.565	2.06	0.152	1.760	0.81–3.81

Child's age (10–12 months vs 6–9)	-0.279	0.52	0.472	0.756	0.35–1.62
Birth weight (2.5–3.5 vs <2.5)	0.512	1.45	0.229	1.668	0.72–3.84
(>3.5 vs <2.5)	-0.240	0.21	0.646	0.787	0.28–2.19
Previous breastfeeding experience (yes vs no)	0.667	3.13	0.077	1.947	0.93–4.07
Skin-to-skin (yes vs no)	0.732	4.95	0.026	2.080	1.09–3.96
Rooming-in (yes vs no)	-0.209	0.41	0.524	0.812	0.43–1.54
Colostrum feeding (yes vs no)	0.921	7.58	0.006	2.511	1.30–4.84
Prelacteal feeding (yes vs no)	-0.989	9.48	0.002	0.372	0.20–0.70
Breastfeeding initiation (after 3 days vs none)	0.500	1.17	0.280	1.649	0.67–4.09
(before 3 days vs none)	1.010	5.05	0.025	2.744	1.14–6.62
Breastfeeding frequency (<8 vs none)	1.113	8.17	0.004	3.042	1.42–6.52
(>8 vs none)	1.938	22.27	<0.001	6.945	3.11–15.53
Inter-birth interval (<24-month vs first)	0.507	1.68	0.195	1.660	0.77–3.57
(≥24-month vs first)	0.497	1.24	0.265	1.644	0.69–3.95
Breast/nipple problems (yes vs no)	0.042	0.02	0.895	1.043	0.56–1.94
Insufficient milk (yes vs no)	-0.905	8.17	0.004	0.405	0.22–0.75
Return to work or study (yes vs no)	-0.894	7.87	0.005	0.409	0.22–0.76
New pregnancy (yes vs no)	0.366	1.33	0.249	1.442	0.77–2.69
Accompanying during childbirth (yes vs no)	-0.630	2.57	0.109	0.533	0.25–1.15
Husband support (yes vs no)	1.712	20.29	<0.001	5.538	2.63–11.66
Traditions hindering EBF (yes vs no)	-2.266	37.33	<0.001	0.104	0.05–0.22
Antenatal care visits (1–3 vs none)	1.299	8.85	0.003	3.664	1.56–8.62
(>3 vs none)	1.942	18.97	<0.001	6.976	2.91–16.72
Antenatal EBF education (yes vs no)	1.079	10.11	0.001	2.941	1.51–5.72
Advice after delivery (yes vs no)	1.461	17.64	<0.001	4.312	2.18–8.53
Source of EBF information (non-health facility vs non)	0.153	0.08	0.780	1.165	0.40–3.41
(health facility vs non)	0.440	0.52	0.469	1.553	0.47–5.12
Knowledge of duration (yes vs no)	0.723	3.39	0.066	2.060	0.95–4.45
Knowledge of definition (yes vs no)	0.971	7.18	0.007	2.642	1.30–5.38
EBF benefits awareness (yes vs no)	-0.118	0.11	0.746	0.889	0.44–1.81
Awareness of BFHI (yes vs no)	0.777	4.22	0.040	2.174	1.04–4.56

V. DISCUSSION

This study provides evidence on the determinants of EBF in Al-Kharj Governorate, Saudi Arabia, a region that is largely underrepresented in national research on maternal and child health. The current findings reflect the status of EBF in the Governorate, where the EBF rate has reached 38.0%. This represents an increase when compared to a previous study, which reported a prevalence of only 27.3% [23].

More than 3 antenatal care visits were associated with approximately 12-fold higher odds of EBF (AOR = 11.94). The mechanism behind this strong association likely involves the cumulative effect of repeated counseling, which reinforces maternal self-efficacy and provides multiple opportunities to address misconceptions before birth. These visits serve as a vital platform for psychological readiness and practical preparation, making the transition to EBF more resilient against post-delivery challenges. Local [7, 8, 12, 30] and regional [11, 14, 31] studies confirm the importance of frequent visits for focused breastfeeding counseling and the practical support. The BFHI unit of Al-Kharj MCH is the main provider of antenatal care services in Al-Kharj; yet, its use rate is still below optimal levels.

Other important factors associated with successful EBF included breastfeeding more than eight times per day (AOR 7.44), colostrum feeding, previous breastfeeding experience, an inter-birth interval of at least 24 months, breastfeeding initiation within three days, skin-to-skin contact, and rooming-in. These results are consistent with previous Saudi and regional studies [9, 11, 15, 32]. Notably, the high frequency of

breastfeeding (>8 times/day) emerged as one of the most powerful independent predictors of EBF success, indicating that promoting frequent breastfeeding is a critical clinical intervention for sustaining breastfeeding.

Antenatal EBF education, knowledge of the definition of EBF awareness of BFHI, and knowledge of the recommended duration were all associated with increased odds of EBF. Previous studies suggest that such programs may play a role in correcting misconceptions, that women often have poor knowledge about breastfeeding challenges and need appropriate education, and that counselling is one of the most actionable strategies which can be used to improve EBF [33-36]. Furthermore, husband support was correlated to EBF success indicating the importance of family engagement. Saudi evidence and international evidence both support one another, with respect to family and community support and social acceptance [22, 37]. Infants born at full term were 3.36 times more likely to be exclusively breastfed compared to those born preterm, which highlights that premature infants often face clinical hurdles that impede early lactation. This finding is consistent with local research [18, 35]. Also, infants with a birth weight of 2.5–3.5 kg and those weighing >3.5 kg had higher odds of EBF compared to those with birth weight <2.5 kg. Previous studies have reported that low weight infants are frequently admitted to special care units, leading to maternal-infant separation and delayed breastfeeding initiation [38, 39].

Compared with mothers younger than 20 years, mothers over the age of 35 were 2.97 times more likely to practice EBF, followed by those aged 21–34. Saudi studies show a similar age-related pattern, with maternal age linked to breastfeeding continuation and early cessation [24, 35]. From an international perspective, older mothers often benefit from greater maturity, previous parenting experience, and a higher level of health awareness compared to younger, less experienced mothers [33, 40]. Highly educated mothers were 2.03 times more likely to maintain EBF. The Saudi literature, however, is not completely uniform on this point. A study from Rabigh found that mothers without university education were more likely to practice EBF [41] while consistency with previous Al-Kharj research suggests that education is linked to a mother's greater capacity to process health information and understand the long-term benefits of EBF [22].

At the international level, higher education is often associated with a better understanding of the definition of EBF, and a strong rejection of cultural pressures to introduce prelacteal feeds [25] Education in the Saudi context appears to have a more nuanced role, not as a direct cause of change but as a sign of access to knowledge, working patterns, and social support. Income showed a non-linear pattern. Moderate income level (5000-10000 SAR) had higher odds (AOR = 2.60) while high income level (above 10000 SAR) had lower odds. High family income was a significant negative predictor in the domain-specific model, but was reduced to non-significance in the fully adjusted sensitivity analysis, although it maintained the same negative direction. The phenomenon can be understood based on the affordability of the formula and the difference in the lifestyle of mothers. High income mothers may have careers that are so demanding and require a very specific work schedule that makes it difficult to maintain EBF. Moderate income mothers, on the other hand, might consider EBF as a cost-effective health intervention. These findings are observed in previous Saudi studies [11, 42, 43]. This interpretation is more consistent with the idea that "wealth reduces breastfeeding."

Conversely, factors associated with a lower odd of EBF included the following. The most strongly associated negative factor for practicing EBF was traditions that hinder it (AOR=0.07). This finding is consistent with evidence from the Saudi literature. Previous studies showed that comfort with breastfeeding in front of relatives and friends, and the absence of a suitable place for breast-feeding, were associated with EBF practices [34]. Also, these have been confirmed by previous studies [41,42]. International reviews make the same point, describing sociocultural beliefs, family norms, and community support as central barriers or facilitators [16, 17]. Perceived insufficient milk and breast or nipple problems were among the most strongly associated negative factors. Our findings are consistent with this pattern.

Saudi women frequently report low milk supply as a reason for stopping EBF, and Saudi studies also show that nipple pain, latching difficulties, and formula introduction during the hospital stay can undermine continuation [31, 35]. Return to work also lowered the odds. This finding has been reported in multiple studies. Saudi reviews and international systematic reviews repeatedly identify maternal employment, inadequate maternity leave, and poor workplace facilities as major obstacles to EBF [5, 8, 35, 42, 43]. This

evidence is particularly significant as it underscores the WHO global nutrition targets, which highlight the critical need for supportive workplace policies to help mothers initiate and sustain EBF. Therefore, this finding may be relevant for informing public health policies and interventions for Al-Kharj and similar Saudi settings.

New pregnancy and prelacteal feeding, both weaken the continuity needed to sustain EBF. A new pregnancy often increases physical strain, making EBF harder to maintain. These findings are consistent with previous local and international studies [5, 6, 8, 11, 31, 35, 41, 42], which identified perceived low milk supply, new pregnancy, mother's employment, and prelacteal feeding as significant barriers to EBF. Despite the high level of general awareness (77.1%) of the benefits of breastfeeding, there are still gaps in specific knowledge about the definition and recommended duration of EBF, which suggests that education alone is insufficient unless reinforced through family engagement, structured prenatal care, and postnatal support [34, 35]. Interestingly, several factors did not substantially predict EBF, including paternal education level, child age, source of EBF information, and EBF benefits awareness. These are consistent with several previous studies that similarly reported no significant relationship between these variables, and EBF practice [11, 13, 22, 31, 32, 44].

A complete multivariable sensitivity analysis was performed for these results to further validate the reliability of the results, all variables theoretically relevant were introduced into one model. The domain-specific models were also very stable, with the results of the fully adjusted model remaining remarkably consistent with the domain-specific models. More than three antenatal care visits and breastfeeding over eight times a day were the strongest independent factors for success with EBF. These results are in close agreement with the findings of local and non-local studies which indicate the positive effects of repeated antenatal visits on breastfeeding counselling and support [7, 8, 11, 12, 30, 31], repeated breastfeeding [9, 11, 15, 32].

Cultural practices which were unfriendly to EBF were more significant and lent support to the overall finding that socio-cultural factors have a stronger influence than individual demographic factors. Results were also consistent with the literature from other parts of the world that focuses on the importance of culturally responsive counseling and community support for maintaining EBF [34-38]. The overall congruence between the domain-specific and fully adjusted models highlights the trustworthiness and internal validity of the results of this study.

Several strengths strengthen this research. Most notably, the study's relatively large sample size (n = 573) provides the statistical power necessary to ensure our results are both reliable. We also took a rigorous approach by assessing EBF in strict accordance with WHO recommendations, which not only ensures methodological consistency but also allows for direct comparisons with international data. This is one of the few studies across Saudi Arabia to apply the full six-month WHO definition of EBF. Furthermore, the questionnaire included clear and specific questions covering all relevant variables. By using structured interviews, we were able to explore a wide range of socio-demographic, obstetric, behavioral, and cultural factors. To further enhance accuracy, we took the extra step of cross-checking maternal responses with hospital records whenever possible. Finally, our use of multivariable logistic regression allowed us to isolate independent predictors while carefully controlling for potential confounders, thereby strengthening the study's internal validity. One of the most notable points that distinguishes this research is that it has been revealed that cultural traditions are the strongest obstacle to EBF. This underscores a vital point often overlooked in previous studies: that education alone is insufficient unless it directly addresses deeply ingrained cultural misconceptions. There are some limitations to consider. The study's cross-sectional design means we can identify strong associations, but we cannot definitively establish cause. Additionally, because we relied on maternal self-reporting, there is a possibility of recall or social desirability bias.

To reduce these biases, the study limited the sample to mothers with an infant less than one year of age to reduce the length of the recall period. Furthermore, structured face-to-face interviews with trained research assistants were employed to establish clarity and uniformity of the data, and where possible, maternal responses were cross-checked with hospital records to facilitate the accuracy of data. Given that approximately 80% of the infants were aged between 6 and 9 months, the transition from EBF was fairly recent for the majority of the sample, thereby enhancing the accuracy of maternal recall.

While the data comes from a single healthcare facility, it is important to emphasize that this hospital serves as the main referral center for the entire Al-Kharj Governorate. Its status as a member of the BFHI and its dedicated breastfeeding unit make it a highly representative and relevant setting for our target population. Despite these constraints, this study offers valuable evidence on the modifiable factors that drive EBF. These insights are essential for creating targeted, culturally appropriate interventions that can support mothers both in Saudi Arabia and in similar regional contexts.

VI. CONCLUSION

1.EMPIRICAL CONCLUSION

Progress towards the suggested WHO target was noted, but EBF rates are still low. Our study found a higher EBF prevalence (38%), compared with the previous study [23], which reported an EBF prevalence of 27.3%. The findings of this study have shown that there are modifiable factors strongly associated with EBF. Frequent antenatal care attendance, frequent breastfeeding, feeding colostrum, prior experience of breastfeeding and antenatal education about breastfeeding were key factors associated with higher odds of EBF. Moreover, supportive practices like skin-to-skin contact and husband support were associated with increased rates of EBF. On the other hand, a number of barriers were found such as perceived inadequate milk supply, return to work/school, and prelacteal feeding. One of the most notable points that distinguishes this research is that it has been revealed that cultural traditions are the strongest obstacle to EBF, and that education alone is insufficient unless it addresses cultural misconceptions.

The fully adjusted multivariable sensitivity analysis strengthened the stability and reliability of study findings. This alignment highlights that number of antenatal care visits and frequent breastfeeding are the strongest independent predictors of EBF success, and the strongest predictors that after simultaneously controlling for all potential confounders. Importantly, the strong negative effect of the cultural traditions as the dominant predictor in the final model underscores that the socio-cultural environment is a more critical driver of breastfeeding behavior than individual demographic characteristics.

2.RECOMMENDATIONS

The results of this study indicate some possible ways to enhance EBF practices. Use of antenatal care services, especially more than three antenatal visits, should be promoted. Breastfeeding more often (more than eight times a day), should be emphasized by healthcare professionals. Healthcare providers should also encourage early initiation of breastfeeding, skin to skin, and discourage prelacteal feeding. Additionally, community-based interventions are required to tackle cultural beliefs that could have a negative impact on breastfeeding and to support families' breastfeeding environment, such as husbands' role in breastfeeding support. Additionally, the workplace should be more supportive by increasing maternity leave, flexible working hours and breastfeeding-friendly workplaces for working mothers. Improving postnatal counseling and lactation support services may also help mothers overcome breastfeeding challenges.

To increase EBF practices in the Al-Kharj region, community initiatives and focused healthcare are needed. Adopting BFHI practices and addressing cultural barriers are essential to achieving optimal EBF rates in the Al-Kharj region and similar environments. The final multivariable sensitivity analysis model corroborated the significant predictors identified in the domain-specific analyses. Particularly regarding antenatal care intensity, breastfeeding frequency, and cultural barriers confirms that these factors are significant determinants of EBF success even after adjusting for a wide array of potential confounders. Consequently, these validated findings provide a reliable evidence base for prioritizing successful EBF practices and achieving national health targets.

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Conflicts of Interest

The authors report no known competing interests associated with this publication.

Data Availability Statement

Data are available from the corresponding author upon reasonable request

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Ethics Approval

This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the relevant authority prior to data collection (Approval No: 3/5/1446; 2024/11/05). All participants had agreed informed consent prior to their participation. The participants were told the purpose of the study, that they could refuse to participate in the study or withdraw from it at any time and there would be no consequences, and that participation was voluntary. Confidentiality and anonymity were maintained by not asking for personal information; all data were kept securely and only for research purposes.

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