

Use of the Brix Refractometer for Monitoring Milk Total Solids and Colostrum Quality

In the past, monitoring colostrum quality on-farm has required the use of imprecise and fragile diagnostic tools (i.e., colostrometer), whereas measuring total solids in pasteurized waste milk has required submission of milk samples to laboratories. In recent years, dairies and calf ranches are turning to use of Brix refractometers to estimate immunoglobulin G (IgG) concentration in maternal colostrum and/or measure and monitor total solids in pasteurized waste milk.

Refractometer Basics

The refractometer used by calf facilities is designed to measure the Brix value of a solution. The Brix scale is used to indicate the sugar content of a solution, but this scale has been adapted for on-farm use on dairies. Here are some examples of refractometers that are appropriate for dairies:

[Reichert Brix/RI-Chek](#)

[Misco Palm Abbe Digital Refractometer 0 to 56 Brix](#)

Colostrum Quality

Colostrum IgG concentration is the most common measure of colostrum quality. IgG concentration can vary considerably from cow to cow, and ideally, colostrum should be tested for quality to avoid feeding poor quality colostrum. A colostrometer can be used to screen for and segregate low quality colostrum but results can be inaccurate due to colostrum temperature. In addition, the colostrometer itself is not very durable. A Brix refractometer offers significant advantages over a colostrometer because instrument accuracy does not appear to be affected by sample temperature [Bielmann et al., 2008, J. Dairy Sci. 91(E-Suppl. 1):354] and is considerably more durable.



Misco Palm Abbe Digital Refractometer

Research by Bielmann et al. (2010, J. Dairy Sci. 93:3713) determined that **a Brix value of 22% is the proper cut-off for determining whether colostrum is of adequate quality (colostrum should measure $\geq 22\%$)**. A Brix value of 22% is equivalent to 50 grams/liter IgG, which is where the green (i.e., good quality) zone begins on the colostrometer.

Managing Total Solids in Pasteurized Waste Milk

Nutrient composition (e.g., total solids, fat, protein) of pasteurized waste milk can be highly variable from day-to-day due to variation in cow population (proportion of fresh vs. treated cows) or inadvertent addition of wash water, thus leading to inconsistent nutrient intake and potentially depressed growth and health in preweaned calves. While monitoring actual fat and protein concentrations is difficult, a Brix refractometer can be used to estimate total solids percentage of waste milk. Subsequently, desired total solids of the liquid feed can be achieved through the addition of milk replacer powder.

For determining total solids with a Brix refractometer, the Brix value needs to be converted using an equation established by Moore et al. (2009, J. Dairy Sci. 92:3503). **The equation is $TS\% = 0.9984(Brix\%) + 2.077$, or essentially $Brix\% + 2$.**

Note: Refractometers may be used to measure total solids in milk replacer solution, but the prediction equation will be unique to each milk replacer and not the same as the one used for whole milk.

Measuring Total Protein in Serum

Typically, clinical refractometers are used to measure the total protein in serum taken from the blood of calves. However, an evaluation by Morrill et al. (2013, J. Dairy Sci. 96:4535–4541) showed that the Brix scale could be used to estimate failure of passive transfer in calves and that 7.8% Brix may be used as the cut point.

Take Home Messages

- **Colostrum Quality:** A brix value of 22% is equivalent to an IgG concentration of 50 g/L. Any colostrum used for the first feeding should be $\geq 22\%$ Brix.
- **Milk Total Solids:** Total solids % = Brix % + 2. Typical total solids % of whole milk is 12.5%.
- **Serum Total Protein:** A Brix measurement of blood serum $\geq 7.8\%$ is a reasonable estimate of 10 mg/ml of IgG which is the accepted definition of effective passive transfer.