



Feed-thickening practices in NICUs in the current era: Variability in prescription and implementation patterns

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Available online 8 August 2015

KEYWORDS

Neonates;
Thickened feeds;
Dysphagia;
Gastroesophageal
reflux

Abstract *Background:* Feed-thickening for infants in the Neonatal Intensive Care Unit (NICU) is performed due to concerns of dysphagia and gastroesophageal reflux disease (GERD). No standards currently exist regarding feed-thickening prescriptions and practices and this results in variable and potentially unsafe feeding approaches.

Methods: Electronic surveys were sent to neonatal feeding therapists and providers in order to determine the prescriptions and practices currently being used for feed-thickening in the NICU.

Abbreviations: NICU, Neonatal Intensive Care Unit; GERD, gastroesophageal reflux disease; NEC, necrotizing enterocolitis; AAP, American Academy of Pediatrics; FDA, United States Food and Drug Administration.

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<http://dx.doi.org/10.1016/j.jnn.2015.07.004>

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Results: A total of 313 responses were collected. Results revealed the majority of providers use thickened feeds for concerns of dysphagia or GERD with some reporting they thicken expressed breast milk. Variability of thickening prescriptions was noted regarding consistencies, thickening agents, and recipes used. Reported approaches for measuring, mixing, and warming thickened feeds varied.

Conclusion: Variability was noted in the feed-thickening prescriptions and practices performed in the NICU. Further research and standardization are required to develop thickening guidelines.

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Introduction

Acquisition of independent, safe oral feeding skills among Neonatal Intensive Care Unit (NICU) infants is an essential criterion for hospital discharge as per the American Academy of Pediatrics (AAP) (AAP Committee on Fetus and Newborn, 2008). Abnormalities of swallowing, also known as dysphagia, prolong hospital discharge and may warrant additional tests and therapies. Specifically, feeding difficulties in infants may be related to immature sucking, dysfunctional suck-swallow-breathe coordination, aspiration, or gastroesophageal reflux disease (GERD). NICU feeding therapists have few strategies to overcome these feeding challenges. This is largely due to variable skill development, aerodigestive and neurological comorbidities, and structural anomalies that are observed in the population. In addition, accuracy of diagnostic tests for dysphagia and lack of standardized swallowing therapies remains controversial. The shortage of research in this area unfortunately leads to the implementation of feeding practices without evidence-based rationales. One of these strategies commonly used in the NICU is feed-thickening. However, little is known about how thickened feeds affect swallow coordination in infants, the appropriate preparation and delivery methods, as well as the short- and long-term consequences of their use.

The mechanics of how thickened feeds affect dysphagia and aerodigestive reflexes are unclear. The decreased flow rate of thickened liquids is thought to increase oropharyngeal transit time allowing for improved oral motor control and airway closure mechanisms, possibly due to the greater availability of sensory information (Goldfield et al., 2013). For infants with GERD, the assumption has been that thickening increases the weight of the liquids, ensuring they remain in the stomach rather than be regurgitated (Orenstein et al., 1987).

Challenges with ensuring appropriate viscosity with thickening agents have been noted with

formula and human milk. When starch-based thickening agents are added to formula, the viscosity progressively increases potentially resulting in difficulties with liquid extraction, prolonged feedings, and increased energy expenditure (de Almeida et al., 2011; September et al., 2014). However, when human milk is thickened, the viscosity decreases over time due to amylase in the milk, which degrades the starch in the thickener (de Almeida et al., 2011). The increased viscosity produced with formula is often deemed safer compared to providing thinned human milk. This logic results in the unfortunate discontinuation of human milk, which negates the policies set forth by the AAP, World Health Organization and Institute of Medicine for exclusive use of human milk for the first six months of life (Institute of Medicine, 2011; AAP Section on Breastfeeding, 2012; World Health Organization, 2001). The alteration of viscosity is also affected by the dwell time, temperature of the liquid, as well as saliva, which makes it challenging to produce an accurate consistency (Cichero et al., 2011; de Almeida et al., 2011; Hanson et al., 2012). Density and yield stress of thickened feeds may be altered in addition to the viscosity. A fluid that is more dense will require more force to move (Cichero and Lam, 2014). Powdered thickeners, such as infant cereals and some artificial thickeners, introduce solid particles, thus altering the texture and requiring a higher yield stress to flow (Cichero and Lam, 2014). These changes in texture may lead to decreased palatability resulting in reduced intake, and have the potential to impact hydration (Stokes et al., 2013).

Clinical implications exist regarding the type of thickener used. Concerns regarding the use of artificial thickeners were raised after the development of necrotizing enterocolitis (NEC) was reported in preterm infants prescribed xanthan or carob-bean gum thickeners (Beal et al., 2012; Clarke and Robinson, 2004; Woods et al., 2012). Consequently, many institutions have opted to provide infant cereals. However, the use of cereals is not

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