What is the impact of gender of new-born, antenatal care and postnatal care on breastfeeding practices in Ethiopia? A systematic review and meta-analysis

Tesfa Dejenie Habtewold[1*], Nigussie Tadesse Sharew[2], Sisay Mulugeta Alemu[3]

[1]Department of Epidemiology, University Medical Centre Groningen, University of Groningen, Groningen, the Netherlands.
[2]Department of Nursing, College of Medicine and Health Science, Debre Berhan University, Debre Berhan, Ethiopia.
[3]Mental Health and Psychosocial Support Program, International Medical Corps, Dolo Ado, Ethiopia

* = Corresponding author
Tesfa Dejenie Habtewold
Email: tesfadej2003@gmail.com

Abstract

Objective: The aim of this systematic review and meta-analysis was to investigate the association of gender of new-born, antenatal care (ANC) and postnatal care (PNC) with TIBF and EBF.

Design: Systematic review and meta-analysis

Methods: PubMed, EMBASE, CINAHL, WHO Global Health Library, Web of Science and SCOPUS databases systematically searched for all available literature, complemented by manual searches. Newcastle-Ottawa Scale (NOS) was used for quality check; Egger's regression test for publication bias at p-value threshold ≤ 0.01; and Cochran's Q X^2 test and I^2 statistics for heterogeneity. A meta-analysis using a weighted inverse variance random-effects model was performed.

Results: Of 523 articles retrieved, 16 studies on TIBF and 23 on EBF fulfilled the eligibility criteria. Antenatal care (Odds ratio (OR) = 1.61, 95% CI 1.01 - 2.57) was significantly associated with TIBF but not gender of new-born (OR = 1.03, 95% CI 0.84 - 1.26). In addition, antenatal (OR = 2.25, 95% CI 1.63 - 3.10) and postnatal care (OR = 1.86, 95% CI 1.41 - 2.47) significantly associated with exclusive breastfeeding (EBF) but not gender of new-born (OR = 1.08, 95% CI 0.86 - 1.36).

Conclusions: Optimal care during pregnancy and after birth is important to ensure adequate breastfeeding. In addition, there was no difference in breastfeeding between male and female new-born. This meta-analysis study provided evidence on breastfeeding practice and its associated factors in an Ethiopian context, which can be useful for cross-country and cross-cultural comparison and for breastfeeding improvement initiative in Ethiopia.

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Strengths and limitations of this study

- This systematic review and meta-analysis was conducted based on the registered and published protocol, and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for literature reviews.
- Since it is the first study of its kind in Ethiopia, the information could be helpful for future researchers and public health practitioners.
- Almost all included studies were observational which may hinder causality inference.
- Based on the conventional methods of heterogeneity test, a few analyses suffer from high between-study variation.

Introduction

World Health Organization (WHO) and United Nations Children's Fund (UNICEF) recommends timely initiation of breastfeeding (TIBF) (i.e. initiating breastfeeding within one hour of birth) and exclusive breastfeeding (EBF) (i.e. feeding only human milk during the first six months).[1] TIBF and EBF are simple and cost-effective interventions beneficial for maintaining maternal and new-born health.[2] Breastfeeding provides optimal nutrition for the new-born, increase cognitive development, reduce morbidity and mortality, and preventing new-born and maternal long-term chronic diseases; for example, TIBF prevents 22 % of neonatal deaths.[3] On the other hand, inappropriate breastfeeding practice causes more than two-thirds of under-five child mortality, of which 41% of these deaths occur in Sub-Saharan Africa.[1,4]

The prevalence of TIBF in developing countries ranges from 10% in Lebanon to 77% in Jordan whereas EBF ranges from 23.70% in Central Africa to 56.57% in Southern Africa.[5,6] Based on our previous meta-analysis, the prevalence of TIBF and EBF in Ethiopia is 66.5% and 60.1% respectively.[7] So far, globally, only 22 nations have achieved WHO goal of 70% in TIBF and 23 countries have achieved at least 60% in EBF.[2]

WHO and UNICEF have been working in developing countries for the actualization of optimal breastfeeding. However, it is challenging and attributed to several factors including inadequate antenatal and post-natal care service as well as gender of new-born.[8,9] Even though several studies have been conducted on breastfeeding advantages, less attention has been given to associated factors and breastfeeding coverage continued to be sub-optimal. In Ethiopia, one meta-analysis assessed the association between place of residence and delivery and TIBF.[10] In our previous meta-analysis, we investigated the association between maternal employment, lactation counseling, model of delivery, place of delivery, maternal age, new-born age and

discarding colostrum and, TIBF and EBF.[7] We also investigated whether TIBF associated with EBF.[7] In this systematic review and meta-analysis, we aimed to investigate whether TIBF and EBF associated with gender of new-born, antenatal and postnatal care in Ethiopia. We hypothesized at least one ANC or PNC visit significantly increases the odds of TIBF and EBF. Additionally, mothers with male new-born have higher odds of TIBF and EBF compared to mothers of female new-born.

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) (CRD42017056768) and published.[11]

Search strategy and databases

PubMed, EMBASE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), WHO Global Health Library, Web of Science and SCOPUS electronic databases were explored to extract all available literature. Population Exposure Controls and Outcome (PECO) searching guide and searching syntax was developed in consultation with a medical information specialist. The search strategy is described in Supplementary file 1; searches began 01 August 2017, and the last search was 29 January 2018. Cross-references of identified articles and gray literature were also hand searched.

PECO guide

Population: All mothers with new-born up to 23 months of age.

Exposure: Gender of the new-born, antenatal and postnatal care.

Controls: Female new-born and those without antenatal and postnatal care.

Outcome: Timely initiation and EBF practice.

Inclusion and exclusion criteria

Studies were included if they met the following criteria: (1) observational studies including cross-sectional, case-control, cohort studies reported the variables of interest; (2) conducted in Ethiopia; (3) published in English language; and (4) published between 2000 and 2017. Studies were excluded on any one of the following conditions: (1) study population with HIV/AIDS,

preterm new-born and new-born in intensive care unit (ICU); (2) publishing language other than English; (3) no full text; and (4) qualitative studies, book chapters, symposium/ conference proceedings, essays, commentaries, editorials and case reports.

Selection and quality assessment

Initially, all identified articles were exported to Refwork citation manager and duplicate studies were canceled. Next, a pair of reviewers identified articles by analyzing the abstract and title for relevance and its compliance with the proposed review topic. Agreement between the two reviewers, as measured by Cohen's Kappa,[12] was 0.76. After removing irrelevant studies, 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.[13] In line with the WHO standard definition, outcome measurements were TIBF (the percentage of new-born who breastfeed within the first hour of birth) and EBF (the percentage of infants who exclusively breastfed up to 6 months since birth). Finally, Joanna Briggs Institute (JBI) tool[14] 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 actual study). Geographic regions were categorized based on the current Federal Democratic Republic of Ethiopia administrative structure.[15] 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 pooled odds ratio (OR). Publication bias was assessed by visual inspection of a funnel plot and Egger's regression test for funnel plot asymmetry using standard error as a predictor in mixed-effects meta-regression model at p-value threshold ≤ 0.01.[16] Duval and Tweedie trim-and-fill method[17] was used if we found asymmetric funnel which indicates publication bias.

Heterogeneity was assessed by Cochran's Q X^2 test (p-value ≤ 0.05) and I^2 statistics;[18] for this meta-analysis, we used a reference value of $I^2 > 80\%$.[11] The data were analyzed using "metafor" packages in R software version 3.2.1 for Windows.

Data synthesis and reporting

We analyzed the data in two groups of outcome measurements: TIBF and EBF. Results for each variable were shown using forest plots. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for literature reviews was strictly followed.[19]

Minor post hoc protocol changes

Before analysis was done, we made the following changes to our methods from the published protocol. We added the Joanna Briggs Institute (JBI) tool[14] to extract the data. In addition, we used Duval and Tweedie trim-and-fill method to manage publication bias.

Patient and public involvement

The research question and outcome measures were developed by the authors (TD and NT) in consultation with public health professionals. Given this is a systematic review and meta-analysis based secondary 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 breastfeeding and disseminating the key findings in local language.

Results

Search results

In total, we obtained 523 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). Forty-eight additional articles were found through a manual search. After removing duplicates and screening of titles and articles, 81 studies were selected for full-text review. Forty-two articles were excluded due to several reasons: 19 studies on complementary feeding, 3 studies on pre-lacteal feeding, 3 studies on malnutrition, 16 studies with different variables of interest and one project review report. As a result, 39 articles (i.e. 16 studies on TIBF and 23 on EBF) fulfilled the inclusion criteria and used in the meta-analyses. The PRISMA flow diagram of literature screening and selection process is shown in figure 1. One study could report the association of outcome measures with more than one factor.

Study characteristics

As presented in table 1, 16 studies reported the association of TIBF and gender of new-born and ANC in 25,323 mothers. Among these studies, 12 of them were conducted in Amhara (n=4), Oromia (n=4) and Southern Nations, Nationalities and Peoples' (SNNP) (n=4) region. Regarding residence status of women, 7 studies were conducted in both urban and rural whereas 6 studies in urban dwellers.

Tables 1: Characteristics of included studies on TIBF

Author/publication year	Study area	Study design	Study population	Sample size/ Participated	Factors	TIBF (outcome)		
						Within 1 hour	After 1 hour	Total
A. Gender of newborn versus TIBF								
Regassa, 2014[20]	SNNPR, Sidama zone	Cross-sectional study	with infants aged between 0 and 6 months old	1100/ 1094	Male	488	107	595
					Femal	389	110	499
					Total	877	217	1094
Alemayehu et.al. 2014[21]	Tigray, Axum town	cross sectional study	mothers who had children aged 6-12 months	418/418	Male	75	141	216
					Femal	99	103	202
					Total	174	244	418
Berhe et.al. 2013[22]	Tigray, Mekelle town	Cross-sectional study	mothers of children aged 0 to 24 months	361/361	Male	166	42	208
					Femal	112	37	149
					Total	278	79	357
Beyene et.al. 2017[23]	SNNPR, Dale Woreda	Cross-sectional study	mothers of children under 24 months	634/ 634	Male	262	51	313
					Femal	255	50	305
					Total	517	101	618
Lakew et.al. 2015[24]	National	Cross-sectional study (EDHS based)	mothers who had children less than 5 years	11,654/11,553	Male	3124	2860	5984
					Femal	3057	2511	5568
					Total	6181	5371	11552
Liben et.al. 2016[25]	Afar, Dubti town	Cross-sectional study	Mothers of infants aged less than 6 months	346/333	Male	81	122	203
					Femal	70	130	200
					Total	151	252	403
Setegn et.al. 2011[26]	Oromia, Goba district	cross sectional study	mothers with children (< 12 months	668/ 608	Male	164	152	316
					Femal	150	133	283
					Total	314	285	599
Wolde et.al. 2014[27]	Oromia, Nekemte town	Cross-sectional study	mothers who had child less than 24 month	182/174	Male	70	10	80
					Femal	84	10	94
					Total	154	20	174
Woldemichael et.al. 2016[28]	Oromia, Tiyo Woreda	Cross-sectional study	mothers who have children Less Than One Year Age	386/373	Male	153	60	213
					Femal	98	62	160
					Total	251	122	373
B. Antenatal care versus TIBF								
Gultie et.al 2016[29]	Amhara, Debre Berhan town	Cross-sectional study	mothers having children aged less than 23 months old	548/548	ANC	482	88	570
					No ANC	16	15	31
					Total	498	103	601
Tamiru et.al 2012[30]	Oromia, Jimma Arjo Woreda	Cross-sectional study	Mothers of index children aged 0 to 6 months	384/ 382	ANC	115	69	184
					No ANC	120	71	191
					Total	235	140	375
Tamiru et.al 2015[31]	SNNPR, Arba Minch Zuria Woreda	cross-sectional study	mothers of infants aged two years and younger	384/384	ANC	179	140	319
					No ANC	40	24	64
					Total	219	164	383
Berhe et.al 2013[22]	Tigray,	Cross-	mothers of children	361/361	ANC	263	66	329

	Mekelle town	sectional study	aged 0 to 24 months		No ANC	15	13	28
					Total	278	79	357
Adugna et.al 2014[32]	SNNPR, Arba Minch Zuria	cross-sectional study	Women who had children under two years	384/383	ANC	179	140	319
					No ANC	40	24	64
					Total	219	164	383
Beyene et.al 2017[23]	SNNPR, Dale Woreda	Cross-sectional study	mothers of children under 24 months	634/ 634	ANC	206	58	264
					No ANC	311	43	354
					Total	517	101	618
Derso et.al 2017[33]	Amhara, Dabat district	Cross-sectional study (EDHS based)	mothers with children under five years of age	6,761/ 6,761	ANC	2135	2220	4355
					No ANC	670	1364	2034
					Total	2805	3584	6389
Liben et.al 2016[25]	Afar, Dubti town	Cross-sectional study	Mothers of infants aged less than 6 months	346/333	ANC	110	196	306
					No ANC	41	56	97
					Total	151	252	403
Seid et.al 2013[34]	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[26]	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[35]	Amhara, Motta town	cross-sectional study	mothers with infant less than six month old	423/405	ANC	282	41	323
					No ANC	37	45	82
					Total	319	86	405
Woldemichael et.al 2016[28]	Oromia, Tiyo Woreda	Cross-sectional study	mothers who have children Less Than One Year Age	386/373	ANC	194	41	235
					No ANC	57	81	138
					Total	251	122	373

EDHS= Ethiopian Demographic Health Survey

Twenty-three studies reported the association of EBF with gender of new-born, ANC and PNC in 17,170 mothers. Of these studies, 10 were conducted in Amhara and 7 in SNNP region. Based on residence status of women, 9 studies were conducted in urban, 8 in urban and rural, and 6 in rural dwellers. Even though almost all studies were cross-sectional, 5 studies have used a nationally representative data of Ethiopian Demographic Health Survey (EDHS) [19-23]. Detailed study characteristics have shown in Table 2.

Tables 2: Characteristics of included studies on EBF

Author/publication year	Study area	Study design	Study population	Sample size/Participated	Factors	EBF (outcome)		
						Yes	No	Total
A. Gender of newborn versus EBF								
Asemahagn 2016[36]	Amhara, Azezo district	Cross-sectional study	Women having children aged from 0–6 months	346/ 332	Male	95	38	133
					Femal	167	32	199
					Total	262	70	332
Setegn et.al. 2012[37]	Oromia, Bale Zone, Goba district	Cross-sectional study	Mothers-infant pairs	668/608	Male	107	43	150
					Femal	92	37	129
					Total	199	80	279
Sonko et.al. 2015[38]	SNNPR, Halaba special woreda	Cross-sectional study	Mothers With children less than six months of age	422/420	Male	145	60	205
					Femal	151	64	215
					Total	296	124	420
Regassa 2014[20]	SNNPR, Sidama zone	Cross-sectional study	with infants aged between 0 and 6 months old	1100/ 1094	Male	109	19	128
					Femal	89	17	106
					Total	198	36	234
Alemayehu et.al. 2014[21]	Tigray, Axum town	cross sectional study	mothers who had children aged 6-12 months	418/418	Male	97	119	216
					Femal	77	128	205
					Total	174	247	421
Biks et.al. 2015[39]	Amhara, Dabat district	Nested case–control study (EDHS based)	All pregnant women in the second/third trimester	1,769/1,769	Male	271	619	890
					Femal	727	1148	1875
					Total	998	1767	2765
Arage et.al. 2016[40]	Amhara, Debre Tabor Town	Cross-sectional study	Mothers of Infants Less Than Six Months of Age	470/453	Male	119	40	159
					Femal	227	67	294
					Total	346	107	453
Adugna et.al. 2017[41]	SNNPR, Hawassa city	Cross-sectional study	Mothers with infants aged 0–6 months	541/529	Male	169	88	257
					Femal	153	119	272
					Total	322	207	529
Egata et.al. 2013[42]	Oromia, Kersa district	Cross-sectional study (DHS based)	Mothers of children under-two years of age	881/860	Male	323	124	447
					Femal	294	119	413
					Total	617	243	860
Teka et al. 2015[43]	Tigray, Enderta Woreda	Cross-sectional study	Mothers having children aged less than 24 months	541/530	Male	158	60	218
					Femal	214	98	312
					Total	372	158	530
Sefene et al. 2013[44]	Amhara, Bahir Dar city	Cross-sectional study	Mothers who had a child age less than 6 months	170/159	Male	36	47	83
					Femal	42	34	76
					Total	78	81	159
B. Antenatal care versus EBF								
Asemahagn 2016[36]	Amhara, Azezo district	Cross-sectional study	Women having children aged from 0–6 months	346/ 332	ANC	243	57	300
					No ANC	19	13	32
					Total	262	70	332
Gultie et.al 2016[29]	Amhara, Debre Berhan town	Cross-sectional study	mothers having children aged less than 23 months old	548/548	ANC	263	253	516
					No ANC	10	21	31
					Total	273	274	547

Hunegnaw et.al. 2017[45]	Amhara, Gozamin district	Cross-sectional study	Mothers who had Infants aged between 6 and 12 months	506/478	ANC	341	109	450
					No ANC	17	11	28
					Total	358	120	478
Lenja et.al. 2016[46]	SNNPR, Offa district	Cross-sectional study	Mothers of infants younger than 6 months	403/396	ANC	233	43	276
					No ANC	44	88	132
					Total	277	131	408
Seid et.al 2013[34]	Amhara, Bahir Dar city	Cross-sectional study	Mothers who Delivered in the last 12 months	819/819	ANC	405	372	777
					No ANC	7	35	42
					Total	412	407	819
Setegn et.al 2011[26]	Oromia, Goba district	cross sectional study	mothers with children (< 12 months	668/ 608	ANC	166	65	231
					No ANC	27	10	37
					Total	193	75	268
Sonko et.al. 2015[38]	SNNPR, Halaba special woreda	Cross-sectional study	Mothers With children less than six months of age	422/420	ANC	258	88	346
					No ANC	38	36	74
					Total	296	124	420
Tadesse et.al. 2016[47]	SNNPR, Sorro District	Cross-sectional Study	Mothers With infants aged of 0–5 months	602/ 579	ANC	211	121	332
					No ANC	59	123	182
					Total	270	244	514
Tariku et.al. 2017[48]	Amhara, Dabat District	Cross-sectional study (EDHS based)	Mothers with children aged less than 59 months	5,227/ 5,227	ANC	1979	1353	3332
					No ANC	713	876	1589
					Total	2692	2229	4921
Tewabe et.al. 2017[35]	Amhara, Motta town, East Gojjam zone	Cross-sectional Study	Mothers with infant less than six Months old	423/405	ANC	185	164	349
					No ANC	18	38	56
					Total	203	202	405
Tamiru et.al 2012[30]	Oromia, Jimma Arjo Woreda	Cross-sectional study	Mothers of index children aged 0 to 6 months	384/ 382	ANC	87	103	190
					No ANC	96	96	192
					Total	183	199	382
Tamiru et.al 2015[31]	SNNPR, Arba Minch Zuria Woreda	cross-sectional study	Mothers of infants aged two years and younger	384/384	ANC	228	92	320
					No ANC	27	37	64
					Total	255	129	384
Biks et.al. 2015[39]	Amhara, Dabat district	Nested case–control study (EDHS based)	All pregnant women in the second/third trimester	1,769/1,769	ANC	180	277	457
					No ANC	363	949	1312
					Total	543	1226	1769
Abera 2012[49]	Harari, Harar twon	Cross-sectional study	Mothers of children aged less than two years	604/583	ANC	194	163	357
					No ANC	13	29	42
					Total	207	192	399
Arage et.al. 2016[40]	Amhara, Debre Tabor Town	Cross-sectional study	Mothers of Infants Less Than Six Months of Age	470/453	ANC	384	39	423
					No ANC	18	12	30
					Total	402	51	453
Adugna et.al. 2017[41]	SNNPR, Hawassa city	Cross-sectional study	Mothers with infants aged 0–6 months	541/529	ANC	221	111	332
					No ANC	101	96	197
					Total	322	207	529

Egata et.al. 2013[42]	Oromia, Kersa district	Cross-sectional study (EDHS based)	Mothers of children under-two years of age	881/860	ANC	233	135	368
					No ANC	384	108	492
					Total	617	243	860
Taddele et.al. 2014[50]	Amhara, Injibara Town	Comparative cross-sectional study	Employed and unemployed mothers of children age ≤ 1 year	524/473	ANC	90	98	188
					No ANC	6	23	29
					Total	96	121	217
Echamo. 2012[51]	SNNPR, Arbaminch town	Cross-sectional study	Mothers of infants within the age of six to twelve months	768/768	ANC	332	360	692
					No ANC	25	51	76
					Total	357	411	768
Teka et al. 2015[43]	Tigray, Enderta Woreda	Cross-sectional study	Mothers having children aged less than 24 months	541/530	ANC	325	134	459
					No ANC	47	24	71
					Total	372	158	530
C. Postnatal care versus EBF								
Asemahagn 2016[36]	Amhara, Azezo district	Cross-sectional study	Women having children aged from 0–6 months	346/ 332	PNC	137	25	162
					No PNC	125	45	170
					Total	262	70	332
Lenja et.al. 2016[46]	SNNPR, Offa district	Cross-sectional study	Mothers of infants younger than 6 months	403/396	PNC	188	33	221
					No PNC	121	54	175
					Total	309	87	396
Sonko et.al. 2015[38]	SNNPR, Halaba special woreda	Cross-sectional study	Mothers with children less than six months of age	422/420	PNC	98	25	123
					No PNC	197	99	296
					Total	295	124	419
Tadesse et.al. 2016[47]	SNNPR, Sorro District	Cross-sectional Study	Mothers With infants aged of 0–5 months	602/ 579	PNC	204	127	331
					No PNC	66	117	183
					Total	270	244	514
Tewabe et.al. 2017[52]	Amhara, Motta town, East Gojjam zone	Cross-sectional Study	Mothers with infant less than six Months old	423/405	PNC	116	81	197
					No PNC	87	121	208
					Total	203	202	405
Abera 2012[49]	Harari, Harar twon	Cross-sectional study	Mothers of children aged less than two years	604/583	PNC	29	31	60
					No PNC	178	161	339
					Total	207	192	399
Teka et al. 2015[43]	Tigray, Enderta woreda	Cross-sectional study	Mothers having children aged less than 24 months	541/530	PNC	167	86	253
					No PNC	205	72	277
					Total	372	158	530

EDHS= Ethiopian Demographic Health Survey

Timely initiation of breastfeeding (TIBF)

Among the 17 selected studies, 9 studies[20–28] reported the association between TIBF and gender of new-born in 15,588 mothers (Table 1A). The pooled odds ratio (OR) of gender of new-born

was 1.03 (95% CI 0.84 - 1.26) (figure 2). Mothers with male new-born had 3% higher chance of initiating breastfeeding within one hour of birth compared to female new-born although not statistically significant. Egger's regression test for funnel plot asymmetry was not significant (z = 0.28, p = 0.78).

Likewise, 12 studies[22,23,25,26,28–33,35,53] reported the association between TIBF and ANC in 11,712 mothers (Table 1B). The pooled OR of ANC was 1.61 (95% CI 1.01 - 2.57) (figure 3). Mothers who had at least one ANC visit had 61% significantly higher chance of initiating breastfeeding within one hour of birth compared to mothers who had no ANC visit. Egger's regression test for funnel plot asymmetry was not significant (z = 1.07, p = 0.28).

Exclusive breastfeeding

Out of the 23 studies included, 11 studies[20,21,36–44] reported the association between EBF and gender of new-born in 6,527 mothers (Table 2A). The pooled OR of new-born gender was 1.08 (95% CI 0.86 1.36) (figure 4). Mothers with male new-born had 8% higher chance of exclusively breastfeeding during the first six months compared to mothers with female new-born although not statistically significant. Egger's regression test for funnel plot asymmetry was significant (z = -3.64, p < 0.001).

Twenty studies[29–31,34,36–43,45–52] reported the association between EBF and ANC in 15,403 mothers (Table 2B). The pooled OR of ANC was 2.25 (95% CI 1.63 3.10) (figure 5). Mothers who had at least one ANC visit had 2.25 times significantly higher chance of exclusively breastfeed compared to mothers who had no ANC visit. Egger's regression test for funnel plot asymmetry was not significant (z = 1.64, p = 0.10).

Furthermore, 7 studies[36,38,43,46,47,49,52] reported the association between EBF and PNC in 2,995 mothers (Table 2C). The pooled OR of PNC was 1.86 (95% CI 1.41 2.47) (figure 6).

Mothers who had PNC follow-up had 86% significantly higher chance of exclusively breastfeed during the first six months compared to mothers who had no PNC follow-up. Egger's regression test for funnel plot asymmetry was not significant ($z = -0.91$, $p = 0.36$).

Discussion

This meta-analysis assessed the association of timely initiation of breastfeeding (TIBF) and exclusive breastfeeding (EBF) with gender of new-born, antenatal and postnatal care. To address these factors, this is the first study of its kind in Ethiopia. Antenatal care (ANC) was significantly

associated with TIBF but not gender of new-born. In addition, both antenatal (ANC) and postnatal care (PNC) were significantly associated with EBF but not gender of new-born.

In congruent with the large body of global evidence,[54–59] our finding indicated that mothers who had at least one antenatal visit had significantly higher chance of initiating breastfeeding within one hour of birth and exclusively breastfeed for the first six months compared to mothers who had no ANC visit. This is in line with our hypothesis. Previous reports have also noted increasing rate of TIBF and EBF in mothers who have a frequent antenatal visit.[54,58,60,61] This significant association may be due to the fact that health professionals provide breastfeeding guidance and counseling during ANC visit. This hypothesis is supported by WHO/UNICEF which emphasizes promoting breastfeeding during pregnancy through Baby-Friendly Hospital Initiative (BFHI) program. Ethiopia has also adopted BFHI as part of national nutrition program and is now actively working to integrate to all public and private health facilities. Moreover, previous studies have shown that health education on breastfeeding during ANC follow-up increased TIBF and EBF practice.[62,63]

We also showed that mothers who had PNC follow-up had nearly twice higher chance of exclusively breastfeeding during the first six months compared to mothers who had no PNC follow-up; this result supported our hypothesis. Several studies have reported a significantly increased rate of EBF in mothers who had a postnatal visit at health institution[59] or postnatal home visit.[64] The possible justification could be postnatal visit health education may positively influence the belief and decision of the mothers to exclusively breastfeed. Previous studies have also shown postnatal education and counseling are important to increase EBF.[65] In addition, in our previous meta-analyses, we showed that guidance and counseling during ANC or PNC significantly associated with high rate of TIBF and EBF. Furthermore, it may be explained by

postnatal care ease breastfeeding difficulty, increase maternal confidence and encourage social/family support which may lead the mother to continue EBF for 6 months.

Finally, in agreement with previous studies,[56,59] we uncovered gender of new-born was not significantly associated with TIBF and EBF. This is against our hypothesis. In this meta-analysis, we disproved the traditional perception and believe in Ethiopia that male new-born have pre-lacteal feeding to be strong and healthy compared to female new-born; however, further investigation is required. On the other hand, several studies[60,61,66] showed that gender of new-born is significantly associated with breastfeeding practice. This discrepancy across studies may be due to the socio-cultural difference.

This systematic review and meta-analysis was conducted based on the registered and published protocol,[11] and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for literature reviews. In addition, publication bias was quantified using Egger's regression statistical test and NOS was used to assess the quality of studies. Since it is the first study of its kind in Ethiopia, the information could be helpful for future researchers and public health practitioners. The inclusion of large sample size and recent studies are further strengths of this study. This study has limitations as well. Almost all included studies were observational which 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 methods of heterogeneity test, a few analyses suffer from high between-study variation. The course of heterogeneity was carefully explored and this variation may be due to the difference of study area; therefore, the result should be interpreted with caution. Lastly, a significant publication bias was detected in

studies reported the association between EBF and gender of new-born. In this case, Duval and Tweedie trim-and-fill method was applied to adjust publication bias.

Conclusions

We found that optimal care during and after pregnancy is important for optimal breastfeeding practice. Gender of new-born was not significantly associated with TIBF and EBF. This meta-analysis study provided evidence on breastfeeding practice and its associated factors in an Ethiopian context, which can be useful for cross-country and cross-cultural comparison and for breastfeeding improvement initiative in Ethiopia. Most importantly, this study provides an overview of up-to-date evidence for public nutrition professionals and policymakers. In addition, the result indicates that increasing the utilization of antenatal and postnatal care have a positive effect on breastfeeding practices. This signifies stakeholders would provide due emphasis on ANC and PNC service to achieve WHO breastfeeding goal.

Data Sharing Statement

All data generated or analysed during this study are included in this published article and its supplementary information files.

Competing interests

The authors declare that they have no competing interests.

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Authors Contribution

NT and TD conceived and designed the study. TD developed a syntax for searching databases and analyzed the data. TD and SM wrote and revised the manuscript. All authors read and approved the final manuscript.

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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. (Note: There are studies reported more than one outcome indicator)

Figure 2: Forest plot of the unadjusted odds ratios with corresponding *95% CI*s of studies on the association of gender of new-born and TIBF. The horizontal line represents the confidence

interval, the box and its size in the middle of the horizontal line represents the weight of sample size. The polygon represents the pooled odds ratio. The reference category is 'Female'. TIBF = timely initiation of breastfeeding; LIBF = late initiation of breastfeeding; REM = random-effects model.

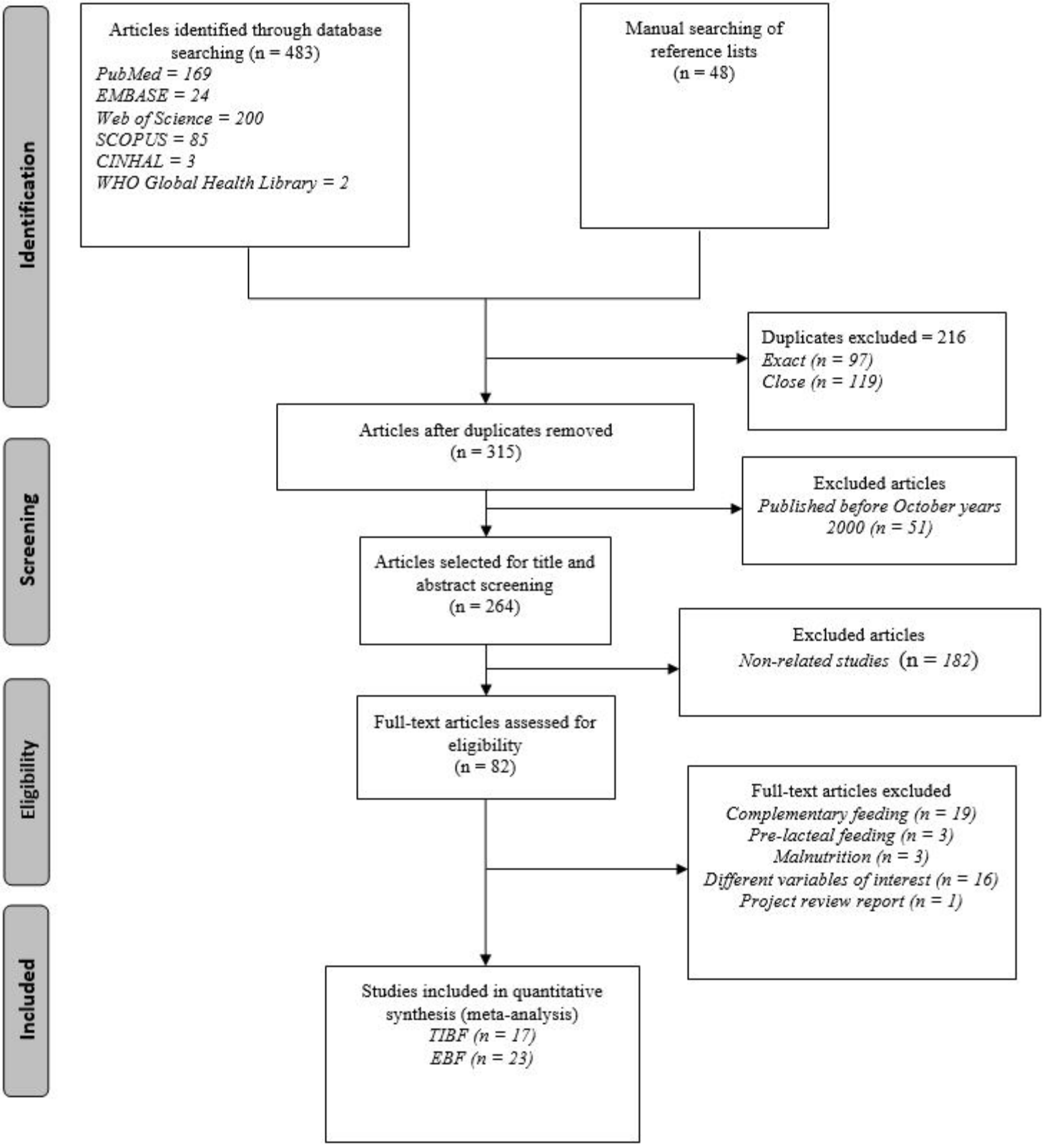
Figure 3: Forest plot of the unadjusted odds ratios with corresponding *95% CI*s of studies on the association of ANC and TIBF. The horizontal line represents the confidence interval, the box and its size in the middle of the horizontal line represents the weight of sample size. The polygon represents the pooled odds ratio. The reference category is 'No ANC follow-up'. TIBF = timely initiation of breastfeeding; LIBF = late initiation of breastfeeding; REM = random-effects model; ANC=Antenatal care.

Figure 4: Forest plot of the unadjusted odds ratios with corresponding *95% CI*s of studies on the association of new-born gender and EBF. The horizontal line represents the confidence interval, the box and its size in the middle of the horizontal line represents the weight of sample size. The polygon represents the pooled odds ratio. The reference category is 'Female'. EBF = Exclusive breastfeeding; NEBF = Non-exclusive of breastfeeding; REM = random-effects model.

Figure 5: Forest plot of the unadjusted odds ratios with corresponding *95% CI*s of studies on the association of ANC and EBF. The horizontal line represents the confidence interval, the box and its size in the middle of the horizontal line represents the weight of sample size. The polygon represents the pooled odds ratio. The reference category is 'No ANC follow-up'. EBF = Exclusive breastfeeding; NEBF = Non-exclusive of breastfeeding; ANC = Antenatal care; REM = random effects model.

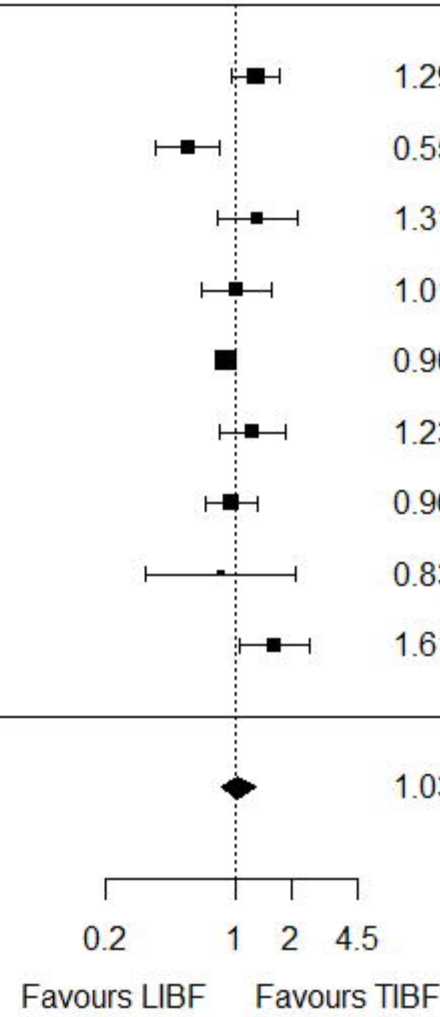
Figure 6: Forest plot of the unadjusted odds ratios with corresponding *95% CI*s of studies on the association of PNC and EBF. The horizontal line represents the confidence interval, the box and

its size in the middle of the horizontal line represents the weight of sample size. The polygon represents the pooled odds ratio. The reference category is ‘No PNC follow-up’. EBF = Exclusive breastfeeding; NEBF = Non-exclusive breastfeeding; PNC = Postnatal care; REM = random-effects model; D = Discarding; NotD = Not discarding.


Identification
Screening
Eligibility
Included
Articles identified through database searching (n = 483)
PubMed = 169
EMBASE = 24
Web of Science = 200
SCOPUS = 85
CINHAL = 3
WHO Global Health Library = 2
Manual searching of reference lists (n = 48)
Duplicates excluded = 216
Exact (n = 97)
Close (n = 119)
Articles after duplicates removed (n = 315)
Excluded articles
Published before October years 2000 (n = 51)
Articles selected for title and abstract screening (n = 264)
Excluded articles
Non-related studies (n = 182)
Full-text articles assessed for eligibility (n = 82)
Full-text articles excluded
Complementary feeding (n = 19)
Pre-lacteal feeding (n = 3)
Malnutrition (n = 3)
Different variables of interest (n = 16)
Project review report (n = 1)
Studies included in quantitative synthesis (meta-analysis)
TIBF (n = 17)
EBF (n = 23)

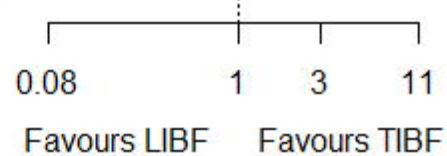
Studies and Publication year	Male TIBF	Male LIBF	Female TIBF	Female LIBF	Odds Ratio [95% CI]
Regassa; 2014	488	107	389	110	1.29 [0.96, 1.74]
Alemayehu et al,; 2014	75	141	99	103	0.55 [0.37, 0.82]
Berhe et al.; 2013	166	42	112	37	1.31 [0.79, 2.16]
Beyene et al.; 2017	262	51	255	50	1.01 [0.66, 1.54]
Lakew et al; 2015	3124	2860	3057	2511	0.90 [0.83, 0.97]
Liben et al; 2016	81	122	70	130	1.23 [0.82, 1.85]
Setegn et al; 2011	164	152	150	133	0.96 [0.69, 1.32]
Wolde et al; 2014	70	10	84	10	0.83 [0.33, 2.12]
Woldemichael et al; 2016	153	60	98	62	1.61 [1.04, 2.50]
Summary					1.03 [0.84, 1.26]

REM test for heterogeneity (Q = 22.22, df = 8, p = 0.00; I^2 = 70.1%)



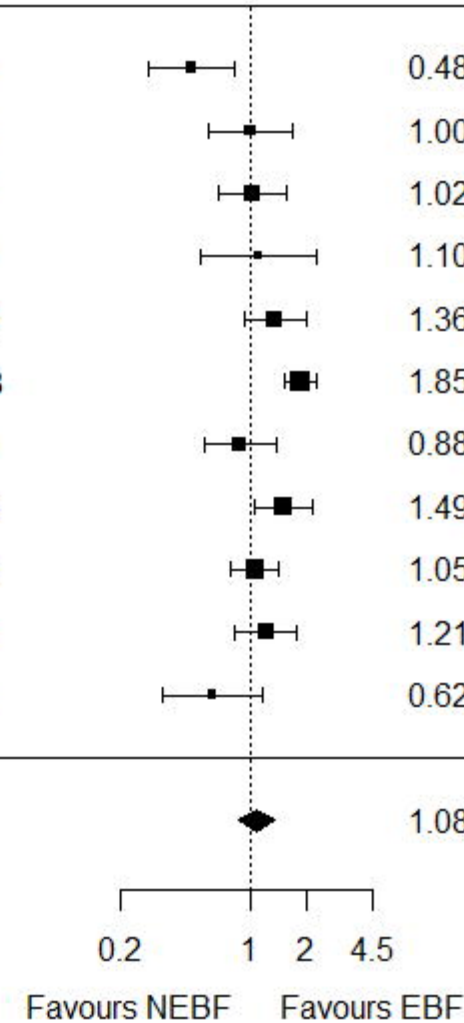
Studies and Publication year	ANC TIBF	ANC LIBF	No ANC TIBF	No ANC LIBF	Odds Ratio [95% CI]
Gultie et al; 2016	428	88	16	15	4.56 [2.17, 9.56]
Tamiru et al.; 2012	115	69	120	71	0.99 [0.65, 1.50]
Tamiru et al; 2015	179	140	40	24	0.77 [0.44, 1.33]
Berhe et al.; 2013	263	66	15	13	3.45 [1.57, 7.61]
Adugna; 2014	179	140	40	24	0.77 [0.44, 1.33]
Beyene et al.; 2017	206	58	311	43	0.49 [0.32, 0.76]
Derso et al.; 2017	2135	2220	670	1364	1.96 [1.75, 2.19]
Liben et al; 2016	110	196	41	56	0.77 [0.48, 1.22]
Seid; 2014	680	94	29	12	2.99 [1.48, 6.07]
Setegn et al; 2011	270	238	37	45	1.38 [0.86, 2.20]
Tewabe; 2016	282	67	37	19	2.16 [1.17, 3.99]
Woldemichael et al; 2016	194	41	57	81	6.72 [4.17, 10.84]
Summary					1.61 [1.01, 2.57]

REM test for heterogeneity (Q = 117.07, df = 11, p = 0.00; I^2 = 93.2%)



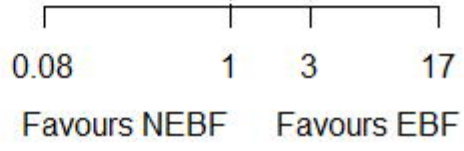
Studies and Publication year	Male EBF	Male NEBF	Female EBF	Female NEBF	Odds Ratio [95% CI]
Asemahagn; 2016	95	38	167	32	0.48 [0.28, 0.82]
Setegn et al.; 2012	107	43	92	37	1.00 [0.59, 1.68]
Sonko et al; 2015	145	60	151	64	1.02 [0.67, 1.56]
Regassa; 2014	109	19	89	17	1.10 [0.54, 2.23]
Alemayehu et al,; 2014	97	119	77	128	1.36 [0.92, 2.00]
Biks et al; 2015	271	619	272	1148	1.85 [1.52, 2.24]
Arage et al; 2016	119	40	227	67	0.88 [0.56, 1.38]
Adugna et al; 2017	169	88	153	119	1.49 [1.05, 2.12]
Egata et al; 2013	323	124	294	119	1.05 [0.78, 1.42]
Teka et al; 2015	158	60	214	98	1.21 [0.82, 1.77]
Sefene et al; 2013	36	47	42	34	0.62 [0.33, 1.16]
Summary					1.08 [0.86, 1.36]

REM test for heterogeneity (Q = 39.19, df = 10, p = 0.00; I^2 = 71.7%)



Studies and Publication year	ANC EBF	ANC NEBF	No ANC EBF	No ANC NEBF	Odds Ratio [95% CI]
Asemahagn; 2016	243	57	19	13	2.92 [1.36, 6.25]
Gultie et al; 2016	263	253	10	21	2.18 [1.01, 4.73]
Hunegnawu et al; 2017	341	109	17	11	2.02 [0.92, 4.45]
Lenja et al.; 2016	223	43	44	88	10.37 [6.37, 16.89]
Seid et al; 2013	405	372	7	35	5.44 [2.39, 12.40]
Setegn et al.; 2012	166	65	27	10	0.95 [0.43, 2.06]
Sonko et al; 2015	258	88	38	36	2.78 [1.66, 4.65]
Tadesse et al; 2016	211	121	59	123	3.64 [2.48, 5.33]
Tariku et al.; 2017	1979	1353	713	876	1.80 [1.59, 2.03]
Tewabe et al.; 2017	185	164	18	38	2.38 [1.31, 4.33]
Tamiru et al.; 2012	87	103	96	96	0.84 [0.57, 1.26]
Tamiru et al; 2015	228	92	27	37	3.40 [1.96, 5.90]
Biks et al; 2015	180	277	363	949	1.70 [1.36, 2.12]
Abera; 2012	194	163	13	29	2.66 [1.34, 5.28]
Arage et al; 2016	384	39	18	12	6.56 [2.95, 14.63]
Adugna et al; 2017	221	111	101	96	1.89 [1.32, 2.71]
Egata et al; 2013	233	135	384	108	0.49 [0.36, 0.66]
Taddele et al; 2014	90	98	6	23	3.52 [1.37, 9.04]
Echamo; 2012	332	360	25	51	1.88 [1.14, 3.11]
Teka et al; 2015	325	134	47	24	1.24 [0.73, 2.11]
Summary					2.25 [1.63, 3.10]

REM test for heterogeneity (Q = 184.57, df = 19, p = 0.00; I^2 = 91.5%)



Studies and Publication year	PNC EBF	PNC NEBF	No PNC EBF	No PNC NEBF	Odds Ratio [95% CI]
Asemahagn; 2016	137	25	125	45	1.97 [1.14, 3.40]
Lenja et al.; 2016	188	33	121	54	2.54 [1.56, 4.15]
Sonko et al; 2015	98	25	197	99	1.97 [1.19, 3.25]
Tadesse et al; 2016	204	127	66	117	2.85 [1.96, 4.14]
Tewabe et al.; 2017	116	81	87	121	1.99 [1.34, 2.96]
Abera; 2012	29	31	178	161	0.85 [0.49, 1.47]
Teka et al; 2015	205	72	167	86	1.47 [1.01, 2.13]
Summary					1.86 [1.41, 2.47]

REM test for heterogeneity (Q = 16.11, df = 6, p = 0.01; I^2 = 63.4%)