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Systematic Review

Breastfeeding Impact on Cancer in Women: A Systematic Review

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Abstract

Introduction

Many studies have emphasized the impact of breastfeeding on the health of both the mother and the infant, especially its impact on the different types of cancers that can develop in the mother. Due to the ongoing conflict regarding whether or not breastfeeding reduces, increases, or has no impact on the risk of cancer, this systematic review was conducted to settle this conflict and shed light on the issue.

Methods

The CINAHL, PubMed/MEDLINE, Cochrane Library, Web of Science, and EMBASE databases were thoroughly searched to identify any studies published in the English Language up to November 25th, 2023.

Results

Out of the initial 170 papers the systematic search brought, 16 of them met all the criteria and were left to be included in the study. A sum of 29,100 patients were included in the study with 19,905 of them having breastfed. A total of 14,817 patients were developing different types of cancer and within them, breast cancer was the most frequent. Furthermore, there seemed to be a majority association between breastfeeding and cancer in the mother as most of the studies concluded that breastfeeding is observed to decrease the risk.

Conclusion

The majority of studies support the hypothesis that breastfeeding and breastfeeding duration both lower the risk of cancer, especially breast cancer, developed in the mother.

1. Introduction

Breast feeding, also referred to as nursing, is the physiological process whereby a mother feeds breast milk to her infant. This can be performed either directly from the breast or through pumping the breast and bottle-feeding the infant [1]. As far as contents go, it is made up of all of the nutrients required by an infant within the first 6 months of life [1,2]. Although the exact composition of human breast milk varies based on environmental factors such as the maternal diet, it is mainly composed of the necessary carbohydrates, fats, proteins, vitamins, minerals, and water the infant requires [2,3].

Furthermore, breastfeeding also provides the infant with the bioactive molecules that take part in organ development, microbial gut colonization, and immune maturation, among others [4]. According to the World Health Organization (WHO), breastfeeding is recommended to be initiated within the first hour of life, given exclusively for up to 6 months, and continued for 2 years; however, women usually do not breastfeed for the recommended time frame given by health experts [5,6]. This is very problematic not only for the infant but also for the mother since breastfeeding has been linked with numerous short-term and long-term health improvements in the mother [7]. In the short run, breastfeeding has been associated with postpartum weight loss in the mother, while in the long term, improvement in diabetes, metabolic, and cardiovascular health are among the benefits. One other benefit breastfeeding is associated with is cancers of the reproductive system in women. Breastfeeding has been observed to decrease the risk for reproductive cancers and this could be attributed to the reduced lifetime exposure to certain hormones like estrogen [8]. According to a meta-analysis conducted by the Collaborative Group on Hormonal Factors in Breast Cancer, both breastfeeding and the average lifetime duration of breastfeeding were inversely correlated with breast cancer [9]. On the contrary to the aforementioned studies, there are studies on the opposite end of this spectrum that found out that breastfeeding is associated with a more aggressive type of breast cancer as well as an earlier presentation [10].

As a result of the ongoing conflict on the impact of breastfeeding on cancer in the mother and the lack of a solid association establishment, we aim to conduct a systematic review with the hope of enlightening the literature with a more definitive correlation.

2. Methods

2.1. Study design

The guideline that was chosen in this systematic review was the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines.

2.2. Data sources and search strategy

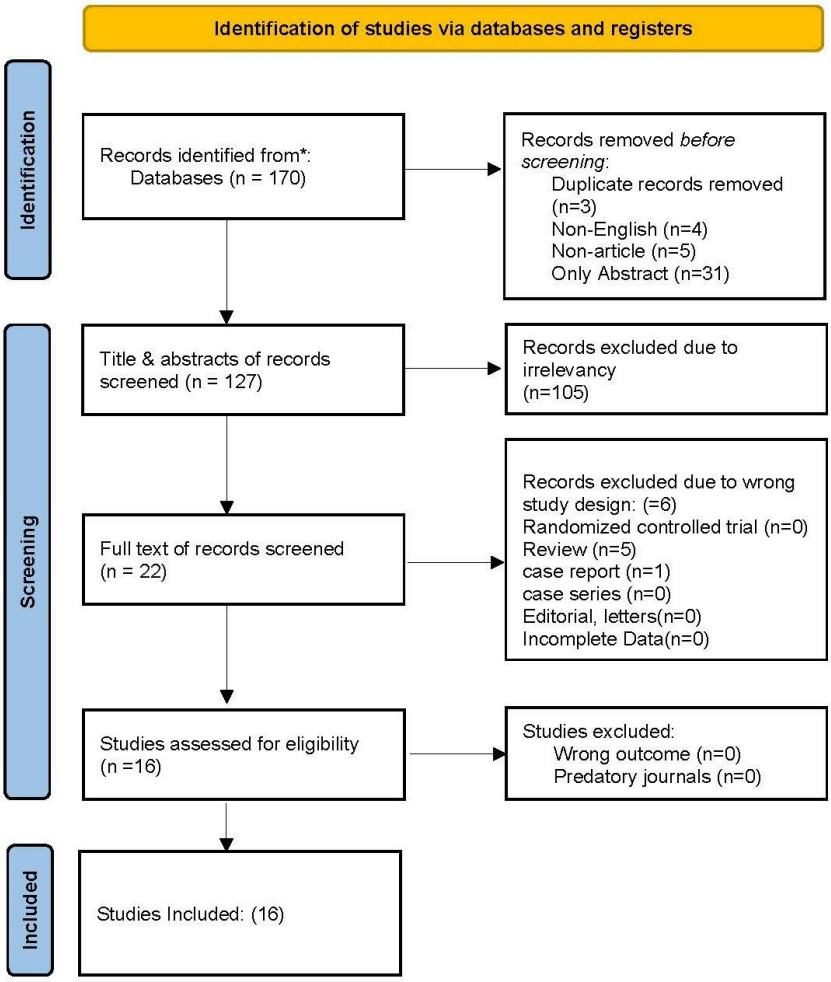

Figure 1. Study selection PRISMA flow chart.

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Table 1: Characteristics of the included studies and the different variables associated with cancer.

Author	Country	Study design	Publication date	N. of patients	Types of cancer developed	Age (year)			N.O. P.W. D.C	N.O. P.W. D.D.C	N.O. P.W. B	Risk factor associated with cancer							
												B.F.D.I.M		A.O.M.I.Y		Mean parity		BMI	
						<40	40-49	≥50				1-5	>5	<12	≥12	1-3	>3	Normal	Over-weight
Jernström et al. (12)	Canada	Cohort	2004	1930	Breast Cancer		39*		965	965	1930	3.5*		12.8*		1.87*		N/A	N/A
Andrieu et al. (13)	Germany	Cohort	2006	1601	Breast Cancer		41.5*		853	748	1249	365	478	N/A	N/A	1138	132	N/A	N/A
Redondo et al. (14)	Spain	Cohort	2012	510	Breast Cancer		54.7*		510	0	357	7.1*		13.2*		2.3*		N/A	N/A
Anderson et al. (15)	South Africa	Case Control	1975	688	Breast Cancer	81	143	464	347	341	616	N/A	N/A	N/A	N/A	330	301	N/A	N/A
Abdou-Daoud et al. (16)	Lebanon	Case Control	1971	901	Breast Cancer		48.7*		389	512	901	63.9*		N/A	N/A	71	105	N/A	N/A
Mengesha et al. (17)	Ethiopia	Case Control	2015	434	Breast Cancer		44.9*		217	217	326	N/A	N/A	15	414	N/A	N/A	N/A	N/A
Sangaramoorthy et al. (18)	United States	Case Control	2020	5957	Breast Cancer	305	850	1548	2703	3254	4398	11.0*		1308	4649	3756	2201	1284	4372
Gustbée et al. (10)	Sweden	Cohort	2013	592	Breast Cancer		59.9**		592	0	592	N/A	N/A	N/A	N/A	N/A	N/A	312	277
Afzal at al. (19)	United States	Case Control	2017	100	Breast Cancer		N/A		50	50	50	N/A	N/A	5	95	N/A	N/A	64	36
Do et al. (20)	Korea	Case Control	2000	229	Breast Cancer	54	79	86	108	121	198	N/A	N/A	N/A	N/A	94	94	104	125
Lehman et al. (21)	United States	Case Control	2014	2546	Breast Cancer		54*		2546	2546	1871	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Newcomb et al. (22)	United States	Case Control	2000	2239	Endometrial Cancer	0	116	2122	586	1653	1159	640	499	N/A	N/A	N/A	N/A	886	1169
Ing et al. (23)	Japan	Cohort	1977	2403	Breast Cancer		N/A		2403	2403	1441	12.0*		16*		4.0*		N/A	N/A
Jordan et al. (24)	United States	Case Control	2012	2226	Epithelial Ovarian Cancer		N/A		881	1345	1583	878	705	N/A	N/A	1843	383	1824	382
Titus-Ernstoff et al. (25)	United States	Case Control	2009	2475	Ovarian Cancer		54.5*		1231	1244	898	573	325	N/A	N/A	N/A	N/A	N/A	N/A
Gwinn et al. (26)	United States	Case Control	1990	4269	Epithelial Ovarian Cancer		N/A		436	3833	2336	954	978	3364	886	2230	1130	N/A	N/A

** Mean,** Median, N.O.P.W.B: Number of Patients Who Breastfed, B.F.D.I.M: Breast Feeding Duration in Months, N.O.P.W.D.C: Number of Patients Who Developed Cancer, N.O.P.W.D.D.C: Number of Patients Who Didn't Developed Cancer, T.O.C.D: Type of Cancer Developed, A.O.M.I.Y: Age of Menarche In Years, N.O.P.I.M: Number of Patients in Menopause, A.O.P: Age of Pregnancy, O.C.P: Oral Contraceptive Pills, B.M.I: Body Mass Index (Normal = 18.5-24.9), (Overweight= ≥25)*

Table 1: Continued…

Risk Factor Associated with Cancer					
BRCA1/ BRCA2 Mutation	Smoker	OCP	P.I.	N.O. M	
685/280	346	673	N/A		
1601	N/A	N/A	373		
N/A	N/A	N/A	N/A		
N/A	N/A	N/A	395		
N/A	N/A	N/A	N/A		
N/A	217	N/A	273		
N/A	N/A	1618	1547		
N/A	130	N/A	N/A		
N/A	N/A	N/A	56		
N/A	N/A	N/A	102		
N/A	N/A	637	N/A		
N/A	1262	N/A	N/A		
N/A	N/A	N/A	1019		
N/A	1089	N/A	N/A		
N/A	N/A	1011	1854		
N/A	N/A	2512	N/A		

Through the CINAHL, PubMed/MEDLINE, Cochrane Library, Web of Science, and EMBASE databases, a systematic search was conducted to identify studies published up to November 25th, 2023. The search was done using these keywords: (breastfeeding cancer OR Breastfed OR metastatic OR metastasis OR metastases OR cancers OR carcinoma OR lactation OR malignancy OR malignant OR carcinomas). The search was limited to studies in the English language.

2.3. Eligibility criteria

Only studies that met these inclusion criteria were included in this systematic review: 1) Studies that were either a cohort or a case-control study. 2) The study included patients who breastfed. 3) The association of breastfeeding was studied with the probability of developing cancer in the mother.

2.4. Study selection and data items

Two different researchers first worked on screening the titles and the abstracts of the mentioned studies and selecting them based on the previously mentioned inclusion criteria. Whenever there was a disagreement or a conflict among the researchers, a third researcher joined in to settle the conflict

2.5. Data items

Multiple data were collected from the included articles, including the year of publication, first author, country, study design, breastfeeding, breastfeeding duration, number of patients who developed cancer, type of cancer-associated, age of menarche, parity, BRCA1/BRCA2 mutation, use of oral contraceptive, smoking, and menopausal status.

2.6. Data analysis and synthesis

The extracted data were used in qualitative synthesis. They were re-analyzed using the Statistical Package for Social Sciences (SPSS) 26.0 software for quantitative synthesis. Summary tables with relevant variables were designed which were presented as frequency, mean, and percentage.

3. Results

3.1. Study selection

The systematic search initially came up with a total of 170 articles. Before further screening, 3 duplicates, 4 non-English, 31 only abstract articles, and 5 non-articles were removed from the 170 papers. Among the remaining 127, titles and abstracts were screened, of which a further 105 studies were excluded since they were irrelevant. Out of the remaining 22 articles that were screened, a total of 6 of them were excluded as a result of the wrong study design. This left only 16 articles to be screened to find possible wrong outcomes or predatory journals; However, none were found. Finally, the remaining 16 articles were all deemed eligible and were included in the systematic review. The detailed PRISMA flow chart is shown in Figure 1.

3.2. Characteristics of the included studies

All of the studies included in this review were either a cohort or a case-control study. Out of the 16 studies, 7 of them were conducted in the United States making it the most contributing country. Apart from the United States, other countries such as Canada, Germany, Spain, South Africa, Lebanon, Ethiopia, Sweden, Korea and Japan were all included. Table 1 provides all of the necessary information regarding the studies included.

3.3. Participants

A total of 29,100 patients were included in this systematic review. Among the patients with known age groups, those with an age of 50 or more years were the most common. Furthermore, breast cancer was found to be by far the most common form of cancer associated with breastfeeding, followed by ovarian and then endometrial cancer. Out of the 29,100 patients, a total of 19,905 of them breastfed making up 68.4% of the patients. Number of patients developing all types of cancers was 14,817 with 69.7% of them breastfeeding.

3.4. Main findings

The United States researchers published 7 studies which was the country with the most (43.75%) number of studies. Eleven studies (68.75%) were case-control, and 5 (31.25%) studies were cohort (table 1`). Among the 14,817 patients who developed cancer, 11,688 (78.9%) were breast cancer followed by ovarian cancer (2548, 17.2%) (Table 2). Of those 14,817 patients who developed cancer, 10,327 of them reported a history of breastfeeding making up (69.7%) of the cancer patients. Among the total 16 studies, 12 (75%) of them conclude that breastfeeding decreases the risk of cancer, 3 of them (18.75%) conclude that there is no significant association while

1 study (6.25%) implies that breastfeeding is observed to be associated with a more aggressive type of breast cancer (table 3).

Table 2: Frequency and percentages of different variables such as age group, country of study, study design, type of cancer developed, breastfeeding and its duration, BMI, smoking, OCP, Menopausal status, BRCA1/BRCA2 mutations as well as the final conclusion provided in the studies regarding the association between breastfeeding and cancer.

Variables	Number of patients (29,100)	References [10-25]
Age	Number of patients (29,100)	
<40	440 (1.5%)	[14,17,19,21]
40 – 49	1,188 (4.1%)	[14,17,19,21]
≥50	4,220 (14.5%)	[14,17,19,21]
Others	23,252 (79.9%)	[10-13,15,16,18,20,22-25]
Country of study	Number of studies (16)	
Canada	1 (6.25%)	[11]
Germany	1 (6.25%)	[12]
Spain	1 (6.25%)	[13]
South Africa	1 (6.25%)	[14]
Lebanon	1 (6.25%)	[15]
Ethiopia	1 (6.25%)	[16]
United States	7 (43.75%)	[17,18,20,21,23-25]
Sweden	1 (6.25%)	[10]
Korea	1 (6.25%)	[19]
Japan	1 (6.25%)	[22]
Study design	Number of studies (16)	
Cohort Study	5 (31.25%)	[10-13,22]
Case Control	11 (68.75%)	[14-21,23-25]
Type of Cancer Developed	Patients with Cancer (14,817)	
Breast Cancer	11,688 (78.9%%)	[10-20,22]
Endometrial Cancer	586 (3.95%)	[21]
Ovarian Cancer	2548 (17.2%)	[23-25]
Breast Feeding	Number of Patients (29,100)	
Patients who breastfed	19,905 (68.4%)	[10-25]
Patients who did not breastfed	9,195 (32.4%)	
Breast Feeding Duration	Number of patients who breastfed (19,905)	
1-5 months	3,410 (17.1%)	[12,21,23-25]
>5 months	2,985 (15%)	[12,21,23-25]
Others	13,510 (67.9%)	[11,13-20,22,24]
BMI	Number of Patients (10,835)	
Normal	4,474 (41.3%)	[10,17-19,21,23]
Overweight	6,361 (58.7%)	
Others	Number of Patients (29,100)	
Smoker	3,044 (10.5%)	[11,16,10,21,23]
Oral Contraceptive Pill	6,451 (22.2%)	[11,17,20,24,25]
No of patients in Menopause	5,619 (19.3%)	12,14,16-19,22,24]
BRCA1/BRCA2 Mutation	2,566 (8.8%)	[11,12]

Table 2: Continued...

Breast feeding association on cancer	Number of studies (16)	
Increases the risk	1 (6.25%)	[10]
Decreases the risk	12 (75%)	[11,13,14,16,17,19-25]
Has no impact	3 (18.75%)	[12,15,18]

4. Discussion

Breastfeeding is considered the most important protective factor for the lives of infants [26]. Murphy et al. conducted a study to investigate the impact of exclusive breastfeeding for a minimum duration of 90 days and the incidence of illness in infants. The findings indicated that breastfeeding for 90 days and more was associated with a significant decrease in the likelihood of being admitted to the hospital, the number of nights spent in the hospital, and also the proneness for developing respiratory diseases such as chest infections, asthma, and common colds [27]. Furthermore, many studies emphasize the role of breastfeeding in the immune development of the infant since the primary milk produced by the mother is rich in immunologically active molecules and various other key nutrients and vitamins [26]. Breastfeeding the infant early in life has been observed to result in developed immunity against numerous diseases while also keeping the infant devoid of malnutrition issues [28,29]. Despite the many known benefits of breastfeeding, it is found that only 37% of children younger than 6 months are breastfed exclusively in low- and middle-income countries and that the prevalence of breastfeeding at 12 months is lower than 20% in the majority of the high-income countries [30]. In our review and among the 29,100 patients included, 19,905 patients which made up 68.4% of the total patients breastfed.

These data indicate that breastfeeding has not yet reached the optimal prevalence in the majority of the countries globally and as previously focused on, this poses a problem not only for the infants but also for the mother due to the many health benefits the mother can obtain from breastfeeding [26,27]. According to Victoria et al., 823,000 deaths in children younger than the age of 5 and up to 20,000 deaths from breast cancer can be prevented each year only by scaling up the level of breastfeeding to a near-universal level [30]. Breastfeeding has many impacts on both the physiological and the psychological health of the mother. According to Labbok, breastfeeding can reduce the amount of postpartum blood loss by increasing the rate at which the uterine contracts. Furthermore, it can lower the severity of anemia while also mediating certain physiological changes that can protect the mother against infections, especially bladder. Interestingly, breastfeeding is seen to lower the risk of spinal and hip fractures in postmenopausal women despite the apparent bone loss [31]. Psychologically, breastfeeding mothers do report lowered stress, negative mood, and anxiety when compared to mothers who are stuck to formula feeding [32]. Among the many impacts of breastfeeding on the mother's health, the association of breastfeeding by the mother and its correlation with the different types of cancer developed in the mother is the one of utmost importance.

Cancers of the reproductive system such as ovarian and breast cancer are among the most commonly correlated cancers with breastfeeding. Among the 14,817 patients who developed breast cancer in our review, breast cancer was observed to be the most common form of cancer with 11,688 (78.9%) of the patients developing it, followed by ovarian cancer with 2548 (17.2%) patients and endometrial cancer with 586 (3.95%) patients. Many studies conclude that breastfeeding results in a lower risk of developing cancers of the reproductive system, especially of the breast. This could be attributed to the endogenous hormonal changes lactation inflicts, mainly the lowering of estrogen and the increase of prolactin production. This will lower the overall lifetime exposure to estrogen which then thereby indirectly inhibits the growth of cancer cells in the breast [33]. Other studies focus on other roles of lactation such as the extended terminal differentiation of the mammary gland epithelial cells which can make the breast tissue more resistant to carcinogenic and subsequently reduce the risk of breast cancer [34]. Oral contraceptive pills (OCP) are also frequently assessed to determine their impact on cancer development due to their significant hormonal changing properties. Information regarding OCP and various other factors such as smoking, menopausal status, BMI, and the presence of BRCA1/BRCA2 mutations have all been gathered in this review and listed in Table 2.

According to Stordal et al., for every 12 months of breastfeeding, the risk of developing breast cancer is reduced by 4.3% [35]. Other studies have further emphasized this inverse relationship of breastfeeding duration with the development of breast cancer. Gajalakshmi et al. conducted a study that revealed a statistically significant linear trend between the duration of breastfeeding and the reduced risk of breastfeeding [36]. Within our patients, only 3,410 (17.1%) out of the total 19,905 patients who breastfed had a breastfeeding history of 1 to 5 months while the other patients mostly had longer durations. Ovarian cancer is another form of cancer in the mother that seems to be associated with breastfeeding so much so that women with a breastfeeding history of more than 13 months are found to be 63% less likely to develop ovarian tumors when compared to women with a breastfeeding history of less than 7 months [37]. Jordan et al. also performed a study to study the association between breastfeeding and its duration with the risk of developing epithelial ovarian cancer. They concluded that among the women who breastfed, the longer the duration of breastfeeding, the lower the risk of developing ovarian cancer [23]. Other researchers such as Afzal et al. and Abdou-Daoud et al. similarly tried to study the relationship between breastfeeding and its role as a protective factor in reducing the risk of cancer in the mother; however, they found no significant role between them [15,18].

Table 3: Breastfeeding characteristics per study and the final conclusion the study yielded with regards to the hypothesis.

Study Authors	Number of patients in study	Number of patients who breastfed	Breast feeding duration		Number of patients who developed cancer	Type of cancer developed	Conclusion
			1-5 months	>5 months			
Jernström et al. (11)	1930	1930	3.5*		965	Breast Cancer	In women with BRCA1 mutation, 1 or more years of breastfeeding was associated with decreased risk of breast cancer by 45%.
Andrieu et al. (12)	1601	1249	365	478	853	Breast Cancer	Breastfeeding was not associated with the risk of breast cancer.
Redondo et al. (13)	510	357	7.1*		510	Breast Cancer	Breastfeeding is associated with reduced odds of triple negative breast cancer as compared to luminal A breast cancers.
Anderson et al. (14)	688	616	N/A	N/A	347	Breast Cancer	Breastfeeding probably protects premenopausal women from developing breast cancer, especially women of white ethnicity.
Abdou-Daoud et al. (15)	901	901	63.9*		389	Breast Cancer	Breastfeeding duration was not found to be a protective factor against breast cancer.
Mengesha et al. (16)	434	326	N/A	N/A	217	Breast Cancer	Breastfeeding was associated with reduced risk of both HR+ and ER-PR-breast cancer among Hispanic women.
Sangaramoorthy et al. (17)	5957	4398	11.0*		2703	Breast Cancer	Breastfeeding, among other factors such as family history of breast cancer and being in menopause, is associated with reduced risk of breast cancer.
Gustbée et al. (10)	592	592	N/A	N/A	592	Breast Cancer	Patients with excessive milk production seemed to have a more aggressive type of breast cancer as well as an earlier presentation.
Afzal at al. (18)	100	50	N/A	N/A	50	Breast Cancer	Breastfeeding did not have a significant role in breast cancer.
Do et al. (19)	229	198	N/A	N/A	108	Breast Cancer	Lactation and more importantly breastfeeding duration reduce the risk of breast cancer.
Lehman et al. (20)	2546	1871	N/A	N/A	2546	Breast Cancer	Breast feeding decreases the incidence of cancer.
Newcomb et al. (21)	2239	1159	640	499	586	Endometrial Cancer	Lactation is inversely correlated with breast cancer.
Ing et al. (22)	2403	1441	12.0*		2403	Breast Cancer	Three to fourfold increase in risk of cancer in the unsuckled breast for patients aged 55 and over.
Jordan et al. (23)	2226	1583	878	705	881	Epithelial Ovarian Cancer	Among women who have had the opportunity to breast feed, ever breast-feeding and increasing durations of episodes of breast-feeding are associated with a decrease in the risk of ovarian cancer
Titus-Ernstoff et al. (24)	2475	898	573	325	1231	Ovarian Cancer	Breastfeeding is strongly associated with decreased risk of ovarian cancer; however, this is mainly if the last-born child is breastfed.
Gwinn et al. (25)	4269	2336	954	978	436	Epithelial Ovarian Cancer	Breastfeeding is among the factors associated with decreased risk of epithelial ovarian cancer.

Contrary to the previously aforementioned studies, Gustbée et al. observed earlier presentation and even more aggressive form of breast cancer type amongst the women who breastfed when compared to those who did not [10].

5. Conclusion

We conducted this systematic review to shed light on the different conclusions researchers have gathered over the years regarding this matter. Out of the 16 studies included in this review, 12 (75%) of them show a reduced risk of cancer development in the mother when breastfeeding. Due to the other studies not reaching the same conclusion, we advocate other researchers to further study this topic to come up with a stronger correlation and possibly the settlement of this conflict.

Declarations

Conflicts of interest: The author(s) have no conflicts of interest to disclose.

Ethical approval: Not applicable.

Patient consent (participation and publication)**:** Not applicable.

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Authors' contributions: FHK was a major contributor to the conception of the study, as well as to the literature search for related studies. BAA, ASA, SO, and HOA were Involved in the literature review, the writing of the manuscript, and data analysis and interpretation. HMM, LRAP, and RMA Literature review, final approval of the manuscript, and processing of the tables. NHAA, KMH, AMM, and AMS were involved in the literature review, the design of the study, and the critical revision of the manuscript. BAA and FHK Confirmation of the authenticity of all the raw data. All authors approved the final version of the manuscript.

Data availability statement: Not applicable.

References

1. National Institutes of Health. About Breastfeeding and Breast Milk [Internet]. http://www.nichd.nih.gov/. 2017. Available from: https://www.nichd.nih.gov/health/topics/breastfeeding/conditioninfo
2. World Health Organization. The physiological basis of breastfeeding. Nih.gov. World Health Organization; 2009. Available from: https://www.ncbi.nlm.nih.gov/books/NBK148970/
3. Kim SY, Yi DY. Components of human breast milk: from macronutrient to microbiome and microRNA. Clinical and Experimental Pediatrics. 2020;63(8):301–9. doi:10.3345/cep.2020.00059
4. Camacho-Morales A, Caba M, García-Juárez M, Caba-Flores MD, Viveros-Contreras R, Martínez-Valenzuela C. Breastfeeding Contributes to Physiological Immune Programming in the Newborn. Frontiers in pediatrics. 2021;9:744104. doi:10.3389/fped.2021.744104
5. North K, Gao M, Allen G, Lee AC. Breastfeeding in a Global Context: Epidemiology, Impact, and Future Directions. Clinical Therapeutics. 2021;44(2). doi:10.1016/j.clinthera.2021.11.017
6. Johnston M, Landers S, Noble L, Szucs K, Viehmann L. Breastfeeding and the use of human milk. Pediatrics. 2012;129(3):e827-41. doi:10.1542/peds.2011-3552
7. Godfrey JR, Lawrence RA. Toward optimal health: the maternal benefits of breastfeeding. Journal of women's health. 2010;19(9):1597-602. doi:10.1089/jwh.2010.2290
8. Dieterich CM, Felice JP, O'Sullivan E, Rasmussen KM. Breastfeeding and Health Outcomes for the Mother-Infant Dyad. Pediatric Clinics of North America. 2013;60(1):31–48. doi:10.1016/j.pcl.2012.09.010
9. Collaborative Group on Hormonal Factors in Breast Cancer. Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, including 50 302 women with breast cancer and 96 973 women without the disease. The Lancet. 2002;360(9328):187–95. doi:10.1016/S0140-6736(02)09454-0
10. Gustbée E, Anesten C, Markkula A, Simonsson M, Rose C, Ingvar C, et al. Excessive milk production during breast-feeding prior to breast cancer diagnosis is associated with increased risk for early events. SpringerPlus. 2013;2(1). doi:10.1186/2193-1801-2-298
11. Jernström H, Lubinski J, Lynch HT, Ghadirian P, Neuhausen S, Isaacs C, et al. Breast-feeding and the Risk of Breast Cancer in BRCA1 and BRCA2 Mutation Carriers. JNCI: Journal of the National Cancer Institute. 2004;96(14):1094–8. doi:10.1093/jnci/djh211
12. Andrieu N, Goldgar DE, Easton DF, Rookus M, Brohet R, Antoniou AC, et al. Pregnancies, Breast-Feeding, and Breast Cancer Risk in the International BRCA1/2 Carrier Cohort Study (IBCCS). JNCI: Journal of the National Cancer Institute. 2006;98(8):535–44. doi:10.1093/jnci/djj132
13. Redondo CM, Gago-Domínguez M, Ponte SM, Castelo ME, Jiang X, García AA, et al. Breast Feeding, Parity and Breast Cancer Subtypes in a Spanish Cohort. Toland AE, editor. PLoS ONE. 2012;7(7):e40543. doi:10.1371/journal.pone.0040543
14. Anderson JD. Breast feeding and breast cancer. South African Medical Journal. 1975;49(13):479-82. *doi:N/A*
15. Abou-Daoud KT. Cancer of the breast and breast-feeding: Study of 279 porous women and matched controls. Cancer. 1971;28(3):781-4. doi:10.1002/1097-0142(197109)28:3%3C781::AID-CNCR2820280337%3E3.0.CO;2-B
16. Mengesha H. Association of Non Breast Feeding and Breast Cancer among Patients on Chemotherapy and Radiotherapy at Tikur Anbessa Specialized Hospital: A Case-Control Study(Doctoral dissertation, Addis Ababa University). *doi:N/A*
17. Sangaramoorthy M, Hines LM, Torres-Mejía G, Phipps AI, Baumgartner KB, Wu AH, et al. A Pooled Analysis of Breastfeeding and Breast Cancer Risk by Hormone Receptor Status in Parous Hispanic Women. Epidemiology. 2019;30(3):449–57. doi:10.1097%2FEDE.0000000000000981
18. Afzal S, Farooqui AA, Rizwan H, Akram A, Bajwa SA, Ul Rasool MH, et al. Effects of Breast Feeding and Nutritional Habits on Breast Cancer in Females. PAKISTAN JOURNAL OF MEDICAL & HEALTH SCIENCES. 2017;11(3):1078-81. *doi:N/A*
19. Do MH, Lee SS, Jung PJ, Lee MH. Breast Feeding and Breast Cancer Risk: A Case-control Study in Korea. Nutritional Sciences. 2000;3(2):77-82. *doi:N/A*
20. Lehman T, Shaik M, Modali R, Hrinczenko B. Effects of Breast-feeding and Oral Contraception on the Risk of Recurrence in Breast Cancer: A Multinational Study. *doi:N/A*
21. Newcomb PA, Trentham-Dietz A. Breast feeding practices in relation to endometrial cancer risk, USA. Cancer Causes & Control. 2000;11:663-7. doi:10.1023/A:1008978624266
22. Ing R, Ho JHC, Petrakis NicholasL. UNILATERAL BREAST-FEEDING AND BREAST CANCER. The Lancet. 1977;310(8029):124–7. doi:10.1016/S0140-6736(77)90131-3
23. Jordan SJ, Cushing-Haugen KL, Wicklund KG, Doherty JA, Rossing MA. Breast-feeding and risk of epithelial ovarian cancer. Cancer Causes & Control. 2012;23:919-27. doi:10.1007/s10552-012-9963-4
24. Titus-Ernstoff L, Rees JR, Terry KL, Cramer DW. Breast-feeding the last born child and risk of ovarian cancer. Cancer Causes & Control. 2010;21:201-7. doi:10.1007/s10552-009-9450-8
25. Gwinn ML, Lee NC, Rhodes PH, Layde PM, Rubin GL. Pregnancy, breast feeding, and oral contraceptives and the risk of epithelial ovarian cancer. Journal of Clinical Epidemiology. 1990;43(6):559–68. doi:10.1016/0895-4356(90)90160-Q
26. Alotiby AA. The role of breastfeeding as a protective factor against the development of the immune-mediated diseases: A systematic review. Frontiers in Pediatrics. 2023;11:1086999. doi:10.3389/fped.2023.1086999
27. Murphy S, Carter L, Al Shizawi T, Queally M, Brennan S, O'Neill S. Exploring the relationship between breastfeeding and the incidence of infant illnesses in Ireland: evidence from a nationally representative prospective

cohort study. BMC Public Health. 2023;23(1):140. doi:10.1186/s12889-023-15045-8
28. Donovan SM. The role of lactoferrin in gastrointestinal and immune development and function: a preclinical perspective. The Journal of pediatrics. 2016;173:S16-28. doi:10.1016/j.jpeds.2016.02.072
29. Cacho NT, Lawrence RM. Innate immunity and breast milk. Frontiers in immunology. 2017;8:584. doi:10.3389/fimmu.2017.00584
30. Victora CG, Bahl R, Barros AJ, França GV, Horton S, Krasevec J, Murch S, Sankar MJ, Walker N, Rollins NC. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. The lancet. 2016;387(10017):475-90. doi:10.1016/S0140-6736(15)01024-7
31. Labbok MH. Effects of breastfeeding on the mother. Pediatric Clinics of North America. 2001;48(1):143-58. doi:10.1016/S0031-3955(05)70290-X
32. Krol KM, Grossmann T. Psychological effects of breastfeeding on children and mothers. Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz. 2018;61(8):977. doi:10.1007/s00103-018-2769-0
33. Stordal B. Breastfeeding reduces the risk of breast cancer: A call for action in high-income countries with low rates of breastfeeding. Cancer Medicine. 2023;12(4):4616-25. doi:10.1002/cam4.5288
34. Gajalakshmi V, Mathew A, Brennan P, Rajan B, Kanimozhi VC, Mathews A, Mathew BS, Boffetta P. Breastfeeding and breast cancer risk in India: A multicenter case-control study. International journal of cancer. 2009;125(3):662-5. doi:10.1002/ijc.24429
35. Extended Breastfeeding Reduces the Risk of Ovarian Cancer [Internet]. OCRA. 2013. Available from: https://ocrahope.org/news/extended-breastfeeding-reduces-the-risk-of-ovarian-cancer/#:~:text=Women%20who%20had%20three%20children
36. Russo J, Russo IH. Toward a physiological approach to breast cancer prevention. Cancer epidemiology, biomarkers & prevention: a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology. 1994;3(4):353-64. doi:N/A
37. Byers TI, Graham S, Rzepka T, Marshall J. Lactation and breast cancer: evidence for a negative association in premenopausal women. American Journal of Epidemiology. 1985;121(5):664-74. doi:10.1093/aje/121.5.664