Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed (Review)

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[Intervention Review]

Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed

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ABSTRACT

Background

Breast milk provides optimal nutrition for newborn infants, and the ideal way for infants to receive breast milk is through suckling at the breast. Unfortunately, this may not always be possible, as there are numerous reasons why a newborn infant may not be able to breastfeed and, as a result, require supplemental feeding. Currently, there are a variety of ways in which newborn infants can receive supplemental feeds. Traditionally, bottles and nasogastric tubes have been used; however, more recently, cup feeding has become a popular practice in many nurseries in an attempt to improve breastfeeding rates. There is no consistency to guide the choice of supplementation.

Objectives

To determine the effects of cup feeding versus other forms of supplemental enteral feeding on weight gain and achievement of successful breastfeeding in newborn infants who are unable to fully breastfeed.

Search strategy

We searched the Cochrane Central Register of Controlled Trials (CENTRAL, The Cochrane Library, Issue 2, 2006), CINAHL (1982 - April 2006) and MEDLINE (1966 - April 2006).

Selection criteria

Randomised or quasi-randomised controlled trials comparing cup feeding to other forms of enteral feeding for the supplementation of newborn infants.

Data collection and analysis

Quality assessments and data extraction for included trials were conducted independently by the review authors. Outcomes reported from these studies were: weight gain, proportion not breastfeeding at hospital discharge, proportion not feeding at three months of age, proportion not feeding at six months of age, proportion not fully feeding at hospital discharge, proportion not fully breastfeeding at three months of age, proportion not fully breastfeeding at six months of age, average time per feed (minutes), length of stay and physiological events of instability such as bradycardia, apnea, and low oxygen saturation. For continuous variables such as weight gain, mean differences and 95% confidence intervals were reported. For categorical outcomes such as mortality, the relative risks (RR) and 95% confidence intervals were reported.

Main results

Four studies were eligible for inclusion. The experimental intervention was cup feeding and the control intervention was bottle feeding in all four studies included in this review. There was no statistically significant difference in the incidence of not breastfeeding at hospital discharge in three included studies (typical RR 0.82, 95% CI 0.62, 1.09) and not breastfeeding at three months in two included studies (typical RR 0.88, 95% CI 0.76, 1.03) or six months for the one study that reported this outcome (RR 0.91, 95% CI 0.78, 1.05). There was a statistically significant difference in not fully breastfeeding at hospital discharge (from three included studies) in favour of cup feeding (typical RR 0.75, 95% CI 0.61, 0.92). However, this was not statistically significant at three months (one study, RR 1.18, 95% CI 0.88, 1.58) or six months (one study, RR 1.31, 95% CI 0.89, 1.92). There was no statistically significant difference in weight gain from one study that reported this outcome (MD -0.60, 95% CI -3.21, 2.01). In the one study that assessed it, there was a significantly increased length of hospital stay in the cup fed infants [mean difference between groups was 10.1 days (95% CI 3.9, 16.3)]. Time to full breastfeeding was not assessed in any study.

Authors' conclusions

Cup feeding cannot be recommended over bottle feeding as a supplement to breastfeeding because it confers no significant benefit in maintaining breastfeeding beyond hospital discharge and carries the unacceptable consequence of a longer stay in hospital.

PLAIN LANGUAGE SUMMARY

Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed

Is cup feeding a better way to feed babies, rather than giving bottles or feeding with a tube, when mothers are unable to fully breastfeed? We wanted to identify the best way of offering feeds to babies when mothers are unable to breastfeed, or initially have difficulty with breastfeeding. Alternative feeding methods include using a cup, bottle or feeding tube. Four included studies compared cup and bottle feeding: the results of three of these studies demonstrate that infants who were cup fed were more likely to be exclusively breastfed at hospital discharge. However, at three and six months, there was no difference in the number of infants fully or partially breastfeeding, whether initially fed by cup, bottle or feeding tube. The results of one study demonstrated that those infants feed by cup spent approximately ten days longer in hospital. Therefore, based on available evidence, we cannot recommend cup feeding.

BACKGROUND

The optimal milk for newborn infants is their mother's breast milk, and the best way for them to achieve this is by sucking on the breast. However, there are numerous reasons why a baby may not be able to breastfeed. If a newborn infant cannot breastfeed, then an alternative form of enteral feeding is required. Alternatives include gastric tube feeding, bottle-feeding and cup feeding.

Traditionally, bottles and gastric tubes have been used routinely in neonatal units to feed infants who are unable to fully breastfeed, particularly at night and when mothers are unable to be present for all feeds (Lang 1994b). While this may not be desired by either staff or mothers, there are limited options for an unsettled infant when the mother is not available to breastfeed and gastric tube feeding does not satisfy the infant's psychological and social needs (Lang 1994b). Cup feeding has been suggested as an alternative.

It is argued that because cup feeding only requires the infant to 'lap' the milk and then coordinate swallowing and breathing, the preterm infant can be fed using a cup from as early as 30 weeks gestation. This is well before the time that breast and bottle feeding can be introduced as this requires the coordination of sucking, swallowing and breathing, which are often uncoordinated until approximately 32 - 35 weeks of age (Lang 1994a; Lang 1994b; Palmer 1993). Artificial feeding methods consisting of pap bowls (a bowl with a wide brimmed lip), feeding horns (a bowl with a funnel like horn), cups with lips, and bottles have existed throughout history (Foote 1944; Lang 1994a). Originally, cup feeding was used to feed newborns who were born with oral deformities such as a cleft lip or cleft palate (Fredeen 1948). Cup feeding has been used

in developing countries for several decades, where the care and hygiene facilities for bottles and nipples have been limited and gastric tubes are not readily available (Dowling 2002; Lang 1994b). More recently cup feeding is gaining increased use as an alternative feeding method in maternity and neonatal units for preterm and term infants who are unable to fully breastfeed (NANN 2004). The theoretical benefits include avoiding the confusion between breast and bottle (Dowling 2002; Gupta 1999; Thorley 1997); enhancing the newborn's ability to develop a suckling action for breastfeeding (Thorley 2004); and facilitating the newborn's ability to self regulate feeds and demand feeds (Vallenas 1998). The Baby Friendly Hospital Initiative (BFHI) training literature and guideline recommends the use of cup feeding for infants intending to breastfeed, so that no artificial nipples are introduced to these infants (Lang 1994b; Vallenas 1998).

The literature suggests that there are many advantages to cup feeding (Cousins 1999; Fredeen 1948; Gupta 1999; Kuehl 1997; Lang 1994a; Lang 1994b). These include the fact that cup feeding is a simple procedure that can involve both parents, early positive body and eye contact is fostered, the infant receives positive tactile and olfactory stimulation, cardiorespiratory and oxygen saturation can be maintained (Dowling 2002; Lang 1994a; Lang 1994b), the infant controls the feed and can pace the intake and the total volume of milk taken, and there is minimal risk of aspiration and minimal energy expended (Lang 1994a; Lang 1994b; Thorley 2004). However, many of these advantages could also be claimed of bottle feeding.

While there may be many benefits of feeding preterm and term infants with a cup, there are also potential risks that need to be considered when introducing this practice into maternity and neonatal units (NANN 2004). Some authors have reported that cup feeding is awkward at first and that the infant is at risk of aspiration pneumonia when the improper technique is used resulting in the milk being 'poured into' the infants mouth rather than allowing the infant to 'lap' or sip the milk (Lang 1994b; Thorley 2004). Other potential risks include physiological instability (bradycardia, apnea, low oxygen saturation) (Freer 1999), and choking and poor weight gain (Kuehl 1997), which can result in extended hospitalisation and additional cost of care. Lastly, undesirable outcomes have been reported: nursing workload may be increased as a result of extra nursing time needed to cup feed, and term infants may refuse the breast, becoming addicted to the cup if use is prolonged and they are not given the opportunity to breastfeed (Lang 1994b; Thorley 1997; Thorley 2004). If infants require treatment as a result of an adverse event or if term infants reject the breast, this may result in increased stress and anxiety to the parents and family.

Before the introduction of cup feeding into neonatal nurseries, this practice must be evaluated for efficacy and safety in terms of clinical outcomes, human resource use, cost and time.

OBJECTIVES

To determine the effects of cup feeding versus other forms of supplemental enteral feeding on weight gain and achievement of successful breastfeeding in newborn infants that are unable to fully breastfeed.

To determine if outcomes differ by:

Population:

- born preterm (less than 37 weeks gestation) versus term (greater than or equal to 37 weeks gestation)
- born with oral-facial abnormalities such as a cleft lip and/or cleft palate versus no oral-facial abnormalities

METHODS

Criteria for considering studies for this review

Types of studies

Randomised and some types of non randomised (i.e. quasi-randomised) controlled trials in which newborn infants who are unable to fully breastfeed were allocated to a policy of cup feeding versus other forms of supplemental enteral feeding. Crossover studies were to be excluded.

Types of participants

Newborn infants up to 44 weeks postmenstrual age or 28 days postnatal age that are unable to fully breastfeed.

Types of interventions

Oral feeding of either expressed breast milk or a combination of expressed breast milk and artificial formula via a cup (or of a similar design so that the infant 'laps' the milk) versus other forms of supplemental enteral feeding (such as tube feeds and bottle feeds).

Types of outcome measures

Primary:

- Weight gain (g/kg/day)
- Time to full breastfeeding with acceptable weight gain (15 - 30 grams/day)
- Proportion not breastfeeding at hospital discharge and at three and six months of age
- Proportion not fully breastfeeding at hospital discharge and at three and six months of age

Secondary:

- Average time per feed (minutes)
- Number of reported choking events per infant or per cup feed over the duration of cup feeding period, depending on how described in individual studies
- Number of reported aspiration events per infant or per cup feed over the duration of cup feeding period, depending on how described in individual studies
- Number of reported infection events per infant or per cup feed over the duration of cup feeding period, depending on how described in individual studies
- Number of reported physiological instability events i.e. bradycardia, apnea, low oxygen saturations per infant or per cup feed over the duration of the cup feeding period, depending on how described in individual studies
- Postnatal age at discharge (days)
- Length of hospital stay (days)
- Cost
- Parental satisfaction (however assessed in individual studies)
- Parental anxiety (however assessed in individual studies)
- Neurodevelopmental outcomes at 18 and 24 months of age (e.g. Bayley's; Griffiths)
- Death prior to discharge
- Death by 28 days of age
- Death by 12 months of age

Full breastfeeding is defined in this review as only having breast feeds and no other supplemental feeds.

Search methods for identification of studies

The standard search strategy for the Cochrane Neonatal Review Group was used. See: Neonatal Review Group search strategy. This included searches of the following electronic databases:

- The Cochrane Central Register of Controlled Trials (CENTRAL, The Cochrane Library, Issue 2, 2006);
- CINAHL 1987 to April 2006
- MEDLINE 1966 to April 2006.

Searches of the electronic databases will be based on the following search terms:
The MeSH terms 'Infant, Newborn' OR 'Nurseries, Hospital' OR 'Intensive Care Units, Neonatal'
AND
The textword "cup"
We also searched previous reviews including cross-references, abstracts, conference and symposia proceedings, expert informants, and journal hand searching in the English language. No other language restrictions applied.
The title and abstract of each retrieved study was examined to assess eligibility. If there was uncertainty, the full paper was examined.

Data collection and analysis

The standard methods of the Cochrane Collaboration (Alderson 2004) and its Neonatal Review Group were used to assess the methodological quality of the trials. At least two of the review authors worked independently to search for and assess trials for inclusion and methodological quality. Studies were assessed using the following key criteria: allocation concealment (blinding of randomisation), blinding of intervention, completeness of follow up and blinding of outcome measurement. We assigned a rating of 'Yes', 'No' or 'Can't tell' for each. The reviewers extracted data independently. Differences were resolved by discussion. Attempts were made to contact study investigators for additional information or data as required. One author was contacted for additional information and supplied further data as requested (Collins 2004).
Data analysis:
All data were analysed according to the treatment group allocated.
For individual trials, for continuous variables such as weight gain, mean differences, and 95% confidence intervals were reported. For categorical outcomes such as mortality, the relative risks (RR) and 95% confidence intervals were reported.
For pooled results, continuous variables, weighted mean differences (WMD) and 95% confidence intervals were reported. For categorical outcomes, the relative risks (RR) and 95% confidence intervals were reported. Each treatment effect was tested for heterogeneity using the I^2 test. The fixed effects model was used for meta-analysis. Sources of statistical heterogeneity were examined.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.
Fifteen studies were identified as potentially eligible for inclusion in this review. Eight studies were excluded because they were neither randomised controlled trials nor non-randomised controlled trials that used quasi-randomised group allocation (Brown 1999; Davis 1948; Dowling 2001; Dowling 2002; Fredeen 1948; Freer 1999; Gupta 1999; Malhotra 1999; Marinelli 2001). One study was excluded since the study randomised exclusively formula feeding infants to either bottle or cup (did not meet our definition for study participants), and an exclusively breastfeeding group of infants were used as a comparison group (Howard 1999). One further study was excluded since this study did not meet the inclusion criteria for this review since participants were not infants that were unable to fully breastfeed (Howard 2003) . Reasons for exclusion for excluded studies can be seen in the table 'Characteristics of Excluded Studies'.

The remaining four studies were included in this review (Collins 2004; Gilks 2004; Mosley 2001; Rocha 2002). Full details on included studies can be seen in the table 'Characteristics of Included Studies'. Studies enrolled preterm infants with mean gestational ages at birth from 29 to 35 weeks, and all studies compared cup versus bottle feeds as a supplement to breastfeeding when transitioning from full nasogastric feeds to full breast feeds.

Collins 2004

The study of Collins 2004 included preterm infants (mean gestational ages 29.3 and 30.0, mean birth weights 1334 g and 1446 g for the respective study groups; cup and bottle) of mothers who had indicated that they intended to breastfeed. Infants born less than 34 weeks were eligible for inclusion in the study and were randomised to either supplemental feeds via a cup or bottle. This study also randomised infants to either dummy (pacifier) or no dummy within each of the two study groups. The initiation of the allocated supplemental feeds was determined by the attending nurse/midwife or neonatologist and occurred when the mother was unavailable to breastfeed or when additional oral feeds of milk were required after a breastfeed.

The authors report that compliance to the allocated intervention, in particular to cup feeding, was poor and, therefore, reduced the power to identify a real treatment effect. The tertiary hospital that had previously been using cup feeding was more compliant with the intervention than the other tertiary recruiting hospital (where cup feeding was introduced for the study) or the participating fifty-four peripheral hospitals (where the use of cup feeding was uncommon).

The main outcome measures were partial or fully breastfeeding or no breastfeeding on discharge home. Secondary outcomes included length of hospital stay and prevalence of breastfeeding at three and six months post discharge.

Gilks 2004

Participants in the study of Gilks 2004 study were preterm infants (median gestational ages 31 weeks and 32 weeks, median birth weights 1560 g and 1750 g for the respective study groups; cup and bottle) of mothers who had indicated an intention to breastfeed. For infants to be eligible for the study, they needed to be born between 30 and 35 + 5 weeks gestation. Once enrolled into the study, the infant was randomised to receive supplemental feeds either by cup or bottle in addition to nasogastric tube feeds and breastfeeds. It is unclear who determined when supplemental feeds by cup or bottle were begun, the criteria for assessing which feed would be given by cup or bottle, and how often the infants received the allocated treatments as opposed to receiving feeds by nasogastric tube or the breast. Cup feeding had been introduced into the hospital six months prior to the initiation of the study, and staff had received information sheets and attended a teaching programme during the introduction phase.

The main outcome measure was partial or exclusively breastfeeding rates at discharge. Secondary outcomes included breastfeeding rates at term, at six weeks post term and post-conceptional age at which the nasogastric tube was withdrawn.

Mosley 2001

The study by Mosley 2001 was a pilot study to establish the feasibility of conducting a randomised controlled trial of supplemental feeding methods. Recruitment of infants took place over a three month period, resulting in the recruitment of 16 preterm infants, only 14 infants of which had data presented. The study compared two methods of supplementary feeding (bottle versus cup) for preterm infants of mothers who indicated a desire to breastfeed. The initiation of oral feeding or supplemental feeding was at the discretion of the physician or advanced neonatal nurse practitioner, which was the normal practice in the study hospital.

The main outcome measure was breastfeeding rates at discharge. Other outcomes were examined retrospectively, following assessment of the data set. These included the use of a pacifier (dummy), influence of assisted delivery on breastfeeding, previous experience of breastfeeding, influence of prematurity on breastfeeding rates, influence of support to breastfeed and the impact of delayed breastfeeding initiation.

Rocha 2002

The study by Rocha 2002 was a stratified randomised control trial; infants were randomised to either cup or bottle. Infants were between 32 - 36 weeks gestation weighing < 1700 grams. Stratification encompassed three groups 500g - 999g; 1000g - 1499g, 1500g - 1699g. All infants were fed by nasogastric tube until they weighed 1600 grams, at which time breastfeeding was encouraged. If supplemental feeds were required, they were offered feeding by the assigned method. Prior to the study, there was education of all staff about cup feeding technique. After a week of oral feeds, monitoring was begun by an investigator who examined oxygen saturation before during and after the feed. Weight gain and feed interval were also recorded. Follow-up was conducted until the third month or when the infant weaned.

The main outcome measure was to examine the impact of cup and bottle feeding on subsequent breastfeeding of preterm infants. Secondary outcomes examined the difference between oxygen saturation levels in bottle, cup and breast fed infants.

Risk of bias in included studies

All the included studies were randomised and allocation concealment was adequate; however, because of the nature of the experimental and control interventions, blinding of the participants and their care takers could not be achieved. As far as can be ascertained, all outcome measures until hospital discharge were complete; however, follow up rates following hospital discharge decreased over time.

Rocha 2002

Allocation concealment (blinding of randomisation): Unclear

Blinding of intervention: No

Completeness of follow up: Yes at hospital discharge; no thereafter

Blinding of outcome measurement: No

Collins 2004

Allocation concealment (blinding of randomisation): Yes (assignments concealed in sequentially numbered opaque envelopes held in an independent ward to the nursery within each hospital).

Blinding of intervention: No

Completeness of follow up: Yes at hospital discharge; no thereafter

Blinding of outcome measurement: No

Gilks 2004

Allocation concealment (blinding of randomisation): Yes (concealed cards in envelopes)

Blinding of intervention: No

Completeness of follow up: Yes at hospital discharge; no thereafter

Blinding of outcome measurement: No

Mosley 2001

Allocation concealment (blinding of randomisation): Yes (sealed numbered opaque envelope)

Blinding of intervention: No

Completeness of follow up: Yes at hospital discharge; no thereafter

Blinding of outcome measurement: No

Effects of interventions

The results of four trials are included in this review (Collins 2004; Gilks 2004; Mosley 2001; Rocha 2002). All data were analysed according to the treatment group allocated.

SUPPLEMENTAL FEED USING CUP VERSUS BOTTLE (Comparison 01)

Primary Outcome Measures

Weight gain (Outcome 01.01)

Only one study (Rocha 2002) reported results for weight gain (in the first week) and there was no significant difference between groups - the mean difference was -0.60 g/kg/day [95% CI -3.21, 2.01]. Collins 2004; Gilks 2004 and Mosley 2001 did not report this outcome.

Proportion not breastfeeding at hospital discharge (Outcome 01.02)

Three studies reported this outcome:

Collins 2004 reported RR of 0.80 [95% CI 0.56, 1.14];

Gilks 2004 reported RR of 0.87 [95% CI 0.52, 1.45]; and

Rocha 2002 reported RR of 0.88 [95% CI 0.36, 2.19].

Mosley 2001 did not report this outcome.

The meta-analysis (I^2 0%) of the three trials reporting this outcome showed typical RR of 0.82 [95% CI 0.62, 1.09]. The analysis demonstrates no significant reduction in the proportion of infants not breastfeeding at hospital discharge.

Proportion not breastfeeding at three months of age (Outcome 01.03)

Two studies reported this outcome:

Collins 2004 reported RR of 0.90 [95%CI 0.75, 1.09];

Rocha 2002 reported RR of 0.83 [95%CI 0.65, 1.05].

Gilks 2004 and Mosley 2001 did not report this outcome.

The meta-analysis (I^2 0%) of the two trials reporting this outcome showed a typical RR of 0.88 [95% CI 0.76, 1.03]. The results from Collins 2004 included in this meta-analysis is an evaluation of infants seen at follow-up, not all infants who were randomised. The analysis demonstrates no significant reduction in the proportion of infants not breastfeeding at three months of age.

Proportion not breastfeeding at six months of age (Outcome 01.04)

Only one study (Collins 2004) reported results for this outcome and there was no significant difference between groups - RR 0.91 [95%CI 0.78, 1.05]. The results from Collins 2004 is an evaluation of infants seen at follow-up, not all infants who were randomised.

Gilks 2004; Mosley 2001 and Rocha 2002 did not report this outcome.

Proportion not fully breastfeeding at hospital discharge (Outcome 01.05)

Three studies reported this outcome:

Collins 2004 reported RR of 0.74 [95% CI 0.58, 0.95];

Gilks 2004 reported RR of 0.74 [95% CI 0.53, 1.03];

Mosley 2001 reported RR of 1.33 [95% CI 0.26, 6.94].

Rocha 2002 did not report this outcome.

The meta-analysis (I^2 0%) of the three trials reporting this outcome showed a typical RR of 0.75 [95% CI 0.61, 0.92] with a NNT of 7.3 [95% CI 4.6, 22.3]. The analysis demonstrates that the group of infants who were cup fed had a reduction in the proportion of infants not fully breastfeeding at hospital discharge (i.e. an increase in the proportion of infants exclusively breastfeeding at discharge).

Proportion not fully breastfeeding at three months of age (Outcome 01.06)

Only one study (Collins 2004) reported results for this outcome and there was no significant difference between groups - RR was 1.18 [95% CI 0.88, 1.58]. The results from Collins 2004 is an evaluation of infants seen at follow-up, not all infants who were randomised.

Gilks 2004; Mosley 2001; Rocha 2002 did not report this outcome

Proportion not fully breastfeeding at six months of age (Outcome 01.07)

Only one study (Collins 2004) reported results for this outcome and there was no significant difference between groups - RR was 1.31 [95% CI 0.89, 1.92]. The results from Collins 2004 is an evaluation of infants seen at follow-up, not all infants who were randomised.

Gilks 2004; Mosley 2001; Rocha 2002 did not report this outcome.

Secondary Outcomes

Average time per feed (minutes) (Outcome 01.08)

Only one study (Rocha 2002) reported results for average time per feed and there was no significant difference between groups - the mean difference was -1.60 minutes [95% CI -3.69, 0.49].

Collins 2004; Gilks 2004 and Mosley 2001 did not report this outcome.

Number of reported physiological instability events

Rocha 2002 reported episodes of oxygen desaturation. The outcome 'lowest oxygen saturations (%) during feeding' was reported. Mean (SD) oxygen saturation in the cup feeding group was 90.8 (4.8)%, range 75 - 99% and mean (SD) oxygen saturation in the bottle feeding group was 87.7 (7.6%, range 68 - 97%). The difference between means was not statistically significant. They also reported desaturation episodes of less than 85 and 90 percent. However, it is not clear whether the data reported are the proportion of time spent less than the cut-off oxygen saturation (85 or 90 percent) or the proportion of infants who had an oxygen saturation less than the cut-off at some stage.

Collins 2004; Gilks 2004 and Mosley 20012001 did report this outcome.

Length of hospital stay (days) (Outcome 01.09)

Only one study (Collins 2004) assessed length of stay. The original report included only median days and interquartile range (IQR). In the cup feeding group, the median (IQR) length of stay was 59 (37 - 85) days and in the bottle feeding group it was 48 (33 - 65) days. On request, the authors provided these data as means and standard deviations. This data demonstrates that there was a significantly increased length of hospital stay in the cup fed infants. The mean difference between groups was 10.1 days [95% CI 3.9, 16.3].

Gilks 2004; Mosley 2001 and Rocha 2002 did not report this outcome.

Unreported outcomes

None of the following outcomes were reported in any of the included studies for *Primary Outcome*: Time to full breastfeeding with acceptable weight gain.

None of the following outcomes were reported in any of the included studies for *Secondary Outcomes*: Number of reported choking events; number of reported aspiration events; number of reported infection events; postnatal age at discharge; cost; parental satisfaction; parental anxiety; neurodevelopmental outcomes at 18 and 24 months of age; death prior to discharge; death by 28 days of age; death by 12 months of age.

Other outcomes reported

Collins 2004 reported that non-compliance to the experimental intervention was high, with 56% (85/151) of cup feeding infants having a bottle introduced. Of the 44% of mothers who decided to introduce a bottle, 39% reported that they did not like, or had problems with, cup feeding. These problems included the infant not managing cup feeds, spilling a lot, not being satisfied, or taking too long to feed. Twelve percent of mothers reported that staff refused to cup feed their infant.

Collins 2004 reported no adverse events.

Rocha 2002 reported no cases of aspiration or apnea. Rocha 2002 report that there was no difference in mean oxygen saturations between cup fed or bottle fed infants during feeds.

DISCUSSION

Preterm infants are at increased risk of not achieving successful breastfeeding (Dowling 2002). Therefore, all studies included in this review studied pertinent populations of preterm infants who were moving from full nasogastric feeds to full breastfeeds.

The results of this review demonstrate marginal improvements in only one of six breastfeeding outcomes. Pooled results from three studies that assessed whether infants were exclusively breast fed or not at the time of hospital discharge showed an advantage for cup fed infants. However, this result is dominated by one study (Collins 2004), which also reported that non-compliance to the experimental intervention was high, with 56% (85/151) of cup feeding infants having a bottle introduced. Of the 44% of mothers who decided to introduce a bottle, 39% reported that they did not like, or had problems with cup feeding, including the infant not managing cup feeds, spilling a lot, not being satisfied, or taking too long to feed. Twelve percent of mothers reported that staff refused to cup feed their infant. All of the other breastfeeding outcomes (including the more clinically relevant ones at three and six months) did not show any difference between the two groups.

While infants who were cup fed demonstrated marginal improvement in breastfeeding (as described above), they also had a statistically significant longer length of stay in hospital. Once again, this result is dominated by the one study that reported this outcome (Collins 2004). On average, the group of cup fed infants spent 10 more days in hospital when compared with bottle supplemented babies. However, the attainment of full suck feeding may be delayed in those infants who are making the transition with cup feeding because they cannot go home cup feeding (as was the case in the study by Collins 2004). In an environment where hospitals are attempting to reduce length of stay, a finding such as this will significantly affect financial and bed management resources. The cost implications related to length of stay need to be considered against a short term gain in exclusive breastfeeding at discharge. Because the interventions used in the included studies (especially those of the single dominant study by Collins 2004) were unblinded, these results may be open to other interpretations. Overall, results show that while the numbers of infants exclusively breast fed at discharge are higher in the cup feeding groups, this is not sustained and no differences in breastfeeding rates were found between the cup and bottle supplemented infants at three and six months.

AUTHORS' CONCLUSIONS

Implications for practice

Cup feeding cannot be recommended over bottle feeding as a supplement to breastfeeding because it confers no benefit in maintaining breastfeeding beyond hospital discharge and may carry the unacceptable consequence of a longer stay in hospital.

Implications for research

While the limitations of the studies included in the review might lead the review authors to conclude that further large high quality randomised control trials should be undertaken, the issue of high rates of non-compliance with the intervention of cup feeding by both practitioners and parents as reported in the majority of previous studies may make this a futile undertaking. Interventions aimed at maintaining breastfeeding longer term (e.g. early and regular skin to skin contact, rooming in, non-separation of mother and baby as possible, non-introduction of supplemental feeds unless medically indicated, antenatal breastfeeding education as documented in WHO 1998) should be given due consideration before further trials of cup feeding are undertaken.

ACKNOWLEDGEMENTS

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Collins 2004

Methods	Randomised controlled trial. Allocation concealment (blinding of randomisation): Yes Blinding of intervention: No Completeness of follow up: Yes Blinding of outcome measurement: No
Participants	319 Preterm infants (Cup feeding group n=161; bottle feeding group n=158) (mean gestational ages 29.3 and 30.0 weeks); Conducted in Australia; Involved 2 tertiary hospitals and 54 peripheral hospitals (this number of peripheral hospitals were involved as they were the receiving hospitals for the babies from the tertiary hospitals). Eligibility criteria: preterm infants less than 34 weeks gestational age whose mothers wanted to breastfeed.
Interventions	Randomised to supplemental feeds via cup or bottle
Outcomes	Not breastfeeding at hospital discharge: number assessed - cup feeding group N=151; bottle feeding group N=152. Not breastfeeding at 3 months: number assessed - cup feeding group N=144; bottle feeding group N=139 Not breastfeeding at 6 months: number assessed - cup feeding group N=142; bottle feeding group N=139 Not fully breastfeeding at hospital discharge: number assessed - cup feeding group N=151; bottle feeding group N=152 Not fully breastfeeding at 3 months: number assessed - cup feeding group N=144; bottle feeding group N=139 Not fully breastfeeding at 6 months: number assessed - cup feeding group N=142; bottle feeding group N=139 Length of hospital stay: number assessed - cup feeding group N=149; bottle feeding group N=152
Notes	Results are an evaluation of infants followed at 3 & 6 months and not all infants randomised

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Gilks 2004

Methods	Randomised Controlled Trial Allocation concealment (blinding of randomisation): Yes (assignments concealed in sequentially numbered opaque envelopes held in an independent ward to the nursery within each hospital). Blinding of intervention: No Completeness of follow up: Yes at hospital discharge; no thereafter Blinding of outcome measurement: No
Participants	54 Preterm infants (Cup feeding group n=27; bottle feeding group n=27) (mean gestational ages 31.0 and 32.0 weeks); Conducted in the UK; single centre trial Eligibility Criteria: preterm infants who were less than 35 weeks completed gestation and more than 30 weeks gestation whose mothers intended to breastfeed.
Interventions	Randomised to supplemental feeds via cup or bottle
Outcomes	Not breastfeeding at hospital discharge: number assessed - cup feeding group N=27; bottle feeding group N=27 Not fully breastfeeding at hospital discharge: number assessed - cup feeding group N=27; bottle feeding group N=27. This study also looked at the following outcomes: breast feeding rates at term, at six weeks post term and post conceptional age.
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Mosley 2001

Methods	Randomised Controlled Trial Allocation concealment (blinding of randomisation): Yes (concealed cards in envelopes) Blinding of intervention: No Completeness of follow up: Yes at hospital discharge; no thereafter Blinding of outcome measurement: No
Participants	16 Preterm infants (Cup feeding group n=8; bottle feeding group n=8) (mean gestational age of 35.2 to 35.5 weeks); Conducted in the UK; single centre trial Eligibility Criteria: preterm infants who were between 30 and 37 weeks gestation, admitted to the special care nursery, whose mothers intended to breastfeed.
Interventions	Randomised to supplemental feeds via cup or bottle
Outcomes	Not fully breastfeeding at hospital discharge: number assessed - cup feeding group N=6; bottle feeding group N=8.
Notes	

Mosley 2001 (*Continued*)

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Yes	A - Adequate

Rocha 2002

Methods	Randomised Controlled Trial Allocation concealment (blinding of randomisation): Yes (sealed numbered opaque envelope) Blinding of intervention: No Completeness of follow up: Yes at hospital discharge; no thereafter Blinding of outcome measurement: No
Participants	83 Preterm infants (Cup feeding group n=46; bottle feeding group n=37) (mean gestational age of 32.5 to 32.7 weeks); Conducted in Brazil; single centre trial Eligibility Criteria: preterm infants who were born between 32 and 36 weeks gestation, and weighting less than 1700 g, admitted to the intensive care nursery, whose mothers intended to breastfeed.
Interventions	Randomised to supplemental feeds via cup or bottle
Outcomes	Not breastfeeding at hospital discharge: number assessed - cup feeding group N=44; bottle feeding group N=34. Not breastfeeding at 3 months: number assessed - cup feeding group N=44; bottle feeding group N=34. Weight gain: number assessed - cup feeding group N=44; bottle feeding group N=34. Average time per feed: number assessed - cup feeding group N=44; bottle feeding group N=34. Other outcomes assessed: differences between oxygen saturation levels in bottle, cup and breast-fed infants.
Notes	

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Characteristics of excluded studies *[ordered by study ID]*

Brown 1999	Was neither a randomised controlled trial nor a non-randomised controlled trial using quasi-randomised group allocation. A retrospective chart review.
Davis 1948	Was neither a randomised controlled trial nor a non-randomised controlled trial using quasi-randomised group allocation.

(*Continued*)

Dowling 2001	Was neither a randomised controlled trial nor a non-randomised controlled trial using quasi-randomised group allocation. Descriptive literature on nipple confusion and alternative feeding methods.
Dowling 2002	Was neither a randomised controlled trial nor a non-randomised controlled trial using quasi-randomised group allocation. A non-experimental convenience sample.
Fredeen 1948	Was neither a randomised controlled trial nor a non-randomised controlled trial using quasi-randomised group allocation. A descriptive report on experience with cup feeding of newborn infants
Freer 1999	Was neither a randomised controlled trial nor a non-randomised controlled trial using quasi-randomised group allocation. A convenience sample of newborn infants exposed to breast and cup feeding
Gupta 1999	Was neither a randomised controlled trial nor a non-randomised controlled trial using quasi-randomised group allocation. A retrospective chart review.
Howard 1999	A randomised controlled trial of formula feeding infants only. Infants randomised to either receive feeds via cup or bottle. A group of exclusively breast feeding infants were used as a comparison group.
Howard 2003	This study did not meet the inclusion criteria for this review as participants were not infants that were unable to fully breastfeed. Participants were infant-mother dyads. Unborn infants were randomised on maternal admission to either early or late pacifier use or cup or bottle supplemental feeding if required. A large proportion of the babies randomised were part of the study because of maternal choice to offer supplemental feeds not because the infants were unable to fully breastfeed.
Malhotra 1999	Was neither a randomised controlled trial nor a non-randomised controlled trial using quasi-randomised group allocation. Crossover design was employed.
Marinelli 2001	Was neither a randomised controlled trial nor a non-randomised controlled trial using quasi-randomised group allocation. Crossover design was employed.

DATA AND ANALYSES

Comparison 1. Supplemental feed using cup versus bottle

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Weight gain (g/kg/day)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2 Not breastfeeding at hospital discharge	3	435	Risk Ratio (M-H, Fixed, 95% CI)	0.82 [0.62, 1.09]
3 Not breastfeeding at three months	2	361	Risk Ratio (M-H, Fixed, 95% CI)	0.88 [0.76, 1.03]
4 Not breastfeeding at six months	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
5 Not fully breastfeeding at hospital discharge	3	371	Risk Ratio (M-H, Fixed, 95% CI)	0.75 [0.61, 0.92]
6 Not fully breastfeeding at three months	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
7 Not fully breastfeeding at six months	1		Risk Ratio (M-H, Fixed, 95% CI)	Totals not selected
8 Average time per feed (minutes)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
9 Length of stay (days)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected

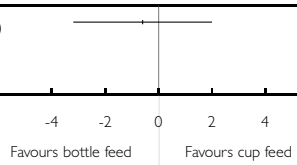
Analysis 1.1. Comparison 1 Supplemental feed using cup versus bottle, Outcome 1 Weight gain (g/kg/day).

Review: Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed

Comparison: 1 Supplemental feed using cup versus bottle

Outcome: 1 Weight gain (g/kg/day)

Study or subgroup	Cup feeding N	Mean(SD)	Bottle feeding N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Rocha 2002	44	14.1 (6.1)	34	14.7 (5.6)		-0.60 [-3.21, 2.01]



Analysis 1.2. Comparison 1 Supplemental feed using cup versus bottle, Outcome 2 Not breastfeeding at hospital discharge.

Review: Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed

Comparison: 1 Supplemental feed using cup versus bottle

Outcome: 2 Not breastfeeding at hospital discharge

Study or subgroup	Cup feeding n/N	Bottle feeding n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Collins 2004	39/151	49/152		68.1 %	0.80 [0.56, 1.14]
Gilks 2004	13/27	15/27		20.9 %	0.87 [0.52, 1.45]
Rocha 2002	8/44	7/34		11.0 %	0.88 [0.36, 2.19]
Total (95% CI)	**222**	**213**		**100.0 %**	**0.82 [0.62, 1.09]**

Total events: 60 (Cup feeding), 71 (Bottle feeding)

Heterogeneity: $Chi^2 = 0.08$, df = 2 (P = 0.96); $I^2 = 0.0\%$

Test for overall effect: Z = 1.34 (P = 0.18)

Analysis 1.3. Comparison 1 Supplemental feed using cup versus bottle, Outcome 3 Not breastfeeding at three months.

Review: Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed

Comparison: 1 Supplemental feed using cup versus bottle

Outcome: 3 Not breastfeeding at three months

Study or subgroup	Cup feeding n/N	Bottle feeding n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Collins 2004	83/144	89/139		73.5 %	0.90 [0.75, 1.09]
Rocha 2002	31/44	29/34		26.5 %	0.83 [0.65, 1.05]
Total (95% CI)	**188**	**173**		**100.0 %**	**0.88 [0.76, 1.03]**

Total events: 114 (Cup feeding), 118 (Bottle feeding)

Heterogeneity: $Chi^2 = 0.33$, df = 1 (P = 0.56); $I^2 = 0.0\%$

Test for overall effect: Z = 1.64 (P = 0.10)

Analysis 1.4. Comparison 1 Supplemental feed using cup versus bottle, Outcome 4 Not breastfeeding at six months.

Review: Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed

Comparison: 1 Supplemental feed using cup versus bottle

Outcome: 4 Not breastfeeding at six months

Study or subgroup	Cup feeding n/N	Bottle feeding n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Collins 2004	98/142	106/139		0.90 [0.78, 1.05]

Analysis 1.5. Comparison 1 Supplemental feed using cup versus bottle, Outcome 5 Not fully breastfeeding at hospital discharge.

Review: Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed

Comparison: 1 Supplemental feed using cup versus bottle

Outcome: 5 Not fully breastfeeding at hospital discharge

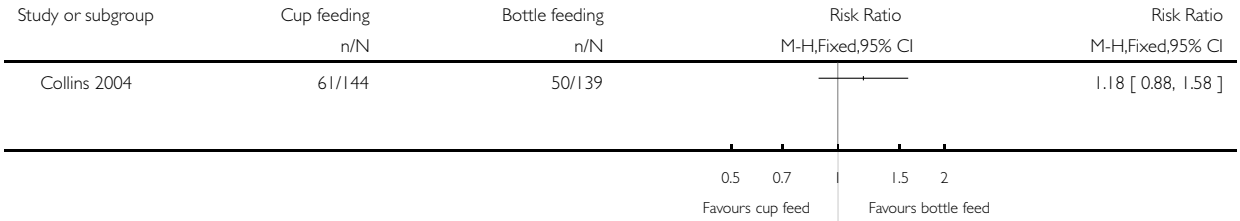
Study or subgroup	Cup feeding n/N	Bottle feeding n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Collins 2004	59/151	80/152		76.3 %	0.74 [0.58, 0.95]
Gilks 2004	17/27	23/27		22.0 %	0.74 [0.53, 1.03]
Mosley 2001	2/6	2/8		1.6 %	1.33 [0.26, 6.94]
Total (95% CI)	**184**	**187**		**100.0 %**	**0.75 [0.61, 0.92]**
Total events: 78 (Cup feeding), 105 (Bottle feeding)					
Heterogeneity: Chi^2 = 0.48, df = 2 (P = 0.79); I^2 =0.0%					
Test for overall effect: Z = 2.72 (P = 0.0065)					

Analysis 1.6. Comparison 1 Supplemental feed using cup versus bottle, Outcome 6 Not fully breastfeeding at three months.

Review: Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed

Comparison: 1 Supplemental feed using cup versus bottle

Outcome: 6 Not fully breastfeeding at three months

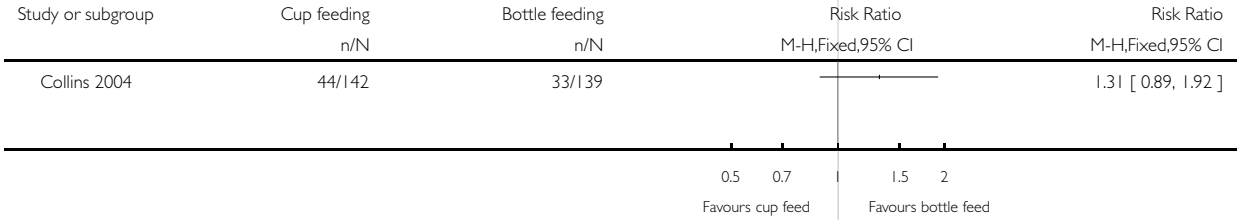


Analysis 1.7. Comparison 1 Supplemental feed using cup versus bottle, Outcome 7 Not fully breastfeeding at six months.

Review: Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed

Comparison: 1 Supplemental feed using cup versus bottle

Outcome: 7 Not fully breastfeeding at six months



Analysis 1.8. Comparison 1 Supplemental feed using cup versus bottle, Outcome 8 Average time per feed (minutes).

Review: Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed

Comparison: 1 Supplemental feed using cup versus bottle

Outcome: 8 Average time per feed (minutes)

Study or subgroup	Cup feeding N	Mean(SD)	Bottle feeding N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Rocha 2002	44	11.8 (4.5)	34	13.4 (4.8)		-1.60 [-3.69, 0.49]

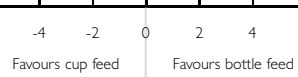
Analysis 1.9. Comparison 1 Supplemental feed using cup versus bottle, Outcome 9 Length of stay (days).

Review: Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed

Comparison: 1 Supplemental feed using cup versus bottle

Outcome: 9 Length of stay (days)

Study or subgroup	Cup feeding N	Mean(SD)	Bottle feeding N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Collins 2004	149	62.17 (30.37)	152	52.09 (24.15)		10.08 [3.87, 16.29]



F E E D B A C K

Rajiv Bahl Feedback October/07 and Review Author Response

Summary

Date of Submission: 19-Oct-2007
Name: Rajiv Bahl
Email Address: bahlr@who.int
Personal Description: Occupation Medical Officer WHO

Feedback:
Conclusions of the Cochrane review on cup feeding for newborns unable to fully breastfeed are not supported by the findings
This recently published systematic Cochrane review based on four relatively small studies makes a general conclusion "Cup feeding cannot be recommended over bottle feeding as a supplement to breastfeeding because it confers no significant benefit in maintaining

breastfeeding beyond hospital discharge and carries the unacceptable consequence of longer stay in hospital" (1). We feel that the findings of the review do not support this conclusion. Justification for this feeling is provided below.

The risk of infection should be an important consideration in the choice of feeding method. One of the major potential advantages of cup feeding over bottle feeding is in reducing the risk of infection, particularly in developing countries. All studies (2-4) included in the review except a small study from Brazil (5) are from developed countries and none has reported on the risk of infection. Although infection was included as an outcome in the protocol for this Cochrane review, the lack of data on this important outcome is not discussed.

On the outcomes on which data is presented, the number of participants in all studies is small. The total number of infants included in the meta-analysis on any breastfeeding is about 400. For comparison, in another study in term infants, Howard et al estimated that at least 700 infants would be needed to detect a 10% difference in breastfeeding cessation with 90% power and 5% significance level (6). The lack of significant effect on many outcomes could therefore have been just because of lack of statistical power. We think that the "lack of evidence of effect" cannot be taken as the "evidence of lack of effect".

The authors base their conclusions on their findings related to the lack of significant benefit of cup feeding beyond hospital discharge. However, all the studies included in the review were hospital studies with the primary outcomes limited to the time of hospital discharge. Only two studies reported effect at 3 months and one study at 6 months after discharge, as a secondary outcome. It is clear that even in these studies, sample sizes were not calculated, follow up was not complete and the quality of data cannot therefore be considered to be same as that for the primary outcome. Considering only the primary outcomes, there was a 18% non-significant benefit in any breastfeeding and 25% significant benefit in full breastfeeding rates associated with cup feeding. While these findings cannot be considered conclusive in favour of cup feeding, they are certainly indicative of a benefit. In any case, this is clearly not evidence of lack of benefit.

One of the possible reasons for only a modest benefit of cup feeding on subsequent breastfeeding could be the lack of compliance with the allocated intervention. Although the authors of the Cochrane review have recognized this, we think that they have not discussed it appropriately. For example, the researchers in the largest included study (2) considered the lack of compliance as the main limitation of their study which could have lead to an underestimate of the effect. Indeed, the researchers state in their paper that "Compliance analysis showed a significant increase in the prevalence of any breastfeeding with cup feeding (Odds ratio 21.09, 95% CI 2.62 to 169.75, P=0.004) with no significant difference in length of hospital stay (hazard ratio 0.82, 95% CI 0.58 to 1.17, P=0.27). Such compliance analysis needs to be interpreted with caution and highlight the need for further research." Further, they state that "Compliance differed between recruiting hospitals, the hospital with the better compliance has used cup feeding before, in the other it was introduced for the trial. Most peripheral hospitals had not used cup feeding before. Some staff had strong feelings against cup feeding?". The authors of the Cochrane review have not considered the lack of previous experience of staff with a new feeding method as one of the potential causes of lack of compliance with cup feeding.

The finding related to length of hospital stay (about a 15% increase in the duration of stay) needs to be interpreted with caution as it comes from a single study. Further, a possible reason for this could again be the lack of confidence of the treating physicians about the ability of the mother to feed the infant related to less experience in having used cup feeding relative to bottle feeding.

The conclusions and the plain language summary seem to indicate that the findings of this review are generalizable to all infants, in all settings. However, the studies reviewed included only those preterm infants who are not able to fully breastfeed. In this regard, it is important to consider the findings of an excluded study in term, healthy, breastfed infants (Howard et al), which show that for infants who received more than 2 supplemental feeds per day, cup feeding has distinct advantage over bottle feeding on breastfeeding duration. Also the findings may not be applicable to preterm infants in developing country settings.

Finally, we find the authors' conclusion that conducting further large, high quality RCTs on this issue may be a "futile undertaking" highly questionable. As stated above the problem of compliance in previous studies is an argument for doing better designed studies in health facilities that have experience in both cup and bottle feeding. Further, the importance of other factors like skin to skin contact, rooming in etc. should not be used an argument for not conducting research on appropriate feeding methods for infants who are not able to fully breastfeed. In our opinion, this meta-analysis underscores the need for further well-designed studies on this subject, in both developing and developed countries.

Rajiv Bahl, Constanza Vallenas, Jose Martines
Department of Child and Adolescent Health and Development
World Health Organization, Geneva

Disclaimer: The authors of this feedback are staff members of the World Health Organization. The authors alone are responsible for the views expressed in this publication and they do not necessarily represent the decisions or the stated policy of the World Health Organization.

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Reply

Thank you for your comment on our review "Cup feeding versus other forms of supplemental enteral feeding for newborn infants unable to fully breastfeed".

The authors disagree with the statement from Rajiv B et al that the findings from the review do not support the conclusion. The conclusions were drawn from the evidence presented in the four included randomised control trials.

The author's acknowledge that infection is important and thus, it was included as an outcome. A thorough literature search was undertaken on all published and unpublished studies and no data from either randomised nor non-randomised trials was found for this outcome. Several other papers from India (Gupta 1999, Malhotrata 1998) were found. Whilst they were not eligible to be included in the review, again neither of these two papers considered or discussed risks of infection, despite one discussing different utensils for delivering milk. Given that milk delivered by any utensil, irrespective of whether it is a bottle, teat, spoon or cup, each require cleaning. The authors do not feel that conducting a trial on comparing different delivery utensils and infection rates is of benefit. Without any supporting evidence or discussion in any papers regarding cup feeding in developing countries, the authors are reluctant to discuss and draw conclusions regarding this outcome We have acknowledged in the text of the review under unreported outcomes, "that none of the following outcomes were reported in any of the included studies".

Rajiv B et al comment on methodological influences which the authors have no impact on, such as sample size calculation. The statement made by the authors in the review is based on the evidence available; inferences cannot be made about design and sample size estimation by the authors. At this point in time there is a lack of evidence of effect.

Rajiv B et al again comment on design and methodology. The authors disagree with the comments and are adamant conclusions can only be based on the evidence found to be included in the review.

It is not the role of authors of Cochrane reviews to hypothesise on potential causes for lack of compliance for any intervention.

Again, the authors have presented the data available from included studies.

In reference to the excluded paper of healthy term newborn infants; this study was excluded because the population studied were healthy, term infants that were able to fully breastfeed; with supplemental feeds being offered as maternal choice, not because these were infants who were unable to fully breastfeed. This review is addressing the issue of supplemental feeds in the population of infants (irrespective of gestation age) who are unable to fully breastfeed. The authors have the view that term infants who can be fully breastfed should not be offered supplemental feeds as per the Baby Friendly Hospital Initiative (WHO1998). In addition, there are reports in the literature that caution needs to be exercised when cup feeding term infants due to the different tongue action required from that of breastfeeding, and term infants may reject the breast.

In the majority of the articles reviewed, the authors of these papers made a comment about the difficulty of ensuring compliance with this intervention. This is often the reality of conducting clinical trials in clinical settings with clinical staff. In this case, the authors do not feel that it was a question of poorly designed clinical trials.

Based on the current literature and the evidence that was reviewed, the authors disagree with the closing comment and maintain their conclusion.

The authors look forward to updating this review should further randomised controlled trials be conducted.

In conclusion, if WHO have any unpublished data regarding term infants that are unable to fully breastfeed, we would be happy to include it in future updates of the review.

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Contributors

A. Flint, K. New, M. Davies

WHAT'S NEW

Last assessed as up-to-date: 10 December 2006.

14 February 2008	Amended	Converted to new review format.
14 February 2008	Feedback has been incorporated	Feedback comments and response to comments included in review.

HISTORY

Protocol first published: Issue 1, 2005

Review first published: Issue 2, 2007

CONTRIBUTIONS OF AUTHORS

Conceiving the review - AF, KN

Data collection for the review - AF, KN

Designing search strategies - AF, KN, MWD

Undertaking searches - AF, KN, MWD

Screening search results - AF, KN

Organising retrieval of papers - AF, KN

Screening retrieved papers against inclusion criteria - AF, KN

Appraising quality of papers - AF, KN

Extracting data from papers - AF, KN

Writing to authors of papers for additional information - AF, KN

Entering data into RevMan - AF, KN

Analysis of data - AF, KN

Interpretation of data - AF, KN, MWD

Writing the review - AF, KN

Revising review - MWD

Providing general advice on the review - MWD

DECLARATIONS OF INTEREST

None

SOURCES OF SUPPORT

Internal sources

- Grantley Stable Neonatal Unit, Royal Brisbane & Women's Hospital, Brisbane, Australia.
- Dept of Paediatrics and Child Health, University of Queensland, Brisbane, Australia.

External sources

- No sources of support supplied

INDEX TERMS

Medical Subject Headings (MeSH)

*Cooking and Eating Utensils; Bottle Feeding; Breast Feeding; Enteral Nutrition [instrumentation; *methods]; Infant, Newborn; Infant, Premature; Length of Stay

MeSH check words

Humans