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# BMJ Open

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

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4 1 **Effective Breastfeeding Technique and Associated Factors Among**  
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7 2 **Lactating Mothers at Gidan District, Northeast, Ethiopia, 2021**

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## 19 Abstract

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

22 **Design:** Community based cross-sectional study

23 **Setting:** Gidan District, Northeast, Ethiopia

24 **Participants:** lactating mothers

25 **Primary outcome:** Effective breastfeeding technique

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

34 **Results:** The proportion of effective breastfeeding technique was 42.9% (95% CI, 39.4,  
35 46.4%). Antenatal care follow up (AOR=1.75(95%CI=1.10, 2.77)), delivering at hospital  
36 (AOR=2.85(95%CI=1.22, 6.66)), delivering at health center (AOR=2.15(95%CI=1.25, 3.68))  
37 and receiving postpartum home visit by the health extension workers (AOR=2.12(1.55, 2.92)  
38 were significantly associated with an increased odds of effective breastfeeding technique.

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

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3 43 home visit by the health extension workers are recommended to improve the practice of effective  
4  
5 44 breastfeeding techniques  
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8 45 **Keywords:** Effective breastfeeding technique, factors, lactating mothers, Gidan, Ethiopia  
9

#### 10 11 46 **Strengths and limitations of the study**

- 12  
13 47 ➤ This study was conducted in a community with including both rural and urban areas  
14  
15 that addresses mothers who did not have a history of visiting health facilities  
16  
17 48 ➤ The study might not free from bias due to introducing inter-observer variability and  
18  
19 hawthorn effect.  
20  
21 49 ➤ Employing the HEWs registration book as a sampling frame may provide a biased  
22  
23 estimate through missing new lactating mothers.  
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#### 27 53 **Introduction**

28  
29 54 Breastfeeding, is a process of providing essential nutrients for children directly from the  
30  
31 mother's breast, is indispensable for the healthy growth and development of the children.<sup>1</sup>  
32

33  
34 56 World Health Organization (WHO) and the United Nations Children's Fund recommended the  
35  
36 57 initiation of breastfeeding within one hour of birth and practice exclusive breastfeeding (EBF)  
37  
38 58 for the first six months of newborn life.<sup>2</sup>  
39  
40

41  
42 59 Breastfeeding is a learned skill as it is not a single suckling action but a series of behaviors  
43  
44 60 which depends on the integrated coordination between mothers and infants that can be effective  
45  
46 61 or ineffective. Effective breastfeeding technique (EBT) remains one of the best ways of  
47  
48 62 promoting EBF practice that prevents early weaning.<sup>3</sup> Appropriate breastfeeding practice had  
49  
50 63 numerous importance in preventing communicable and non-communicable diseases, including  
51  
52 64 but not limited to type 2 diabetes, ear infections, asthma, lower respiratory infections, diarrhea  
53  
54 65 and vomiting, eczema, childhood leukemia, and sudden infant death syndrome (SIDS).<sup>4</sup>  
55  
56  
57 66 Breastfeeding also improves intelligence quotient (IQ), school attendance, and it is associated  
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3 67 with higher wages in adult life.<sup>5</sup> Ineffective breastfeeding technique (IBT) could have adverse  
4  
5 68 outcomes both in the child and the mother's life.<sup>6</sup>  
6  
7

8 69 More than half a million infants die each year due to nutritional deficiency ascribed by  
9  
10 70 inadequate breastfeeding and/or IBT.<sup>7</sup> Besides the mortality, there are hundreds of thousands  
11  
12 71 children that suffered from poor growth and development.<sup>8</sup> In Ethiopia, sub-optimal  
13  
14 72 breastfeeding practices (including ineffective breastfeeding techniques) also contribute to the  
15  
16 73 higher under-fives mortality rate.<sup>9 10</sup> Making the biggest number of under-five mortality in the  
17  
18 74 world. In Ethiopia, the burden of malnutrition particularly undernutrition begins in early time  
19  
20 75 life, primarily during the first year, due to suboptimal breastfeeding practices.<sup>10 11</sup> Similarly,  
21  
22 76 IBT practices including incorrect positioning, attachment, and sucking could result in different  
23  
24 77 untoward consequences in mothers well-being such as crackled nipple, breast engorgement,  
25  
26 78 and mastitis.<sup>12</sup>  
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30  
31 79 Globally, there are an estimated 20,000 maternal deaths from breast cancer that could be  
32  
33 80 prevented through increasing breastfeeding practices.<sup>13</sup> Adoption of optimal and effective  
34  
35 81 breastfeeding technique among children aged less than two years are also indicated to humper  
36  
37 82 820, 000 under-five mortality that attributed by preventable cause and malnutrition.<sup>14</sup>  
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40  
41 83 The practice of effective breastfeeding techniques vary across different settings that range from  
42  
43 84 30 to 70 % in Brazil, Nepal, Denmark, India, Libya, and Ethiopia.<sup>15-20</sup> Multiple factors like  
44  
45 85 parity, maternal and child age, level of education, place of delivery, antenatal and postnatal,  
46  
47 86 and knowledge of breastfeeding techniques care follow up are some of the identified factors  
48  
49 87 that can affect practice of effective breastfeeding techniques.<sup>15 21 22</sup>  
50

51  
52 88 Although few studies were conducted previously, they had limitations that might introduce bias  
53  
54 89 in the estimate. Some important variables that might potentially correlation with EBT such as  
55  
56 90 postpartum home visit by health extension workers were not previously addressed. Likewise,  
57  
58 91 the former studies have been conducted among mothers soon after birth before the mother was  
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3 92 stabilized and gets comfortable, which could ultimately affect the breastfeeding techniques. In  
4  
5 93 addition, majority of the prior studies were based at institutions involving mothers who come  
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7  
8 94 to vaccination or postnatal care, populations that presumed to obtain breastfeeding counseling  
9  
10 95 service. Moreover, there was a paucity of evidence concerning EBT in the northern Ethiopia.  
11  
12 96 Therefore, this study aimed to assess effective breastfeeding technique and identify its  
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15 97 associated factors among lactating mothers, which will bring concert evidence for  
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17 98 policymakers and concerned bodies to work on the identified attributes to further improve  
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19 99 adoption of EBT.  
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## 100 **Methods**

### 101 **Study setting, design and period**

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

### 111 **Source population and study population**

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

### 116 **Inclusion and exclusion criteria**

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

### 121 **Sample size determination and sampling procedures**

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

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3 124 corresponding to 95% confidence level<sup>24</sup>, 10% of non-response rate, design effect of 2, and the  
4  
5 125 proportion of effective breastfeeding technique was 36.5% which was taken from similar study  
6  
7  
8 126 which give the final sample size to be 786.<sup>15</sup>  
9

10 127 A multistage sampling technique was used to select 786 study participants. Seven kebeles in  
11  
12 128 the district were randomly chosen using lottery method. The list of lactating mothers with  
13  
14 129 children aged under six months were identified from the health extension workers registration  
15  
16 130 book at the health posts of each selected Kebeles and considered as a sampling frame. Then,  
17  
18 131 the sample size was proportionally allocated to each selected kebeles considering the number  
19  
20 132 of lactating mothers. Simple random sampling (Open Epi Random Program version 3) was  
21  
22 133 used to select lactating mothers from each kebele of HEWs registration book list at the health  
23  
24 134 post.  
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### 29 135 **Data Collection tools and quality control**

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32 136 A structured observational checklist adopted from the WHO breastfeeding observational  
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34 137 checklist and an interviewer-administered questionnaire developed from reviewing different  
35  
36 138 related literatures were used for data collection.<sup>15 18 21 22 25 26</sup> Data collectors were approached  
37  
38 139 by introducing themselves and interviewing the selected respondent after obtaining an  
39  
40 140 informed consent.  
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43

44 141 The data collectors observed BFT while the mother was at home if the infant did not feed in  
45  
46 142 the previous one hour and each respondent was observed in a private place. The observation  
47  
48 143 last at least for five minutes and the data collector recorded the breastfeeding positioning,  
49  
50 144 attachment and suckling as per the WHO breastfeeding observation check list. . If the infant  
51  
52 145 had received milk in the previous one hour, the mother was asked when the infant would have  
53  
54 146 the next feed and the observation assessment was planned accordingly. If the mother-child pair  
55  
56 147 had ineffective breastfeeding technique, the data collectors advise/demonstrate the mother  
57  
58 148 about the technique of breastfeeding after finishing the questions.  
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3 149 Eight female BSc midwife data collectors and two supervisors of the same field having  
4  
5 150 experience in research and fieldwork coordination were participated in the data collection  
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7  
8 151 process. Data collectors and supervisors were oriented and trained for one day focusing on how  
9  
10 152 to interview, fill the observation checklist, and record the data before starting the actual data  
11  
12 153 collection. The questionnaires were pretested on 40 study participants (5%) at kubalafto district  
13  
14  
15 154 and modification were undertaken according to the result of the pretest.

### 17 155 **Data processing and analysis**

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21 156 The collected data were checked manually for completeness and consistency. Then it was  
22  
23 157 entered into the Epi-data version 4.6 software package and exported to Stata version 14 for  
24  
25 158 cleaning, coding, and analysis. Descriptive statistics was described using frequencies,  
26  
27  
28 159 percentages, mean and standard deviation, presented using a table, figure, and texts. Normality  
29  
30 160 tests such as kurtosis and skewness were employed to see the normal distribution of continuous  
31  
32 161 variables and to identify appropriate summary measures.

33  
34  
35 162 Variables to ascertain the outcome were computed and recoded. Questions to measure  
36  
37 163 positioning were computed and categorized as good, average and poor positioning. Then, to  
38  
39 164 create a dummy variable good and average positioning were merged as good and labeled as 1  
40  
41 165 and poor positioning was coded as it is and labeled as 0 and the same was applied for  
42  
43 166 attachment. Suckling in the other hand was categorized and coded as effective and ineffective  
44  
45  
46 167 suckling.

47  
48 168 The outcome variable was dichotomized as effective and ineffective breastfeeding technique  
49  
50  
51 169 and it was labeled as 1 and 0, respectively. Independent factors, with a p-value <0.2 in binary  
52  
53 170 logistic regression analysis, was considered in multivariable analysis. In the multivariable  
54  
55 171 logistic regression models with a p-value <0.05 was considered as an indicator of statistical  
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57  
58 172 significance. Moreover, AOR with its corresponding 95% of CI was used to show the strength  
59  
60 173 and direction of the association.

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3 174 **Operational definitions**  
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5 175 **Positioning:** Good positioning was explained when at least three out of four criteria for infant  
6  
7 positioning have been fulfilled; average positioning was explained if any two of the four criteria  
8 176  
9 were correct and poor positioning was explained when only one or none criterion have been  
10 177  
11 fulfilled.<sup>15 27</sup>  
12 178

13  
14 179 **Attachment:** Good attachment was explained when at least three out of four criterions have  
15  
16 been fulfilled. Average attachment was explained if any two of the four criterions have been  
17 180  
18 fulfilled. Poor attachment was explained when only one or none out of four criterions have  
19 181  
20 been fulfilled.  
21 182

22  
23  
24 183 **Suckling:** Effective suckling was explained when at least two out of three criterions have been  
25  
26 fulfilled. Ineffective suckling was explained if only one or none from three criterions has been  
27 184  
28 fulfilled.<sup>15 27</sup>  
29 185

30  
31  
32 186 **Slow suckling:** suckling pattern of infant about one suck per second.<sup>28</sup>  
33

34  
35 187 **Deep suckling:** The baby's cheeks are not drawn inward and are rounded during a feed,  
36  
37 evidenced by visible or audible swallowing after every one or two sucks.<sup>28</sup>  
38 188

39  
40 189 **Effective breastfeeding technique:** The combination of at least two criteria from positioning,  
41  
42 three criteria from the attachment, and two criteria from suckling while mothers' breastfeeds  
43 190  
44 their infant.<sup>29 30</sup>  
45 191

46  
47 192 **Breast problem:** A mother is explained to have breast problems if she has any of the following:  
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49  
50 193 ✓ Inverted nipple: A portion of or the entire nipple is buried below the plane of the areola  
51  
52 and does not evert at all.<sup>31</sup>  
53 194

54  
55 195 ✓ Engorgement: Breasts are painfully overfull.

56  
57 196 ✓ Cracked nipple: Damage to the integrity of the skin on the nipple.  
58  
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3 197 ✓ Mastitis: Inflammatory condition of the breast, which may or may not be accompanied  
4  
5 198 by infection.<sup>32</sup>  
6  
7

## 8 199 **Ethics**

10  
11 200 Ethical clearance was obtained from the Institutional Review Board (IRB) of the University of  
12  
13 201 Gondar, College of Medicine and Health Sciences, Institute of Public Health (Ref. No:  
14  
15 202 IPH/142/2013). Similarly, a supportive letter was taken from the district administrative office  
16  
17 203 to be given for the selected kebeles. After a brief explanation of the study objective and  
18  
19 204 purpose, oral informed consent was obtained from each participant. Participants were also  
20  
21 205 informed that participation was on a voluntary base, and they have the right to withdraw from  
22  
23 206 the study at any time they want. All data obtained from participants were kept confidential and  
24  
25 207 used for this study only. The study was conducted according to Helsinki declarations.  
26  
27  
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29

## 30 208 **Patient and public involvement statement**

31  
32  
33 209 Lactating mothers were included in this study by providing their valuable information  
34  
35 210 including measurements. Despite this, they have never been involved in the study design,  
36  
37 211 protocol and data collection tools, in reporting and disseminating the finding  
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## 212 **Results**

### 213 **Socio-demographic characteristic of the respondents**

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

### 220 **Obstetric and Infant Characteristics**

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

### 226 **Proportion of effective breastfeeding technique**

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

### 230 **Factors associated with effective breastfeeding technique**

231 After adjusting potential confounding factors, variables such as ANC follow up, place of  
232 delivery, and receiving postpartum home visit by the health extension workers were remained  
233 statistically significant with effective breastfeeding technique having a p-value of less than  
234 0.05.

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2  
3 235 The odds of effective breastfeeding techniques among mothers who had at least one ANC  
4  
5 236 follow up during their index pregnancy were 1.75 times (AOR = 1.75(95%CI= 1.10, 2.77))  
6  
7 237 higher as compared to their counterpart. Similarly, the odds of following EBT was 2.15  
8  
9 238 (AOR=2.15(95%CI=1.25, 3.68)) and about 2.85 (AOR=2.85(95%CI=1.22, 6.66) times higher  
10  
11 239 among mothers who had delivered at health centers and hospitals, respectively compared to  
12  
13 240 those who delivered at home. Likewise, effective breastfeeding technique was twice higher  
14  
15 241 (AOR=2.12(95% CI=1.55,2.92)) among respondents who had received postpartum home visit  
16  
17 242 by the HEW as compared to those who did not got postpartum home visit by the HEWs (Table  
18  
19 243 3).

## 244 **Discussion**

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

250 The proportion of mothers following effective way of BFT was 42.9% (95% CI, 39.4-46.4%).  
251 This finding is in line with the study conducted in India (43%) and Harar, Ethiopia (43.4%).<sup>16</sup>  
252 <sup>33</sup> However, the result of this study is higher than studies conducted in West Bengal hospital,  
253 India (30.3%) and Ari, District, Southern Ethiopia (36.5%).<sup>15 34</sup> The observed discrepancy  
254 might be due to the time laps between the studies since the former studies were conducted in  
255 2013 and there have been different strategies including BFT counseling, promoting  
256 institutional delivery, and postpartum home visit by HEWs that presumed to further improve  
257 maternal practices in adopting EBT.<sup>35</sup> The existence of some variability in the obstetric  
258 characteristics of participants between the studies could be another reason for the above

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3 259 variation. For instance, the proportion of mothers who have ANC visit and receive counseling  
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5 260 during the ANC follow up in this study were higher (75.4%) as compared to the former studies  
6  
7 261 conducted in southern Ethiopia (59.2%), where having ANC visit and obtaining breastfeeding  
8  
9 262 counseling service during the follow up showed an improved practice of EBT.<sup>15 33</sup>  
10  
11 263 On the other hand, the proportion of EBT in the current study is lower than previous studies in  
12  
13 264 Libya (48%), rural population of India (51%), and West Denmark (52%).<sup>29 36 37</sup> The possible  
14  
15 265 explanation might be the difference in the study setting in which the former studies were based  
16  
17 266 at institutions that recruits mothers who came to the health institutions either for vaccination  
18  
19 267 and/or PNC services as study participant, subjects that usually considered to have better  
20  
21 268 opportunities for obtaining breastfeeding counseling. In addition, the proportion of educated  
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23 269 participants (secondary school and above) were lower (12.1%) in this study compared to the  
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25 270 studies conducted earlier( in rural population of India (78.1%) and West Denmark (71.1%)),  
26  
27 271 that might makes the proportion of mothers following effective breastfeeding technique lower  
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29 272 in the current study.<sup>29 37</sup> As level of education is proven by several evidence to have an impact  
30  
31 273 on health literacy level of individuals that likewise can be an influencing factor for adopting  
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33 274 EBT.<sup>38</sup>  
34  
35 275 Mothers who had at least one ANC follow up have higher odds to exhibit EBT as compared to  
36  
37 276 their counterparts. The finding is consistent with studies conducted in South-East Nigeria.<sup>39</sup>  
38  
39 277 The reason behind might be the fact that mothers who had ANC follow up would receive  
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41 278 counseling and education about breastfeeding technique that enhances mother's awareness,  
42  
43 279 understanding, and appreciation of EBT and further promote their practice.<sup>15 40</sup> Moreover,  
44  
45 280 mothers who had at least one ANC visit during pregnancy were more likely to have an  
46  
47 281 institutional delivery that provides an opportunity for mothers to receive postpartum  
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49 282 breastfeeding counselling.<sup>15 33 41</sup>  
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3 283 Likewise, the odds of EBT was 2.15 and 2.85 times higher among participants who had  
4  
5 284 delivered at health center and hospital, respectively as compared to mothers who had delivered  
6  
7 285 at home. The finding is in congruent with previous evidence from Bhaktapur district of Nepal,  
8  
9 286 and Harar, Ethiopia.<sup>16 42</sup> Women who had delivered at health institutions might possibly have  
10  
11 287 a better opportunity to receive counseling related to breastfeeding technique immediately after  
12  
13 288 delivery that will further has a positive impact on mother's breastfeeding technique.<sup>16</sup>  
14  
15 289 Furthermore, women who had delivered at home are usually less educated and had less access  
16  
17 290 to health messages, which might have an impact on healthy practices including EBT.<sup>43 44</sup>  
18  
19 291 Similarly, postpartum home visit by the health extension workers have a positive association  
20  
21 292 with adopting EBT, where the odds of having EBT was 2.12 times higher among mothers who  
22  
23 293 had received postpartum home visit by the health extension workers as compared to their  
24  
25 294 counterparts. The result is not supported by previous evidence. The possible reason could be  
26  
27 295 women who had received postnatal home visit by the HEW might get breastfeeding counseling  
28  
29 296 and demonstration service that will help mothers through improving their attitude, knowledge,  
30  
31 297 and practice regarding breastfeeding technique. Moreover, those women having postpartum  
32  
33 298 home visit by HEW may get psychological support from the HEWs that further promote  
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35 299 effective breastfeeding technique as psychosocial well-being of mothers have a significant  
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37 300 effect on their care and practice towards their baby.<sup>45 46</sup>  
38  
39 301 To summarize, the present study had several strengths. For instance, this study identifies post-  
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41 302 partum home visit by health extension workers as an associated factors of EBT that help health  
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43 303 care workers to emphasize the identified factors and further avoid ineffective breastfeeding  
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45 304 technique. Moreover, this study was conducted in a large community including both mothers  
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47 305 who had a history of visiting health institutions and those who had not, which helps the  
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49 306 researcher to generalize the finding of this study for other similar populations  
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3 307 On the other hand, this study was not avoid of limitations. Even though all possible strategies  
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5 308 such as using female data collectors, providing training for data collectors, employing pretest,  
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7  
8 309 using standardized tool, and securing privacy were applied, the study might not free from bias  
9  
10 310 due to introducing inter-observer variability and hawthorn effect. Similarly, employing the  
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12 311 HEWs registration book as a sampling frame may provide a biased estimate through missing  
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14  
15 312 new lactating mothers.

### 17 313 **Conclusion**

18  
19 314 The study highlighted that more than half of the mothers failed to adopt effective technique  
20  
21 315 while breastfeeding. Factors such as having ANC follow up, delivering at health institution,  
22  
23 316 and receiving postnatal home visit by the health extension workers were found to be  
24  
25 317 significantly associated with EBT. Therefore, promoting ANC visit, institutional delivery, and  
26  
27 318 postpartum home visit by HEWs could have the capacity to improve EBT technique that further  
28  
29 319 avert sup-optimal feeding, childhood malnutrition, morbidity, and even child mortality. Better  
30  
31 320 to advocate the utilization of ANC follow up and institutional delivery as it opens the window  
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33 321 of opportunity for breastfeeding counseling

### 38 322 **Abbreviations**

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41 323 ANC: Antenatal Care; AOR: Adjusted Odd Ratio; BFT; Breastfeeding Technique; CI;  
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43 324 Confidence Interval; COR; Crude Odd Ratio; EBF; Exclusive Breastfeeding; EBT; Effective  
44  
45 325 Breastfeeding Technique; EDHS; Ethiopian Demographic and Health Survey; HEW; Health  
46  
47 326 Extension Workers; OR; Odds Ratio; PNC; Postnatal Care; WDA; Women Development  
48  
49 327 Army; WHO; World Health Organization

### 53 328 **Consent for publication**

54  
55 329 Not applicable

### 58 330 **Data sharing statement**

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3 331 All the data generated in this study are included in this manuscript. The datasets used and/or  
4  
5 332 analyzed to produce the current manuscript will be obtained from the corresponding author  
6  
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8 333 whenever required  
9

10 334 **Competing interests**

11  
12 335 The authors declare that they have no competing interests.  
13

14 336 **Funding source**

15  
16 337 Not applicable  
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19 338 **Authors' contributions**

20  
21  
22 339 DBA conceived the idea for this study, developed the proposal and supervised fieldwork, made  
23  
24 340 the analysis, interpretation and manuscript write up. YAH and EGM assisted in the conception  
25  
26 341 of the study, involved in the method development, analysis, and interpretation of the findings.  
27  
28 342 DZD and WDN participated in analysis, interpretation of the findings and manuscript write up.  
29  
30 343 All the authors read, revised and approved the final manuscript  
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38  
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41 347 participants, data collectors, and supervisors  
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56 476 **Figure legend**  
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9 477 **Figure 1.** Positioning, attachment, and suckling of infant during feeding at Gidan, District,  
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11 478 Northeast, Ethiopia, 2021 (n=760)  
1213  
14 479 **Table 1.** Sociodemographic characteristics of respondents at Gidan, District, Northeast  
15  
16 480 Ethiopia, 2021 (n= 760).  
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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

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

482 **Table 2.** Obstetric and infant characteristics of the respondent at Gidan, District, Northeast  
 483 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 delivery	Yes	378	56.3
	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 HEW**	Yes	374	49.2
	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

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

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

Variables	EBT		COR (95%CI)	AOR (95%CI)
	Yes (n, %)	No (n, %)		
<b>Age of the mothers'</b>				
<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)
<b>Educational status of the mothers'</b>				
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	49(57.3)	43(42.7)	1.48(0.94,2.33)	1.18(0.71,1.96)
and above				
<b>Parity</b>				
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)
<b>Antenatal care</b>				
Yes	293(45.1)	357(54.9)	1.92(1.24,2.96)	<b>1.75(1.10,2.77)*</b>
No	33(30)	77(70)	1	<b>1</b>
<b>Place of delivery</b>				
Hospital	22(57.5)	18(42.5)	3.40(1.77,8.61)	<b>2.85(1.22,6.66)*</b>
Health center	283(44.6)	349(55.4)	2.59(1.55,8.61)	<b>2.15(1.25,3.68)**</b>
Home	21(23.9)	67(76.1)	1	<b>1</b>
<b>Being a membership of</b>				
<b>WDA</b>				
Yes	86(55.1)	70(44.9)	1.86(1.26,2.57)	1.41(0.96,2.07)

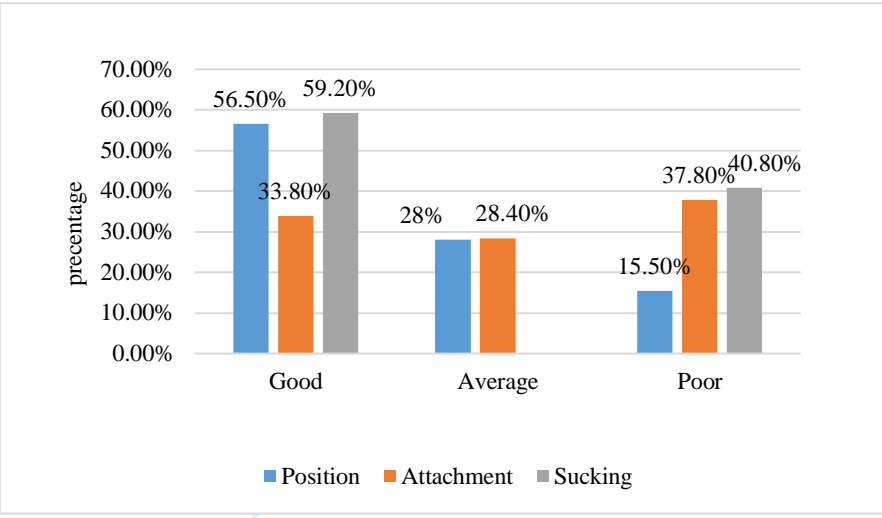
No	240(39.8)	364(60.2)	1	1
Received postpartum visit by HEW				
Yes	205(54.5)	169(45.5)	2.66(1.93,3.49)	<b>2.12(1.55,2.92)**</b>
No	121(31.6)	265(68.4)	1	<b>1</b>
Brest problem				
Yes	6(28.6)	15(71.4)	0.52(0.2, 1.36)	0.55(0.20,1.51)
No	320(43.3)	419(66.7)	1	1
Residency				
Urban	94(50.3)	93(49.7)	1.49(1.07,2.07)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

487 \*Significant at  $p < 0.05$ , \*\*Significant at  $p < 0.01$ , EBT=effective breastfeeding technique,

488 WDA=women development army and HEW=health extension workers, Hosmer and

489 Lemeshow goodness of fit ( $p$ -value=0.22), Multicollinearity test (VIF)=1.68.

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

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



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

		(b) Describe any methods used to examine subgroups and interactions  <b>NA</b>
		(c) Explain how missing data were addressed  <b>NA</b>
		(d) If applicable, describe analytical methods taking account of sampling strategy  <b>NA</b>
		(e) Describe any sensitivity analyses  <b>NA</b>
<b>Results</b>		
Descriptive data	12	Give characteristics of study participants (eg, demographic, clinical, social) and information on exposure and potential confounders  <b>Page 10, line number 208-216</b>
Outcome data	13	Report numbers of outcome events or summary measures  <b>Page 10, line number 219-222</b>
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  <b>Page 11, line number 223-234</b>

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

		<b>Page 15, line number 337</b>
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**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.plosmedicine.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](http://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

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3 **1 Effective breastfeeding technique and associated factors among lactating mothers at**  
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5 **2 Gidan District, Northeast, Ethiopia: A community-based cross-sectional study**  
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## 19 Abstract

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

22 **Design:** A community-based cross-sectional study.

23 **Setting:** Gidan District, Northeast, Ethiopia.

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

25 **Outcome:** Effective breastfeeding technique.

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

33 **Results:** Overall, the prevalence of effective breastfeeding techniques was 42.9% (95% CI,  
34 39.4, 46.4%). Having antenatal care follow-up (AOR=1.75(95%CI=1.10, 2.77)), delivering at  
35 health institutions [(hospital) (AOR=2.85(95%CI=1.22, 6.66)) and health center  
36 (AOR=2.15(95%CI=1.25, 3.68))], and receiving postpartum home visits by the health  
37 extension workers (AOR=2.12(1.55, 2.92)) were significantly associated with the practice of  
38 effective breastfeeding technique.

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



1  
2  
3 44 institutional delivery. Strategies to advocate postpartum home visits by health extension  
4  
5 45 workers and strengthen existing promotion activities are also recommended.  
6  
7

8 46 **Keywords:** Effective breastfeeding technique, Factors, lactating mothers, Gidan, Ethiopia  
9

10  
11 47 **Strengths and limitations of the study**  
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- 13  
14  
15 48 ➤ Since the outcome variable was computed by scores given by different observers, some  
16  
17 49 necessary measures, including delivering training and providing time to practice in a  
18  
19 50 real environment before the data collection, were done to reduce measurement errors  
20  
21 51 and interobserver variability.  
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23  
24 52 ➤ Due to inter-observer variability and the hawthorn effect, the study might not be free  
25  
26 53 from bias.  
27  
28 54 ➤ Using the registration book as a sampling frame may introduce selection bias as new  
29  
30 55 lactating mothers might not get registered.  
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## 56 **Introduction**

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

1  
2  
3 80 IBF not only threatens the infants' lives but also negatively impacts the health of the mother [15](#).

4  
5 81 IBT is one of the major causes of cracked nipples among lactating mothers.[15](#) Nipple damage,

6  
7 82 mastitis, and other similar complications are more common among lactating mothers with

8  
9 83 IBT.[7](#)

10  
11 84 The practice of EBT varies across different settings. For instance, in South Ari district,

12  
13 85 Southern Ethiopia 36.5%,[9](#) Harar city, Eastern Ethiopia 43.4%,[16](#) Gondar town, Ethiopia 48%,[17](#)

14  
15 86 West Bengal hospital India 30.3%,[18](#) Rural population of India 51%,[19](#) India 43%,[20](#) West

16  
17 87 Denmark 52%,[21](#) Libya 48%.[7](#) Multiple factors like parity, maternal and child age, level of

18  
19 88 education, place of delivery, antenatal care (ANC), postnatal natal care (PNC), and knowledge

20  
21 89 of breastfeeding techniques, counseling about EBT are some of the identified factors that can

22  
23 90 affect the practice of effective breastfeeding technique.[9](#) [17](#) [22](#) [23](#)

24  
25 91 There have been several strategies to avert the problem, although sufficient improvement has

26  
27 92 not been observed in the past decade [11](#). The WHO and the baby-friendly hospital initiative

28  
29 93 have designed the EBT counselling, teaching, and demonstrations for mothers in all maternity

30  
31 94 care services and all mothers with sick children in accordance with the integrated management

32  
33 95 of neonates and childhood illness (IMNCI) guidelines [6](#) [24](#). Ethiopia has also recently

34  
35 96 incorporated IBT with the national acute malnutrition management guideline as a diagnostic

36  
37 97 criterion for severe acute malnutrition among infants under six months.[25](#)

38  
39 98 Nutritional problems among children remain the most significant challenge towards achieving

40  
41 99 the Ethiopian government's target to end childhood undernutrition by 2030 with a commitment

42  
43 100 to the 'Seqota' Declaration.[26](#) To achieve the aforementioned target, we need to encourage EBT

44  
45 101 during infancy, and early childhood and science-backed interventions would have a significant

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47 102 role.

48  
49 103 Although few studies have been conducted in Ethiopia, almost all of them were conducted

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51 104 among mothers who pursued health services (institution-based) in which those women

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3 105 considerably have better knowledge about healthy practices.<sup>7, 9, 16, 17</sup> Similarly, the previous  
4  
5 106 studies have been conducted, including mothers soon after birth before the mother is stabilized  
6  
7  
8 107 and becomes comfortable, which could ultimately affect the breastfeeding techniques.<sup>8, 9, 21</sup>  
9  
10 108 Moreover, there was a paucity of evidence concerning EBT in northern Ethiopia. Therefore,  
11  
12 109 this study aimed to assess effective breastfeeding technique and identify its associated factors  
13  
14 110 among lactating mothers. The finding will provide evidence for policymakers and concerned  
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16  
17 111 bodies to work on the identified attributes to improve the practice of EBT further.  
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For peer review only

## 112 **Methods**

### 113 **Study setting, design, and period**

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

### 121 **Study participants**

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

### 126 **Sample size determination and sampling procedures**

127 The sample size was calculated using a single population proportion formula, considering the  
128 following statistical assumptions: margin of error 5% (0.05), Z-value 1.96 corresponding to  
129 95% confidence level, 10% non-response, design effect of 2, and the proportion of effective  
130 breastfeeding technique was 36.5%, which gave a final sample size of 786.<sup>9</sup>

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

1  
2  
3 136 sampling frame. Then, the sample size was proportionally allocated to each selected kebele  
4  
5 137 considering the number of lactating mothers. Simple random sampling using the Open Epi  
6  
7  
8 138 Random Program version 3 was used to draw the participants from each kebele.  
9

### 10 139 **Variable measurement and definition of terms**

11  
12 140 **Positioning:** It was explained when at least three out of four criteria for infant positioning have  
13  
14 141 been fulfilled. Average positioning was defined if any two of the four criteria were correctly  
15  
16 142 applied, whereas poor positioning was explained when only one or none criterion had been  
17  
18 143 fulfilled.<sup>9, 28</sup>

19  
20  
21 144 **Attachment:** Good attachment was described when at least three out of four criteria have been  
22  
23 145 fulfilled. The average attachment was explained if any two of the four criteria had been  
24  
25 146 fulfilled. Poor attachment was described when only one or none of the four criteria had been  
26  
27 147 fulfilled.

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31 148 **Suckling:** Effective suckling was explained when at least two out of three criteria have been  
32  
33 149 fulfilled. Ineffective suckling was explained if only one or none from three criterions has been  
34  
35 150 fulfilled.<sup>9, 28</sup>

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39 151
  - **Slow suckling:** suckling pattern of an infant about one suck per second.<sup>29</sup>
  - **Deep suckling:** the baby's cheeks are not drawn inward and are rounded during  
40  
41 152 a feed, evidenced by visible or audible swallowing after every one or two  
42  
43 153 sucks.<sup>29</sup>

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48  
49 155 **Effective breastfeeding technique:** the combination of at least two criteria from positioning,  
50  
51 156 three criteria from the attachment, and two criteria from suckling. <sup>16, 21</sup>

52  
53 157 **Breast problem:** a mother is explained to have breast problems if she has any of the following:  
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56 158

- ✓ **Inverted nipple:** a portion of or the entire nipple is buried below the plane of the areola  
57  
58 159 and does not evert at all.<sup>30</sup>

- 1  
2  
3 160 ✓ **Engorgement:** breasts are painfully overfull.  
4  
5 161 ✓ **Cracked nipple:** any damage and excoriation to the integrity of the skin on the nipple.  
6  
7 162 ✓ **Mastitis:** an inflammatory condition of the breast, which may or may not be  
8  
9 accompanied by infection.<sup>31</sup>  
10  
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### 13 164 **Data collection tools and quality control**

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15  
16 165 A structured observational checklist adopted from the WHO breastfeeding observational  
17  
18 166 checklist and interviewer-administered questionnaires were developed from reviewing  
19  
20 167 different related literature.<sup>8, 9, 22, 23, 32, 33</sup> According to the WHO criteria, we developed and  
21  
22 168 adopted an arbitrary scoring and grading system to grade positioning, infant's, mouth  
23  
24 169 attachment, and effective suckling during breastfeeding.<sup>34</sup> Each criterion scored 1 point (Table  
25  
26 170 1).

27  
28  
29  
30 171 Eight female BSc midwives (data collectors) and two supervisors from the same field with  
31  
32 172 experience in research and fieldwork coordination participated in the data collection process.  
33  
34 173 Data collectors and supervisors were oriented and trained for one day, focusing on how to  
35  
36 174 interview, examine and diagnose mothers with breast problems, tips to score the observational  
37  
38 175 checklist, and bias controlling mechanisms. The data collectors have also received  
39  
40 176 simulation/real-environment training, and their score was compared to see the effect of  
41  
42 177 interobserver variability. This was repeated until the result of two data collectors on the same  
43  
44 178 participant became approximately the same by helping and providing corrective measures.  
45  
46 179 Moreover, we recruited data collectors having similar educational statuses and considerable  
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48 180 similar experiences to reduce interobserver variability.

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51 181 The questionnaires were pretested on 40 study participants (5%) at Gubalafto district, and  
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53 182 modifications were made according to the pretest results. Data collectors approach participants  
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3 183 by introducing themselves and interviewing the selected respondent after obtaining oral  
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5 184 informed consent.  
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8 185 The data collectors observed BFT while the mother was at home in a private place. To reduce  
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10 186 the Hawthorn effect, mothers were oriented to show how they routinely breastfeed their infant,  
11  
12 187 and they won't be judged by their way of doing it. The observation lasted at least five minutes,  
13  
14 188 and the data collectors recorded the breastfeeding positioning, attachment, and suckling as per  
15  
16 189 the WHO breastfeeding observation checklist. If the infant had breastfed in the previous one  
17  
18 190 hour, the mother was asked when the infant would have the next feed, and the observation  
19  
20 191 assessment was planned accordingly. Finally, the participants were interviewed for part two-  
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22 192 interview questionnaire.  
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### 26 27 193 **Data processing and analysis**

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29  
30 194 The collected data were checked manually for completeness and consistency. Then, it was  
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32 195 entered into the Epi-data version 4.6 software package and exported to Stata version 14 for  
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34 196 cleaning, coding, and analysis. Descriptive statistics were described using frequencies,  
35  
36 197 percentages, mean, and standard deviation and presented using tables, figures, and text.  
37  
38 198 Normality tests such as kurtosis and skewness were employed to examine the distribution of  
39  
40 199 continuous variables and identify the appropriate summary measures.  
41  
42  
43 200 EBT was ascertained by computing the positioning, attachment, and suckling scores. The  
44  
45 201 scores of each item of the three techniques have been computed first. In other words, questions  
46  
47 202 to measure positioning were computed and categorized as good, average, and poor. Then, to  
48  
49 203 create a dummy variable, good and average positioning were merged as good and labelled as  
50  
51 204 '1' and poor positioning was coded as '0'. The same procedure was applied for attachment.  
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54 205 Moreover, suckling was categorized and coded as effective and ineffective suckling.  
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3 206 The outcome variable was dichotomized as an ‘effective’ and ‘ineffective’ breastfeeding  
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5 207 technique, and it was labeled as ‘1’ and ‘0’, respectively. The binary logistic regression analysis  
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8 208 was applied. Independent variables with a p-value of 0.2 in the bi-variable analysis were  
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10 209 considered in the multivariable model. Variables with a p-value  $\leq 0.05$  were regarded as  
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12 210 statistically significant. AOR with its corresponding 95% CI was used to examine the strength  
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15 211 and direction of the association.

### 16 17 212 **Ethical approval**

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20 213 Ethical clearance was obtained from the Institutional Review Board (IRB) of the University of  
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22 214 Gondar, College of Medicine and Health Sciences, Institute of Public Health (Ref. No:  
23  
24 215 IPH/142/2013). Similarly, a support letter was taken from the district administrative office and  
25  
26  
27 216 handed to the selected kebeles. After a brief explanation of the study objective and purpose,  
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29 217 oral informed consent was obtained from each participant. Participants were also informed that  
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31 218 participation was voluntary, and they had the right to withdraw from the study at any time  
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33  
34 219 during the data collection. After the interview, the data collectors advise/demonstrate the  
35  
36 220 mother about the effective breastfeeding technique if the mother-infant pair had an IBT.  
37  
38 221 Furthermore, all data obtained from participants were kept confidential and used for this study  
39  
40 222 only. The study was also conducted according to Helsinki declarations.

### 41 42 43 223 **Patient and public involvement statement**

44  
45  
46 224 Lactating mothers were included in this study by providing valuable information, including  
47  
48 225 measurements. Nevertheless, they have never been involved in the study design, protocol, data  
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51 226 collection tools, and reporting and disseminating the finding.  
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## 227 **Results**

### 228 **Socio-demographic characteristics**

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

### 235 **Obstetric and infant characteristics**

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

### 239 **Prevalence of effective breastfeeding technique**

240 The overall prevalence of mothers who had practiced effective breastfeeding technique was  
241 42.9% (95% CI, 39.4-46.4%). Good breastfeeding positioning, attachment, and sucking were  
242 observed among 56.5%, 33.8%, and 59.2% of mothers, respectively (figure 1).

### 243 **Factors associated with effective breastfeeding technique**

244 After adjusting for potential confounding factors, variables such as ANC-follow up, place of  
245 delivery, and receiving postpartum home visits by HEWs remained significantly associated  
246 with effective breastfeeding technique. The odds of effective breastfeeding technique among  
247 mothers who had ANC follow-up during their index pregnancy was 1.75 times (AOR =  
248 1.75(95%CI= 1.10, 2.77)) higher than their counterparts. Similarly, the odds of practicing EBT  
249 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)  
250 times higher among mothers who had delivered at health centers and hospitals, respectively,

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3 251 compared to those who had delivered at home. Likewise, effective breastfeeding technique was  
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5 252 twice higher (AOR=2.12 (95% CI=1.55,2.92)) among respondents who had received  
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7 253 postpartum home visits by the HEWs as compared to those who had received no postpartum  
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9 254 home visits by the HEWs (table 4).  
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## 255 Discussion

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

261 The prevalence of EBF was 42.9% (95% CI, 39.4-46.4%), which implies several infants in the  
262 study areas are suffering from the aftermaths of suboptimal breastfeeding, such as malnutrition.  
263 This finding is in line with the studies conducted in India (43%) and Harar, Ethiopia (43.4%).[20](#),  
264 [36](#) However, the result of this study is higher than studies conducted in West Bengal hospital,  
265 India (30.3%) and Ari, District, Southern Ethiopia (36.5%). [9](#), [18](#) The observed discrepancy  
266 might be due to the time gap between the studies. Since the former studies were conducted in  
267 2013 and there have been different strategies, including BFT counseling, promoting  
268 institutional delivery, and postpartum home visits by HEWs, that are presumed to improve  
269 maternal practices in EBT.[37](#) The existence of some variability in the obstetric characteristics  
270 of participants between the studies could also be another reason for the above variation. For  
271 instance, the proportion of mothers who had ANC visits and received counselling during the  
272 ANC follow up in this study was higher (75.4%) as compared to the study conducted in  
273 southern Ethiopia (59.2%), where having ANC visits and obtaining breastfeeding counselling  
274 service during the follow up showed an improved practice of EBT.[9](#), [20](#) In light of this, the  
275 current promotion strategies to improve ANC follow-up and breastfeeding should be  
276 strengthened to improve the BFT and maintain the health of children.

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

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3 280 setting, in which the former studies were based at health institutions that recruited mothers who  
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5 281 came to the health facilities either for vaccination or PNC services. These populations are  
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8 282 usually considered to have better health literacy and opportunities to obtain breastfeeding  
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10 283 counselling. In addition, the proportion of educated participants (secondary school and above)  
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12 284 was lower (12.1%) in our study compared to the studies conducted earlier (in the rural  
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14 285 populations of India (78.1%) and West Denmark (71.1%)), that might make the prevalence of  
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16 286 EBT lower than their finding.<sup>19, 21</sup> Although no association has been observed between the level  
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18 287 of education and EBT practice in our study, several shreds of evidence indicated that level of  
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20 288 education impacts individuals' health literacy level. It can also be further an influencing factor  
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22 289 for practicing EBT.<sup>38</sup>  
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24 290 Mothers who had ANC follow-up had higher odds of exhibiting EBT than their counterparts.  
25  
26 291 The finding is consistent with studies conducted in South-East Nigeria.<sup>39</sup> Mothers who visit  
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28 292 health institutions for ANC follow-up receive counselling about breastfeeding technique that  
29  
30 293 enhances mothers' awareness, understanding, and appreciation of the sequelae of IBT and  
31  
32 294 further promote their practice.<sup>9, 40</sup> Moreover, mothers who had ANC follow-up during  
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34 295 pregnancy were more likely to have an institutional delivery that makes them lose the  
35  
36 296 opportunity to receive postpartum breastfeeding counselling.<sup>9, 20, 41</sup> Thus, strengthening the  
37  
38 297 existing effort to improve ANC follow-up and institutional delivery would help improve  
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40 298 breastfeeding practice beyond preventing life-threatening maternal and neonatal  
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42 299 complications.  
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44 300 Likewise, the odds of EBT were 2.15 and 2.85 times higher among participants who had  
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46 301 delivered at the health center and hospital, respectively, as compared to mothers who had  
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48 302 delivered at home. The finding is congruent with previous evidence from the Bhaktapur district  
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50 303 of Nepal, and Harar, Ethiopia.<sup>36, 42</sup> Women who had delivered at health institutions might  
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52 304 possibly have a better opportunity to receive counseling related to breastfeeding technique  
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3 305 immediately after delivery. That will further have a positive impact on the mothers'  
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5 306 breastfeeding technique.<sup>36</sup> Furthermore, women who had delivered at home were usually less  
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7 307 educated and had less access to health messages, which might impact healthy practices,  
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9 308 including EBT.<sup>43, 44</sup>

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12 309 Similarly, postpartum home visits by health extension workers have a positive association with  
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14 310 adopting EBT . The odds of having EBT was 2.12 times higher among mothers who had  
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16 311 received postpartum home visits by health extension workers compared to their counterparts.  
17  
18 312 The possible reason could be that women who have received postnatal home visits by the HEW  
19  
20 313 might get breastfeeding counselling and demonstration that will help mothers improve their  
21  
22 314 attitude, knowledge, and practice regarding breastfeeding technique. Furthermore, women who  
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24 315 receive postpartum home visits from HEWs may receive psychological support from the  
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26 316 HEWs, which further promotes effective breastfeeding techniques, as mothers' psychosocial  
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28 317 well-being significantly impacts their care and practice towards their baby.<sup>45, 46</sup> The result is a  
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30 318 call for action to further improve postnatal home visits to promote EBT and infant nutrition.

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33 319 This finding shows more than half of lactating mothers are not practicing EBT, which implies  
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35 320 thousands of infants are receiving insufficient nutrients to maintain their growth and  
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37 321 development. Therefore, it is crucial to counteract the problem by working on the mothers'  
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39 322 skills in breastfeeding technique.

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42 323 The study had better strength in measuring the outcome. Since the outcome variable was  
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44 324 computed by scores given by different observers, different measures, including delivering  
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46 325 training and providing time to practice in a real environment before the data collection, were  
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48 326 done to reduce measurement errors and interobserver variability.

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51 327 On the other hand, this study was not avoiding limitations. Even though all possible strategies  
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53 328 such as using female data collectors, providing training for data collectors, employing pretest,  
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55 329 using standardized tools, and securing privacy were applied, the study might not be free from  
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3 330 bias due to introducing inter-observer variability and the hawthorn effect. Similarly, employing  
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5 331 the HEWs registration book as a sampling frame may provide a biased estimate through  
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8 332 missing new lactating mothers.

### 10 333 **Conclusion**

11  
12 334 The study revealed that the prevalence of effective breastfeeding technique was low. The  
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14 335 practice of EBT was significantly associated with mothers who have ANC follow-up, deliver  
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16 336 at health institutions, and receive postnatal home visits by the health extension workers. Hence,  
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18 337 maternal, neonatal, and child health care providers and health extension workers are expected  
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20 338 to ensure antenatal care utilization and institutional delivery. Strategies to advocate postpartum  
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22 339 home visits by health extension workers and strengthen existing promotion activities are also  
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24 340 recommended.

### 29 341 **Abbreviations**

30  
31  
32 342 ANC: Antenatal Care; AOR: Adjusted Odd Ratio; BFT; Breastfeeding Technique; CI;  
33  
34 343 Confidence Interval; COR; Crude Odd Ratio; EBF; Exclusive Breastfeeding; EBT; Effective  
35  
36 344 Breastfeeding Technique; EDHS; Ethiopian Demographic and Health Survey; HEW; Health  
37  
38 345 Extension Workers; OR; Odds Ratio; PNC; Postnatal Care; WDA; Women Development  
39  
40 346 Army; WHO; World Health Organization

### 44 347 **Consent for publication**

45  
46 348 Not applicable

### 49 349 **Data sharing statement**

50  
51 350 All the data generated in this study are included in this manuscript. The datasets used and  
52  
53 351 analyzed to produce the current manuscript will be obtained from the corresponding author  
54  
55 352 upon request.

### 58 353 **Competing interests**

1  
2  
3 354 The authors declare that they have no competing interests.  
4

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6  
7  
8 356 Not applicable  
9

10 357 **Authors' contributions**

11  
12  
13 358 DBA conceived the idea for this study, developed the proposal, supervised fieldwork, and made  
14  
15 359 the analysis, interpretation, and manuscript write up. YAH and EGM assisted in the conception  
16  
17 360 of the study, involved in the method development, analysis, and interpretation of the findings.  
18  
19 361 DZD and WDN participated in the analysis, interpretation of the findings, and writing the  
20  
21 362 manuscript. All the authors have read, revised, and approved the final manuscript  
22  
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490 **Figure legend**

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

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

<b>Criteria for correct body positioning:</b>		
-	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	
<b>Criteria for grading body positioning:</b>		
	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
<b>Criteria for correctness of attachment:</b>		
-	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	
<b>Criteria for grading of correct attachment:</b>		
	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
<b>Criteria for correctness of effective suckling:</b>		
- Slow suckling		
- Deep suckling		
- Sometimes pausing		
<b>Criteria for grading of effective suckling:</b>		
	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

495

496 **Table 2.** Sociodemographic characteristics of respondents at Gidan, District, Northeast  
 497 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

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

499 **Table 3.** Obstetric and infant characteristics of the respondent at Gidan, District, Northeast  
 500 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 delivery	Yes	378	56.3
	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 HEW**	Yes	374	49.2
	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

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

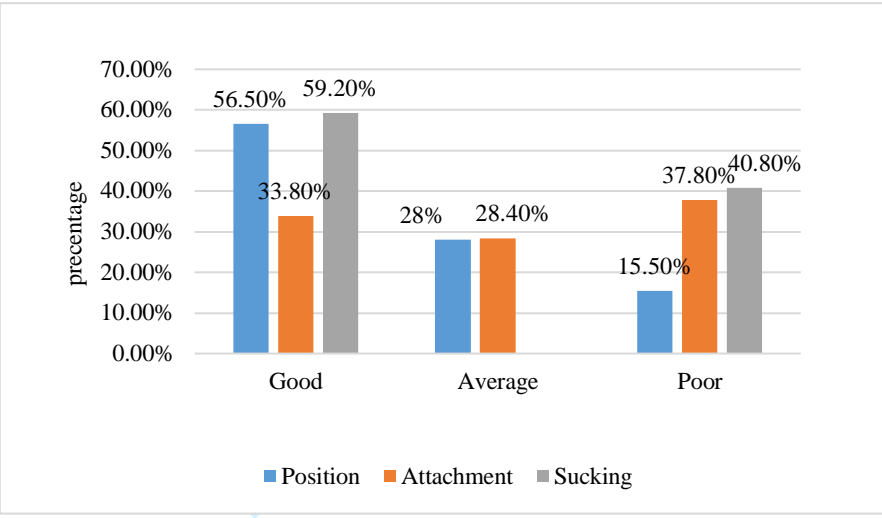
502 **Table 4.** Association of effective breastfeeding technique with different characteristics of  
 503 lactating mothers in Gidan, District, Northeast Ethiopia, 2021(n=760).

Variables	EBT		COR (95%CI)	AOR (95%CI)
	Yes (n, %)	No (n, %)		
<b>Age of the mothers'</b>				
<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)
<b>Educational status of the mothers'</b>				
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	49(57.3)	43(42.7)	1.48(0.94,2.33)	1.18(0.71,1.96)
and above				
<b>Parity</b>				
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)
<b>Antenatal care</b>				
Yes	293(45.1)	357(54.9)	1.92(1.24,2.96)	<b>1.75(1.10,2.77)*</b>
No	33(30)	77(70)	1	<b>1</b>
<b>Place of delivery</b>				

Hospital	22(57.5)	18(42.5)	3.40(1.77,8.61)	<b>2.85(1.22,6.66)*</b>
Health center	283(44.6)	349(55.4)	2.59(1.55,8.61)	<b>2.15(1.25,3.68)**</b>
Home	21(23.9)	67(76.1)	1	<b>1</b>
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)	<b>2.12(1.55,2.92)**</b>
No	121(31.6)	265(68.4)	1	<b>1</b>
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

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

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

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

Participants	6	Give the eligibility criteria, and the sources and methods of selection of participants  <b>Page 6, line number 112-120</b>
		Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifier, Give diagnostic, if applicable  <b>Page 7-8, line number 151-174</b>
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  <b>Page 6-7, line number 131-150</b>
Bias	8	Describe any efforts to address potential sources of bias  <b>Page 3 , line number 48-55</b>
Study size	9	Explain how the study design was arrived  <b>Page 6, line number 119-130</b>
Quantitative variables	10	Explain how quantitative variables were handled in the analysis , if applicable describe which groupings chose and why  <b>Page 9, line number 180-192</b>
Statistical methods	11	(a)Describe all statistical methods, including those used to control for confounding  <b>Page 9 , line number 175-192</b>

		(b) Describe any methods used to examine subgroups and interactions  <b>NA</b>
		(c) Explain how missing data were addressed  <b>NA</b>
		(d) If applicable, describe analytical methods taking account of sampling strategy  <b>NA</b>
		(e) Describe any sensitivity analyses  <b>NA</b>
<b>Results</b>		
Descriptive data	12	Give characteristics of study participants (eg, demographic, clinical, social) and information on exposure and potential confounders  <b>Page 10, line number 208-216</b>
Outcome data	13	Report numbers of outcome events or summary measures  <b>Page 10, line number 219-222</b>
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  <b>Page 11, line number 223-234</b>

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



		<b>Page 15, line number 337</b>
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**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.plosmedicine.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](http://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

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<b>Primary Subject Heading</b>:	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

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3 **1 Effective breastfeeding technique and associated factors among lactating mothers at**  
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5 **2 Gidan District, Northeast, Ethiopia: A community-based cross-sectional study**  
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3 19 **Abstract**  
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6 20 **Objective:** To assess effective breastfeeding techniques and associated factors among lactating  
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8 21 mothers in Gidan District, Northeast Ethiopia.  
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10 22 **Design:** A community-based cross-sectional study  
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13 23 **Setting:** Gidan District, Northeast, Ethiopia.  
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15 24 **Participants:** A total of 786 lactating mothers were included between March 30 and April 29, 2021.  
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17 25 **Outcome:** Effective breastfeeding technique.  
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20 26 **Methods:** A multi-stage sampling technique was employed to recruit participants. Pretested  
21  
22 27 interviewer-administered questionnaires and an observational checklist were used to collect the data.  
23  
24 28 Individual scores of three variables about breastfeeding, namely positioning, attachment, and suckling,  
25  
26 29 were computed to generate the outcome variable, breastfeeding technique. The binary logistic  
27  
28 30 regression analyses were carried out to determine the association between independent variables and  
31  
32 31 effective breastfeeding technique. Statistical significance was declared at a p-value  $\leq 0.05$  with a  
33  
34 32 corresponding 95% confidence interval.  
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36 33 **Results:** Overall, the prevalence of effective breastfeeding technique was 42.9% (326/760).  
37  
38 34 Having antenatal care follow-up (AOR=1.75(95%CI=1.10, 2.77)), delivering at health  
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40 35 institutions [(hospital) (AOR=2.85(95%CI=1.22, 6.66)) and health center  
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42 36 (AOR=2.15(95%CI=1.25, 3.68))], and receiving postpartum home visits by the health  
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44 37 extension workers (AOR=2.12(1.55, 2.92)) were significantly associated with the practice of  
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46 38 effective breastfeeding technique.  
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50 39 **Conclusion:** The study revealed that the prevalence of effective breastfeeding technique was  
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52 40 low. The finding highlights the importance of promoting utilization of antenatal care follow-  
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54 41 up, institutional delivery, and postpartum home visits by health extension workers, which play  
55  
56 42 a substantial role in promoting effective breastfeeding technique.  
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3 43 **Keywords:** Effective breastfeeding technique, Factors, lactating mothers, Gidan, Ethiopia  
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6 44 **Strengths and limitations of the study**  
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- 9 45 ➤ Since the outcome variable was computed by scores given by different observers, some  
10  
11 necessary measures, including delivering training and providing time to practice in a  
12 46  
13 real environment before the data collection, were done to reduce measurement errors  
14 47  
15 and interobserver variability.  
16 48  
17 ➤ Due to inter-observer variability and the Hawthorn effect, the study might not be free  
18 49  
19 from bias.  
20 50  
21 ➤ Using the registration book as a sampling frame may introduce selection bias as new  
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23 lactating mothers might not get registered.  
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## 53 Introduction

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

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3 77 IBF not only threatens the infants' lives but also negatively impacts the health of the mother. [15](#)

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5 78 IBT is one of the major causes of cracked nipples among lactating mothers. [15](#) Nipple damage,

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7 79 mastitis, and other similar complications are more common among lactating mothers with

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10 80 IBT. [7](#)

11  
12 81 The practice of EBT varies across different settings. For instance, in South Ari district,

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14 82 Southern Ethiopia 36.5%,<sup>9</sup> Harar city, Eastern Ethiopia 43.4%,<sup>16</sup> Gondar town, Ethiopia 48%,<sup>17</sup>

15  
16 83 West Denmark 52%,<sup>18</sup> Libya 48%.<sup>7</sup> Furthermore, small-localized studies in India found that

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18 84 the practice of EBT ranged from 30.3% to 51%. [19-21](#) Multiple factors like parity, maternal and

19  
20 85 child age, level of education, place of delivery, antenatal care (ANC), postnatal natal care

21  
22 86 (PNC), knowledge of breastfeeding techniques, and counseling about EBT are some of the

23  
24 87 identified factors that can affect the practice of effective breastfeeding technique. [9, 17, 22, 23](#)

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26 88 There have been several strategies to avert the problem, although sufficient improvement has

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28 89 not been observed in the past decade [11](#). The WHO and the baby-friendly hospital initiative

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30 90 have designed the EBT counseling, teaching, and demonstrations for mothers in all maternity

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32 91 care services and all mothers with sick children in accordance with the integrated management

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34 92 of neonates and childhood illness (IMNCI) guidelines [6, 24](#). Ethiopia has also recently

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36 93 incorporated IBT into the national acute malnutrition management guideline as a diagnostic

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38 94 criterion for severe acute malnutrition among infants under six months. [25](#)

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40 95 Nutritional problems among children remain the most significant challenge towards achieving

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42 96 the Ethiopian government's target to end childhood undernutrition by 2030 with a commitment

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44 97 to the 'Seqota' Declaration. [26](#) To achieve the aforementioned target, we need to encourage EBT

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46 98 during infancy, and early childhood and science-backed interventions would have a significant

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48 99 role.

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50 100 Although few studies have been conducted in Ethiopia, almost all of them were conducted

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52 101 among mothers who pursued health services (institution-based) in which those women



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3 102 considerably have better knowledge about healthy practices.<sup>7, 9, 16, 17</sup> Similarly, the previous  
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5 103 studies have been conducted, including mothers soon after birth before the mother is stabilized  
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8 104 and becomes comfortable, which could ultimately affect the breastfeeding techniques.<sup>8, 9, 18</sup>  
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10 105 Moreover, there was a paucity of evidence concerning EBT in northern Ethiopia. Therefore,  
11  
12 106 this study aimed to assess effective breastfeeding technique and identify its associated factors  
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15 107 among lactating mothers. The finding will provide evidence for policymakers and concerned  
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17 108 bodies to work on the identified attributes to improve the practice of EBT further.  
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## 109 **Methods**

### 110 **Study setting, design, and period**

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

### 118 **Study participants**

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

### 123 **Sample size determination and sampling procedures**

124 The sample size was calculated using a single population proportion formula, considering the  
125 following statistical assumptions: margin of error 5% (0.05), Z-value 1.96 corresponding to  
126 95% confidence level, 10% non-response, design effect of 2, and the proportion of effective  
127 breastfeeding technique was 36.5%, which gave a final sample size of 786.<sup>9</sup>

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

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3 133 sampling frame. Then, the sample size was proportionally allocated to each selected kebele  
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5 134 considering the number of lactating mothers. Simple random sampling using the Open Epi  
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8 135 Random Program version 3 was used to draw the participants from each kebele.  
9

### 10 136 **Variable measurement and definition of terms**

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12 137 **Positioning:** It was explained when at least three out of four criteria for infant positioning have  
13  
14 138 been fulfilled. Average positioning was defined if any two of the four criteria were correctly  
15  
16 139 applied, whereas poor positioning was explained when only one or none criterion had been  
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18 140 fulfilled.<sup>9, 28</sup>

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21 141 **Attachment:** Good attachment was described when at least three out of four criteria have been  
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23 142 fulfilled. The average attachment was explained if any two of the four criteria had been  
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25 143 fulfilled. Poor attachment was described when only one or none of the four criteria had been  
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27 144 fulfilled.

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31 145 **Suckling:** Effective suckling was explained when at least two out of three criteria have been  
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33 146 fulfilled. Ineffective suckling was explained if only one or none from three criterions has been  
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35 147 fulfilled.<sup>9, 28</sup>

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  - **Slow suckling:** suckling pattern of an infant about one suck per second.<sup>29</sup>
  - **Deep suckling:** the baby's cheeks are not drawn inward and are rounded during  
41 149 a feed, evidenced by visible or audible swallowing after every one or two  
42 150 sucks.<sup>29</sup>

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49 152 **Effective breastfeeding technique:** the combination of at least two criteria from positioning,  
50  
51 153 three criteria from the attachment, and two criteria from suckling. <sup>16, 18</sup>

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53 154 **Breast problem:** a mother is explained to have breast problems if she has any of the following:  
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- ✓ **Inverted nipple:** a portion of or the entire nipple is buried below the plane of the areola  
57 156 and does not evert at all.<sup>30</sup>

- 1  
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3 157 ✓ **Engorgement:** breasts are painfully overfull.  
4  
5 158 ✓ **Cracked nipple:** any damage and excoriation to the integrity of the skin on the nipple.  
6  
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8 159 ✓ **Mastitis:** an inflammatory condition of the breast, which may or may not be  
9  
10 accompanied by infection.<sup>31</sup>  
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### 13 161 **Data collection tools and quality control**

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16 162 A structured observational checklist adopted from the WHO breastfeeding observational  
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18 163 checklist and interviewer-administered questionnaires were developed from reviewing  
19  
20 164 different related literature.<sup>8, 9, 22, 23, 32, 33</sup> According to the WHO criteria, we developed and  
21  
22  
23 165 adopted an arbitrary scoring and grading system to grade positioning, infant's, mouth  
24  
25 166 attachment, and effective suckling during breastfeeding.<sup>34</sup> Each criterion scored 1 point (Table  
26  
27 167 1).  
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30 168 Eight female BSc midwives (data collectors) and two supervisors from the same field with  
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32 169 experience in research and fieldwork coordination participated in the data collection process.

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35 170 Data collectors and supervisors were oriented and trained for one day, focusing on how to  
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37 171 interview, examine and diagnose mothers with breast problems, tips to score the observational  
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39 172 checklist, and bias controlling mechanisms. The data collectors have also received  
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42 173 simulation/real-environment training, and their score was compared to see the effect of  
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44 174 interobserver variability. This was repeated until the result of two data collectors on the same  
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46 175 participant became approximately the same by helping and providing corrective measures.  
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49 176 Moreover, we recruited data collectors having similar educational statuses and considerable  
50  
51 177 similar experiences to reduce interobserver variability.  
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54 178 The questionnaires were pretested on 40 study participants (5%) at Gubalafto district, and  
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56 179 modifications were made according to the pretest results. Data collectors approach participants  
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3 180 by introducing themselves and interviewing the selected respondent after obtaining oral  
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5 181 informed consent.  
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8 182 The data collectors observed BFT while the mother was at home in a private place. To reduce  
9  
10 183 the Hawthorn effect, mothers were oriented to show how they routinely breastfeed their infant,  
11  
12 184 and they won't be judged by their way of doing it. The observation lasted at least five minutes,  
13  
14 185 and the data collectors recorded the breastfeeding positioning, attachment, and suckling as per  
15  
16 186 the WHO breastfeeding observation checklist. If the infant had breastfed in the previous one  
17  
18 187 hour, the mother was asked when the infant would have the next feed, and the observation  
19  
20 188 assessment was planned accordingly. Finally, the participants were interviewed for part two-  
21  
22 189 interview questionnaire. The data collectors linked the mothers to the nearest health facilities  
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26 190 who had breast problems such as mastitis, engorgement, and crackle nipple.  
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### 30 191 **Data processing and analysis**

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33 192 The collected data were checked manually for completeness and consistency. Then, it was  
34  
35 193 entered into the Epi-data version 4.6 software package and exported to Stata version 14 for  
36  
37 194 cleaning, coding, and analysis. Descriptive statistics were described using frequencies,  
38  
39 195 percentages, mean, and standard deviation and presented using tables, figures, and text.  
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41 196 Normality tests such as kurtosis and skewness were employed to examine the distribution of  
42  
43 197 continuous variables and identify the appropriate summary measures.  
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46  
47 198 EBT was ascertained by computing the positioning, attachment, and suckling scores. The  
48  
49 199 scores of each item of the three techniques have been computed first. In other words, questions  
50  
51 200 to measure positioning were computed and categorized as good, average, and poor. Then, to  
52  
53 201 create a dummy variable, good and average positioning were merged as good and labelled as  
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55 202 '1' and poor positioning was coded as '0'. The same procedure was applied for attachment.  
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58 203 Moreover, suckling was categorized and coded as effective and ineffective suckling.  
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3 204 The outcome variable was dichotomized as an ‘effective’ and ‘ineffective’ breastfeeding  
4  
5 205 technique, and it was labeled as ‘1’ and ‘0’, respectively. The binary logistic regression analysis  
6  
7  
8 206 was applied. Independent variables with a p-value of 0.2 in the bi-variable analysis were  
9  
10 207 considered in the multivariable model. Variables with a p-value  $\leq 0.05$  were regarded as  
11  
12 208 statistically significant. AOR with its corresponding 95% CI was used to examine the strength  
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15 209 and direction of the association.

### 17 210 **Ethical approval**

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20 211 Ethical clearance was obtained from the Institutional Review Board (IRB) of the University of  
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22 212 Gondar, College of Medicine and Health Sciences, Institute of Public Health (Ref. No:  
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24 213 IPH/142/2013). Similarly, a support letter was taken from the district administrative office and  
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26  
27 214 handed to the selected kebeles. After a brief explanation of the study objective and purpose,  
28  
29 215 oral informed consent was obtained from each participant. Participants were also informed that  
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31 216 participation was voluntary, and they had the right to withdraw from the study at any time  
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33  
34 217 during the data collection. After the interview, the data collectors advise/demonstrate the  
35  
36 218 mother about the effective breastfeeding technique if the mother-infant pair had an IBT.  
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38 219 Furthermore, all data obtained from participants were kept confidential and used for this study  
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40 220 only. The study was also conducted according to Helsinki declarations.

### 43 221 **Patient and public involvement statement**

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46 222 Lactating mothers were included in this study by providing valuable information, including  
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48 223 measurements. Nevertheless, they have never been involved in the study design, protocol, data  
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50  
51 224 collection tools, and reporting and disseminating the finding.

## 225 **Results**

### 226 **Socio-demographic characteristics**

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

### 233 **Obstetric and infant characteristics**

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

### 237 **Prevalence of effective breastfeeding technique**

238 The overall prevalence of mothers who had practiced effective breastfeeding technique was  
239 42.9% (95% CI, 39.4-46.4%). Good breastfeeding positioning, attachment, and sucking were  
240 observed among 56.5%, 33.8%, and 59.2% of mothers, respectively (figure 1).

### 241 **Factors associated with effective breastfeeding technique**

242 After adjusting for potential confounding factors, variables such as ANC-follow up, place of  
243 delivery, and receiving postpartum home visits by HEWs remained significantly associated  
244 with effective breastfeeding technique. The odds of effective breastfeeding technique among  
245 mothers who had ANC follow-up during their index pregnancy was 1.75 times (AOR =  
246 1.75(95%CI= 1.10, 2.77)) higher than their counterparts. Similarly, the odds of practicing EBT  
247 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)  
248 times higher among mothers who had delivered at health centers and hospitals, respectively,

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2  
3 249 compared to those who had delivered at home. Likewise, effective breastfeeding technique was  
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5 250 twice higher (AOR=2.12 (95% CI=1.55,2.92)) among respondents who had received  
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7 251 postpartum home visits by the HEWs as compared to those who had received no postpartum  
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9 252 home visits by the HEWs (table 4).  
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For peer review only



## 253 Discussion

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

259 The prevalence of EBF was 42.9% (95% CI, 39.4-46.4%), which implies several infants in the  
260 study areas are suffering from the aftermaths of suboptimal breastfeeding, such as malnutrition.  
261 This finding is in line with the studies conducted in India (43%) and Harar, Ethiopia (43.4%).[21](#),  
262 [36](#) However, the result of this study is higher than studies conducted in West Bengal hospital,  
263 India (30.3%) and Ari, District, Southern Ethiopia (36.5%). [9](#), [19](#) The observed discrepancy  
264 might be due to the time gap between the studies. Since the former studies were conducted in  
265 2013 and there have been different strategies, including BFT counseling, promoting  
266 institutional delivery, and postpartum home visits by HEWs, that are presumed to improve  
267 maternal practices in EBT.[37](#) The existence of some variability in the obstetric characteristics  
268 of participants between the studies could also be another reason for the above variation. For  
269 instance, the proportion of mothers who had ANC visits and received counselling during the  
270 ANC follow up in this study was higher (75.4%) as compared to the study conducted in  
271 southern Ethiopia (59.2%), where having ANC visits and obtaining breastfeeding counselling  
272 service during the follow up showed an improved practice of EBT.[9](#), [21](#) In light of this, the  
273 current promotion strategies to improve ANC follow-up and breastfeeding should be  
274 strengthened to improve the BFT and maintain the health of children.

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

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3 278 setting, in which the former studies were based at health institutions that recruited mothers who  
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5 279 came to the health facilities either for vaccination or PNC services. These populations are  
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8 280 usually considered to have better health literacy and opportunities to obtain breastfeeding  
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10 281 counselling. In addition, the proportion of educated participants (secondary school and above)  
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12 282 was lower (12.1%) in our study compared to the studies conducted earlier (in the rural  
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14 283 populations of India (78.1%) and West Denmark (71.1%)), that might make the prevalence of  
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16 284 EBT lower than their finding.<sup>18, 20</sup> Although no association has been observed between the level  
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18 285 of education and EBT practice in our study, several sherds of evidence indicated that level of  
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20 286 education impacts individuals' health literacy level. It can also be further an influencing factor  
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22 287 for practicing EBT.<sup>38</sup>  
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24 288 Mothers who had ANC follow-up had higher odds of exhibiting EBT than their counterparts.  
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26 289 The finding is consistent with studies conducted in South-East Nigeria.<sup>39</sup> Mothers who visit  
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28 290 health institutions for ANC follow-up receive counselling about breastfeeding technique that  
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30 291 enhances mothers' awareness, understanding, and appreciation of the sequelae of IBT and  
31  
32 292 further promote their practice.<sup>9, 40</sup> Moreover, mothers who had ANC follow-up during  
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34 293 pregnancy were more likely to have an institutional delivery that makes them lose the  
35  
36 294 opportunity to receive postpartum breastfeeding counselling.<sup>9, 21, 41</sup> Thus, strengthening the  
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38 295 existing effort to improve ANC follow-up and institutional delivery would help improve  
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40 296 breastfeeding practice beyond preventing life-threatening maternal and neonatal  
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42 297 complications.  
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44 298 Likewise, the odds of EBT were 2.15 and 2.85 times higher among participants who had  
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46 299 delivered at the health center and hospital, respectively, as compared to mothers who had  
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48 300 delivered at home. The finding is congruent with previous evidence from the Bhaktapur district  
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50 301 of Nepal, and Harar, Ethiopia.<sup>36, 42</sup> Women who had delivered at health institutions might  
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52 302 possibly have a better opportunity to receive counseling related to breastfeeding technique  
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3 303 immediately after delivery. That will further have a positive impact on the mothers'  
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5 304 breastfeeding technique.<sup>36</sup> Furthermore, women who had delivered at home were usually less  
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7 305 educated and had less access to health messages, which might impact healthy practices,  
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9 306 including EBT.<sup>43, 44</sup>

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12 307 Similarly, postpartum home visits by health extension workers have a positive association with  
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14 308 adopting EBT . The odds of having EBT was 2.12 times higher among mothers who had  
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16 309 received postpartum home visits by health extension workers compared to their counterparts.  
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18 310 The possible reason could be that women who have received postnatal home visits by the HEW  
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20 311 might get breastfeeding counselling and demonstration that will help mothers improve their  
21  
22 312 attitude, knowledge, and practice regarding breastfeeding technique. Furthermore, women who  
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24 313 receive postpartum home visits from HEWs may receive psychological support from the  
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26 314 HEWs, which further promotes effective breastfeeding techniques, as mothers' psychosocial  
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28 315 well-being significantly impacts their care and practice towards their baby.<sup>45, 46</sup> The result is a  
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30 316 call for action to further improve postnatal home visits to promote EBT and infant nutrition.

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33 317 This finding shows more than half of lactating mothers are not practicing EBT, which implies  
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35 318 thousands of infants are receiving insufficient nutrients to maintain their growth and  
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37 319 development. Therefore, it is crucial to counteract the problem by working on the mothers'  
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39 320 skills in breastfeeding technique.

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42 321 The study had better strength in measuring the outcome. Since the outcome variable was  
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44 322 computed by scores given by different observers, different measures, including delivering  
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46 323 training and providing time to practice in a real environment before the data collection, were  
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48 324 done to reduce measurement errors and interobserver variability.

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51 325 On the other hand, this study was not avoiding limitations. Even though all possible strategies  
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53 326 such as using female data collectors, providing training for data collectors, employing pretest,  
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55 327 using standardized tools, and securing privacy were applied, the study might not be free from  
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3 328 bias due to introducing inter-observer variability and the Hawthorn effect. Similarly, employing  
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5 329 the HEWs registration book as a sampling frame may provide a biased estimate through  
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8 330 missing new lactating mothers.

### 10 331 **Conclusion**

11  
12 332 The study revealed that the prevalence of effective breastfeeding technique was low. The  
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14 333 finding highlights the importance of promoting utilization of antenatal care follow-up,  
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16 334 institutional delivery, and postpartum home visits by health extension workers, which play a  
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18  
19 335 substantial role in promoting effective breastfeeding technique.

### 22 336 **Abbreviations**

23  
24  
25 337 ANC: Antenatal Care; AOR: Adjusted Odd Ratio; BFT; Breastfeeding Technique; CI;  
26  
27 338 Confidence Interval; COR; Crude Odd Ratio; EBF; Exclusive Breastfeeding; EBT; Effective  
28  
29 339 Breastfeeding Technique; EDHS; Ethiopian Demographic and Health Survey; HEW; Health  
30  
31 340 Extension Workers; OR; Odds Ratio; PNC; Postnatal Care; WDA; Women Development  
32  
33 341 Army; WHO; World Health Organization

### 37 342 **Consent for publication**

38  
39 343 Not applicable

### 42 344 **Data sharing statement**

43  
44 345 All the data generated in this study are included in this manuscript. The datasets used and  
45  
46 346 analyzed to produce the current manuscript will be obtained from the corresponding author  
47  
48 347 upon request.

### 51 348 **Competing interests**

52  
53 349 The authors declare that they have no competing interests.

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57  
58 351 Not applicable

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3 352 **Authors' contributions**  
4  
5

6 353 DBA conceived the idea for this study, developed the proposal, supervised fieldwork, and made  
7  
8 354 the analysis, interpretation, and manuscript write up. YAH and EGM assisted in the conception  
9  
10 355 of the study, involved in the method development, analysis, and interpretation of the findings.  
11  
12  
13 356 DZD and WDN participated in the analysis, interpretation of the findings, and writing the  
14  
15 357 manuscript. All the authors have read, revised, and approved the final manuscript.  
16  
17

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20

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24  
25  
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3 485 **Figure legend**  
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6 486 **Figure 1.** Positioning, attachment, and suckling of infant during feeding at Gidan, District,  
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8 487 Northeast, Ethiopia, 2021 (n=760)  
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10  
11 488 **Table 1.** Criteria and grading system for positioning, attachment and suckling among lactating  
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13 489 mothers at Gidan district, northeast, Ethiopia, 2021 (n=760)  
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17 **Criteria for correct body positioning:**  
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- 19 - Baby's body close to the mother's body  
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21 - Baby body and neck straight  
22  
23 - Baby facing toward the mothers breast  
24  
25 - The whole body supported by mother  
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29 **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

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38 **Criteria for correctness of attachment:**  
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- 40 - More areola is seen above the baby's top lip  
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42 - Baby's mouth is wide open  
43  
44 - Baby's lower lip turned outwards  
45  
46 - Baby's chin touching the breast  
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50 **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

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59 **Criteria for correctness of effective suckling:**  
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- Slow suckling

- Deep suckling

- Sometimes pausing

Criteria for grading of effective suckling:	Grade	Score
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• None or only one of the three criterion has been achieved	Ineffective	0-1
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• Any two or all three criteria has been achieved	Effective	2-3
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491 **Table 2.** Sociodemographic characteristics of respondents at Gidan, District, Northeast

492 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
	Widowed	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

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

494 **Table 3.** Obstetric and infant characteristics of the respondent at Gidan, District, Northeast  
 495 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 delivery	Yes	378	56.3
	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 HEW**	Yes	374	49.2
	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

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

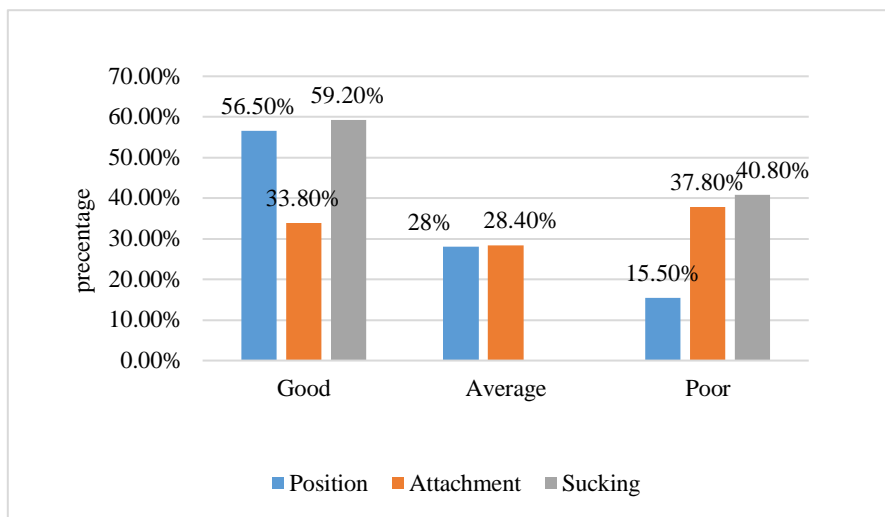
497 **Table 4.** Association of effective breastfeeding technique with different characteristics of  
 498 lactating mothers in Gidan, District, Northeast Ethiopia, 2021(n=760).

Variables	EBT		COR (95%CI)	AOR (95%CI)
	Yes (n, %)	No (n, %)		
<b>Age of the mothers'</b>				
<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)
<b>Educational status of the mothers'</b>				
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	49(57.3)	43(42.7)	1.48(0.94,2.33)	1.18(0.71,1.96)
and above				
<b>Parity</b>				
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)
<b>Antenatal care</b>				
Yes	293(45.1)	357(54.9)	1.92(1.24,2.96)	<b>1.75(1.10,2.77)*</b>
No	33(30)	77(70)	1	<b>1</b>
<b>Place of delivery</b>				
Hospital	22(57.5)	18(42.5)	3.40(1.77,8.61)	<b>2.85(1.22,6.66)*</b>
Health center	283(44.6)	349(55.4)	2.59(1.55,8.61)	<b>2.15(1.25,3.68)**</b>



Home	21(23.9)	67(76.1)	1	<b>1</b>
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)	<b>2.12(1.55,2.92)**</b>
No	121(31.6)	265(68.4)	1	<b>1</b>
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

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



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

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

Participants	6	Give the eligibility criteria, and the sources and methods of selection of participants  <b>Page 6, line number 112-120</b>
		Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifier, Give diagnostic, if applicable  <b>Page 7-8, line number 151-174</b>
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  <b>Page 6-7, line number 131-150</b>
Bias	8	Describe any efforts to address potential sources of bias  <b>Page 3 , line number 48-55</b>
Study size	9	Explain how the study design was arrived  <b>Page 6, line number 119-130</b>
Quantitative variables	10	Explain how quantitative variables were handled in the analysis , if applicable describe which groupings chose and why  <b>Page 9, line number 180-192</b>
Statistical methods	11	(a)Describe all statistical methods, including those used to control for confounding  <b>Page 9 , line number 175-192</b>

		(b) Describe any methods used to examine subgroups and interactions  <b>NA</b>
		(c) Explain how missing data were addressed  <b>NA</b>
		(d) If applicable, describe analytical methods taking account of sampling strategy  <b>NA</b>
		(e) Describe any sensitivity analyses  <b>NA</b>
<b>Results</b>		
Descriptive data	12	Give characteristics of study participants (eg, demographic, clinical, social) and information on exposure and potential confounders  <b>Page 10, line number 208-216</b>
Outcome data	13	Report numbers of outcome events or summary measures  <b>Page 10, line number 219-222</b>
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  <b>Page 11, line number 223-234</b>

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

		<b>Page 15, line number 337</b>
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**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.plosmedicine.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](http://www.strobe-statement.org).