FrontLine
TECHNICAL INFORMATION FOR TODAY'S FEED PROFESSIONAL

Importance of The Colostral Milk

Pathogens and their secretions (toxins) are called antigens.[1] These antigens can cause various disease processes in the body. The body can protect itself against the antigens by forming antibodies. Antibodies are proteins of complex structure (immunoglobulins) which block the pathogen or its toxins and make it effective. This is called an antigen-antibody reaction. During the development of the calf in the dam's body, maternal antibodies cannot be passed on to the fetus via the placenta. Thus the calf is born without antibody protection and is unable to form antibodies of its own for several weeks.

With the enhanced blood flow to the udder tissue shortly before calving, large quantities of these antibodies (immunoglobulins) are stored in the tissue of the lactiferous gland and are passed on after birth. In the colostrum. These antibodies are of vital importance to the newborn calf which is initially without protection.

The uptake of immunoglobulins by the calf is called "passive immunity". By contrast, the formation of endogenous antibodies is known as "active immunization" leading to "active immunity".

The extent of passive immunity is decided in the first few hours of the calf's life. The reasons for this are as follows:

- The largest number of antibodies is secreted in the first milk. The immunoglobulins content of subsequent milkings decreases rapidly. The second milk only has 50% of the antibody content of the first milk. On the third day after birth the composition is almost that of normal milk.
- At first the abomasums products only the enzymes chymosin and cathepsin. Hydrochloric acid production starts slowly as early as 6 hours after birth. Hydrochloric acid precipitates the immunoglobulins of the Colostral milk, leading to a loss of effectiveness.
- It is only during the first 6 to 8 (maximum 12) hours of life that the intestinal mucosa is able to let the relatively large protein bodies of the immunoglobulins
- pass through the cell wall and the cell fissures of the intestinal villi without breaking them down.
- In addition, colostrum contains a substance (trypsin inhibiting factor) which delays the enzymatic breakdown of immunoglobulins in the intestine.

It is only die to these particular characteristics that antibodies can pass into the calf's lymphatic channel and blood stream intact and build up passive immunity. Later on such passage is no longer possible and the immunoglobulins are then digested like normal protein and only serve as a source of protein for the calf.

However, the initially high degree of permeability of the intestinal mucosa also has the disadvantage that other large molecules can pass into the blood stream. This explains the great sensitivity of the young calf to harmful pathogens, toxins (e.g. mycotoxins) or medicinal products wrongly dosed for this phase of the calf's life. In the young calf the metabolic capacity of the liver and kidneys has not yet fully developed, and for this reason there is no adequate detoxication and elimination of noxious substances.

The immunoglobulin content of Colostral milk depends on a number of external factors:

- The nature and extent of infections to which the dam was exposed determine the nature and level of the immunoglobulins. Animals that are kept in the herd for at least 6 to 8 weeks before calving can only form antibodies against the pathogens prevailing in the herd.

Drying the cow 6 to 8 weeks before calving enables antibodies to concentrate in the udder. Cows milked right through to calving are unable to form colostrum with the required content of immunoglobulins.

- The dam's age is of considerable importance. The colostrum of older cows shows particularly high immunoglobulins contend, whereas the colostrum of heifers shows a relatively low level.
- Feeding that is appropriate for ruminants will promote the formation of immunoglobulins.

In connection with the protective function of colostrum, it is necessary to recall the ability of vitamin A to protect the intestinal mucosa against the adhesion of, and subsequent invasion by, pathogens.

Since it is β-carotene that enables vitamin A to be transported from the dam's liver to the fetus, cows should receive an optimal supply of β-carotene, which is ensured by keeping the animals on the pasture of feeding them green silage inside. Such cows are able to supply the fetus with large reserves of vitamin A via the placenta and their colostrum likewise has a high vitamin A content. Thus the newborn calf already has appropriate protection against infections in the intestine.

In problem herds with a high incidence of early scours in calves (rota-corona-coli infection) a bovine gammaglobulin and a vitamin A product should be administered immediately after birth and before the first Colostral milk is given. In this way the calf receives additional protection against a virus infection.

However, the effectiveness of colostrum in the calf is not only limited to the protection against infection by immunoglobulins and vitamin A. It differs significantly from normal milk in its other constituents. It has high levels of fat, protein, minerals and vitamins, making it a concentrated, nutritious feed.

The high content of magnesium salts promotes the excretion of fetal feces and stimulates peristalsis the intestine, thereby starting up its function.

A further aspect to be considered here is the pronounced anti-infective property of colostrum to stimulate the formation of certain antibodies in the intestinal mucosa by its raised content of active defensive cells. Thus, going beyond the immunoglobulins, Colostral milk has the capacity to build up additional defenses against infection.

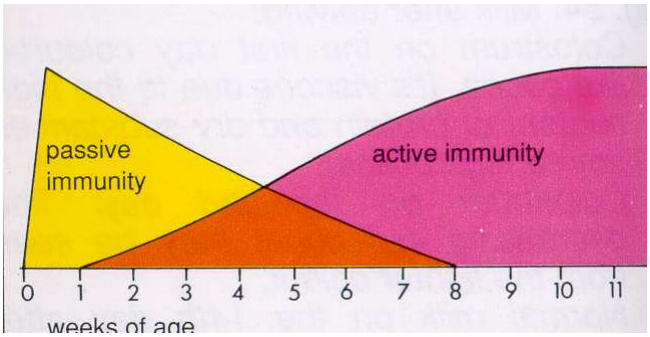
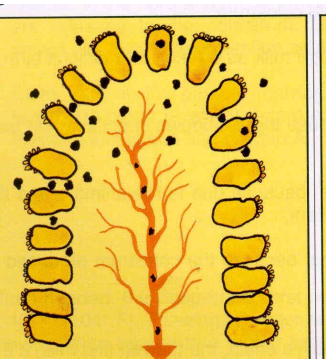


Fig. 4

Composition of Colostrum
Transitional Milk and Whole Milk[2]

	Milking Number (Cows Milked Twice Daily)					
	1	2	3	4	5	11
%	Colostrum		Transitional Milk		Whole Milk	
Solids	23.9	17.9	14.1	13.9	13.6	12.9
Protein	14.0	8.4	5.1	4.2	4.1	4.0
Total Ig	6.0	4.2	2.4	0.2	0.1	0.09
Fat	6.7	5.4	3.9	4.4	4.3	4.0
Lactose	2.7	3.9	4.4	4.6	4.7	4.9
Minerals	1.11	0.95	0.87	0.82	0.81	0.74
Vit. A (IU/kg)	12000	8000	4000	3000		700



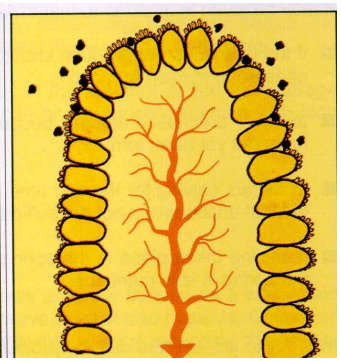


Fig. 1 *Fig. 2*

Figs. 1 and 2. It is only for 6 to 8 hours after birth that the intestinal mucosa is permeable to the large protein bodies of the immunoglobulins (Fig. 1). The cell walls and interstitial spaces are closed as early as 10 to 12 hours after birth, so that the immunoglobulins can no longer pass through without being first broken down to amino acids (Fig. 2.). However, when they are broken down, the globulins lose their protective effect.

Fig. 3. Build-up of immunity in the calf: Via the colostrum, the calf receives antibodies against infective pathogens to which the dam has been exposed. This defense mechanism gradually loses its effect and ceases altogether in about the 8th week of life. From the 1st week onwards, the calf-under the protection of the maternal antibodies-develops its own defense against infections. During the 4th and 5th weeks of life the calf is particularly susceptible, when antibody levels are lowest.

Fig. 4. Comparison of the composition of colostrum, transitional milk and whole milk: The extremely high protein content (especially albumin and globulin) and the high Vitamin A content of the Colostral milk are particularly striking. A few hours after birth the level of these valuable nutrients decreases rapidly and by the third milking only a fraction of the original amount is left.

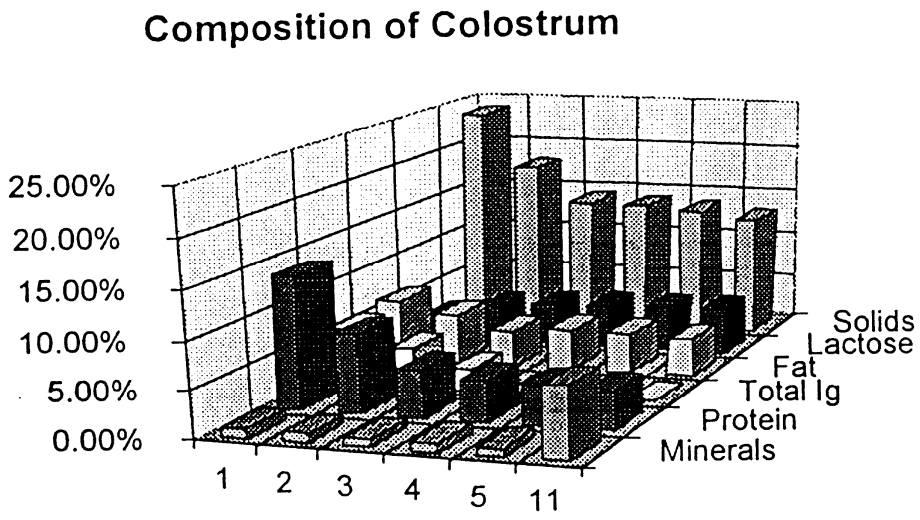
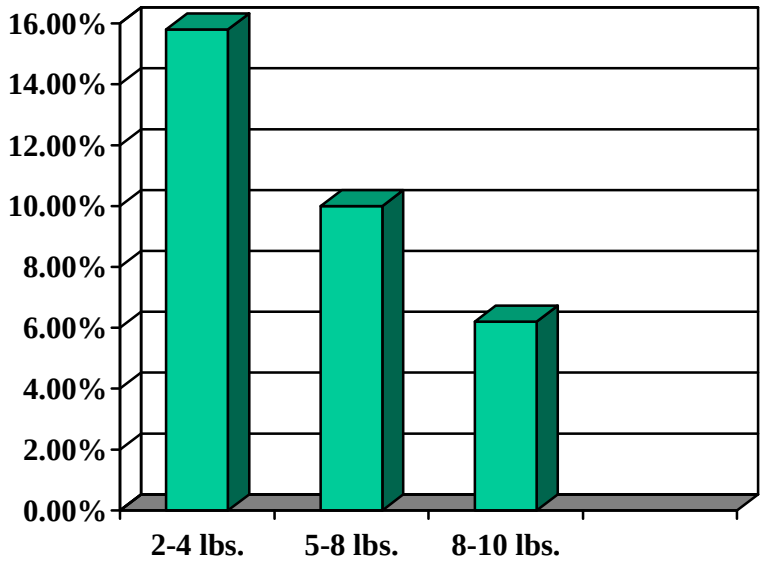


Fig. 1

Colostrum contains more vitamins that whole milk
Source: University of Minnesota

Colostrum Fed During the First 12 Hours After Birth and Heifer Calf Mortality



[1](Mortality of calves from 1 week to 6 months of age)
Source: Clemson University

Fig. 2

Reprinted with the permission from The Calf Book,
Schober Verlags-GMBH, Dr. med. Vet. Ludwig Schrag.
Ing. Agr. Heinz Singer