

Colostrum: A food for calves and humans

Fionnuala McDermott^{1,2}, Sean Hogan² and Emer Kennedy¹

¹Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork;

²Teagasc Food Research Centre, Food Chemistry and Technology Department, Moorepark, Fermoy, Co. Cork

Summary

- Consumption of high quality colostrum following birth is critical for calf health and survival.
- Colostrum management is a key factor in determining calf health and lifelong productivity.
- Excess colostrum may be utilised for nutritional purposes for the benefit of human health.

Introduction

Colostrum is the first milk produced following calving and accounts for approximately 0.5% of a cow's annual milk production. Irish dairy cows produce an average of 6.7 kg of colostrum but ranges from 0.1 – 24 kg. Cows have an epitheliochorial placenta which prevents the transfer of passive immunity to the foetus during gestation. As calves are born without an active immune system, they rely almost entirely on the absorption of immunoglobulin (antibodies) within colostrum to provide initial immunity. Therefore, it is critical that the calf receives an adequate supply of colostrum immediately after birth as the ability to absorb these antibodies decreases as the permeability of the gut diminishes rapidly over the first 24 h postpartum. Colostrum quality is determined by the concentration of IgG where high quality colostrum is defined as IgG levels of >50 g/L (>22% on Brix refractometer). Ensuring calves receive three litres of high quality colostrum within two hours of birth will encourage optimal absorption of these antibodies and therefore, provide immunity to disease over the initial days of life.

Colostrum management

Managing colostrum is the most important factor in determining calf health and survival. Failure to provide high quality colostrum, in a timely manner, to the neonate results in failure of passive transfer (FPT) of critical IgG which contributes to high pre-weaning mortality rates. Colostrum quality (IgG concentration) is the primary factor in ensuring transfer of immunity to the calf, however, a number of other factors affect colostrum quality. Colostrum must be collected as soon as possible following birth as its quality decreases as time postpartum increases (once cows are calved over nine hours, colostrum quality may be too poor to feed to calves as their first feed). If colostrum cannot be collected from the dam immediately following parturition, high quality colostrum obtained from another dam should be administered to the calf. Pooling colostrum from multiple dams has been shown to dilute the quality, with the absorption of IgG greater in calves fed single dam colostrum than pooled colostrum. Volume of colostrum is critical to ensure the calf receives an adequate feed, it is recommended that colostrum be fed at a rate of 8.5% of the birth body weight (3 L for a 35 kg calf). Highest absorption of antibodies occurs within the first two hours of birth, as the permeability of the calf gastrointestinal tract decreases following birth. Using the colostrum 1-2-3 rule (1st milking for the 1st feed, within 2 h of birth, at least 3 L of colostrum) is a simple tool for farmers to effectively provide adequate colostrum to the calf. Long term benefits have also been associated with good colostrum management, including improved average daily gain, improved feed efficiency, reduced age of first calving and improved first and second lactation performance.

Utilisation of excess colostrum for human consumption

In general, cows produce colostrum in excess of the volume required by the calf. Bovine colostrum has previously been classified as unmarketable for human consumption but with current processing technology this issue is resolved. Manufactures of functional foods and dietary supplements have recently taken a greater interest in colostrum given the array of beneficial bioactive ingredients available, as seen in Figure 1. Colostrum acts as a potential reservoir for the extraction of these valuable components, which are present at higher concentrations in colostrum compared to whole milk. Excess colostrum provides a potentially viable volume for processing on a seasonal basis within the Irish spring calving system. This market may act as a means by which farmers can add additional value to their excess colostrum in the future. In particular, the high contents of immunoglobulins and oligosaccharides could be nutritionally beneficial to infant and human nutritional formulations. Excess colostrum is used for humans in the US but not currently Irish colostrum.

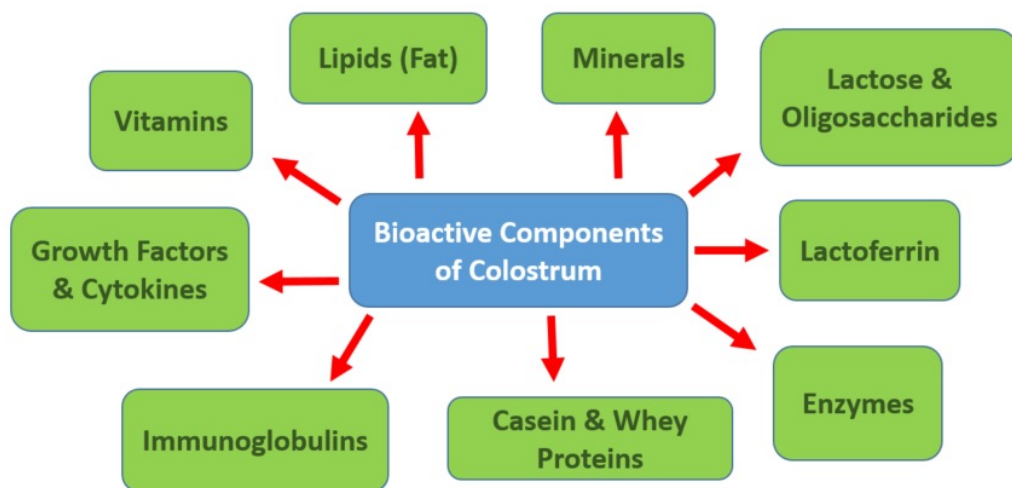


Figure 1. The numerous bioactive ingredients available within colostrum

Conclusions

Colostrum management is critical in determining calf health and survival. Simple steps ensuring high quality colostrum (>22% Brix) is provided within two hours of birth, at a rate of three litres/calf, will ensure that the immune system is supported over the initial days of life, a particularly vulnerable period for neonatal calves. Ensuring colostrum management is maintained to a high standard will optimise lifelong productivity within the herd. As colostrum is generally produced in excess of what is required by the calf, utilising the excess for the production of human health supplements and infant formulas may provide additional value to colostrum.