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REVIEW

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Predictors of exclusive breastfeeding: a systematic review and meta-analysis

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Abstract

Background Breast milk is the ideal and complete food for infants. Demographic, social, economic and clinical factors affect exclusive breastfeeding (EBF). Identifying and understanding these factors can improve breastfeeding success. This study systematically reviews and analyzes the predictors of EBF.

Methods This study is a systematic review and meta-analysis. we searched electronic databases including PubMed/MEDLINE, Web of Science, PsycINFO, Cochrane, Scopus, EMBASE, Google Scholar, SID, and Magiran. we examined articles published between 2000 to 2023 using keywords like "risk factors", "related factors", "predictive factors", "exclusive breastfeeding ", and "women". The review included observational studies. Two reviewers independently selected the studies extracted data. Quality assessment was based on the Newcastle–Ottawa Scale. The association between predictive factors and breastfeeding was combined in a meta-analysis using a restricted maximum likelihood method (REML). Heterogeneity was quantified using I^2 and investigated through meta-regression, subgroup, and sensitivity analyses, while publication bias was assessed via a funnel plot.

Result Thirty eight articles were included in this review. Predictive factors in EBF were categorized into seven groups: mother's awareness of breastfeeding benefits, support received in breastfeeding and child-rearing, early breastfeeding after birth, mother's education level, annual income, mother's age, and prenatal care. Nineteen articles with a sample size of 70,183 were included in the meta-analysis. Results showed that a mother's awareness of breastfeeding benefits increases the odds of EBF by 2.70 times, support in child-rearing by 2.57 times, early breastfeeding (< 24 h) by 1.853 times, higher education level by 1.44 times, self-efficacy by 1.067, multiparity ≥ 2 by 1.50 times, having upper-middle annual income was associated with 28.3% higher than odds of EBF (95% CI 1.68, 1.54), female sex of infant by 1.07 times, and one to three antenatal visits by 0.108 times, (95% CI 1.27, 4.18). In normal vaginal delivery (NVD), the odds increased 2.22 fold, all statistically significant (95% CI 0.91, 5.43).

Conclusion The maternal awareness of the benefits of breastfeeding, maternal support, early breastfeeding, high education level, and improved family economic conditions are associated with EBF. Therefore, improving the educational, social, and economic levels of mothers improves EBF.

Systematic review registration PROSPERO CRD42023483049.

Keywords Risk factor, Related factor, Exclusive BreastFeeding, Women

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Background

Breast milk is the ideal and complete food for a baby during the first few months of life [1]. Today, exclusive breastfeeding (EBF) is considered by the United Nations International Children's Emergency Fund (UNICEF) and the World Health Organization (WHO) as a basic strategy for ensuring the growth and survival of children [2]. The maximum benefits of breast milk are achieved when the child is exclusively breastfed until the age of six months [3]. Stopping breastfeedinghas severe negative effects on the emotional and physical health of both the mother and child [4]. EBF has increased in almost all regions of the developing world, with the greatest progress seen in West and Central Africa [5]. The global target by year 2025 is to increase the rate of EBF in the first six months of life to at least 50% [6]. However, it is still far from reaching the ideal level. According to the WHO report, only 39% of babies under six months in developing countries EBF for the first six months of their lives [7].

The initiation of breastfeeding is influenced by socioeconomic, health, and personal factors. Social and economic conditions affect individual factors such as childbearing age, maternal nutrition, family income, and family and community support. Additionally, cultural conditions affect the number of children and the desire to breastfeed. Government policies influence health, education, breastfeeding policies, mothers'access to services, breastfeeding challenges, and the education and awareness of families [8, 9]. Studies have shown that factors such as mother's age, education, employment status, ethnic background, social class, attitude towards breastfeeding, mother-infant bond, religion, appropriate breastfeeding methods, nipple problems, family support during breastfeeding, and EBF are effective predictive factors of breastfeeding success [10, 11]. Factors related to mother and infant such as insufficient breastfeeding, the child's illness, a singleton births, the type of delivery, and the mother's desire to breastfeed, have all influenced EBF [12]. Knowledge, attitude, subjective norms, and breastfeeding behavior of mothers are associated with a higher rate of EBF [13]. Among these, awareness of the benefits of breastfeeding is the most important factor in achieving EBF. This factor is related to the level of knowledgeand education of the mother [14].

Studies mention that previous breastfeeding experience, early initiation of breastfeeding, participation in antenatal classes, strengthening the Baby-Friendly Hospital initiatives to encourage early initiation of breastfeeding, providing services and skills to diagnose and solve breastfeeding problems, the mother's strong desire for EBF increase the rate of EBF. The health policies of each society influence these factors. These policies also affect the social, economic, and cultural factors of breastfeeding which are often neglected. Multifactorial determinants of breastfeeding need supportive measures at many levels, from legal and policy directives to social attitudes and values, women's work and employment conditions, and health-care services to enable women to breastfeed. When relevant interventions are delivered adequately, breastfeeding practices are responsive and can improve rapidly [15, 16]. The breastfeeding success rates decrease with maternal age, having an unwanted pregnancy, and cesarean delivery. These factors are also influenced by the economic and cultural conditions of societies [17, 18]. Despite a general awareness of optimal EBF practices, this knowledge has not been translated into action, leading to suboptimal breastfeeding practices [19]. Consequently, by predicting these factors, communities will gain better awareness of the factors that contribute to reducing EBF rates and can implement better interventions. The present study was conducted to investigate the predictors of EBF in women through a systematic review and meta-analysis.

Methods

This systematic review and meta-analysis adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Guidelines [20]. The article was registered in the International Prospective Register of Systematic Reviews (PROSPERO) under the registration number CRD42023483049.

The review question was framed using the PICO (Population, Intervention/Index, Control, and Outcomes). In this study, the population consists of women who have given birth. The intervention is predictive factors. There is no control group, and the outcome is EBF. There is no control group, and the outcome is EBF.

Eligibility criteria

The inclusion and exclusion criteria for the present study are as follows.

Inclusion criteria

The inclusion criteria were as follows: (a) the articles were published in English or Persian from 1 January 2000, to 30 November 2023; (b) the definition of EBF was provided (exclusively breastfeeding for the first six months and no use of other liquids or solids even water); (c) the women studied had no high-risk pregnancies such as pre-eclampsia, diabetes, high blood pressure, IUGR, preterm labor, abruption placentae, placenta previa; (d) the articles used observational methods, including cohort, cross-sectional, descriptive, longitudinal, or comparative designs; (e) the baby's gestational age was 37 weeks or

more; (f) the weight of the baby was between 2500 and 4000 g; (g) singleton pregnancies.

Exclusion criteria

Exclusion criteria are studies that only examined intention, duration, breastfeeding decisions, and practices. Studies that investigate sick babies such as neonatal with RDS, preterm labor, low birth weight, newborns admitted to the hospital, and babies with congenital abnormalities,were excluded. Additionally, studies that investigate physical and mental illnesses of the mother (except postpartum depression) were not included. Furthermore, the articles with a lack of access to the full text of the review were also excluded.

Search strategies

We conducted a comprehensive search in international and national databases, including PubMed/MEDLINE, Web of Science, PsycINFO, Cochrane Review, Scopus, EMBASE, Google Scholar, Sientific Information Database (SID), and Magiran, covering the period from 1 January 2000, to 30 November 2023 in English or Persian. In addition, the authors hand-searched abstracts of review articles from a previous literature search on predictors of EBF. Search terms were formulated following the PICO guidelines and utilized the Boolean operators'AND'and'OR'. The search filters included English and Persian languages, as well as the range from 2000 to 2023. Due to the impact of social, economic, political, and cultural factors on EBF, it was decided to review studies from 2000 onwards.

Two independent researchers searched and extracted relevant articles using similar keywords. All fields and medical subject headings (MeSH terms) were used to refine the search in PubMed Advanced Search.

The following search strategies were employed across various databases using two important Boolean operators and search engines with primary search terms ((("breastfeeding") OR ("exclusive breastfeeding") OR ("breastfed"), OR (breast feeding, exclusive), OR (exclusive breast feeding), OR (breastfeeding, exclusive) OR (exclusive breastfeeding)) AND (("predictors") OR ("risk factors") OR ("affecting factors") OR ("related factors") OR ("risk") OR ("associated factors") OR (predicted factors) OR (determinants) OR (factors) OR (Risk factor) OR (Predictive factor) OR (Risk factor*) OR (Related factor) OR (Affecting factor) OR (Associated factor)) AND ((women) OR (lactating women)). Additional file 1 shows the search strategy for finding relevant studies in PubMed [see Additional file 1]. The same search strategy, with necessary modifications, was used for other electronic databases.

Outcomes

In this study, the independent variables were predictor factors and the dependent variable was EBF.

Independent variable

Predictor factors included multiple influencing factors including individual, psychological, obstetric, and economic factors.

- Individual factors include the mothers and father's age, occupation, and education.
- Psychological factors include a history of postpartum depression, the mother's awareness of the benefits of breastfeeding, the spouse's support, and family and social support.
- Obstetric factors include the number of pregnancies, the number of deliveries, the number of children, the female sex of infant, unwanted pregnancy, breastfeeding experience, initiating breastfeeding in the first hour (timely or early initiation) after birth, and the number of prenatal visits.
- Economic factors include family income and financial support.

Dependent variable

In this study, EBF means that infants should be exclusively breastfed for the first six months of life to achieve optimal growth, development, and health. No other liquids or solids are given—not even water—except oral rehydration solution or drops/syrups of vitamins, minerals, or medicines [21].

Study selection and extraction

Related articles published from early 2000 to 2023 were searched on the frequency of studies. After removing the duplicate studies using EndNote software, the titles and abstracts of the remaining articles were examined. Data were extracted according to the study characteristics (name of the first author, place, design, and year of publication), effective factors (individual factors, psychological factors, obstetric factors, and economic factors:), participants characteristics (age and sample size), and key measures (mean ± standard deviation, relative risk (RR), crude odds ratio (OR), adjusted OR, 95% CI (lower limit–upper limit), sample size (n), mean difference, and standard mean difference). Two reviewers used the data extraction checklist for data extraction. In cases of disagreement, the two reviewers reached an

agreement through discussion. A third reviewer was involved if disagreements persisted.

Evaluating the quality of articles

To assess the quality of articles, the Ottawa Newcastle Scale adapted for cross-sectional studies and the Ottawa Newcastle Scale adapted for cohort studies were used [22]. The evaluation checklists had three main parts. The first part measures the methodological quality; the second part measures comparability; and the last part measures the quality of the studies based on the appropriateness of the statistical method used. This study was conducted by two researchers, ZK and MK, and the Kappa coefficient of agreement between the researchers was taken (K = 0.9). In cases of disagreement between the two researchers, the opinion of a third expert was used. The quality evaluation scores of the articles were as follows: very good studies: 9–10 points; good studies: 7–8 points; satisfactory studies: 5–6 points; and unfavorable studies: 0–4 points (Table No. 1).

Statistical analysis and data synthesis

The factors affecting EBF were first systematically examined, and then the predictors of EBF were examined using the meta-analysis method. The heterogeneity of the meta-analysis was checked with I^2. CMA3.1 software was used for data analysis. All the extracted data were analyzed using CMA 2. Initially, systematic synthesis was conducted based on the data obtained from the checklist. Thus, the results, organized based on the main outcomes, were compared and presented separately for each subgroup. Effect estimates (mean difference) and their standard deviations from each study were combined using a fixed-effects or random-effects model. A *P*-value of less than 0.05 was considered significant.

Heterogeneity assessment

The methodological and statistical heterogeneity of the studies were investigated. I^2 values below 25%, 25–50%, 50–75%, and above 75% were considered low, medium, high, and very high heterogeneity, respectively. Cochran's Q test was used to evaluate heterogeneity in meta-analysis. The classic measure of heterogeneity is Cochran's Q, which is calculated as the weighted sum of squared differences between individual study effects and the pooled effect across studies, with weights used in the pooling method [23]. Fixed or random effects models (FEM or REM, respectively) were used according to the conditions. In cases of methodological and statistical homogeneity (low heterogeneity), the FEM model is used, and otherwise, the REM model, which is a more conservative method, is used. Subgroup analysis may be applied by the authors [24]. In the cases of moderate to high heterogeneity, the random model was used, and in the cases of low or no heterogeneity, the fixed model was used. In this study, the effect size R index was used for meta-analysis. Sensitivity analysis was performed using the leave-one-out method for our primary outcomes.

Evaluation of publication bias

Prevention is the best approach to dealing with publication bias [25]. In addition, if the number of eligible studies was greater than 10, the funnel plot method was adopted to assess publication bias. When the number of studies was less than 10, more than 20, or 10 to 20, respectively, the Begg and Egger methods and a combination of the two are used to measure publication bias. When the P values resulting from the assessment of publication bias are significant ($P < 0.05$), the trim-and-fill method, was used to correct the publication bias [26].

Publication bias

The rank correlation test introduced by Begg and Mazumdar is extensively used in meta-analysis to test for publication bias in clinical and epidemiological studies. It is based on correlating the standardized treatment effect with the variance of the treatment effect using Kendall's tau as the measure of association [27].

In this study, to investigate the publication bias, the studies in each subject were analyzed separately using Begg and Mazumdar rank correlation test. The Begg and

Table 1 Determining the publication bias of studies

categories of study	Begg and Mazumdar rank correlation Kendall's tau with continuity correlation		Publication Bias
	Tau	*P*-value	
Mother's awareness of the benefits of breastfeeding and EBF	0.30	0.50	No
Mother's support in child rearing circle and EBF	0.8	0.08	No
Breastfeeding in the first hourand EBF	0.1	07	No
Maternal education level and EBF	0.5	0.3	No
Annual income and EBF	0.2	0.7	No
Mother's age and EBF	0.5	0.3	No
Antenatal clinic visits and EBF	0.09	0.7	No
Normal Vaginal Delivery (NVD) and EBF	0.0	1	No
Female sex of infant and EBFand EBF	0.6	0.2	
Multiparity and EBF	0.0	1.0	NO
Self-Efficacy and EBF	0.6	0/2	No

Mazumdar adjusted rank correlation test suggests a very low probability of publication bias (Table 1).

Ethical consideration

The present study has been registered with the code of ethics IR.SBMU.PHARMACY.REC.1401.202 at the Midwifery and Reproductive Health Research Center, Faculty of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences. The research registration number in PROSPERO is CRD42023483049.

Result

In the initial search, 9,111 articles were obtained, along with 2 articles from the manual search. Then the title, abstract, and review of all articles were screened by the researcher; 4,562 duplicate and unrelated items were removed, leaving 4,551 articles after the title and abstract review, 3,246 articles were removed, leaving 1,305 articles. After a review of the full text of the articles, studies that did not meet the inclusion criteria were excluded. As result, 1,270 articles were excluded, and finally, 38 articles that met the inclusion criteria for this study were selected. The flowchart for selecting studies is shown in Fig. 1.

Finally, we included 38 studies to examine predictive factorss of EBF in postpartum women. The studies included 26 cross-sectional studies [28–53], 6 cohort studies [12, 54–58], 2 survey studies [59, 60], 3 prospective studies [61–63], and 1 descriptive and analytical study [64] (Table 2).

These studies were conducted in various regions of the world. The Asian region included China, Sri Lanka, Bangladesh, Vietnam, Korea,, Iran, Japan, Indonesia, Malaysia, Egypt, and Turkey. From the African region, the studies were conducted in Ethiopia, Uganda, Malawi, Libya, Sub-Saharan Africa, and Nigeria. Other studies

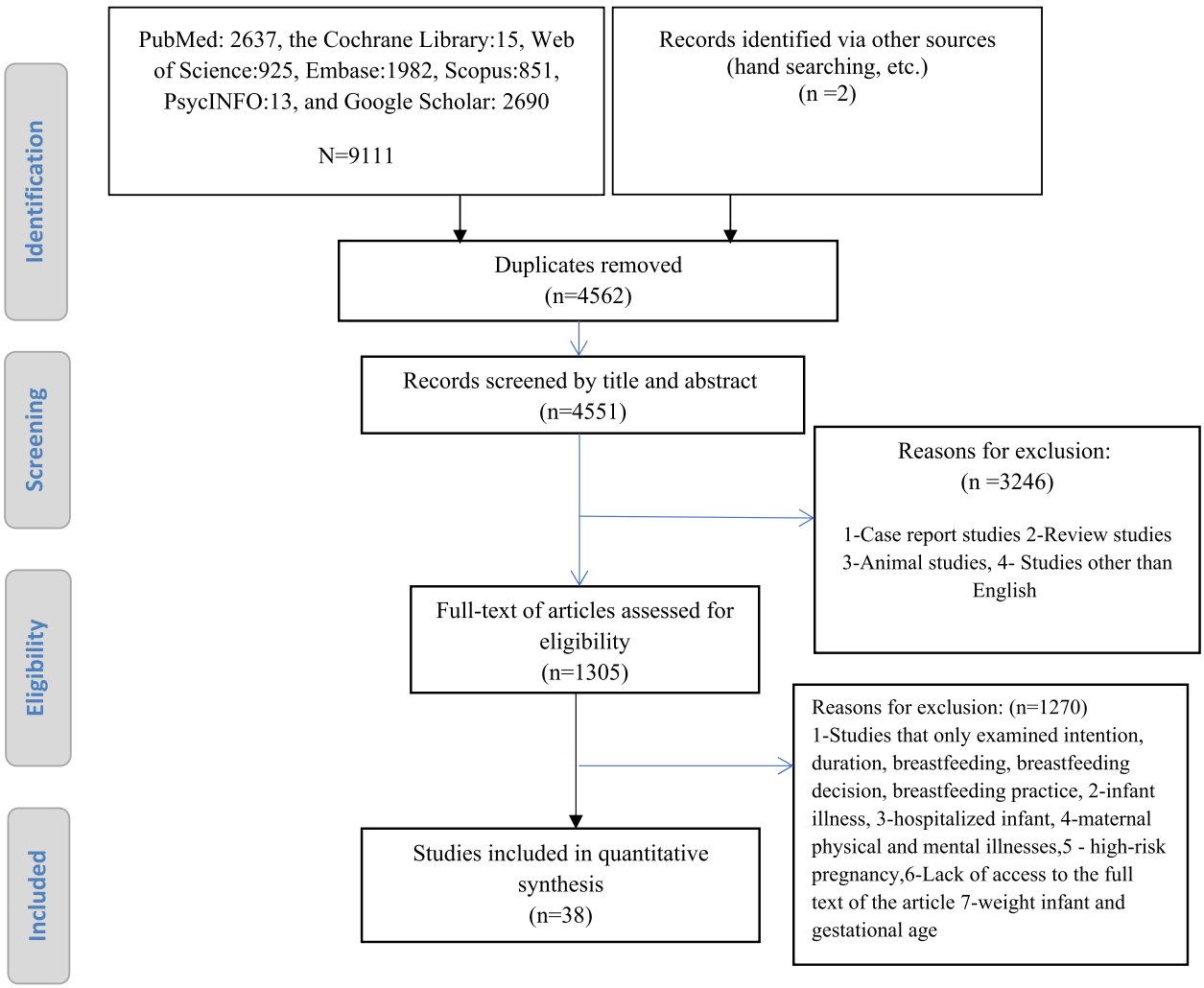

Fig. 1 PRISMA flow diagram for selection of studies

Table 2 Characteristics of the studies selected for the systematic review

ID	Authors	Year of publication	countries	Age of mother (Y) (mean ± SD)	Type of study	Sample size	Factors	Age of infant (Mon)	Quality assessment
1	Chipojola et al. [28]	2020	Malawi	28.16 ± 4.9	The cross-sectional	7282	Factors that increase the probability of EBF: 1. Frequent prenatal care visits 2. Cesarean section 3. Multiparous women 4. birth at hospital 5. infants' age (6 months old and more than one month old) 6. maternal age (24–35 years) 7. Parental education 8. Rural mothers	1–5	9
2	Karaçam [29]	2008	Turkey	27.32 ± 2.36	The cross-sectional	514	Factors affecting the increase in EBF: 1.Mothers with university education and higher 2.Employed mothers 3.Cesarean delivery Effective factors in reducing EBF 1: Type of delivery 2: Mothers with difficulty soothing their baby 3: Baby's frequent crying	0–4	8
3	Margotti and Epifanio [64]	2014	Brazil	29.48 ± 4.21	The descriptive and analytical	158	Effective factors for reducing EBF: Non-child-friendly hospital Mother's education: ≤ 8th grade employed mother 1: Maternal age 2: Breastfeeding Self-Efficacy 3: Type of Delivery 4: Maternal schooling 5: A non-accredited hospital as child-friendly	0–4	6
4	Koosha et al. [30]	2008	Iran	26.9 ± 5.84	The cross-sectional	650	Factors affecting the increase in EBF Infant feeding on demand Babies who were breastfed more than eight times a day Birth weight between 2500–4,000 gr Effective factors for reducing EBF: Using pacifier 1-No. of deliveries (3 or more) 2-Birth weight 3-demand feeding	0–5	7

Table 2 (continued)

ID	Authors	Year of publication	countries	Age of mother (Y) (mean ± SD)	Type of study	Sample size	Factors	Age of infant (Mon)	Quality assessment
5	Yeneabat et al. [31]	2014	Ethiopia	29.27 ± 6.2	The community-based cross-sectional	224	Factors affecting the increase in EBF: 1.Mothers who live in rural areas 2.Baby girl 3.Mothers under the age of 20 4.Breastfeeding counseling during pregnancy 5.Delivery in health centers 6.Support from family, friends, and relatives 7.Having prenatal care 8.Less food insecurity Early termination of EBF: 1. Mother's university education 2. University education of partners 3. The type of mother's job (official employee, laborer, servant, etc.) compared to stay-at-home mothers 4. Fathers who were official employees 5. Birth at home 6. Cesarean section 7. Failure to teach the mother by birth attendants 8. First rank of birth relative to 5 and above 9. Being prime par 10: age of mother 11: educational status of mother and partner 12: occupation of the mother and partner 13: Place of residence 14: Provision of counseling on EBF during ANC 15: delivery place 16: Mode of Delivery 17: birth attendant, 18: PNC utilization 19: Provision of counseling on EBF during PNC 20: Parity of the mother 21-birth order of the index infant 22: Food insecurity	0–6	8
6	Otim et al. [32]	2022	Uganda	28.56 ± 6.78	The cross-sectional	362	Factors that increase the probability of EBF: 1.Mothers had less education (higher education is the least likely) 2.Older mothers (30–49 years old) 3. age of mother 4. educational status of mother	0–6	8
7	Parera et al. [61]	2012	Sri Lanka	27.45 ± 3.26	The prospective observational	500	Effective factors in reducing EBF: 1. Mothers over 30 years old 2. The first child compared to the second 3. Mother's anxiety due to insufficient milk 4. Insufficient weighing of the infant 5. Higher education 6. age of mother 7.birth order 8.educational status of mother	0–6	8

Table 2 (continued)

ID	Authors	Year of publication	countries	Age of mother (Y) (mean ± SD)	Type of study	Sample size	Factors	Age of infant (Mon)	Quality assessment
8	Wu et al. [54]	2019	China	27.23 ± 3.72	The cohort study	951	Effective factors in reducing EBF: 1. The age of the baby; 2. Exposure to cigarette smoke 3. Minor postpartum depression 4. Using a milk bottle 5. Cesarean delivery 6. Delay in starting breastfeeding; 7. Multiparous 8. Start breastfeeding after the first hour after birth 9.The type of delivery 10. Minor postnatal depression 11. Passive smoking after delivery 12. Breastfeeding initiation 13. age of infant	0–6	8
9	Jamei et al. [33]	2017	Iran	26.56 ± 5.16	The cross-sectional	400	Factors that increase the probability of EBF: 1. Baby girl 2. Desired pregnancy 3.type of delivery 4. Type of pregnancy 5. Infant sex	0–6	7
10	Özgürhan and Cömert [62]	2020	Turkey	28.3 ± 5.2	The prospective and comparative	355	Factors affecting the increase in EBF duration: 1. Increasing the mother's education level; 2. Mothers who had a healthy medical history 3. Mothers who had help at home. Factors affecting the early termination of EBF: Use a pacifier 4.educational status of mother 5. Helper at hom	0–6	7
11	Jebena et al. [51]	2022	Ethiopia	30.08 ± 4.69	The community-based cross-sectional	649	Factors affecting the increase of EBF: 1. Having information about breastfeeding during prenatal care 2. Postnatal care 3. Having a 0–1 month old baby; 4. Singleton birth 5. Appropriate monthly income 6. Start breastfeeding within an hour after 7. Care during pregnancy and breastfeeding 8.having monthly income 9.age of infant 10.breastfeeding initiation within one hour of birth 11.antenatal care 5- postnatal care follow-up	0–6	8
12	Laugen et al. [59]	2016	Canada	31.05 ± 4.87	The survey	2133	Factors affecting the increase in EBF: 1. Higher education 2. Mother's age (over 30) 3. Higher household income 4. High support levels Marital status (married mothers) 5. educational status of mother 6. Social Support 7.Marital Status 8. Maternal age	0–6	9

Table 2 (continued)

ID	Authors	Year of publication	countries	Age of mother (Y) (mean ± SD)	Type of study	Sample size	Factors	Age of infant (Mon)	Quality assessment
13	Mateus Solarte [55]	2019	Colombia		The cohort study	438	Factors affecting the increase in duration: EBF: 1. Start breastfeeding in the first 4 h 2. Father's positive opinion on breastfeeding mode 3. Birth weight (weight range between 2500–3021 g and 4500–3388 g) 4. The mother's confidence in her ability to breastfeed 5.breastfeeding initiation within four hour of birth 6. self-perceived sureness for breastfeeding 7. positive opinion of the baby's father regarding breastfeeding 8. newborn weight	0–6	8
14	Shiraishi et al. [56]	2020	Japan	33.4 ± 4.6	The prospective cohort	61	Factors affecting exclusive breastfeeding in the 3 months after delivery: 1. Having a university degree 2. Not having a plan to return to work until 6 months after giving birth 3. Exclusive breastfeeding 4. A higher breastfeeding self-efficacy score 5. Absence of breast complications within one month after delivery 6. Multipar mothers 7. Multiparity 8. Having a university degree 9. No plan to return to work by 6 months postpartum 10. Higher breastfeeding self-efficacy	0–3	6
15	Hunegnaw et al. [34]	2017	Ethiopia	28.62 ± 4.95	The community based cross-sectiona	478	Factor affecting the increase EBF: 1. Giving birth in public health institutions and hospitals Factors affecting the reduction of EBF: 1. Government employee mothers (compared to private jobs and housekeeping) 2. Failure to receive breastfeeding advice after delivery 3. Maternal age 4. Family monthly income 5. Occupation of the mother 6. Place of delivery 7. Counseling about breastfeeding after delivery	0–6	7

Table 2 (continued)

ID	Authors	Year of publication	countries	Age of mother (Y) (mean ± SD)	Type of study	Sample size	Factors	Age of infant (Mon)	Quality assessment
16	Salcan and et al. [35]	2019	Turkey	30.1 ± 5.3	The cross-sectional	635	Factors affecting the increase in duration EBF: 1. term babies compared to pre-term and post-term babies; 2. non-working mothers 3 Postpartum training Factors affecting duration reduction EBF: 1. Smoking by the mother; 2. Postpartum depression 3. Nutrition with other nutrients 4. Use of milk bottles and pacifiers1- 5. Postnatal working status 6. Postpartum smoking	0–6	8
17	Noughabi et al. [36]	2014	Iran	29.7 2± 5.4 1	The community based cross-sectiona		Factors affecting the increase in EBF: 1. breastfeeding intention before delivery; 2. the baby's first contact with the breast 30–60 min after birth 3. Skin-to-skin contact between the baby and the mother after delivery 4. Support of spouse, family, or friends in breastfeeding Factors affecting the reduction of EBF: 1. Use of formulas in the hospital 2. Receiving conflicting advice on infant feeding 3. Using a pacifier in the first week of life 4. The time of first skin-to-skin contact 5. The time of the first breast-feed 6. Mother's intention to breastfeed before childbirth 7. Husband's support 8. Having enough time for exclusive breast-feeding 9. Mother receiving conflicting infant feeding advice in the first 6 months 10. Family upport for exclusive breastfeeding 11. Pacifier use during the first week of life	0–6	8
18	Pereira et al. [37]	2010	Brazil	31.1 ± 3.3	The cross-sectional	1029	Factors affecting the chance EBF: 1. White skin color 2. School education 3. Marital status 4. History of breastfeeding 5. Start exclusive feeding before discharge from the hospital 6. Group support for the mother 7. Orientation about breastfeeding 8. Schooling 9. Marital status 10. previous breastfeeding 11. Exclusive breastfeeding at the time of hospital discharge 12. Group support for the mother 13. Orientation on breastfeeding	0–6	8

Table 2 (continued)

ID	Authors	Year of publication	countries	Age of mother (Y) (mean ± SD)	Type of study	Sample size	Factors	Age of infant (Mon)	Quality assessment
19	Rimes et al. [38]	2019	Brazil	28.96 ± 3.85	The cross-sectional	429	Factors affecting the increase in the duration EBF: 1. Mother's age (20–45) 2. Non-white mothers 3. Lower education; 4. Having a partner 5. Mother's monthly income 6. Number of prenatal visits (6 and more) 7. Non-estrogenic contraceptives 8. Not drinking alcohol 9. Do not smoke 10. Age of the baby (0 to 1 month is the most common) 11. Not using a pacifier 12. Having leave after childbirth 13. Have a partner 14. Number of prenatal appointments 15. Maternal consumption of alcoholic beverages 16. Child's age 17. Maternity leave 18. Use of pacifier	0–6	
20	Jessri et al. [57]	2013	Canada	31.0 ± 6.0	The prospective cohort	600	Factors that increase the chance of EBF: 1. Mothers with graduate university degrees 2. Multiparous mothers who had a history of breastfeeding 3. Mothers who were in the highest quartile of infant feeding attitude scores (Iowa) 4. Post-graduate university degrees 5. Multiparity 6. The highest quartile of the Iowa Infant Feeding Attitude Score	0–6	7
21	Ruan et al. [39]	2019	China	29.37 ± 2.62	The cross-sectional	417	Factors affecting the increase in the chances of EBF: 1. Higher annual income in the family 2. Mothers who received information related to breastfeeding 3. Higher average household income per year 4. Mothers who received breastfeeding information 5. Mothers' age 6. Mothers' education 7. Fathers' education 8. Fathers' occupation 9. Delivery mode 10. Current birth		9

Table 2 (continued)

ID	Authors	Year of publication	countries	Age of mother (Y) (mean ± SD)	Type of study	Sample size	Factors	Age of infant (Mon)	Quality assessment
22	Kaneko et al. [40]	2006	Japan	31.2 ± 2.98	The cross-sectional	46,569	Factors affecting the increase in EBF: 1. women in their age of 20s 2. increasing the number of births 3. sufficient leave for 6 months for working mothers 4. counsel on childbearing and child care for the wife 5. education of the birth attendant, nurse, or peers regarding parenting 6. Higher annual household income 7. baby girl Factors affecting the reduction of EBF: 1. Women who live with their grandparents 2. Working mothers 3. Low birth weight 4. Multiple births 5. Smoking by parents (father, mother, or both) 6. Not having a favorable feeling towards the child 7. Feeling of heaviness and burden 8. Sufficient childcare leave 9. Consultation about childrearing with the spouse, a birth attendant and/or nurse 10. A peer in a child-rearing circle		10
23	Dalili et al. [41]	2014	Iran	27.01 ± 5.36	The cross-sectional	175	Factors affecting the increase of probability EBF: 1.Breastfeeding in the first hour of birth 2.Breastfeeding eight or more times a day 3. receiving breastfeeding education during pregnancy Factors affecting the reduction of probability EBF: 1.lack of breast feeding 2.Tjere is a problem in breast feeding with a bottle 3.Doctor's or family's recommendation not to breastfeed 4.baby's refusal to breastfeed 1-breastfeeding within the first hour of birth 2- 8 or more times of breastfeeding per day 3- receiving breastfeeding education in pregnancy		6

Table 2 (continued)

ID	Authors	Year of publication	countries	Age of mother (Y) (mean ± SD)	Type of study	Sample size	Factors	Age of infant (Mon)	Quality assessment
24	Tsegaw et al. [42]	2021	Ethiopia	30.3 ± 4.1 8	The cross-sectional	1185	Factors affecting the increase of increase of probability EBF: 1.Baby girl 2.High-income families 3.prenatal and postnatal visits 4.high level of prenatal care services 5.existence of employment levels with suitable income in society 6.a healthy baby compared to a morbid baby 7.younger age of the baby (0–1 month) 8. 4–5 months age infant 9. Female infants 10. Infant comorbidities 11. Household wealth index 12. Antenatal care 13. Postnatal visit 14. Maternal employment	0–6	9
25	Dwinanda et al. [12]	2018	Indonesia	29.25 ± 6.04	The prospective cohort study	243	Factors that increase the chance of EBF: 1.Confidence in the mother to produce milk 2.Spouse or family support 3. non-working mother 4. husband or family support 5. The mother's confidence in breast milk production	0–6	6
26	Agho et al. [43]	2011	Nigeria	31.08 ± 5.37	The cross-sectional	658	Factors that increase the chance of EBF: 1.In rich and middle class families 2.Having four or more prenatal visits 3.female infant The effective factor in reducing the chance of EBF: 1.Increasing the age of the EBF baby 1- Female infants 2-Antenatal clinic visits	0–6	7
27	Tan et al. [44]	2011	Malaysia	29.63 ± 4.19	The cross-sectional	682	Effective factors on EBF: 1- Rural residence 2- Non-working 3-Non-smoking mothers 4- Multiparous mothers 5- Mothers with husbands who support breastfeeding 6- Mothers who practice bed-sharing	0–6	8
28	Joshi et al. [45]	2014	Bangladesh	24.36 ± 6.32	The cross-sectional	121	Factors affecting the increase of probability EBF: 1.Cesarean delivery 2.better economic situation 3.Tyoe of delivery	0–6	6

Table 2 (continued)

ID	Authors	Year of publication	countries	Age of mother (Y) (mean ± SD)	Type of study	Sample size	Factors	Age of infant (Mon)	Quality assessment
29	Kimuli et al. [46]	2023	Uganda	26.1 ± 6.4	The cross-sectional	7210	Factors affecting the increase in the chances of EBF: 1.Mother's age (mothers over 20 years old compared to teenagers) 2.Life in the village 3. Having prenatal care 4.Not using modern family planning methods Factors affecting chance reduction: EBF 1. Age of the baby (3 to 5 month old baby is younger than younger)	0–6	9
30	Niazy et al. [47]	2022	Egypt	25.69 ± 2.27	The cross-sectional	200	Factors affecting the increase EBF: 1.Younger age of the mother 2. less education of the mother 3. low income level 4. more mother's knowledge about breastfeeding 5. Better mother's attitude about the importance of breastfeeding 6. Higher attitude of breastfeeding 7. More knowledgeable about the importance of breastfeeding	0–6	7
31	Abdulmalek [48]	2018	Libya	26.53 ± 4.02	The cross-sectional	314	Effective factors on EBF: 1.Mothers'knowledge about breastfeeding 2. A non-working mother 3. Vaginal delivery 4. Starting breastfeeding with a short interval after delivery (compared to 2 h later) 5. Breastfeeding according to the baby's demand 6. Not using a pacifier	0–6	7
32	Mosquera et al. [49]	2019	Brazil	25.32 ± 6.6	The cross-sectional	1538	Effective factor in increasing the duration of EBF: 1- Multiparous Effective factor in reducing duration EBF: 1. Using pacifier 2. Having a Whizzing	0–1	7
33	Duong et al. [63]	2005	Vietnam	NA	The prospectiveal study	463	Factors affecting the increase in probability EBF: 1- mother's education level' 2- mother's decision-making on breast-feeding 3- mother's comfort to breast-feed in public places 4- father's occupation 5- feeding preference of father 6- having sufficient food for the family	0–6	8
34	Kim et al. [60]	2013	Korea	30.5 ± 3.8	The survey	143	Factors affecting the increase in probability EBF: 1-younger maternal age 2-higher maternal education level 3-living in a capital city	0–6	7
35	Elalfy et al. [50]	2022	Egypt	28.86 ± 3.69	The cross-sectional	670	Factors affecting the increase in probability EBF: 1- Mothers age < 30 y 2-Mother's Occupation (Housewife) 3- Frequency of ANC visits > 4 4- Mode of delivery (VD) 5- Initiation of BF (Early)		7

Table 2 (continued)

ID	Authors	Year of publication	countries	Age of mother (Y) (mean ± SD)	Type of study	Sample size	Factors	Age of infant (Mon)	Quality assessment
36	Yalçin SS [52]	2016	27 sub-Saharan Africa (SSA) countries	15–35	cross-sectional	25 084	Overall EBF Prevalence: 36.0% among ever breastfed children in SSA Maternal Age: Approximately 52.3% of mothers belonged to the 20–29 years age group Education: 46.2% of mothers had no formal education Employment: More than half of mothers worked in the past 12 months (60.3%) Residence: 73.5% of mothers lived in rural areas Household Wealth: Approximately 24.6% belonged to the poorest household wealth quantile Birth Rank and Interval: About 40.7% had a 2nd–4th birth rank and birth interval ≥ 24 months Antenatal Care: 43.5% of mothers had 4 + ANC visits Delivery Location: More than half of deliveries took place at a health facility Perception of Size at Birth: Nearly half perceived their babies as average size at birth Breastfeeding Initiation: More than half initiated breastfeeding within 1 h Bivariate Analysis Higher EBF Rates: Observed in the 30–34 years age group (38.8% in SSA) Maternal Education: Higher EBF rates among mothers with primary education Education Impact: EBF rates increased significantly with higher maternal education in several countries Employment Status: Working mothers had higher EBF rates in three countries but lower rates in six countries Rural vs. Urban: Rural mothers in Ethiopia, Rwanda, and Tanzania had higher EBF rates; urban mothers in Ghana, Mozambique, Nigeria, Zambia, and Zimbabwe had higher rates ANC Visits: EBF rates were lower among mothers without ANC visits; significantly lower rates in multiple countries Delivery Factors: Delivery places and types affected EBF rates Infant Age: EBF rates decreased with infant age; 53.1% at 0–1.9 months and 20.9% at 4.0–5.9 months Female sex of infant: Female infants had significantly higher EBF rates in certain countries, but lower rates in Gabon Early Breastfeeding: Mothers who initiated breastfeeding early had significantly higher EBF rates in several countries, but lower rates in Burundi	under 6 months	10

Table 2 (continued)

ID	Authors	Year of publication	countries	Age of mother (Y) (mean ± SD)	Type of study	Sample size	Factors	Age of infant (Mon)	Quality assessment
37	Yourkavitch, [53]	2022	U.S	N/A	cross-sectional	51	Exclusive Breastfeeding at 6 Months • Political Participation: IRR = 1.02 (95% CI: 1.01, 1.03) • Employment and Earnings: IRR = 1.19 (95% CI: 1.03, 1.37) • Work and Family: IRR = 1.02 (95% CI: 0.95, 1.10) • Poverty Among Women: IRR = 0.03 (95% CI: 0.01, 0.20) • Reproductive Rights: IRR = 1.02 (95% CI: 0.99, 1.05) • IBCLCs per 1000 Live Births: IRR = 1.06 (95% CI: 1.04, 1.09) • La Leche League Leaders per 1000 Live Births: IRR = 1.16 (95% CI: 1.10, 1.22) • Baby-Friendly Hospital Births: IRR = 1.71 (95% CI: 1.04, 2.81)	**at 6 Months**	9

Table 2 (continued)

ID	Authors	Year of publication	countries	Age of mother (Y) (mean ± SD)	Type of study	Sample size	Factors	Age of infant (Mon)	Quality assessment
38	Li et al. [58]	2020	China	18–35	prospective cohort	394	Demographic Characteristics of Participants: •Total Participants: 394 individuals, with 65.7% being primiparas and 34.3% multiparas 1. Previous Breastfeeding Experience (PBE): 27.7% of participants reported having PBE 2. Descriptive Analysis of Breastfeeding-Related Scales •Mean Scores: •Breastfeeding Knowledge: 14.77 •IIFAS: 46.51 •BSES-SF: 60.57 •MBFES: 114.05 •BES: 33.95 These scores indicate that participants generally possess positive knowledge and attitudes toward breastfeeding, particularly regarding maternal satisfaction 3..Association Between PBE and Self-Efficacy, Attitude, and Difficulties in Breastfeeding •ANOVA results indicate that PBE has a significant impact on breastfeeding self-efficacy (BSES-SF) and attitudes (IIFAS), but not on breastfeeding knowledge •Multiple Comparisons reveal no significant differences in self-efficacy and difficulties between multiparas with and without PBE, although significant differences are noted in attitudes 4. Association Between Participant Characteristics and Breastfeeding at 4 and 6 Months •Parity: Significantly associated with exclusive breastfeeding (EBF) at both 4 and 6 months •PBE: Significantly associated with both exclusive and any breastfeeding •Breastfeeding Initiation Time: Significantly associated with any breastfeeding at both time points 5. Multivariate Logistic Regression Model •Indicates that multiparas with PBE are more likely to continue breastfeeding at 4 and 6 months •Self-efficacy and breastfeeding difficulties significantly impact breastfeeding status 6. Overall Findings •The exclusive breastfeeding rates in this study are higher than previous statistics, which may relate to participants'education levels and economic status •PBE is identified as a key factor influencing long-term breastfeeding success, particularly through enhanced self-efficacy and improved attitudes	6–12	9

were from Brazil, Colombia, USA, and Canada. In general, the studied population included mothers who had given birth to babies aged 0 to 6 months, with average ages ranging between 24 and 33 years. The sample size of the studies ranged from 61 to the largest sample size of 46,569 in a cross-sectional study in Japan.

According to the studies, various factors affect EBF, which we classified into seven main groups: demographic characteristics of the mother and family, infant factors, factors related to breastfeeding, clinical factors, health, and medical services, economic and social factors, and maternal factors mentioned.

1-Demographic characteristics

One of the most important variables is demographic characteristics. Among the influencing factors in this group are the mother's age, parents' education levels, mother's employment status, place of residence [28, 31, 44, 46, 52, 60], marital status [37, 38, 59], and father's occupation [31]. In this group, parents' education level was the most effective factor, as mentioned in 15 studies. Most studies have shown that mothers and fathers with higher education (university education) are more likely to practice EBF [28, 29, 31, 32, 37, 47, 52, 56, 57, 59–64]. After that, the mother's employment status is cited as another important factor in 13 studies. Mothers who were not working or had enough leave (at least 9 months) after childbirth continued EBF for a longer period of time [12, 29, 31, 34, 35, 38, 40, 42, 44, 48, 50, 56, 64]. The next significant variable is the mother's age, which is found in 12 studies. In most of these studies, younger mothers (less than 35 years) were more likely to be successful in EBF [28, 31, 32, 38, 40, 46, 47, 50, 52, 59–61].

2-Economic and social factors

The next group is related to economic and social factors, which include variables such as family income, support from spouse, family, or friends, food insecurity [31, 63], the father's opinion about breastfeeding [55, 63], help with chores [62], and the mother's comfort with breastfeeding in public places [63]. Meanwhile, the level of household income and the support of spouse, family, or friends, respectively, had the greatest impact on exclusive feeding, so their role has been mentioned in 11 studies. An increase in family income was associated with an increase in the probability of EBF [38–40, 42, 43, 45–47, 51, 52, 59]. Poverty, and employment and earnings were associated with breastfeeding, indicating a relationship between economic status and breastfeeding [53]. Mothers who received more support from their husbands and relatives in breastfeeding were more likely to have EBF [12, 31, 37, 44, 54, 59].

3- Factors related to breastfeeding

The factors related to breastfeeding also involve many variables. A review of studies has highlighted factors such as the use of feeding bottles and pacifiers, the time to start breastfeeding after delivery (the first one to four hours after birth), the mother's confidence in milk production, anxiety about insufficient milk, breastfeeding self-efficacy [52, 56, 64], feeding on demand [30, 48], the number of breastfeeding sessions [30, 41], feeding with other nutrients [35, 56], history of breastfeeding [37], lack of milk [41], and the use of formula [36]. These factors were found to be effective in determining the duration and likelihood of EBF. It has been stated in nine studies that mothers who used bottles and pacifiers for their babies had a shorter duration of exclusive feeding [30, 35, 36, 38, 41, 48, 49, 54, 62]. The timing of when breastfeeding begins after birth was mentioned in seven studies. Various studies considered the optimal period to begin breastfeeding as one to hours after delivery. Delays in initiation have been associated with a decrease in EBF during the first six months after delivery [37, 41, 48, 50–52, 54, 55]. In three studies, it was noted that mothers who were confident about the sufficiency of their milk and did not have anxiety in this regard were more likely to practice EBF [12, 55, 61].

4- Clinical factors

The next group pertains to clinical factors. In this context, factors such as the number of deliveries, type of delivery, smoking and exposure to cigarettes, place of delivery [49, 53, 63], number of babies [40, 51], breast complications [41, 56], health history [62], alcohol consumption and contraceptive use [38] were found to be effective in EBF. In this group, the most significant factor was the number of deliveries, mentioned in ten studies. Multiparous mothers had a higher chance of EBF [28, 30, 31, 40, 44, 49, 54, 56–58], however, in 2 of 9 articles, these mothers had a lower EBF rates [30, 54]. The type of delivery was another variable, mentioned in seven articles [28, 29, 31, 45, 48, 50, 54]. Four of these seven studies reported that vaginal delivery increased the likelihood of EBF [31, 48, 50, 54],while another three studies indicated that mothers who had cesarean deliveries had higher rates of EBF [28, 29, 45]. Additionally, five studies have emphasized the role of smoking. Mothers who smoked or were exposed to cigarettes had a reduced chance of EBF [35, 38, 40, 44, 54].

5- Factors related to health and medical services

Another group of important factors related to EBF involves health and medical services. Various studies have mentioned the role of providing information,

breastfeeding education and counseling, pregnancy care and the number of visits (at least 8 visits), postpartum care [51], child-friendly hospitals [64] and high levels of prenatal services (adequate health staff and appropriate equipment) are related with EBF [42]. It has been shown in eight studies the most significant impact is attributed to providing information, education, and counseling regarding breastfeeding and the benefits of breast milk, which are offered to the mother in health and treatment centers during care or after delivery. Likewise, frequent pregnancy care and increasing the number of visits positively affect EBF [28, 31, 38, 42, 43, 46, 50–52].

6- Factors related to the baby

Another group of factors is related to the baby. Variables such as the baby's age, baby's sex, birth weight [30, 40, 55], birth rank [31, 61], insufficient weight gain [61], gestational age [35], frequency of crying [29], the initial contact of the baby with the mother's breast, skin-to-skin contact [36], refusal to eat milk [41] and healthy baby (absence of infant comorbidities) [42] were effective in determining the possibility of EBF. The strongest evidence was for EBF to be higher in younger babies. Most of the studies have linked younger age of infancy for beginning breastfeeding (between zero and one or two months) to an increased probability of EBF [28, 38, 42, 43, 46, 51, 52, 54]. The baby's sex was another factor, mentioned in six studies, and in all of them, the chance of exclusively breastfeeding was higher among female babies [31, 33, 40, 42, 43, 52].

7- Factors related to the mother

The factors related to the mother also influence the probability of achieving EBF. In this group, there are variables such as: mother's intention and attitude to exclusively breastfeed [36, 47, 57], her knowledge [47, 48, 51], postpartum depression [35, 54], difficulty in calming the baby [29], maternal feelings towards breastfeeding [40], wanted pregnancy [33] and the decision to breastfeed [63] are mentioned in the studies. In three studies, it has been stated that mothers who have a positive intention and attitude towards breastfeeding their baby have a higher chance of achieving EBF six months after delivery [36, 47, 57]. Additionally, it has been shown in three other studies that a mother's knowledge about breastfeeding and its benefits leads to an increase in EBF [47, 48, 51]. Additionally, previous breastfeeding experience was associated with the possibility of increased breastfeeding. Therefore, multiparous women, especially those with previous breastfeeding experience, were more likely to breastfeed for an extended period due to their knowledge, attitude, self-efficacy, and ability to manage problems [58].

A- Meta-analysis Results

Of the 38 articles included in the systematic review, 19 articles were not suitable for meta-analysis due to insufficient sample size, similarity to other articles, or inadequate data. Ultimately, 19 articles with a combined sample size of 70,183, were included in the meta-analysis to investigate predictive factors of EBF. The results were categorized and reported in the following categories:

A.1 Mother's awareness of the benefits of breastfeeding and EBF

A meta-analysis of four articles with a combined sample size of 2,259 was conducted to investigate the OR effect size of mother's knowledge and EBF. An OR of 2.70 was obtained (95% CI 1.28, 5.72), indicating that higher level of awareness of the benefits of breastfeeding increases the odds ratio of EBF by 2.70 times, which was reported to be statistically significant [37, 39, 41, 51]. Due to high heterogeneity (I^2 = 87.73%), a random model was used for the meta-analysis (Fig. 2).

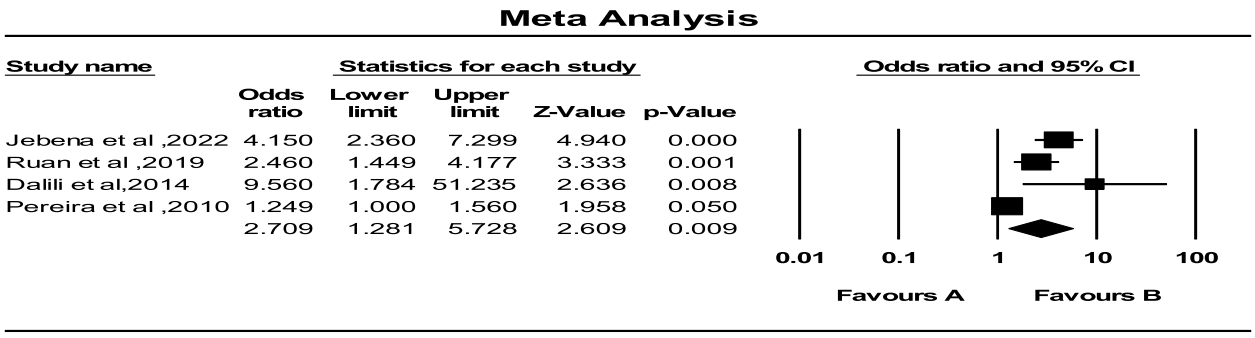

Fig. 2 Forest plot diagram of mothers' awareness of the benefits of breastfeeding and EBF

A.2 Mother's support for breastfeeding in child-rearing circle and EBF.

A meta-analysis of five articles with a combined sample size of 48,541 was conducted to investigate the effect size of OR for mother's support in the child's rearing circle and EBF. A significant OR of 2.57 was obtained (95% CI 1.50, 6.29).. Mother's support for breastfeeding (Support from husband or family, support for breastfeeding in primary health care, social support, child-rearing support, supported with appropriate and consistent education) in the child-rearing circle increases the odds of EBF by 2.57 times, which is statistically significant [12, 37, 40, 53, 62]. Due to the moderate heterogeneity of $I^2 = 96.87\%$, a random-effects model was used for the meta-analysis (Fig. 3).

A.3 Breastfeeding in the first hourand EBF

A meta-analysis of six articles with a combined sample size of 15,564 was conducted to investigate the effect size of OR for breastfeeding in the first hour and EBF. An OR of 1.853 was obtained (95% CI 1.14, 3.00), indicating that breastfeeding in the first hourafter birth (< 24 h) increases the odds of EBF by 1.853 times, which was reported to be statistically significant [36, 41, 50–53]. Due to high heterogeneity ($I^2 = 84.53\%$), a random-effects model was used for the meta-analysis (Fig. 4).

A.4 Maternal education level and EBF

A meta-analysis of six articles with a combined sample size of 36,005 was conducted to investigate the effect size of OR for higher maternal education level and EBF. An OR of 1.44 was obtained (95% CI 1.16, 1.78). Higher maternal education levels increase the odds of EBF by 1.44 times, which is statistically significant [37, 44, 52, 56, 59, 60]. Due to the high heterogeneity ($I^2 = 49.38\%$), a random-effects model was used for the meta-analysis (Fig. 5).

A.5 Annual income and EBF

A meta-analysis of seven articles with a combined sample size of 58, 675 was conducted to investigate the effect size of OR for upper middle annual income and EBF. An OR of 1.283 was obtained (95% CI 1.68, 1.54). The findings showed that sufficient annual income increased the

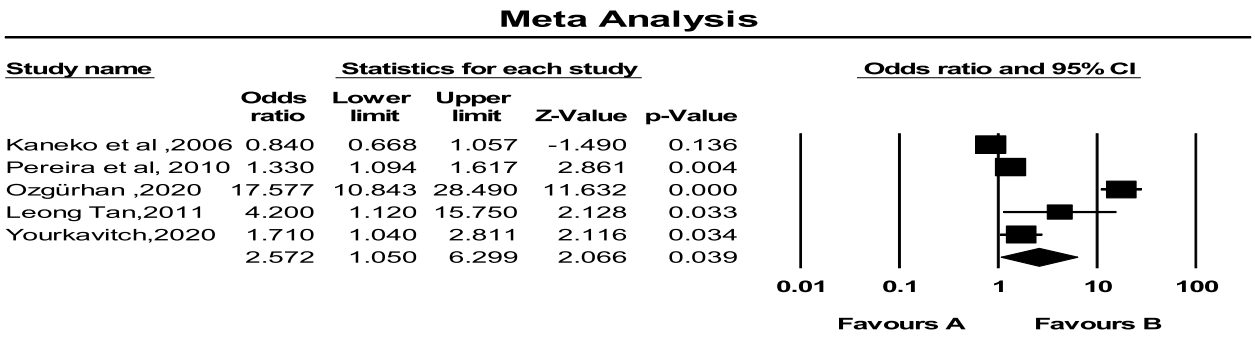

Fig. 3 Forest plot diagram of mother's support in child-rearing circle and EBF

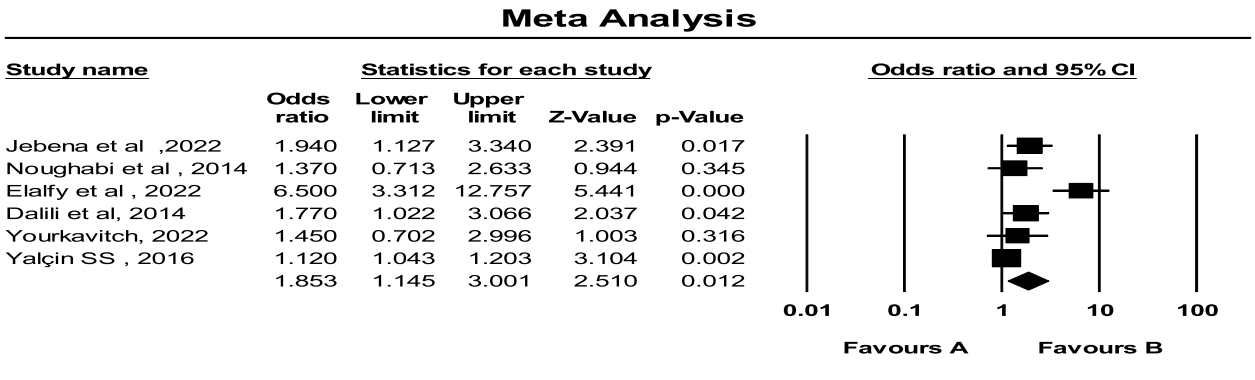

Fig. 4 Forest plot diagram of breastfeeding in the first hour and EBF

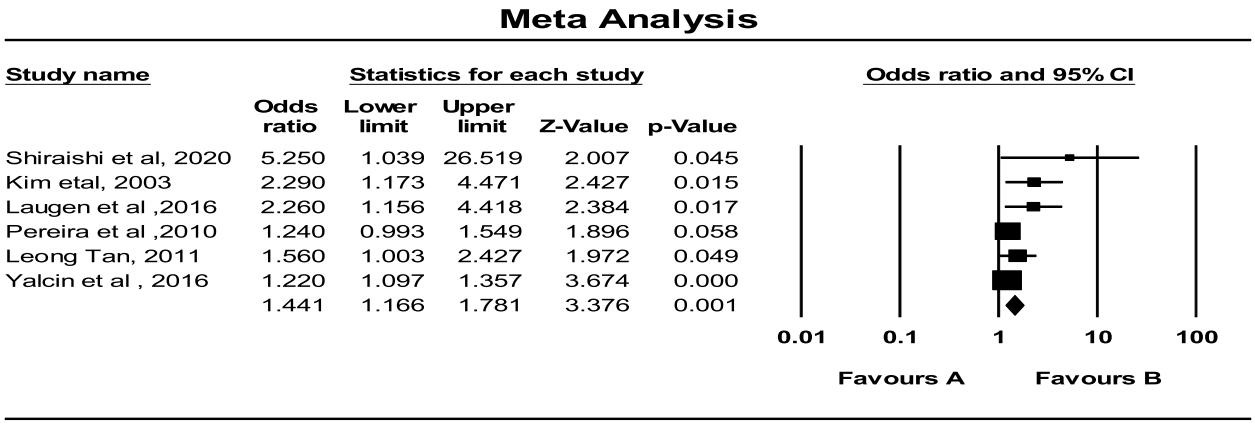

Fig. 5 Forest plot diagram of maternal education level and EBF

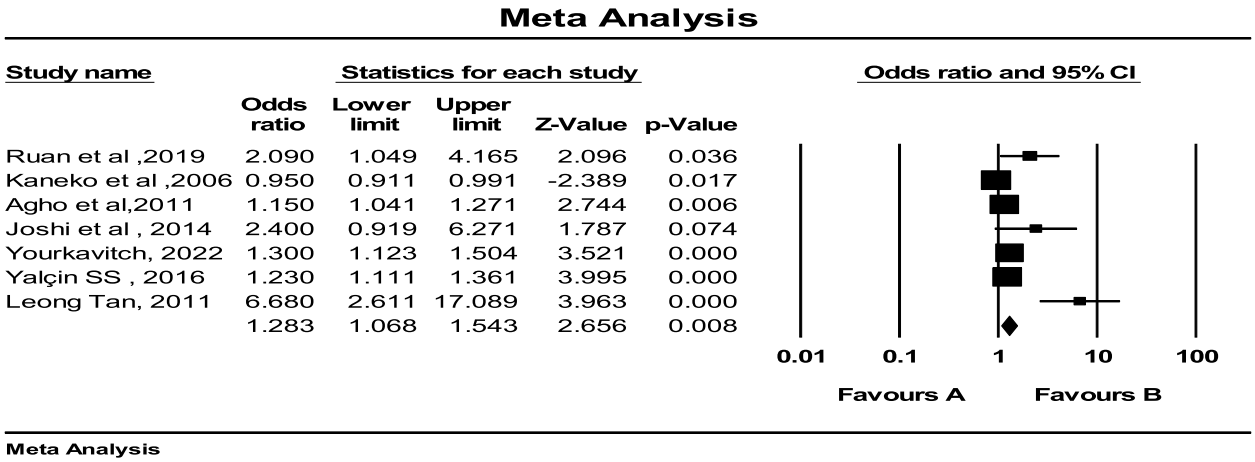

Fig. 6 Forest plot diagram of Upper Middle annual income and EBF

odds of EBF by 1.283 times, approaching statistically significant [39, 40, 43–45, 52, 53]. Due to high heterogeneity (I^2 = 90.41%), a random-effects model was used for the meta-analysis (Fig. 6).

A.6 Mother's age and EBF

A meta-analysis of four articles with a combined sample size of 51,710 was conducted to investigate the effect size of OR for mother's age and EBF. An OR 0.971 was obtained (95% CI 0.86, 1.09). Mother's age between 28–35 years increases the odds of EBF by 1.971 times, which is not statistically significant [50, 52, 60, 64]. Due to high heterogeneity, I^2 = 85.91%, a random-effects model was used for the meta-analysis (Fig. 7).

A.7 Antenatal clinic visits and EBF

A meta-analysis of five articles with a combined sample size of 13,626 was conducted to investigate the effect size of correlation coefficient (R) for antenatal clinic visits (at least one to three prenatal clinic visits) comparing with no visit and EBF. A correlation of R = 0.108 was obtained (95% CI 1.27, 4.18),, which was reported to be statistically significant [28, 43, 50, 52, 58]. Due to moderate heterogeneity, I2 = 48.38%, a random-effects model was used for the meta-analysis (Fig. 8).

A.8 Multiparity and EBF

A meta-analysis of four articles with a combined sample size of 47,598 was conducted to investigate the effect size of OR for multiparity and EBF. An OR of 1.50 was obtained (95% CI 1.07, 2.11), indicating that multiparity ≥ 2 increases the odds of EBF by 1.50 times, and this was reported to be statistically significant [40, 44, 57, 58]. Due to high heterogeneity (I^2 = 86.479%), a random-effects model was used for the meta-analysis (Fig. 9).

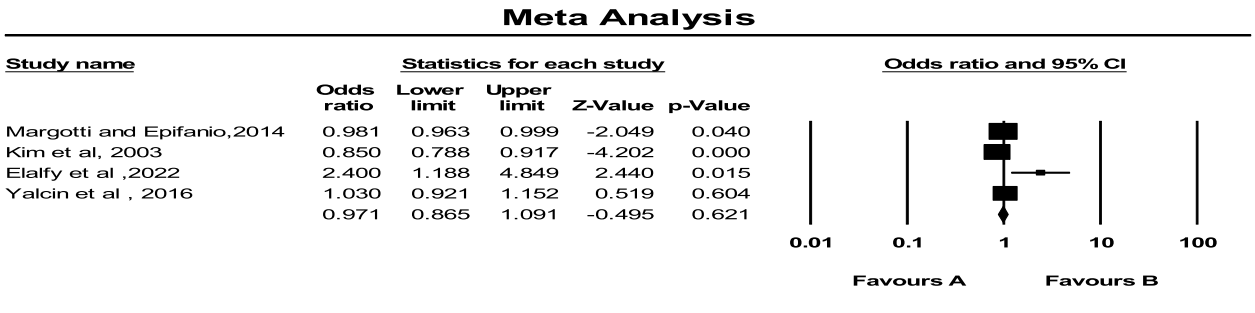

Fig. 7 Forest plot diagram of mother's age (28- 35 years old) and EBF

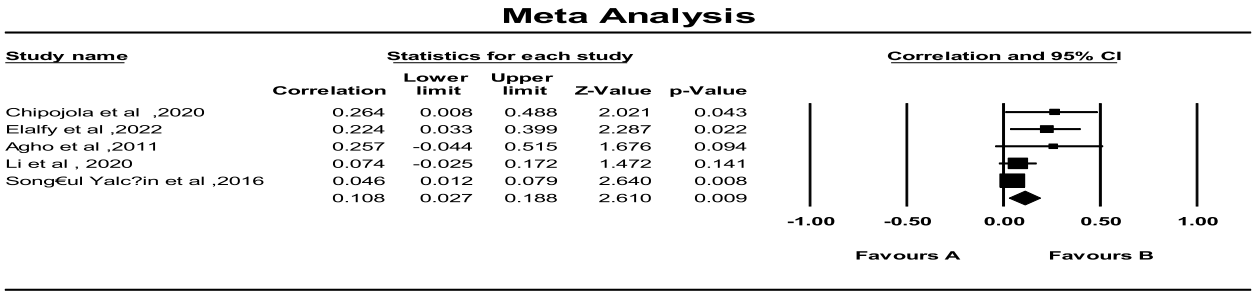

Fig. 8 Forrest plot diagram of antenatal clinic visits and EBF

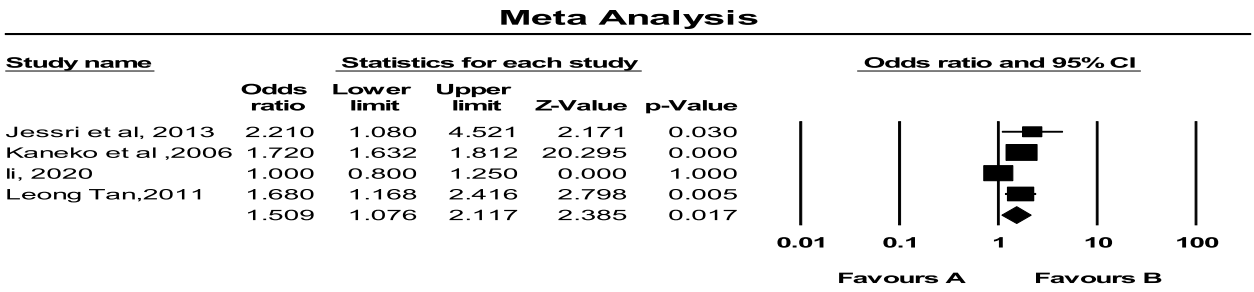

Fig. 9 Forrest plot diagram of Multiparity and EBF

A.9 Self-Efficacy and EBF

A meta-analysis of three articles with a combined sample size of 613 was conducted to investigate the effect size of OR for self-efficacy and EBF. An OR of 1.067 was obtained (95% CI 1.04, 1.08). Self-efficacy increases the odds of EBF by 1.067 times, and this was reported to be statistically significant [56, 58, 64]. Due to the lack of heterogeneity, a fixed-effects model was used for the meta-analysis(Fig. 10).

A.10 Normal Vaginal Delivery (NVD) and EBF

A meta-analysis of three articles with a combined sample size of 14,777 was conducted to investigate the effect size of OR for NVD and EBF. An OR of 2.22 was obtained (95% CI 0.91, 5.43). NVD increases the odds of EBF by 2.22 times; however, this is not statistically significant [50, 52, 54]. Due to high heterogeneity, I^2= 95.77%, a random-effects model was used for the meta-analysis (Fig. 11).

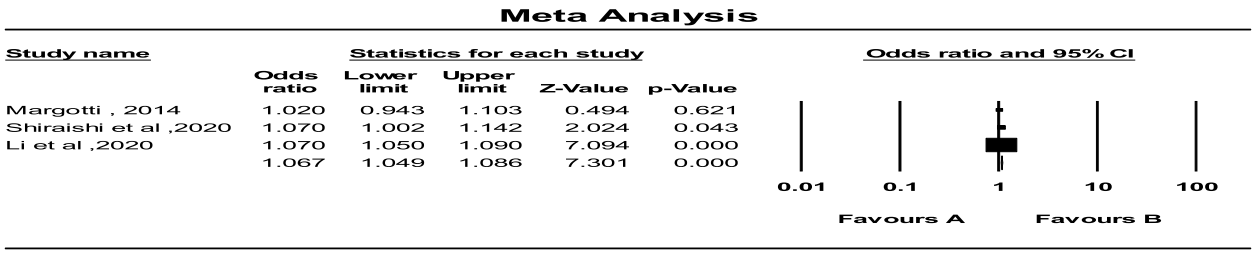

Fig. 10 Forrest plot diagram of Self-Efficacy and EBF

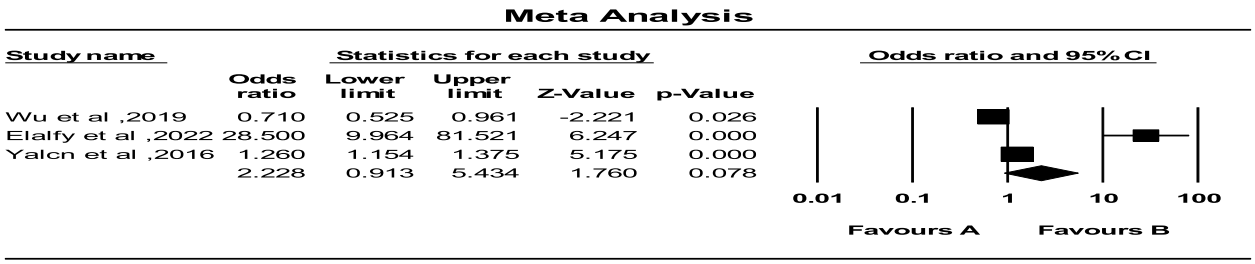

Fig. 11 Forrest plot diagram of NVD and EBF

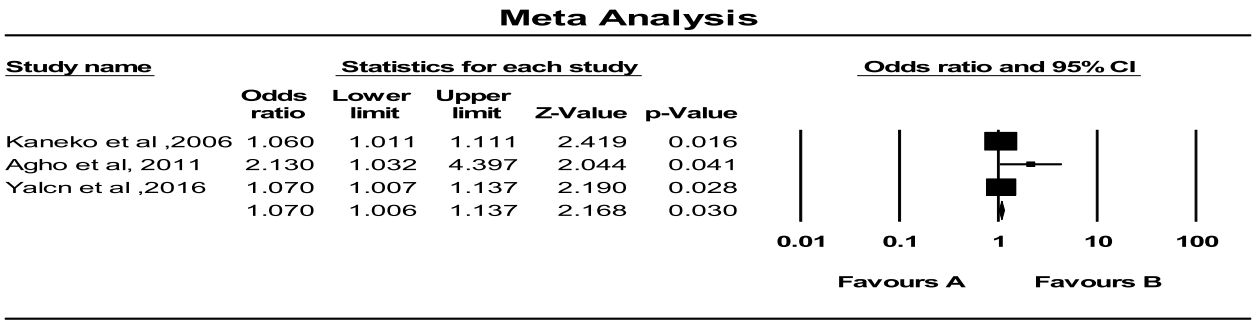

Fig. 12 Forrest plot diagram of Female sex of infant and EBF

A.11 Female sex of infant and EBF

A meta-analysis of three articles with a combined sample size of 51,67 was conducted to investigate the effect size of OR for Female and EBF. An OR of 1.07 was obtained (95% CI 1.00, 1.37). Female increases the odds of EBF by 1.07 times, which is statistically significant [40, 43, 52]. Due to moderate heterogeneity ($I^2 = 44.01\%$), a random-effects model was used for the meta-analysis (Fig. 12).

Discussion

In this systematic review and meta-analysis, the factors influencing EBF in postpartum women were classified into seven categories: demographic characteristics of the mother and family, neonatal factors, factors related to breastfeeding, clinical factors, health and treatment services, socio-economic factors, and maternal factors.

Demographic characteristics are among the most important variables affecting EBF. Within these variables, the strongest evidence was for an association between high education and EBF. These findings align with a review from Ethiopia, which showed that higher maternal education enhances knowledge of newborn health and breastfeeding, enabling mothers to identify and address breastfeeding issues more effectively [65]. Additionally, a meta-analysis from Qena shows that increased education correlates with higher rates of EBF [66]. In fact, maternal education is associated with maternal ability and self-efficacy. Mothers with higher education seek reliable scientific sources to solve their breastfeeding problems [43, 67]. The present study indicates that self-efficacy increases the odds of EBF by 1.067 times. Breastfeeding self-efficacy, or a mother's confidence in

her ability to breastfeed, is linked to positive outcomes in breastfeeding initiation, duration, and exclusivity [68, 69]. Therefore, public health policies should focus on programs that enhance parental education and support maternal self-efficacy to positively impact breastfeeding practices [70–72].

Household income and support from family and friends were the most influential socio-economic factors. The current study showed that supporting the mother increases the chance of EBF by 12.57 times. Additionally, average to high annual income increases the odds of EBF by 1.283 times. EBF appears to be influenced by economic factors. Studies show that poverty and poor economic conditions reduce the success of EBF [53]. Furthermore, research indicates that EBF is significantly influenced by pre-pregnancy nutritional status, which is affected by family income. Therefore, the economic status of the family plays an important role in the success of breastfeeding [73]. Mothers in low-income households often work outside the home, limiting their time for breastfeeding [74]. Studies show a socioeconomic gradient in breastfeeding, with higher income and education levels correlating with increased breastfeeding rates [75]. Therefore, improving economic and social conditions is crucial for enhancing EBF rates, warranting attention in government policies [76].

Evidence show that emotional and psychological support, support in caring for the baby, support with household responsibilities, financial support and professional health increase EBF. Breastfeeding support should be provided as a social culture and part of routine health services [77]. The success of breastfeeding programs requires commitment, supportive policies, and comprehensive breastfeeding promotion, advocacy, and support programs [78]. Also, the participation of fathers in breastfeeding increases its success and is one of the determining factors in this process [79]. Support from husbands and other family members can increaseenhance a the mother's ability to breastfeed exclusively, helping her feel feeling calm and comfortable [80]. In addition to family support, it should be kept in mind that the support includes the support provided by healthcare providers such as midwives and nurses [81]. The results showed that support from employees and service providers can significantly increase the duration of the EBF [82, 83]. It is essential that individuals in supportive roles maintain a positive attitude toward breastfeeding. Support can have a positive effect on this health behavior [84]. Breastfeeding support needs to begin before birth and be given throughout the postnatal period and beyond. Families and health workers must pay attention to this issue [85].

Among the factors influencing breastfeeding, the timing of initiation after childbirth was particularly significant. The evidence shows that breastfeeding within the first 24 h of birth is a key determinant of EBF [86]. Evidence suggests that vaginal delivery in a health facility was strongly associated with early initiation of breastfeeding. This is because the importance of breastfeeding is taught to the mother, and skin-to-skin contact and early breastfeeding are done immediately after delivery. Vaginal delivery is also important in the sense that the mother is almost conscious and available after giving birth and she can actively participate in breastfeeding [87]. Enhancing health services for pregnancy and childbirth, increasing normal deliveries, and training skilled birth attendants in childbirth, early breastfeeding initiation, and skin-to-skin contact are essential for improving breastfeeding rates [88]. A study in Bangladesh showed that interventions such as skin-to-skin contact and early initiation of breastfeeding impact EBF. Therefore, the government should help promote skin-to-skin contact and early initiation of breastfeeding through targeted interventions such as prenatal care and skilled birth attendants [89].

Clinical factors were among the other areas affecting the success of EBF. Among these, the number of births was reported to be the most influential factor. The results of the study by Hackman et al. also showed that the number of births has a positive relationship with breastfeeding success, and in nulliparous women, the time interval between childbirth and the start of the first breastfeed was also greater than in multiparous women [90]. Additionally, the results of the study by Kitano et al. showed that the mother's primiparous status and age over 35 years are factors associated with the reduction of EBF [91]. Studies mention that having a previous child leads to breastfeeding experience and the mother can identify her breastfeeding problems. Therefore, multiparity is an influential factor in breastfeeding [91, 92].

Research indicates that maternal age significantly influences EBF success, with mothers in their 20 s experiencing the highest rates of EBF. As mothers age, busy lifestyles can lead to reduced breastfeeding duration, while adolescent mothers often struggle due to a lack of knowledge and skills [93]. Consequently, healthcare programs should focus on providing optimal care and education for adolescent and aging mothers to improve breastfeeding outcomes [94].

Health services were another key area related to EBF. Among these services, mothers' education and counseling regarding breastfeeding, along with visits, and care during pregnancy, were identified as some of the most important factors. The results of the Florida Boa and Augustin study also showed that the provision of correct and complete counseling by health care providers to nursing mothers has a significant role in the success of

EBF. Appropriate breastfeeding education and counseling increase mothers'awareness and help identify and resolve breastfeeding problems [95].

Prenatal visits and care during pregnancy have a significant positive relationship with EBF. The present study showed that making at least one to three prenatal clinic visits increases the chance of EBF by 2.47 times. The results of a meta-analysis conducted in Ethiopia also showed that EBF was significantly higher in mothers who received prenatal care [96]. This difference may be because mothers who visit clinics and health centers for care receive knowledge related to nutrition and health, which has a significant impact on EBF [97].

The present study showed that the sex of the baby also affects breastfeeding. The female sex of an infant increases the likelihood of EBF by 1.07 times.. The US study which found sons of Hispanic mothers had lower rates of breastfeeding than daughters [98]. The boys were in an unfavorable position compared to girls regarding the initiation and duration of breastfeeding. On the other hand, there is the thought that boys have more nutritional needs than girls and the use of formula and supplementary food increases in boys. The future research is needed into the reason why EBF was highter in baby girls [99].

Finally, our review study showed that EBF is more likely among women who have greater support through knowledge and awareness, education, prenatal care, and breastfeeding in the first hour after birth. In fact, EBF is not only one of the best and most effective solutions for reducing malnutrition in infants and reducing the mortality of children under 5 years of age, but it also provides numerous health benefits for the mother [100].

Conclusion

The results of the present study showed that increasing society awareness about breastfeeding, comprehensive support for the mother (social, political, economic, family, psychological), having a natural birth, starting feeding in the first hours of life, and receiving appropriate health care are effective on breastfeeding. Therefore, by providing solutions such as increasing awareness and education of breastfeeding, political and financial of brestfeeding, social, and family support for breastfeeding women, creating facilities and programs to encourage normal delivery, providing appropriate maternal services, and improving maternal and newborn care in the first hours of life can be increased of EBF.

Abbreviations

CMA	Comprehensive Meta-Analysis Software
EBF	Exclusive breastfeeding
MeSH	Medical subject files and headings
NOS	Newcastle-Ottawa scale
ORS	Oral rehydration solution
REML	Restricted maximum likelihood
PROSPERO	Prospective Register of Systematic Reviews
RCT	Randomized controlled trial
PRISMA	Preferred Reporting Items for Systematic Review and Meta-Analysis

Supplementary Information

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Additional file 1

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Authors' contributions

M.K. and M.S. (corresponding author) conceived the study and drafted the manuscript. M.Y., S.H., Z.K., Z.E., M.S., B.KH., M.J., and H.N. acquired the data and approved the final version of the paper. M.S. is the guarantor for the study. All the authors read and approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

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Competing interests

The authors declare no competing interests.

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