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## *Calf Note 183 – Refractometer and Jersey Colostrum*

### Introduction

Estimating the quality of colostrum is essential. It is well known that cows produce colostrum of widely different quality and some of that colostrum is not suitable to feed to newborn calves.

Of course, it's important to define what we mean by quality. Although colostrum is replete with many different (and important) proteins, fats, vitamins and minerals, we typically evaluate colostrum on the basis of its immunoglobulin G (IgG) concentration. This is almost certainly an oversimplification, as colostrum is a source of many important nutrients, growth factors and other proteins; however, the role of many of these factors await further quantification.

Accurately measuring IgG is normally done in the laboratory using one of several methods, including radial immunodiffusion (RID), enzyme-linked immunosorbent assay (ELISA), and turbidimetric immunoassay (TIA). Of these, the most common method and the de facto “gold standard” is RID. All of these methods are time consuming, require laboratory equipment and expertise and, thus, are not suited for continual, on-farm testing. A quicker, cheaper and more practical approach is to estimate the IgG content of colostrum using a surrogate measure such as the BRIX refractometer. The BRIX refractometer is a simple and relatively inexpensive – optimal refractometers are available for less than \$100 – test that measures the solids content of liquid, including colostrum. The solids content can then be used to estimate IgG, assuming that higher solids content in colostrum is associated with higher IgG content.

Several studies have evaluated the BRIX refractometer as a means to estimate the IgG content of colostrum. A recent paper reported the acceptable relationship between the BRIX refractometer and colostrum IgG (measured by RID) in Holstein colostrum and suggested that a break-point of 21 percent BRIX be used to indicate high versus low quality colostrum.

The BRIX refractometer measures total solids concentration and not IgG. It is known that the amount and type of solids in Jersey colostrum can differ from that found in Holstein colostrum; thus, it is not clear whether the refractometer will be equally as accurate when testing colostrum from Jersey cows compared to Holsteins. It is very timely that the research group from Iowa State University, led by Drs. Kim Morrill and Howard Tyler, evaluated this specific question.

### The research

Colostrum samples were collected from Jersey cows (n = 58) from one dairy farm during June of 2012. The samples were quickly analyzed for IgG by RID, BRIX, and were also tested using a colostrometer.

The colostrometer is a hygrometer that also estimates IgG on the basis of total solids (specific gravity) of colostrum. It has been criticized for being inaccurate and particularly sensitive to colostrum temperature. The advantage of the colostrometer is simplicity, although most devices are made from glass, which can break easily in the harsh environment of the dairy farm.

The variation of samples collected in the study are in Table 1. Range of colostrum IgG was 13 to 154 g/L, which is typical of studies that have evaluated IgG in first milking colostrum. This is a great reminder that colostrum must be tested on farm; the amount of variation, even on one dairy, is tremendous. Certainly,

Item	Mean	SE
<b>IgG (g/L)</b>	<b>72.9</b>	<b>3.3</b>
<b>Low</b>	<b>12.8</b>	
<b>High</b>	<b>154.3</b>	
<b>BRIX (%)</b>	<b>21.2</b>	<b>0.3</b>
<b>Colostrometer (g/L)</b>	<b>84.5</b>	<b>0.9</b>

Table 1. Mean values for IgG, BRIX, and colostrometer readings from Jersey colostrum.  
From: Morrill et al., 2015.

calves fed colostrum containing only 13 g/L will not achieve successful passive immunity, whereas calves fed the highest IgG colostrum would likely achieve successful passive immunity.

The relationship between IgG and BRIX was high, with an  $r^2$  of 0.63 (the closer the  $r^2$  is to 1.0, the better the relationship). Generally, samples that varied from the regression line (Figure 1) were on the higher side of the line, suggesting that, as IgG increased, the amount of other, non-IgG solids may have decreased. However, these data are consistent with other research studies comparing BRIX to colostrum IgG content.

Interestingly, in this study, the relationship between the colostrometer and colostrum IgG had the same  $r^2$  as the BRIX refractometer. Other studies have criticized the use of the colostrometer, indicating that it was not an accurate method for estimating IgG in colostrum.

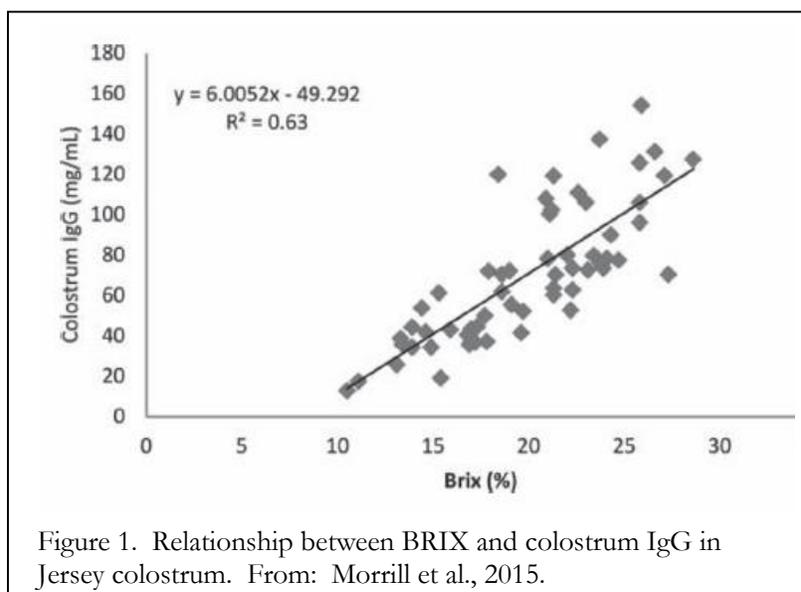


Figure 1. Relationship between BRIX and colostrum IgG in Jersey colostrum. From: Morrill et al., 2015.

The authors conducted an evaluation of the sensitivity, specificity, error rates and overall accuracy of various cut points for estimating high quality (defined as colostrum with 50 g of IgG/L or more) versus low quality (<50 g/L) colostrum. Overall, the cut point of 18 percent BRIX gave the greatest accuracy compared to cut points of 19, 20 or 21 percent. Therefore, it was recommended that Jersey colostrum, the cut point of 18 percent be used to differentiate between high and low quality colostrum for Jersey colostrum. This varies from the finding of Quigley et al. that a cut point of 21 percent was most accurate for Holstein cows.

### Summary

The BRIX refractometer is a fast, easy and reasonably accurate estimate of colostrum from Jersey cows. Colostrum can be tested shortly after collection (preferably prior to freezing) and the cut point of 18 percent BRIX can be used to determine if Jersey colostrum is high quality ( $\geq 50$  g of IgG/L) or low quality (<50 g/L). The BRIX refractometer is inexpensive, simple and should be a standard tool for modern dairy farms.

### References

- Bielmann, V., J. Gillan, N. R. Perkins, A. L. Skidmore, S. Godden, and K. E. Leslie. 2010. An evaluation of BRIX refractometry instruments for measurement of colostrum quality in dairy cattle. *J. Dairy Sci.* 93:3713–3721.
- Morrill, K. M., K. E. Robertson, M. M. Spring, A. L. Robinson and H. D. Tyler. 2015. Validating a refractometer to evaluate immunoglobulin G concentration in Jersey colostrum and the effect of multiple freeze–thaw cycles on evaluating colostrum quality. *J. Dairy Sci.* 98:1–7.
- Quigley, J. D., A. Lago, C. Chapman, P. Erickson, and J. Polo. 2013. Evaluation of the Brix refractometer to estimate immunoglobulin G concentration in bovine colostrum. *J. Dairy Sci.* 96:1148–1155.

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