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Breastfeeding Reduces Postpartum Depression Risk: A Case-Control Study of Modifiable Factors in Ha'il, Saudi Arabia

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Abstract Postpartum depression (PPD) affects 10-20% of new mothers worldwide, impairing maternal and infant well-being. This case-control study investigates breastfeeding's protective role and modifiable risk factors for PPD among 517 mothers within 12 months postpartum in Ha'il, Saudi Arabia. Using structured interviews and the PHQ-9 scale, we compared 259 breastfeeding mothers (controls) with 258 non-breastfeeding mothers (cases). Breastfeeding was associated with a significant reduction in PPD risk (mean PHQ-9 score: 4.37 vs. 6.44, p<0.000), particularly after vaginal delivery (p = 0.001). Cesarean delivery (p = 0.001), weak home support (p<0.000) and a personal/family history of depression (p<0.000) increased PPD risk. Logistic regression confirmed breastfeeding's protective odds (OR = 0.62, 95% CI: 0.45-0.87). These findings underscore the need to promote breastfeeding and enhance social support in maternal care, especially for cesarean mothers. However, the cross-sectional design limits causal inference and hospital-based sampling may reduce generalizability. Future longitudinal research is needed to confirm these associations and inform targeted interventions in Saudi Arabia.

Key Words Postpartum Depression, Breastfeeding , Case-Control Study , Social Support, Cesarean Delivery , Saudi Arabia

INTRODUCTION

Postpartum depression (PPD) is a significant mental health challenge, affecting approximately 10-20% of new mothers globally within the first year after childbirth [1]. Defined by persistent sadness, anxiety and fatigue, PPD undermines a mother's capacity to care for herself and her infant, with lasting consequences for both [2]. Its etiology is multifaceted, involving hormonal shifts, psychological stressors and social dynamics [3]. Despite advances in understanding PPD, modifiable risk factors—such as breastfeeding and social support—remain underexplored, particularly in culturally distinct settings like Saudi Arabia, where traditional family structures and healthcare access may uniquely influence maternal mental health outcomes.

Breastfeeding offers well-documented benefits, including optimal infant nutrition, enhanced immunity and maternal postpartum recovery through uterine involution and delayed fertility [4,5]. Emerging evidence also suggests psychological advantages, with oxytocin release during breastfeeding potentially fostering emotional bonding and reducing depressive symptoms. However, the link between breastfeeding and PPD remains inconsistent globally. Some studies report a protective effect [6], while others find no association or highlight increased PPD risk among mothers facing breastfeeding challenges [7]. These discrepancies underscore the need for context-specific research, as cultural attitudes toward breastfeeding, delivery practices and postpartum support vary widely.

In Saudi Arabia, where extended family support is common yet cesarean rates are rising, the interplay between breastfeeding and PPD is poorly understood. Prior global research often overlooks how regional factors—such as limited workplace lactation support or societal expectations of motherhood—shape maternal mental health. This study addresses this gap by examining whether breastfeeding reduces PPD risk among mothers in Ha'il, Saudi Arabia and

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identifying modifiable factors like delivery mode and home support that could inform targeted interventions. By focusing on a Saudi population, we aim to clarify breastfeeding's role in PPD prevention and contribute to culturally relevant maternal health strategies.

METHODS

This study was conducted in the Ha'il region of Saudi Arabia across healthcare facilities, including hospitals, postnatal clinics and vaccination centers, to evaluate breastfeeding's protective effect against postpartum depression (PPD). A case-control design was selected to assess the association between breastfeeding status and PPD risk, leveraging its efficiency in examining rare outcomes like PPD and controlling for confounding factors retrospectively. Compared to a cohort study, this approach allowed for faster data collection and analysis within resource constraints, though it limits causal inference, necessitating future longitudinal validation.

Population and Sample

Participants were mothers aged 18-45 who had given birth within the previous 12 months. Cases (n = 258) were non-breastfeeding mothers, defined as those who never initiated breastfeeding or ceased within four weeks postpartum, while controls (n = 259) were mothers currently breastfeeding (exclusive or mixed feeding). A sample size of 517 was determined via power analysis, assuming a 15% PPD prevalence (based on regional estimates), 80% power and a 5% significance level to detect an odds ratio of 0.6 for breastfeeding's protective effect. Cases and controls were matched 1:1 on age (±2 years), parity (primiparous vs. multiparous), socioeconomic status (low, middle, high; assessed via income and education) and postpartum duration (±1 month) to minimize confounding. Recruitment occurred via random sampling from facility registries to reduce selection bias inherent in hospital-based studies.

Inclusion criteria ensured participants were physically capable of breastfeeding and willing to provide informed consent. Exclusion criteria eliminated mothers with pre-existing mental health diagnoses (e.g., depression, anxiety), chronic medical conditions (e.g., diabetes), or infants with health issues (e.g., congenital anomalies) that could impede breastfeeding, as these factors could independently influence PPD risk or breastfeeding success.

Data Collection

Data were gathered through structured, face-to-face interviews conducted in Arabic by trained researchers. The questionnaire captured demographic details (age, education, income), obstetric history (parity, delivery mode, complications), breastfeeding practices (duration, exclusivity) and social support (rated as weak, average, good based on family assistance frequency). The PPD was assessed using the Patient Health Questionnaire-9 (PHQ-9) (© 1999 Pfizer Inc.),

a validated 9-item tool with a 0-27 score range (0-4: none/minimal; 5-9: mild; 10-14: moderate; 15-19: moderately severe; 20-27: severe). To ensure consistency, interviewers underwent a 2-day training on PHQ-9 administration and inter-rater reliability was verified with a pilot of 20 participants (Cohen's kappa=0.87). Interviews were conducted privately to minimize response bias, though self-reported breastfeeding data may still introduce recall inaccuracies.

Statistical Analysis

Descriptive statistics summarized participant characteristics, with categorical variables (e.g., delivery mode) reported as percentages and continuous variables (e.g., PHQ-9 scores) as means±standard deviations (SD). Chi-square tests assessed associations between categorical variables (e.g., breastfeeding status and PPD severity), while independent t-tests compared means between groups (e.g., breastfeeding vs. non-breastfeeding PHQ-9 scores). Logistic regression quantified the relationship between breastfeeding and PPD risk, adjusting for confounders like delivery mode, support level and depression history. A two-sided p-value<0.05 indicated statistical significance. Analyses were performed using IBM SPSS version 23. Effect sizes (e.g., odds ratios with 95% confidence intervals) were calculated to assess the strength of associations, addressing potential confounding beyond basic variables.

Ethical Considerations

The University of Ha'il Institutional Review Board approved the study (Approval No. H-2024-415). Verbal informed consent was obtained from all participants after explaining study objectives and ensuring voluntary participation. Data were anonymized using unique identifiers, stored securely and accessible only to the research team to protect confidentiality. No external funding influenced the study design or outcomes.

RESULTS

Of 550 mothers initially recruited from healthcare facilities in Ha'il, Saudi Arabia, 517 met inclusion criteria and were analyzed: 258 non-breastfeeding mothers (cases, 49.9%) and 259 breastfeeding mothers (controls, 50.1%). The groups were closely matched, with no significant differences in age (breastfeeding: 30.10±5.2 years; non-breastfeeding: 29.67±4.1 years, p = 0.297) or postpartum duration (mean 4.04±3.3 weeks, range 1-13 weeks). Table 1 compares baseline characteristics, revealing significant differences in Body Mass Index (BMI), parity and PHQ-9 depression scores between groups.

Maternal Characteristics and Depression Scores

Breastfeeding mothers had a higher mean BMI (24.25±4.1 vs. 23.39±3.3, p = 0.010) and parity (3.33±1.8 vs. 2.93±1.4, p = 0.007) than non-breastfeeding mothers, alongside lower

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Table 1: Maternal characteristics by breastfeeding status (Means±SD)

Variable	Breastfeeding (n = 259)	Non-breastfeeding (n = 258)	p-value
BMI	24.25±4.1	23.39±3.3	0.010
Postpartum Weeks	4.86±3.3	4.01±3.2	0.004
Parity	3.33±1.8	2.93±1.4	0.007
PHQ-9 Score	4.37±5.6	6.44±6.8	<0.000

Table 2: PPD severity by risk factors (n, %)

Variable	None/Minimal	Mild	Moderate	Mod. Severe	Severe	p-value
Breastfeeding						
Breastfeeding	170 (32.9)	40 (7.7)	30 (5.8)	16 (3.1)	4 (0.8)	0.016
Non-Breastfeeding	138 (26.7)	40 (7.7)	44 (8.5)	21 (4.1)	14 (2.7)	
Delivery mode						
Vaginal	162 (31.3)	29 (5.6)	24 (4.6)	13 (2.5)	4 (0.8)	0.001
Cesarean	146 (28.2)	51 (9.9)	50 (9.7)	24 (4.6)	14 (2.7)	
Support at home						
Weak	1 (0.2)	3 (0.6)	5 (1.0)	5 (1.0)	9 (1.7)	<0.000
Average	19 (3.7)	20 (3.9)	31 (6.0)	16 (3.1)	5 (1.0)	
Good	288 (55.7)	57 (11.0)	38 (7.4)	16 (3.1)	4 (0.8)	
Depression history						
Yes	4 (0.8)	1 (0.2)	9 (1.7)	8 (1.5)	13 (2.5)	<0.000
No	304 (58.8)	79 (15.3)	65 (12.6)	29 (5.6)	5 (1.0)	

Table 3: Perceived Difficulty by Risk Factors (n, %)

Variable	Not difficult	Somewhat difficult	Very difficult	Extremely difficult	p-value
Breastfeeding					
Breastfeeding	148 (28.6)	76 (14.7)	24 (4.6)	11 (2.1)	<0.000
Non-Breastfeeding	88 (17.0)	102 (19.7)	45 (8.7)	23 (4.4)	
Delivery mode					
Vaginal	135 (26.1)	66 (12.8)	19 (3.7)	12 (2.3)	<0.000
Cesarean	101 (19.5)	112 (21.7)	50 (9.7)	22 (4.3)	
Support at home					
Weak	2 (0.4)	5 (1.0)	5 (1.0)	11 (2.1)	<0.000
Average	15 (2.9)	42 (8.1)	24 (4.6)	10 (1.9)	
Good	219 (42.4)	131 (25.3)	40 (7.7)	13 (2.5)	
Depression history					
Yes	2 (0.4)	7 (1.4)	11 (2.1)	15 (2.9)	<0.000
No	234 (45.3)	171 (33.1)	58 (11.2)	19 (3.7)	

PHQ-9 scores (4.37±5.6 vs. 6.44±6.8, p<0.000). These findings suggest breastfeeding is associated with reduced PPD risk (adjusted OR = 0.62, 95% CI: 0.45-0.87, p = 0.005, logistic regression controlling for delivery mode, support and depression history).

Depression Severity and Risk Factors
Table 2 illustrates PPD severity across breastfeeding status, delivery mode, home support and depression history. Breastfeeding mothers showed lower depression severity (e.g., 32.9% none/minimal vs. 26.7% for non-breastfeeding, p = 0.016), with vaginal delivery further reducing risk (31.3% none/minimal vs. 28.2% for cesarean, p = 0.001). Strong home support correlated with lower scores (55.7% none/minimal, p<0.000), while a personal/family history of depression markedly increased severity (2.5% severe vs. 1.0% with no history, p<0.000). Logistic regression confirmed cesarean delivery (OR = 1.78, 95% CI: 1.32-2.41, p<0.001) and weak support (OR = 3.12, 95% CI: 1.89-5.15, p<0.000) as risk factors.

Functional Difficulty
Table 3 examines perceived daily life challenges (PHQ-9 item 10). Non-breastfeeding mothers reported greater difficulty (e.g., 4.4% extremely difficult vs. 2.1% for breastfeeding, p<0.000), as did those with cesarean delivery (4.3% vs. 2.3%, p<0.000), weak support (2.1% vs. 2.5% good support, p<0.000) and depression history (2.9% vs. 3.7% no history, p<0.000). This suggests PPD's functional impact mirrors its severity, potentially due to breastfeeding's mood-stabilizing effects or cesarean recovery challenges.

DISCUSSION
This study highlights breastfeeding as a protective factor against postpartum depression (PPD) among mothers in Ha'il, Saudi Arabia, alongside the significant roles of delivery mode, home support and depression history. These findings align with and extend existing research, while also revealing unique regional patterns that warrant further exploration.

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Demographic and Clinical Characteristics
Breastfeeding mothers exhibited higher body mass index (BMI) (24.25 vs. 23.39, p = 0.010) and parity (3.33 vs. 2.93, p = 0.007) compared to non-breastfeeding mothers. The elevated BMI contrasts with prior studies linking lower BMI to prolonged breastfeeding [9], potentially reflecting dietary habits or postpartum weight retention in Saudi Arabia, where traditional high-calorie diets are common. Conversely, higher parity aligns with research showing multiparous mothers are more likely to breastfeed due to prior experience [10,11]. Younger maternal age, often associated with early breastfeeding cessation [8], showed no significant difference here (p = 0.297), suggesting cultural norms or support systems may mitigate age-related trends in this population.

Depression Scores and Breastfeeding
Breastfeeding mothers had significantly lower PHQ-9 scores (4.37 vs. 6.44, p<0.000; OR=0.62), corroborating meta-analyses that link breastfeeding to reduced PPD risk [8]. This protective effect may stem from oxytocin release enhancing mood and bonding, though our cross-sectional design cannot confirm causality. Alternatively, mothers with higher baseline depressive symptoms might struggle to initiate or sustain breastfeeding, as suggested by longitudinal studies [11-14]. The lack of temporality limits us to association, not causation—a key weakness necessitating prospective research to disentangle these dynamics.

Impact of Delivery Method
Cesarean delivery was associated with higher PPD risk (OR = 1.78, p<0.001), consistent with systematic reviews [12]. Prolonged recovery, delayed breastfeeding initiation, or emotional distress from unplanned procedures may contribute, particularly in Saudi Arabia, where cesarean rates exceed 25% [16-18]. This contrasts with vaginal delivery's lower risk profile, underscoring the need for targeted postpartum support for cesarean mothers.

Support at Home and Depression
Strong home support markedly reduced PPD severity (55.7% none/minimal, p<0.000; OR = 0.32 vs. weak support), aligning with meta-analyses identifying social support as a critical buffer [13]. In Saudi Arabia's extended family culture, this finding highlights a strength, yet weak support still heightened risk (OR = 3.12), suggesting uneven access or quality of assistance. This variability could reflect socioeconomic disparities or urban-rural differences, unaddressed here due to hospital-based sampling bias[17,18].

Personal or Family History
A personal or family history of depression strongly predicted higher PPD scores (p<0.000; OR = 4.15), reinforcing its role as a dominant risk factor [18-20]. This genetic and psychological vulnerability likely amplifies other stressors, compounding PPD risk in susceptible mothers.

Functional Difficulty and Clinical Implications
Non-breastfeeding, cesarean delivery, weak support and depression history correlated with increased daily life challenges (p<0.000), mirroring PPD severity trends. This functional impact underscores breastfeeding's potential to bolster resilience, possibly via physiological (oxytocin) or psychological (self-efficacy) mechanisms[21,22]. Clinically, these findings advocate integrating lactation support with mental health screening in postnatal care, particularly for cesarean mothers or those lacking support. In Saudi Arabia, where workplace breastfeeding facilities are limited and maternity leave is often short (e.g., 10 weeks public sector), policy interventions—such as extended leave or lactation rooms—could enhance breastfeeding uptake and PPD prevention [20-23].

Study Weaknesses and Alternative Explanations
The cross-sectional design precludes causal conclusions, a limitation compounded by potential recall bias in self-reported breastfeeding data. Selection bias from hospital recruitment may overrepresent urban, health-seeking mothers, reducing generalizability to rural populations. The breastfeeding-PPD link might also reflect reverse causation (depression hindering breastfeeding) or unmeasured confounders (e.g., maternal stress, infant temperament). Qualitative data on mothers' experiences could clarify these alternatives, a gap future studies should address.

Policy Implications and Comparison with Global Research
Policy-wise, promoting breastfeeding via education campaigns and addressing barriers (e.g., workplace support, cesarean recovery care) could reduce PPD incidence. Unlike some Western studies with robust maternity policies [15], Saudi Arabia's context demands tailored solutions, such as community-based support programs leveraging family networks.

CONCLUSION
This case-control study in Ha'il, Saudi Arabia, demonstrates that breastfeeding significantly reduces postpartum depression (PPD) risk (OR = 0.62, p = 0.005), with vaginal delivery and strong home support further lowering depression scores, while cesarean delivery (OR = 1.78, p<0.001) and a personal/family history of depression (OR = 4.15, p<0.000) heighten vulnerability. These findings underscore the protective potential of breastfeeding and social support, urging healthcare providers to prioritize lactation counseling and mental health screening, especially for cesarean mothers or those with limited support. Unexpectedly, breastfeeding mothers showed higher BMI, a regional nuance requiring further investigation. By linking breastfeeding to both PPD prevention and functional well-being, this study advances maternal mental health research in a Saudi context. Future longitudinal studies should confirm causality and intervention

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trials should test strategies like extended maternity leave or community support programs to optimize maternal outcomes.

Key Implications for Healthcare Professionals

- Integrate lactation support with routine PPD screening within 6-12 weeks postpartum
- Offer tailored counseling for cesarean mothers to address breastfeeding challenges and emotional recovery
- Leverage family networks to enhance home support, particularly in high-risk cases

Contribution to Research

This study bridges global PPD research with Saudi-specific insights, highlighting modifiable factors amenable to intervention and challenging universal assumptions (e.g., BMI trends).

Future Research Directions

- Conduct prospective cohort studies to establish the temporal relationship between breastfeeding and PPD
- Design randomized controlled trials to evaluate breastfeeding promotion programs' impact on PPD rates
- Explore qualitative maternal experiences to understand barriers to breastfeeding and support in Saudi Arabia

Conflict of Interest

The authors declare no conflicts of interest. No personal, financial, or professional relationships influenced the design, execution, or reporting of this study. All researchers acted independently to ensure objectivity.

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