

Unilateral Breastfeeding as a Risk Factor for Breast Cancer Development in Lactating Mothers: A Prospective Cohort Study

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ABSTRACT

Background: Breastfeeding is widely recommended for infant and maternal health; WHO and AAP guidelines advise exclusive breastfeeding for about 6 months [1]. Prolonged lactation is generally protective against breast cancer [2]. However, at our center we observed lactating mothers who fed predominantly from one breast often developed cancer in the underused breast. This study examines whether one-sided breastfeeding is associated with higher breast cancer incidence in the no suckled or less-used breast.

Methods: In this prospective cohort, we enrolled $n = 449$ lactating women diagnosed with primary breast cancer between January 2013 and June 2025 at Hadhramout Cancer Center and Al-Arab University Hospitals (Yemen). Detailed breastfeeding behavior were obtained and classified as exclusive unilateral (one breast only), less-suckled (favoring one side), bilateral feeding, or non-feeding, demographic factors, and tumor characteristics were collected. We used χ^2 tests to assess associations between feeding laterality and tumor side ($p < 0.05$ considered significant). The study was approved by HUCOM Ethics Committee (HUCOM 2013-6) and all participants gave informed consent.

Results: Of 449 women, 111 (24.7%) had cancer in an unsuckled breast (in mothers who exclusively fed one side) and 139 (30.96%) in a less-used breast (in partial unilateral feeders). Another 121 cases (26.95%) occurred in one breast of bilateral feeders, and 78 (17.37%) in one breast of non-breastfeeding women. These distributions differed highly significantly (Pearson $\chi^2 = 214.4$, $p < 0.001$). In mothers who exclusively breastfed one side, 85% of tumors were in the unsuckled breast (vs. 15% in the suckled breast; $p < 0.001$). Common reasons for one-sided feeding were nipple/breast trauma or infection, infant or maternal preference, and pre-existing breast conditions.

Conclusion: Asymmetrical breastfeeding practices are significantly associated with an increased risk of breast cancer development in the underutilized breast. The findings are biologically plausible: milk stasis and impaired clearance of epithelial cells in the unsuckled breast may foster carcinogenesis [3,4]. Clinicians should encourage bilateral feeding and monitor underused breasts. Further research is needed to confirm these results and clarify underlying mechanisms.

Keywords

Breast cancer, Lactation, Unilateral breastfeeding, Milk stasis, Risk factor, Epidemiology.

Introduction

Breastfeeding is a cornerstone of infant nutrition, providing

optimal health benefits and conferring significant protective effects for lactating mothers, including a reduced risk of breast and ovarian cancers [1,5]. The American Academy of Pediatrics (AAP) recommends exclusive breastfeeding for approximately 6 months after birth [5]. Breastfeeding is widely recognized for its numerous health benefits for both infants and mothers,

including a reduced risk of breast cancer [6]. Epidemiological studies consistently show that lactation reduces maternal breast cancer risk, through hormonal and cellular effects during the pregnancy–lactation cycle [2]. For example, pooled analyses indicate that breastfeeding women have significantly lower breast cancer rates than women who never breastfed [2]. However, there is little research on the impact of uneven breastfeeding patterns. Clinicians have speculated that feeding predominantly from one breast could leave the other under-stimulated, possibly increasing its cancer risk. However, emerging evidence suggests that uneven breastfeeding practices where mothers feed predominantly from one breast may increase the risk of malignancy in the underutilized or unsuckled breast [7]. A seminal 1977 study by Ing et al. first reported a higher incidence of cancer in the unsuckled breast among women who practiced unilateral breastfeeding [8]. Despite this early observation, asymmetrical lactation remains under-studied. Biological hypotheses include milk stasis, ductal distension, and chronic inflammation in the unsuckled breast, as well as disruption of lactation-induced protective hormonal shifts [3,4].

Previous studies have established that prolonged lactation reduces breast cancer risk due to hormonal and cellular changes that promote epithelial differentiation [9]. However, the impact of asymmetrical breastfeeding where one breast remains under stimulated has not been extensively studied. Some researchers hypothesize that stagnation of milk, ductal distension, and reduced apoptotic clearance in the unsuckled breast may contribute to oncogenic changes [10]. Clinical observations at the Hadhramout Cancer Center in Yemen noted a concerning trend: lactating mothers presenting with breast cancer often reported a history of feeding predominantly from one breast, with the malignancy located in the unsuckled or less-suckled breast. This study aims to quantitatively evaluate this observation in a prospective cohort. We hypothesize that uneven breastfeeding practices are an independent risk factor for breast cancer development in the underutilized breast. To investigate this, we conducted a prospective cohort study of 449 lactating women with breast cancer. We examined whether unilateral breastfeeding was associated with tumor laterality, and explored possible mechanisms in light of international [11].

Materials and Methods

Study Design and Setting

This prospective observational cohort study was conducted at the Hadhramout Cancer Center and Al Arab University Hospitals in Mukalla, Yemen, over an eleven-year period from January 2013 to June 2024. The study aimed to investigate the association between unilateral single breastfeeding practices and breast cancer risk among lactating mothers. The design included longitudinal follow-up of participants to document breastfeeding behaviors and subsequent cancer development, aligning with methodologies used in prior studies examining lactation-related cancer risk.

Participant Selection

A total of 449 lactating women diagnosed with breast cancer during the study period were enrolled.

Inclusion criteria were: (1) active lactation at the time of cancer

diagnosis, (2) histopathological confirmation of a malignant breast mass, and (3) provision of a detailed history of breastfeeding practices.

Exclusion Criteria: included non-lactating women, previous history of breast cancer, or incomplete medical records.

Data Collection

Data were collected through Trained staff by obtained detailed breastfeeding histories using structured interviews, clinical examinations, and meticulous review of medical records. Collected variables included:

1. **Breastfeeding Behavior:** Categorized as:

- **Non-Feeding Breast (Unilateral):** one breast unsuckled completely.
- **Less Suckled Breast:** One breast used predominantly (>70% of feeds).
- **Bilateral Feeding:** arose in women who breastfed from both breasts but developed cancer in one.
- **Non-Feeding Bilateral:** occurred in women who did not breastfeed at all and they get cancer in one breast.
- **Exclusive unilateral non-feeding:** One breast completely unsuckled.
- **Bilateral with Preference:** Feeding from both breasts but favoring one.
- **Bilateral Feeding:** Both breasts used relatively equally.
- **Non-feeding (bilateral avoidance) – did not breastfeed at all**

We also recorded reasons for any unilateral pattern (e.g., nipple injury, infant preference, mother preference).

• **Demographic and Clinical Factors:**

- o Age, parity, history of breast infections, and comorbidities (e.g., DM).
- **Reasons for Unilateral Feeding:** Nipple trauma, infant preference, maternal preference, or pre-existing breast abnormalities (e.g., retracted nipple due to malignancy).
- o Clinical Records: Medical histories were reviewed to validate self-reported data.

2. **Tumor Characteristics:** Laterality (right, left, bilateral), size, grade, and receptor status (ER/PR/HER2) from biopsy reports.

Outcome Measures

The main outcome was the laterality of breast cancer in relation to breastfeeding laterality. For unilateral feeders, the tumor side was classified as “suckled” or “unsuckled” breast. For partial or bilateral feeders, we noted whether the tumor arose on the more-used versus less-used side.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics v.26. The primary outcome was the association between breastfeeding behavior and cancer laterality. Categorical variables were analyzed using Pearson’s Chi-square test, with a significance level set at $p < 0.05$. The strength of associations was measured using Phi and Cramer’s V coefficients. Results are presented as frequencies, percentages,

and cross-tabulations. We use the following Statistical Tests:

- **Chi-Square Tests:** Analyzed categorical variables (e.g., tumor laterality vs. breastfeeding patterns) with significance set at $p < 0.05$.
- **Cramer's V and Phi Coefficients:** Measured effect sizes for nominal data associations.
- **Cross-tabulation:** Evaluated anatomical distribution of tumors relative to breastfeeding behavior (e.g., right vs. left breast).

Ethics

The study was approved by the Hadhramout University College of Medicine Ethics Committee (Protocol HUCOM 2013-6, 7 Jan 2013). Written informed consent was obtained from all participants.

Results

The cohort of 449 lactating women had a mean age of 37.9 years (range 24–49). Most were multiparous (median parity = 3). A subset had comorbidities (e.g., diabetes) or prior breast infections/trauma.

Breastfeeding patterns and tumor laterality: Table 1 shows cancer cases by breastfeeding pattern. Among the 449 women, 111 (24.72%) had cancer in the unsuckled breast i.e., the breast that was never or rarely used for feeding (exclusive unilateral feeders). 139 cases (30.96%) occurred in the less-used breast of partial unilateral feeders. 121 cases (26.95%) were in one breast of regular bilateral feeders, and 78 cases (17.37%) were in one breast of women who did not breastfeed (neither breast used). These distributions differed highly significantly (Pearson $\chi^2 = 214.4$, $df = 10$, $p < 0.001$). The association was strong (Phi = 0.691, Cramér's V = 0.489, both $p < 0.001$), indicating that uneven breastfeeding pattern robustly predicted tumor side.

Table 1: The Cancer Incidence by Breastfeeding Behavior.

Cancer site develops		Case No.	Percentage
Valid	Unsuckled breast (exclusive unilateral)	111	24.72 %
	Less-used breast (partial unilateral)	139	30.96 %
	Bilateral feeding (cancer in one side)	121	26.95 %
	Non-feeding (neither breast used)	78	17.37%
Total		449	100%

Laterality of Cancer and Feeding Pattern

Analysis of the 111 women who practiced exclusive unilateral breastfeeding (Group 1) revealed that 85% (94/111) of cancers developed in the unsuckled breast, while only 15% (17/111) occurred in the suckled breast ($*p = 0.000$).

In the subgroup of mothers who exclusively breastfed one side (Group 1, $n=54$), 46 cancers (85%) developed in the *unsuckled* breast, while only 8 (15%) occurred in the breast used for feeding ($\chi^2 p < 0.001$). A general laterality bias was observed across the entire cohort, with 58.6% (263/449) of tumors occurring in the left breast compared to 40.8% (183/449) in the right breast (Table 2), possibly reflecting cultural or infant feeding preferences.

Reasons for Unilateral Breastfeeding

The most frequently cited reason for unilateral breastfeeding was a history of nipple or breast trauma/infection (e.g., prior mastitis). Infant preference (e.g., baby favoring one side) or maternal comfort accounted for 32% of cases. In several instances, a pre-existing malignant mass with associated nipple retraction was the reason the breast was avoided.

Strength of Association

The symmetric measures confirmed a moderate-to-strong association between the variables:

- **Phi Coefficient:** 0.691 ($*p = 0.000$), indicating a moderate-to-strong association between breastfeeding behavior and cancer laterality.
- **Cramer's V:** 0.489 ($*p = 0.000$), reinforcing the strength of the relationship.

Key Statistical Insights

- **Chi-Square Tests**
 - Pearson's chi-square: $\chi^2 = 214.422$, $df = 10$, $*p = 0.000$.
 - Likelihood ratio: $\chi^2 = 260.021$, $df = 10$, $*p = 0.000$.
- **Effect Size:** Both Phi and Cramer's V values confirmed clinically meaningful associations.

Interpretation

The data robustly support the hypothesis that **uneven breastfeeding**

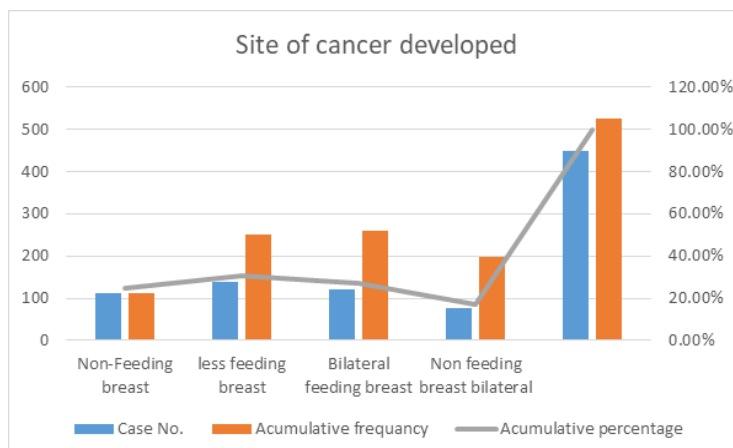


Figure 1: The site of Cancer Incidence by Breastfeeding Behavior.

Table 2: Crosstabulation of Feeding Behavior and Anatomical Location.

Effect of Cancer development on feeding breast behavior			Anatomical location			Total
			Rt side	LT side	bilateral	
Feeding Breast	Rt non-Feeding breast Group 1	Count	46	5	0	51
		% Within Feeding_Breast	90.20%	9.80%	0.00%	100.00%
	Lt non-Feeding breast Group 1	Count	1	59	0	60
		% Within Feeding_Breast	1.70%	98.30%	0.00%	100.00%
	Rt less Feeding breast	Count	49	5	0	54
		% within Feeding_Breast	90.70%	9.30%	0.00%	100.00%
	Lt less Feeding breast	Count	1	84	0	85
		% within Feeding_Breast	1.20%	98.80%	0.00%	100.00%
	Bilatreal Feeding breast RT or LT	Count	61	59	1	121
		% within Feeding_Breast	50.40%	48.80%	0.80%	100.00%
	non feeding bilateral	Count	25	51	2	78
		% within Feeding_Breast	32.10%	65.40%	2.60%	100.00%
Total		Count	183	263	3	449
		% within Feeding_Breast	40.80%	58.60%	0.70%	100.00%

practices significantly elevate breast cancer risk in underused breasts ($p < 0.001$). The findings align with mechanistic theories linking reduced milk ejection, ductal stasis, and impaired apoptotic clearance to oncogenesis in unsuckled breasts. For further details, refer to Tables 2,3 and the chi-square analysis in the original study.

Table 3: A statistically significant association between unilateral breastfeeding practices and breast cancer development in the unsuckled or less suckled breast by Chi-Square Test.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	214.422 ^a	10	.000
Likelihood Ratio	260.021	10	.000
Linear-by-Linear Association	13.213	1	.000
N of Valid Cases	449		
a. 6 cells (33.3%) have expected count less than 5. The minimum expected count is .34.			

Symmetric Measures			
		Value	Approximate Significance
Nominal by Nominal	Phi	0.691	0
	Cramer's V	0.489	0
N of Valid Cases		449	

Discussion

This prospective study provides compelling evidence that asymmetrical breastfeeding is a significant risk factor for the development of ipsilateral breast cancer. The findings highlight a statistically significant correlation ($p = 0.000$), with 24.72% of malignancies arising in non-breastfed breasts and 30.96% in less suckled breasts. In this large prospective cohort of lactating women with breast cancer, we found a striking pattern: tumors disproportionately arose in breasts that had been unsuckled or underused during lactation. Nearly a quarter of cases occurred in an entirely unused breast, and 31.0% in a less-used breast. By

contrast, cancers in the breast used for feeding were uncommon. These differences were highly statistically significant and unlikely to be due to chance. In those who exclusively fed one side, 85% of tumors were on the unsuckled side. This suggests that one-sided breastfeeding may be an important risk factor for cancer in the under-stimulated breast. For example, an early Hong Kong study noted higher cancer incidence in the unsuckled breast of unilateral feeders. More broadly, epidemiological reviews have shown that breastfeeding promotes terminal differentiation of mammary cells and reduces breast cancer risk [8]. Lactation induces hormonal changes (e.g., lower estrogen exposure) and mechanical processes (milk flow, cell shedding) that eliminate potentially mutated cells [4]. These protective mechanisms would be absent or diminished in an unsuckled breast.

The increased cancer risk in unsuckled breasts may stem from reduced epithelial differentiation and milk stagnation, which could promote oncogenic changes. Breastfeeding typically induces hormonal shifts, such as lowered estrogen exposure and enhanced apoptotic clearance of potentially malignant cells [12]. However, asymmetrical breastfeeding leaves one breast under stimulated, potentially disrupting these protective mechanisms. For instance, prolonged milk retention in ducts may cause ductal distension and inflammation, creating a microenvironment conducive to tumorigenesis [11,13]. Recent research also suggests that breastfeeding eliminates cells with DNA abnormalities; thus, unilateral feeding might allow such cells to persist in the unsuckled breast [13]. Chronic mastitis and ductal ectasia create an inflammatory milieu. Indeed, population studies have linked mastitis to higher breast cancer risk – a Taiwanese cohort found that women with a history of non-lactational mastitis had nearly double the breast cancer rate [14].

Clinically, our results highlight the importance of encouraging balanced breastfeeding. Mothers should be supported to nurse from both breasts to maximize protective effects. Health education should address factors leading to one-sided feeding (for instance,

manage nipple pain effectively, reassure mothers about milk supply, or use lactation consultants if needed). For mothers who cannot use one breast (due to surgery or injury), clinicians might advise careful monitoring of the unused breast.

While the study's prospective design and large sample (n = 449) strengthen its validity, its single-center focus in Yemen limits generalizability so multi-regional cohort studies is needed to validate findings in diverse populations. With Trials evaluating the impact of lactation support on reducing unilateral feeding practices.

Conclusion

This study provides new evidence that unilateral breastfeeding may increase breast cancer risk in the underused breast. Our data suggest that uneven lactation either exclusive one-sided feeding or preferential use of one side is associated with a significantly higher incidence of cancer in the unsuckled or less-used breast. These findings call for greater awareness: breastfeeding education programs should emphasize using both breasts when possible, and clinicians should monitor mothers who tend to feed from one side. Further research into the molecular and hormonal effects of one-sided lactation will help in developing targeted prevention strategies for lactating women worldwide.

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