International Journal of Public Health (2019) 64:999–1014
https://doi.org/10.1007/s00038-019-01266-5

REVIEW

The effect of home-based intervention with professional support on promoting breastfeeding: a systematic review

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Received: 12 October 2018 / Accepted: 29 May 2019 / Published online: 14 June 2019

Abstract

Objectives Low breastfeeding rate and high early cessation of breastfeeding are observed worldwide. There is a need to review the effects of home visits with professional support on promoting breastfeeding. The present study evaluated the efficacy of home visits on promoting breastfeeding outcomes (i.e., breastfeeding initiation rate, exclusive breastfeeding rate/duration, and breastfeeding rate/duration) using a systematic review.

Methods Search of EMBASE, MEDLINE, CENTRAL—Cochrane central register of controlled trials, PsycInfo, and ClinicalTrials.gov was conducted by February 28, 2019, to identify relevant studies.

Results A total of 26 studies were included. Fourteen of the included studies investigated rate/duration of exclusive breastfeeding; ten of them demonstrated a significant increase on the rate/duration of exclusive breastfeeding. Sixteen of the included studies investigated rate/duration of breastfeeding; four of them demonstrated a significant increase on the rate/duration of breastfeeding. Four studies evaluated initiation of breastfeeding and three of them did not show a significant effect.

Conclusions Findings suggest that breastfeeding can be increased by home-based interventions with professional support. Support-based intervention is likely an effective way to promote breastfeeding.

Keywords Breastfeeding · Home visits · Professional support · Systematic review

Introduction

World Health Organization (WHO) recommends that infants should be fed exclusively on breast milk up to 6 months of age, and with continued breastfeeding along with complementary foods up to 2 years of age (World Health Organization 2003). Breastfeeding has numerous benefits on infants' and mothers' health. For example, infants who are breastfed have lower risk of respiratory tract infections, gastrointestinal tract infections, asthma, sudden infant death syndrome, obesity, and type 1 diabetes (Ip et al. 2007). For maternal health, breastfeeding is found to be positively associated with decreasing risk of type II diabetes, osteoporosis, breast cancer, ovarian cancer and postnatal depression (Ip et al. 2007).

Although the benefits of breastfeeding have been widely established, early cessation of breastfeeding is a worldwide issue (Centers for Disease Control and Prevention 2016; Kools et al. 2005; Organization for Economic Co-operation and Development 2009). Globally, the percentage of exclusive breastfeeding for 6 months is only 37% (United Nations Children's Fund 2012). Late initiation of breastfeeding has found to be a strong risk factor for early breastfeeding termination (DiGirolamo et al. 2001; Marandi et al. 1993). Despite the effort and success on breastfeeding promotion after childbirth in hospital settings, the progressive decrease in the length of the

Major Revision: 16 November 2018.
Minor Revision: 24 April 2019.

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s00038-019-01266-5) contains supplementary material, which is available to authorized users.

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postpartum hospital stay observed (Buie et al. 2010) implies that mothers may leave the hospital before milk come-in, without having adequate opportunity for learning effective breastfeeding techniques and early signs of breastfeeding failure (Braveman et al. 1995).

Due to early hospital discharge after delivery, healthcare professionals have proposed to provide postpartum follow-up for both mothers and their newborns through home-based support (Eaton 2001; Vallely et al. 2005). Home visiting for breastfeeding education and support is a relatively new concept in most countries. It was developed to provide support for mothers to promote health and breastfeeding outcomes. It was commonly provided by midwives or lactation consultants. The content of the home visit varies but typically includes breastfeeding education, skills and problem management, emotional support, discussion on various aspects with regards to infant care, and referrals to physicians if needed (Johnson et al. 1999). Various home-based support trials in perinatal period have been done in the recent years, and the responses from the healthcare professionals and mothers have been positive (Johnson et al. 1999). However, mixed results have been observed with regard to its efficacy in promoting breastfeeding outcomes, and varied research designs have been used by studies that have demonstrated effectiveness. In addition, there is a lack of in-depth systematic review on the timing and the features of home-based interventions. There is a need to conduct a synthesis on the efficacy of breastfeeding promotion programs conducted out of hospital in promoting breastfeeding, and to identify the components that may lead to program success.

Three systematic reviews on the effects of interventions with professional support on promoting breastfeeding have been conducted. These studies suggested that interventions with professional support had the potential to increase duration of breastfeeding (Britton et al. 2007; Hannula et al. 2008) and exclusive breastfeeding (Skouteris et al. 2014). However, all three reviews did not only include interventions that were conducted through home visits, but also interventions that were conducted through hospital/clinic visits, group education, phone counseling, etc. One review also included volunteer support (Britton et al. 2007) and another review only included studies conducted in high-income countries with a follow-up period of less than 4 months (Skouteris et al. 2014). From our understanding, there was no systematic review specifically concerning home-based professional support. A review on the efficacy of home-based interventions with professional support can provide important insights into the design of health programs to promote breastfeeding among women.

The present study

Home visits with professional support for breastfeeding have been widely implemented in many settings. However, a systematic evaluation on its efficacy is lacking. The present study aimed to conduct a systematic review on the efficacy of home-based interventions with professional support on breastfeeding outcomes (i.e., breastfeeding initiation (BFI) rate, exclusive breastfeeding (EBF) rate/duration, and breastfeeding (BF) rate/duration) and to identify the effective components that may lead to program success.

Methods

Sources

To extract studies evaluating the efficacy of home-based intervention with professional support, studies of all types, including journal articles, book chapters, and dissertations, were identified in five major online databases, namely MEDLINE, CENTRAL—Cochrane Central Register of Controlled Trials, PsycInfo, EMBASE and clinicaltrials.gov using the medical subject headings (MeSH) terms "breast feeding," "lactation," "nursing," "weaning" and "clinical trial." Equivalent free-text search terms, such as "breastfeed," "lactating," "weanling" "home visit," "community care" and "randomized" were used. A list of the keywords used in the article search is presented in Table 1.

Study selection

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA, 2015) guidelines were followed in performing the systematic review.

Table 1 Keywords used in article search

P (Patient)	Breastfeeding [MeSH Terms]/Breastfeed/Lactation [MeSH Terms]/Lactating/Nursing [MeSH Terms]/Pregnant
I (Intervention)	Home/Home visit/Home support/Home counseling/Home consultation/Home care/Community/Community care/Domestic/Outreach
C (Comparator)	–
O (Outcome)	Breastfeeding [MeSH Terms]/Breastfeed/Weaning [MeSH Terms]/Weanling
S (Study design)	Clinical trial [MeSH Terms]/Randomized/Randomly/Trial/Experiment/Experimental

Inclusion criteria

Studies were included if they fulfilled the following criteria: (1) the study included a component on home visit by professionals, which were supplementary to standard care with the purpose of facilitating continued breastfeeding during perinatal period; (2) the home visits were provided by professionals including physicians, nurses, midwives, international board certified lactation consultant (IBCLC) or trained workers who completed either the 18-h or 40-h World Health Organization/United Nations Children's Fund breastfeeding counseling/lactation management courses; (3) the intervention was conducted between antenatal period and postnatal period up to 2 years after delivery; (4) the study had at least one outcome related to breastfeeding, which was defined by BFI rate, EBF rate/duration, or BF rate/duration; and (5) the study used a randomized controlled trial (RCTs) or quasi-experimental trial design.

Exclusion criteria

Studies were excluded if they were interventions specifically designed to preterm babies, low birth weight babies, babies with prenatal disease, born to drug using mothers or babies in the Neonatal Intensive Care Unit (NICU). Articles were also excluded if primary aim of the study was not specifically related to breastfeeding, or used a different sample for post-intervention evaluations.

Screening

Two reviewers independently reviewed and screened the articles. Disagreements were resolved by discussion.

Data synthesis

A descriptive synthesis was conducted. A data extraction form was designed and reviewed by the authors. The following details were coded: location of the study, year of publication, sample characteristics), characteristics of the intervention (e.g., content of the intervention, follow-up time), and outcomes. The following three outcomes with regards to breastfeeding were retrieved: BFI rate, EBF rate/duration, and BF rate/duration. According to the WHO (World Health Organization 1991), EBF was defined as infants being fed only breast milk (no other liquids or solids, including water); and BF was defined as infants being fed with breast milk alone or along with a supplementary food or liquid. In addition, "rate" refers to the proportion of infants receiving any BF/EBF at a specific time point; "duration" refers to the length of time that any BF/EBF lasts or continues; and "initiation rate" was defined as the proportion of the first BF at a specific time point (e.g., within 1 h of birth). To adopt a more systematic approach to synthesis, findings were grouped and discussed by the type of outcome measured (i.e., BFI rate, EBF rate/duration, or BF rate/duration), then further by the successfulness of the intervention (i.e., whether it produced a statistically significant effect on improving relative outcomes at $p < .05$ level). A vote counting, which was a simple but common way of data synthesis by comparing the number of positive and negative studies, was conducted to count the number of successful/unsuccessful studies based on the significance of the change in the outcomes. For studies that assessed outcomes at multiple time-points, multiple settings/locations, or assessed both EBF/BF rate and duration, studies were considered successful only if statistically significant changes were consistently observed in all of the multiple outcomes.

Assessment of risk of bias

Two reviewers assessed the risk of bias in the included studies independently using the Cochrane Collaboration's tool (Higgins et al. 2011; Higgins and Green 2009). Any disagreement was resolved through discussion. RevMan version 5.3.5 was used to generate the figure and summary.

Results

Search results

A total of 2009 articles were identified from the five databases. Two-hundred and seventy-one duplicated abstracts were removed. A total of 1580 citations did not meet the inclusion criteria. A total of 158 citations were retained for further examination of their full texts. Among them, the full texts of eight citations could not be retrieved either through interlibrary loans or contacting the authors. Overall, a total of 26 articles were retained for coding (see Fig. 1).

Risk of bias in the included studies

Figure 2 summarizes the assessment of risk of bias for the 26 individual trials. Allocation concealment was judged to be adequate in 14 studies (14/26). Only five trials (5/26) reported blinding of participants and personnel. Blinding of outcome assessors was judged to be adequate in 15 trials (15/26), and incomplete outcome data were judged to be adequately dealt with in 14 studies (14/26).

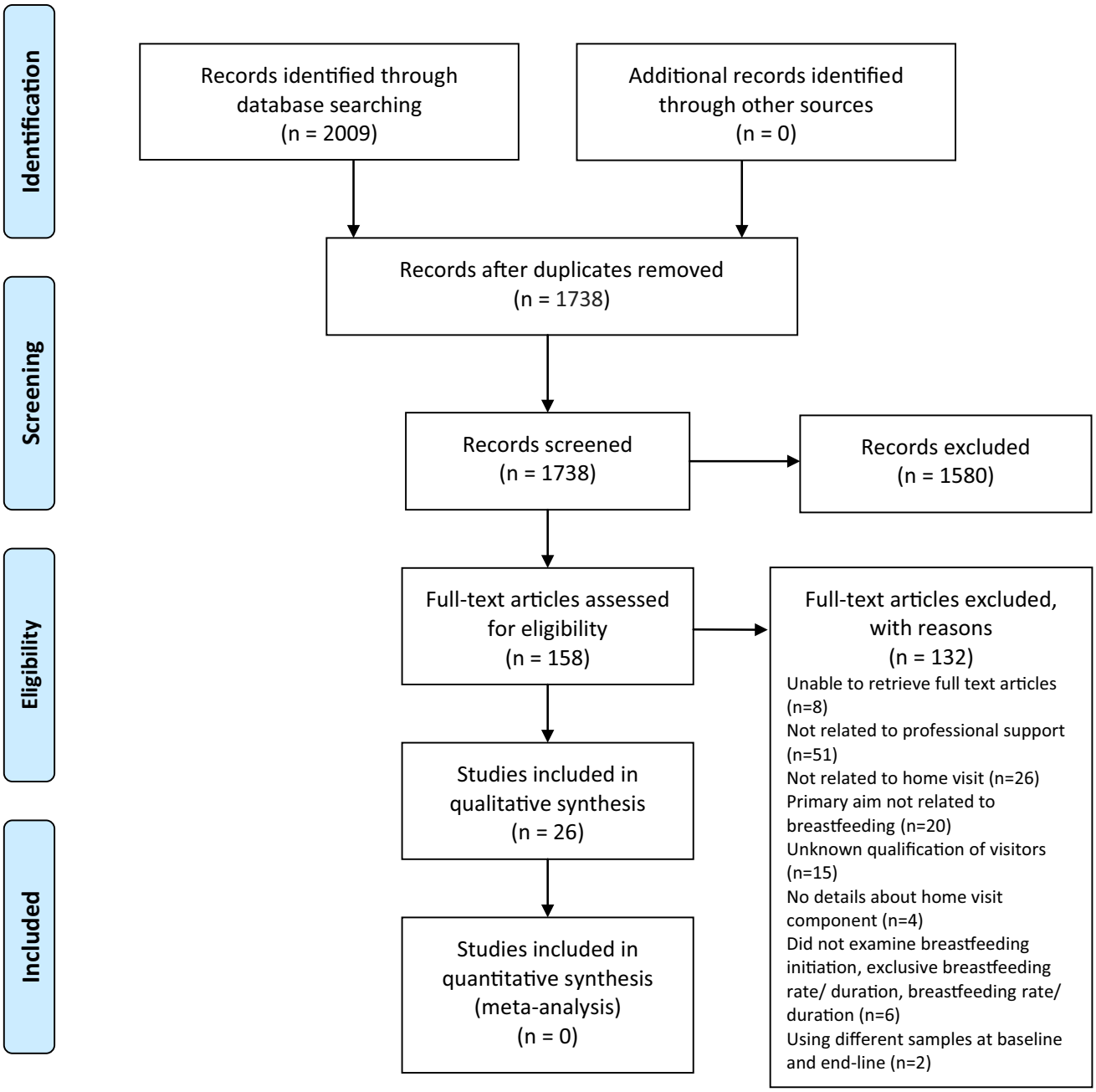

Fig. 1 PRISMA flow diagram of selection process of studies relevant to home-based intervention with professional support on promoting breastfeeding. From: Moher et al. (2009)

Study characteristics

The sample size of the studies varied considerably from 52 to 7483. Five studies were undertaken in USA, four in Brazil, three each in Australia, Africa and Canada, two in Bangladesh, and one each in Switzerland, Denmark, Syria, Italy, Turkey and Netherlands. Nineteen of them were randomized control trials, six were cluster randomized control trials, and one was a nested randomized control trial (Table 2 of ESM).

Seven interventions were implemented by home visitors who were trained by using 18 h/40 h WHO/UNICEF Breastfeeding Counseling Training Course (Anderson et al. 2005; Ara et al. 2018; Coutinho et al. 2005; Engebretsen et al. 2014; Khan et al. 2017; Kimani-Murage et al. 2017; Tylleskar et al. 2011). Seven interventions were conducted by nurses (Albernaz et al. 2003; Gagnon et al. 2002; Kronborg et al. 2007; McLachlan et al. 2016; Paul et al. 2012; Pugh and Milligan 1998; Wen et al. 2011). Five interventions were conducted by midwives (Bashour et al.

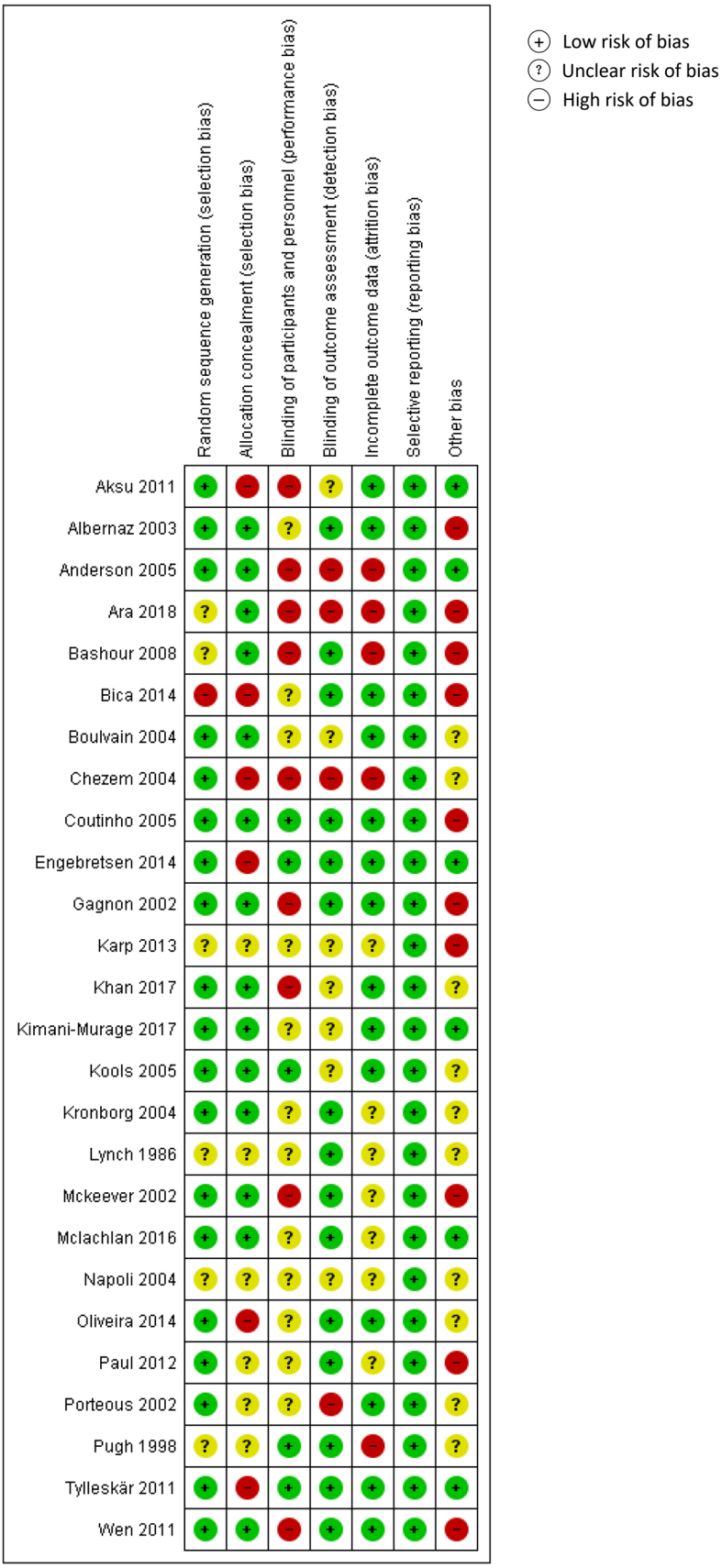

Fig. 2 Risk of bias summary: review authors' judgements about each risk of bias item for each included study

2008; Boulvain et al. 2004; Di Napoli et al. 2004; Karp et al. 2013; Porteous et al. 2000). Three of them were conducted by IBCLC (Chezem et al. 2004; Lynch et al. 1986; McKeever et al. 2002). The others were delivered by a team with combination of nurse, midwife, lactation consultant, nutritionist or pediatrician (Aksu et al. 2011; Bica and Giugliani 2014; Dias de Oliveira et al. 2014; Kools et al. 2005).

Nine studies selected the participants who intended to breastfeed (Aksu et al. 2011; Albernaz et al. 2003; Anderson et al. 2005; Di Napoli et al. 2004; Engebretsen et al. 2014; Lynch et al. 1986; Paul et al. 2012; Porteous et al. 2000; Tylleskar et al. 2011); five studies selected the participants who started breastfeeding (Bica and Giugliani 2014; Chezem et al. 2004; Dias de Oliveira et al. 2014; Gagnon et al. 2002; McKeever et al. 2002) and twelve studies did not set breastfeeding intention/behavior as inclusive criteria (Ara et al. 2018; Bashour et al. 2008; Boulvain et al. 2004; Coutinho et al. 2005; Karp et al. 2013; Khan et al. 2017; Kimani-Murage et al. 2017; Kools et al. 2005; Kronborg et al. 2007; McLachlan et al. 2016; Pugh and Milligan 1998; Wen et al. 2011).

Effect of home visits with professional support on EBF

Fourteen studies investigated EBF rate/duration. Ten (10/14) demonstrated a significant increase on EBF rate/duration (Aksu et al. 2011; Anderson et al. 2005; Ara et al. 2018; Bashour et al. 2008; Coutinho et al. 2005; Dias de Oliveira et al. 2014; Khan et al. 2017; Kronborg et al. 2007; McKeever et al. 2002; Tylleskar et al. 2011). Of all these significant results, seven studies (7/10) investigated the effects up to 6 months postpartum and all of them shown significantly increased EBF rates/duration by then (Aksu et al. 2011; Ara et al. 2018; Coutinho et al. 2005; Dias de Oliveira et al. 2014; Khan et al. 2017; Kronborg et al. 2007; Tylleskar et al. 2011). Details of the fourteen included interventions are list in Table 2 of ESM and Table 2.

Successful interventions on EBF

Among ten successful interventions for EBF rate/duration (10/14), three (3/10) studies selected the participants who intended to breastfeed (Aksu et al. 2011; Anderson et al. 2005; Tylleskar et al. 2011); two (2/10) studies selected the participants who had started breastfeeding (Dias de Oliveira et al. 2014; McKeever et al. 2002) and five (5/10) studies did not set breastfeeding intention/behavior as inclusive criteria (Ara et al. 2018; Bashour et al. 2008; Coutinho et al. 2005; Khan et al. 2017; Kronborg et al. 2007). Successful interventions tend to be support-based. Among nine of ten successful interventions, the mothers in the experimental condition were provided with the support on positioning (Aksu et al. 2011; Anderson et al. 2005; Bashour et al. 2008; Coutinho et al. 2005; Dias de Oliveira et al. 2014; Khan et al. 2017; Kronborg et al. 2007; McKeever et al. 2002; Tylleskar et al. 2011), one provided hands-on breastfeeding support (Anderson et al. 2005). Most of the successful interventions were knowledge enhancing program, especially on the topics on the benefits for EBF (Aksu et al. 2011; Anderson et al. 2005; Coutinho et al. 2005; Dias de Oliveira et al. 2014; Tylleskar et al. 2011), the mechanism of breastfeeding and milk flow (Aksu et al. 2011; Ara et al. 2018; Coutinho et al. 2005; Dias de Oliveira et al. 2014; Kronborg et al. 2007) and avoidance of the use of feeding bottles and pacifiers (Aksu et al. 2011; Anderson et al. 2005; Dias de Oliveira et al. 2014; Kronborg et al. 2007).

Of the ten successful interventions, four (4/10) commenced in pregnancy and continued to postpartum period (Anderson et al. 2005; Ara et al. 2018; Khan et al. 2017; Tylleskar et al. 2011). And the rest (6/10) studies began intervention after delivery (Aksu et al. 2011; Bashour et al. 2008; Coutinho et al. 2005; Dias de Oliveira et al. 2014; Kronborg et al. 2007; McKeever et al. 2002).

Seven (7/10) of the successful studies consisted of three or more home visits during the intervention period (Anderson et al. 2005; Ara et al. 2018; Coutinho et al. 2005; Dias de Oliveira et al. 2014; Khan et al. 2017; McKeever et al. 2002; Tylleskar et al. 2011), yet the remaining three (3/10) studies contained a basic single home visit (Aksu et al. 2011; Bashour et al. 2008; Kronborg et al. 2007). Majority of the successful interventions had a longer intervention period: from a minimum of 1 day (Aksu et al. 2011), 12 days (McKeever et al. 2002), 30 days (Bashour et al. 2008), 5 weeks (Kronborg et al. 2007), 6 weeks (Anderson et al. 2005) up to 4 months (Dias de Oliveira et al. 2014) though to 6 months (Ara et al. 2018; Coutinho et al. 2005; Khan et al. 2017; Tylleskar et al. 2011).

Unsuccessful interventions on EBF

Four (4/14) out of the fourteen studies did not demonstrate a significant increase in the rate/durations of EBF (Albernaz et al. 2003; Gagnon et al. 2002; Kimani-Murage et al. 2017; Kools et al. 2005). Among the unsuccessful interventions, two (2/4) interventions selected the participants who intended to breastfeed or had started breastfeeding (Albernaz et al. 2003; Gagnon et al. 2002).

Two (2/4) of the unsuccessful interventions were short-term and unstructured in which the number of home visits and content of the education were determined subjectively by evaluation of the community nurses (Gagnon et al. 2002; Kools et al. 2005). Both of them provided only one

Table 2 Details of the fourteen included interventions for exclusive breastfeeding

References, country	EBF outcome		Support with latch and position	Knowledge enhancing education	Time to commence	Intervention period	Follow-up time span (after discharge)	Number of home visits	Who conducted home visits	Control group	Supplementary intervention		
	Sig.	Not sig.									Phone consultation/ hotline	Leaflet/booklet	Drop-out center
Aksu et al. (2011), Turkey	✔		✔	✔	After discharge	Day 3	18 months	1	Nurses and midwives	Received standard breastfeeding education or support from hospital, but no home visit			
Albernaz et al. (2003), Brazil		✔	✔	✔	Postnatal ward	120 days	120 days	6	Nurses	Received standard breastfeeding education or support from hospital, but no home visit	+	+	
Anderson et al. (2005), USA	✔		✔	✔	Prenatal	From prenatal to 6 weeks	3 months	12	Home visitors trained by using WHO/ UNICEF Breastfeeding Training Course	Received standard breastfeeding education or support from hospital, but no home visit	+		
Ara et al. (2018), Bangladesh	✔			✔	Prenatal	From the third trimester to 6 months	6 months	10	Peer counsellors trained by using WHO/ UNICEF Breastfeeding Counselling Course	Received no home visit. No other detail was described			
Bashour et al. (2008), Syria	✔		✔	✔	After discharge	30 days	4 months	4 (group A) or 1 (group B)	Midwives	Received standard breastfeeding education and support from hospital, but no home visit			
Coutinho et al. (2005), Brazil	✔		✔	✔	After discharge	6 months	6 months	10	Home visitors trained by using WHO/ UNICEF Breastfeeding Training Course	Received hospital-based intervention (e.g., support, guidance and encouragement for initiation and exclusive breastfeeding; skin-to-skin contact; position, breastfeeding technique, video daily) but no home visit		+	
Gagnon et al. (2002), Australia		✔			After discharge	Day 3	2 weeks	1	Nurses	Received standard breastfeeding education or support from hospital, but no home visit			
Khan et al. (2017), Bangladesh	✔		✔	✔	Prenatal	From the last trimester to 6 months	6 months	8	Breastfeeding counsellors trained by using WHO/ UNICEF Breastfeeding Training Course	Received standard breastfeeding education or support from hospital, but no home visit			

Table 2 (continued)

References, country	EBF outcome		Support with latch and position	Knowledge enhancing education	Time to commence	Intervention period	Follow-up time span (after discharge)	Number of home visits	Who conducted home visits	Control group	Supplementary intervention		
	Sig.	Not sig.									Phone consultation/ hotline	Leaflet/booklet	Drop-out center
Kimani-Murage et al. (2017), Africa		✔	✔		Prenatal	From pregnancy to 6 months	6 months	24	Home visitors trained by using WHO/ UNICEF Breastfeeding Training Course	The control arm was visited by CHWs who were not trained in MIYCN and they provided standard care		+	
Kools et al. (2005), The Netherlands		✔			Prenatal	14 days	3 months	2	Nurses/ Lactation consultants	Received standard breastfeeding education or support from hospital, but no home visit	+	+	
Kronborg et al. (2007), Denmark	✔		✔	✔	After discharge	5 weeks	6 months	1–3	Nurses	Revived usual practice consisting of one or more non-standardized visits from health visitors who did not receive the 18-h training course		+	
Mckeever et al. (2002), Canada	✔		✔		After discharge	12 days	Not mentioned	3	IBCLC	Received standard breastfeeding education or support from hospital and were discharged using standard hospital criteria at 48–60 h postpartum, but no home visit	+		
Dias de Oliveira et al. (2014), Brazil	✔		✔	✔	Postnatal ward	120 days	6 months	5	Nurses, a nutritionist and a pediatrician	Received standard breastfeeding education or support from hospital, but no home visit		+	
Tylleskär et al. (2011), Africa	✔		✔	✔	Prenatal	From the third trimester to 10 or 20 weeks	6 months	At least 5	Peer counsellors trained by using WHO/ UNICEF Breastfeeding Counselling Course	Mothers and infants in control clusters in Burkina Faso and Uganda were given standard health care only, and in South Africa, peer support for families to obtain birth certificates and social welfare grants by separate counsellors was provided			

or two home visits without any supporting intervention. The remaining studies were relatively long-term intervention with 6 visits and 24 home visits until 3 months and 12 months postpartum, respectively (Albernaz et al. 2003; Kimani-Murage et al. 2017).

Effect of interventions on BF rate/duration

Sixteen studies investigated BF rate/duration. Only 4 (4/16) studies demonstrated a significant increase on BF rate/duration. Among them, two (2/4) investigated the effects on BF rates till 6 months (Aksu et al. 2011; Wen et al. 2011), one investigated the effects on BF duration till 12 months (Wen et al. 2011) and another one till 18 months (Aksu et al. 2011). None of the studies followed the participants till 2 years postpartum. Details of the studies are listed in Table 2 of ESM and Table 3.

Successful interventions on BF rate/duration

Among the four (4/16) successful interventions for BF rate/duration, three interventions (3/4) selected the participants who intended to breastfeed (Aksu et al. 2011; Albernaz et al. 2003; Porteous et al. 2000); and one (1/4) study did not set breastfeeding intention/behavior as inclusive criteria (Wen et al. 2011). Only one (1/4) commenced in pregnancy and continued to postpartum period (Wen et al. 2011). Three of them (3/4) started after delivery (Aksu et al. 2011; Albernaz et al. 2003; Porteous et al. 2000). Successful interventions tend to be support-based and education-based. During home visits, health professions discussed with the participants on the topics of feeding practice (Aksu et al. 2011; Albernaz et al. 2003), the mechanism of breastfeeding and milk flow, and avoidance of the use of feeding bottles and pacifiers (Aksu et al. 2011), and milk expression technique (Albernaz et al. 2003). The participating mothers were provided with support on positioning in three studies (Aksu et al. 2011; Albernaz et al. 2003; Porteous et al. 2000).

All successful interventions were with relatively long intervention period. Two of them had a longer intervention period: from a minimum of 120 days to 12 months and had five or more home visits (Albernaz et al. 2003; Wen et al. 2011). Another two (2/4) successful interventions only had a 1-day or 6-week intervention period and one home visit within the first week after hospital discharge (Aksu et al. 2011; Porteous et al. 2000).

Unsuccessful interventions on BF rate/duration

Among twelve unsuccessful interventions (12/16), four interventions (4/12) selected the participants who intended to breastfeed (Anderson et al. 2005; Di Napoli et al. 2004; Lynch et al. 1986; Paul et al. 2012); three (3/12) studies selected the participants who had started breastfeeding (Bica and Giugliani 2014; Chezem et al. 2004; Gagnon et al. 2002) and five (5/12) did not set breastfeeding intention/behavior as inclusive criteria (Bashour et al. 2008; Boulvain et al. 2004; Kools et al. 2005; McLachlan et al. 2016; Pugh and Milligan 1998).

Of the unsuccessful interventions, two (2/12) commenced in pregnancy and continued to postpartum period (Anderson et al. 2005; Kools et al. 2005). And Majority (10/12) started after delivery (Bashour et al. 2008; Bica and Giugliani 2014; Boulvain et al. 2004; Chezem et al. 2004; Di Napoli et al. 2004; Gagnon et al. 2002; Lynch et al. 1986; McLachlan et al. 2016; Paul et al. 2012; Pugh and Milligan 1998).

Most of the unsuccessful interventions spanned a shorter intervention period with fewer home visits for the participants. Four of them (4/12) provided a single home visit at postpartum (Di Napoli et al. 2004; Gagnon et al. 2002; Lynch et al. 1986; Paul et al. 2012). In three of the (3/12) unsuccessful interventions, participants were visited twice only in their homes (Chezem et al. 2004; Kools et al. 2005; Pugh and Milligan 1998). One of the studies (1/11) provided midwifery visits and the number of visits and the interval between visits were determined by the needs of the family (Boulvain et al. 2004). One (1/12) did not mention the number of home visits provided (McLachlan et al. 2016); Only three studies (3/12) had a relatively longer intervention period, with 4 weeks postpartum (Bashour et al. 2008; Chezem et al. 2004) and 6 weeks postpartum (Anderson et al. 2005), respectively. Furthermore, most of the unsuccessful interventions provided relatively inadequate support on positioning and/or knowledge enhancing education (Chezem et al. 2004; Di Napoli et al. 2004; Gagnon et al. 2002; Kools et al. 2005; Lynch et al. 1986; McLachlan et al. 2016; Paul et al. 2012; Pugh and Milligan 1998).

Effect of intervention on BFI rate

Four studies investigated the effects of home visits with professional support on BFI (Ara et al. 2018; Engebretsen et al. 2014; Karp et al. 2013; Kools et al. 2005). Three (3/4) did not demonstrate a significant effect on BFI rate (Engebretsen et al. 2014; Karp et al. 2013; Kools et al. 2005). Two (2/3) did not provide support on positioning and/or knowledge enhancing education (Karp et al. 2013; Kools et al. 2005). Details of the four studies are presented in Table 2 of ESM and Table 3.

Table 3 Details of the nineteen included interventions for breastfeeding

References, country	BF rate/duration		BF Initiation		Support with latch and position	Knowledge enhancing education	Time to commence	Intervention period	Follow-up time span (after discharge)	Number of home visits	Who conduct home visits	Control group	Supplementary intervention		
	Sig.	Not sig.	Sig.	Not sig.									Phone consultation/ hotline	Leaflet/ booklet	Drop-out center
Aksu et al. (2011), Turkey	✔				✔	✔	After discharge	Day 3	18 months	1	Nurses and midwives	Received standard breastfeeding education or support from hospital, but no home visit			
Albernaz et al. (2003), Brazil	✔				✔	✔	Postnatal ward	120 days	120 days	6	Nurses	Received standard breastfeeding education or support from hospital, but no home visit	+	+	
Anderson et al. (2005), USA		✔			✔	✔	Prenatal	From prenatal to 6 weeks	3 months	12	Home visitors trained by using WHO/ UNICEF Breastfeeding Training Course	Received standard breastfeeding education or support from hospital, but no home visit	+		
Ara et al. (2018), Bangladesh			✔			✔	Prenatal	From the third trimester to 6 months	6 months	10	Peer counsellors trained by using WHO/ UNICEF Breastfeeding Counselling Course	Received no home visit. No other detail was described			
Bashour et al. (2008), Syria		✔			✔	✔	After discharge	30 days	4 months	4	Midwives	Received standard breastfeeding education and support from hospital, but no home visit			
Bica and Giugliani (2014), Brazil		✔			✔	✔	Postnatal ward	120 days	12 months	5	2 nurses, a nutritionist and a pediatrician	Received standard breastfeeding education or support from hospital, but no home visit		+	
Boulvain et al. (2004), Switzerland		✔					After discharge	Determined by need	6 months	Determined by need	Midwives	Women in the hospital-based care group were hospitalized for 4–5 days and received no home visit			

Table 3 (continued)

References, country	BF rate/duration		BF Initiation		Support with latch and position	Knowledge enhancing education	Time to commence	Intervention period	Follow-up time span (after discharge)	Number of home visits	Who conduct home visits	Control group	Supplementary intervention		
	Sig.	Not sig.	Sig.	Not sig.									Phone consultation/ hotline	Leaflet/ booklet	Drop-out center
Chezem et al. (2004), USA		✔				✔	After discharge	4 weeks	16 weeks	2	IBCLC	Mothers in the control group received contact with a lactation educator only on request. And they were scheduled to visit the WIC office at 8 and 16 weeks postpartum	+		
Engebretsen et al. (2014), Africa			✔		✔	✔	Prenatal	Within the third trimester	1 week	1	Peer counsellors trained by using WHO/ UNICEF Breastfeeding Counselling Course	Mothers and infants in control clusters in Burkina Faso and Uganda were given standard health care only, and in South Africa, peer support for families to obtain birth certificates and social welfare grants by separate counsellors was provided			
Gagnon et al. (2002), Australia		✔					After discharge	Day 3	2 weeks	1	Nurses	Received standard breastfeeding education or support from hospital, but no home visit			
Karp et al. (2013), USA				✔		✔	Prenatal	Not mentioned	Not mentioned	4	Nurses	Received standard prenatal care but no home visit			
Kools et al. (2005), The Netherlands		✔		✔			Prenatal	14 days	3 months	2	Nurses/ Lactation consultants	Received standard breastfeeding education or support from hospital, but no home visit	+	+	

Table 3 (continued)

References, country	BF rate/duration		BF Initiation		Support with latch and position	Knowledge enhancing education	Time to commence	Intervention period	Follow-up time span (after discharge)	Number of home visits	Who conduct home visits	Control group	Supplementary intervention		
	Sig.	Not sig.	Sig.	Not sig.									Phone consultation/ hotline	Leaflet/ booklet	Drop-out center
Lynch et al. (1986), Canada		✔			✔		After discharge	5 days	9 months	1	IBCLC	Received a routine home visit by a public health nurse shortly after hospital discharge. Prenatal classes were also available	+		
Mclachlan et al. (2016), Australia		✔					After discharge	Not mentioned	6 months	Not mentioned	Nurses	Received usual care, but no home-based support and the community-based breastfeeding drop-in center	+		+
Di Napoli et al. (2004), Italy		✔					After discharge	7 days	6 months	1	Midwives	Received no home visit. No other detail was described	+		
Paul et al. (2012), USA		✔					After discharge	3–5 days	6 months	1	Nurses	Received office-based care, but no home nursing visits			
Porteous et al. (2000), Canada	✔				✔	✔	Postnatal ward	7 days	3 months	1	Midwives	Received standard breastfeeding education or support from hospital, and a public health hotline telephone number as a community support resource, but no home visit	+		
Pugh and Milligan (1998), USA		✔			✔		After discharge	12 days	6 weeks	2	Nurses	Received no home visit. No other detail was described			
Wen et al. (2011), Australia	✔					✔	Prenatal	12 months	12 months	5 or 6	Nurses	Received the usual childhood nursing service, comprising 1 home visit within a month of birth if needed			

Discussion

The present study aims to evaluate studies on home-based interventions with professional support in promoting breastfeeding. To summarize, ten out of the fourteen studies that measured EBF rate/duration demonstrated a significant increase on the rate/duration of EBF. Four out of sixteen studies that measured BF rate/duration showed statistically significant effects in increasing BF rate/duration. Only four studies examined BF initiation and there was little evidence that home-based interventions with professional support were effective in promoting BF initiation. Direct comparison between studies is difficult as the included studies varied greatly in sample characteristics, intention, duration and content of intervention, and length of follow-up. However, findings seem to suggest that home-based interventions with professional support may be beneficial in promoting breastfeeding, particularly in promoting EBF. Based on the results of the review, several features of successful interventions have been identified. First, interventions that were successful in promoting breastfeeding seem to have provided support with latch and positioning. The finding is similar to previous systematic review (Haroon et al. 2013). It was reported that maternal breastfeeding self-efficacy, exposure to breastfeeding, and perception of being supported were positively associated with the duration of breastfeeding (Blyth et al. 2002, 2004; Dennis 1999). Professional home-based interventions could improve women's perception of support, and provision of support with latch and positioning could encourage women to master breastfeeding experiences and remove the barriers associated with breastfeeding, therefore promoting their breastfeeding self-efficacy and breastfeeding outcomes.

Second, successful interventions also seem to have continued for a relatively longer period of time. Interventions with prolonged follow-up tend to have more numbers of visits by professionals and thus are likely to be more intensive in nature. Prolonged follow-up could also help participants review and reflect on the successful breastfeeding experiences, which would be effective in sustaining the effects. Such finding is consistent with a previous systematic review (Skouteris et al. 2014), which found that extended contact with support persons was effective in promoting maternal confidence, self-efficacy and motivation.

Third, it is important to note that the majority of the successful interventions commenced in the postnatal period, suggesting that postnatal time is likely the best time to achieve successful breastfeeding outcome. This finding is different from a previous systematic review (Hannula et al. 2008), which suggested that interventions expanding from pregnancy to the intrapartum period and throughout the infancy were found to be more effective than interventions conducted in just one period. It may be due to the different intervention characteristics included in the studies. Also, the number of home-based interventions starting from pregnancy period included in this review was limited, which precludes the opportunity in providing sufficient evidence to evaluate the effectiveness of cross-perinatal intervention. More studies are needed to conclude the best time for intervention to achieve the best outcome.

Most of the included studies were judged to have poor quality. Most of them demonstrated unclear or poor blinding and/or allocation concealment. In fact, blinding of participants and personnel was relatively difficult for interventions related to breastfeeding promotion because the program itself was very explicit. It was impossible to blind participants assigned to intervention groups. Therefore, limitation on the quality of methodology is inevitable. More studies with better quality are warranted.

It is found that proportionally more studies reported significant effects in promoting EBF (10 out of 14) than that for BF (4 out of 16). It may be due to the fact that a higher proportion of studies that investigated EBF had a longer follow-up period compared to those that investigated BF. Nevertheless, some studies that looked into both EBF and BF rate showed that the intervention was effective in promoting EBF but ineffective in promoting BF (Anderson et al. 2005; Bashour et al. 2008). This may be due to the fact that the usual care or minimum support that the women in control group received was effective enough in promoting BF rate/duration.

There were four studies investigating BFI rate, three of them did not report significant results. There were insufficient studies to draw up a conclusion. More studies are needed to determine the effects of home-based professional intervention in promoting BFI.

Limitations of the study

The study had several limitations. First, there is a possibility that some articles may have been overlooked. Nevertheless, a range of databases was searched and articles that did not explicitly mention home-based intervention were retained screening. Second, risk of publication bias might exist, as negative or insignificant results are less likely to be published. Third, meta-analysis was not conducted as clinical and methodological heterogeneity was found across studies due to variability in interventions, exposure to intervention, intervention in control groups and definitions of outcomes. Fourth, the studies were inconsistent in their definition of "usual care." In trials where usual care was defined, there were substantial variations in

their content. In an instance where "usual care" was very supportive, the effect of home-based professional support on breastfeeding outcome might have been devalued. Fifth, different definitions on EBF were used in the studies, and some did not provide a definition (Bashour et al. 2008; Dias de Oliveira et al. 2014; Gagnon et al. 2002). For example, six of the fourteen trials which investigated EBF stated explicitly that they adopted the WHO's definition of exclusive breastfeeding (Aksu et al. 2011; Albernaz et al. 2003; Ara et al. 2018; Coutinho et al. 2005; Kimani-Murage et al. 2017; Kools et al. 2005). Alternatively, four studies defined EBF as a child being fed only on mother's milk (Anderson et al. 2005; Khan et al. 2017; Tylleskar et al. 2011; Wen et al. 2011) while one study defined EBF as the mother feeding the newborn by breast but excluding supplementation with expressed breast milk or formula (McKeever et al. 2002). The lack of a standardized definition of EBF might lead to bias in interpreting the results. Finally, the huge variability in the design, methodology, and outcome accessed across all the studies precluded the possibility to determinate the clinical significance of the studies. Nevertheless, for studies that have shown significant differences in demographic factors between groups at baseline, adjusted results (e.g., aOR, aRR) were reported. For studies that accessed multiple outcomes, only those that consistently reported significant results across outcomes were considered successful. Therefore, it is believed that the most conservative results were reported in the current review.

Implications for research and practice

Findings of the present review have important implications both for clinical practice and future research. First, findings suggest that continuous professional support offered by professionals in postpartum period is likely to be effective in promoting breastfeeding outcomes. They should be incorporated in the future development of breastfeeding programs to promote breastfeeding. Nevertheless, future research should address the cost of home visits with professional support. The possible increased costs to healthcare system should be considered due to increased expense on involvement of professional healthcare workers for home visits. Moreover, further studies should include a longer follow-up period, i.e., at least 6 months for EBF and 2 years for BF, corresponding with WHO recommendation on EBF and BF. Finally, almost all of the studies for professional home-based breastfeeding support had been done in western countries so far. More studies should be conducted in Asia to assess whether the home-based professional support also works in other countries and cultures.

Conclusion

In conclusion, the present study suggests that both EBF and BF can be promoted by home-based professional interventions at postpartum period. Professional support-based intervention using a home setting seems to be a feasible and useful way to promote breastfeeding. Future studies should seek to include a longer follow-up, use a more standardized definition on EBF and BF, and investigate the effect on BFI. Studies being conducted in non-Western countries are also warranted.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

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