BMJ Open

Effective Breastfeeding Technique and Associated Factors Among Lactating Mothers at Gidan District, Northeast, Ethiopia, 2021

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-059518
Article Type:	Original research
Date Submitted by the Author:	22-Nov-2021
Complete List of Authors:	Asmamaw, Desale; University of Gondar, Department of Reproductive Health, Institute of Public Health Habitu, Yohannes; University of Gondar, Department of Reproductive Health, Institute of Public Health Mekonnen, Eskedar; University of Gondar, Department of Reproductive Health, Institute of Public Health Desta, Dawit Zenamarkos; University of Gondar, Department of Health Systems and Policy Negash, Wubshet Debebe; University of Gondar, Department of Health Systems and Policy
Keywords:	Sexual dysfunction < UROLOGY, Nutrition < TROPICAL MEDICINE, Respiratory infections < THORACIC MEDICINE, PUBLIC HEALTH, Infectious diseases & infestations < DERMATOLOGY

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Effective Breastfeeding Technique and Associated Factors Among Lactating Mothers at Gidan District, Northeast, Ethiopia, 2021

Desale Bihonegn Asmamaw[1*], Yohannes Ayanaw Habitu[1], Eskedar Getie Mekonnen[1], Dawit Zenamarkos Desta[2], Wubshet Debebe Negash[2],

[1]Department of Reproductive Health, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia.

[2]Department of Health Systems and Policy, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

Author-Emails:

DBA: desalebihonegn1988@gmail.com

YAH: yohaneshabitu@gmail.com

EGM: eskedargetie18@gmail.com

DZD: dawit.zemark@gmail.com

WDN: wubshetdn@gmail.com

***Corresponding author:**

DBA: desalebihonegn1988@gmail.com

Phone: +251-949897164

P.O.Box: 196; University of Gondar, Gondar, Ethiopia

Abstract

Objective: To assess effective breastfeeding technique and its associated factors among lactating mothers at Gidan District, Northeast Ethiopia.

Design: Community based cross-sectional study

Setting: Gidan Distrct, Northeast, Ethiopia

Participants: lactating mothers

Primary outcome: Effective breastfeeding technique

Methods: A multi-stage simple random sampling technique was employed to recruit participants. An interviewer-administered questionnaires and observational checklist were used to collect the data. The data were entered into Epi-data version 4.6 software and exported in to Stata version 14 for the purpose of analysis. Binary logistic regression was used to model the odds of having positive association with effective breastfeeding technique and to investigate factors associated with the behavior Adjusted Odds Ratio with its corresponding confidence interval (95%) was used as a measure of association and in the multivariable logistic regression model p-value of < 0.05 as an indicator of statistical significance.

Results: The proportion of effective breastfeeding technique was 42.9% (95% CI, 39.4, 46.4%). Antenatal care follow up (AOR=1.75(95%CI=1.10, 2.77)), delivering at hospital (AOR=2.85(95%CI=1.22, 6.66)), delivering at health center (AOR=2.15(95%CI=1.25, 3.68)) and receiving postpartum home visit by the health extension workers (AOR=2.12(1.55, 2.92) were significantly associated with an increased odds of effective breastfeeding technique.

Conclusion: The study underscores lower than half of mothers follow effective ways of breastfeeding technique. The odds of adopting effective breastfeeding technique was higher among mothers who had ANC follow up, institutional delivery, and received postpartum home visit by the health extension workers. Therefore promoting ANC follow up, institutional delivery and strengthening postpartum

home visit by the health extension workers are recommended to improve the practice of effective breastfeeding techniques

Keywords: Effective breastfeeding technique, factors, lactating mothers, Gidan, Ethiopia

Strengths and limitations of the study

- This study was conducted in a community with including both rural and urban areas that addresses mothers who did not have a history of visiting health facilities
- The study might not free from bias due to introducing inter-observer variability and hawthorn effect.
- Employing the HEWs registration book as a sampling frame may provide a biased estimate through missing new lactating mothers.

Introduction

Breastfeeding, is a process of providing essential nutrients for children directly from the mother's breast, is indispensable for the healthy growth and development of the children.[1] World Health Organization (WHO) and the United Nations Children's Fund recommended the initiation of breastfeeding within one hour of birth and practice exclusive breastfeeding (EBF) for the first six months of newborn life.[2]

Breastfeeding is a learned skill as itis not a single suckling action but a series of behaviors which depends on the integrated coordination between mothers and infants that can be effective or ineffective. Effective breastfeeding technique (EBT) remains one of the best ways of promoting EBF practice that prevents early weaning.[3] Appropriate breastfeeding practice had numerous importance in preventing communicable and non-communicable diseases, including but not limited to type 2 diabetes, ear infections, asthma, lower respiratory infections, diarrhea and vomiting, eczema, childhood leukemia, and sudden infant death syndrome (SIDS).[4] Breastfeeding also improves intelligence quotient (IQ), school attendance, and it is associated

with higher wages in adult life.[5] Ineffective breastfeeding technique (IBT) could have adverse outcomes both in the child and the mother's life.[6]

More than half a million infants die each year due to nutritional deficiency ascribed by inadequate breastfeeding and/or IBT.[7] Besides the mortality, there are hundreds of thousands children that suffered from poor growth and development.[8] In Ethiopia, sub-optimal breastfeeding practices (including ineffective breastfeeding techniques) also contribute to the higher under-fives mortality rate. [9 10] Making the biggest number of under-five mortality in the world. In Ethiopia, the burden of malnutrition particularly undernutrition begins in early time life, primarily during the first year, due to suboptimal breastfeeding practices.[10 11] Similarly, IBT practices including incorrect positioning, attachment, and sucking could result in different untoward consequences in mothers well-being such as crackled nipple, breast engorgement, and mastitis.[12]

Globally, there are an estimated 20,000 maternal deaths from breast cancer that could be prevented through increasing breastfeeding practices.[13] Adoption of optimal and effective breastfeeding technique among children aged less than two years are also indicated to humper 820, 000 under-five mortality that attributed by preventable cause and malnutrition.[14]

The practice of effective breastfeeding techniques vary across different settings that range from 30 to 70 % in Brazil, Nepal, Denmark, India, Libya, and Ethiopia. [15-20] Multiple factors like parity, maternal and child age, level of education, place of delivery, antenatal and postnatal, and knowledge of breastfeeding techniques care follow up are some of the identified factors that can affect practice of effective breastfeeding techniques.[15 21 22]

Although few studies were conducted previously, they had limitations that might introduce bias in the estimate. Some important variables that might potentially correlation with EBT such as postpartum home visit by health extension workers were not previously addressed. Likewise, the former studies have been conducted among mothers soon after birth before the mother was

stabilized and gets comfortable, which could ultimately affect the breastfeeding techniques. In addition, majority of the prior studies were based at institutions involving mothers who come to vaccination or postnatal care, populations that presumed to obtain breastfeeding counseling service. Moreover, there was a paucity of evidence concerning EBT in the northern Ethiopia. Therefore, this study aimed to assess effective breastfeeding technique and identify its associated factors among lactating mothers, which will bring concert evidence for policymakers and concerned bodies to work on the identified attributes to further improve adoption of EBT.

Methods

Study setting, design and period

A community-based cross-sectional study was conducted from March 30 to April 29, 2021. The study was conducted at Gidan District, North Wollo zone, Northeast Ethiopia. The district is 595 km far from Addis Ababa, the capital city of Ethiopia and, it has two urban and 21 rural kebeles (the lowest administrative unite). An estimated 148,058 population based on the population projection from 2007 census in 2020 were found in the district. The proportion of male and female were 49.7% and 50.3%, respectively, of which under-five children and lactating mothers account for 15.2% (22523) and 4.3%(6320) of the population, respectively. The district has six health centers and 23 health posts that provide routine health services for the catchment population.[23]

Source population and study population

All lactating mothers (mother-child pairs) having child less than six months of age at Gidan district were the source of population, and the study population were Lactating mothers (mother-child-pairs) having child under six months of age in the selected kebeles at Gidan district.

Inclusion and exclusion criteria

Lactating mothers (mother-child-pairs) having child under six months of age in the selected kebeles at Gidan district were included in this study. Lactating mothers who were critically ill or unable to breastfeed their child and infants with critically illness at the time of data collection were excluded from the study.

Sample size determination and sampling procedures

The required sample size was calculated using single population proportion formula, considering the following statistical assumptions: margin of error 5%(0.05), Z-value 1.96

corresponding to 95% confidence level[24], 10% of non-response rate, design effect of 2, and the proportion of effective breastfeeding technique was 36.5% which was taken from similar study which give the final sample size to be 786.[15]

A multistage sampling technique was used to select 786 study participants. Seven kebeles in the district were randomly chosen using lottery method. The list of lactating mothers with children aged under six months were identified from the health extension workers registration book at the health posts of each selected Kebeles and considered as a sampling frame. Then, the sample size was proportionally allocated to each selected kebeles considering the number of lactating mothers. Simple random sampling (Open Epi Random Program version 3) was used to select lactating mothers from each kebele of HEWs registration book list at the health post.

Data Collection tools and quality control

A structured observational checklist adopted from the WHO breastfeeding observational checklist and an interviewer-administered questionnaire developed from reviewing different related literatures were used for data collection.[15 18 21 22 25 26] Data collectors were approached by introducing themselves and interviewing the selected respondent after obtaining an informed consent.

The data collectors observed BFT while the mother was at home if the infant did not feed in the previous one hour and each respondent was observed in a private place. The observation last at least for five minutes and the data collector recorded the breastfeeding positioning, attachment and suckling as per the WHO breastfeeding observation check list. . If the infant had received milk in the previous one hour, the mother was asked when the infant would have the next feed and the observation assessment was planned accordingly. If the mother-child pair had ineffective breastfeeding technique, the data collectors advise/demonstrate the mother about the technique of breastfeeding after finishing the questions.

Eight female BSc midwife data collectors and two supervisors of the same field having experience in research and fieldwork coordination were participated in the data collection process. Data collectors and supervisors were oriented and trained for one day focusing on how to interview, fill the observation checklist, and record the data before starting the actual data collection. The questionnaires were pretested on 40 study participants (5%) at kubalafto district and modification were undertaken according to the result of the pretest.

Data processing and analysis

The collected data were checked manually for completeness and consistency. Then it was entered into the Epi-data version 4.6 software package and exported to Stata version 14 for cleaning, coding, and analysis. Descriptive statistics was described using frequencies, percentages, mean and standard deviation, presented using a table, figure, and texts. Normality tests such as kurtosis and skewness were employed to see the normal distribution of continuous variables and to identify appropriate summary measures.

Variables to ascertain the outcome were computed and recoded. Questions to measure positioning were computed and categorized as good, average and poor positioning. Then, to create a dummy variable good and average positioning were merged as good and labeled as 1 and poor positioning was coded as it is and labeled as 0 and the same was applied for attachment. Suckling in the other hand was categorized and coded as effective and ineffective suckling.

The outcome variable was dichotomized as effective and ineffective breastfeeding technique and it was labeled as 1 and 0, respectively. Independent factors, with a p-value <0.2 in binary logistic regression analysis, was considered in multivariable analysis. In the multivariable logistic regression models with a p-valve<0.05 was considered as an indicator of statistical significance. Moreover, AOR with its corresponding 95% of CI was used to show the strength and direction of the association.

Operational definitions

Positioning: Good positioning was explained when at least three out of four criteria for infant positioning have been fulfilled; average positioning was explained if any two of the four criteria were correct and poor positioning was explained when only one or none criterion have been fulfilled.[15 27]

Attachment: Good attachment was explained when at least three out of four criterions have been fulfilled. Average attachment was explained if any two of the four criterions have been fulfilled. Poor attachment was explained when only one or none out of four criterions have been fulfilled.

Suckling: Effective suckling was explained when at least two out of three criterions have been fulfilled. Ineffective suckling was explained if only one or none from three criterions has been fulfilled.[15 27]

Slow suckling: suckling pattern of infant about one suck per second.[28]

Deep suckling: The baby's cheeks are not drawn inward and are rounded during a feed, evidenced by visible or audible swallowing after every one or two sucks.[28]

Effective breastfeeding technique: The combination of at least two criteria from positioning, three criteria from the attachment, and two criteria from suckling while mothers' breastfeeds their infant. [29 30]

Breast problem: A mother is explained to have breast problems if she has any of the following:

- ✓ Inverted nipple: A portion of or the entire nipple is buried below the plane of the areola and does not evert at all.[31]
- ✓ Engorgement: Breasts are painfully overfull.
- ✓ Cracked nipple: Damage to the integrity of the skin on the nipple.

- ✓ Mastitis: Inflammatory condition of the breast, which may or may not be accompanied by infection.[32]

Ethics

Ethical clearance was obtained from the Institutional Review Board (IRB) of the University of Gondar, College of Medicine and Health Sciences, Institute of Public Health (Ref. No: IPH/142/2013). Similarly, a supportive letter was taken from the district administrative office to be given for the selected kebeles. After a brief explanation of the study objective and purpose, oral informed consent was obtained from each participant. Participants were also informed that participation was on a voluntary base, and they have the right to withdraw from the study at any time they want. All data obtained from participants were kept confidential and used for this study only. The study was conducted according to Helsinki declarations.

Patient and public involvement statement

Lactating mothers were included in this study by providing their valuable information including measurements. Despite this, they have never been involved in the study design, protocol and data collection tools, in reporting and disseminating the finding

Results

Socio-demographic characteristic of the respondents

A total of 760 mothers with children aged between 0-6 months old were participated making a response rate of 96.7%. The mean age of participants were 26.98(SD) (±5.3) and 306 (40.3%) of participants fall within the age category of 26-30 years. Close to three fourth (75.4%) of the respondents were rural dwellers and almost all 757 (99.6%) participants were orthodox Christian followers. Regarding the educational status of the mothers more than half (57.2%) of them had no attending formal education (Table 1).

Obstetric and Infant Characteristics

Among the participants 612 (80.5%) and 650(85.5%) of the mothers were multipara and had ANC visit for their index child, respectively. Six hundred seventy two of the children were born at health institutions. More than half (55%) of the participants received breastfeeding techniques counseling immediately after delivery. About 438 (57.6%) of the infants were female (Table 2).

Proportion of effective breastfeeding technique

The overall proportion of mothers adopting effective breastfeeding technique was 42.9% (95% CI, 39.4-46.4%). Good breastfeeding positioning, attachment, and sucking were observed among 56.5%, 33.8% and 59.2% mothers, respectively (Figure 1).

Factors associated with effective breastfeeding technique

After adjusting potential confounding factors, variables such as ANC follow up, place of delivery, and receiving postpartum home visit by the health extension workers were remained statistically significant with effective breastfeeding technique having a p-value of less than 0.05.

The odds of effective breastfeeding techniques among mothers who had at least one ANC follow up during their index pregnancy were 1.75 times (AOR = 1.75(95%CI= 1.10, 2.77)) higher as compared to their counterpart. Similarly, the odds of following EBT was 2.15 (AOR=2.15(95%CI=1.25, 3.68)) and about 2.85 (AOR=2.85(95%CI=1.22, 6.66) times higher among mothers who had delivered at health centers and hospitals, respectively compared to those who delivered at home. Likewise, effective breastfeeding technique was twice higher (AOR=2.12(95% CI=1.55,2.92)) among respondents who had received postpartum home visit by the HEW as compared to those who did not got postpartum home visit by the HEWs (Table 3).

Discussion

Effective breastfeeding technique is the ideal way of promoting exclusive breastfeeding as a baby who breastfeeds effectively shows readiness for feeding and latch on deeply at the breast that satisfies the nutritional requirement of the infant and keep the mother's comfort.[3] The goal of this study was therefore to determine the proportion of mothers who adopt EBT and to identify associated factors among lactating mothers at Gidan District, Northeast Ethiopia.

The proportion of mothers following effective way of BFT was 42.9% (95% CI, 39.4-46.4%). This finding is in line with the study conducted in India (43%) and Harar, Ethiopia (43.4%).[16 33] However, the result of this study is higher than studies conducted in West Bengal hospital, India (30.3%) and Ari, District, Southern Ethiopia (36.5%).[15 34] The observed discrepancy might be due to the time laps between the studies since the former studies were conducted in 2013 and there have been different strategies including BFT counseling, promoting institutional delivery, and postpartum home visit by HEWs that presumed to further improve maternal practices in adopting EBT.[35] The existence of some variability in the obstetric characteristics of participants between the studies could be another reason for the above

variation. For instance, the proportion of mothers who have ANC visit and receive counseling during the ANC follow up in this study were higher (75.4%) as compared to the former studies conducted in southern Ethiopia (59.2%), where having ANC visit and obtaining breastfeeding counseling service during the follow up showed an improved practice of EBT.[15 33]

On the other hand, the proportion of EBT in the current study is lower than previous studies in Libya (48%), rural population of India (51%), and West Denmark (52%).[29 36 37] The possible explanation might be the difference in the study setting in which the former studies were based at institutions that recruits mothers who came to the health institutions either for vaccination and/or PNC services as study participant, subjects that usually considered to have better opportunities for obtaining breastfeeding counseling. In addition, the proportion of educated participants (secondary school and above) were lower (12.1%) in this study compared to the studies conducted earlier(in rural population of India (78.1%) and West Denmark (71.1%)), that might makes the proportion of mothers following effective breastfeeding technique lower in the current study.[29 37] As level of education is proven by several evidence to have an impact on health literacy level of individuals that likewise can be an influencing factor for adopting EBT.[38]

Mothers who had at least one ANC follow up have higher odds to exhibit EBT as compared to their counterparts. The finding is consistent with studies conducted in South-East Nigeria.[39] The reason behind might be the fact that mothers who had ANC follow up would receive counseling and education about breastfeeding technique that enhances mother's awareness, understanding, and appreciation of EBT and further promote their practice.[15 40] Moreover, mothers who had at least one ANC visit during pregnancy were more likely to have an institutional delivery that provides an opportunity for mothers to receive postpartum breastfeeding counselling.[15 33 41]

Likewise, the odds of EBT was 2.15 and 2.85 times higher among participants who had delivered at health center and hospital, respectively as compared to mothers who had delivered at home. The finding is in congruent with previous evidence from Bhaktapur district of Nepal, and Harar, Ethiopia.[16 42] Women who had delivered at health institutions might possibly have a better opportunity to receive counseling related to breastfeeding technique immediately after delivery that will further has a positive impact on mother's breastfeeding technique. [16] Furthermore, women who had delivered at home are usually less educated and had less access to health messages, which might have an impact on healthy practices including EBT.[43 44]

Similarly, postpartum home visit by the health extension workers have a positive association with adopting EBT, where the odds of having EBT was 2.12 times higher among mothers who had received postpartum home visit by the health extension workers as compared to their counterparts. The result is not supported by previous evidence. The possible reason could be women who had received postnatal home visit by the HEW might get breastfeeding counseling and demonstration service that will help mothers through improving their attitude, knowledge, and practice regarding breastfeeding technique. Moreover, those women having postpartum home visit by HEW may get psychological support from the HEWs that further promote effective breastfeeding technique as psychosocial well-being of mothers have a significant effect on their care and practice towards their baby.[45 46]

To summarize, the present study had several strengths. For instance, this study identifies post-partum home visit by health extension workers as an associated factors of EBT that help health care workers to emphasize the identified factors and further avoid ineffective breastfeeding technique. Moreover, this study was conducted in a large community including both mothers who had a history of visiting health institutions and those who had not, which helps the researcher to generalize the finding of this study for other similar populations

On the other hand, this study was not avoid of limitations. Even though all possible strategies such as using female data collectors, providing training for data collectors, employing pretest, using standardized tool, and securing privacy were applied, the study might not free from bias due to introducing inter-observer variability and hawthorn effect. Similarly, employing the HEWs registration book as a sampling frame may provide a biased estimate through missing new lactating mothers.

Conclusion

The study highlighted that more than half of the mothers failed to adopt effective technique while breastfeeding. Factors such as having ANC follow up, delivering at health institution, and receiving postnatal home visit by the health extension workers were found to be significantly associated with EBT. Therefore, promoting ANC visit, institutional delivery, and postpartum home visit by HEWs could have the capacity to improve EBT technique that further avert sup-optimal feeding, childhood malnutrition, morbidity, and even child mortality. Better to advocate the utilization of ANC follow up and institutional delivery as it opens the window of opportunity for breastfeeding counseling

Abbreviations

ANC: Antenatal Care; AOR: Adjusted Odd Ratio: BFT; Breastfeeding Technique: CI; Confidence Interval: COR; Crude Odd Ratio: EBF; Exclusive Breastfeeding: EBT; Effective Breastfeeding Technique: EDHS; Ethiopian Demographic and Health Survey: HEW; Health Extension Workers: OR; Odds Ratio: PNC; Postnatal Care: WDA; Women Development Army: WHO; World Health Organization

Consent for publication

Not applicable

Data sharing statement

All the data generated in this study are included in this manuscript. The datasets used and/or analyzed to produce the current manuscript will be obtained from the corresponding author whenever required

Competing interests

The authors declare that they have no competing interests.

Funding source

Not applicable

Authors' contributions

DBA conceived the idea for this study, developed the proposal and supervised fieldwork, made the analysis, interpretation and manuscript write up. YAH and EGM assisted in the conception of the study, involved in the method development, analysis, and interpretation of the findings. DZD and WDN participated in analysis, interpretation of the findings and manuscript write up. All the authors read, revised and approved the final manuscript

Acknowledgments

Our great gratitude goes to the University of Gondar for approving ethical clearance. We are also pleased to extend our appreciation to the Gidan District administrative offices, the study participants, data collectors, and supervisors

References

1. Aryeetey R, Dykes F. Global implications of the new WHO and UNICEF implementation guidance on the revised Baby-Friendly Hospital Initiative. Maternal & child nutrition 2018;14(3):e12637.
2. Friedrich M. Early initiation of breastfeeding. Jama 2018;320(11):1097-97.
3. Puapornpong P, Paritakul P, Suksamarnwong M, et al. Nipple pain incidence, the predisposing factors, the recovery period after care management, and the exclusive breastfeeding outcome. Breastfeeding Medicine 2017;12(3):169-73.
4. Lassi ZS, Rind F, Irfan O, et al. Impact of infant and young child feeding (IYCF) nutrition interventions on breastfeeding practices, growth and mortality in low-and middle-income countries: systematic review. Nutrients 2020;12(3):722.
5. Motee A, Jeewon R. Importance of exclusive breastfeeding and complementary feeding among infants. Current Research in Nutrition and Food Science Journal 2014;2(2):56-72.
6. Bass JL, Gartley T, Kleinman R. World Health Organization baby-friendly hospital initiative guideline and 2018 implementation guidance. JAMA pediatrics 2019;173(1):93-94.
7. Burrell A, Kueter AM, Ariful S, et al. Appropriate Infant and Young Child Feeding Practices in an Emergency for Non-Breastfed Infants Under Six Months: The Rohingya Experience. J Hum Lact 2020;36(3):510-18. doi: 10.1177/0890334420906838 [published Online First: 2020/03/14]
8. Collective GB. Global breastfeeding scorecard, 2018: Enabling women to breastfeed through better policies and programmes. Retrieved from UNICEF & WHO website: https://www who int/nutrition/publications/infantfeeding/global-bf-scorecard-2018 pdf 2018

9. Binns C, Lee MK, Low WY, et al. The role of public health nutrition in achieving the sustainable development goals in the Asia Pacific Region. Asia Pacific Journal of Public Health 2017;29(7):617-24.

10. Federal M. National strategy for infant and young child feeding. Ethiopia: Addis Ababa 2004

11. Demographic I. Health survey 2016: key indicators report. Addis Ababa, Ethiopia, and Rockville, Maryland, USA Ethiopia: Ethiopia Demographic and Health Survey 2016

12. Ahmed K, Page A, Arora A, et al. Global Maternal and Child Health Research collaboration (GloMACH)(2020). Associations between infant and young child feeding practices and acute respiratory infection and diarrhoea in Ethiopia: A propensity score matching approach. PloS One 2020;15(4):e0230978.

13. Du Plessis L, Peer N, English R, et al. Breastfeeding in South Africa: are we making progress? South African Health Review 2016;2016(1):109-23.

14. Victora CG, Bahl R, Barros AJ, et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. The Lancet 2016;387(10017):475-90.

15. Yilak G, Gebretsadik W, Tadesse H, et al. Prevalence of ineffective breastfeeding technique and associated factors among lactating mothers attending public health facilities of South Ari district, Southern Ethiopia. PloS one 2020;15(2):e0228863.

16. Tiruye G, Mesfin F, Geda B, et al. Breastfeeding technique and associated factors among breastfeeding mothers in Harar city, Eastern Ethiopia. Int Breastfeed J 2018;13:5. doi: 10.1186/s13006-018-0147-z [published Online First: 2018/02/13]

17. Degefa N, Tariku B, Bancha T, et al. Breast feeding practice: positioning and attachment during breast feeding among lactating mothers visiting health facility in Areka Town, Southern Ethiopia. International journal of pediatrics 2019;2019

18. Aswathaman N, Sajjid M, Kamalarathnam C, et al. Assessment of breastfeeding position and attachment (ABPA) in a tertiary care centre in Chennai, India: an observational descriptive cross-sectional study. International Journal of Contemporary Pediatrics 2018;5(6):2209.

19. Coca KP, Gamba MA, Silva R, et al. Does breastfeeding position influence the onset of nipple trauma. Rev Esc Enferm USP 2009;43(2):446-52.

20. Dessalegn T, Hunduma J. Breastfeeding skills in Arba Minch Zuria: The positioning and attachment initiatives. International Journal of Nursing and Midwifery 2017;9(4):46-52. doi: 10.5897/ijnm2016.0237

21. Tamiru D, Jisha H. Breastfeeding skills in Arba Minch Zuria: The positioning and attachment initiatives. International Journal of Nursing and Midwifery 2017;9(4):46-52.

22. Rinata E, Sari PA. BREASTFEEDING PRACTICES [POSITIONING, ATTACHMENT/LATCH-ON AND EFFECTIVE SUCKLING. SEAJOM: The Southeast Asia Journal of Midwifery 2017;3(2):1-6.

23. Gidan Disrict Community Health Information System report. 2020

24. Gaskins ASC. International reproductive health: a perspective on research, policy, and practice. Humboldt State University, 2011.

25. Rinata E, Sari PA. breastfeeding practices (postioning, attachment-on and effective sucking). Seajom: The Southeast Asia Journal of Midwifery 2017;3(2):1-6.

26. Parashar M, Singh S, Kishore J, et al. Breastfeeding attachment and positioning technique, practices, and knowledge of related issues among mothers in a resettlement colony of Delhi. ICAN: Infant, Child, & Adolescent Nutrition 2015;7(6):317-22.

27. Tella K, Guruvare S, Hebbar S, et al. Knowledge, attitude, and practice of techniques of breast-feeding among postnatal mothers in a coastal district of Karnataka. International Journal of Medical Science and Public Health 2016;5(1):28-34.

28. Network EN. Infant Feeding in Emergencies. Module 2 Version 1.0 for health and nutrition workers in emergencies: ENN. http://www. ennonline. net/ifemodule2, 2007.

29. Kronborg H, Væth M. How are effective breastfeeding technique and pacifier use related to breastfeeding problems and breastfeeding duration? Birth 2009;36(1):34-42.

30. Tiruye G, Mesfin F, Geda B, et al. Breastfeeding technique and associated factors among breastfeeding mothers in Harar city, Eastern Ethiopia. International breastfeeding journal 2018;13(1):1-9.

31. Stevens WG, Fellows DR, Vath SD, et al. An integrated approach to the repair of inverted nipples. Aesthetic surgery journal 2004;24(3):211-15.

32. World Health Organization. Mastitis: causes and management: World Health Organization, 2000.

33. Nagendra K, Shetty P, Rudrappa S, et al. Evaluation of breast feeding techniques among postnatal mothers and effectiveness of intervention: Experience in a tertiary care centre. Sri Lanka Journal of Child Health 2017;46(1)

34. Dasgupta U, Mallik S, Bhattacharyya K, et al. Breastfeeding practices: positioning, attachment and effective suckling—a hospital based study in West Bengal/Kolkata. Indian Journal of Maternal and Child Health 2013;15(1):10.

35. Health FMo. National Reproductive Health Strategy 2016-2020: Federal Ministry of Health (FMOH) Addis Ababa, Ethiopia, 2016.

36. Goyal RC, Banginwar AS, Ziyo F, et al. Breastfeeding practices: positioning, attachment (latch-on) and effective suckling–a hospital-based study in Libya. Journal of Family and Community Medicine 2011;18(2):74.

37. Kishore MSS, Kumar P, Aggarwal AK. Breastfeeding knowledge and practices amongst mothers in a rural population of North India: a community-based study. Journal of tropical pediatrics 2009;55(3):183-88.

38. Adnan N, Muniandy ND. The relationship between mothers' educational level and feeding practices among children in selected kindergartens in Selangor, Malaysia: A cross-sectional study. Asian Journal of Clinical Nutrition 2012;4(2):39.

39. Nduagubam OC, Ndu IK, Bisi-Onyemaechi A, et al. Assessment of breastfeeding techniques in Enugu, South-East Nigeria. Annals of African Medicine 2021;20(2):98.

40. Mekuria G, Edris M. Exclusive breastfeeding and associated factors among mothers in Debre Markos, Northwest Ethiopia: a cross-sectional study. International breastfeeding journal 2015;10(1):1-7.

41. Abeje G, Azage M, Setegn T. Factors associated with Institutional delivery service utilization among mothers in Bahir Dar City administration, Amhara region: a community based cross sectional study. Reproductive Health 2014;11(1):1-7.

42. Paudel DP, Giri S. Breast feeding practices and associated factors in Bhaktapur District of Nepal: A community based cross-sectional study among lactating mothers. Journal of the Scientific Society 2014;41(2):108.

43. Fikre AA, Demissie M. Prevalence of institutional delivery and associated factors in Dodota Woreda (district), Oromia regional state, Ethiopia. Reproductive health 2012;9(1):1-6.

44. Wolelie A, Aychiluhm M, Awoke W. Institutional delivery service utilization and associated factors in Banja District, Awie zone, Amhara regional sate, Ethiopia. Open Journal of Epidemiology 2014;2014

45. Tesfau YB, Kahsay AB, Gebrehiwot TG, et al. Postnatal home visits by health extension workers in rural areas of Ethiopia: a cross-sectional study design. BMC Pregnancy and Childbirth 2020;20:1-9.

46. Mannan I, Rahman SM, Sania A, et al. Can early postpartum home visits by trained community health workers improve breastfeeding of newborns? Journal of Perinatology 2008;28(9):632-40.

Figure legend

Figure 1. Positioning, attachment, and suckling of infant during feeding at Gidan, District, Northeast, Ethiopia, 2021 (n=760)

Table 1. Sociodemographic characteristics of respondents at Gidan, District, Northeast Ethiopia, 2021 (n= 760).

Variables	Categories	Frequency	Percent (%)
Age of the mothers'	<20	74	9.7
	20-25	197	25.9
	26-30	306	40.3
	>30	183	24.1
Religion	Orthodox	757	99.6
	Muslim	3	0.4
Educational status of the mothers'	Not attending formal education	435	57.2
	Primary school	233	30.7
	Secondary school and above	92	12.1
Occupation of the mothers'	Housewife	645	84.9
	Government employed	83	10.9
	Self employed	24	3.1
	Other*	8	1.1
Marital status	Married	684	90.0
	Single	53	7

	Windowed	16	2.1
	Other**	7	0.9
Educational status of the husband	Not attending formal education	372	54.3
	Primary school	202	29.4
	Secondary school and above	110	16
Occupation of the husbands'	Farmer	552	80.7
	Government employed	51	7.4
	Self employed	61	8.9
	Other***	20	2.9
Residence	Rural	573	75.4
	Urban	187	24.6

*student, **divorced, and separated, ***daily labor, and soldier

Table 2. Obstetric and infant characteristics of the respondent at Gidan, District, Northeast Ethiopia, 2021(n=760)

Variables	Categories	Frequency(n)	Percent (%)
Parity	Primipara	148	19.5
	Multipara	612	80.5
Antenatal care visit	Yes	650	85.5
	No	110	14.5
BFT* counseling during ANC	Yes	492	75.7
	No	158	24.3
Place of delivery	Hospital	40	5.2
	Health center	632	83.2

	Home	88	11.6
BFT* counseling immediately after	Yes	378	56.3
delivery	No	294	43.7
Postnatal care	Yes	143	18.8
	No	617	81.2
Age of the infants	≤60 days	307	40.4
	60-120 days	249	32.7
	121-179 days	204	26.9
Sex of the infants	Male	322	42.4
	Female	438	57.6
Breast problems	Yes	21	2.8
	No	739	97.3
Breastfeeding experiences	Yes	616	81.0
	No	144	19.0
Received postpartum home visit by	Yes	374	49.2
HEW**	No	386	50.8
Being member of WDA***	Yes	156	20.5
	No	604	79.5
previous information about BFT*	Yes	506	66.6
	No	254	33.4

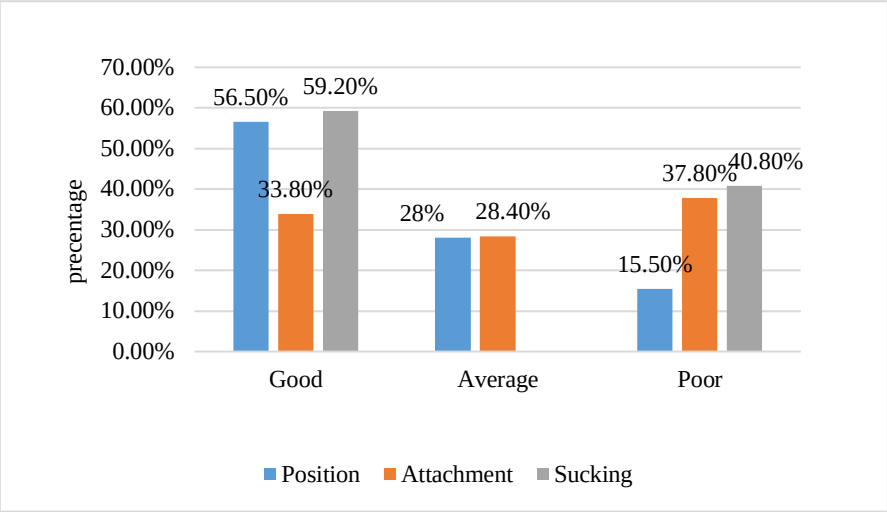
*Breastfeeding technique, **health extension workers, and ***woman development army

Table 3. Association of effective breastfeeding technique with different characteristics of lactating mothers in Gidan, District, Northeast Ethiopia, 2021(n=760).

Variables	EBT		COR (95%CI)	AOR (95%CI)
	Yes (n, %)	No (n, %)		
Age of the mothers'				
<20	19(27)	55(73)	1	1
20-25	77(38.6)	120(61.4)	1.86(0.94,3.05)	1.48(0.78, 2.81)
26-30	147(48)	159(52)	2.68(1.43,4.37)	2.31(0.91,3.70)
>30	83(45.4)	100(54.6)	2.40(1.24,4.04)	1.85(0.95,3.63)
Educational status of the mothers'				
No formal education	189(43.4)	246(56.6)	1	1
Primary education	88(37.8)	145(62.2)	0.79(0.57,1.09)	0.79(0.56,1.12)
Secondary education and above	49(57.3)	43(42.7)	1.48(0.94,2.33)	1.18(0.71,1.96)
Parity				
Primipara	49(33.1)	99(66.9)	1	1
Multipara	277(45.3)	335(54.7)	1.67(1.15,2.44)	1.17(0.75,1.83)
Antenatal care				
Yes	293(45.1)	357(54.9)	1.92(1.24,2.96)	**1.75(1.10,2.77)***
No	33(30)	77(70)	1	**1**
Place of delivery				
Hospital	22(57.5)	18(42.5)	3.40(1.77,8.61)	**2.85(1.22,6.66)***
Health center	283(44.6)	349(55.4)	2.59(1.55,8.61)	**2.15(1.25,3.68)****
Home	21(23.9)	67(76.1)	1	**1**
Being a membership of WDA				
Yes	86(55.1)	70(44.9)	1.86(1.26,2.57)	1.41(0.96,2.07)

No	240(39.8)	364(60.2)	1	1
Received postpartum visit by HEW				
Yes	205(54.5)	169(45.5)	2.66(1.93,3.49)	**2.12(1.55,2.92)****
No	121(31.6)	265(68.4)	1	**1**
Brest problem				
Yes	6(28.6)	15(71.4)	0.52(0.2, 1.36)	0.55(0.20,1.51)
No	320(43.3)	419(66.7)	1	1
Residency				
Urban	94(50.3)	93(49.7)	1.49(1.07,2.07)	1.41(0.97,2.05)
Rural	232(40.5)	341(59.5)	1	1

*Significant at $p < 0.05$, **Significant at $p<0.01$, EBT=effective breastfeeding technique, WDA=women development army and HEW=health extension workers, Hosmer and Lemeshow goodness of fit (p-value=0.22), Multicollinearity test (VIF) =1.68.



STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

Items	Number	Recommendations
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **page 1, line number 1-3**
		(b) provide in the abstract an informative and balanced summary of what was done and what was found **Page 2, line number 19-45**
Introduction		
Background/rational	2	Explain the scientific background and rationale for the investigation being reported **Page 3-5, line number 53-99**
Objective	3	State specific objectives, including any prespecified hypotheses **Page 2, line number 20**
Methods		
Study design	4	Present key elements of study design early in the paper **page 5, line number 1052-103**
Setting	5	Describer the setting, location, and relevant dates including period of recruitment and data collection **Page number 5, line number 103-111**

Participants	6	Give the eligibility criteria, and the sources and methods of selection of participants **Page 6, line number 112-120**
		Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifier, Give diagnostic, if applicable **Page 7-8, line number 151-174**
Data source and measurement	7	For each variables of interest, give source of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **Page 6-7, line number 131-150**
Bias	8	Describe any efforts to address potential sources of bias **Page 3 , line number 48-55**
Study size	9	Explain how the study design was arrived **Page 6, line number 119-130**
Quantitative variables	10	Explain how quantitative variables were handled in the analysis , if applicable describe which groupings chose and why **Page 9, line number 180-192**
Statistical methods	11	(a)Describe all statistical methods, including those used to control for confounding **Page 9 , line number 175-192**

		(*b*) Describe any methods used to examine subgroups and interactions **NA**
		(*c*) Explain how missing data were addressed **NA**
		(*d*) If applicable, describe analytical methods taking account of sampling strategy **NA**
		(*e*) Describe any sensitivity analyses **NA**
Results		
Descriptive data	12	Give characteristics of study participants (eg, demographic, clinical, social) and information on exposure and potential confounders **Page 10, line number 208-216**
Outcome data	13	Report numbers of outcome events or summary measures **Page 10, line number 219-222**
Main results	14	(a) Give unadjusted estimates and, if applicable, confounder adjusted estimates and their precision (e.g., 95% confidence interval).Make clear which confounders were adjusted for and why they were included **Page 11, line number 223-234**

		(b) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period **NA**
Other analysis	15	Report other analyses doing analyses of subgroups and interactions, and sensitive analysis **NA**
Discussion		
Key result	16	Summaries key results with reference to study objectives **Page 11-13, line number 236-288**
Limitations	17	Discuss limitations of the study, taking into account sources of potential bias or imprecision. discuss both direction and magnitude of any bias **Page 14, page 307-312**
Interpretation	18	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analysis, result from similar studies, and other relevant evidence **Page 12-13, line number 241-300**
Generalizability	19	Discuss the generalizability (external validity) of the study results **page 14, line number 301-306**
Funding	20	Give the source of funding and the role of the funders for the present study and if applicable for the original study on which the present article is based

		Page 15, line number 337

Note: An explanation and elaboration article discusses each checklist item and gives methodological background published examples of transport reporting. The STROBE checklist is best used in conjunction with this articles (freely available on the web sites of PloS Medicine at http://www.plosmedicene.org/.Annals of internal medicine http://www.annals.org/, and Epidemiology at http://www.epidem.com/ information on the STROBE initiative is available at www.strobe-statement.org.

BMJ Open

Effective breastfeeding technique and associated factors among lactating mothers at Gidan District, Northeast, Ethiopia: A community-based cross-sectional study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-059518.R1
Article Type:	Original research
Date Submitted by the Author:	07-Mar-2022
Complete List of Authors:	Asmamaw, Desale; University of Gondar, Department of Reproductive Health, Institute of Public Health Habitu, Yohannes; University of Gondar, Department of Reproductive Health, Institute of Public Health Negash, Wubshet Debebe; University of Gondar, Department of Health Systems and Policy Desta, Dawit Zenamarkos; University of Gondar College of Medicine and Health Sciences, Health Systems and Policy Mekonnen, Eskedar; University of Gondar College of Medicine and Health Sciences, Reproductive and child health; University of Gondar College of Medicine and Health Sciences, Reproductive and child health
Primary Subject Heading:	Public health
Secondary Subject Heading:	Public health, Qualitative research
Keywords:	Sexual dysfunction < UROLOGY, Nutrition < TROPICAL MEDICINE, Respiratory infections < THORACIC MEDICINE, PUBLIC HEALTH, Infectious diseases & infestations < DERMATOLOGY

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Effective breastfeeding technique and associated factors among lactating mothers at Gidan District, Northeast, Ethiopia: A community-based cross-sectional study

Desale Bihonegn Asmamaw[1*], Yohannes Ayanaw Habitu[1], Wubshet Debebe Negash[2], Dawit Zenamarkos Desta[2] and Eskedar Getie Mekonnen[1]

[1]Department of Reproductive Health, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia.

[2]Department of Health Systems and Policy, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

Authors' addresses

DBA: desalebihonegn1988@gmail.com

YAH: yohaneshabitu@gmail.com

WDN: wubshetdn@gmail.com

DZD: dawit.zemark@gmail.com

EGM: eskedargetie18@gmail.com

[*]**Corresponding author:**

DBA: desalebihonegn1988@gmail.com

Phone: +251-949897164

P.O.Box: 196; University of Gondar, Gondar, Ethiopia

Abstract

Objective: To assess effective breastfeeding techniques and associated factors among lactating mothers at Gidan District, Northeast Ethiopia.

Design: A community-based cross-sectional study.

Setting: Gidan District, Northeast, Ethiopia.

Participants: A total of 786 lactating mothers were included between March 30 and April 29, 2021.

Outcome: Effective breastfeeding technique.

Methods: A multi-stage sampling technique was employed to recruit participants. Pretested interviewer-administered questionnaires and an observational checklist were used to collect the data. Individual scores of three variables about breastfeeding, namely positioning, attachment, and suckling, were computed to generate the outcome variable, breastfeeding technique. The binary logistic regression analyses were carried out to determine the association between independent variables and effective breastfeeding technique. Statistical significance was declared at a p-value ≤ 0.05 with a corresponding 95% confidence interval.

Results: Overall, the prevalence of effective breastfeeding techniques was 42.9% (95% CI, 39.4, 46.4%). Having antenatal care follow-up (AOR=1.75(95%CI=1.10, 2.77)), delivering at health institutions [(hospital) (AOR=2.85(95%CI=1.22, 6.66)) and health center (AOR=2.15(95%CI=1.25, 3.68))], and receiving postpartum home visits by the health extension workers (AOR=2.12(1.55, 2.92) were significantly associated with the practice of effective breastfeeding technique.

Conclusion: The study revealed that the prevalence of effective breastfeeding technique was low. The practice of effective breastfeeding technique was significantly associated among mothers who have ANC follow-up, deliver at health institutions, and receive postnatal home visits by the health extension workers. Hence, maternal, neonatal, and child health care providers and health extension workers are expected to ensure antenatal care utilization and

institutional delivery. Strategies to advocate postpartum home visits by health extension workers and strengthen existing promotion activities are also recommended.

Keywords: Effective breastfeeding technique, Factors, lactating mothers, Gidan, Ethiopia

Strengths and limitations of the study

- Since the outcome variable was computed by scores given by different observers, some necessary measures, including delivering training and providing time to practice in a real environment before the data collection, were done to reduce measurement errors and interobserver variability.
- Due to inter-observer variability and the hawthorn effect, the study might not be free from bias.
- Using the registration book as a sampling frame may introduce selection bias as new lactating mothers might not get registered.

Introduction

Breastfeeding technique is defined as the composite of positioning, attachment, and suckling during breastfeeding.[1] Position indicates the capacity of the mother to carry her child to her body. At the same time, attachment denotes whether the mother attaches the baby with her breast and to her nipple, keeping most of the areola in the baby's mouth.[2] Similarly, suckling is a part of the breastfeeding technique, which reflects the infant's performance of expressing milk, which can be explained by the depth and speed of sucking.[1] Those techniques collectively imply the status of breastfeeding of infants. The World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF) recommend breastfeeding within one hour of birth and exclusive breastfeeding for the first six months.[3] As a result, infants can get the required amount of energy and nutrients. Applying effective breastfeeding techniques can foster sufficient milk production and release.[4] In addition, appropriate breastfeeding help prevent communicable and non-communicable diseases.[5, 6] Ineffective breastfeeding technique (IBT), on the other hand, is attributed to poor positioning, attachment, and suckling, which could result in early cessation of exclusive breastfeeding (EBF) and put infants at risk.[6] Several pieces of evidence showed that more than half of the mothers with IBT cease EBF earlier, which ultimately result in severe infectious and non-infectious chronic disease among the child.[6-8] [9] Globally, more than half a million infants die each year due to nutritional deficiency ascribed by suboptimal breastfeeding.[10] Aside from the mortality, there are hundreds of thousands of children whose growth and development is impaired.[11] In Ethiopia, suboptimal breastfeeding practices (including ineffective breastfeeding techniques) contribute to the higher under-five mortality resulting from malnutrition.[12, 13] In the country, the burden of malnutrition, particularly undernutrition, begins at the earlier stage of life, and it's believed to be due to suboptimal breastfeeding practices.[13, 14]

IBF not only threatens the infants' lives but also negatively impacts the health of the mother [15]. IBT is one of the major causes of cracked nipples among lactating mothers.[15] Nipple damage, mastitis, and other similar complications are more common among lactating mothers with IBT.[7]

The practice of EBT varies across different settings. For instance, in South Ari district, Southern Ethiopia 36.5%,[9] Harar city, Eastern Ethiopia 43.4%,[16] Gondar town, Ethiopia 48%,[17] West Bengal hospital India 30.3%,[18] Rural population of India 51%,[19] India 43%,[20] West Denmark 52%,[21] Libya 48%.[7] Multiple factors like parity, maternal and child age, level of education, place of delivery, antenatal care (ANC), postnatal natal care (PNC), and knowledge of breastfeeding techniques, counseling about EBT are some of the identified factors that can affect the practice of effective breastfeeding technique.[9, 17, 22, 23]

There have been several strategies to avert the problem, although sufficient improvement has not been observed in the past decade [11]. The WHO and the baby-friendly hospital initiative have designed the EBT counselling, teaching, and demonstrations for mothers in all maternity care services and all mothers with sick children in accordance with the integrated management of neonates and childhood illness (IMNCI) guidelines [6, 24]. Ethiopia has also recently incorporated IBT with the national acute malnutrition management guideline as a diagnostic criterion for severe acute malnutrition among infants under six months.[25]

Nutritional problems among children remain the most significant challenge towards achieving the Ethiopian government's target to end childhood undernutrition by 2030 with a commitment to the 'Seqota' Declaration.[26] To achieve the aforementioned target, we need to encourage EBT during infancy, and early childhood and science-backed interventions would have a significant role.

Although few studies have been conducted in Ethiopia, almost all of them were conducted among mothers who pursued health services (institution-based) in which those women

considerably have better knowledge about healthy practices.[7, 9, 16, 17] Similarly, the previous studies have been conducted, including mothers soon after birth before the mother is stabilized and becomes comfortable, which could ultimately affect the breastfeeding techniques.[8, 9, 21] Moreover, there was a paucity of evidence concerning EBT in northern Ethiopia. Therefore, this study aimed to assess effective breastfeeding technique and identify its associated factors among lactating mothers. The finding will provide evidence for policymakers and concerned bodies to work on the identified attributes to improve the practice of EBT further.

Methods

Study setting, design, and period

A community-based cross-sectional study was conducted from March 30 to April 29, 2021, in Gidan District, North Wollo zone, Northeast Ethiopia. The district is 595 km from Addis Ababa, the capital of Ethiopia, and it has two urban and 21 rural kebeles (the lowest administrative unit). Close to half (49.7%) of the population in the district are females. Under-five children and lactating mothers account for 15.2% (22523) and 4.3% (6320) of the population, respectively. The district has six health centers and 23 health posts that provide routine health services for the catchment population.[27]

Study participants

All lactating mothers (mother-infant pairs) having infants under six months of age in the selected kebeles in the Gidan district were included. Lactating mothers who were critically ill or unable to breastfeed their infants and infants with a critical illness at the time of data collection were excluded from the study.

Sample size determination and sampling procedures

The sample size was calculated using a single population proportion formula, considering the following statistical assumptions: margin of error 5% (0.05), Z-value 1.96 corresponding to 95% confidence level, 10% non-response, design effect of 2, and the proportion of effective breastfeeding technique was 36.5%, which gave a final sample size of 786.[9]

A multistage sampling technique stratified by urban and rural kebeles was employed. From 21 rural and two urban kebeles found in the district, 30% of the total kebeles (six kebeles from rural and one kebele from urban) were selected by a simple random sampling technique. The list of lactating mothers with children aged under six months was taken from the health extension workers' registration book of each selected Keeble's health post and considered as a

sampling frame. Then, the sample size was proportionally allocated to each selected kebele considering the number of lactating mothers. Simple random sampling using the Open Epi Random Program version 3 was used to draw the participants from each kebele.

Variable measurement and definition of terms

Positioning: It was explained when at least three out of four criteria for infant positioning have been fulfilled. Average positioning was defined if any two of the four criteria were correctly applied, whereas poor positioning was explained when only one or none criterion had been fulfilled.[9, 28]

Attachment: Good attachment was described when at least three out of four criteria have been fulfilled. The average attachment was explained if any two of the four criteria had been fulfilled. Poor attachment was described when only one or none of the four criteria had been fulfilled.

Suckling: Effective suckling was explained when at least two out of three criteria have been fulfilled. Ineffective suckling was explained if only one or none from three criterions has been fulfilled.[9, 28]

- **Slow suckling**: suckling pattern of an infant about one suck per second.[29]
- **Deep suckling**: the baby's cheeks are not drawn inward and are rounded during a feed, evidenced by visible or audible swallowing after every one or two sucks.[29]

Effective breastfeeding technique: the combination of at least two criteria from positioning, three criteria from the attachment, and two criteria from suckling. [16, 21]

Breast problem: a mother is explained to have breast problems if she has any of the following:

- ✓ **Inverted nipple:** a portion of or the entire nipple is buried below the plane of the areola and does not evert at all.[30]

- ✓ **Engorgement:** breasts are painfully overfull.
- ✓ **Cracked nipple**: any damage and excoriation to the integrity of the skin on the nipple.
- ✓ **Mastitis:** an inflammatory condition of the breast, which may or may not be accompanied by infection.[31]

Data collection tools and quality control

A structured observational checklist adopted from the WHO breastfeeding observational checklist and interviewer-administered questionnaires were developed from reviewing different related literature.[8, 9, 22, 23, 32, 33] According to the WHO criteria, we developed and adopted an arbitrary scoring and grading system to grade positioning, infant's, mouth attachment, and effective suckling during breastfeeding.[34] Each criterion scored 1 point (Table 1).

Eight female BSc midwives (data collectors) and two supervisors from the same field with experience in research and fieldwork coordination participated in the data collection process. Data collectors and supervisors were oriented and trained for one day, focusing on how to interview, examine and diagnose mothers with breast problems, tips to score the observational checklist, and bias controlling mechanisms. The data collectors have also received simulation/real-environment training, and their score was compared to see the effect of interobserver variability. This was repeated until the result of two data collectors on the same participant became approximately the same by helping and providing corrective measures. Moreover, we recruited data collectors having similar educational statuses and considerable similar experiences to reduce interobserver variability.

The questionnaires were pretested on 40 study participants (5%) at Gubalafto district, and modifications were made according to the pretest results. Data collectors approach participants

by introducing themselves and interviewing the selected respondent after obtaining oral informed consent.

The data collectors observed BFT while the mother was at home in a private place. To reduce the Hawthorn effect, mothers were oriented to show how they routinely breastfeed their infant, and they won't be judged by their way of doing it. The observation lasted at least five minutes, and the data collectors recorded the breastfeeding positioning, attachment, and suckling as per the WHO breastfeeding observation checklist. If the infant had breastfed in the previous one hour, the mother was asked when the infant would have the next feed, and the observation assessment was planned accordingly. Finally, the participants were interviewed for part two-interview questionnaire.

Data processing and analysis

The collected data were checked manually for completeness and consistency. Then, it was entered into the Epi-data version 4.6 software package and exported to Stata version 14 for cleaning, coding, and analysis. Descriptive statistics were described using frequencies, percentages, mean, and standard deviation and presented using tables, figures, and text. Normality tests such as kurtosis and skewness were employed to examine the distribution of continuous variables and identify the appropriate summary measures.

EBT was ascertained by computing the positioning, attachment, and suckling scores. The scores of each item of the three techniques have been computed first. In other words, questions to measure positioning were computed and categorized as good, average, and poor. Then, to create a dummy variable, good and average positioning were merged as good and labelled as '1' and poor positioning was coded as '0'. The same procedure was applied for attachment. Moreover, suckling was categorized and coded as effective and ineffective suckling.

The outcome variable was dichotomized as an 'effective' and 'ineffective' breastfeeding technique, and it was labeled as '1' and '0', respectively. The binary logistic regression analysis was applied. Independent variables with a p-value of 0.2 in the bi-variable analysis were considered in the multivariable model. Variables with a p-value ≤0.05 were regarded as statistically significant. AOR with its corresponding 95% CI was used to examine the strength and direction of the association.

Ethical approval

Ethical clearance was obtained from the Institutional Review Board (IRB) of the University of Gondar, College of Medicine and Health Sciences, Institute of Public Health (Ref. No: IPH/142/2013). Similarly, a support letter was taken from the district administrative office and handed to the selected kebeles. After a brief explanation of the study objective and purpose, oral informed consent was obtained from each participant. Participants were also informed that participation was voluntary, and they had the right to withdraw from the study at any time during the data collection. After the interview, the data collectors advise/demonstrate the mother about the effective breastfeeding technique if the mother-infant pair had an IBT. Furthermore, all data obtained from participants were kept confidential and used for this study only. The study was also conducted according to Helsinki declarations.

Patient and public involvement statement

Lactating mothers were included in this study by providing valuable information, including measurements. Nevertheless, they have never been involved in the study design, protocol, data collection tools, and reporting and disseminating the finding.

Results

Socio-demographic characteristics

A total of 760 breastfeeding mothers participated, making the response of 96.7%. The mean age of participants was 26.98 (±5.3 years). About 40.3% of participants fell within the age category of 26-30 years. A bit more than three-fourths (75.4%) of the respondents were rural dwellers, and almost all (99.6%) participants were orthodox Christian followers. Regarding the educational status of the mothers, more than half (57.2%) of them had no formal education (Table 2).

Obstetric and infant characteristics

About 80.5% and 85.5% of the mothers were multipara and had an ANC visit for their index child, respectively. More than half (55%) of the participants received breastfeeding technique counselling immediately after delivery (Table 3).

Prevalence of effective breastfeeding technique

The overall prevalence of mothers who had practiced effective breastfeeding technique was 42.9% (95% CI, 39.4-46.4%). Good breastfeeding positioning, attachment, and sucking were observed among 56.5%, 33.8%, and 59.2% of mothers, respectively (figure 1).

Factors associated with effective breastfeeding technique

After adjusting for potential confounding factors, variables such as ANC-follow up, place of delivery, and receiving postpartum home visits by HEWs remained significantly associated with effective breastfeeding technique. The odds of effective breastfeeding technique among mothers who had ANC follow-up during their index pregnancy was 1.75 times (AOR = 1.75(95%CI= 1.10, 2.77)) higher than their counterparts. Similarly, the odds of practicing EBT was 2.15 (AOR =2.15 (95%CI=1.25, 3.68)) and about 2.85 (AOR=2.85(95%CI=1.22, 6.66) times higher among mothers who had delivered at health centers and hospitals, respectively,

compared to those who had delivered at home. Likewise, effective breastfeeding technique was twice higher (AOR=2.12 (95% CI=1.55,2.92)) among respondents who had received postpartum home visits by the HEWs as compared to those who had received no postpartum home visits by the HEWs (table 4).

Discussion

Effective breastfeeding technique is the ideal way of promoting exclusive breastfeeding. A baby who breastfeeds effectively shows readiness for feeding and latch on deeply at the breast that satisfies the infant's nutritional requirements and maintains the mother's comfort [35]. This study aimed to determine the prevalence of EBT and identify associated factors among lactating mothers in Gidan District, Northeast Ethiopia.

The prevalence of EBF was 42.9% (95% CI, 39.4-46.4%), which implies several infants in the study areas are suffering from the aftermaths of suboptimal breastfeeding, such as malnutrition. This finding is in line with the studies conducted in India (43%) and Harar, Ethiopia (43.4%).[20, 36] However, the result of this study is higher than studies conducted in West Bengal hospital, India (30.3%) and Ari, District, Southern Ethiopia (36.5%). [9, 18] The observed discrepancy might be due to the time gap between the studies. Since the former studies were conducted in 2013 and there have been different strategies, including BFT counseling, promoting institutional delivery, and postpartum home visits by HEWs, that are presumed to improve maternal practices in EBT.[37] The existence of some variability in the obstetric characteristics of participants between the studies could also be another reason for the above variation. For instance, the proportion of mothers who had ANC visits and received counselling during the ANC follow up in this study was higher (75.4%) as compared to the study conducted in southern Ethiopia (59.2%), where having ANC visits and obtaining breastfeeding counselling service during the follow up showed an improved practice of EBT.[9, 20] In light of this, the current promotion strategies to improve ANC follow-up and breastfeeding should be strengthened to improve the BFT and maintain the health of children.

On the other hand, the proportion of EBT in the current study is lower than in previous studies done in Gondar, Northwest Ethiopia (48%), Libya (48%), rural population of India (51%), and West Denmark (52%).[7, 17, 19, 21] The possible explanation might be the difference in the study

setting, in which the former studies were based at health institutions that recruited mothers who came to the health facilities either for vaccination or PNC services. These populations are usually considered to have better health literacy and opportunities to obtain breastfeeding counselling. In addition, the proportion of educated participants (secondary school and above) was lower (12.1%) in our study compared to the studies conducted earlier (in the rural populations of India (78.1%) and West Denmark (71.1%)), that might make the prevalence of EBT lower than their finding.[19, 21] Although no association has been observed between the level of education and EBT practice in our study, several sherds of evidence indicated that level of education impacts individuals' health literacy level. It can also be further an influencing factor for practicing EBT.[38]

Mothers who had ANC follow-up had higher odds of exhibiting EBT than their counterparts. The finding is consistent with studies conducted in South-East Nigeria.[39] Mothers who visit health institutions for ANC follow-up receive counselling about breastfeeding technique that enhances mothers' awareness, understanding, and appreciation of the sequelae of IBT and further promote their practice.[9, 40] Moreover, mothers who had ANC follow-up during pregnancy were more likely to have an institutional delivery that makes them lose the opportunity to receive postpartum breastfeeding counselling.[9, 20, 41]. Thus, strengthening the existing effort to improve ANC follow-up and institutional delivery would help improve breastfeeding practice beyond preventing life-threatening maternal and neonatal complications.

Likewise, the odds of EBT were 2.15 and 2.85 times higher among participants who had delivered at the health center and hospital, respectively, as compared to mothers who had delivered at home. The finding is congruent with previous evidence from the Bhaktapur district of Nepal, and Harar, Ethiopia.[36, 42] Women who had delivered at health institutions might possibly have a better opportunity to receive counseling related to breastfeeding technique

immediately after delivery. That will further have a positive impact on the mothers' breastfeeding technique. [36] Furthermore, women who had delivered at home were usually less educated and had less access to health messages, which might impact healthy practices, including EBT.[43, 44].

Similarly, postpartum home visits by health extension workers have a positive association with adopting EBT . The odds of having EBT was 2.12 times higher among mothers who had received postpartum home visits by health extension workers compared to their counterparts. The possible reason could be that women who have received postnatal home visits by the HEW might get breastfeeding counselling and demonstration that will help mothers improve their attitude, knowledge, and practice regarding breastfeeding technique. Furthermore, women who receive postpartum home visits from HEWs may receive psychological support from the HEWs, which further promotes effective breastfeeding techniques, as mothers' psychosocial well-being significantly impacts their care and practice towards their baby.[45, 46] The result is a call for action to further improve postnatal home visits to promote EBT and infant nutrition.

This finding shows more than half of lactating mothers are not practicing EBT, which implies thousands of infants are receiving insufficient nutrients to maintain their growth and development. Therefore, it is crucial to counteract the problem by working on the mothers' skills in breastfeeding technique.

The study had better strength in measuring the outcome. Since the outcome variable was computed by scores given by different observers, different measures, including delivering training and providing time to practice in a real environment before the data collection, were done to reduce measurement errors and interobserver variability.

On the other hand, this study was not avoiding limitations. Even though all possible strategies such as using female data collectors, providing training for data collectors, employing pretest, using standardized tools, and securing privacy were applied, the study might not be free from

bias due to introducing inter-observer variability and the hawthorn effect. Similarly, employing the HEWs registration book as a sampling frame may provide a biased estimate through missing new lactating mothers.

Conclusion

The study revealed that the prevalence of effective breastfeeding technique was low. The practice of EBT was significantly associated with mothers who have ANC follow-up, deliver at health institutions, and receive postnatal home visits by the health extension workers. Hence, maternal, neonatal, and child health care providers and health extension workers are expected to ensure antenatal care utilization and institutional delivery. Strategies to advocate postpartum home visits by health extension workers and strengthen existing promotion activities are also recommended.

Abbreviations

ANC: Antenatal Care; AOR: Adjusted Odd Ratio: BFT; Breastfeeding Technique: CI; Confidence Interval: COR; Crude Odd Ratio: EBF; Exclusive Breastfeeding: EBT; Effective Breastfeeding Technique: EDHS; Ethiopian Demographic and Health Survey: HEW; Health Extension Workers: OR; Odds Ratio: PNC; Postnatal Care: WDA; Women Development Army: WHO; World Health Organization

Consent for publication

Not applicable

Data sharing statement

All the data generated in this study are included in this manuscript. The datasets used and analyzed to produce the current manuscript will be obtained from the corresponding author upon request.

Competing interests

The authors declare that they have no competing interests.

Funding source

Not applicable

Authors' contributions

DBA conceived the idea for this study, developed the proposal, supervised fieldwork, and made the analysis, interpretation, and manuscript write up. YAH and EGM assisted in the conception of the study, involved in the method development, analysis, and interpretation of the findings. DZD and WDN participated in the analysis, interpretation of the findings, and writing the manuscript. All the authors have read, revised, and approved the final manuscript

Acknowledgements

Our great gratitude goes to the University of Gondar for approving the ethical clearance. We are also pleased to extend our appreciation to the Gidan District administrative offices, study participants, data collectors, and supervisors.

References

1. Ahmed K, Page A, Arora A, Ogbo F. Global Maternal and Child Health Research collaboration (GloMACH)(2020). Associations between infant and young child feeding practices and acute respiratory infection and diarrhoea in Ethiopia: A propensity score matching approach. PloS One. 2020; 15:e0230978.
2. Kent JC, Ashton E, Hardwick CM, Rowan MK, Chia ES, Fairclough KA, et al. Nipple pain in breastfeeding mothers: incidence, causes and treatments. International journal of environmental research and public health. 2015; 12:12247-63.
3. Friedrich M. Early initiation of breastfeeding. Jama. 2018; 320:1097-.
4. Johnson R, Taylor W. Skills for midwifery practice: Elsevier Health Sciences; 2010.
5. Lassi ZS, Rind F, Irfan O, Hadi R, Das JK, Bhutta ZA. Impact of infant and young child feeding (IYCF) nutrition interventions on breastfeeding practices, growth and mortality in low- and middle-income countries: systematic review. Nutrients. 2020; 12:722.
6. Child WHODo, Health A, Organization WH, UNICEF. Handbook IMCI: integrated management of childhood illness: World Health Organization; 2005.
7. Goyal RC, Banginwar AS, Ziyo F, Toweir AA. Breastfeeding practices: positioning, attachment (latch-on) and effective suckling–a hospital-based study in Libya. Journal of Family and Community Medicine. 2011; 18:74.
8. Parashar M, Singh S, Kishore J, Patavegar BN. Breastfeeding attachment and positioning technique, practices, and knowledge of related issues among mothers in a resettlement colony of Delhi. ICAN: Infant, Child, & Adolescent Nutrition. 2015; 7:317-22.
9. Yilak G, Gebretsadik W, Tadesse H, Debalkie M, Bante A. Prevalence of ineffective breastfeeding technique and associated factors among lactating mothers attending public health facilities of South Ari district, Southern Ethiopia. Plos one. 2020; 15:e0228863.

10. Arts M, Taqi I, Bégin F. Improving the early initiation of breastfeeding: the WHO-UNICEF breastfeeding advocacy initiative. Breastfeeding Medicine. 2017; 12:326-7.

11. Collective GB. Global breastfeeding scorecard, 2018: Enabling women to breastfeed through better policies and programmes. Retrieved from UNICEF & WHO website: https://www who int/nutrition/publications/infantfeeding/global-bf-scorecard-2018 pdf. 2018.

12. Binns C, Lee MK, Low WY, Zerfas A. The role of public health nutrition in achieving the sustainable development goals in the Asia Pacific Region. Asia Pacific Journal of Public Health. 2017; 29:617-24.

13. Federal M. National strategy for infant and young child feeding. Ethiopia: Addis Ababa. 2004.

14. Demographic I. Health survey 2016: key indicators report. Addis Ababa, Ethiopia, and Rockville, Maryland, USA Ethiopia: Ethiopia Demographic and Health Survey. 2016.

15. Santos KJdS, Santana GS, Vieira TdO, Santos CAdST, Giugliani ERJ, Vieira GO. Prevalence and factors associated with cracked nipples in the first month postpartum. BMC pregnancy and childbirth. 2016; 16:1-8.

16. Tiruye G, Mesfin F, Geda B, Shiferaw K. Breastfeeding technique and associated factors among breastfeeding mothers in Harar city, Eastern Ethiopia. International breastfeeding journal. 2018; 13:1-9.

17. Safayi BL, Assimamaw NT, Kassie DG. Breastfeeding technique and associated factors among lactating mothers visiting Gondar town health facilities, Northwest Ethiopia: observational method. Italian journal of pediatrics. 2021; 47:1-10.

18. Dasgupta U, Mallik S, Bhattacharyya K, Sarkar J, Bhattacharya S, Halder A. Breastfeeding practices: positioning, attachment and effective suckling—a hospital based study in West Bengal/Kolkata. Indian J Mater Child Health. 2013; 15:1-11.

19. Kishore MSS, Kumar P, Aggarwal AK. Breastfeeding knowledge and practices amongst mothers in a rural population of North India: a community-based study. Journal of tropical pediatrics. 2009; 55:183-8.

20. Nagendra K, Shetty P, Rudrappa S, Jaganath S, Nair R. Evaluation of breast feeding techniques among postnatal mothers and effectiveness of intervention: Experience in a tertiary care centre. Sri Lanka Journal of Child Health. 2017; 46.

21. Kronborg H, Væth M. How are effective breastfeeding technique and pacifier use related to breastfeeding problems and breastfeeding duration? Birth. 2009; 36:34-42.

22. Tamiru D, Jisha H. Breastfeeding skills in Arba Minch Zuria: The positioning and attachment initiatives. International Journal of Nursing and Midwifery. 2017; 9:46-52.

23. Rinata E, Sari PA. BREASTFEEDING PRACTICES [POSITIONING, ATTACHMENT/LATCH-ON AND EFFECTIVE SUCKLING. SEAJOM: The Southeast Asia Journal of Midwifery. 2017; 3:1-6.

24. Organization WH. Guideline: protecting, promoting and supporting breastfeeding in facilities providing maternity and newborn services: World Health Organization; 2017.

25. FMoH GoE. National Guideline for the Management of Acute Malnutrition. FMOH Addis Ababa; 2019.

26. Ethiopia commits to ending undernutrition by 2030 with the Seqota Declaration. 2015.

27. Yadav K, Agarwal M, Shukla M, Singh JV, Singh VK. Unmet need for family planning services among young married women (15–24 years) living in urban slums of India. BMC women's health. 2020; 20:1-17.

28. Tella K, Guruvare S, Hebbar S, Adiga P, Rai L. Knowledge, attitude, and practice of techniques of breast-feeding among postnatal mothers in a coastal district of Karnataka. International Journal of Medical Science and Public Health. 2016; 5:28-34.

29. Network EN. Infant Feeding in Emergencies. Module 2 Version 1.0 for health and nutrition workers in emergencies. ENN. http://www. ennonline. net/ifemodule2; 2007.

30. Stevens WG, Fellows DR, Vath SD, Stoker DA. An integrated approach to the repair of inverted nipples. Aesthetic surgery journal. 2004; 24:211-5.

31. World Health Organization. Mastitis: causes and management: World Health Organization2000.

32. Aswathaman N, Sajjid M, Kamalarathnam C, Seeralar AA. Assessment of breastfeeding position and attachment (ABPA) in a tertiary care centre in Chennai, India: an observational descriptive cross-sectional study. International Journal of Contemporary Pediatrics. 2018; 5:2209.

33. Rinata E, Sari PA. breastfeeding practices (postioning, attachment-on and effective sucking). Seajom: The Southeast Asia Journal of Midwifery. 2017; 3:1-6.

34. Organization WH. Breastfeeding counselling: a training course: World Health Organization1993.

35. Puapornpong P, Paritakul P, Suksamarnwong M, Srisuwan S, Ketsuwan S. Nipple pain incidence, the predisposing factors, the recovery period after care management, and the exclusive breastfeeding outcome. Breastfeeding Medicine. 2017; 12:169-73.

36. Tiruye G, Mesfin F, Geda B, Shiferaw K. Breastfeeding technique and associated factors among breastfeeding mothers in Harar city, Eastern Ethiopia. Int Breastfeed J. 2018; 13:5.

37. Health FMo. National Reproductive Health Strategy 2016-2020. Federal Ministry of Health (FMOH) Addis Ababa, Ethiopia; 2016.

38. Adnan N, Muniandy ND. The relationship between mothers' educational level and feeding practices among children in selected kindergartens in Selangor, Malaysia: A cross-sectional study. Asian Journal of Clinical Nutrition. 2012; 4:39.

39. Nduagubam OC, Ndu IK, Bisi-Onyemaechi A, Onukwuli VO, Amadi OF, Okeke IB, et al. Assessment of breastfeeding techniques in Enugu, South-East Nigeria. Annals of African Medicine. 2021; 20:98.

40. Mekuria G, Edris M. Exclusive breastfeeding and associated factors among mothers in Debre Markos, Northwest Ethiopia: a cross-sectional study. International breastfeeding journal. 2015; 10:1-7.

41. Abeje G, Azage M, Setegn T. Factors associated with Institutional delivery service utilization among mothers in Bahir Dar City administration, Amhara region: a community based cross sectional study. Reproductive Health. 2014; 11:1-7.

42. Paudel DP, Giri S. Breast feeding practices and associated factors in Bhaktapur District of Nepal: A community based cross-sectional study among lactating mothers. Journal of the Scientific Society. 2014; 41:108.

43. Fikre AA, Demissie M. Prevalence of institutional delivery and associated factors in Dodota Woreda (district), Oromia regional state, Ethiopia. Reproductive health. 2012; 9:1-6.

44. Wolelie A, Aychiluhm M, Awoke W. Institutional delivery service utilization and associated factors in Banja District, Awie zone, Amhara regional sate, Ethiopia. Open Journal of Epidemiology. 2014; 2014.

45. Tesfau YB, Kahsay AB, Gebrehiwot TG, Medhanyie AA, Godefay H. Postnatal home visits by health extension workers in rural areas of Ethiopia: a cross-sectional study design. BMC Pregnancy and Childbirth. 2020; 20:1-9.

46. Mannan I, Rahman SM, Sania A, Seraji HR, Arifeen S, Winch P, et al. Can early postpartum home visits by trained community health workers improve breastfeeding of newborns? Journal of Perinatology. 2008; 28:632-40.

Figure legend

Figure 1. Positioning, attachment, and suckling of infant during feeding at Gidan, District, Northeast, Ethiopia, 2021 (n=760)

Table 1. Criteria and grading system for positioning, attachment and suckling among lactating mothers at Gidan district, northeast, Ethiopia, 2021 (n=760)

Criteria for correct body positioning:		
- Baby's body close to the mother's body		
- Baby body and neck straight		
- Baby facing toward the mothers breast		
- The whole body supported by mother		
Criteria for grading body positioning:	Grade	Score
None or only one out of four criteria has been fulfilled	Poor	0-1
Any two of the four criteria has been fulfilled	Average	2
Three/all the four criteria for body positioning were fulfilled	Good	3-4
Criteria for correctness of attachment:		
- More areola is seen above the baby's top lip		
- Baby's mouth is wide open		
- Baby's lower lip turned outwards		
- Baby's chin touching the breast		
Criteria for grading of correct attachment:	Grade	Score
None of or only one out of four criteria has been fulfilled	Poor	0-1
Any two of the four criteria has been fulfilled	Average	2

Any three or all the four criteria has been fulfilled	Good	3-4
Criteria for correctness of effective suckling:		
- Slow suckling		
- Deep suckling		
- Sometimes pausing		
Criteria for grading of effective suckling:	Grade	Score
• None or only one of the three criterion has been achieved	Ineffective	0-1
• Any two or all three criteria has been achieved	Effective	2-3

Table 2. Sociodemographic characteristics of respondents at Gidan, District, Northeast Ethiopia, 2021 (n= 760).

Variables	Categories	Frequency	Percent (%)
Age of the mothers'	<20	74	9.7
	20-25	197	25.9
	26-30	306	40.3
	>30	183	24.1
Religion	Orthodox	757	99.6
	Muslim	3	0.4
Educational status of the mothers'	Not attending formal education	435	57.2
	Primary school	233	30.7
	Secondary school and above	92	12.1
Occupation of	Housewife	645	84.9

the mothers'	Government employed	83	10.9
	Self employed	24	3.1
	Other*	8	1.1
	Married	684	90.0
Marital status	Single	53	7
	Windowed	16	2.1
	Other**	7	0.9
Educational	Not attending formal education	372	54.3
status of the	Primary school	202	29.4
husband	Secondary school and above	110	16
Occupation of	Farmer	552	80.7
the husbands'	Government employed	51	7.4
	Self employed	61	8.9
	Other***	20	2.9
Residence	Rural	573	75.4
	Urban	187	24.6

*student, **divorced, and separated, ***daily labor, and soldier

Table 3. Obstetric and infant characteristics of the respondent at Gidan, District, Northeast Ethiopia, 2021(n=760)

Variables	**Categories**	**Frequency(n)**	**Percent (%)**
Parity	Primipara	148	19.5
	Multipara	612	80.5
Antenatal care visit	Yes	650	85.5

	No	110	14.5
BFT* counseling during ANC	Yes	492	75.7
	No	158	24.3
Place of delivery	Hospital	40	5.2
	Health center	632	83.2
	Home	88	11.6
BFT* counseling immediately after	Yes	378	56.3
delivery	No	294	43.7
Postnatal care	Yes	143	18.8
	No	617	81.2
Age of the infants	≤60 days	307	40.4
	60-120 days	249	32.7
	121-179 days	204	26.9
Sex of the infants	Male	322	42.4
	Female	438	57.6
Breast problems	Yes	21	2.8
	No	739	97.3
Breastfeeding experiences	Yes	616	81.0
	No	144	19.0
Received postpartum home visit by	Yes	374	49.2
HEW**	No	386	50.8
Being member of WDA***	Yes	156	20.5
	No	604	79.5

previous information about BFT*	Yes	506	66.6
	No	254	33.4

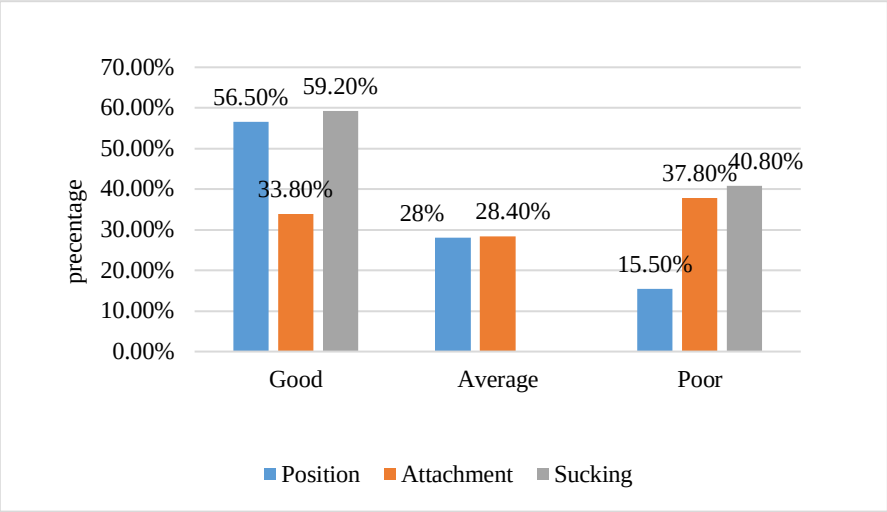
*Breastfeeding technique, **health extension workers, and ***woman development army

Table 4. Association of effective breastfeeding technique with different characteristics of lactating mothers in Gidan, District, Northeast Ethiopia, 2021(n=760).

Variables	EBT		COR (95%CI)	AOR (95%CI)
	Yes (n, %)	No (n, %)		
Age of the mothers'				
<20	19(27)	55(73)	1	1
20-25	77(38.6)	120(61.4)	1.86(0.94,3.05)	1.48(0.78, 2.81)
26-30	147(48)	159(52)	2.68(1.43,4.37)	2.31(0.91,3.70)
>30	83(45.4)	100(54.6)	2.40(1.24,4.04)	1.85(0.95,3.63)
Educational status of the mothers'				
No formal education	189(43.4)	246(56.6)	1	1
Primary education	88(37.8)	145(62.2)	0.79(0.57,1.09)	0.79(0.56,1.12)
Secondary education and above	49(57.3)	43(42.7)	1.48(0.94,2.33)	1.18(0.71,1.96)
Parity				
Primipara	49(33.1)	99(66.9)	1	1
Multipara	277(45.3)	335(54.7)	1.67(1.15,2.44)	1.17(0.75,1.83)
Antenatal care				
Yes	293(45.1)	357(54.9)	1.92(1.24,2.96)	**1.75(1.10,2.77)***
No	33(30)	77(70)	1	**1**
Place of delivery				

Hospital	22(57.5)	18(42.5)	3.40(1.77,8.61)	**2.85(1.22,6.66)***
Health center	283(44.6)	349(55.4)	2.59(1.55,8.61)	**2.15(1.25,3.68)****
Home	21(23.9)	67(76.1)	1	**1**
Being a membership of WDA				
Yes	86(55.1)	70(44.9)	1.86(1.26,2.57)	1.41(0.96,2.07)
No	240(39.8)	364(60.2)	1	1
Received postpartum visit by HEW				
Yes	205(54.5)	169(45.5)	2.66(1.93,3.49)	**2.12(1.55,2.92)****
No	121(31.6)	265(68.4)	1	**1**
Brest problem				
Yes	6(28.6)	15(71.4)	0.52(0.2, 1.36)	0.55(0.20,1.51)
No	320(43.3)	419(66.7)	1	1
Residency				
Urban	94(50.3)	93(49.7)	1.49(1.07,2.07)	1.41(0.97,2.05)
Rural	232(40.5)	341(59.5)	1	1

*Significant at p < 0.05, **Significant at p<0.01, EBT=effective breastfeeding technique, WDA=women development army and HEW=health extension workers, Hosmer and Lemeshow goodness of fit (p-value=0.22), Multicollinearity test (VIF) =1.68.



STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

Items	Number	Recommendations
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **page 1, line number 1-3**
		(b) provide in the abstract an informative and balanced summary of what was done and what was found **Page 2, line number 19-45**
Introduction		
Background/rational	2	Explain the scientific background and rationale for the investigation being reported **Page 3-5, line number 53-99**
Objective	3	State specific objectives, including any prespecified hypotheses **Page 2, line number 20**
Methods		
Study design	4	Present key elements of study design early in the paper **page 5, line number 1052-103**
Setting	5	Describer the setting, location, and relevant dates including period of recruitment and data collection **Page number 5, line number 103-111**

Participants	6	Give the eligibility criteria, and the sources and methods of selection of participants **Page 6, line number 112-120**
		Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifier, Give diagnostic, if applicable **Page 7-8, line number 151-174**
Data source and measurement	7	For each variables of interest, give source of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **Page 6-7, line number 131-150**
Bias	8	Describe any efforts to address potential sources of bias **Page 3 , line number 48-55**
Study size	9	Explain how the study design was arrived **Page 6, line number 119-130**
Quantitative variables	10	Explain how quantitative variables were handled in the analysis , if applicable describe which groupings chose and why **Page 9, line number 180-192**
Statistical methods	11	(a)Describe all statistical methods, including those used to control for confounding **Page 9 , line number 175-192**

		(*b*) Describe any methods used to examine subgroups and interactions **NA**
		(*c*) Explain how missing data were addressed **NA**
		(*d*) If applicable, describe analytical methods taking account of sampling strategy **NA**
		(*e*) Describe any sensitivity analyses **NA**
Results		
Descriptive data	12	Give characteristics of study participants (eg, demographic, clinical, social) and information on exposure and potential confounders **Page 10, line number 208-216**
Outcome data	13	Report numbers of outcome events or summary measures **Page 10, line number 219-222**
Main results	14	(a) Give unadjusted estimates and, if applicable, confounder adjusted estimates and their precision (e.g., 95% confidence interval).Make clear which confounders were adjusted for and why they were included **Page 11, line number 223-234**

		(b) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period **NA**
Other analysis	15	Report other analyses doing analyses of subgroups and interactions, and sensitive analysis **NA**
Discussion		
Key result	16	Summaries key results with reference to study objectives **Page 11-13, line number 236-288**
Limitations	17	Discuss limitations of the study, taking into account sources of potential bias or imprecision. discuss both direction and magnitude of any bias **Page 14, page 307-312**
Interpretation	18	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analysis, result from similar studies, and other relevant evidence **Page 12-13, line number 241-300**
Generalizability	19	Discuss the generalizability (external validity) of the study results **page 14, line number 301-306**
Funding	20	Give the source of funding and the role of the funders for the present study and if applicable for the original study on which the present article is based

		Page 15, line number 337

Note: An explanation and elaboration article discusses each checklist item and gives methodological background published examples of transport reporting. The STROBE checklist is best used in conjunction with this articles (freely available on the web sites of PloS Medicine at http://www.plosmedicene.org/.Annals of internal medicine http://www.annals.org/, and Epidemiology at http://www.epidem.com/ information on the STROBE initiative is available at www.strobe-statement.org.

BMJ Open

Effective breastfeeding technique and associated factors among lactating mothers at Gidan District, Northeast, Ethiopia: A community-based cross-sectional study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-059518.R2
Article Type:	Original research
Date Submitted by the Author:	22-May-2022
Complete List of Authors:	Asmamaw, Desale; University of Gondar, Department of Reproductive Health, Institute of Public Health Habitu, Yohannes; University of Gondar, Department of Reproductive Health, Institute of Public Health Negash, Wubshet Debebe; University of Gondar, Department of Health Systems and Policy Desta, Dawit Zenamarkos; University of Gondar College of Medicine and Health Sciences, Health Systems and Policy Mekonnen, Eskedar; University of Gondar College of Medicine and Health Sciences, Reproductive and child health; University of Gondar College of Medicine and Health Sciences, Reproductive and child health
Primary Subject Heading:	Public health
Secondary Subject Heading:	Public health, Qualitative research
Keywords:	Sexual dysfunction < UROLOGY, Nutrition < TROPICAL MEDICINE, Respiratory infections < THORACIC MEDICINE, PUBLIC HEALTH, Infectious diseases & infestations < DERMATOLOGY

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Effective breastfeeding technique and associated factors among lactating mothers at Gidan District, Northeast, Ethiopia: A community-based cross-sectional study

Desale Bihonegn Asmamaw[1*], Yohannes Ayanaw Habitu[1], Wubshet Debebe Negash[2], Dawit Zenamarkos Desta[2] and Eskedar Getie Mekonnen[1]

[1]Department of Reproductive Health, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia.

[2]Department of Health Systems and Policy, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

Authors' addresses

DBA: desalebihonegn1988@gmail.com

YAH: yohaneshabitu@gmail.com

WDN: wubshetdn@gmail.com

DZD: dawit.zemark@gmail.com

EGM: eskedargetie18@gmail.com

[*]**Corresponding author:**

DBA: desalebihonegn1988@gmail.com

Phone: +251-949897164

P.O.Box: 196; University of Gondar, Gondar, Ethiopia

Abstract

Objective: To assess effective breastfeeding techniques and associated factors among lactating mothers in Gidan District, Northeast Ethiopia.

Design: A community-based cross-sectional study

Setting: Gidan District, Northeast, Ethiopia.

Participants: A total of 786 lactating mothers were included between March 30 and April 29, 2021.

Outcome: Effective breastfeeding technique.

Methods: A multi-stage sampling technique was employed to recruit participants. Pretested interviewer-administered questionnaires and an observational checklist were used to collect the data. Individual scores of three variables about breastfeeding, namely positioning, attachment, and suckling, were computed to generate the outcome variable, breastfeeding technique. The binary logistic regression analyses were carried out to determine the association between independent variables and effective breastfeeding technique. Statistical significance was declared at a p-value ≤ 0.05 with a corresponding 95% confidence interval.

Results: Overall, the prevalence of effective breastfeeding technique was 42.9% (326/760). Having antenatal care follow-up (AOR=1.75(95%CI=1.10, 2.77)), delivering at health institutions [(hospital) (AOR=2.85(95%CI=1.22, 6.66)) and health center (AOR=2.15(95%CI=1.25, 3.68))], and receiving postpartum home visits by the health extension workers (AOR=2.12(1.55, 2.92) were significantly associated with the practice of effective breastfeeding technique.

Conclusion: The study revealed that the prevalence of effective breastfeeding technique was low. The finding highlights the importance of promoting utilization of antenatal care follow-up, institutional delivery, and postpartum home visits by health extension workers, which play a substantial role in promoting effective breastfeeding technique.

Keywords: Effective breastfeeding technique, Factors, lactating mothers, Gidan, Ethiopia

Strengths and limitations of the study

- Since the outcome variable was computed by scores given by different observers, some necessary measures, including delivering training and providing time to practice in a real environment before the data collection, were done to reduce measurement errors and interobserver variability.
- Due to inter-observer variability and the hawthorn effect, the study might not be free from bias.
- Using the registration book as a sampling frame may introduce selection bias as new lactating mothers might not get registered.

Introduction

Breastfeeding technique is defined as the composite of positioning, attachment, and suckling during breastfeeding.[1] Position indicates the capacity of the mother to carry her child on her body. At the same time, attachment denotes whether the mother attaches the baby to her breast and to her nipple, keeping most of the areola in the baby's mouth.[2] Similarly, suckling is a part of the breastfeeding technique, which reflects the infant's performance of expressing milk, which can be explained by the depth and speed of sucking.[1] Those techniques collectively imply the status of breastfeeding infants. The World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF) recommend breastfeeding within one hour of birth and exclusive breastfeeding for the first six months.[3] As a result, infants can get the required amount of energy and nutrients. Applying effective breastfeeding techniques can foster sufficient milk production and release.[4] In addition, appropriate breastfeeding helps prevent communicable and non-communicable diseases.[5, 6]

On the other hand, ineffective breastfeeding technique (IBT) is attributed to poor positioning, attachment, and suckling, which could result in early cessation of exclusive breastfeeding (EBF) and put infants at risk.[6] Several pieces of evidence show that more than half of mothers with IBT discontinue EBF earlier, resulting in severe infectious and non-infectious chronic diseases in their children.[6-8 9] Globally, more than half a million infants die each year due to nutritional deficiency attributed suboptimal breastfeeding.[10] Aside from the mortality, there are hundreds of thousands of children whose growth and development is impaired.[11] In Ethiopia, suboptimal breastfeeding practices (including ineffective breastfeeding techniques) contribute to the higher under-five mortality resulting from malnutrition.[12, 13] In the country, the burden of malnutrition, particularly undernutrition, begins at an early stage of life, and it's believed to be due to suboptimal breastfeeding practices.[13, 14]

IBF not only threatens the infants' lives but also negatively impacts the health of the mother. [15] IBT is one of the major causes of cracked nipples among lactating mothers.[15] Nipple damage, mastitis, and other similar complications are more common among lactating mothers with IBT.[7]

The practice of EBT varies across different settings. For instance, in South Ari district, Southern Ethiopia 36.5%,[9] Harar city, Eastern Ethiopia 43.4%,[16] Gondar town, Ethiopia 48%,[17] West Denmark 52%,[18] Libya 48%.[7] Furthermore, small-localized studies in India found that the practice of EBT ranged from 30.3% to 51%. [19-21] Multiple factors like parity, maternal and child age, level of education, place of delivery, antenatal care (ANC), postnatal natal care (PNC), knowledge of breastfeeding techniques, and counseling about EBT are some of the identified factors that can affect the practice of effective breastfeeding technique.[9, 17, 22, 23]

There have been several strategies to avert the problem, although sufficient improvement has not been observed in the past decade [11]. The WHO and the baby-friendly hospital initiative have designed the EBT counseling, teaching, and demonstrations for mothers in all maternity care services and all mothers with sick children in accordance with the integrated management of neonates and childhood illness (IMNCI) guidelines [6, 24]. Ethiopia has also recently incorporated IBT into the national acute malnutrition management guideline as a diagnostic criterion for severe acute malnutrition among infants under six months.[25]

Nutritional problems among children remain the most significant challenge towards achieving the Ethiopian government's target to end childhood undernutrition by 2030 with a commitment to the 'Seqota' Declaration.[26] To achieve the aforementioned target, we need to encourage EBT during infancy, and early childhood and science-backed interventions would have a significant role.

Although few studies have been conducted in Ethiopia, almost all of them were conducted among mothers who pursued health services (institution-based) in which those women

considerably have better knowledge about healthy practices.[7, 9, 16, 17] Similarly, the previous studies have been conducted, including mothers soon after birth before the mother is stabilized and becomes comfortable, which could ultimately affect the breastfeeding techniques.[8, 9, 18] Moreover, there was a paucity of evidence concerning EBT in northern Ethiopia. Therefore, this study aimed to assess effective breastfeeding technique and identify its associated factors among lactating mothers. The finding will provide evidence for policymakers and concerned bodies to work on the identified attributes to improve the practice of EBT further.

Methods

Study setting, design, and period

A community-based cross-sectional study was conducted from March 30 to April 29, 2021, in Gidan District, North Wollo zone, Northeast Ethiopia. The district is 595 km from Addis Ababa, the capital of Ethiopia, and it has two urban and 21 rural kebeles (the lowest administrative unit). Close to half (49.7%) of the population in the district are females. Under-five children and lactating mothers account for 15.2% (22523) and 4.3% (6320) of the population, respectively. The district has six health centers and 23 health posts that provide routine health services for the catchment population.[27]

Study participants

All lactating mothers (mother-infant pairs) having infants under six months of age in the selected kebeles in the Gidan district were included. Lactating mothers who were critically ill or unable to breastfeed their infants and infants with a critical illness at the time of data collection were excluded from the study.

Sample size determination and sampling procedures

The sample size was calculated using a single population proportion formula, considering the following statistical assumptions: margin of error 5% (0.05), Z-value 1.96 corresponding to 95% confidence level, 10% non-response, design effect of 2, and the proportion of effective breastfeeding technique was 36.5%, which gave a final sample size of 786.[9]

A multistage sampling technique stratified by urban and rural kebeles was employed. From 21 rural and two urban kebeles found in the district, 30% of the total kebeles (six kebeles from rural and one kebele from urban) were selected by a simple random sampling technique. The list of lactating mothers with children aged under six months was taken from the health extension workers' registration book of each selected Keeble's health post and considered as a

sampling frame. Then, the sample size was proportionally allocated to each selected kebele considering the number of lactating mothers. Simple random sampling using the Open Epi Random Program version 3 was used to draw the participants from each kebele.

Variable measurement and definition of terms

Positioning: It was explained when at least three out of four criteria for infant positioning have been fulfilled. Average positioning was defined if any two of the four criteria were correctly applied, whereas poor positioning was explained when only one or none criterion had been fulfilled.[9, 28]

Attachment: Good attachment was described when at least three out of four criteria have been fulfilled. The average attachment was explained if any two of the four criteria had been fulfilled. Poor attachment was described when only one or none of the four criteria had been fulfilled.

Suckling: Effective suckling was explained when at least two out of three criteria have been fulfilled. Ineffective suckling was explained if only one or none from three criterions has been fulfilled.[9, 28]

- **Slow suckling**: suckling pattern of an infant about one suck per second.[29]
- **Deep suckling**: the baby's cheeks are not drawn inward and are rounded during a feed, evidenced by visible or audible swallowing after every one or two sucks.[29]

Effective breastfeeding technique: the combination of at least two criteria from positioning, three criteria from the attachment, and two criteria from suckling. [16, 18]

Breast problem: a mother is explained to have breast problems if she has any of the following:

- ✓ **Inverted nipple:** a portion of or the entire nipple is buried below the plane of the areola and does not evert at all.[30]

- ✓ **Engorgement:** breasts are painfully overfull.
- ✓ **Cracked nipple**: any damage and excoriation to the integrity of the skin on the nipple.
- ✓ **Mastitis:** an inflammatory condition of the breast, which may or may not be accompanied by infection.[31]

Data collection tools and quality control

A structured observational checklist adopted from the WHO breastfeeding observational checklist and interviewer-administered questionnaires were developed from reviewing different related literature.[8, 9, 22, 23, 32, 33] According to the WHO criteria, we developed and adopted an arbitrary scoring and grading system to grade positioning, infant's, mouth attachment, and effective suckling during breastfeeding.[34] Each criterion scored 1 point (Table 1).

Eight female BSc midwives (data collectors) and two supervisors from the same field with experience in research and fieldwork coordination participated in the data collection process. Data collectors and supervisors were oriented and trained for one day, focusing on how to interview, examine and diagnose mothers with breast problems, tips to score the observational checklist, and bias controlling mechanisms. The data collectors have also received simulation/real-environment training, and their score was compared to see the effect of interobserver variability. This was repeated until the result of two data collectors on the same participant became approximately the same by helping and providing corrective measures. Moreover, we recruited data collectors having similar educational statuses and considerable similar experiences to reduce interobserver variability.

The questionnaires were pretested on 40 study participants (5%) at Gubalafto district, and modifications were made according to the pretest results. Data collectors approach participants

by introducing themselves and interviewing the selected respondent after obtaining oral informed consent.

The data collectors observed BFT while the mother was at home in a private place. To reduce the Hawthorn effect, mothers were oriented to show how they routinely breastfeed their infant, and they won't be judged by their way of doing it. The observation lasted at least five minutes, and the data collectors recorded the breastfeeding positioning, attachment, and suckling as per the WHO breastfeeding observation checklist. If the infant had breastfed in the previous one hour, the mother was asked when the infant would have the next feed, and the observation assessment was planned accordingly. Finally, the participants were interviewed for part two-interview questionnaire. The data collectors linked the mothers to the nearest health facilities who had breast problems such as mastitis, engorgement, and crackle nipple.

Data processing and analysis

The collected data were checked manually for completeness and consistency. Then, it was entered into the Epi-data version 4.6 software package and exported to Stata version 14 for cleaning, coding, and analysis. Descriptive statistics were described using frequencies, percentages, mean, and standard deviation and presented using tables, figures, and text. Normality tests such as kurtosis and skewness were employed to examine the distribution of continuous variables and identify the appropriate summary measures.

EBT was ascertained by computing the positioning, attachment, and suckling scores. The scores of each item of the three techniques have been computed first. In other words, questions to measure positioning were computed and categorized as good, average, and poor. Then, to create a dummy variable, good and average positioning were merged as good and labelled as '1' and poor positioning was coded as '0'. The same procedure was applied for attachment. Moreover, suckling was categorized and coded as effective and ineffective suckling.

The outcome variable was dichotomized as an 'effective' and 'ineffective' breastfeeding technique, and it was labeled as '1' and '0', respectively. The binary logistic regression analysis was applied. Independent variables with a p-value of 0.2 in the bi-variable analysis were considered in the multivariable model. Variables with a p-value ≤0.05 were regarded as statistically significant. AOR with its corresponding 95% CI was used to examine the strength and direction of the association.

Ethical approval

Ethical clearance was obtained from the Institutional Review Board (IRB) of the University of Gondar, College of Medicine and Health Sciences, Institute of Public Health (Ref. No: IPH/142/2013). Similarly, a support letter was taken from the district administrative office and handed to the selected kebeles. After a brief explanation of the study objective and purpose, oral informed consent was obtained from each participant. Participants were also informed that participation was voluntary, and they had the right to withdraw from the study at any time during the data collection. After the interview, the data collectors advise/demonstrate the mother about the effective breastfeeding technique if the mother-infant pair had an IBT. Furthermore, all data obtained from participants were kept confidential and used for this study only. The study was also conducted according to Helsinki declarations.

Patient and public involvement statement

Lactating mothers were included in this study by providing valuable information, including measurements. Nevertheless, they have never been involved in the study design, protocol, data collection tools, and reporting and disseminating the finding.

Results

Socio-demographic characteristics

A total of 760 breastfeeding mothers participated, making the response of 96.7%. The mean age of participants was 26.98 (±5.3 years). About 40.3% of participants fell within the age category of 26-30 years. A bit more than three-fourths (75.4%) of the respondents were rural dwellers, and almost all (99.6%) participants were orthodox Christian followers. Regarding the educational status of the mothers, more than half (57.2%) of them had no formal education (Table 2).

Obstetric and infant characteristics

About 80.5% and 85.5% of the mothers were multipara and had an ANC visit for their index child, respectively. More than half (55%) of the participants received breastfeeding technique counselling immediately after delivery (Table 3).

Prevalence of effective breastfeeding technique

The overall prevalence of mothers who had practiced effective breastfeeding technique was 42.9% (95% CI, 39.4-46.4%). Good breastfeeding positioning, attachment, and sucking were observed among 56.5%, 33.8%, and 59.2% of mothers, respectively (figure 1).

Factors associated with effective breastfeeding technique

After adjusting for potential confounding factors, variables such as ANC-follow up, place of delivery, and receiving postpartum home visits by HEWs remained significantly associated with effective breastfeeding technique. The odds of effective breastfeeding technique among mothers who had ANC follow-up during their index pregnancy was 1.75 times (AOR = 1.75(95%CI= 1.10, 2.77)) higher than their counterparts. Similarly, the odds of practicing EBT was 2.15 (AOR =2.15 (95%CI=1.25, 3.68)) and about 2.85 (AOR=2.85(95%CI=1.22, 6.66) times higher among mothers who had delivered at health centers and hospitals, respectively,

compared to those who had delivered at home. Likewise, effective breastfeeding technique was twice higher (AOR=2.12 (95% CI=1.55,2.92)) among respondents who had received postpartum home visits by the HEWs as compared to those who had received no postpartum home visits by the HEWs (table 4).

Discussion

Effective breastfeeding technique is the ideal way of promoting exclusive breastfeeding. A baby who breastfeeds effectively shows readiness for feeding and latch on deeply at the breast that satisfies the infant's nutritional requirements and maintains the mother's comfort [35]. This study aimed to determine the prevalence of EBT and identify associated factors among lactating mothers in Gidan District, Northeast Ethiopia.

The prevalence of EBF was 42.9% (95% CI, 39.4-46.4%), which implies several infants in the study areas are suffering from the aftermaths of suboptimal breastfeeding, such as malnutrition. This finding is in line with the studies conducted in India (43%) and Harar, Ethiopia (43.4%).[21, 36] However, the result of this study is higher than studies conducted in West Bengal hospital, India (30.3%) and Ari, District, Southern Ethiopia (36.5%). [9, 19] The observed discrepancy might be due to the time gap between the studies. Since the former studies were conducted in 2013 and there have been different strategies, including BFT counseling, promoting institutional delivery, and postpartum home visits by HEWs, that are presumed to improve maternal practices in EBT.[37] The existence of some variability in the obstetric characteristics of participants between the studies could also be another reason for the above variation. For instance, the proportion of mothers who had ANC visits and received counselling during the ANC follow up in this study was higher (75.4%) as compared to the study conducted in southern Ethiopia (59.2%), where having ANC visits and obtaining breastfeeding counselling service during the follow up showed an improved practice of EBT.[9, 21] In light of this, the current promotion strategies to improve ANC follow-up and breastfeeding should be strengthened to improve the BFT and maintain the health of children.

On the other hand, the proportion of EBT in the current study is lower than in previous studies done in Gondar, Northwest Ethiopia (48%), Libya (48%), rural population of India (51%), and West Denmark (52%).[7, 17, 18, 20] The possible explanation might be the difference in the study

setting, in which the former studies were based at health institutions that recruited mothers who came to the health facilities either for vaccination or PNC services. These populations are usually considered to have better health literacy and opportunities to obtain breastfeeding counselling. In addition, the proportion of educated participants (secondary school and above) was lower (12.1%) in our study compared to the studies conducted earlier (in the rural populations of India (78.1%) and West Denmark (71.1%)), that might make the prevalence of EBT lower than their finding.[18, 20] Although no association has been observed between the level of education and EBT practice in our study, several sherds of evidence indicated that level of education impacts individuals' health literacy level. It can also be further an influencing factor for practicing EBT.[38]

Mothers who had ANC follow-up had higher odds of exhibiting EBT than their counterparts. The finding is consistent with studies conducted in South-East Nigeria.[39] Mothers who visit health institutions for ANC follow-up receive counselling about breastfeeding technique that enhances mothers' awareness, understanding, and appreciation of the sequelae of IBT and further promote their practice.[9, 40] Moreover, mothers who had ANC follow-up during pregnancy were more likely to have an institutional delivery that makes them lose the opportunity to receive postpartum breastfeeding counselling.[9, 21, 41]. Thus, strengthening the existing effort to improve ANC follow-up and institutional delivery would help improve breastfeeding practice beyond preventing life-threatening maternal and neonatal complications.

Likewise, the odds of EBT were 2.15 and 2.85 times higher among participants who had delivered at the health center and hospital, respectively, as compared to mothers who had delivered at home. The finding is congruent with previous evidence from the Bhaktapur district of Nepal, and Harar, Ethiopia.[36, 42] Women who had delivered at health institutions might possibly have a better opportunity to receive counseling related to breastfeeding technique

immediately after delivery. That will further have a positive impact on the mothers' breastfeeding technique. [36] Furthermore, women who had delivered at home were usually less educated and had less access to health messages, which might impact healthy practices, including EBT.[43, 44].

Similarly, postpartum home visits by health extension workers have a positive association with adopting EBT . The odds of having EBT was 2.12 times higher among mothers who had received postpartum home visits by health extension workers compared to their counterparts. The possible reason could be that women who have received postnatal home visits by the HEW might get breastfeeding counselling and demonstration that will help mothers improve their attitude, knowledge, and practice regarding breastfeeding technique. Furthermore, women who receive postpartum home visits from HEWs may receive psychological support from the HEWs, which further promotes effective breastfeeding techniques, as mothers' psychosocial well-being significantly impacts their care and practice towards their baby.[45, 46] The result is a call for action to further improve postnatal home visits to promote EBT and infant nutrition.

This finding shows more than half of lactating mothers are not practicing EBT, which implies thousands of infants are receiving insufficient nutrients to maintain their growth and development. Therefore, it is crucial to counteract the problem by working on the mothers' skills in breastfeeding technique.

The study had better strength in measuring the outcome. Since the outcome variable was computed by scores given by different observers, different measures, including delivering training and providing time to practice in a real environment before the data collection, were done to reduce measurement errors and interobserver variability.

On the other hand, this study was not avoiding limitations. Even though all possible strategies such as using female data collectors, providing training for data collectors, employing pretest, using standardized tools, and securing privacy were applied, the study might not be free from

bias due to introducing inter-observer variability and the hawthorn effect. Similarly, employing the HEWs registration book as a sampling frame may provide a biased estimate through missing new lactating mothers.

Conclusion

The study revealed that the prevalence of effective breastfeeding technique was low. The finding highlights the importance of promoting utilization of antenatal care follow-up, institutional delivery, and postpartum home visits by health extension workers, which play a substantial role in promoting effective breastfeeding technique.

Abbreviations

ANC: Antenatal Care; AOR: Adjusted Odd Ratio: BFT; Breastfeeding Technique: CI; Confidence Interval: COR; Crude Odd Ratio: EBF; Exclusive Breastfeeding: EBT; Effective Breastfeeding Technique: EDHS; Ethiopian Demographic and Health Survey: HEW; Health Extension Workers: OR; Odds Ratio: PNC; Postnatal Care: WDA; Women Development Army: WHO; World Health Organization

Consent for publication

Not applicable

Data sharing statement

All the data generated in this study are included in this manuscript. The datasets used and analyzed to produce the current manuscript will be obtained from the corresponding author upon request.

Competing interests

The authors declare that they have no competing interests.

Funding source

Not applicable

Authors' contributions

DBA conceived the idea for this study, developed the proposal, supervised fieldwork, and made the analysis, interpretation, and manuscript write up. YAH and EGM assisted in the conception of the study, involved in the method development, analysis, and interpretation of the findings. DZD and WDN participated in the analysis, interpretation of the findings, and writing the manuscript. All the authors have read, revised, and approved the final manuscript.

Acknowledgements

Our great gratitude goes to the University of Gondar for approving the ethical clearance. We are also pleased to extend our appreciation to the Gidan District administrative offices, study participants, data collectors, and supervisors.

References

1. Ahmed K, Page A, Arora A, Ogbo F. Global Maternal and Child Health Research collaboration (GloMACH)(2020). Associations between infant and young child feeding practices and acute respiratory infection and diarrhoea in Ethiopia: A propensity score matching approach. PloS One. 2020; 15:e0230978.

2. Kent JC, Ashton E, Hardwick CM, Rowan MK, Chia ES, Fairclough KA, et al. Nipple pain in breastfeeding mothers: incidence, causes and treatments. International journal of environmental research and public health. 2015; 12:12247-63.

3. Friedrich M. Early initiation of breastfeeding. Jama. 2018; 320:1097-.

4. Johnson R, Taylor W. Skills for midwifery practice: Elsevier Health Sciences; 2010.

5. Lassi ZS, Rind F, Irfan O, Hadi R, Das JK, Bhutta ZA. Impact of infant and young child feeding (IYCF) nutrition interventions on breastfeeding practices, growth and mortality in low-and middle-income countries: systematic review. Nutrients. 2020; 12:722.

6. Child WHODo, Health A, Organization WH, UNICEF. Handbook IMCI: integrated management of childhood illness: World Health Organization; 2005.

7. Goyal RC, Banginwar AS, Ziyo F, Toweir AA. Breastfeeding practices: positioning, attachment (latch-on) and effective suckling–a hospital-based study in Libya. Journal of Family and Community Medicine. 2011; 18:74.

8. Parashar M, Singh S, Kishore J, Patavegar BN. Breastfeeding attachment and positioning technique, practices, and knowledge of related issues among mothers in a resettlement colony of Delhi. ICAN: Infant, Child, & Adolescent Nutrition. 2015; 7:317-22.

9. Yilak G, Gebretsadik W, Tadesse H, Debalkie M, Bante A. Prevalence of ineffective breastfeeding technique and associated factors among lactating mothers attending public health facilities of South Ari district, Southern Ethiopia. Plos one. 2020; 15:e0228863.

10. Arts M, Taqi I, Bégin F. Improving the early initiation of breastfeeding: the WHO-UNICEF breastfeeding advocacy initiative. Breastfeeding Medicine. 2017; 12:326-7.

11. Collective GB. Global breastfeeding scorecard, 2018: Enabling women to breastfeed through better policies and programmes. Retrieved from UNICEF & WHO website: https://www who int/nutrition/publications/infantfeeding/global-bf-scorecard-2018 pdf. 2018.

12. Binns C, Lee MK, Low WY, Zerfas A. The role of public health nutrition in achieving the sustainable development goals in the Asia Pacific Region. Asia Pacific Journal of Public Health. 2017; 29:617-24.

13. Federal Minstery of Health. National strategy for infant and young child feeding. Ethiopia: Addis Ababa. 2004.

14. Demographic Health survey 2016: key indicators report. Addis Ababa, Ethiopia, and Rockville, Maryland, USA Ethiopia: Ethiopia Demographic and Health Survey. 2016.

15. Santos KJdS, Santana GS, Vieira TdO, Santos CAdST, Giugliani ERJ, Vieira GO. Prevalence and factors associated with cracked nipples in the first month postpartum. BMC pregnancy and childbirth. 2016; 16:1-8.

16. Tiruye G, Mesfin F, Geda B, Shiferaw K. Breastfeeding technique and associated factors among breastfeeding mothers in Harar city, Eastern Ethiopia. International breastfeeding journal. 2018; 13:1-9.

17. Safayi BL, Assimamaw NT, Kassie DG. Breastfeeding technique and associated factors among lactating mothers visiting Gondar town health facilities, Northwest Ethiopia: observational method. Italian journal of pediatrics. 2021; 47:1-10.

18. Kronborg H, Væth M. How are effective breastfeeding technique and pacifier use related to breastfeeding problems and breastfeeding duration? Birth. 2009; 36:34-42.

19. Dasgupta U, Mallik S, Bhattacharyya K, Sarkar J, Bhattacharya S, Halder A. Breastfeeding practices: positioning, attachment and effective suckling—a hospital based study in West Bengal/Kolkata. Indian J Mater Child Health. 2013; 15:1-11.

20. Kishore MSS, Kumar P, Aggarwal AK. Breastfeeding knowledge and practices amongst mothers in a rural population of North India: a community-based study. Journal of tropical pediatrics. 2009; 55:183-8.

21. Nagendra K, Shetty P, Rudrappa S, Jaganath S, Nair R. Evaluation of breast feeding techniques among postnatal mothers and effectiveness of intervention: Experience in a tertiary care centre. Sri Lanka Journal of Child Health. 2017; 46.

22. Tamiru D, Jisha H. Breastfeeding skills in Arba Minch Zuria: The positioning and attachment initiatives. International Journal of Nursing and Midwifery. 2017; 9:46-52.

23. Rinata E, Sari PA. Breastfeeding *practices* (position, attachment/latch-on and effective suckling. Seajom: The Southeast Asia Journal of Midwifery. 2017; 3:1-6.

24. World Health Organization. Guideline: protecting, promoting and supporting breastfeeding in facilities providing maternity and newborn services: World Health Organization; 2017.

25. National Guideline for the Management of Acute Malnutrition. FMOH Addis Ababa; 2019.

26. Ethiopia commits to ending undernutrition by 2030 with the Seqota Declaration. 2015.

27. Yadav K, Agarwal M, Shukla M, Singh JV, Singh VK. Unmet need for family planning services among young married women (15–24 years) living in urban slums of India. BMC women's health. 2020; 20:1-17.

28. Tella K, Guruvare S, Hebbar S, Adiga P, Rai L. Knowledge, attitude, and practice of techniques of breast-feeding among postnatal mothers in a coastal district of Karnataka. International Journal of Medical Science and Public Health. 2016; 5:28-34.

29. Network EN. Infant Feeding in Emergencies. Module 2 Version 1.0 for health and nutrition workers in emergencies. ENN. http://www. ennonline. net/ifemodule2; 2007.

30. Stevens WG, Fellows DR, Vath SD, Stoker DA. An integrated approach to the repair of inverted nipples. Aesthetic surgery journal. 2004; 24:211-5.

31. World Health Organization. Mastitis: causes and management: World Health Organization2000.

32. Aswathaman N, Sajjid M, Kamalarathnam C, Seeralar AA. Assessment of breastfeeding position and attachment (ABPA) in a tertiary care centre in Chennai, India: an observational descriptive cross-sectional study. International Journal of Contemporary Pediatrics. 2018; 5:2209.

33. Rinata E, Sari PA. breastfeeding practices (postioning, attachment-on and effective sucking). Seajom: The Southeast Asia Journal of Midwifery. 2017; 3:1-6.

34. World Health Organization. Breastfeeding counselling: a training course: World Health Organization 1993.

35. Puapornpong P, Paritakul P, Suksamarnwong M, Srisuwan S, Ketsuwan S. Nipple pain incidence, the predisposing factors, the recovery period after care management, and the exclusive breastfeeding outcome. Breastfeeding Medicine. 2017; 12:169-73.

36. Tiruye G, Mesfin F, Geda B, Shiferaw K. Breastfeeding technique and associated factors among breastfeeding mothers in Harar city, Eastern Ethiopia. Int Breastfeed J. 2018; 13:5.

37. National Reproductive Health Strategy 2016-2020. Federal Ministry of Health (FMOH) Addis Ababa, Ethiopia; 2016.

38. Adnan N, Muniandy ND. The relationship between mothers' educational level and feeding practices among children in selected kindergartens in Selangor, Malaysia: A cross-sectional study. Asian Journal of Clinical Nutrition. 2012; 4:39.

39. Nduagubam OC, Ndu IK, Bisi-Onyemaechi A, Onukwuli VO, Amadi OF, Okeke IB, et al. Assessment of breastfeeding techniques in Enugu, South-East Nigeria. Annals of African Medicine. 2021; 20:98.

40. Mekuria G, Edris M. Exclusive breastfeeding and associated factors among mothers in Debre Markos, Northwest Ethiopia: a cross-sectional study. International breastfeeding journal. 2015; 10:1-7.

41. Abeje G, Azage M, Setegn T. Factors associated with Institutional delivery service utilization among mothers in Bahir Dar City administration, Amhara region: a community based cross sectional study. Reproductive Health. 2014; 11:1-7.

42. Paudel DP, Giri S. Breast feeding practices and associated factors in Bhaktapur District of Nepal: A community based cross-sectional study among lactating mothers. Journal of the Scientific Society. 2014; 41:108.

43. Fikre AA, Demissie M. Prevalence of institutional delivery and associated factors in Dodota Woreda (district), Oromia regional state, Ethiopia. Reproductive health. 2012; 9:1-6.

44. Wolelie A, Aychiluhm M, Awoke W. Institutional delivery service utilization and associated factors in Banja District, Awie zone, Amhara regional sate, Ethiopia. Open Journal of Epidemiology. 2014; 2014.

45. Tesfau YB, Kahsay AB, Gebrehiwot TG, Medhanyie AA, Godefay H. Postnatal home visits by health extension workers in rural areas of Ethiopia: a cross-sectional study design. BMC Pregnancy and Childbirth. 2020; 20:1-9.

46. Mannan I, Rahman SM, Sania A, Seraji HR, Arifeen S, Winch P, et al. Can early postpartum home visits by trained community health workers improve breastfeeding of newborns? Journal of Perinatology. 2008; 28:632-40.

Figure legend

Figure 1. Positioning, attachment, and suckling of infant during feeding at Gidan, District, Northeast, Ethiopia, 2021 (n=760)

Table 1. Criteria and grading system for positioning, attachment and suckling among lactating mothers at Gidan district, northeast, Ethiopia, 2021 (n=760)

Criteria for correct body positioning:		
- Baby's body close to the mother's body		
- Baby body and neck straight		
- Baby facing toward the mothers breast		
- The whole body supported by mother		
Criteria for grading body positioning:	Grade	Score
None or only one out of four criteria has been fulfilled	Poor	0-1
Any two of the four criteria has been fulfilled	Average	2
Three/all the four criteria for body positioning were fulfilled	Good	3-4
Criteria for correctness of attachment:		
- More areola is seen above the baby's top lip		
- Baby's mouth is wide open		
- Baby's lower lip turned outwards		
- Baby's chin touching the breast		
Criteria for grading of correct attachment:	Grade	Score
None of or only one out of four criteria has been fulfilled	Poor	0-1
Any two of the four criteria has been fulfilled	Average	2
Any three or all the four criteria has been fulfilled	Good	3-4
Criteria for correctness of effective suckling:		

- Slow suckling		
- Deep suckling		
- Sometimes pausing		
Criteria for grading of effective suckling:	Grade	Score
• None or only one of the three criterion has been achieved	Ineffective	0-1
• Any two or all three criteria has been achieved	Effective	2-3

Table 2. Sociodemographic characteristics of respondents at Gidan, District, Northeast Ethiopia, 2021 (n= 760).

Variables	Categories	Frequency	Percent (%)
Age of the mothers'	<20	74	9.7
	20-25	197	25.9
	26-30	306	40.3
	>30	183	24.1
Religion	Orthodox	757	99.6
	Muslim	3	0.4
Educational status of the mothers'	Not attending formal education	435	57.2
	Primary school	233	30.7
	Secondary school and above	92	12.1
Occupation of the mothers'	Housewife	645	84.9
	Government employed	83	10.9
	Self employed	24	3.1

	Other*	8	1.1
	Married	684	90.0
Marital status	Single	53	7
	Windowed	16	2.1
	Other**	7	0.9
Educational status of the husband	Not attending formal education	372	54.3
	Primary school	202	29.4
	Secondary school and above	110	16
Occupation of the husbands'	Farmer	552	80.7
	Government employed	51	7.4
	Self employed	61	8.9
	Other***	20	2.9
Residence	Rural	573	75.4
	Urban	187	24.6

*student, **divorced, and separated, ***daily labor, and soldier

Table 3. Obstetric and infant characteristics of the respondent at Gidan, District, Northeast Ethiopia, 2021(n=760)

Variables	Categories	Frequency(n)	Percent (%)
Parity	Primipara	148	19.5
	Multipara	612	80.5
Antenatal care visit	Yes	650	85.5
	No	110	14.5
BFT* counseling during ANC	Yes	492	75.7

	No	158	24.3
Place of delivery	Hospital	40	5.2
	Health center	632	83.2
	Home	88	11.6
BFT* counseling immediately after	Yes	378	56.3
delivery	No	294	43.7
Postnatal care	Yes	143	18.8
	No	617	81.2
Age of the infants	≤60 days	307	40.4
	60-120 days	249	32.7
	121-179 days	204	26.9
Sex of the infants	Male	322	42.4
	Female	438	57.6
Breast problems	Yes	21	2.8
	No	739	97.3
Breastfeeding experiences	Yes	616	81.0
	No	144	19.0
Received postpartum home visit by	Yes	374	49.2
HEW**	No	386	50.8
Being member of WDA***	Yes	156	20.5
	No	604	79.5
previous information about BFT*	Yes	506	66.6
	No	254	33.4

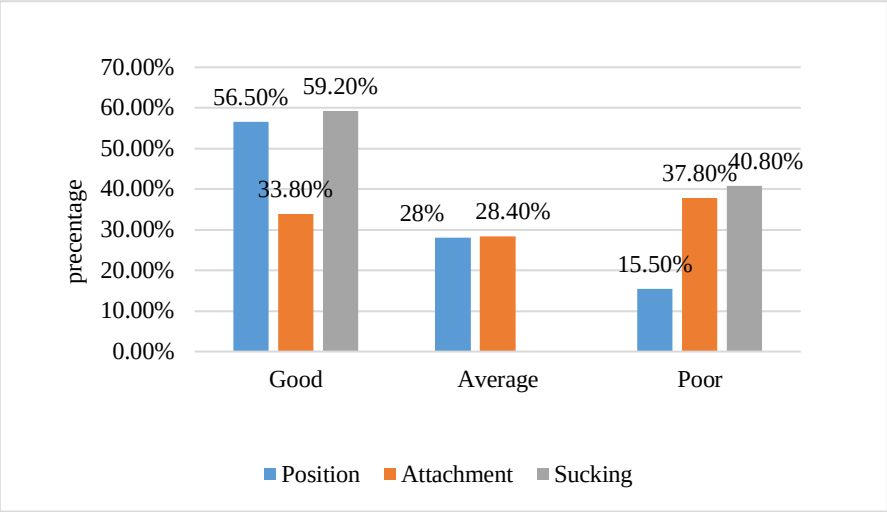
*Breastfeeding technique, **health extension workers, and ***woman development army

Table 4. Association of effective breastfeeding technique with different characteristics of lactating mothers in Gidan, District, Northeast Ethiopia, 2021(n=760).

Variables	EBT		COR (95%CI)	AOR (95%CI)
	Yes (n, %)	No (n, %)		
Age of the mothers'				
<20	19(27)	55(73)	1	1
20-25	77(38.6)	120(61.4)	1.86(0.94,3.05)	1.48(0.78, 2.81)
26-30	147(48)	159(52)	2.68(1.43,4.37)	2.31(0.91,3.70)
>30	83(45.4)	100(54.6)	2.40(1.24,4.04)	1.85(0.95,3.63)
Educational status of the mothers'				
No formal education	189(43.4)	246(56.6)	1	1
Primary education	88(37.8)	145(62.2)	0.79(0.57,1.09)	0.79(0.56,1.12)
Secondary education and above	49(57.3)	43(42.7)	1.48(0.94,2.33)	1.18(0.71,1.96)
Parity				
Primipara	49(33.1)	99(66.9)	1	1
Multipara	277(45.3)	335(54.7)	1.67(1.15,2.44)	1.17(0.75,1.83)
Antenatal care				
Yes	293(45.1)	357(54.9)	1.92(1.24,2.96)	**1.75(1.10,2.77)***
No	33(30)	77(70)	1	**1**
Place of delivery				
Hospital	22(57.5)	18(42.5)	3.40(1.77,8.61)	**2.85(1.22,6.66)***
Health center	283(44.6)	349(55.4)	2.59(1.55,8.61)	**2.15(1.25,3.68)****

Home	21(23.9)	67(76.1)	1	**1**
Being a membership of WDA				
Yes	86(55.1)	70(44.9)	1.86(1.26,2.57)	1.41(0.96,2.07)
No	240(39.8)	364(60.2)	1	1
Received postpartum visit by HEW				
Yes	205(54.5)	169(45.5)	2.66(1.93,3.49)	**2.12(1.55,2.92)****
No	121(31.6)	265(68.4)	1	**1**
Brest problem				
Yes	6(28.6)	15(71.4)	0.52(0.2, 1.36)	0.55(0.20,1.51)
No	320(43.3)	419(66.7)	1	1
Residency				
Urban	94(50.3)	93(49.7)	1.49(1.07,2.07)	1.41(0.97,2.05)
Rural	232(40.5)	341(59.5)	1	1

*Significant at $p < 0.05$, **Significant at $p<0.01$, EBT=effective breastfeeding technique, WDA=women development army and HEW=health extension workers, Hosmer and Lemeshow goodness of fit (p-value=0.22), Multicollinearity test (VIF) =1.68.



STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

Items	Number	Recommendations
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **page 1, line number 1-3**
		(b) provide in the abstract an informative and balanced summary of what was done and what was found **Page 2, line number 19-45**
Introduction		
Background/rational	2	Explain the scientific background and rationale for the investigation being reported **Page 3-5, line number 53-99**
Objective	3	State specific objectives, including any prespecified hypotheses **Page 2, line number 20**
Methods		
Study design	4	Present key elements of study design early in the paper **page 5, line number 1052-103**
Setting	5	Describer the setting, location, and relevant dates including period of recruitment and data collection **Page number 5, line number 103-111**

Participants	6	Give the eligibility criteria, and the sources and methods of selection of participants **Page 6, line number 112-120**
		Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifier, Give diagnostic, if applicable **Page 7-8, line number 151-174**
Data source and measurement	7	For each variables of interest, give source of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **Page 6-7, line number 131-150**
Bias	8	Describe any efforts to address potential sources of bias **Page 3 , line number 48-55**
Study size	9	Explain how the study design was arrived **Page 6, line number 119-130**
Quantitative variables	10	Explain how quantitative variables were handled in the analysis , if applicable describe which groupings chose and why **Page 9, line number 180-192**
Statistical methods	11	(a)Describe all statistical methods, including those used to control for confounding **Page 9 , line number 175-192**

		(*b*) Describe any methods used to examine subgroups and interactions **NA**
		(*c*) Explain how missing data were addressed **NA**
		(*d*) If applicable, describe analytical methods taking account of sampling strategy **NA**
		(*e*) Describe any sensitivity analyses **NA**
Results		
Descriptive data	12	Give characteristics of study participants (eg, demographic, clinical, social) and information on exposure and potential confounders **Page 10, line number 208-216**
Outcome data	13	Report numbers of outcome events or summary measures **Page 10, line number 219-222**
Main results	14	(a) Give unadjusted estimates and, if applicable, confounder adjusted estimates and their precision (e.g., 95% confidence interval).Make clear which confounders were adjusted for and why they were included **Page 11, line number 223-234**

		(b) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period **NA**
Other analysis	15	Report other analyses doing analyses of subgroups and interactions, and sensitive analysis **NA**
Discussion		
Key result	16	Summaries key results with reference to study objectives **Page 11-13, line number 236-288**
Limitations	17	Discuss limitations of the study, taking into account sources of potential bias or imprecision. discuss both direction and magnitude of any bias **Page 14, page 307-312**
Interpretation	18	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analysis, result from similar studies, and other relevant evidence **Page 12-13, line number 241-300**
Generalizability	19	Discuss the generalizability (external validity) of the study results **page 14, line number 301-306**
Funding	20	Give the source of funding and the role of the funders for the present study and if applicable for the original study on which the present article is based

		Page 15, line number 337

Note: An explanation and elaboration article discusses each checklist item and gives methodological background published examples of transport reporting. The STROBE checklist is best used in conjunction with this articles (freely available on the web sites of PloS Medicine at http://www.plosmedicene.org/.Annals of internal medicine http://www.annals.org/, and Epidemiology at http://www.epidem.com/ information on the STROBE initiative is available at www.strobe-statement.org.