Research Article

The Promotion of Exclusive Breastfeeding in Preterm Infants using Cup Feeding: A Literature Review

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Abstract

Exclusive breastfeeding of newborns during the first six months of life has been widely recommended by the World Health Organisation and United Nations Children's Fund as a global life-saving infant and young child feeding practice. This paper evaluates the effectiveness of cup feeding in promoting exclusive breastfeeding in preterm infants compared to bottle feeding. A literature review of ten studies (mainly systematic reviews of randomised control trials) primarily located using the EBSCOhost database was carried out. The main findings of the review suggest that cup feeding when compared to bottle feeding leads to reduced negative sucking behaviours, long hospital stays, and inability to maintain exclusive breastfeeding (EBF) after discharge from hospital.

Keywords: Exclusive Breastfeeding, Cup Feeding, Newborns, Preterm Infants, Bottle Feeding

Introduction

The exceptional nutritional, immunological, and psychological benefits of breastfeeding have led to its continual promotion by the World Health Organisation (WHO) and United Nations Children's Fund (UNICEF) as the safest, most natural and effective means of feeding infants and young children (WHO and UNICEF, 1989; Nascimento and Issler, 2003; WHO and UNICEF, 2003;

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Health Canada, 2012). It is recommended that in exclusive breastfeeding (EBF), newborns should be fed with only breast milk during the first 6 months of life, after which other liquids and solids can be added gradually to complement breastfeeding up to 2 years or longer to achieve optimal and healthy infant growth and development (WHO and UNICEF, 1989; WHO, 2002; WHO and UNICEF, 2003; Kramer and Kakuma, 2007; UNICEF, 2011; WHO, 2011). However, mothers who choose to breastfeed their preterm infants (i.e. babies born before 37 weeks gestation) experience difficulty in initiating EBF, because preterm infants (PIs) are usually weak and unable to fully breastfeed (Nascimento and Issler, 2004; WHO and UNICEF, 2009). In such situations, alternatives to breastfeeding known as supplemental feeding methods such as bottle feeding (BF) and cup feeding (CF) are adopted in the Newborn Intensive Care Unit (NICU) of hospitals to support the establishment of successful EBF in PIs (WHO, 1998; WHO, 2003; Nascimento and Issler, 2004).

BF, being the most commonly used supplemental feeding method, has been suggested by previous studies to be ineffective in promoting EBF (Nascimento and Issler, 2004; Collins et al., 2008). Kramer and Kakuma (2007) argue that BF potentially increases the risks for infection and confusion between breast and bottle in infants (a phenomenon known as "nipple confusion"); this may interfere with successful initiation and completion of EBF. Consequently, CF has been widely recommended as a suitable alternative to BF by the WHO/UNICEF through the Baby-Friendly Hospital Initiative (BFHI) (WHO and UNICEF, 1989; WHO, 1998; Vannuchi et al., 2004; WHO, 2009). Despite these recommendations, deficiencies still exists in the adequate implementation of the BFHI at the NICU level of hospitals in many countries (Agampodi, 2007; WHO, 2009; Health Canada, 2012).

Moreover, only a few studies have actually compared the effect of both CF and BF on initiation and duration of successful EBF in PIs (Collins et al., 2004; Kramer and Kakuma, 2007; Abouelfettoh et al., 2008; Flint et al., 2008; Huang et al., 2009; Al-Sahab et al., 2010). It is essential that priority should be given to the PI population, especially since existing evidence demonstrates that, when compared to term infants, PIs are considered most-at-risk of not achieving successful EBF (WHO, 2002; Nascimento and Issler, 2003; WHO and UNICEF, 2009; WHO, 2011; Health Canada, 2012).

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Therefore, the aim of this review is "to evaluate the effectiveness of CF in promoting EBF in PIs compared to BF".

Table 1 presents the list of acronyms used in this paper and their expansions/meanings.

Table 1 List of Acronyms

Acronym	Expansion/Meaning
α	Statistical power level/value
%	Percentage
BFHI	Baby-friendly hospital initiative
BF	Bottle feeding
CF	Cup feeding
CI	Confidence interval
EBF	Exclusive breastfeeding
p	Statistical significance level/value
PCS	Prospective cohort study
PI	Preterm infant
PIBBS	Premature infant breastfeeding behavior scale
n	Number
NICU	Newborn intensive care unit
NNT	Number needed to treat
RCT	Randomised controlled trail
RR	Risk ratio
t	Test of difference value
UNICEF	United Nations Children's Fund
WHO	World Health Organisation

Results

A total of 104,823 records from electronic database search and 19 additional records from other sources were identified. However, only 10 studies met the eligibility criteria and were included in qualitative synthesis (see Figure 1).

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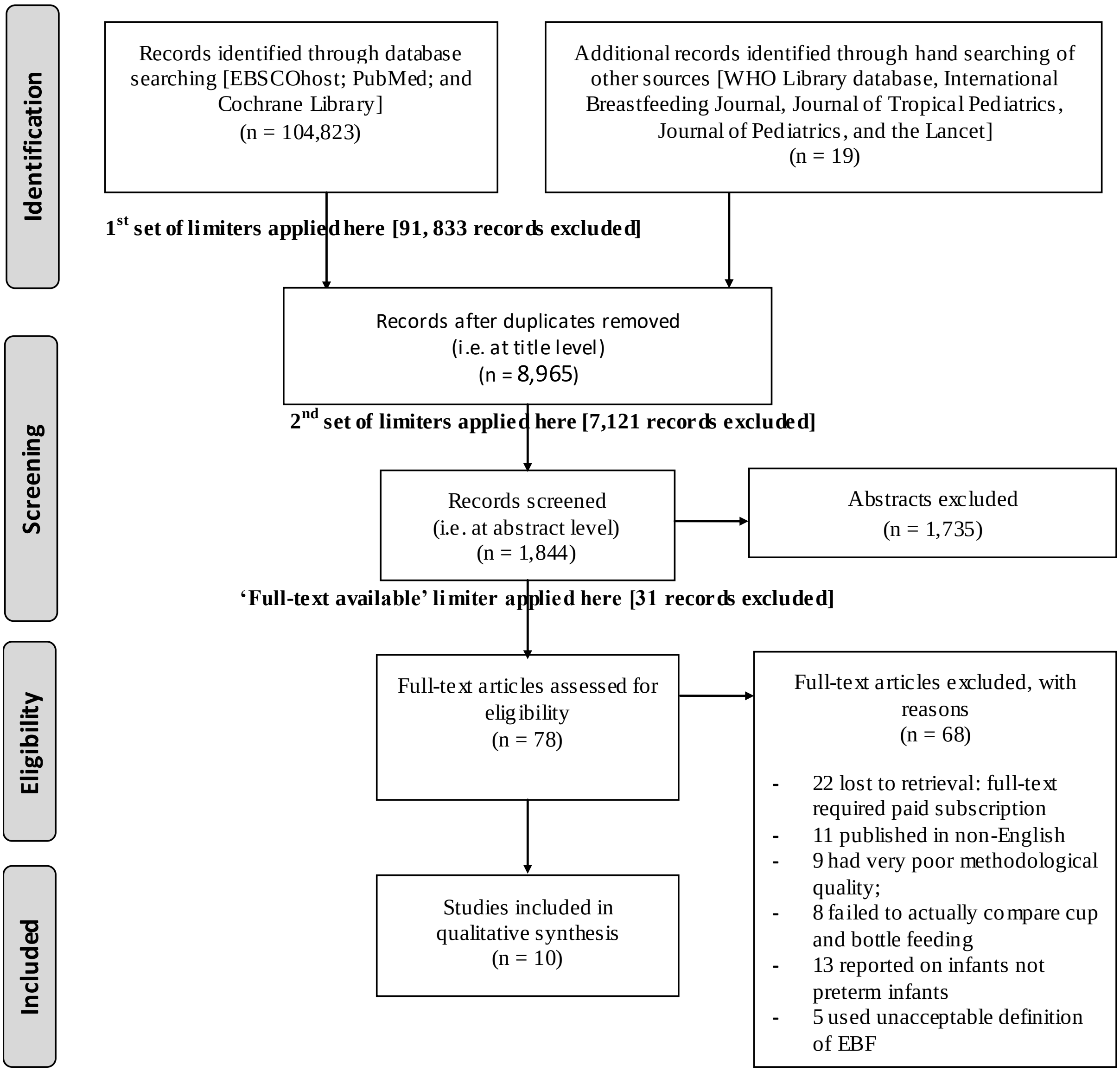

Where:-

- 1st set of limiters include: Human, Published Date from January 2002 to December 2012, and Peer reviewed.
- 2nd set of limiters include: Systematic Reviews, Randomized Controlled Trials, Clinical Trials, and Reviews.

Figure 1 Flow of Information through the Different Phases of the Literature Search Process

Table 2 presents a summary of the study design, characteristics of sample, and setting for each of the included studies.

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Table 2 Main Characteristics of Included Studies

Study	Main characteristics
Abouelfettoh et al (2008)	Quasi-experimental study involving 50 preterm infants with 35.13 weeks mean gestational age recruited from a Paediatric Hospital in Cairo, Egypt.
Al-Sahab et al (2010)	Cross sectional study involving 87 nurses from 5 hospitals in Toronto, Canada.
Collins et al (2004)	Randomised control trial (RCT) involving 319 preterm infants (between 23-33 weeks of gestation) recruited from 2 large Tertiary Hospitals in Australia.
Collins et al (2008)	Systemic review of 5 RCTs involving 543 preterm infants (between 23-36 weeks of gestation) recruited from General District Hospitals in UK (2), Brazil (2), and Australia (1).
Flint et al (2008)	Systemic review of 4 RCTs involving 472 preterm infants (between 28-35 weeks of gestation) recruited from Tertiary Hospitals in Brazil (1). UK (2), and Australia (1).
Huang et al (2009)	Prospective cohort study (PCS) involving 205 preterm infants (between 32-36 weeks of gestation) recruited from Tertiary Medical Centre in Taiwan.
Kramer and Kakuma (2007)	Systematic review of 16 studies (2 RCTs and 14 PCS) of 9,465 infants (2,050 preterm, 7,415 term and post term infants) recruited from 7 developing and 9 developed countries.
Nascimento and Issler (2003)	Systemic review of 3 PCS involving 493 preterm infants (between 25-31 weeks of gestation) recruited from Tertiary Hospitals in Brazil.
Nascimento and Issler (2004)	Systemic review of 3 RCTs involving 307 preterm infants (between 24-33 weeks of gestation) recruited from General District Hospitals in Brazil (2), and Peru (1).
Vannuchi et al (2004)	Systemic review of 2 RCTs involving 426 preterm infants (between 26-36 weeks of gestation) recruited from General District Hospitals in Brazil.

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The results of the included studies were considered under 4 themes: breastfeeding behaviours, baseline breastfeeding rates at hospital discharge, prevalence of breastfeeding after hospital discharge, and length of hospital stay; as follows:

Breastfeeding Behaviours

Breastfeeding behaviours of PIs were reported in 7 studies (Nascimento and Issler, 2003; Vannuchi et al., 2004; Kramer and Kakuma, 2007; Abouelfettoh et al., 2008; Collins et al., 2008; Huang et al., 2009; Al-Sahab et al., 2010; Abouelfettoh et al., 2008) in a quasi-experimental study involving 60 PIs (30 randomly allocated to both CF and BF groups), observing the Premature Infant Breastfeeding Behaviour Scale (PIBBS) mean scores in both groups at 6 time intervals, starting at week 1 to week 6 after hospital discharge. PIs in CF group had consistently higher PIBBS mean scores (9.8, 8.9, 12.3, 13.5, 14.2, and 14.6) than those in BF group (5.3, 6.9, 9.9, 11, 12.4, and 13.2); which were statistically significant (p=<0.01).

In addition, Huang et al. (2009) recruited 205 PIs into 3 cohorts (breastfeeding (76), BF (62), and CF (67)), which were prospectively followed at hospital discharge: third day, second week, and fourth week after hospital discharge. The proportions of PIs in BF and CF groups experiencing negative and positive sucking behaviours at hospital discharge, second and fourth week after hospital discharge were not statistically significant when compared to the breastfeeding group. However, a statistically significant difference was seen on the third day after hospital discharge (p=<0.01; adjusted residuals>1.96), when BF (38.7%) compared to CF (31.3%) displayed more negative sucking behaviour during attempts to initiate EBF at the breast.

On the other hand, in a cross-sectional study involving a small and convenience sample of 87 nurses, Al-Sahab et al. (2010) argue that 69% of nurses disbelieved in ‘nipple confusion’ phenomenon and were nearly six times (RR=5.85; 95% CI 1.22 to 27.99) more likely to use BF than their remaining colleagues.

The pooled results suggest that the high proportions of negative sucking behaviours reported in the BF group might have resulted from the development of ‘nipple confusion’, making the

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establishment of EBF difficult; this was consistent with previous studies (Nascimento and Issler, 2003; Kramer and Kakuma, 2007; Collins et al., 2008). Notably, Vannuchi et al. (2004) argue that the absence of 'nipple confusion' in CF group was inconclusive, because performance bias was observed in the provision of additional care to mothers of PIs in CF group.

Baseline Breastfeeding Rates at Hospital Discharge

This outcome was reported in 5 studies (Collins et al., 2004; Abouelfettoh et al., 2008; Collins et al., 2008; Flint et al., 2008; Al-Sahab et al., 2010). In a RCT consisting of 303 PIs included in the intention-to-treat analysis, Collins et al. (2004) report the proportions of PIs who were fully breastfeeding to those not breastfeeding and partially breastfeeding (i.e. combined) in CF (92/151 or 61%) and BF (72/152 or 47%) groups respectively at hospital discharge; the number needed to treat (NNT) for 1 extra infant to be discharged home fully breastfeeding was 7 (95% CI 4 to 41). The data suggests that CF significantly increased the likelihood of PIs being fully breastfed at hospital discharge by almost two-fold (RR=1.73; 95% CI 1.04 to 2.88; p=0.03). These results are consistent with previous studies (Collins et al., 2008; Flint et al., 2008). Collins et al. (2008) and Flint et al. (2008) observe statistically significant difference in proportions of PIs not breastfeeding fully at discharge from hospital; in favour of CF (RR=0.75; 95% CI 0.61 to 0.91) and BF (RR=0.82; 95% CI 0.62 to 1.09) respectively.

However, Abouelfettoh et al. (2008) report the baseline result at 1 week after hospital discharge as proportions of PIs exclusively breastfed to those not exclusively breastfed in CF (14/30 or 47%) and BF (10/30 or 33%) groups respectively. This result may indicate that more PIs in CF compared to BF group, were exclusively breastfed at 1 week after hospital discharge, however, the two groups did not significantly differ in terms of full and partial breastfeeding (t=1.11; p=0.29). Al-Sahab et al. (2010) on the other hand, argue that 63% of the nurses disbelieved that CF when compared to BF increases the breastfeeding rates of PIs at hospital discharge.

The pooled results demonstrate that CF when compared to BF significantly increases the likelihood of PIs achieving full breastfeeding status on discharge home. This evidence seems to have a high consistency across all the included studies that reported this outcome. However, the results used

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for this evidence were reported from hospital settings where the BFHI was already in place before the study was conducted, which may have made it convenient for the nurses at the NICU to practice CF.

Prevalence of Breastfeeding after Hospital Discharge

This outcome was reported in 4 studies as the prevalence of not breastfeeding or partially breastfeeding at 3 and 6 months after hospital discharge (Collins et al., 2004; Kramer and Kakuma, 2007; Collins et al., 2008; Flint et al., 2008). Collins et al. (2004) observe that both CF and BF groups showed no significant difference in not breastfeeding or partial breastfeeding prevalence at 3 months (RR=1.31; 95% CI 0.77 to 2.23; p=0.33) and 6 months (RR=1.44; 95% CI 0.81 to 2.57; p=0.22) after hospital discharge. However, Collins et al. (2008) suggest that CF compared to BF showed an increase in breastfeeding fully prevalent at 3 months (RR=0.59; 95% CI 0.40 to 0.87) and 6 months (RR= 0.65; 95% CI 0.48 to 0.89) after hospital discharge. The slight difference between the results from Collins et al. (2004) and Collins et al. (2008) could be as a result of withdrawal of some of the mothers of the PIs in CF group, who were dissatisfied with using CF.

In contrast, Kramer and Kakuma (2007) and Flint et al. (2008), argue that CF compared to BF resulted in no significant increase in breastfeeding fully prevalent at 3 months (typical RR=1.18; 95% CI 0.88 to 1.58), (typical RR=0.83; 95% CI 0.65 to 1.05); and 6 months (typical RR=1.31; 95% CI 0.89 to 1.92), (typical RR=1.33; 95% CI 0.82 to 1.14) respectively after hospital discharge.

The pooled results suggest that there was no significant difference between CF and BF in terms of the establishment of successful EBF after hospital discharge (i.e. measured at the 6th month), but, the high degree of noncompliance reported in these studies (Collins et al., 2004; Kramer and Kakuma, 2007; Collins et al., 2008; Flint et al., 2008) might have actually limited the investigation of the true effect of the treatment (i.e. CF) beyond hospital discharge.

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Length of Hospital Stay

Length of hospital stay (in days) was reported in 6 studies (Collins et al., 2004; Nascimento and Issler, 2004; Kramer and Kakuma, 2007; Abouelfettoh et al., 2008; Collins et al., 2008; Flint et al., 2008). Collins et al. (2004) observe that CF group stayed longer in hospital than BF group by an average of 10.1 days (95% CI 3.9 to 16.3). This result was consistent with 4 other studies (Nascimento and Issler, 2004; Kramer and Kakuma, 2007; Collins et al., 2008; Flint et al., 2008). Abouelfettoh et al. (2008) on the other hand, observe shorter hospital stays in CF group (9.1 days ± 5.61) than BF group (12.5 days ± 8.20). This variation might have resulted from the late inclusion of a cohort design by Abouelfettoh et al. (2008) to prevent the exposure of BF to CF.

The pooled results indicate that CF when compared to BF significantly delayed the discharge of PIs from hospital.

Critical Analysis of Included Studies

The strengths of the included studies are that Collins et al. (2004) and Abouelfettoh et al. (2008) used intention-to-treat analysis to minimise compliance and attrition biases. In these studies (Collins et al., 2004; Abouelfettoh et al., 2008; Huang et al., 2009; Al-Sahab et al., 2010), there seems to be rigor in data analysis; they reported adjusted results which further accounted for baseline differences between control and treatment groups.

However, the included studies had some limitations; firstly, it was only Collins et al. (2004) that reported the use of statistical power analysis (α=0.05, 80%) to calculate the sample size that was needed to measure the minimum treatment effect. Notably, the sample size used by Collins et al. (2004) appears to be a true representation of the study population (i.e. PIs), making the results from such study more applicable to a similar population of PIs elsewhere. The sample sizes used in these studies (Abouelfettoh et al., 2008; Huang et al., 2009; Al-Sahab et al., 2010) appear not to be truly representative of the study population, because no power calculation was reported and participants were recruited using convenience sampling. However, Abouelfettoh et al. (2008) minimised contamination bias by including a cohort study design in which BF group was studied first.

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Secondly, Abouelfettoh et al. (2008) and Huang et al. (2009) reported very short follow-up periods of 6 and 4 weeks respectively, which may have limited the studies' ability to adequately assess possible long-term effect of the treatment. But, Huang et al. (2009) argue that a short-term follow-up duration was used to prevent loss to follow-up.

Thirdly, Al-Sahab et al. (2010) and Collins et al. (2004) reported wide CI, which suggests that their sample sizes were small and may limit generalisability of their results. Conversely, Collins et al. (2008) reported a narrow CI, which implies that the sample size was adequate. However, there is overlap in the CI reported by these studies (Collins et al., 2004; Kramer and Kakuma, 2007; Collins et al., 2008; Flint et al., 2008), which implies weak precision of their results. Furthermore, the generalisability of the findings of Al-Sahab et al. (2010) is limited by the type of research - cross-sectional study does not measure causality (Evans, 2003; Fineout-Overholt et al., 2005). With the exception of Al-Sahab et al. (2010), the bottom line of these studies is that their findings have clinical and policy implications in promoting EBF in PIs using CF approach in similar settings and population.

Conclusion

In this review, evidence from pooled results may seem to suggest that CF when compared to BF is associated with reduced negative sucking behaviours (suggestive of the absence of nipple confusion phenomenon), unacceptably long hospital stays, and the inability to maintain EBF after discharge from hospital. However, there is insufficient credible evidence in this literature review on which to base recommendations of CF over BF as an exclusive supplemental feeding method for promoting EBF in PIs.

Consequently, the implications of this evidence for future research and practice is that other factors such as hygiene, setting/environment and economic status should also be considered when investigating and/or deciding whether CF is better than BF.

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