

Dairy Herd Health & Management

PD-2019-05-01

Using the Optical Refractometer to Manage Calf Health

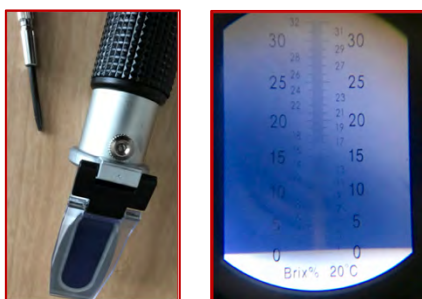
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Introduction

Many research publications and resources are available to help calf raisers use refractometers. This bulletin summarizes current recommendations and references. For digital refractometer information refer to “Using the Digital Refractometer to Manage Calf Health” PD-2019-05-02 bulletin.

The Brix refractometer measures sucrose concentrations in liquids like wine and fruit juice. When used to measure non-sucrose containing liquids, the Brix% approximates the total solids percentage. Questions that can be answered with a refractometer include:

- What is the colostrum immunoglobulin content?
- What is the passive antibody transfer success rate?
- What is the total solids content of the whole milk or milk replacer?



Photos: Optical Brix Refractometer.

Calibration

Optical refractometers need to be calibrated periodically to ensure accurate readings. This can be done using distilled or de-ionized water and turning the adjustment screw until the Brix reading shows zero percent.

Temperature Equilibration

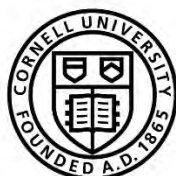
For the best results, the sample and refractometer should both be at about room temperature (~68°F). Since the sample volume is just a couple drops, it has a low thermal mass and temperature adjusts pretty quickly. Instruments that are automatically temperature compensated (ATC) can accommodate temperature differences within the range indicated by the device. If the device is hot or cold right before it's to be used, allow time for the refractometer to temperature acclimate (one to two minutes).

Colostrum Immunoglobulin Content

Testing immunoglobulin content of colostrum is a good way to inform the calf feeder and management. Colostrum testing 22 percent Brix has an IgG level of 50 gm/L and is considered good quality. For a heifer's first colostrum feeding, switch low testing colostrum with high quality colostrum. Colostrum testing below 22 percent can be used for second and greater feedings.

Successful Antibody Passive Transfer

Checking how well colostrum antibodies are absorbed by calves is a great way to evaluate overall colostrum management. One simple and inexpensive way to do this is to check serum total solids concentration. Brix% is highly correlated with IgG. In order to do this correctly, first select the right calves to sample. Test at least twelve healthy calves between 24 hrs and seven days of age about 1 ½ hours after their last milk feeding. Blood samples should be collected in red top tubes and centrifuged at 2200 to 2500 RPM (standard) for 10 minutes to obtain serum. If a centrifuge is not available, the



tubes should sit undisturbed at room temperature (60°–75°F) for one hour prior to collecting the serum for testing. A calf is considered to have adequate passive transfer of antibodies with a serum IgG concentration ≥ 10 g/L, which correlates to ≥ 8.5 Brix%.

Table 1: Successful antibody passive transfer cutpoints by test.

Test	Successful Antibody Passive Transfer
RID Immunoassay	≥ 10 g/L
Serum Protein Concentration	≥ 5.5 g/dL
Brix%	$\geq 8.5\%$

Whole Milk Total Solids

Total solids content can vary in nonsalable milk, and routine measurement using a digital refractometer can inform the feeding program. Remember to take samples from well mixed milk prior to pasteurization.



Figure 1: Optical Brix refractometer adjustment to measure total solids concentration in whole milk.

Milk Replacer Total Solids

Day-to-day consistency is important for good calf health and growth. Milk replacers mixed below recommended concentration will slow growth. Milk replacers mixed too concentrated can lead to digestive problems and disease. The optical refractometer can be used to evaluate correct mixing of milk replacers and consistency of mixing procedure. Start by calculating what the total solids percent of the milk replacer product should be by collecting the feeding amounts from the label.

$$\% \text{ Total Solids of Milk Replacer} = \left(\frac{\text{Lbs of Powder}}{\text{Lbs of Powder} + \text{Lbs of Water}} \right) \times 100$$

Figure 2: Calculation of percent total solids of milk replacer. Divide the weight of powder by a combination of the weight of the powder and weight of the water to be used.

Due to variation between milk replacer ingredients, a customized plot of known solution concentrations of the product being fed is needed. From the curve generated, sample Brix% readings can be converted to total solids and compared to the target concentration.

Directions on how to do this can be found at the University of Wisconsin–Madison School of Veterinary Medicine website.

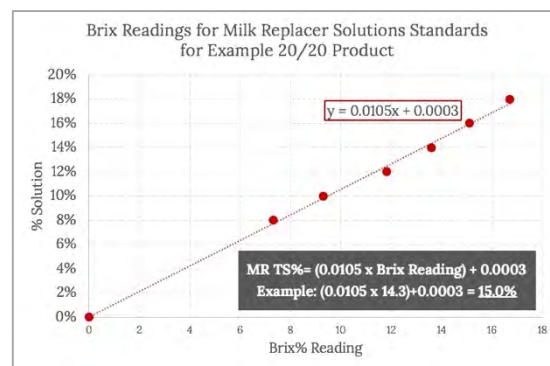


Figure 3: Custom Brix% concentration curve using known milk replacer concentration solutions.

References

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