

Prevalence of Cracked Nipple and its Associated Factors during the Postpartum Period

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1.ABSTRACT

Background: Cracked nipples, as a complication associated with breast-feeding, are considered the most significant factor affecting the uptake and continuation of breastfeeding, especially in the first 30 days postpartum. **Aim:** This study aimed to estimate the prevalence of cracked nipple and its associated factors during the postpartum period. **Study design:** A descriptive cross-sectional study design was used. **Setting:** The study was carried out at Nabaroh Central Hospital and Nabaroh Health Care Center, Nabaroh, Egypt. **Study subjects:** A convenient sample of 817 postpartum women was utilized. **Tools:** Three tools were used: a structured interview questionnaire, a Nipple soreness rating scale, and a Cracked Nipples-Associated Factors questionnaire. **Results:** Nearly three-quarters of postnatal women had cracked nipples; more than one-third of women had 2nd and 3rd degrees of cracked nipples; nearly two-thirds of women had incorrect nipple attachment; and most women performed improper breastfeeding techniques. **Conclusion:** The prevalence of cracked nipples was high among the studied postpartum women and associated with women who were aged 20–30 years, unemployed women, delivered via caesarean section, not receiving guidance about breastfeeding during the 1st week of the postpartum period, incorrect nipple preparation during pregnancy, breast engorgement, incorrect breast care technique, feeding baby on demand, pulling the nipple from the baby's mouth by force after breastfeeding, using pacifiers, improper latch-on technique, improper body position technique during breastfeeding, and improper breastfeeding techniques. **Recommendation:** Designing nursing guidelines for pregnant and postpartum women about proper breastfeeding technique and cracked nipple prevention.

Keywords: Prevalence, Breastfeeding, Cracked nipples, Postpartum

2.Introduction

The postpartum phase is the period that starts as soon as a baby is born and lasts for approximately six weeks. It is a very special phase in the life of a newly delivered woman and newborn. It is the most significant, transformative, and life-altering occasion that brings forth intense emotions, physical changes, and modifications to the mother role (El-Salam & Ashour, 2020).

Breastfeeding is essential for the health of the child and the mother. The World Health Organization (WHO) advises mothers to start breastfeeding their newborn within the first hour of delivery (WHO, 2019). Breastfeeding positively affects the health of the nursing mother (Snyder & Worlton, 2021). These advantages include better postpartum recovery, fast weight loss after giving birth, a lower risk of postpartum depression, and a reduced risk of breast and ovarian cancer, which is

considered the most important benefit (Nagel et al., 2022). The ideal nutrition for newborns is breast milk. It is sterile, secure, and contains antibodies that help in the prevention of common pediatric illnesses (Neter & Bagants, 2020). Breastfeeding raises the intelligence quotient (IQ), increases school attendance, and is associated with increased income in later life (Vafadar, Masoumi, Shobeiri, & Mohammadi, 2022).

Early breastfeeding difficulties are common and present serious challenges to effective breastfeeding. Breast abscesses, mastitis, sore and cracked nipples, breast engorgement, and flat or inverted nipples are a few of the most typical breast issues. The majority of these issues start in the first or second postpartum week and can last for up to two months (Ozhuner & Ozerdogan, 2022). Nipples that are uncomfortable or cracked

are the second most prevalent reason to stop breastfeeding, according to mothers (Milinco et al., 2020).

A cracked nipple is defined as a macroscopic cutaneous lesion in the areas of the nipple and areola. Cracked nipple is an alteration in the normal anatomy of the nipple skin with the presence of a primary lesion that appears as a change in the color and thickness of the nipple skin (Nageeb, Fadel, & Hassan, 2018; Nakamura & Asaka, 2022).

Although lactating mothers have been reporting cracked nipples more frequently over time, the incidence and frequency of cracked nipples are still mostly unknown because the majority of studies have focused on prevention and therapy (Douglas, 2022). Cracked nipples are widespread and have a high prevalence, particularly in the first 30 days after birth. Cracked nipples affect between 26% and 52% of women, occur between the third and seventh postpartum days, and in some mothers may last as long as six weeks (Nageeb et al., 2018; Talae, Mohammadzadeh, & Rahimi, 2021).

The most frequent causes of cracked nipples have been shown to be improper positioning and attachment of the infant to the breasts, poor breastfeeding technique, breast engorgement, and depigmented nipples (Amir, Baeza, Charlamb, & Jones, 2021). Other potential causes of cracked nipples and pain include flat or inverted nipples, using soap to cleanse the nipple and minimizing sunshine, vitamin deficiencies, using a pacifier and feeding bottle, improper removal of the infant from the breast, using nipple shields, and changing the frequency or duration of feeds (Kent et al., 2015; Morais, Souza, Vieira, Bessa & Jesus, 2020; Niazi, Rahimi, Askari, Rahmanian-Devin & Askari, 2021).

Cracked nipples could be presented with a number of symptoms, including ulcerations, erythema, edema, fissures, damaged skin, ecchymosis, blisters, cracks, abrasions, and dark spots (Eksioglu, Yesil, Demir Gungor, & Ceber Turfan, 2017; Ismail, Hafez, & Ghaly, 2019). Lesions characterized by disruption of the skin in the nipple-areola region include *Abrasion*: excoriation of the skin that occurs, exposing a portion of the dermis, *cracked skin*: superficial skin lesions with involvement of the epidermis or *Fissure*: slit-like lesion with involvement of the upper dermis (Page, Emmott, & Myers, 2022).

Treatment of cracked nipples is a hard process because the infant continues to nurse and keeps being exposed to oral flora (Abdoli, Jenabi, Masoumi, Kazemi, & Moradkhani, 2020). The appropriate treatment of cracked nipples is based on eliminating the etiology and promoting the curing process. Positioning is the most common etiology, but repositioning cannot repair a significantly injured nipple without some medical attention (Rabadiya, Yadav, & Doss, 2021).

Avoiding shampoos and soaps, drying with air, not leaving colostrum on the nipple after feeding, preventing nipple abrasion, and wearing bras with the edges hanging on the breast are some common nipple care and treatment practices (Gharakhani Bahar et al., 2018). The nipple and surrounding area should be massaged, according to numerous publications. Vaseline and ointment are suitable substitutes. Health education about breastfeeding is essential in reducing breastfeeding problems (Anipindi, Field, Neville & Field, 2020; Coentro et al., 2021; Laageide, Radke, Santillan, Ten Eyck & Powers, 2021).

Maternity nurses play an essential role in giving women the knowledge and care they need about breastfeeding while also providing the mothers with physical, psychological, and emotional support (Piro & Ahmed, 2020). The nurse caring for the breastfeeding mother should be able to assist the woman in becoming independent and successful in her feeding attempts. The nurse can use their own resources to have a positive experience and assist women and their families (Abdullah et al., 2022).

2.1 Significance of the Study

Cracked nipples are the most important factor influencing the start and maintenance of breastfeeding in the initial postpartum weeks (Morais et al., 2020). Worldwide, the incidence of cracked nipples ranges from 34 to 96%; furthermore, 80 to 95% of women with cracked nipples experience some degree of nipple pain in the first week after childbirth, while 26% of them report severe pain (Masoudin, Shahnazi, Kamalifard, Shahrak & Esmacili, 2019; Sağlık & Kısacık, 2021). In Egypt, the prevalence of cracked nipples is 85.9%, about 65.4% of women have some level of nipple pain, and 38.3% of women express severe pain (Abdallah, Nour-Eldin, & Gad, 2018).

Up to one-third of women with cracked nipples may use alternative infant nutrition during the first six months after delivery (Oliveira,

Vieira, Guimarães, Aredes, & Campbell, 2021). Several factors affect exclusive breastfeeding for women suffering from cracked nipples. Identification of these factors contributes to the development of preventative actions that could minimize not only the appearance of cracked nipples but also their consequences. Therefore, this study was carried out to estimate the prevalence of cracked nipples and their associated factors during the postpartum period.

2.2 Aim of the Study

This study aims to estimate the prevalence of cracked nipple and its associated factors during the postpartum period.

2.3 Research Questions:

- 1) What is the prevalence of cracked nipple among postpartum women?
- 2) What are the factors associated with the occurrence of cracked nipple among postpartum women?

2.4 Operational definition:

Cracked nipple is defined in this study as the sensation of friction, irritability, and suction lesions of the nipple, which ranges from a discomforting sensation to extreme pain with physical trauma during sucking.

3. Subjects and method

3.1 Study design:

A descriptive cross-sectional study design was used to estimate the prevalence and factors associated with cracked nipples during postpartum. It inspects the prevalence of a disease or a condition in a defined population at a specific point or period in time without attempting to draw any inferences or offer any causes or the prevalence (**Wang & Cheng, 2020**).

3.2 Study Setting

This study was carried out at two health settings in Nabaroh city, Dakahlia governorate, Egypt, which were Nabaroh Central Hospital and Nabaroh Health Care Center. **Nabaroh Central Hospital** has five floors: the first floor includes the admission department and outpatient clinics; the second floor includes the operation department, nursery, laboratories, dialysis, ICU, and CCU; the third floor includes obstetrics, gynecology, cardiology, and medical departments; the fourth floor includes the NICU; pediatric and surgical departments; and the fifth floor includes housing for doctors and nurses and management

information offices. The hospital is open twenty-four hours a day, seven days a week. The flow rate of the obstetrics and gynecology departments is nearly 50 women per day. It provides care and follow-up care for pregnant, parturient, and postpartum women. **Nabaroh health care center** consists of two floors; the first floor includes a waiting hall and two rooms for infant and maternal immunization; the second floor includes four rooms (family planning services, laboratory investigations, a mother's breast examination to detect the need for artificial milk, and an infant follow-up room). The health center is open daily from Saturday to Wednesday, from 9 a.m. to 2 p.m., and nearly 30 women visit the center daily.

3.3 Sample Size

Based on data from the literature (**da Silva Santos et al., 2016**), to calculate the sample size with a precision/absolute error of 5% and a type 1 error of 5%:

$$\text{Sample size} = [(Z_{1-\alpha/2})^2 \cdot P(1-P)] / d^2$$

Where,

$Z_{1-\alpha/2}$ is the standard normal variate; at 5% type 1 error ($p < 0.05$), it is 1.96.

P is the expected proportion of the population based on previous studies.

d = absolute error or precision. So,

$$\text{Sample size} = [(1.96)^2 \cdot (0.32) \cdot (1-0.32)] / (0.032)^2 = 816.3$$

Based on the above formula, the sample size required for the study is 817.

3.4 Sample type

A convenient sample of 817 postpartum women who are breastfeeding and attended the previously mentioned settings was utilized.

3.5 Data Collection Tools

Data was collected using three tools:

Tool I: A Structured Interview Questionnaire:

This tool was developed by the researchers after reviewing the related national and international literature (**Altwalbeh, 2021; Bheeman, Leena, & Pushpalatha, 2021; Hassan, Kholy, Ateya, & Hassan, 2020**). It included two parts:

Part 1: General characteristics of the studied postpartum women, such as age, education, marital status, occupation, residence, and telephone number.

Part 2: Obstetric history of the studied postpartum women: such as (parity, gestational age, mode of delivery, age of baby (in days), place of birth)

Tool II: Nipple soreness rating scales (NSRs) This tool was adopted from **Ismail et al. (2019)** and used to assess the degree of nipple soreness. It was rated as normal nipple color, no tenderness = 0, nipple slightly red and/or tender for first 5-10 seconds of feeding = 1, nipple red and tender for longer than 10 seconds of feeding = 2, tender between feeding, makes mother grimace when baby starts feeding = 3, nipple beginning to crack involuntary gasps of pain when baby starts feeding = 4, nipple cracked, feels sore "down to my toes" when baby starts feeding = 5.

Tool III: Cracked Nipples Associated Factors Questionnaire: It was developed by the researchers after reviewing related literature (**Abdallah et al., 2018; Barbosa et al., 2018; da Silva Santos et al., 2016; Onubogu & Okari, 2021**) to identify factors associated with the occurrence of cracked nipples in the postpartum period. It included ten questions such as receiving guidance about breastfeeding, preparation of nipples during pregnancy, occurrence of breast engorgement, breast care technique, baby feeding time, technique of nipple withdrawal, use of pacifier, use of feeding bottle, attachment (latch-on technique), and body position technique of breastfeeding.

3.6 Validity of the tools:

Data collection tools were tested and juried for content validity by three specialists in the maternity nursing field. These specialists assessed the tool for clarity, relevance, and applicability. Changes were considered according to their comments, as certain sentences were simplified to be easily understood by the women.

3.7 Reliability of the tools:

The Cronbach's alpha value of the nipple soreness rating scale (NSRs) was 0.892 and of the cracked nipple associated factors was 0.901, which indicates the high reliability of the tools.

3.8 Pilot study

A pilot study was carried out on 81 women (10% of the sample size) who attended the previously mentioned settings. The goal of the pilot study was to evaluate the clarity and applicability of the tools used in the study prior to the start of data collection, as well as the time required for

response. The pilot findings were included in the sample size.

3.9 Field work:

The current study was carried out through three phases

1-Preparatory Phase

This phase was started by obtaining ethical approval from the head of the Woman's Health and Midwifery Nursing Department, followed by approval from the Research Ethics Committee at the Faculty of Nursing, Mansoura University, to perform the study. Official permissions were obtained from the directors of the predetermined settings to carry out the study after explaining the aim of the study. Tools for data collection were designed after reviewing national and international related literature. Then a pilot study was conducted on 81 postpartum women before collecting the actual sample. This phase took about one month, from the beginning of December 2021 to the beginning of January 2022.

2-Data collection phase

- The current study was carried out for five months, from the beginning of February 2022 to the end of June 2022.
- The researchers attended the previously mentioned settings three days weekly, from 9:00 a.m. to 2:00 p.m. The researchers introduced themselves to the women, explained the aim of the study, and obtained the women's consent to participate in the study after ensuring the confidentiality of the data.
- The researchers interviewed each woman individually for about 10–15 minutes in a comfortable room to collect general characteristics, obstetric histories of postpartum women, and nipple soreness rating scales (NSRs) to estimate the prevalence, degree, and factors associated with cracked nipples by using tools I, II, and III.
- The researchers asked the woman and recorded her answers on the data collection sheet.
- The researchers asked the women to breastfeed the children in front of them so that they were able to determine if the women performed correctly or incorrectly (latch-on, body position technique, breastfeeding technique).

- Women were permitted to ask for any interpretation or explanation.
- The researchers followed the recommended personal protective measures (wearing a mask, maintaining social distance, and disinfecting hands between each woman) during the data collection process, and privacy and safety were absolutely assured.
- Data were gathered by the researchers until the end of the data collection period.
- The researchers continued to attend the previously mentioned setting until the total sample was collected.

3.10 Data Analysis phase

All statistical analyses were performed using SPSS for Windows version 21.0 (SPSS, Chicago, IL). Continuous data were normally distributed and expressed as mean \pm standard deviation (SD). Categorical data were expressed in numbers and percentages. A chi-square test was used for the comparison of variables with categorical data. The reliability (internal consistency) test for the questionnaires used in the study was calculated using Cronbach's alpha. Statistical significance was set at $p < 0.05$.

3.11 Ethical consideration

An ethical approval was obtained from the head of the Woman's Health and Midwifery Nursing Department, followed by approval from the Research Ethics Committee at the Faculty of Nursing, Mansoura University, to perform the study. After the study's nature and objectives were made clear, each postpartum woman who would be participating in the study granted informed written consent before the study began. Anonymity, privacy, safety, and confidentiality were completely guaranteed throughout the whole study. Participants were made aware that taking part in the study was entirely voluntary and that they had the freedom to leave at any moment. Code numbers instead of the names of the postpartum women were used for identification. All sheets were burned once the data gathering was completed. The findings were used in the required research for a master's degree as well as for publications and educational purposes.

4. Results

Table 1 shows that the majority of women aged between 20 and 30 years had a mean of 26.3 ± 4.7 ; nearly half of them had middle education. In addition to being married (98.3%), about three-

quarters of women were housewives and came from rural residences.

Table 2 illustrates that more than half of women were multipara (2–3) and delivered via cesarean section. The majority of women had full-term gestation, with a mean of 38.1 ± 0.9 . 73.7% of women gave birth in a public hospital.

Figure 1. shows that 72.7% of women had cracked nipples to different degrees.

Figure 2. shows that more than one-third of women had 2nd and 3rd degrees of nipple soreness (nipple red and tender for longer than 10 seconds of feeding; tenderness between feeding makes mothers grimace when babies start feeding).

Table 3 displays that more than half of women didn't receive guidance about breastfeeding during the 1st week of the postpartum period, performed breast care incorrectly, used pacifiers, and bottle fed. While 85.6% of the women incorrectly prepared the nipple during pregnancy, Regarding the technique of nipple withdrawal, about two-thirds of women pulled the nipple from the baby mouth by force after breastfeeding and had breast engorgement. Regarding latch-on technique, 62.1% of women had incorrect nipple attachment (introduced nipple only into the baby's mouth during breastfeeding). Most women feed their babies on demand and perform improper body position techniques during breastfeeding.

Figure 3. displays that the majority of women received guidance about breastfeeding technique during the first week of postpartum from family and friends.

Figure 4. shows that most women had improper breastfeeding techniques.

Table 4 shows that there was a highly statistically significant association between sociodemographic characteristics, obstetric history of the studied postpartum women, and the prevalence of cracked nipples. Postpartum women who were aged 20–30 years, housewives, delivered via CS, multigravida, and multipara (2–3 times) had cracked nipples.

Table 5 shows that there was a highly significant statistical association between the prevalence of cracked nipples and its associated factors, such as not receiving guidance about breastfeeding during the 1st week of the postpartum period, incorrect nipple preparation during pregnancy, breast engorgement, incorrect breast care technique, feeding the baby on demand, pulling the nipple from the baby's mouth by force after feeding, using a pacifier, incorrect nipple attachment, and

improper body position technique during breastfeeding.

Table 1. General Characteristics of the Studied Postpartum Women

Items		
Age (years)		
< 20	40	4.9
20 – 30	656	80.3
31 – 40	121	14.8
Mean \pm SD	26.3 \pm 4.7	
Education		
Illiterate	22	2.7
Read and write	95	11.6
Middle education	370	45.3
High education	330	40.4
Marital status		
Married	803	98.3
Divorced	10	1.2
Widowed	4	0.5
Occupation		
Employed	208	25.5
Housewife	609	74.5
Residence		
Rural	652	79.8
Urban	165	20.2

Table 2. Obstetric History of Studied Postpartum Women

Items	N (n=817)	%
Parity		
Once	198	24.2
2 – 3 times	469	57.4
More than 3 times	150	18.4
Gestational Age		
Preterm	46	5.6
Full term	732	89.6
Post term	39	4.8
Mean \pm SD	38.1 \pm 0.9	
Mode of last Delivery		
Spontaneous vaginal delivery	359	43.9
Cesarean section	458	56.1
Place of birth		
Public hospital	602	73.7
Private hospital	215	26.3
Baby Age (Days)		
< 15	724	88.6
15 – 30	86	10.5

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31 – 45	7	0.9
Mean ±SD	9.0 ±5.1	

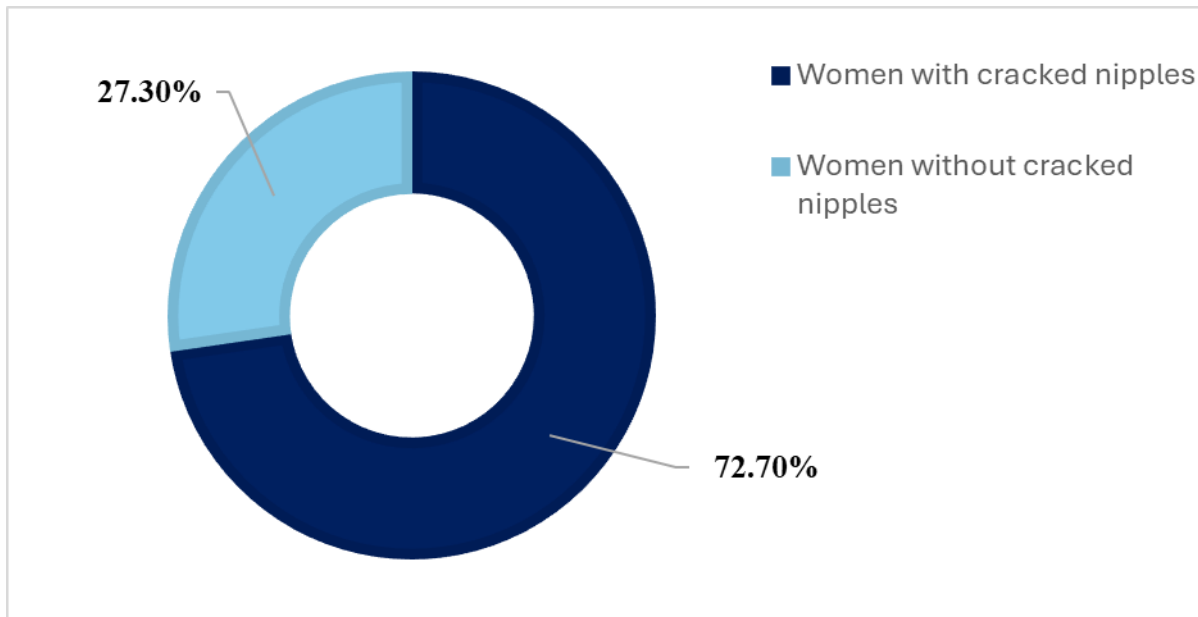


Figure 1. The prevalence of cracked nipples among studied postnatal women (n=817).

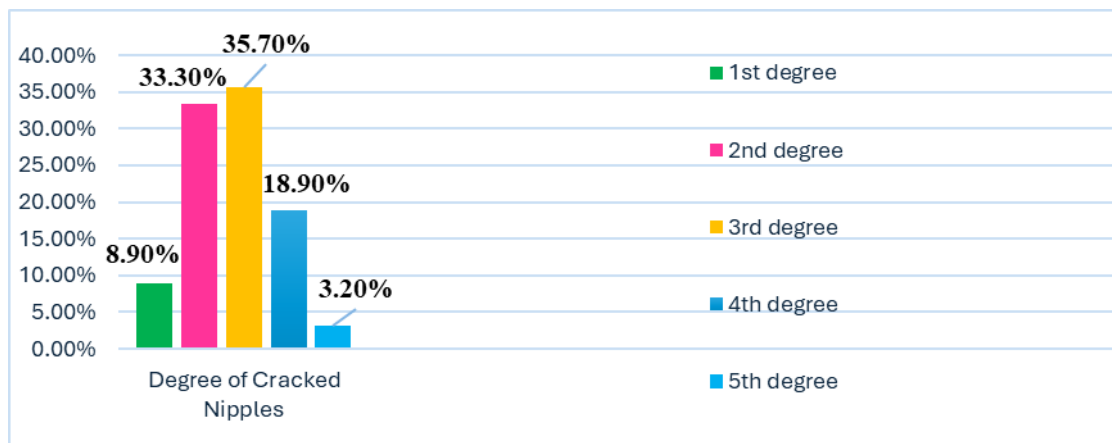


Figure 2. Degree of nipple soreness among studied postpartum women (n=594).

Table 3. Factors Associated with the Occurrence of Cracked Nipples among Studied Postpartum Women

Items	N (n=817)	%
Guidance about breastfeeding during 1st week of postpartum period		
Yes	381	46.6
No	436	53.4
Technique of preparing the nipple during pregnancy		
Correct	118	14.4
Incorrect	699	85.6
Breasts engorgement		
Yes	532	65.1
No	285	34.9
Breast care technique		
Correct	401	49.1
Incorrect	416	50.9
Baby feeding time		
On demand	777	95.1
Scheduled	40	4.9
Technique of nipple withdrawal after feeding		

Pulling nipple from baby's mouth by force	498	61.0
Baby leaves nipple spontaneously	319	39.0
Using a pacifier		
Yes	429	52.5
No	388	47.5
Using a bottle feeding		
Yes	415	50.8
No	402	49.2
Attachment (Latch-on technique)		
Correct	310	37.9
Incorrect	507	62.1
Body position technique of breastfeeding		
Proper	49	6.0
Improper	768	94.0

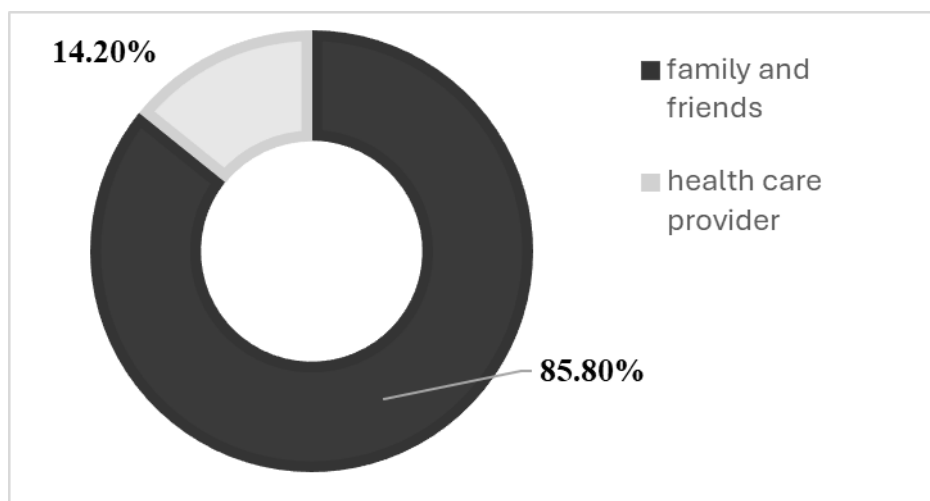


Figure 3. Source of guidance about breastfeeding technique during the 1st week of postpartum (n= 381).

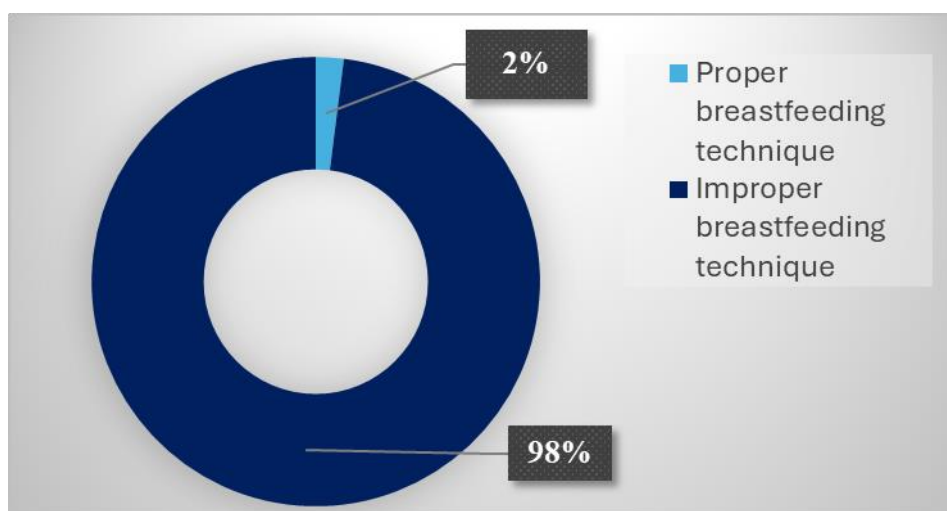


Figure 4. Breastfeeding technique among studied postpartum women (n=817).

Table 4. Association between the General Characteristics and the Obstetric History of the Women with Prevalence of Cracked Nipples

	Women with a cracked nipple (n= 594)		Women without a cracked nipple (n= 223)		Chi-Square	
	N	%	N	%	X2	P
Age (years)						
< 20	35	5.9	5	2.2		

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20 – 30	550	92.6	106	47.5		
31 – 40	9	1.5	112	50.3	305.141	<0.001**
Education						
Illiterate	20	3.4	2	0.9		
Read and write	90	15.1	5	2.2		
Middle education	300	50.5	70	31.4		
High education	184	31.0	146	65.5	87.753	<0.001**
Occupation						
Employed	88	14.8	120	53.8		
Housewife	506	85.2	103	46.2	129.925	<0.001**
Gravidity						
Once	131	22.1	24	10.8		
2 – 3 times	383	64.5	61	26.3		
More than 3 times	80	13.4	138	61.9	13.877	<0.001**
Parity						
Once	163	27.4	35	15.7		
2 – 3 times	395	66.5	74	33.2		
4 – 5 times	36	6.1	114	51.1	219.881	<0.001**
Mode of last Delivery						
Spontaneous vaginal delivery	232	39.9	127	57		
Cesarean section	362	60.1	96	43	21.074	<0.001**

Table 5. Association between Factors Associated with Cracked Nipples and Prevalence of Cracked Nipples

	Women with a cracked nipple (n= 594)		Women without a cracked nipple (n= 223)		Chi-Square	
	N	%	N	%	X ²	P
Guidance about breastfeeding during the 1st week of postpartum period						
Yes	220	37	161	72.2		
No	374	63	62	27.8	80.539	<0.001**
Preparing the nipple during pregnancy						
Correct	10	1.7	108	48.4		
Incorrect	584	98.3	115	51.6	286.722	<0.001**
Breast engorgement						
Yes	429	72.2	103	46.1		
No	165	27.8	120	53.9	48.377	<0.001**
Breast care technique						
Correct	231	38.9	170	76.2		
Incorrect	363	61.1	53	23.8	19.980	<0.001**
Baby feeding time						
On Demand	585	98.5	192	86.1		
Scheduled	9	1.5	31	13.9	53.421	<0.001**
Technique of nipple withdrawal after feeding						
Pulling nipple from baby's mouth by force	387	65.2	111	49.8		
Baby leaves nipple spontaneously	207	34.8	112	50.2	16.105	<0.001**
Using a pacifier						
Yes	350	58.9	79	35.4		
No	244	41.1	144	64.6	35.895	<0.001**
Using a bottle feeding						
Yes	306	51.5	109	48.9		
No	288	48.5	114	51.1	0.451	0.502
Attachment (Latch-on technique)						

Incorrect	486	81.8	21	9.4		
Correct	108	18.2	202	90.6	22.973	<0.001**
Body position technique during breastfeeding						
Proper	4	0.7	45	20.2		
Improper	590	99.3	178	79.8	54.348	<0.001**

5. Discussion

The current study aimed to estimate the prevalence of cracked nipple and its associated factors during the postpartum period. The results of the study answered the study questions and assessed the prevalence of cracked nipples and factors associated with the occurrence of cracked nipples in the studied postpartum women.

Regarding the prevalence of cracked nipples, the study reported that about three-quarters of postpartum women had cracked nipples. This is in line with **Gomez et al. (2021)**, who studied the prevalence of nipple soreness at 48 hours postpartum in Spain and observed that most studied women had nipple soreness. Similarly, **Gurkan, Abbasogu, Ozkan, and Aliogullari (2022)**; **Oliveira et al. (2021)**; and **de Senna et al. (2020)** found that nearly half of women had cracked nipples.

Contrarily, **Saddki, Mohamad, Johar, Alina Tengku Ismail, and Sulaiman (2022)**, who investigated determinants of non-exclusive breastfeeding practice during the first 6 months after an elective caesarean birth, reported that the majority of women didn't have cracked nipples. Also, **Li et al. (2022)**, who studied determinants of breastfeeding self-efficacy among postpartal women in rural China, reported that more than half of women didn't have cracked nipples.

Concerning the degree of nipple soreness among the studied postpartal women, the study revealed that more than one-third of women had nipple red and tender for longer than 10 seconds of feeding, and nipple tender between feeding made mothers grimace when babies started feeding (2nd and 3rd degree of nipple soreness). This is in line with **Abdallah et al. (2018)**, who studied breast and nipple problems encountered among puerperal primipara women in Egypt and reported that more than one-third of women had nipple tenderness between feedings, making mothers grimace when babies start feeding (3rd degree of nipple soreness).

Similarly, **Abdullah, Eshra, and Ashour (2022)**, who studied the effect of expressed milk and peppermint water versus routine care on cracked nipples among lactating women in Egypt, noted that more than one-fourth of women had

nipple tenderness between feedings, making mothers grimace when babies start feeding (3rd degree of nipple soreness).

This is in disagreement with **Abd-Elwahab, Abd-Elsalam, Mohamed, and Kamal (2022)**, who studied the application of olive oil on nipples in late pregnancy to prevent nipple trauma during lactation in Egypt and illustrated that nearly one-third of women had nipples that were slightly red and tender for the first 5–10 seconds of feeding (1st degree of nipple soreness). Contrarily, **Oliveira et al. (2021)**, who studied the effect of lanolin and prenatal health education for the prevention of nipple pain and trauma in Brazil, showed that nearly half of women had nipple cracks and felt sore down to their toes when babies started feeding (5th degree of nipple soreness).

Regarding factors associated with the occurrence of cracked nipples among the studied postpartal women, The study showed that more than half of women didn't receive guidance about breastfeeding technique during the first week of the postpartum period. This is in line with **Barbosa et al. (2018)**, who assessed the factors associated with nipple trauma in Brazil and reported that the majority of women didn't receive guidance about breastfeeding technique. Similarly, **Hassan et al. (2020)**, who studied breast feeding knowledge and practices among primiparous women with caesarean sections: impact on breast engorgement in Egypt, reported that most women didn't receive information about breastfeeding.

This is in disagreement with **Titaley et al. (2021)**, who reported that more than half of mothers received information on breastfeeding technique. Also, **Oliveira et al. (2021)** found that about two-thirds of mothers received guidance on breastfeeding. In addition, **Masoudin et al. (2019)**, who studied the effect of dexpanthenol on the treatment of nipple injuries in breastfeeding mothers in Iran, reported that more than three-quarters of mothers received education about breastfeeding.

The present study revealed that the majority of the women incorrectly prepared the nipple during pregnancy. This is in line with **Wardani (2022)**, who studied determinants related to breast care in pregnant women in the third trimester to

prepare nipples for breastfeeding in Indonesia and reported that more than two-thirds of women performed nipple preparation incorrectly. Similarly, **Abd-El-Khalik, Fadel, and El-Nemer (2022)**, who studied the factors associated with the cessation of exclusive breastfeeding among lactating mothers in Egypt, reported that more than half of women incorrectly prepared the nipple.

The current study also revealed that nearly two-thirds of women had breast engorgement. This finding is similar to **Chaudhary, Banu, and Farswal (2019)**; **Li et al. (2022)** reported that more than two-thirds of women had breast engorgement. Similarly, **Dutta and Gowder (2018)** assessed the prevalence and predisposing factors of mastitis in lactating mothers and reported that three-quarters of women had breast engorgement. This can be explained by the fact that more than half of women delivered via CS, so they didn't breastfeed their babies frequently during the first week after delivery due to caesarean section wound pain.

The current study findings revealed that more than half of women performed breast care incorrectly. Similarly, **Hassan et al. (2020)** reported that most women performed breast care incorrectly. Contrarily, **Ismawati and Sulfiati (2021)**, who studied factors causing breast milk dams in postpartal mothers, reported that two-thirds of women performed breast care correctly. This can be explained as nearly half of women had middle school education and were not well informed about how to perform breast care correctly.

The current study showed that most women feed their babies on demand. This is in line with **Cecilio et al. (2022)**; **Niazy and Fathy (2022)** reported that most women breastfeed their babies on demand. Also, **Abobakar et al. (2020)** and **Abdallah et al. (2018)** reported that the majority of women breastfeed their babies on demand. Contrarily, **Hables and Mahrous (2021)** reported that nearly two-thirds of women breastfeed their babies on schedule. The result of the present study was accepted because the WHO and UNICEF recommended that breastfeeding should be on-demand, not on a strict schedule (**Nyqvist et al. 2015**).

Regarding the nipple withdrawal technique, about two-thirds of women pulled the nipple from the baby's mouth by force after breastfeeding. This is in line with **Abobakar et al.'s (2020)** report that about two-thirds of women's method of nipple withdrawal was pulling the nipple from the infant's mouth. Similarly, **Hables and Mahrous (2021)** reported that more than half of women pulled the

nipple from their baby mouths during breastfeeding. Also, **Hassan et al. (2020)** reported that more than three-quarters of women grasp a nipple from an infant's mouth.

Regarding latch-on technique, the current study reported that about two-thirds of women had incorrect nipple attachment. This result is supported by **Abobakar et al.'s (2020)** report that about two-thirds of women introduced the nipple only into the infant's mouth. Similarly, **Hassan et al. (2020)** reported that more than three-quarters of women introduced the nipple only into the infant's mouth. Also, **Abdullah et al. (2022)** reported that most women had poor breastfeeding attachment.

The current study reported that most studied women performed improper body position techniques during breastfeeding. This is in line with **Abdullah et al. (2022)**, who reported that more than three-quarters of women performed poorly during breastfeeding. Also, **Abobakar et al. (2020)** reported that about two-thirds of women performed poorly during breastfeeding.

The current study reported that most women had improper breastfeeding techniques. This study finding is in accordance with **Bahar et al. (2018)** and **Santos et al. (2016)**, who reported that most women had poor breastfeeding technique. Similarly, **Mustafa, Hamedo, and Mustafa (2021)**, who studied the effect of lanolin versus breast milk on traumatic nipples for lactating mothers in Egypt, reported that more than three-quarters of women performed poor breastfeeding techniques. Contrarily, **Nduagubam et al. (2021)**, who assessed breastfeeding techniques in Enugu, South-East Nigeria, reported that nearly half of mothers practiced good breastfeeding techniques.

Concerning the association between demographic characteristics and the obstetric history of the studied postpartal women with the prevalence of cracked nipples. The present study result revealed that there was a highly statistically significant association between the prevalence of cracked nipples and women who aged 20–30 years old, housewives, delivered via CS, and multipara (2–3 times) had cracked nipples, while women with high education are free from cracked nipples.

Similarly, **Abdullah et al. (2022)**, **As'adi, Kariman, Mojab, and Pourhoseingholi (2017)** reported that there was a significant association between housewives, women with CS delivery, and sore nipples. This can be explained as housewives frequently breastfeed their babies and women with CS delivery had improper body position technique

during breastfeeding secondary to CS-wound.

This is in disagreement with **Oliveira et al. (2021)**; **Rashid and Mir (2021)** reported that there was no significant association between sore nipple and demographic variables such as age, education, marital status, occupation, and income among postpartum mothers. This may be explained as high-education women had good information about how to prepare the nipple for breastfeeding correctly, proper breastfeeding positions, attachment, and technique. Contrarily, **Barbosa et al. (2018)** and **Gomez et al. (2021)** reported that there was no statistically significant difference found between parity and the incidence of cracked nipples. This may be explained by the increased risk of nipple soreness in multipara due to a decrease breast skin elasticity.

Regarding the association between factors associated with the occurrence of cracked nipples and the prevalence of cracked nipples, It showed that the prevalence of cracked nipples was highly statistically associated with not receiving guidance about breastfeeding during the 1st week of the postpartum period, incorrect nipple preparation during pregnancy, breast engorgement, incorrect breast care technique, feeding the baby on demand, pulling the nipple from the baby's mouth by force after feeding, using a pacifier, incorrect nipple attachment, and improper body position technique during breastfeeding.

These findings are supported by **Aydn (2018)**, who reported that there was a significant relationship between the occurrence of cracked nipples and incorrect nipple preparation before delivery, incorrect breast care, incorrect nipple attachment, and incorrect body position technique during breastfeeding. This can be explained as the correct breastfeeding position and extensive training on breastfeeding and nipple care can significantly reduce rates of nipple pain and crack development.

Therefore, the assessment of the prevalence and factors associated with cracked nipples during postpartum could help in improving postpartum women's knowledge and practices concerning breastfeeding and cracked nipples before discharge from the hospital through clear and comprehensive education, thus reducing breastfeeding problems and improving the breastfeeding rate.

6. Conclusion

Regarding the prevalence of cracked nipples, nearly three-quarters of the studied postpartum women had cracked nipples to different degrees. More than one-third of women had 2nd and

3rd degrees of cracked nipples (nipples red and tender for longer than 10 seconds of feeding; tenderness between feeding made them grimace when babies started feeding). The most common factors associated with cracked nipples were not receiving guidance about breastfeeding during the 1st week of the postpartum period, incorrect nipple preparation during pregnancy, improper breastfeeding technique, improper latch-on technique, improper body position technique during breastfeeding, pulling the nipple from the baby's mouth by force after breastfeeding, breast engorgement, and using a pacifier and bottle feeding.

7. Recommendations

- 1) Designing nursing guidelines for pregnant and postpartum women about proper breast feeding technique and cracked nipple prevention.
- 2) Incorporating nipple preparation for breastfeeding and breast care within components of antenatal care to prevent cracked nipples.
- 3) Establishing an education center at the inpatient postnatal unit in the hospital will facilitate the follow-up of cases.
- 4) Training for healthcare providers to improve their skills in providing breastfeeding counseling and education during antenatal and postnatal follow-up.
- 5) Ongoing education for maternity nurses about utilizing evidence-based interventions to alleviate cracked nipples among early lactating women.
- 6) Further studies are recommended to:
 - Evaluate the effectiveness of a breastfeeding training program for pregnant and postpartum women before discharge on the incidence of breast problems.
 - Assess the effect of applying a breastfeeding educational program for maternity nurses on postpartum women's knowledge and practices regarding breastfeeding and its issues.
 - Evaluate the effect of evidence-based intervention on cracked nipples among primipara breastfeeding mothers.

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