

Why there is no such thing as colostrum quality

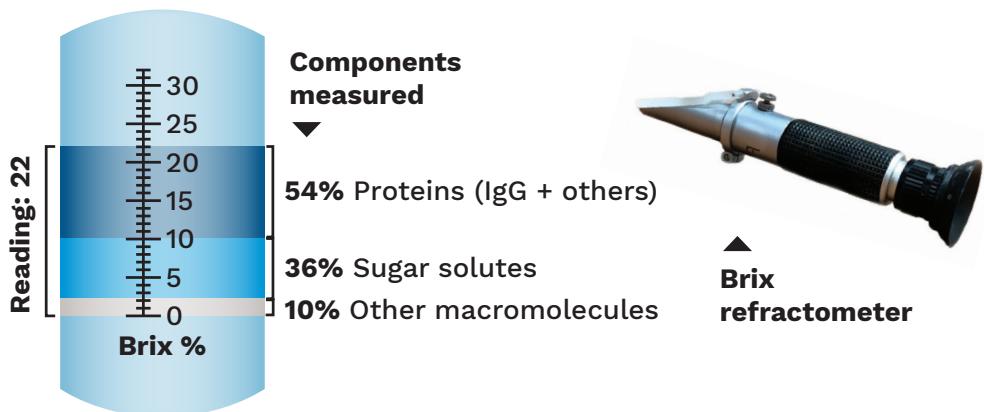
Vimal Selvaraj, Kasey Schalich, and Rob Lynch

In the early 1800s, Adolf Brix introduced specific gravity measurements as a method to estimate the sugar concentration in liquids. Even today sugar concentration by percentage mass is measured using the Brix refractometer in the beverage industry, including for ripening wine grapes and other juices and beer. In 1978, the Brix refractometer was first experimented as a crude method to estimate the immunoglobulin G (IgG) concentration in horse colostrum. Since the late 1990s the dairy industry has recommended this method to determine IgG content in cow colostrum. Given the original design and use of the Brix refractometer, and the distinct physical properties of proteins and sugars, we performed a simple study to investigate the question: What components in colostrum make up the Brix score?

To address this, we measured the Brix score of colostrum samples before and after removal of lipids, proteins, and sugars. Our results showed that lipids did not influence Brix scores, but sugars and proteins have an almost equal

FIGURE 1

Component breakdown of a representative sample Brix score of 22



Only 54 percent of a Brix score represents proteins (IgG and other protein components in colostrum). The remainder of the Brix score is made up of sugars (36 percent) and other non-protein macromolecules (10 percent). All these represent variables that contribute to a Brix score reading.

influence on the Brix score, indicating that colostrum Brix scores are a reflection of both the sugar and protein content. To us these results were quite eye-opening, as variations to sugar content or proteins other than immunoglobulins do not appear to be discussed with regards to how they can influence colostrum Brix scores. Identifying these variables then raised another important question: How well correlated is the relationship between colostrum IgG concentration and Brix scores?

In a field test, we collected colostrum samples from primiparous and multiparous Holstein cows with a range of low to high Brix scores and directly quantified the sample IgG concentrations in the lab. We did not find a significant correlation. In other words, our results show that high Brix colostrum does not necessarily mean it has high IgG, and low Brix does not mean it has low IgG. Given the makeup of variables that contribute to the

Continued on page 2

Brix score, this finding that Brix scores and IgG concentrations are not correlated made sense.

HANG ON, THIS GOES AGAINST PREVIOUS RESEARCH!

So why are our results so different from previous research that seemed to establish a relationship between Brix and IgG? The answer is because we are simply using new and more rigorous technology to specifically quantify IgG. This is in contrast to older laboratory techniques that, while cutting-edge when first used in the 1970s to 1990s, today over 30 to 50 years later, are known to have significant shortcomings as highlighted in several studies. Ultimately, in light of these findings on how IgG is just one of several variables that contribute to the Brix score, we offer two points to consider in the formulation of calf feeding protocols.

FIRST

Because Brix score and IgG concentration are not correlated, the concept of “colostrum quality” does not have strong evidence.

This means that since we aren't gaining any information about IgG concentration from checking the Brix, four liters of any available colostrum can just be fed to calves for their first meal.

SECOND

While research has made clear the importance of feeding IgG to calves, the relevance of which IgG is fed (what specific pathogens the IgGs binds to) has not received appropriate equal consideration. From immuno-physiology we know that the IgG a cow provides is specific to the pathogens on that dairy. As such, IgG in maternal colostrum is much more protective and relevant to the environment where the calf is raised than IgG in commercial replacements that is likely derived from cows living far off site and exposed to a different cohort of pathogens. Therefore, even lower levels of highly relevant IgG are far superior than high levels of irrelevant IgG.

CONCLUSION

Ultimately, we believe that our results are exciting because

they indicate producers do not need to measure colostrum Brix scores or have to worry about having enough colostrum above a “cut-off” Brix score. We now know such cut offs are quite arbitrary. For the first meal, we recommend just feeding four liters of colostrum. It is much better for neonatal calves than any replacement formula. Colostrum, irrespective of its Brix score, is still the finest choice for feeding calves. ■

Vimal Selvaraj, B.V.Sc., Ph.D. (vs88@cornell.edu), **Kasey Schalich, Ph.D.** (kms433@cornell.edu) and **Rob Lynch, DVM** (ral328@cornell.edu) are with the Department of Animal Science, Cornell University.

Acknowledgements

This research was funded by the Northeast Sustainable Agriculture Research and Education (NE-SARE) grant GNE19-220-33243, the Cornell CALS Charitable Trust Research Fund, and startup funds from Cornell CALS.

Reference

Schalich KM, Reiff OM, Nguyen BT, Lamb CL, Mendoza CR and Selvaraj V. (2021). Temporal kinetics of bovine mammary IgG secretion into colostrum and transition milk. Journal of Animal Science. doi:10.1093/jas/skab083.

**"Producers do not need to measure colostrum Brix scores...
We now know that such cut-offs are quite arbitrary."**
