BMJ Open Evidence on the effect of gender of newborn, antenatal care and postnatal care on breastfeeding practices in Ethiopia: a meta-analysis and meta-regression analysis of observational studies

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ABSTRACT

Objectives The aim of this systematic review and meta-analysis was to investigate the association of gender of newborn, antenatal care (ANC) and postnatal care (PNC) with timely initiation of breast feeding (TIBF) and exclusive breastfeeding (EBF) practices in Ethiopia.

Design Systematic review and meta-analysis.

Data sources To retrieve all available literature, PubMed, EMBASE, CINAHL, WHO Global Health Library, Web of Science and SCOPUS databases were systematically searched and complemented by manual searches. The search was done from August 2017 to September 2018.

Eligibility criteria All observational studies including cross-sectional, case-control, cohort studies conducted in Ethiopia from 2000 to 2018 were included. Newcastle-Ottawa Scale was used for quality assessment of included studies.

Data extraction and synthesis Study area, design, population, number of mothers (calculated sample size and participated in the study) and observed frequency data were extracted using Joanna Briggs Institute tool. To obtain the pooled effect size, a meta-analysis using weighted inverse variance random-effects model was performed. Cochran's Q χ^2 test, τ^2 and I^2 statistics were used to test heterogeneity, estimate amount of total/residual heterogeneity and measure variability attributed to heterogeneity, respectively. Mixed-effects meta-regression analysis was done to identify possible sources of heterogeneity. Egger's regression test at p value threshold ≤ 0.01 was used to examine publication bias. Furthermore, the trend of evidence over time was examined by performing a cumulative meta-analysis.

Results Of 523 articles retrieved, 17 studies (n=26 146 mothers) on TIBF and 24 studies (n=17 819 mothers) on EBF were included in the final analysis. ANC (OR=2.24, 95% CI 1.65 to 3.04, $p<0.001$, $I^2=90.9\%$), PNC (OR=1.86, 95% CI 1.41 to 2.47, $p<0.001$, $I^2=63.4\%$) and gender of newborn (OR=1.31, 95% CI 1.01 to 1.68, $p=0.04$, $I^2=81.7\%$) significantly associated with EBF. ANC (OR=1.70, 95% CI 1.10 to 2.65, $p=0.02$, $I^2=93.1\%$) was also significantly associated with TIBF but not with gender of newborn (OR=1.02, 95% CI 0.86 to 1.21, $p=0.82$, $I^2=66.2\%$).

Strengths and limitations of this study

- This systematic review and meta-analysis was conducted based on the registered and published protocol.
- Since this is the first study in Ethiopia, the evidence could be helpful for future researchers, public health practitioners and healthcare policy-makers.
- Almost all included studies were observational which might weaken the strength of evidence and hinder causality inference.
- Perhaps, the results may not be nationally representative given that studies from some regions are lacking.
- Based on the conventional method of heterogeneity test, a few analyses suffer from high between-study variation.

Conclusions In line with our hypothesis, gender of newborn, ANC and PNC were significantly associated with EBF. Likewise, ANC was significantly associated with TIBF. Optimal care during pregnancy and after birth is important to ensure adequate breast feeding. This meta-analysis study provided up-to-date evidence on breastfeeding practices and its associated factors, which could be useful for breastfeeding improvement initiative in Ethiopia and cross-country and cross-cultural comparison.

Trial registration number CRD42017056768

INTRODUCTION

WHO and Unicef recommend timely initiation of breast feeding (TIBF) (ie, initiating breast feeding within 1 hour of birth) and exclusive breast feeding (EBF) (ie, feeding only human milk during the first 6 months)¹ for maintaining maternal and newborn health.² Breast feeding provides optimal nutrition, increase cognitive development, reduce morbidity and mortality for the newborn; for

example, TIBF prevents 22% of neonatal deaths.³ Inappropriate breastfeeding practice, on the other hand, causes more than two-thirds of under-five child mortality, of which 41% of these deaths occur in Sub-Saharan Africa.^{1,4} Breast feeding also prevents maternal long-term chronic diseases, such as diabetes mellitus.³

According to a new 2017 global Unicef and WHO report, only 42% start breast feeding within an hour of birth, leaving an estimated 78 million newborns to wait over 1 hour to be put to the breast, the majority born in low-income and middle-income countries.⁵ The prevalence rate of TIBF varies widely across regions from 35% in the Middle East and North Africa to 65% in Eastern and Southern Africa. Another report also shows that only two in five infants <6 months of age are exclusively breast fed.⁶ The prevalence rate of EBF ranges from 22% in East Asia and Pacific to 56% in Eastern and Southern Africa.⁶ Based on our meta-analysis in 2018, the prevalence of TIBF and EBF in Ethiopia is 66.5% and 60.1% respectively.⁷ To date, globally, only 22 nations have achieved the WHO goal of 70% coverage in TIBF and 23 countries have achieved at least 60% coverage in EBF.²

To promote optimal breast feeding, WHO, Unicef and other (inter)national organisations have been working in developing countries, and several studies have been conducted on the advantages of breast feeding. However, it is still challenging to achieve the expected coverage and attributed to several factors including antenatal (ANC), postnatal care (PNC) and gender of newborn,^{8,9} and breastfeeding coverage continued to be suboptimal as a result. In Ethiopia, several meta-analyses studies were done on infant and young child feeding.^{7,10-14} In our previous meta-analysis, we explored the association between maternal employment, lactation counselling, mode of delivery, place of delivery, maternal age, newborn age and discarding colostrum breastfeeding practices (ie, TIBF and EBF).^{7,10} We also separately studied the association between TIBF and EBF.⁷ However, none of these meta-analyses did study the pooled effect of gender of newborn, ANC and PNC on TIBF and EBF. Given the absence of pooled estimates, up-to-date evidence is required to design intervention-based studies targeting these factors. Therefore, we aimed to investigate whether TIBF and EBF in Ethiopia are influenced by gender of newborn, ANC and PNC. We hypothesised at least one ANC or PNC visit significantly improves TIBF and EBF practices. Additionally, mothers with male newborn have higher odds of TIBF and EBF compared with mothers with female newborn.

METHODS

Protocol registration and publication

The study protocol was registered with the University of York, Centre for Reviews and Dissemination, International prospective register of systematic reviews (PROSPERO) and published.¹⁵

Search strategy and databases

PubMed, EMBASE, CINAHL, WHO Global Health Library, Web of Science and SCOPUS electronic databases were searched to extract all available literature. The search strategy was developed using Population Exposure Controls and Outcome (PECO) searching guide in consultation with a medical information specialist (online supplementary file 1). The search was done from August 2017 to September 2018. Grey literature and cross-references of included articles and previous meta-analysis were also hand searched.

PECO guide

Population

All mothers with newborn up to 23 months of age.

Exposure

Gender of the newborn, ANC and PNC visit (at least one visit).

Comparison

Female newborn, no ANC visit and no PNC visit.

Outcome

TIBF and EBF practices.

Inclusion and exclusion criteria

Studies were included if they met the following criteria: (1) observational studies including cross-sectional, case-control, cohort studies; (2) conducted in Ethiopia; (3) published in English language and (4) published between 2000 and 2018. Studies were excluded on any one of the following conditions: (1) conducted in women with HIV/AIDS, preterm newborn and newborn in intensive care unit; (2) published in language other than English; (3) abstracts without full text and (4) qualitative studies, symposium/conference proceedings, essays, commentaries and case reports.

Selection and quality assessment

Initially, all identified articles were exported to Refwork citation manager (RefWorks 2.0; ProQuest LLC, Bethesda, Maryland, USA, <http://www.refworks.com>), and duplicate studies were cancelled. Next, a pair of independent reviewers identified articles by analysing the title and abstract for relevance and its compliance with the proposed review topic. Agreement between the two reviewers, as measured by Cohen's Kappa,¹⁶ was 0.76. After removing irrelevant studies through a respective decision after discussion, full texts were systematically reviewed for further eligibility analysis. Newcastle-Ottawa Scale (NOS) was used to examine the quality of studies and for potential risk of bias.¹⁷ In line with the WHO standard definition, outcome measurements were TIBF (the percentage of newborn who breast feed within the first hour of birth) and EBF (the percentage of infants who exclusively breast fed up to 6 months since birth). Finally, Joanna Briggs Institute (JBI) tool¹⁸ was used to extract the following data: study area (region and place), method (design), population, number of mothers (calculated sample size and participated in

the study) and observed data (ie, 2×2 table). Geographic regions were categorised based on the current Federal Democratic Republic of Ethiopia administrative structure.¹⁹ Disagreement between reviewers was solved through discussion and consensus.

Statistical analysis

A meta-analysis using a weighted inverse variance random-effects model was performed to obtain a pooled OR. In addition, a cumulative meta-analysis was done to illustrate the trend of evidence regarding the effect of gender of newborn, ANC and PNC on breastfeeding practices. Publication bias was assessed by visual inspection of a funnel plot and Egger's regression test for funnel plot asymmetry using SE as a predictor in mixed-effects meta-regression model at a p value threshold ≤ 0.010 .²⁰ Duval and Tweedie trim-and-fill method²¹ was used to manage publication bias. Cochran's Q X^2 test, τ^2 and I^2 statistics were used to test heterogeneity, estimate amount of total/residual heterogeneity and measure variability attributed to heterogeneity, respectively.²² Mixed-effects meta-regression analysis was done to examine the effect of variation in study area (region), residence of women, sample size and publication year on between-study heterogeneity.²³ The total amount of heterogeneity (R^2) accounted for these factors was calculated by subtracting the residual amount of heterogeneity from the total amount of heterogeneity and dividing by the total amount of heterogeneity. Moreover, to assess the moderation effect of these factors, Omnibus test of moderators was applied. The data were analysed using 'metafor' packages in R software V.3.2.1 for Windows.²³

Data synthesis and reporting

We analysed the data in two groups based on outcome measurements (ie, TIBF and EBF). Results are presented using forest plots. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline was strictly followed to report our results.²⁴

Minor post hoc protocol changes

Based on the authors' decision and reviewers' recommendation, the following changes were made to our published protocol methods.¹⁵ We added the JBI tool¹⁸ to extract the data. In addition, we used the Duval and Tweedie trim-and-fill method to manage publication bias. Furthermore, cumulative meta-analysis and mixed-effects meta-regression analysis were done to reveal the trends of evidence and identify possible sources of between-study heterogeneity, respectively.

Patient and public involvement

The research questions and outcome measures were developed by the authors (TDH and NTS) in consultation with public health professionals and previous studies. Given this is a systematic review and meta-analysis based on published data, patients/study participants were not directly involved in the design and analysis of this study. The results of this study will be disseminated to patients/

study participants through health education on factors affecting breast feeding and disseminating the key findings using brochure in the local language.

RESULTS

Search results

In total, we obtained 533 articles from PubMed (n=169), EMBASE (n=24), Web of Science (n=200), SCOPUS (n=85) and CINHAL and WHO Global Health Library (n=5). Fifty additional articles were found through manual search. After removing duplicates and screening of titles and abstracts, 84 studies were selected for full-text review. Of these, 43 articles were excluded due to several reasons: 19 studies on complementary feeding, 3 studies on prelacteal feeding, 3 studies on malnutrition, 17 studies with different variables of interest and 1 project review report. As a result, 41 articles fulfilled the inclusion criteria and used in this meta-analysis: 17 studies investigated the association between TIBF and gender of newborn and ANC whereas 24 studies between EBF and gender of newborn, ANC and PNC. The PRISMA flow diagram of literature screening and selection process is shown in figure 1. One study could report more than one outcome measures or associated factors.

Study characteristics

As presented in table 1, 17 studies reported the association of TIBF and gender of newborn and ANC in 26 146 mothers. Among these studies, 13 of them were conducted in Amhara (n=5), Oromia (n=4) and Southern Nations, Nationalities and Peoples' (SNNP) (n=4) region. Regarding the residence status, eight studies were conducted in both urban and rural whereas six studies in urban women. All studies passed the NOS quality assessment criteria at a cut-off value ≥ 7 .

Twenty-four studies reported the association between EBF and gender of newborn, ANC and PNC in 17 819 mothers. Of these studies, 11 were conducted in Amhara and seven in SNNP region. Based on the residence status, 10 studies were conducted in urban, 8 in urban and rural, and 6 in rural women. Even though almost all studies were cross-sectional, five studies have used nationally representative data of the Ethiopian Demographic Health Survey.^{19–23} Detailed characteristics of the included studies are shown in table 2.

Meta-analysis

Timely initiation of breast feeding

Among the 17 selected studies, 10 studies^{25–34} reported the association between TIBF and gender of newborn in 16 411 mothers (table 1A). The pooled OR of gender of newborn was 1.02 (95% CI 0.86 to 1.21, $p=0.82$, $I^2=66.2\%$) (figure 2). Mothers with male newborn had 2% higher chance of initiating breast feeding within 1 hour of birth compared with female newborn although not statistically significant. There was no significant publication bias ($z=0.41$, $p=0.68$) (online supplementary figure 1).

Figure 1 PRISMA flow diagram of literature screening and selection process; 'n' in each stage represents the total number of studies that fulfilled particular criteria. EBF, exclusive breast feeding; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; TIBF, timely initiation of breast feeding.

Likewise, 13 studies^{27 28 30 31 33–41} reported the association between TIBF and ANC in 12 535 mothers (table 1B). The pooled OR of ANC was 1.70 (95% CI 1.10 to 2.65, $p=0.02$, $I^2=93.1\%$) (figure 3). Mothers who had at least one ANC visit had 70% significantly higher chance of initiating breast feeding within 1 hour of birth compared with mothers who had no ANC visit. There was no significant publication bias ($z=0.96$, $p=0.34$) (online supplementary figure 2).

Exclusive breast feeding

Out of the 24 studies included, 11 studies^{25 26 42–50} reported the association between EBF and gender of newborn in 6527 mothers (table 2A). The pooled OR of newborn gender was 1.08 (95% CI 0.86 to 1.36, $p=0.49$, $I^2=71.7\%$) (figure 4). Since significant publication bias detected ($z=-3.64$, $p<0.001$), we did Duval and Tweedie trim-and-fill analysis and calculated a new effect size

for gender of newborn (OR=1.31, 95% CI 1.01 to 1.68, $p=0.04$, $I^2=81.7\%$) after including imputed studies (ie, estimated number of missing studies=4) (online supplementary figure 3). Therefore, mothers with male newborn had 31% significantly higher chance of exclusive breast feeding during the first 6 months compared with mothers with female newborn.

Twenty-one studies^{35–37 42–49 51–60} reported the association between EBF and ANC in 16 052 mothers (table 2B). The pooled OR of ANC was 2.24 (95% CI 1.65 to 3.04, $p<0.0001$, $I^2=90.9\%$) (figure 5). Mothers who had at least one ANC visit had 2.24 times significantly higher chance of exclusively breast feed compared with mothers who had no ANC visit. There was no significant publication bias ($z=1.69$, $p=0.09$) (online supplementary figure 4).

Table 1 Characteristics of included studies on TIBF

Author/publication year	Study area	Study design	Study population	Sample size/ Participated	Factors	TIBF	
						Within 1 hour	After 1 hour Total
A. Gender of newborn versus TIBF							
Regassa 2014 ²⁵	SNNPR, Sidama zone	Cross-sectional study	Mothers with infants aged between 0 and 6 months old	1 100/1094	Male Female Total	488 389 877	107 110 217 1094
Alemayehu 2014 ²⁶	Tigray, Axum town	Cross-sectional study	Mothers who had children aged 6–12 months	418/418	Male Female Total	75 99 174	141 103 244 418
Berhe et al 2013 ²⁷	Tigray, Mekelle town	Cross-sectional study	Mothers of children aged 0–24 months	361/361	Male Female Total	166 112 278	42 37 79 208 149 357
Beyene et al 2016 ²⁸	SNNPR, Dale Woreda	Cross-sectional study	Mothers of children <24 months	634/634	Male Female Total	262 255 517	51 50 101 313 305 618
Lakew et al 2015 ²⁹	National	Cross-sectional study*	Mothers who had children <5 years	11 654/11 553	Male Female Total	3124 3057 6181	2860 2511 5371 5984 5568 11 552
Liben and Yesuf 2016 ³⁰	Afar, Dubti town	Cross-sectional study	Mothers of infants aged <6 months	346/333	Male Female Total	81 70 151	122 130 252 203 200 403
Setegn et al 2011 ³¹	Oromia, Goba district	Cross-sectional study	Mothers with children (<12 months)	668/608	Male Female Total	164 150 314	152 133 285 316 283 599
Wolde et al 2014 ³²	Oromia, Nekemte town	Cross-sectional study	Mothers who had a child less <24 months	182/174	Male Female Total	70 84 154	10 10 20 80 94 174
Woldemichael 2016 ³³	Oromia, Tiyo Woreda	Cross-sectional study	Mothers who have children <1 year age	386/373	Male Female Total	153 98 251	60 62 122 213 160 373

Continued

Table 1 Continued

Author/publication year	Study area	Study design	Study population	Sample size/ Participated	Factors	TIBF	
						Within 1 hour	After 1 hour Total
Mekonen <i>et al</i> 2018 ³⁴	Amhara, South Gondar	Cross-sectional study	Mothers of infants <12 months	845/823	Male Female Total	214 187 401	229 193 422
B. Antenatal care versus TIBF							
Gultie and Sebsibie ³⁵	Amhara, Debre Berhan town	Cross-sectional study	Mothers having children aged <23 months old	548/548	ANC No ANC Total	482 16 498	88 15 103
Tamiru <i>et al</i> 2012 ³⁶	Oromia, Jimma Arjo Woreda	Cross-sectional study	Mothers of index children aged 0–6 months	384/382	ANC No ANC Total	115 120 235	69 71 140
Tamiru and Tamrat ³⁷	SNNPR, Arba Minch Zuria Woreda	Cross-sectional study	Mothers of infants aged ≤2 years	384/384	ANC No ANC Total	179 40 219	140 24 164
Berhe <i>et al</i> 2013 ²⁷	Tigray, Mekelle town	Cross-sectional study	Mothers of children aged 0–24 months	361/361	ANC No ANC Total	263 15 278	66 13 79
Aduugna 2014 ³⁸	SNNPR, Arba Minch Zuria	Cross-sectional study	Women who had children <2 years	384/383	ANC No ANC Total	179 40 219	140 24 164
Beyene <i>et al</i> 2016 ²⁸	SNNPR, Dale Woreda	Cross-sectional study	Mothers of children <24 months	634/634	ANC No ANC Total	206 311 517	58 43 101
Derso <i>et al</i> 2017 ³⁹	Amhara, Dabat district	Cross-sectional study*	Mothers with children <5 years of age	6761/6761	ANC No ANC Total	2135 670 2805	2220 1364 3584
Liben and Yesuf 2016 ³⁰	Afar, Dubti town	Cross-sectional study	Mothers of infants aged <6 months	346/333	ANC No ANC Total	110 41 151	196 56 252
						403	Continued

Table 1 Continued

Author/publication year	Study area	Study design	Study population	Sample size/ Participated	Factors	TIBF		
						Within 1 hour	After 1 hour	Total
Seid et al 2013 ⁵¹	Amhara, Bahir Dar city	Cross-sectional study	Mothers who delivered in the last 12 months	819/819	ANC	680	94	774
					No ANC	29	12	41
					Total	709	106	815
Setegn et al 2011 ³¹	Oromia, Goba district	Cross-sectional study	Mothers with children (<12 months)	668/608	ANC	270	238	508
					No ANC	37	19	56
					Total	307	257	564
Tewabe 2016 ⁴⁰	Amhara, Motta town	Cross-sectional study	Mothers with infant <6 months-old	423/405	ANC	282	41	323
					No ANC	37	45	82
					Total	319	86	405
Woldemichael 2016 ³³	Oromia, Tiyo Woreda	Cross-sectional study	Mothers who have children <1 year age	386/373	ANC	194	41	235
					No ANC	57	81	138
					Total	251	122	373
Mekonen et al 2018 ³⁴	Amhara, South Gondar	Cross-sectional study	Mothers of infants <12 months	845/823	ANC	370	332	702
					No ANC	31	90	121
					Total	401	422	823

*Used nationally representative EDHS data.

ANC, antenatal care; EDHS, Ethiopian Demographic Health Survey; SNNPR, Southern Nations, Nationalities and Peoples' Region ; TIBF, timely initiation of breast feeding.

Table 2 Characteristics of included studies on EBF

Author/publication year	Study area	Study design	Study population	Sample size/ Participated	Factors	EBF	
						Yes	No
A. Gender of newborn versus EBF							
Asemahagn 2016 ⁴²	Amhara, Azezo district	Cross-sectional study	Women having children aged from 0 to 6 months	346/332	Male	95	38
					Female	167	32
					Total	262	70
Setegn <i>et al</i> 2012 ⁴³	Oromia, Bale Zone, Goba district	Cross-sectional study	Mothers–infant pairs	668/608	Male	107	43
					Female	92	37
					Total	199	80
Sonko and Worku 2015 ⁴⁴	SNNPR, Halaba special woreda	Cross-sectional study	Mothers with children <6months of age	422/420	Male	145	60
					Female	151	64
					Total	296	124
Regassa 2014 ²⁵	SNNPR, Sidama zone	Cross-sectional study	With infants aged between 0 and 6 months old	1100/1094	Male	109	19
					Female	89	17
					Total	198	36
Alemayehu 2014 ²⁶	Tigray, Axum town	Cross-sectional study	Mothers who had children aged 6–12 months	418/418	Male	97	119
					Female	77	128
					Total	174	247
Biks <i>et al</i> 2015 ⁴⁵	Amhara, Dabat district	Nested case–control study*	All pregnant women in the second/third trimester	1769/1769	Male	271	619
					Female	727	1148
					Total	998	1767
Arage and Gedamu 2016 ⁴⁶	Amhara, Debre Tabor Town	Cross-sectional study	Mothers of infants <6 months of age	470/453	Male	119	40
					Female	227	67
					Total	346	107
Aduugna <i>et al</i> 2017 ⁴⁷	SNNPR, Hawassa city	Cross-sectional study	Mothers with infants aged 0–6 months	541/529	Male	169	88
					Female	153	119
					Total	322	207
Egata <i>et al</i> 2013 ⁴⁸	Oromia, Kersa district	Cross-sectional study*	Mothers of children <2years of age	881/860	Male	323	124
					Female	294	119
					Total	617	243
Teka <i>et al</i> 2015 ⁴⁹	Tigray, Enderta Woreda	Cross-sectional study	Mothers having children aged <24 months	541/530	Male	158	60
					Female	214	98
					Total	372	158

Continued

Table 2 Continued

Author/publication year	Study area	Study design	Study population	Sample size/ Participated	Factors	EBF		Total
						Yes	No	
Sefene 2013 ⁵⁰	Amhara, Bahir Dar city	Cross-sectional study	Mothers who had a child aged <6 months	170/159	Male Female Total	36 42 78	47 34 81	83 76 159
B. Antenatal care versus EBF								
Asemahagn 2016 ⁴²	Amhara, Azezo district	Cross-sectional study	Women having children aged from 0 to 6 months	346/332	ANC No ANC Total	243 19 262	57 13 70	300 32 332
Gultie and Sebsbie 2016 ³⁵	Amhara, Debre Berhan town	Cross-sectional study	Mothers having children aged <23 months old	548/548	ANC No ANC Total	263 10 273	253 21 274	516 31 547
Hunegnaw et al 2017 ⁵²	Amhara, Gozamin district	Cross-sectional study	Mothers who had infants aged between 6 and 12 months	506/478	ANC No ANC Total	341 17 358	109 11 120	450 28 478
Lenja et al 2016 ⁵³	SNNPR, Offa district	Cross-sectional study	Mothers of infants <6 months	403/396	ANC No ANC Total	233 44 277	43 88 131	276 132 408
Seid et al 2013 ⁵¹	Amhara, Bahir Dar city	Cross-sectional study	Mothers who delivered in the last 12 months	819/819	ANC No ANC Total	405 7 412	372 35 407	777 42 819
Setegn et al 2011 ³¹	Oromia, Goba district	Cross-sectional study	Mothers with children (<12 months)	668/608	ANC No ANC Total	166 27 193	65 10 75	231 37 268
Sonko and Worku 2015 ⁴⁴	SNNPR, Halaba special woreda	Cross-sectional study	Mothers with children <6 months of age	422/420	ANC No ANC Total	258 38 296	88 36 124	346 74 420
Tadesse et al 2016 ⁵⁴	SNNPR, Sorro District	Cross-sectional Study	Mothers with infants aged 0–5 months	602/579	ANC No ANC Total	211 59 270	121 123 244	332 182 514
Tariku et al 2017 ⁵⁵	Amhara, Dabat District	Cross-sectional study *	Mothers with children aged <59 months	5227/5227	ANC No ANC Total	1979 713 2692	1353 876 2229	3332 1589 4921

Continued

Table 2 Continued

Author/publication year	Study area	Study design	Study population	Sample size/ Participated	Factors	EBF	
						Yes	No
Tewabe 2016 ⁴⁰	Amhara, Motta town, East Gojjam zone	Cross-sectional study	Mothers with an infant <6 months old	423/405	ANC No ANC Total	185 18 203	164 38 202
Tamiru <i>et al</i> 2012 ³⁶	Oromia, Jimma Arjo Woreda	Cross-sectional study	Mothers of index children aged 0–6 months	384/382	ANC No ANC Total	87 96 183	103 96 199
Tamiru and Tamrat 2015 ³⁷	SNNPR, Arba Minch Zuria Woreda	Cross-sectional study	Mothers of infants aged ≤2 years	384/384	ANC No ANC Total	228 27 255	92 37 129
Biks <i>et al</i> 2015 ⁴⁵	Amhara, Dabat district	Nested case-control study*	All pregnant women in the second/third trimester	1769/1769	ANC No ANC Total	180 363 543	277 949 1226
Abera 2012 ⁵⁶	Harari, Harar town	Cross-sectional study	Mothers of children aged <2 years	604/583	ANC No ANC Total	194 13 207	163 29 192
Arage and Gedamu 2016 ⁴⁶	Amhara, Debre Tabor Town	Cross-sectional study	Mothers of infants <6 months of age	470/453	ANC No ANC Total	384 18 402	39 12 51
Adugna <i>et al</i> 2017 ⁴⁷	SNNPR, Hawassa city	Cross-sectional study	Mothers with infants aged 0–6 months	541/529	ANC No ANC Total	221 101 322	111 96 207
Egata <i>et al</i> 2013 ⁴⁸	Oromia, Kersa district	Cross-sectional study*	Mothers of children <2 years of age	881/860	ANC No ANC Total	233 384 617	135 108 243
Taddele 2014 ⁵⁷	Amhara, Injibara Town	Comparative cross-sectional study	Employed and unemployed mothers of children aged ≤1 year	524/473	ANC No ANC Total	90 6 96	98 23 121
Echamo 2012 ⁵⁸	SNNPR, Arbaminch town	Cross-sectional study	Mothers of infants within the age of 6–12 months	768/768	ANC No ANC Total	332 25 357	360 51 411

Continued

Table 2 Continued

Author/publication year	Study area	Study design	Study population	Sample size/ Participated	Factors	EBF		Total
						Yes	No	
Teka <i>et al</i> 2015 ⁴⁹	Tigray, Enderta Woreda	Cross-sectional study	Mothers having children aged <24 months	541/530	ANC No ANC Total	325 47 372	134 24 158	459 71 530
Chekol <i>et al</i> 2017 ⁵⁹	Amhara, Gondar town	Cross-sectional study	Mothers with children aged 7–12 months	333/333	ANC No ANC Total	131 29 160	117 56 173	248 85 333
C. Postnatal care versus EBF								
Asemahagn 2016 ⁴²	Amhara, Azezo district	Cross-sectional study	Women having children aged from 0 to 6 months	346/332	PNC No PNC Total	137 125 262	25 45 70	162 170 332
Lenja <i>et al</i> 2016 ⁵³	SNNPR, Offa district	Cross-sectional study	Mothers of infants <6 months	403/396	PNC No PNC Total	188 121 309	33 54 87	221 175 396
Sonko and Worku 2015 ⁴⁴	SNNPR, Halaba special woreda	Cross-sectional study	Mothers with children <6 months of age	422/420	PNC No PNC Total	98 197 295	25 99 124	123 296 419
Tadesse <i>et al</i> 2016 ⁵⁴	SNNPR, Sorro District	Cross-sectional Study	Mothers with infants aged 0–5 months	602/579	PNC No PNC Total	204 66 270	127 117 244	331 183 514
Tewabe <i>et al</i> 2016 ⁶⁰	Amhara, Motta town, East Gojjam zone	Cross-sectional Study	Mothers with an infant <6 months old	423/405	PNC No PNC Total	116 87 203	81 121 202	197 208 405
Abera 2012 ⁵⁶	Harari, Harar town	Cross-sectional study	Mothers of children aged <2 years	604/583	PNC No PNC Total	29 178 207	31 161 192	60 339 399
Teka <i>et al</i> 2015 ⁴⁹	Tigray, Enderta woreda	Cross-sectional study	Mothers having children aged <24 months	541/530	PNC No PNC Total	167 205 372	86 72 158	253 277 530

*Used nationally representative EDHS data.

ANC, antenatal care; EBF, exclusive breast feeding; EDHS, Ethiopian Demographic Health Survey; PNC, postnatal care; SNNPR, Southern Nations, Nationalities and Peoples' Region.

Figure 2 Forest plot of the unadjusted odds ratios with corresponding 95% CIs of 10 studies on the association of gender of newborn and TIBF. The horizontal line represents the CI, the box and its size in the middle of the horizontal line represents the weight of sample size. The polygon represents the pooled OR. The reference category is 'Female'. LIBF, late initiation of breast feeding; REM, random-effects model; TIBF, timely initiation of breast feeding.

Furthermore, seven studies^{42 44 49 53 54 56 60} reported the association between EBF and PNC in 2995 mothers (table 2C). The pooled OR of PNC was 1.86 (95% CI 1.41 to 2.47, p<0.0001, I²=63.4%) (figure 6). Mothers

Figure 3 Forest plot of the unadjusted odds ratios with corresponding 95% CIs of 13 studies on the association of ANC and TIBF. The horizontal line represents the CI, the box and its size in the middle of the horizontal line represents the weight of sample size. The polygon represents the pooled OR. The reference category is 'No ANC follow-up'. ANC, antenatal care; LIBF, late initiation of breast feeding; REM, random-effects model; TIBF, timely initiation of breast feeding.

Figure 4 Forest plot of the unadjusted odds ratios with corresponding 95% CIs of 11 studies on the association of newborn gender and EBF. The horizontal line represents the CI, the box and its size in the middle of the horizontal line represents the weight of sample size. The polygon represents the pooled OR. The reference category is 'Female'. EBF, exclusive breast feeding; NEBF, non exclusive of breast feeding; REM, random-effects model.

who had at least one PNC visit had 86% significantly higher chance of exclusively breast feed during the first 6 months compared with mothers who had no PNC

Figure 5 Forest plot of the unadjusted odds ratios with corresponding 95% CIs of 21 studies on the association of ANC and EBF. The horizontal line represents the CI, the box and its size in the middle of the horizontal line represents the weight of sample size. The polygon represents the pooled OR. The reference category is 'No ANC follow-up'. ANC, antenatal care; EBF, exclusive breast feeding; NEBF, non-exclusive of breast feeding; REM, random-effects model.

Figure 6 Forest plot of the unadjusted odds ratios with corresponding 95% CIs of seven studies on the association of PNC and EBF. The horizontal line represents the CI, the box and its size in the middle of the horizontal line represents the weight of sample size. The polygon represents the pooled OR. The reference category is 'No PNC follow-up'. EBF, exclusive breast feeding; NEBF, non-exclusive breast feeding; PNC, postnatal care; REM, random-effects model.

follow-up. There was no significant publication bias ($z = -0.91$, $p = 0.36$) (online supplementary figure 5).

Cumulative meta-analysis

As illustrated in figure 7, the effect of gender of newborn (figure 7) has not been changed whereas the effect of ANC on TIBF (figure 8) has been increasing over time.

Similarly, the effect of gender of newborn on EBF (figure 9) has not been changed over time. The effect

Figure 7 Forest plot showing the results from a cumulative meta-analysis of studies examining the effect of gender of newborn on TIBF. TIBF, timely initiation of breast feeding.

Figure 8 Forest plot showing the results from a cumulative meta-analysis of studies examining the effect of ANC on TIBF. ANC, antenatal care; TIBF, timely initiation of breast feeding.

of ANC (figure 10) and PNC (figure 11) have been increasing.

Meta-regression analysis

In studies reporting the association between TIBF and ANC, 26.29% of the heterogeneity was accounted for the variation in study area (region), residence of mothers, sample size and publication year. Based on the omnibus test of moderators, however, none of these factors influenced association between TIBF and ANC ($Q_M = 11.57$, $df = 8$, $p = 0.17$). In studies reporting the association between TIBF and gender of newborn, the estimated amount of total heterogeneity was substantially low ($\tau^2 = 4.28\%$);

Figure 9 Forest plot showing the results from a cumulative meta-analysis of studies examining the effect of gender of newborn on EBF. EBF, exclusive breast feeding.

Figure 10 Forest plot showing the results from a cumulative meta-analysis of studies examining the effect of ANC on EBF. ANC, antenatal care; EBF, exclusive breast feeding.

as a result, it is not relevant to investigate the possible reasons for heterogeneity.

Among studies reporting the association between EBF and gender of newborn, ANC and PNC, 77.66%, 60.29% and 100% of the heterogeneity were accounted for the variation in study area (region), residence of mothers, sample size and publication year, respectively. Based on the omnibus test of moderators, study area (region) and publication year negatively influenced the association between gender of newborn and EBF practice ($Q_M=18.46$, $df=7$, $p=0.01$). Study area (region) negatively influenced the association between ANC and EBF practice ($Q_M=27.55$, $df=8$, $p=0.001$) (table 3).

Figure 11 Forest plot showing the results from a cumulative meta-analysis of studies examining the effect of PNC on EBF. EBF, exclusive breast feeding; PNC, postnatal care.

DISCUSSION

This meta-analysis assessed the association between breastfeeding practices (ie, TIBF and EBF) and gender of newborn, ANC and PNC. The key findings were EBF was significantly associated with ANC, PNC and gender of newborn whereas TIBF was significantly associated with ANC but not with gender of newborn.

In congruent with our hypothesis and the large body of global evidence,^{61–66} our finding indicated that mothers who had at least one antenatal visit had a significantly higher chance of initiating breast feeding within 1 hour of birth and exclusively breast feed for the first 6 months compared with mothers who had no ANC visit. This may be because health professionals provide breastfeeding guidance and counselling during ANC visit.⁷ The Ethiopian Ministry of Health has also adopted Baby-Friendly Hospital Initiative programme as part of the national nutrition programme and is now actively working to integrate to all public and private health facilities and improving breastfeeding practice as a result.

We also showed that mothers who had at least one PNC visit had nearly twice higher chance of exclusively breast feeding during the first 6 months compared with mothers who had no PNC follow-up. This result supported our hypothesis, and various studies have similarly reported a significantly high rate of EBF in mothers who had a postnatal visit at health institution⁶⁶ or postnatal home visit.⁶⁷ The possible justification could be that postnatal visit health education may positively influence the belief and decision of the mothers to exclusively breast feed. Previous studies have also shown that postnatal education and counselling are important to increase EBF practice.⁶⁸ In addition, in our previous meta-analyses, we showed that guidance and counselling during PNC was significantly associated with high-rate EBF.⁷ Furthermore, PNC may ease breastfeeding difficulty, increase maternal confidence and encourage social/family support which lead the mother to continue EBF for 6 months.

Finally, in agreement with our hypothesis and previous studies,^{69–71} we uncovered gender of newborn was significantly associated with EBF practice. Mothers with male newborn had a 31% significantly higher chance of exclusively breast feeding during the first 6 months compared with mothers of female newborn. This finding disproved the traditional perception and belief in Ethiopia that male newborn has prelacteal feeding to be strong and healthy compared with female newborn. On the other hand, several studies^{63,66} depicted that gender of newborn is not significantly associated with breastfeeding practice, such as TIBF as we showed in our meta-analysis. This discrepancy might be due to the sociocultural difference and lack of adequate power given that we only found 10 studies to estimate the pooled effect size.

This systematic review and meta-analysis was conducted based on published protocol,¹⁵ and PRISMA guideline for literature reviews. In addition, publication bias was quantified using Egger's regression statistical test and NOS was used to assess the quality of included studies. Since it is

Table 3 Meta-regression analysis to identify possible factors of heterogeneity among the included studies

Variables (reference category)*	Estimate	SE	Z value	P value	CI.lb	CI.ub
TIBF						
ANC						
Amhara region (Afar)	1.71	1.17	1.46	0.15	-0.59	4.01
Oromia region (Afar)	1.48	0.91	1.62	0.10	-0.31	3.28
SNNPR region (Afar)	0.54	1.09	0.50	0.62	-1.58	2.67
Tigray region (Afar)	1.58	1.30	1.21	0.23	-0.97	4.12
Urban residence (Rural)	0.71	1.07	0.67	0.51	-1.38	2.80
Urban and rural residence (Rural)	0.65	1.25	0.52	0.61	-1.81	3.10
≥501 mothers (≤500 mothers)	-0.54	0.81	-0.66	0.51	-2.13	1.06
Published 2016–2018 (2011–2015)	0.14	0.82	0.17	0.87	-1.47	1.74
EBF						
Gender of newborn						
Oromia region (Amhara)	-0.54	0.24	-2.22	0.03	-1.02	-0.06
SNNPR region (Amhara)	0.12	0.26	0.46	0.64	-0.39	0.63
Tigray region (Amhara)	-0.39	0.30	-1.31	0.19	-0.98	0.19
Urban residence (Rural)	0.79	0.51	1.57	0.12	-0.20	1.78
Urban and rural residence (Rural)	-0.10	0.44	-0.24	0.81	-0.96	0.75
≥501 mothers (≤500 mothers)	0.78	0.23	3.34	<0.001	0.32	1.24
Published 2016–2018 (2011–2015)	-1.14	0.44	-2.59	0.01	-1.99	-0.28
ANC						
Harari region (Amhara)	-0.11	0.64	-0.17	0.87	-1.37	1.16
Oromia region (Amhara)	-1.27	0.39	-3.28	0.001	-2.03	-0.51
SNNPR region (Amhara)	0.09	0.35	0.27	0.78	-0.59	0.78
Tigray region (Amhara)	-0.49	0.57	-0.87	0.38	-1.60	0.62
Urban residence (Rural)	-0.18	0.38	-0.47	0.63	-0.92	0.56
Urban and rural residence (Rural)	-0.26	0.52	-0.49	0.62	-1.28	0.76
≥501 mothers (≤500 mothers)	-0.30	0.34	-0.87	0.38	-0.96	0.37
Published 2016–2018 (2011–2015)	0.08	0.28	0.29	0.77	-0.46	0.62
PNC†						
Harari region (Amhara)	-0.60	0.48	-1.24	0.22	-1.54	0.35
SNNPR region (Amhara)	0.25	0.30	0.82	0.41	-0.34	0.83
Tigray region (Amhara)	-0.16	0.64	-0.25	0.80	-1.42	1.10
≥501 mothers (≤500 mothers)	0.11	0.31	0.36	0.72	-0.50	0.73
Published 2016–2018 (2011–2015)	0.26	0.36	0.71	0.47	-0.45	0.96

*Since we do not have a specific hypothesis, the reference category is selected arbitrarily; †Residence is dropped from the model due to small sample size of included studies. Cut-off value for sample size and publication year was arbitrarily chosen.

ANC, antenatal care; CI.lb, CI interval, lower bound; CI.ub, CI interval, upper bound; EBF, exclusive breast feeding; PNC, postnatal care; SNNPR, Southern Nations, Nationalities and Peoples' Region; TIBF, timely initiation of breast feeding.

the first study in Ethiopia, the evidence could be helpful for future researchers, public health practitioners and healthcare policy-makers. The inclusion of all previously published studies is a further strength of this meta-analysis. This study has limitations as well. Almost all included studies were observational, which weakens the strength of evidence and hinder causality inference. Even though we have used broad search strategies, the possibility of

missing relevant studies cannot be fully exempted and the finding may not be nationally representative. Based on the conventional method of heterogeneity test, a few analyses suffer from high between-study variation. The course of heterogeneity was carefully explored using meta-regression analysis, and this variation may be due to the difference in study area (region), residence of mothers, sample size, publication year or other residual

factors; therefore, the result should be interpreted with caution. Moreover, the dose–response relationship between the number of ANC or PNC visits and breastfeeding practices was not examined. Lastly, significant publication bias was detected in studies that reported the association between EBF and gender of newborn. We did Duval and Tweedie trim-and-fill analysis to adjust publication bias and to provide an unbiased estimate; however, the result should be cautiously interpreted.

CONCLUSIONS

In line with our hypothesis, we found that increasing the use of antenatal and PNC has a positive effect on breastfeeding practices (ie, TIBF and EBF), which signifies stakeholders would provide emphasis on ANC and PNC service to optimise breast feeding. This meta-analysis study provided an overview of up-to-date evidence for public nutrition professionals and policy-makers in Ethiopia. It could also be useful for breastfeeding improvement initiative in Ethiopia and cross-country and cross-cultural comparison. From the research point of view, in general, intervention and outcome based studies on breast feeding in Ethiopia are required.

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REFERENCES

- World Health Organization. *Infant and young child feeding: a tool for assessing national practices, policies and programmes*, 2003.
- World Health Organization. Babies and mothers worldwide failed by lack of investment in breastfeeding. *Saudi Med J* 2017;38:974–5.
- Edmond KM, Zandoh C, Quigley MA, *et al*. Delayed breastfeeding initiation increases risk of neonatal mortality. *Pediatrics* 2006;117:e380–6.
- World Health Organization. *Infant and young child feeding: model chapter for textbooks for medical students and allied health professionals. Infant and young child feeding: model chapter for textbooks for medical students and allied health professionals*, 2009.
- Unicef W. *Capture the Moment – Early initiation of breastfeeding: The best start for every newborn*, 2018.
- UNICEF. Infant and young child feeding. 2018. Available at <https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding/> (Accessed 20 Sep 2018).
- Habtewold TD, Mohammed SH, Endalamaw A, *et al*. Breast and complementary feeding in Ethiopia: new national evidence from systematic review and meta-analyses of studies in the past 10 years. *Eur J Nutr* 2018.
- Boccolini CS, MLd C. Oliveira, Maria Inês Couto de. Factors associated with exclusive breastfeeding in the first six months of life in Brazil: a systematic review. *Rev Saude Publica* 2015;49.
- Sharma IK, Byrne A. Early initiation of breastfeeding: a systematic literature review of factors and barriers in South Asia. *Int Breastfeed J* 2016;11:17.
- Alemu SM, Alemu YM, Habtewold TD. Association of age and colostrum discarding with breast-feeding practice in Ethiopia: systematic review and meta-analyses. *Public Health Nutr* 2019;1–20.
- Alebel A, Dejen G, Mullu G, *et al*. Timely initiation of breastfeeding and its association with birth place in Ethiopia: a systematic review and meta-analysis. *Int Breastfeed J* 2017;12:44.
- Alebel A, Tesma C, Temesgen B, *et al*. Exclusive breastfeeding practice in Ethiopia and its association with antenatal care and institutional delivery: a systematic review and meta-analysis. *Int Breastfeed J* 2018;13:31.
- Temesgen H, Negesse A, Woyraw W, *et al*. Dietary diversity feeding practice and its associated factors among children age 6–23 months in Ethiopia from 2011 up to 2018: a systematic review and meta-analysis. *Ital J Pediatr* 2018;44:109.
- Temesgen H, Negesse A, Woyraw W, *et al*. Prelacteal feeding and associated factors in Ethiopia: systematic review and meta-analysis. *Int Breastfeed J* 2018;13:49.
- Habtewold TD, Islam MA, Sharew NT, *et al*. SystEmatic review and meta-aNalysis of infanT and young child feeding Practices (ENAT-P) in Ethiopia: protocol. *BMJ Open* 2017;7:e017437.
- Kraemer HC. Kappa coefficient. *Wiley StatsRef: Statistics Reference Online* 2014;1–4.
- Peterson J, Welch V, Losos M, *et al*. The Newcastle-Ottawa scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. 2011.
- Munn Z, Tufanaru C, Aromataris E. JBI's systematic reviews: data extraction and synthesis. *Am J Nurs* 2014;114:49–54.
- Brinkhoff T. Federal Democratic Republic of Ethiopia. 2015. 2018. Available at <http://www.citypopulation.de/Ethiopia.html>.
- Egger M, Davey Smith G, Schneider M, *et al*. Bias in meta-analysis detected by a simple, graphical test. *BMJ* 1997;315:629–34.
- Duval S, Tweedie R. Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics* 2000;56:455–63.
- Higgins JP, Thompson SG. Quantifying heterogeneity in a meta-analysis. *Stat Med* 2002;21:1539–58.
- Viechtbauer W. Conducting Meta-Analyses in R with the metafor Package. *J Stat Softw* 2010;36.
- Moher D, Liberati A, Tetzlaff J, *et al*. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med* 2009;6:e1000097.
- Regassa N. Infant and child feeding practices among farming communities in Southern Ethiopia. *Kontakt* 2014;16:e215–22.
- Alemayehu M. Factors Associated with Timely Initiation and Exclusive Breast Feeding among Mothers of Axum Town, Northern Ethiopia. *Science Journal of Public Health* 2014;2:394–401.
- Berhe H, Mekonnen B, Bayray A, *et al*. Determinants of Breast feeding Practices Among Mothers Attending Public Health Facilities, Mekelle, Northern Ethiopia; A Cross Sectional Study. *International Journal of Pharmaceutical Sciences and Research* 2013;4:650.
- Beyene MG, Geda NR, Habtewold TD, *et al*. Early initiation of breastfeeding among mothers of children under the age of 24 months in Southern Ethiopia. *Int Breastfeed J* 2016;12.
- Lakew Y, Tabar L, Haile D. Socio-medical determinants of timely breastfeeding initiation in Ethiopia: Evidence from the 2011 nation wide Demographic and Health Survey. *Int Breastfeed J* 2015;10.

30. Liben ML, Yesuf EM. Determinants of early initiation of breastfeeding in Amibara district, Northeastern Ethiopia: a community based cross-sectional study. *Int Breastfeed J* 2016;11.
31. Setegn T, Gerbaba M, Belachew T. Determinants of timely initiation of breastfeeding among mothers in Goba Woreda, South East Ethiopia: a cross sectional study. *BMC Public Health* 2011;11:217,2458–11–217.
32. Wolde T, Birhanu T, Ejeta E. Prevalence and determinants of timely initiation of breastfeeding among lactating mothers of urban dwellers in Western Ethiopia: A community based cross sectional study. *Food Science and Quality Management* 2014;31.
33. Woldemichael B. Timely Initiation of Breastfeeding and Its Associated Factors among Mothers in Tiyo Woreda, Arsi Zone, Ethiopia: A Community- Based Cross Sectional Study. *Clinics in Mother and Child Health* 2016;13:221.
34. Mekonen L, Seifu W, Shiferaw Z. Timely initiation of breastfeeding and associated factors among mothers of infants under 12 months in South Gondar zone, Amhara regional state, Ethiopia; 2013. *Int Breastfeed J* 2018;13:17.
35. Gultie T, Sebsibie G. Determinants of suboptimal breastfeeding practice in Debre Berhan town, Ethiopia: a cross sectional study. *Int Breastfeed J* 2016;11.
36. Tamiru D, Belachew T, Loha E, *et al.* Sub-optimal breastfeeding of infants during the first six months and associated factors in rural communities of Jimma Arjo Woreda, Southwest Ethiopia. *BMC Public Health* 2012;12:363,2458–12–363.
37. Tamiru D, Tamrat M. Constraints to the optimal breastfeeding practices of breastfeeding mothers in the rural communities of Arba Minch Zuria Woreda, Ethiopia: a community-based, cross-sectional study. *South African Journal of Clinical Nutrition* 2015;28:134–9.
38. Adugna DT. Women's perception and risk factors for delayed initiation of breastfeeding in Arba Minch Zuria, Southern Ethiopia. *Int Breastfeed J* 2014;9.
39. Derso T, Bikis GA, Tariku A, *et al.* Correlates of early neonatal feeding practice in Dabat HDSS site, northwest Ethiopia. *Int Breastfeed J* 2017;12.
40. Tewabe T. Timely initiation of breastfeeding and associated factors among mothers in Motta town, East Gojjam zone, Amhara regional state, Ethiopia, 2015: a cross-sectional study. *BMC Pregnancy Childbirth* 2016;16:314.
41. Musa Seid A. Vaginal Delivery and Maternal Knowledge on Correct Breastfeeding Initiation Time as Predictors of Early Breastfeeding Initiation: Lesson from a Community-Based Cross-Sectional Study. *ISRN Epidemiology* 2014;2014:1–6.
42. Asemahagn MA. Determinants of exclusive breastfeeding practices among mothers in azezo district, northwest Ethiopia. *Int Breastfeed J* 2016;11.
43. Setegn T, Belachew T, Gerbaba M, *et al.* Factors associated with exclusive breastfeeding practices among mothers in Goba district, south east Ethiopia: A cross-sectional study. *Int Breastfeeding J* 2012;7.
44. Sonko A, Worku A. Prevalence and predictors of exclusive breastfeeding for the first six months of life among women in Halaba special woreda, Southern Nations, Nationalities and Peoples' Region/SNNPR/, Ethiopia: a community based cross-sectional study. *Arch Public Health* 2015;73.
45. Bikis GA, Tariku A, Tessema GA. Effects of antenatal care and institutional delivery on exclusive breastfeeding practice in northwest Ethiopia: a nested case-control study. *Int Breastfeed J* 2015;10:30.
46. Arage G, Gedamu H. Exclusive Breastfeeding Practice and Its Associated Factors among Mothers of Infants Less Than Six Months of Age in Debre Tabor Town, Northwest Ethiopia: A Cross-Sectional Study. *Adv Public Health* 2016;2016:1–7.
47. Adugna B, Tadele H, Reta F, *et al.* Determinants of exclusive breastfeeding in infants less than six months of age in Hawassa, an urban setting, Ethiopia. *Int Breastfeed J* 2017;12:45.
48. Egata G, Berhane Y, Worku A. Predictors of non-exclusive breastfeeding at 6 months among rural mothers in east Ethiopia: a community-based analytical cross-sectional study. *Int Breastfeed J* 2013;8:8.
49. Tekla B, Assefa H, Haileslassie K. Prevalence and determinant factors of exclusive breastfeeding practices among mothers in Enderta woreda, Tigray, North Ethiopia: a cross-sectional study. *Int Breastfeed J* 2015;10:2.
50. Sefene A. Determinants of Exclusive Breastfeeding Practice among Mothers of Children Age Less Than 6 Month in Bahir Dar City Administration, Northwest Ethiopia; A Community Based Cross-Sectional Survey. *Science Journal of Clinical Medicine* 2013;2:153–9.
51. Seid AM, Yesuf ME, Koye DN. Prevalence of Exclusive Breastfeeding Practices and associated factors among mothers in Bahir Dar city, Northwest Ethiopia: a community based cross-sectional study. *Int Breastfeed J* 2013;8:14.
52. Hunegnaw MT, Gezie LD, Teferra AS. Exclusive breastfeeding and associated factors among mothers in Gozamin district, northwest Ethiopia: a community based cross-sectional study. *Int Breastfeed J* 2017;12.
53. Lenja A, Demissie T, Yohannes B, *et al.* Determinants of exclusive breastfeeding practice to infants aged less than six months in Offa district, Southern Ethiopia: a cross-sectional study. *Int Breastfeed J* 2016;11:32.
54. Tadesse T, Mesfin F, Chane T. Prevalence and associated factors of non-exclusive breastfeeding of infants during the first six months in rural area of Sorro District, Southern Ethiopia: a cross-sectional study. *Int Breastfeed J* 2016;11. 25,016-0085-6. eCollection 2016.
55. Tariku A, Alemu K, Gizaw Z, *et al.* Mothers' education and ANC visit improved exclusive breastfeeding in Dabat Health and Demographic Surveillance System Site, northwest Ethiopia. *PLoS One* 2017;12:e0179056.
56. Abera K. Infant and young child feeding practices among mothers living in Harar, Ethiopia. *Harar Bulletin of Health Sciences* 2012;4:66–78.
57. Taddele M. Exclusive Breastfeeding and Maternal Employment in Ethiopia: A Comparative Cross- Sectional Study. *International Journal of Nutrition and Food Sciences* 2014;3:497–503.
58. Echamo M. Exclusive breast feeding in Arbaminch, SNNPR, Ethiopia. *Harar Bull Health Sci* 2012;5:44–59.
59. Chekol DA, Bikis GA, Gelaw YA, *et al.* Exclusive breastfeeding and mothers' employment status in Gondar town, Northwest Ethiopia: a comparative cross-sectional study. *Int Breastfeed J* 2017;12:27.
60. Tewabe T, Mandesh A, Gualu T, *et al.* Exclusive breastfeeding practice and associated factors among mothers in Motta town, East Gojjam zone, Amhara Regional State, Ethiopia, 2015: a cross-sectional study. *Int Breastfeed J* 2016;12.
61. Patel A, Badhoniya N, Khadse S, *et al.* South Asia Infant Feeding Research Network. Infant and young child feeding indicators and determinants of poor feeding practices in India: secondary data analysis of National Family Health Survey 2005–06. *Food Nutr Bull* 2010;31:314–33.
62. Mihrshahi S, Kabir I, Roy SK, *et al.* South Asia Infant Feeding Research Network. Determinants of infant and young child feeding practices in Bangladesh: secondary data analysis of Demographic and Health Survey 2004. *Food Nutr Bull* 2010;31:295–313.
63. Senarath U, Dibley MJ, Godakandage SS, *et al.* South Asia Infant Feeding Research Network (SAIFRN)*. Determinants of infant and young child feeding practices in Sri Lanka: secondary data analysis of Demographic and Health Survey 2000. *Food and nutrition bulletin* 2010;31:352–65.
64. Ogunlesi TA. Maternal socio-demographic factors influencing the initiation and exclusivity of breastfeeding in a Nigerian semi-urban setting. *Matern Child Health J* 2010;14:459–65.
65. Okafor IP, Olatona FA, Olufemi OA. Breastfeeding practices of mothers of young children in Lagos, Nigeria. *Niger J Paediatr* 2014;41:43–7.
66. Subedi N, Paudel S, Rana T, *et al.* Infant and young child feeding practices in Chepang communities. *J Nepal Health Res Council* 2012;10:141–6.
67. Bashour HN, Kharouf MH, Abdulsalam AA, *et al.* Effect of postnatal home visits on maternal/infant outcomes in Syria: a randomized controlled trial. *Public Health Nurs* 2008;25:115–25.
68. Su LL, Chong YS, Chan YH, *et al.* Antenatal education and postnatal support strategies for improving rates of exclusive breast feeding: randomised controlled trial. *BMJ* 2007;335:596.
69. Agho KE, Dibley MJ, Odiase JI, *et al.* Determinants of exclusive breastfeeding in Nigeria. *BMC Pregnancy Childbirth* 2011;11:2.
70. Ogada IA. Effectiveness of couple counselling versus maternal counselling in promoting exclusive breast feeding: a randomised controlled trial in Nyando District, Kenya. 2014.
71. Al Ghwass MM, Ahmed D. Prevalence and predictors of 6-month exclusive breastfeeding in a rural area in Egypt. *Breastfeed Med* 2011;6:191–6.

Correction: Evidence on the effect of gender of new-born, antenatal care and postnatal care on breastfeeding practices in Ethiopia: a meta-analysis and meta-regression analysis of observational studies

Habtewold TD, Sharew NT, Alemu SM. Evidence on the effect of gender of newborn, antenatal care and postnatal care on breastfeeding practices in Ethiopia: a meta-analysis and meta-regression analysis of observational studies. *BMJ Open* 2019;9:e023956. doi: 10.1136/bmjopen-2018-023956

The following amendments were considered to the original version of this article.

Reference 35: Gultie T, Sebsibie G. Determinants of suboptimal breastfeeding practice in Debre Berhan town, Ethiopia: a cross sectional study. *Int Breastfeed J* 2016;11 has been excluded from the published article.

Authors have found in their meta-analysis,¹ that this study in reference 35² was retracted from the International Breastfeeding Journal in 2018 (online: 07 March 2018) because of significant overlap of both text and data with the Master's Thesis of Hilina Ketma, "Assessment of prevalence and determinants of suboptimal breastfeeding among mothers of children aged less than two years in Dire Dawa City Administration, Ethiopia, June 2013", which was defended at the School of Graduate Studies, Addis Ababa University, Addis Ababa, Ethiopia in June 2013.³

Therefore, authors have performed reanalysis by excluding Gultie and Sebsibie study (reference 35), and revised figure 3 and figure 5.

In conclusion, despite having excluded Gultie and Sebsibie study, the results show that antenatal care significantly associated with timely initiation of breastfeeding and exclusive breastfeeding. Therefore, the central findings of the original article remain unaffected.

Please, find the revised figures.

Figure 3 Forest plot of the unadjusted odds ratios with corresponding 95% cis of 13 studies on the association of ANC and TIBF. The horizontal line represents the CI, the box and its size in the middle of the horizontal line represents the weight of sample size. The polygon represents the pooled or. The reference category is 'no ANC follow-up'. ANC, antenatal care; LIBF, late initiation of breast feeding; REM, random-effects model; TIBF, timely initiation of breast feeding.

Figure 5 Forest plot of the unadjusted odds ratios with corresponding 95% cis of 21 studies on the association of ANC and EBF. The horizontal line represents the CI, the box and its size in the middle of the horizontal line represents the weight of sample size. The polygon represents the pooled or. The reference category is 'no ANC follow-up'. ANC, antenatal care; EBF, exclusive breast feeding; NEBF, non-exclusive of breast feeding; REM, random-effects model.

REFERENCES

- 1 Habtewold TD, Sharew NT, Alemu SM. Evidence on the effect of gender of newborn, antenatal care and postnatal care on breastfeeding practices in Ethiopia: a meta-analysis and meta-regression analysis of observational studies. *BMJ Open* 2019;9:e023956.
- 2 Gultie T, Sebsibie G. Determinants of suboptimal breastfeeding practice in Debre Berhan town, Ethiopia: a cross sectional study. *Int Breastfeed J* 2016;11:5. eCollection 2016.
- 3 Gultie T, Sebsibie G. Retraction note: determinants of suboptimal breastfeeding practice in Debre Berhan town, Ethiopia: a cross sectional study. *Int Breastfeed J* 2018;13:13.

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