Limited evidence suggests that ad libitum or demand/semi-demand feeding allows for earlier hospital discharge compared to scheduled feeds for preterm infants

Emily Zimmerman (Commentary author) a 

a Department of Speech-Language Pathology & Audiology, Northeastern University, Boston, MA, USA

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Limited evidence suggests that ad libitum or demand/semi-demand feeding allows for earlier hospital discharge compared to scheduled feeds for preterm infants

Emily Zimmerman (Commentary author)
Department of Speech-Language Pathology & Audiology, Northeastern University, Boston, MA, USA

Q Does an ad libitum or demand/semi-demand feeding protocol for preterm infants improve growth rates and reduce the time to hospital discharge compared with feeding protocols with prescribed volumes at scheduled intervals?

METHODS

Design: Systematic review and meta-analysis.

Data sources: Investigators used the standard search strategy of the Cochrane Neonatal Review. This search comprised the Cochrane Central Register of Controlled Trials (CENTRAL, The Cochrane Library, Issue 4, 2009), MEDLINE (1966 to Oct 2009), EMBASE (1980 to Oct 2009), CINAHL (1982 to Oct 2009), conference proceedings, and previous reviews.

Study selection and assessment: Eight randomized or quasi-randomized controlled trials, including cluster randomized trials, that compared a policy of feeding preterm infants on an ad libitum or demand/semi-demand basis versus feeding at scheduled intervals were identified. Study inclusion: (a) preterm infants (<37 weeks gestation) who were at least partially enterally fed (a mode of feeding that utilizes the gastrointestinal tract); (b) feedings consisted of breast milk/formula through any enteral route (feeding tube, bottle, breast, or cup); (c) groups in each trial must have received the same type(s) of milk, either breast milk or formula, as those in the experimental group; (d) trials that used the response to non-nutritive sucking on a pacifier as a tool for assessing hunger were included; (e) no minimum trial duration was used. Experimental conditions: (a) ad libitum feeding—where the enteral feed starts in response to the infant’s hunger cues and ends when the infant demonstrates satiation; (b) demand/semi-demand feeding—where the enteral feed starts in response to the infant’s hunger cues (crying, quiet wakefulness, hand-to-mouth gestures, and finger/fist sucking) and ends when a prescribed volume of intake is reached (if the infant remains asleep beyond the predefined interval for assessing hunger cues, the infant may be given an enteral tube feed). Control condition: scheduled feedings—where the enteral feed starts at a scheduled...
interval without regard for the infant’s sleep or hunger status (orally fed infants who are asleep are awakened to feed or if they are unable to be awoken, they are fed via an enteral feeding tube). Four trials were excluded based on study designs and methodologies (e.g. observational studies) that were not consistent with the predefined inclusion/exclusion criteria. The criteria and standard methods of the Cochrane Neonatal Review Group were used to independently assess the methodological quality of any included trials in terms of allocation concealment or blinding of parents or caregivers and assessors to the intervention and completeness of assessment in all randomized individuals.

**Outcomes:** Primary outcomes included both the infant’s growth and the duration of hospital stay. Growth outcomes included: weight gain [grams per day (g/day) or grams per kilogram per day (g/kg/day)], linear growth (millimeters per week), head circumference (millimeters per week), skinfold thickness (millimeters per week) during the trial period, and proportion of infants who remain below the 10th percentile for the index population’s distribution of weight, height, or head circumference when assessed at hospital discharge, 40 weeks post-menstrual age (PMA), and during infancy and beyond. Duration of hospital admission was defined as the PMA and/or chronological age (days from birth or from trial enrollment) to discharge home from the hospital. Nine secondary variables included the following: (1) Age (PMA and days from birth) at establishment of full oral feedings (independent of intragastric tube feeding). (2) Nutrition intake during trial period: mean volume of milk and intake of calories/protein per kilogram per day. (3) Duration of breast-feeding (time from start of trial until infant stops receiving any breast milk) and breast-feeding prevalence (any and exclusive) on discharge and at three and six months postterm. (4) Milk aspiration: consistent clinical history and chest X-ray findings. (5) Hypoglycemia requiring treatment with unscheduled enteral supplement or intravenous fluids or glucagon. (6) Feeding intolerance defined as a requirement to cease enteral feeds and commence parenteral nutrition. (7) Necrotizing enterocolitis with at least two of the following features: pneumatosis coli on abdominal radiograph, abdominal distention or abdominal radiograph with gaseous distention or frothy appearance of bowel lumen (or both), blood in stool, lethargy, hypotonia, apnea. (8) Measures of parental satisfaction using validated assessment tools. (9) Neurodevelopmental outcomes at greater than 12 months corrected age measured using validated assessment tools and classifications of disability.

**MAIN RESULTS**

The authors reported on eight randomized controlled trials that compared an *ad libitum* or demand/semi-demand feeding regimen with feeding at scheduled intervals in preterm infants. In general, the trials used for this meta-analysis contained a small sample number with variable methodological quality that made it difficult to detect measurable effects on growth. Three trials reported that using an *ad libitum* or demand/semi-demand feeding regimen allowed for earlier discharge from the hospital.

**AUTHORS’ CONCLUSIONS**

The authors concluded that the limited evidence suggests that feeding preterm infants
with an *ad libitum* or on a demand/semi-demand can result in both earlier attainment of full oral feeding and discharge from hospital. The authors warn that these findings should be interpreted cautiously due to methodological weaknesses in the included trials and suggest that a well-designed randomized controlled trial with large sample sizes is needed to confirm these findings.

**COMMENTARY**

Despite advances in neonatal care, enteral feeding remains a challenge and a source of variability among neonatal intensive care units (NICUs) (King, 2010; Klingenberg, Embleton, Jacobs, O’Connell, & Kuschel, 2012). In fact, Klingenberg and colleagues (2012) examined the various enteral feeding practices in NICUs across different countries and continents and found marked variability in the initiation of enteral feeds, target enteral feed volumes, when/if continuous feeding was used, and the criteria for use and timing of fortified milk. An important first step toward reducing the variability evident among feeding practices in the NICU and informing clinical practice is to complete randomized or quasi-randomized research trials in this area. Here, McCormick and colleagues performed a meta-analysis that was published in the Cochrane Database Systematic Review, comparing the effectiveness of an *ad libitum* or demand/semi-demand feeding regimen to feeding prescribed volumes at scheduled intervals.

The primary outcomes for this review were infant growth rates and age at hospital discharge. The meta-analysis found there to be no statistical difference in the two studies that reported the rate of weight gain g/day and g/kg/day with trial periods lasting longer than one week. The investigators excluded three studies that examined weight gain with trial periods of less than five days. This was an appropriate exclusion, as daily weight gain for premature infants is extremely variable and depends on many factors, such as clinical status, feeding tolerance, and mode of feeding; therefore, a longer study period is likely to be more accurate when examining this outcome. In addition, the meta-analysis revealed PMA at discharge to be significantly lower for infants being fed an *ad libitum* or demand/semi-demand regimen. It is difficult to make any clear conclusions with regard to the secondary outcomes due to the variability in the study designs and methodologies. For instance, three of the included trials reported that *ad libitum* or demand/semi-demand feeding shortened the duration of the transition from tube to full oral feeds; however, these trials enrolled infants when they were already mainly fed orally, thereby making it difficult to draw any solid conclusions from this finding.

The authors of this meta-analysis should be commended for investigating the very important clinical issue of enteral feeding regimens used in the NICU. While the investigators did a thorough review of the literature and used the standard methods of the Cochrane Neonatal Review Group to independently assess the methodological quality of any included trials, additional limitations of this meta-analysis were identified using appraisal considerations for systematic reviews suggested by Schlosser and colleagues (2007) with regard to the temporal, population, and geographical constraints of the included trials (Schlosser, Wendt, & Sigafoos, 2007). First, the investigators completed a literature search that ranged from 1966 to 2009. This temporal range is problematic because: (a) the investigators never explain their rationale for the chosen start or end dates, and (b)
over the past 43 years, the NICU has undergone a tremendous amount of clinical change, especially concerning feeding, which may make it difficult to compare outcomes of older studies versus newer studies. Next, the NICU serves a wide variety of patient populations, and this meta-analysis presented the characteristics of each trial included but never discussed how these different inclusion/exclusion criteria could impinge on the primary/secondary outcomes. For example, one study included infants with a birth weight that ranged from 1800 g to 2500g (Collinge, Bradley, Perks, Rezny, & Topping, 1982); whereas another study included infants with a birth weight that ranged from 800 g to 2500 g (Puckett, Grover, Holt, & Sankaran, 2008). Birth weight is an essential determining factor of nutritional status and growth outcomes (Binkin, Yip, Fleshood, & Trowbridge, 1988). In fact, premature infants with extremely (<1000 g) and very low (<1500 g) birth weights have been associated with poor nutrition and growth outcomes (Cooke, Ainsworth, & Fenton, 2004; Ehrenkranz et al., 1999; Lemons et al., 2001; Weaver, 2006). In addition, low-birth-weight infants often have an increased time to hospital discharge. Therefore, the investigators should have used a low birth weight as an inclusion or exclusion criterion for this meta-analysis. Lastly, all studies included in the analysis were completed in the United States, with the exception of the study by Puckett and colleagues (2008), which was completed in Canada (Puckett et al., 2008). Geographical locations can influence the standard clinical practices, and the investigators should have ensured that all the standard clinical practices were similar, regardless of the geography.

Although this meta-analysis reveals that the data is not sufficient to determine which type of feeding regimen (ad libitum or demand/semi-demand versus prescribed volumes at scheduled intervals) improves outcomes, limited evidence suggested that an ad libitum or demand/semi-demand feeding regimen allows for earlier hospital discharge. Previous studies have shown that preterm infants are capable of self-regulating their enteral intake (Horton, Lubchenco, & Gordon, 1952; Tyson et al., 1983) and while their hunger cues may be more difficult to detect than a full-term infant’s, they are likely distinct enough for caregivers and speech-language pathologists to recognize and respond to accordingly (Ross & Browne, 2002). Failure to wait for hunger cues before oral feeds can lead to choking, hypoxia, aspiration, and/or fatigue during the feed (Lau, 2006). In addition, many caregivers are under pressure for the infants to finish their feeds regardless of the consequences to the infant, because successful oral feeds are often required prior to NICU discharge. Not waiting for hunger cues and rushed oral feeds can lead to feeding aversions that are difficult to treat and often result in prolonged hospitalization and poor outcomes. While more evidence is needed on which feeding regimen is the most beneficial to preterm infants, preliminary recommendations for caregivers and speech-language pathologists are to take a “developmental approach” to feeding by assessing the infant’s state (quiet sleep, active sleep, awake, and drowsy) and hunger cues (crying, quiet wakefulness, hand-to-mouth gestures, and finger/fist sucking) prior to oral feeding in an effort to make it a positively associated experience and to reduce feeding aversions with this fragile population. Future randomized, and quasi-randomized, controlled studies with a larger sample size are needed that compare ad libitum or demand/semi-demand...
feeding regimens to scheduled feeds with the variables of growth rates, attainment of full oral feeding, and age at hospital discharge.

Declaration of interest: The commentary author reports no conflicts of interest and is solely responsible for the content and writing of this structured abstract.

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