

Creamatocrit Measures with Mothers' Milk: Utility in Neonatal Intensive Care

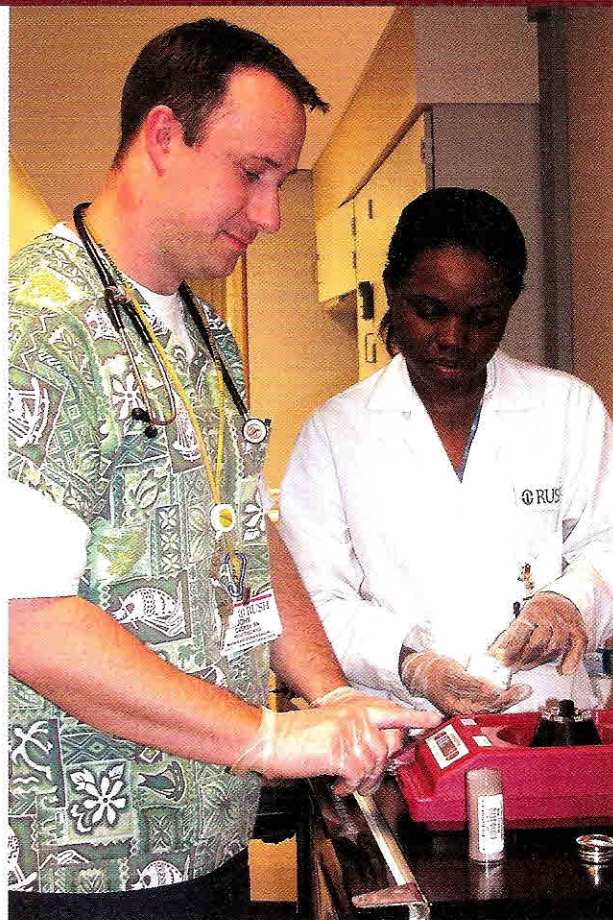
Mothers' milk is the recommended feeding for premature infants because it provides unique nutrition and protection from enteral feed intolerance, nosocomial infection, and necrotizing enterocolitis. However, several older studies indicate that weight gain may be slower in human milk-fed than formula-fed premature infants, raising questions about the caloric adequacy of mothers' milk. The creatmatocrit technique provides objective and specific information about the caloric content in individual mothers' milk collections that are fed in the NICU. Similarly, it can be used to individualize interventions, such as hindmilk fractionation, designed to optimize infant weight gain.

What is the creatmatocrit technique?

The creatmatocrit is a quick, accurate, easy-to-perform measure of the lipid content in mothers' milk. Used extensively in lactation research since 1978, it involves placing a few drops of milk in a capillary tube, and centrifuging it so that the lipid — or “cream” — separates from the aqueous part of the milk. Then, the percent of total milk volume equal to cream can be calculated and converted to estimates of lipid and caloric content. Previously, the creatmatocrit procedure required several steps, and was performed with a cumbersome laboratory centrifuge and calipers, which limited its clinical use. However, the Creatmatocrit Plus™ is small, portable, noiseless, quick, easy to use, and has an embedded reader for caloric calculations, making it ideal for the NICU setting.

Why is it useful to measure the lipid and calories in mothers' milk in the NICU?

Unlike formula, the lipid in expressed mothers' milk samples varies considerably, depending upon the stage of lactation, frequency of milk expression, and completeness of breast emptying. Lipid contributes the majority of the calories in mothers' milk, so fluctuations always affect caloric density. This variability was exemplified in a recent research report in which individually pumped milk specimens in the NICU ranged from 14 to 36 calories per ounce. Older reports suggesting that



preterm mothers' milk contains constant amounts of lipid and calories are based upon 24-hour milk collections, in which milk expressed over the entire day is pooled, so that the variability among individual milk samples “averages out”. However, in nearly all NICUs, individual milk collections — not pooled specimens — are fed to infants, so lipid and calories vary significantly.

What affects the lipid and calories in expressed mothers' milk for NICU infants?

Lipid is relatively low in colostrum (the early milk during the first days post-birth), but provides about 50-55% of the calories in mature milk. The lipid globules are secreted gradually into the milk as the breasts are emptied, so that milk removed near the beginning of the pumping is lower in lipid and calories, whereas the final portion is several times higher. The frequency of milk expression also

affects lipid and calories in mothers' milk. Higher amounts are seen when the breasts are emptied every 2-3 hours, with the lowest amounts occurring after prolonged storage in the breast, often after 6-8 hours of sleep. These variations are normal and don't cause problems for the healthy breastfeeding infant, but can significantly affect weight gain if not understood and managed in the NICU.

How can I use the creatocrit in the NICU?

The most common use of the creatocrit is to provide baseline lipid and calorie measures in mothers' milk that is fed to NICU infants for whom weight gain is especially important, such as fluid-restricted extremely low birthweight infants. If creatocrit values are below those needed for optimal weight gain, the clinician can recommend one of several strategies to concentrate calories. Then, the mother's milk can be re-tested after she tries the recommended strategy to ensure that it had the desired effect.

The creatocrit can be used to diagnosis and manage several easily-remedied iatrogenic problems that reduce calories in mothers' milk, and may result in slow infant weight gain. First, mothers may leave calorie-rich hindmilk in the breasts because they've been told to pump for 15 minutes, and their breasts do not empty in that period of time. Second, a mother who sleeps for 6-8 hours at night frequently expresses a larger volume, low-calorie milk first thing in the morning, and lower-volume, higher-calorie milk later in the day when she pumps more frequently. Creatocrit measures can confirm these variations, and then be used to correct milk expression or storage techniques so that calories are optimized. For example, the mother with an adequate milk volume can freeze the early morning milk for later use when her baby is bigger, and save the milk collected later in the day for feedings when weight gain is critical.

The creatocrit is ideal to guide the separation of foremilk (low-lipid, low calorie milk) and hindmilk (high-lipid, high-calorie), when short-term accelerated weight gain in the infant is desired. Because milk volume and rate of milk flow vary among women, a standardized set of instructions for separating foremilk and hindmilk will be ineffective. The creatocrit can be used to teach mothers about their individual changes in milk lipid over the course of milk expression, and the women can be taught to provide milk with a targeted caloric content. In complicated clinical situations that require fluid restriction and concentrated calories, creatocrits can be performed

on each milk collection that is fed to an infant. Finally, creatocrits can be used to troubleshoot other sources of lipid loss in mothers' milk, such as adherence to continuous gavage infusion tubing. These measures allow the nurse or physician to distinguish among the causes of slow infant weight gain, e.g., the mother's expression technique or the NICU milk handling/infusion practices, so that they can be corrected appropriately.

In the Rush Mothers' Milk Club program, infants' mothers are taught to perform creatocrits on their own milk, so that they can work as partners with the NICU team. Our research has shown that the women can do this as accurately as advance practice nurses, enjoy the ability to participate so uniquely in infant care, and save approximately 186 minutes of nursing time per infant by assuming this responsibility.

Selected References

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