



# Prevalence and Factors Associated with Lactational Mastitis: A Cross-Sectional Study in Al-Ahsa, Saudi Arabia, 2024

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**Abstract Background:** The aim of this study was to estimate the prevalence of self-reported lactational mastitis and identify potential factors contributing to the condition among breastfeeding mothers. **Methods:** This cross-sectional study involved 284 breastfeeding mothers in the first six months of their infants' lives in Al-Ahsa, Eastern Region of Saudi Arabia. The primary outcome of interest was lactational mastitis, which was determined by a self-reported combination of breast symptoms, including redness and swelling and flu-like symptoms, experienced during the six-month period following birth. No minimum symptom duration or predefined combination of symptoms was required for outcome classification. The investigation further sought to identify factors associated with reporting lactational mastitis, using both bivariate and multivariable binary logistic regression analyses. **Results:** The self-reported prevalence of lactational mastitis was 26.8%, 95% CI ranged between 21.9% and 32.1%. Maternal age was significantly associated with lactational mastitis ( $p=0.008$ ), with affected women being younger ( $28.2\pm5.0$  years) than those without lactational mastitis ( $30.1\pm6.1$  years). A multivariable explanatory model incorporating nipple cracks, breast congestion, and ductal obstruction was significantly associated with lactational mastitis ( $p<0.05$ ). Nipple cracks were associated with fourfold higher odds of lactational mastitis (AOR = 4.330, 95% CI: 2.142–8.753), while breast congestion was associated with about 11-fold higher odds (AOR = 10.702, 95% CI: 4.970–23.049). Blocked milk ducts were also associated with higher odds of self-reported mastitis (AOR = 2.813, 95% CI: 1.215–6.514) **Conclusion:** Lactational mastitis is a common postpartum problem affecting over a quarter of breastfeeding mothers in Al-Ahsa. Key detected associated factors, included cracked nipples, breast congestion, and ductal obstruction. These findings emphasize the need for targeted interventions, such as breastfeeding education, proper nipple care, and strategies to prevent and manage breast engorgement.

**Key Words** Breast Feeding, Mastitis, Prevalence, Factors Related to Mastitis

## INTRODUCTION

Breastfeeding is widely known for its numerous health benefits, including improved nutrition, immunological protection, and a lower risk of chronic diseases such as breast and ovarian cancers, type 2 diabetes, and cardiovascular disease. Nevertheless, lactational mastitis and other complications can deter mothers from continuing breastfeeding, which can have a negative impact on the health of infants [1, 2].

Lactational mastitis is an inflammatory condition of the breast that is frequently experienced by lactating mothers. There is a considerable variability in the reported estimates of its occurrence across studies, ranging from approximately 3% to 20%, with some studies have reported that the condition may affect as many as 33% of breastfeeding women during lactation [3].

Lactational mastitis can arise as an inflammatory condition related to milk stasis and inadequate milk removal, with bacterial infection developing in some cases. Accordingly, lactational mastitis should not be regarded as synonymous with bacterial infection [4]. The condition usually manifests within the first six weeks postpartum, and is characterized by localized breast pain, tenderness, erythema, swelling, and systemic flu-like symptoms, including fever and malaise [4, 5]. It may contribute to premature discontinuation of breastfeeding and can progress to complications such as breast abscess [6].

Despite the significant impact of lactational mastitis on maternal health and breastfeeding persistence, previous studies from Saudi Arabia have examined breastfeeding practices and maternal breastfeeding-related experiences, with limited evidence specifically addressing the prevalence

of lactational mastitis and factors associated with its occurrence. A previous systematic review [3] highlighted that most of the evidence on the prevalence of lactational mastitis comes from high- and upper-middle-income countries and concluded that high-quality evidence about the incidence and risk factors of lactational mastitis is strikingly lacking.

Determining the prevalence of lactational mastitis and identifying its associated factors are essential for informing evidence-based breastfeeding support and management strategies. Region-specific epidemiological data can provide healthcare professionals and policymakers with a better understanding of the burden of the condition and facilitate the development of breastfeeding-support programs. Tailored interventions to local needs potentially contributing to improved maternal and child health outcomes[4].

Accordingly, the aim of this study was to estimate the prevalence of self-reported lactational mastitis among breastfeeding mothers in Al-Ahsa, Saudi Arabia and to identify potential factors associated with its occurrence.

## METHODS

### Study Design, Settings, and Duration

This cross-sectional study was conducted in Al-Ahsa Governorate, Eastern Region of Saudi Arabia, between December 2024 and May 2025. Al-Ahsa is a major population center in the Eastern Region and includes a network of primary healthcare facilities providing preventive and maternal and child health services. Participants were recruited from well-baby clinics affiliated with primary healthcare facilities in Al-Ahsa. These clinics provide routine follow-up and preventive care for infants during the first months of life and serve breastfeeding mothers as part of routine maternal and child healthcare services.

### Inclusion Criteria

The study population included women who were currently breastfeeding an infant aged six months or lower at the time of study participation and who were residing in Al-Ahsa, Eastern Region of Saudi Arabia, and willing to participate in the study.

### Exclusion Criteria

Women with a medical history of breast surgery or trauma that could affect lactation, a medical history of breast disease unrelated to lactational mastitis, and immunocompromised lactating women were excluded from the study.

### Sampling and Sample Size

A multistage sampling strategy was used to recruit eligible participants from the well-baby clinics across the Al-Ahsa region, Saudi Arabia. In the first stage, the clinics were randomly selected from the registry of eligible healthcare centers in the region. In the second stage, consecutive sampling was used within the selected clinics to recruit

eligible breastfeeding mothers attending routine postpartum or infant-care clinics during the study period.

The required sample size was calculated using the single-proportion formula for cross-sectional studies, with adjustment for the design effect. With a 95% confidence level, a margin of error of 5%, and an assumed prevalence of 20% based on previously published literature, the initial sample size was estimated at 171 participants. To account for the potential correlation between participants recruited from the same clinic, a design effect (DEFF) of 1.50 was applied, resulting in an adjusted sample size of approximately 256 participants. This DEFF value represents a conservative allowance for a modest intracluster correlation, based on an anticipated average cluster size of approximately 20–25 participants per clinic and an ICC of approximately 0.02–0.025. Finally, allowing for an anticipated 10.0% non-response or incomplete questionnaire rate, the minimum required sample size was increased to approximately 280 participants.

### Data Collection

The data collection process was executed through the administration of questionnaires to a cohort of currently breastfeeding mothers attending well-baby clinics with infants aged six months and under. Recruitment was conducted during routine clinic visits, and eligible mothers were approached by trained healthcare professionals and invited to participate. Mothers who met the eligibility criteria and provided informed consent completed the study questionnaire.

### Data Collection Tool

In this study, an anonymous valid questionnaire was used. The questionnaire was adopted from a previous study [8] with the same objective and consists of three parts. The first part includes the socio-demographic data of the participants, and the second part consists of questions regarding the prevalence and factors associated with lactational mastitis. The third section assessed participants' breastfeeding self-efficacy using a self-administered validated Arabic version of Breastfeeding Self-Efficacy Scale–Short Form (BSES-SF) [9]. The BSES-SF is a valid and reliable 14-item tool designed to assess self-confidence in breastfeeding. It is rated on a 5-point Likert scale where all statements are scored positively, and 1 point is given to "not at all confident" while a score of 5 points is given to "always confident". The total score ranges from 14 to 70, with higher scores reflecting better breastfeeding self-efficacy.

### Description of Variables

The primary outcome was self-reported lactational mastitis. Participants were asked whether they had experienced lactational mastitis from the time of delivery until completion of the questionnaire and were subsequently asked about associated symptoms, including breast tenderness or pain, breast redness, breast lumps, fever, and flu-like symptoms. Lactational mastitis was classified based

on the participant's self-reported history of mastitis; no minimum symptom duration, predefined combination of symptoms, or previous healthcare-provider diagnosis was required for classification. As well, a previous physician or healthcare-professional diagnosis was not required for classification, and no clinical or microbiological confirmation was performed. In addition, the study examined the frequency of mastitis symptoms and whether they led to breastfeeding cessation. The study also controlled for several explanatory variables, including maternal age, parity, education level, and mode of delivery.

Breastfeeding practices were classified using WHO infant and young child feeding definitions. Exclusive breastfeeding denoted feeding only breast milk (including expressed milk), with no other foods or liquids except oral rehydration solution, vitamins, minerals, or prescribed medicines. Predominant breastfeeding indicated breast milk as the main nourishment, permitting water or water-based liquids. Partial breastfeeding involved breast milk alongside other milk, formula, and/or complementary foods. Complementary feeding referred to introducing solid or semi-solid foods while continuing breastfeeding, typically from around 6 months, to meet increasing nutritional needs. These definitions guided data collection and analysis.

### Data Entry and Analysis

Data were tabulated and analyzed using the Statistical Package for the Social Sciences (SPSS) version 27 (IBM Corp., Armonk, NY, USA). Qualitative variables were summarized as numbers and percentages, and associations between them were examined using the Chi-Square test. The Exact test was used instead when the expected frequency was less than 5. Quantitative data were first tested for distribution by using the Shapiro-Wilk test. Normally distributed data were displayed as mean $\pm$ standard deviation (SD). Alternatively, data which do not follow normal distribution were presented as median and interquartile range and were compared by using the nonparametric Mann-Whitney U test. Because multiple statistical comparisons were performed, the potential for inflated false-positive findings was considered. To address this issue, the Benjamini-Hochberg (BH) procedure was applied to the *p*-values for the multiple comparisons presented in Table 3 to control the false discovery rate (FDR). Binary logistic regression analysis was performed to identify factors independently associated with self-reported lactational mastitis. Candidate variables were selected based on their clinical and conceptual relevance to lactational mastitis and the objectives of the study, rather than solely on statistical significance in univariable analyses. The multivariable model included maternal age, total BSES-SF score, nipple cracks, breast congestion, lactating duct obstruction, and breastfeeding type. Breastfeeding type was represented using manually created dummy variables, with complementary breastfeeding used as the reference category. Adjusted odds ratios (AORs) with corresponding 95% confidence intervals (CIs) and *P* values were reported. The

number of model parameters was kept limited in relation to the number of outcome events to reduce the risk of model overfitting. Statistical significance was set at a two-sided *P* value  $<0.05$ .

### Ethical Considerations

The study was conducted following approval from the local Institutional Review Board (ID: 3908-EP-2024, Date: 29-08-2024). To ensure the confidentiality of the collected data, each participant was assigned a unique code number. No names or other personally identifiable information that could raise ethical concerns were collected. Informed consent was obtained from all participants prior to their involvement in the study, following a comprehensive explanation of its objectives.

### RESULTS

Table 1 presents the sociodemographic and delivery characteristics of 284 mothers and their babies. The mean (SD) maternal age was 29.6 (5.9) years. Most mothers were Saudi (94.7%), university graduates (62.7%) housewives (74.6%). The majority live in the Middle and Eastern sectors (38.4 and 32.7%, respectively). Regarding delivery and birth characteristics, 26.1, 26.4, and 24.6% of the mothers have had one, two, or three children each. The mode of delivery of the last baby was commonly vaginal (75.4%). Nearly one-third (27.5%) of newborns required neonatal intensive care unit (NICU) admission. The mean (SD) gestational age at birth, birth weight, and infants' age were 38.5 (2.0) weeks, 2.9 (0.9) kg, and 4.2 (1.7) months, respectively. The distribution of breastfeeding practices showed that exclusive breastfeeding was relatively low (26.4%), while partial (43.7%), and predominant types (27.5%) were more common.

The prevalence of self-reported lactation mastitis was 26.8% (95% CI: 21.9%-32.1%). Table 2 demonstrates the associations between various sociodemographic and delivery-related characteristics and developing lactation mastitis. Maternal age was the only significant factor ( $p=0.008$ ), where women who had lactational mastitis were significantly younger (28.2 $\pm$ 5.0 years) compared to those who did not have mastitis (30.1 $\pm$ 6.1 years). No significant associations were observed between education level, occupation, residence, number of births, mode of delivery, need of the baby to the ICU, or the type of breastfeeding and occurrence of lactation mastitis (All *p* values  $>0.05$ ).

Table 3 shows significant associations between self-reported lactational mastitis during the previous six months and several breast-related conditions. Participants who reported nipple cracks had a significantly higher prevalence of self-reported mastitis compared with those without nipple cracks (52.9% vs. 11.7, respectively; BH-adjusted  $p = 0.002$ ). Similarly, mastitis was more frequently reported among women with breast congestion (75.8% vs. 13.1%; BH-adjusted  $p = 0.003$ ) and among those with lactating duct obstruction (59.6% vs. 20.3%; BH-adjusted  $p = 0.003$ ). A significant association was also observed between using

Table 1: Sociodemographic and Delivery Characteristics (N = 284)

| Parameters                         |                   | N=284     | Percentage |
|------------------------------------|-------------------|-----------|------------|
| Maternal age, years                | Range             | 18.0-45.0 |            |
|                                    | Mean              | 29.6      |            |
|                                    | SD                | 5.9       |            |
| Nationality                        | Saudi             | 269       | 94.7       |
|                                    | Non-Saudi         | 15        | 5.3        |
| Educational level                  | Primary/Secondary | 106       | 37.3       |
|                                    | University        | 178       | 62.7       |
| Occupation                         | Housewife         | 212       | 74.6       |
|                                    | Employed          | 72        | 25.4       |
| Residence                          | Middle sector     | 109       | 38.4       |
|                                    | Eastern sector    | 93        | 32.7       |
|                                    | North sector      | 75        | 26.4       |
|                                    | South sector      | 7         | 2.5        |
| Number of births                   | 1                 | 74        | 26.1       |
|                                    | 2                 | 75        | 26.4       |
|                                    | 3                 | 70        | 24.6       |
|                                    | 4                 | 37        | 13.0       |
|                                    | > 5               | 28        | 9.9        |
| Mode of delivery of the last baby  | Vaginal           | 214       | 75.4       |
|                                    | Cesarean          | 70        | 24.6       |
| The need for NICU admission        | Yes               | 78        | 27.5       |
| Gestational age of the baby, weeks | Mean              | 38.5      |            |
|                                    | SD                | 2.0       |            |
| The baby's weight at birth, kg     | Mean              | 2.9       |            |
|                                    | SD                | 0.9       |            |
| The infant's age, months           | Mean              | 4.2       |            |
|                                    | SD                | 1.7       |            |
| Type of breastfeeding              | Partial           | 124       | 43.7       |
|                                    | Predominant       | 78        | 27.5       |
|                                    | Exclusive         | 75        | 26.4       |
|                                    | Complementary     | 7         | 2.5        |

N: number, SD: standard deviation, NICU: neonatal intensive care unit

Table 2: Association between Sociodemographic Characteristics and Self-Reported Lactation Mastitis (N=284)

| Parameters            |                   | Self-reported lactational mastitis during the previous six months |       |                |       | p-value |
|-----------------------|-------------------|-------------------------------------------------------------------|-------|----------------|-------|---------|
|                       |                   | No 208 (73.2%)                                                    |       | Yes 76 (26.8%) |       |         |
| Maternal age, years   | Mean±SD           | 30.1±6.1                                                          |       | 28.2±5.0       |       | 0.008*  |
| Educational level     | Primary/Secondary | 78                                                                | 73.6% | 28             | 26.4% | 0.919   |
|                       | University        | 130                                                               | 73.0% | 48             | 27.0% |         |
| Occupation            | Employed          | 55                                                                | 76.4% | 17             | 23.6% | 0.485   |
|                       | Housewife         | 153                                                               | 72.2% | 59             | 27.8% |         |
| Residence             | Eastern sector    | 72                                                                | 77.4% | 21             | 22.6% | 0.412   |
|                       | Middle sector     | 81                                                                | 74.3% | 28             | 25.7% |         |
|                       | North sector      | 51                                                                | 68.0% | 24             | 32.0% |         |
|                       | South sector      | 4                                                                 | 57.1% | 3              | 42.9% |         |
| Number of births      | 1                 | 46                                                                | 62.2% | 28             | 37.8% | 0.144   |
|                       | 2                 | 59                                                                | 78.7% | 16             | 21.3% |         |
|                       | 3                 | 54                                                                | 77.1% | 16             | 22.9% |         |
|                       | 4                 | 29                                                                | 78.4% | 8              | 21.6% |         |
|                       | > 5               | 20                                                                | 71.4% | 8              | 28.6% |         |
| Mode of birth         | Caesarean         | 52                                                                | 74.3% | 18             | 25.7% | 0.820   |
|                       | Vaginal           | 156                                                               | 72.9% | 58             | 27.1% |         |
| The need for ICU      | No                | 153                                                               | 74.3% | 53             | 25.7% | 0.523   |
|                       | Yes               | 55                                                                | 70.5% | 23             | 29.5% |         |
| Type of breastfeeding | Partial           | 95                                                                | 76.6% | 29             | 23.4% | 0.541   |
|                       | Predominant       | 55                                                                | 70.5% | 23             | 29.5% |         |
|                       | Exclusive         | 52                                                                | 69.3% | 23             | 30.7% |         |
|                       | Complementary     | 6                                                                 | 85.7% | 1              | 14.3% |         |

\*Significant at  $p < 0.05$ , N: number, SD: standard deviation, ICU: intensive care unit

cream on the nipples and self-reported mastitis, with mastitis reported more frequently among women who used nipple cream than among those who did not (41.0% vs. 16.8%; BH-adjusted  $p = 0.003$ ). Similarly, the use of milk suction was

associated with self-reported mastitis (33.8% vs. 17.7%; BH-adjusted  $p = 0.006$ ). In contrast, evacuation of breast milk, wearing a suitable-sized bra, wearing a bra during sleep, hand washing before breastfeeding, and using

Table 3: Association between Self-Reported Lactation Mastitis and Breast Condition (N=284)

| Parameters                        |     | Self-reported lactational mastitis during the previous six months |       |                |       | p-value | BH-adjusted p-value |
|-----------------------------------|-----|-------------------------------------------------------------------|-------|----------------|-------|---------|---------------------|
|                                   |     | No 208 (73.2%)                                                    |       | Yes 76 (26.8%) |       |         |                     |
| Nipple cracks                     | No  | 159                                                               | 88.3% | 21             | 11.7% | <0.001* | 0.002*              |
|                                   | Yes | 49                                                                | 47.1% | 55             | 52.9% |         |                     |
| Breast congestion                 | No  | 193                                                               | 86.9% | 29             | 13.1% | <0.001* | 0.003*              |
|                                   | Yes | 15                                                                | 24.2% | 47             | 75.8% |         |                     |
| Evacuation of breast milk         | No  | 100                                                               | 78.7% | 27             | 21.3% | 0.060   | 0.083               |
|                                   | Yes | 108                                                               | 68.8% | 49             | 31.2% |         |                     |
| Lactating duct obstruction        | No  | 189                                                               | 79.7% | 48             | 20.3% | <0.001* | 0.003*              |
|                                   | Yes | 19                                                                | 40.4% | 28             | 59.6% |         |                     |
| Wearing a suitable-sized bra      | No  | 21                                                                | 63.6% | 12             | 36.4% | 0.185   | 0.204               |
|                                   | Yes | 187                                                               | 74.5% | 64             | 25.5% |         |                     |
| Wearing a breast bra during sleep | No  | 106                                                               | 76.8% | 32             | 23.2% | 0.186   | 0.204               |
|                                   | Yes | 102                                                               | 69.9% | 44             | 30.1% |         |                     |
| Using cream on nipples            | No  | 139                                                               | 83.2% | 28             | 16.8% | <0.001* | 0.003*              |
|                                   | Yes | 69                                                                | 59.0% | 48             | 41.0% |         |                     |
| The presence of a milk seep       | No  | 100                                                               | 79.4% | 26             | 20.6% | 0.037*  | 0.067               |
|                                   | Yes | 108                                                               | 68.4% | 50             | 31.6% |         |                     |
| Hand washing before breastfeeding | No  | 114                                                               | 70.4% | 48             | 29.6% | 0.208   | 0.208               |
|                                   | Yes | 94                                                                | 77.0% | 28             | 23.0% |         |                     |
| Using milk suction                | No  | 102                                                               | 82.3% | 22             | 17.7% | 0.003*  | 0.006*              |
|                                   | Yes | 106                                                               | 66.3% | 54             | 33.8% |         |                     |
| Using industrial nipples          | No  | 201                                                               | 74.4% | 69             | 25.6% | 0.061   | 0.083               |
|                                   | Yes | 7                                                                 | 50.0% | 7              | 50.0% |         |                     |

\*Significant at  $p < 0.05$ . BH: Benjamini–Hochberg false discovery rate (FDR) adjustment

Table 4: Explanatory multivariable binary logistic regression analysis for determining factors associated with self-reported lactation mastitis

| Predictor                  | B      | SE    | AOR    | 95% CI for AOR | p-value | Overall model |
|----------------------------|--------|-------|--------|----------------|---------|---------------|
| Maternal age (years)       | −0.017 | 0.032 | 0.983  | 0.923–1.047    | 0.590   | <0.001*       |
| BSES-SF total score        | 0.005  | 0.015 | 1.005  | 0.976–1.035    | 0.742   |               |
| Nipple cracks              | 1.466  | 0.359 | 4.330  | 2.142–8.753    | <0.001* |               |
| Breast congestion          | 2.370  | 0.391 | 10.702 | 4.970–23.049   | <0.001* |               |
| Lactating duct obstruction | 1.034  | 0.428 | 2.813  | 1.215–6.514    | 0.016*  |               |
| Breastfeeding type         |        |       |        |                |         |               |
| Exclusive                  | 0.627  | 1.515 | 1.872  | 0.096–36.427   | 0.679   |               |
| Partial                    | 0.433  | 1.446 | 1.542  | 0.091–26.262   | 0.764   |               |
| Predominant                | 0.546  | 1.501 | 1.726  | 0.091–32.723   | 0.716   |               |
| Constant                   | −2.847 | 1.649 | —      | —              | 0.084   |               |

\*Significant at  $p < 0.05$ , AOR: adjusted odds ratio, CI: confidence interval. Reference group for type of feeding is complementary feeding

Table 5: Responses to the Short-Form Breastfeeding Self-Efficacy Scale (BSES-SF)

| Items                                                                         | Always confident N (%) | Confident N (%) | Somewhat confident N (%) | Not confident N (%) | Not at all confident N (%) |
|-------------------------------------------------------------------------------|------------------------|-----------------|--------------------------|---------------------|----------------------------|
| Determine that my baby is getting enough milk                                 | 99 (34.9)              | 57 (20.1)       | 59 (20.8)                | 13 (4.6)            | 56 (19.7)                  |
| Successfully cope with breastfeeding like I have with other challenging tasks | 84 (29.6)              | 44 (15.5)       | 69 (24.3)                | 20 (7.0)            | 67 (23.6)                  |
| Breastfeed my baby without using formula as a supplement                      | 55 (19.4)              | 40 (14.1)       | 64 (22.5)                | 29 (10.2)           | 96 (33.8)                  |
| Ensure that my baby is properly latched on for the whole feeding              | 135 (47.5)             | 47 (16.5)       | 33 (11.6)                | 10 (3.5)            | 59 (20.8)                  |
| Manage the breastfeeding situation to my satisfaction                         | 104 (36.6)             | 64 (22.5)       | 40 (14.1)                | 14 (4.9)            | 62 (21.8)                  |
| Manage to breastfeed even if my baby is crying                                | 74 (26.1)              | 42 (14.8)       | 68 (23.9)                | 28 (9.9)            | 72 (25.4)                  |
| Keep wanting to breastfeed                                                    | 140 (49.3)             | 38 (13.4)       | 37 (13.0)                | 17 (6.0)            | 52 (18.3)                  |
| Comfortably breastfeed with my family members present                         | 82 (28.9)              | 34 (12.0)       | 59 (20.8)                | 17 (6.0)            | 92 (32.4)                  |
| Be satisfied with my breastfeeding experience                                 | 129 (45.4)             | 43 (15.1)       | 48 (16.9)                | 12 (4.2)            | 52 (18.3)                  |
| Deal with the fact that breastfeeding can be time-consuming                   | 78 (27.5)              | 65 (22.9)       | 64 (22.5)                | 21 (7.4)            | 56 (19.7)                  |
| Finish feeding my baby on one breast before switching to the other breast     | 94 (33.1)              | 48 (16.9)       | 54 (19.0)                | 25 (8.8)            | 63 (22.2)                  |
| Continue to breastfeed my baby for every feeding                              | 104 (36.6)             | 52 (18.3)       | 58 (20.4)                | 19 (6.7)            | 51 (18.0)                  |
| Manage to keep up with my baby's breastfeeding demands                        | 126 (44.4)             | 47 (16.5)       | 50 (17.6)                | 16 (5.6)            | 45 (15.8)                  |
| Tell when my baby is finished breastfeeding                                   | 129 (45.4)             | 60 (21.1)       | 34 (12.0)                | 14 (4.9)            | 47 (16.5)                  |

industrial nipples were not significantly associated with self-reported mastitis after adjustment for multiple comparisons (all BH-adjusted  $p > 0.05$ ).

Multivariable logistic regression analysis showed that nipple cracks, breast congestion, and lactating duct obstruction were independently associated with self-reported

Table 6: Comparison of Breastfeeding Self-Efficacy Scale of Women with and Without Self-Reported Lactation Mastitis

| Parameters | Self-reported lactational mastitis during the previous six months |           |           | Difference between medians (95% CI) | p-value |
|------------|-------------------------------------------------------------------|-----------|-----------|-------------------------------------|---------|
|            | No                                                                | Yes       | N         |                                     |         |
| Minimum    | 14.0                                                              | 14.0      | 14.0      | 0.00 (–3.00 to 3.00)                | 0.886   |
| Maximum    | 70.0                                                              | 70.0      | 70.0      |                                     |         |
| Median     | 53.0                                                              | 54.0      | 53.0      |                                     |         |
| IQR        | 39.5–60.0                                                         | 39.5–58.5 | 39.5–59.0 |                                     |         |
| Total      | 208                                                               | 76        | 284       |                                     |         |

IQR: interquartile range, CI: confidence interval. Difference between medians estimated using the independent-samples Hodges–Lehmann method

lactational mastitis. Mothers reporting nipple cracks had more than fourfold higher odds (AOR = 4.330, 95% CI: 2.142–8.753;  $p < 0.001$ ), while breast congestion was associated with approximately elevenfold higher odds of the condition (AOR = 10.702, 95% CI: 4.970–23.049;  $p < 0.001$ ). Lactating duct obstruction was also independently associated with lactational mastitis (AOR = 2.813, 95% CI: 1.215–6.514;  $p = 0.016$ ). In contrast, maternal age, BSES-SF total score, and breastfeeding type were not significantly associated with lactational mastitis after adjustment for the other variables in the model (Table 4).

The self-reported confidence levels of mothers regarding various aspects of breastfeeding were measured using the short-form Breastfeeding Self-Efficacy Scale (BSES-SF) and presented in Table 5. Higher confidence in certain breastfeeding aspects such as keeping the desire to breastfeed (49.3% always confident, 13.4% confident), ensuring the baby is properly latched on (47.5% always confident, 16.5% confident), being satisfied with the breastfeeding experience (45.4% always confident, 15.1% confident), determining when the baby has finished breastfeeding (45.4% always confident, 21.1% confident), and managing to keep up with the baby's breastfeeding demands (44.4% always confident, 16.5% confident). Alternatively, the lowest confidence areas included breastfeeding without using formula as a supplement (33.8% not at all confident), comfortably breastfeeding with family members present (32.4% not at all confident), managing the breastfeeding situation to satisfaction (21.8% not at all confident), and determining if the baby is getting enough milk: (19.7% not at all confident).

Table 6 shows the comparison of the breastfeeding self-efficacy scores of women in participants with and without lactation mastitis. The medians of breastfeeding self-efficacy scores were comparable in both groups with no significant difference ( $p = 0.886$ ).

## DISCUSSION

This study assessed the prevalence of lactational mastitis and its associated factors among a sample of lactating mothers in Al-Ahsa, Eastern Region of Saudi Arabia. The study aimed to address the significant knowledge gap concerning lactational mastitis in this region. A sample of 284 lactating mothers, ranging in age from 18 to 45 years, with an average age of 29.6 years, was analyzed for this study. Most participants were Saudi (94.7%) and housewives (74.6%), with 62.7% having a university education.

In the current study, the estimated prevalence of lactational mastitis in Al-Ahsa was 26.8%, which is generally consistent with the global figures ranging from 3% to 33% [3,10]. This prevalence indicates that more than a quarter of breastfeeding mothers are affected by this condition, suggesting that lactation mastitis remains a prevalent postpartum ailment in this region.

Previous studies from different settings reported varying frequencies of lactational mastitis. The prevalence of lactational mastitis that we have estimated to be 26.8% is higher than that reported by Ouedraogo *et al.* [11], who investigated the prevalence of lactational mastitis among breastfeeding women in four African countries including Ethiopia, Kenya, Malawi, and Tanzania. The study reported a pooled prevalence of 6.7%, with the lowest estimate observed in Ethiopia (3.1%) and the highest in Kenya (12.0%). Other cohort studies from Nepal [12] and Ghana [13] African nations reported lactational mastitis estimates of 8.0% and 11.8%, respectively. A corresponding study from Egypt reported a 20% prevalence of lactational mastitis within six months of delivery (8), and another from Cameroon conducted by Egbe *et al.* [14] reported a 15% prevalence estimate. Furthermore, cohort studies conducted in Australia [15], Iran [16], and China [17] revealed 20.0%, 19.0%, and 6.3% frequencies of lactational mastitis, respectively. In India, a study involving 3,117 postpartum lactating mothers revealed a 5.1% prevalence of mastitis during the initial six weeks of the postpartum period [18]. An earlier cohort study from the United States also reported a lower prevalence of 9.5% [19].

The observed discrepancies in the lactational mastitis estimates among different studies are in part attributed to the substantial variability in the definitions of mastitis used in studies; some studies depended on diagnosis by healthcare providers, and others relied on self-reported breast and systemic symptoms within a specific period after birth. Also, the studied population varied between being general or hospital-based [3,11,17]. Furthermore, true differences in the prevalence of lactational mastitis are likely linked to dissimilarities in breastfeeding practices, maternal education, and healthcare support. Access to lactation consultants or breastfeeding education programs may also play a role in the development and management of mastitis [20]. Hence, the detected relatively high prevalence in this study underscores the need for improved maternal education on breastfeeding techniques, proper nipple care, and the need for early detection of symptoms. In this context, healthcare providers play an important role in promoting effective

latching techniques, encouraging regular milk expression, and guiding in managing early signs of breast complications.

This study also investigated the potential factors associated with lactational mastitis. Maternal age was significantly associated with this outcome, with affected women being younger (28.2 years) than those without mastitis (30.1 years). The increased vulnerability of younger mothers to lactation mastitis agrees with Ouedraogo *et al.* [11] who found a significantly increased prevalence of mastitis among young women (15 – 24 years) than among older ones (25 and more years), and this finding raises the possibility that age-related variables, including breastfeeding technique, confidence, and experience with breastfeeding may contribute to the development of lactational mastitis. In our study, self-reported lactational mastitis was significantly associated with nipple cracks, breast congestion, and lactating duct obstruction, with a higher prevalence of self-reported mastitis among mothers reporting these conditions. These associations may be related to local breast inflammation and impaired milk removal. Although nipple damage and milk stasis have been proposed as possible pathways through which bacterial infection may occur in some cases of mastitis, our study did not include clinical or microbiological confirmation and therefore cannot determine whether the reported episodes were infectious [21].

Breastfeeding type was not significantly associated with self-reported lactational mastitis in the present study. Further, there was relatively low proportion of exclusive breastfeeding in (26.4%). This finding may reflect differences in maternal preferences, social and cultural practices, employment, and access to breastfeeding support.

In this study, nipple cracks, breast congestion, and lactating duct obstruction were significantly associated with self-reported lactational mastitis after adjustment for potential confounders. Women reporting nipple cracks had more than fourfold higher odds of mastitis, while those reporting breast congestion had approximately elevenfold higher odds. Lactating duct obstruction was also associated with higher odds of lactational mastitis. These findings suggest that breastfeeding-related breast symptoms may be important correlates of lactational mastitis. Though, given the cross-sectional design, the temporal direction of these associations cannot be established. In particular, these conditions may have preceded mastitis, developed concurrently, or occurred as manifestations of mastitis. These findings highlight the potential role of breast health in preventing lactational mastitis, and the importance of early identification and management of nipple cracks, breast congestion, and duct obstruction to reduce the occurrence of lactation mastitis. Healthcare providers should focus on preventive measures, such as proper breastfeeding techniques, nipple care, and early intervention for breast-related issues, to support maternal health and improve breastfeeding outcomes [22].

The explored significant factors in this study are in line with a previous case-control study that identified nipple

cracks, engorgement, and plugged ducts as significant contributing factors for mastitis among Chinese breastfeeding women [23]. Further, a meta-analysis identified several maternal risk factors for mastitis, including milk overproduction, duct obstruction, and nipple cracking [24]. Also, a reported decision tree approach identified cracked nipples and breast pumps among the significant determinants of lactational mastitis [25].

Interestingly, nipple cream use and milk suction were negatively associated with self-reported lactational mastitis. However, these findings should be interpreted cautiously because the cross-sectional design does not establish temporality or causality. The observed associations may reflect differences in breastfeeding practices or reverse causation, and further longitudinal studies are needed to clarify these relationships.

Early supplementing and breastfeeding cessation are frequently caused by the mother's perceptions of an inadequate milk supply and low breastfeeding self-efficacy. Breastfeeding self-efficacy is a substantial factor that can predict breastfeeding duration and exclusivity and is linked with feelings of an inadequate milk supply [26]. Assessment of breastfeeding self-efficacy in mothers may therefore provide helpful information to arrange appropriate interventions thus improving breastfeeding behavior, and, in turn, promoting both infant and maternal health [27].

Assessment of the confidence levels of mothers regarding various aspects of breastfeeding was measured in this study by using the short-form Breastfeeding Self-Efficacy Scale (BSES-SF). The scales revealed high confidence in key aspects of breastfeeding, such as maintaining the desire to breastfeed and ensuring a proper latch among many lactating women. However, there was a high frequency of low-confidence responses in areas like exclusive breastfeeding without formula, breastfeeding in the presence of family members, and assessing milk intake. These findings are in line with Nursan *et al.* [28] and Arafa *et al.* [8], and dictate the need for targeted support and education to address areas of lower confidence and enhance the overall breastfeeding experience. Furthermore, lactation mastitis does not seem to have a significant association with breastfeeding self-efficacy scores, as evidenced by the similar median scores in both groups with no significant difference between the breastfeeding self-efficacy scores of women with and without lactation mastitis. Women's confidence in their ability to breastfeed is similar to those without mastitis. Future studies should examine whether particular self-efficacy domains or breastfeeding skills are associated with lactational mastitis, preferably using prospective designs to clarify temporal relationships.

The current study had several limitations. The cross-sectional study design does not allow causal relationships to be established between the identified factors and lactational mastitis. The temporal sequence between nipple cracks, breast congestion, ductal obstruction, and mastitis could not be determined; therefore, these conditions may have preceded mastitis, resulted from it, or occurred concurrently.

Consequently, the findings should be interpreted as associations rather than causal relationships. Even though 284 participants were recruited for the study, a bigger sample size might yield more reliable results and enable more thorough subgroup analyses. In addition, the reliance on self-reported data to determine prevalence and factors associated with lactational mastitis may be subject to recall and social desirability biases, which may lead to under- or over-reporting of events, particularly for mild or transient symptoms. Lactational mastitis was not clinically confirmed by a healthcare professional or through objective diagnostic criteria. Therefore, some reported cases may have represented symptoms attributable to other breast conditions, while some clinically diagnosed cases may have been missed. The sample-size calculation incorporated a design effect to account for potential clustering by primary healthcare center, but analyses were conducted at the individual level without explicit clustering adjustment; residual within-center correlation may therefore have led to underestimation of standard errors. Furthermore, recruitment from well-baby clinics may have introduced selection bias, as attending mothers may differ systematically from non-attenders in healthcare access and behaviors, potentially limiting the generalizability of findings. Another limitation was the composition of the recruited sample, which was predominantly Saudi, university educated, and composed of housewives. This may limit the applicability of the findings to breastfeeding women in other Saudi regions and to non-Saudi populations with different sociodemographic and cultural characteristics.

## CONCLUSIONS

The prevalence of self-reported lactational mastitis among breastfeeding mothers in Al-Ahsa, Saudi Arabia, was 26.8% (95% CI: 21.9%–32.1%). Nipple cracks, breast congestion, and ductal obstruction were significantly associated with higher odds of self-reported lactational mastitis. The findings highlight the importance of comprehensive breastfeeding support, including breastfeeding education, appropriate nipple care, and guidance on managing breast congestion and milk removal. These areas may warrant particular attention in breastfeeding support programs and should be further evaluated in prospective studies.

## Author Contributions

Rahma AlGadeeb, Hassan Al-Rofaie, Zainab Al-Hassan, and Abdullah Al-Majed have full access to all the data in the study and take responsibility for the integrity of the data. All authors contributed to the study conception and design. Material preparation and data collection were performed by Hassan Al-Rofaie, Zainab Al-Hassan, and Abdullah Al-Majed. Formal analysis was performed by Rahma B. AlGadeeb. The first draft of the manuscript was written by Hassan Al-Rofaie, Zainab Al-Hassan, and Abdullah Al-Majed, while Rahma AlGadeeb revised the manuscript. All authors read and approved the final manuscript.

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## Institutional Review Board Statement

This study adheres to the Declaration of Helsinki guidelines, and it was approved by the local Institutional Review Board (ID: 3908-EP-2024, Date: 29-08-2024).

## Informed Consent Statement

All participants provided informed consent, and their confidentiality was maintained.

## Data Availability Statement

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request, subject to applicable ethical and confidentiality requirements.

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## Conflict of Interest Statement

The authors declare no conflicts of interest.

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