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Calf Note #03 – A primer on colostral immunoglobulins

Introduction

Differences from whole milk. **Colostrum** is the secretion from the mammary gland for the first 24 hours after parturition. It differs markedly from milk in composition, physical properties, and function. **Transition milk** is the secretion from the mammary gland from 24 to 72 hours after calving. The composition of transition milk changes to that of milk by 72 hours after calving. Colostrum differs from transition milk (see *Table 1*) as colostrum contains much larger amounts of solids, protein, and immunoglobulins (**Ig**). It is also more important in providing passive immunity to the calf during the first 24 hours after birth.

Colostral Immunoglobulins.

Immunoglobulins (or antibodies) are proteins critical to the identifying and destroying pathogens in the animal.

There are three types of Ig in colostrum of cattle: IgG, IgM, and IgA.

Additionally, there are two isotypes of IgG: IgG₁ and IgG₂. These Ig work together to provide the calf with *passive immunity* (immunity provided by the dam

and not synthesized by the calf) until the calf's own *active immunity* develops. Colostrum contains 70-80% IgG, 10-15% IgM and 10-15% IgA. Most of the IgG in bovine colostrum is IgG₁.

IgG₁ and IgG₂ are transported from the blood of the cow into colostrum by a highly specific transport mechanism. This mechanism moves large amounts of IgG (particularly IgG₁) from blood into the udder. Consequently, serum IgG concentrations of the dam decline precipitously, beginning about 2 to 3 weeks prior to calving. Cows require several weeks to resynthesize the lost IgG. IgM and IgA are synthesized by the plasmacytes in the mammary gland.

What do they do?

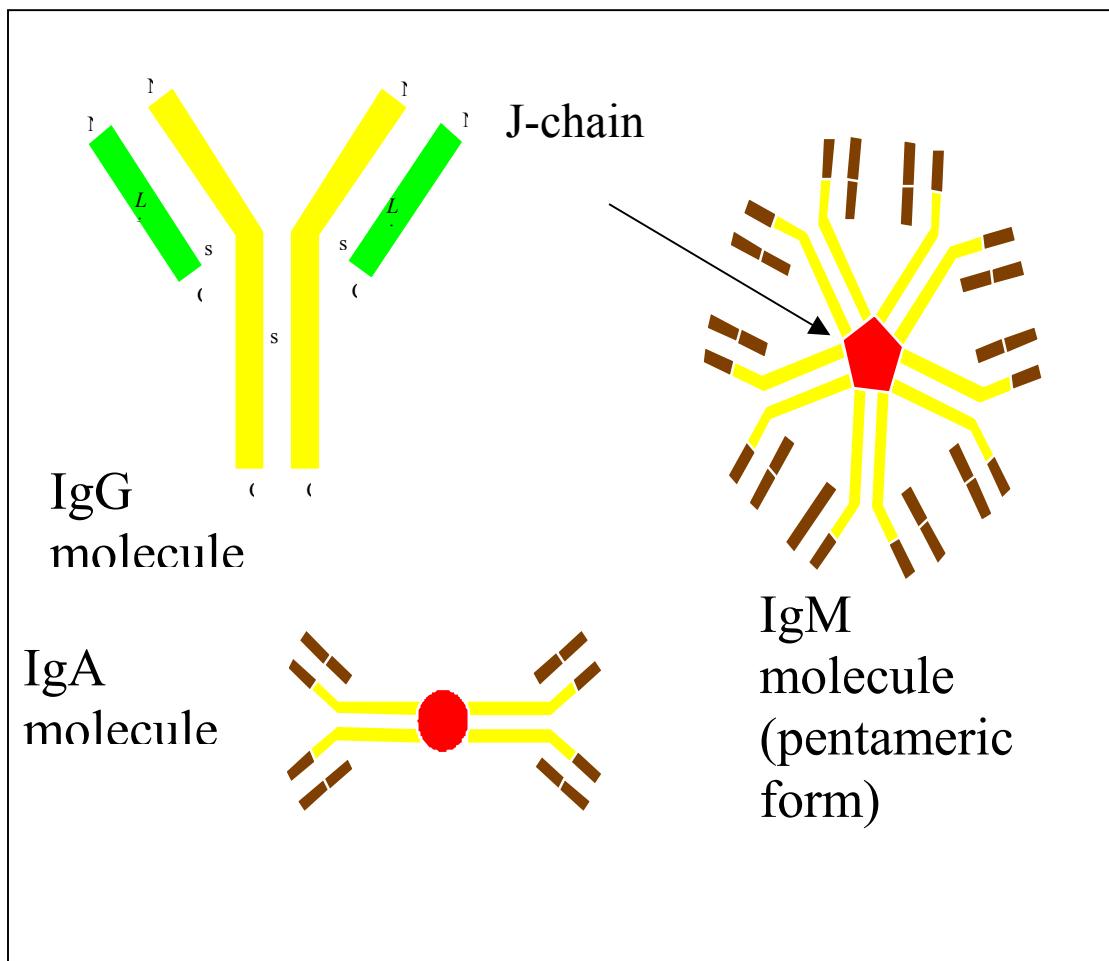
Each Ig has a different role in the animal. IgG is the most prevalent in colostrum and serum. Its primary role is to identify and help destroy invading pathogens. Because it is smaller than other Ig, it can move out of the blood stream and make its way into other body pools where it helps identify pathogens. IgM is the antibody that serves as a first line of defense in cases of septicemia. IgM is a large molecule that stays in the blood and protects against bacterial invasion. IgA protects mucosal surfaces such as the intestine. It attaches to the intestinal lining and prevents pathogens from

Item	Milking Number			Milk
	1	2	3	
Specific Gravity	1.056	1.040	1.035	1.032
Solids, %	23.9	17.9	14.1	12.9
Protein, %	14.0	8.4	5.1	3.1
Casein, %	4.8	4.3	3.8	2.5
IgG, g/L	48	25	15	0.6
Fat, %	6.7	5.4	3.9	3.5
Lactose, %	2.7	3.9	4.4	5.0

Table 1. Composition of bovine colostrum and transition milk.
From: Foley and Otterby, 1978, J. of Dairy Science 61:1033.

attaching and causing disease. Feeding colostrum for 3 days after birth is a good idea - that provides IgA to bathe the gut and protect against pathogens.

Colostrum contains large amounts of IgG and smaller amounts of IgM and IgA. All three Ig are important to the calf, and are necessary to minimize the chance of disease or death. However, it is important to remember that Ig are only **one part** of the calf's immune system. Proper nutrition, minimal stress and a clean environment also help keep calves healthy.



Written by Dr. Jim Quigley (17 February 1997).

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