

# Colostrum Versus Formula Supplementation for Glucose Stabilization in Newborns of Diabetic Mothers

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## ABSTRACT

The purpose of this article is to describe practice change designed to facilitate breastfeeding while maintaining glucose stabilization in infants born to diabetic mothers. Postpractice change outcomes of newborn blood glucose levels, formula supplementation, and colostrum feeds are specifically addressed. There were no significant differences between glucose values for infants given formula supplementation versus those fed colostrum. Postpractice change, admissions to the neonatal intensive care unit (NICU) for glucose stabilization decreased and exclusive breastfeeding increased.

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Newborns of diabetic mothers are an at-risk group and should receive routine blood glucose monitoring (Wight, Marinelli, & the Academy of Breastfeeding Medicine Protocol Committee, 2006). U.S. hospital practices often follow traditional care models of obtaining blood glucose values, typically drawn as point of care, capillary samples within the first hour after birth. This early blood glucose testing often leads to unnecessary treatment of blood glucose values with formula supplementation. Hospital routines such as providing water, glucose water, or formula supplementation reduce the success rate of exclusive breastfeeding (American Academy of Pediatrics [AAP], 2012). The purpose of this article is to describe the results of an evidence-based practice change for glucose monitoring and promoting breastfeeding in this at-risk group by comparing newborns who were fed colostrum versus those who were fed formula. Postpractice change outcomes of newborn blood glucose levels, formula supplementation, and colostrum feeds are described.

## Background and Significance

The Healthy People 2020 goal is to decrease the proportion of newborns who receive formula

during the first 2 days of life from 24.6% to 14.2% (U.S. Department of Health and Human Services [U.S. DHHS], 2013). The Joint Commission (2009) added exclusive breastfeeding at discharge as a Perinatal Core Measure and mandated that hospitals report when formula is being given, especially when it is not medically indicated. When a breastfeeding infant is fed formula soon after birth, he or she often demonstrates a lack of interest in feeding at the breast due to prior satiation from an overfull stomach. The mother's milk production subsequently diminishes, which may lead to poor milk supply and contribute to early discontinuation of breastfeeding (Holmes, 2013). Colostrum contains many properties that ensure optimal health and is genetically designed to be the perfect food for a newborn (World Health Organization [WHO], 2013).

Infants born to diabetic parents have an accelerated risk of becoming diabetic themselves (Florez, Hirschhorn, & Altshuler, 2003). Formula-fed infants are at greater risk of developing type 2 diabetes in later life compared to breastfed infants (Owen, Martin, Whincup, Smith, & Cook, 2006). In overweight or obese children, formula feeding is associated with reduced insulin sensitivity and

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increased insulin secretion (Manco et al., 2011). In a landmark study, Kostraba et al. (1993) postulated that the sensitization and development of immune memory to cow's milk protein in infant formulas could be an initial step in the etiology of type 1 diabetes. This may happen in susceptible infants when exposed to cow's milk formula during the first days of life (Holmberg, Wahlberg, Vaarala, Ludvigsson & the All Babies in Southeast Sweden [ABIS] Study Group, 2007). Beta cell autoimmunity can be triggered through ingesting cow's milk-based formula and this increases the risk for developing type 1 diabetes up to age 5 (Holmberg et al.). Autoantibodies are associated with beta cell destruction and reduced insulin production found in Type 1 diabetes. Holmberg and colleagues reported that short duration of total breastfeeding, short duration of exclusive breastfeeding, and early formula feeding were associated with increased autoantibodies in the sample of 5-year-old nondiabetic children.

In healthy, breastfed, term infants blood glucose levels were lower at one hour after birth than any other time up to 96 hours after birth (Hoseth, Joergensen, Ebbesen & Moeller, 2000). There were no significant differences in blood glucose values for gender, delivery mode, gestational age, or Apgar score. Croke et al. (2009) conducted a meta-analysis of studies reporting neonatal blood glucose levels in the first 3 hours of life. The pooled mean blood glucose was significantly lower at one hour than at 2 or 3 hours after birth, regardless of the feeding method. In at-risk neonates defined as either small or large for gestational age, 1- to 3-hour blood glucose levels did not significantly differ from those of healthy newborns. Croke et al. performed a clinical audit of at-risk newborns that also confirmed the findings of the meta-analysis.

In general, breastfed infants have lower blood glucose values than formula-fed infants (Rozance & Hay, 2010). Furthermore, the definition of *hypoglycemia* is controversial and may not be represented by a single value but rather by a low percentile threshold associated with hours since birth (Alkalay et al., 2006; Rozance & Hay). It is difficult to determine the exact blood glucose value and time period that would ultimately cause neurological impairment in a newborn (Hay, Raju, Higgins, Kalhan, & Devaskar, 2009; Rozance & Hay). Clinical symptoms that may reflect newborn hypoglycemia include alternating tremulousness and lethargy and convulsions responsive to glucose treatment. More severe symptoms of hypoglycemia include "coma, seizures, respiratory

depression and/or apnea with cyanosis, hypotonia or limpness, high pitched cry, hypothermia, and poor feeding after initially feeding well" (Rozance & Hay, p. 279). Although asymptomatic, transient episodes of hypoglycemia during the first hours of life are reported to confer a very low risk of long-term neurologic sequelae (Rozance & Hay; Wight et al., 2006), studies defining the glucose concentrations attributable to adverse neurologic development are lacking (Boluyt, van Kempen, & Offringa, 2006). In one study, Burns, Rutherford, Boardman, and Cowan (2008) reported a variety of brain injury patterns and subsequent neurodevelopmental delay in neonates who experienced symptomatic episodes of hypoglycemia (<1.5 mmol/L= 27 mg/dl). Thus, aggressive treatment of symptomatic hypoglycemia is currently recommended (Chantry & Howard, 2013). For the asymptomatic newborn, the high protein content of colostrum helps with glucose stabilization and promotion of ketogenesis (Marinelli, Stellwagen, & MacEnroe, 2012), which protects the immature brain from low or fluctuating glucose levels.

#### Former Newborn Hypoglycemia Practice

In the study hospital, a tertiary care center in the northeastern United States as well as many American hospitals, the standard of care for newborns at risk for hypoglycemia included early testing of blood glucose values, sometimes as soon as 15 minutes after birth. The target value of 45 to 50 mg/dl was mainstream practice for many years. Another established hospital practice was the supplemental feeding of formula to breastfeeding newborns with the expectation of elevating blood glucose levels. These routine hospital practices lead to a significant decrease in the success of exclusive breastfeeding (American Academy of Family Physicians [AAFP], 2013). Exclusive breastfeeding for the first six months of a child's life is well documented to be best practice for the entire population (AAFP; AAP, 2012; Academy of Breastfeeding Medicine [ABM], 2008; American College of Obstetricians and Gynecologists [ACOG], 2007; WHO, 2013).

Another common practice was the use of intravenous glucose infusions for initial blood glucose values below 45 mg/dl, which often resulted in infant transfer to the neonatal intensive care unit (NICU). Anecdotal observations associated with some diabetic mothers who were highly motivated to avoid formula suggested that the blood glucose levels of infants who were given early and frequent swallows of hand-expressed colostrum and breastfeeding attempts were stable. With these

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