

# Assessment of the Quality of Cow Colostrum Obtained in the First Days After Calving

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## Abstract

For a newborn calf, colostrum is the first and most vital food. Colostrum has an increased proportion of components transferred directly from the mother's blood. A newborn calf's health, productivity, and longevity depend on the type and amount of colostrum they receive initially. By measuring the colostrum's physico-chemical components and refractive index on the Brix scale, the study sought to assess the colostrum's quality during the first five days following calving. The concentration of IgG in bovine colostrum was estimated with a portable and easy-to-use refractometer, and its concentration varied significantly from day two. According to the studies, IgG levels significantly dropped after calving, going from an average of 35 brix on the first day to 10 brix on the fifth. Although its components vary greatly, colostrum up until day five has a higher concentration of lipids, proteins, and dry matter—all of which are vital for the newborn.

**Keywords:** colostrum period, colostrum quality, newborn calves, physico-chemical components

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## 1. Introduction

Colostrum is essential for the health and survival of newborn calves. Colostrum, the mammary gland's first secretion after calving, is known as "Liquid Gold" [1] and has been used for hundreds of years in veterinary medicine as a traditional or additional therapy for a variety of ailments [2, 3]. It supplies passive protection via immunoglobulins (IgG, IgA, and IgM), necessary nutrients, growth factors, and bioactive chemicals that promote intestine development and disease resistance [4]. Colostrum quality is determined by several factors, including the cow's health, breed, nutrition, and collection time. Evaluating colostrum quality ensures that calves have enough immunity and nutrition to get a good start in life. While colostrum quality is primarily assessed within the first few hours postpartum, recent research highlights the importance of monitoring

colostrum composition up to five days after calving. Over this period, the transition from colostrum to mature milk occurs, and significant changes in immunoglobulin levels, nutrient composition, and microbial contamination can be observed. Compared to milk, colostrum contains more components transported directly from the mother's blood and around 60% protein in dry matter, with whey protein accounting for 80% and casein for 20% [5]. Because of the anatomy of the placenta, the foetus in the uterus does not get antibodies from its mother, leaving newborn calves susceptible to all infections in the environment.

The quality of the first colostrum provided to a newborn calf is critical to its future health, production, and longevity. Passive immunity reduces the incidence of digestive and respiratory disorders and deaths in the first few months of birth. According to studies by Faber and collaborators in 2005, four litres of high-quality colostrum (with more than 100 g/l of antibodies) should be taken within two hours following birth

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[6]. The animal will develop, produce, and be healthy in the future thanks to this type of colostrum, which will also guarantee immunity. Calves given more colostrum on their first day of life (4 L vs. 2 L) produced around 10% more milk in their first lactation and 15% more in their second [7].

Gelsinger et al., 2015, evaluated IgG levels in colostrum samples from 50 Holstein cows at 0 to 5 days postpartum [8]. The results revealed: Day one: 70-80 g/L of IgG, Day 2: 40-50 g/L, Day 3: 20-30 g/L, Day 4-5: <15 g/L (transition milk stage). By the third day after birth, IgG

concentrations frequently fall below the recommended 50 g/L level for high-quality colostrum. As a result, only the first milking colostrum is effective at transmitting passive immunity.

Colostrum contains a high concentration of protein, fat, vitamins, and minerals, which provide energy and aid in neonatal development.

However, its composition changes substantially within the first five days. Conneely et al, 2013, analysed colostrum samples from 100 dairy cows during the first five days postpartum and identified the following (Table 1) [9].

**Table 1.** Variation of chemical components in colostrum

Component	Day 1	Day 3	Day 5
Protein (%)	14-18%	7-10%	5-6%
Fat (%)	6-8%	4-6%	3-4%
Lactose (%)	2-3%	3.5-4%	4.5-5%
Total Solids (%)	23-27%	18-22%	12-15%

The gradual decrease in protein content is linked to lactose growth, corresponding to mature milk. These changes indicate that the colostrum has passed into ordinary milk, which no longer provides enough immune support for newly born babies. Colostrum is very sensitive to bacterial contamination, which can reduce IgG absorption in the calf's intestine.

According to studies, incorrect storage, delayed feeding, and inadequate cleanliness procedures all contribute to increased bacterial load over time.

Stewart et al., 2005, examined five-day-old colostrum samples maintained at various temperatures (Table 2) [10].

**Table 2.** Examination of five-day colostrum samples kept at different temperatures

Storage Condition	Total Bacteria Count (CFU/mL)		
	Day 1	Day 3	Day 5
Fresh (4°C, Refrigerated)	10,000	50,000	200,000
Room Temperature (20°C)	50,000	500,000	>1 million
Frozen (-20°C)	10,000	10,000	10,000

*CFU/mL = Colony Forming Units per millilitre (a measure of how many bacteria is present).*

The method of colostrum storage significantly affects bacterial growth over the first five days after collection. Freezing at -20°C is the most effective preservation method, as it keeps bacterial counts low and stable, preventing contamination. Refrigeration at 4°C slows down bacterial multiplication, making it suitable for short-term storage (1-2 days).

In contrast, storing colostrum at room temperature (20°C) promotes rapid bacterial growth, which can compromise its quality and safety. Therefore, to maintain colostrum's nutritional and immunological value, selecting the appropriate storage condition is essential.

## 2. Materials and methods

The study was carried out on a lot of 25 dairy cows from the BNR breed, from which it was harvested 100 ml of colostrum in falcon tubes. Colostrum quality was monitored in the first 5 days after farrowing.

Physico-chemical parameters of the colostrum were determined with the CombiScope automatic analyser. IgG concentration was measured with a portable refractometer, and colostrum density was determined with a colostrometer (Figure 1 and Figure 2) [11].



Figure 1. Illustration refractometer



Figure 2. Illustration colostrometer

### 3. Results and discussion

According to the study, the immunological value of colostrum as measured by the Brix scale levels after calving decreased from an

average of 35 brix on the first day to 10 brix on the fifth. Colostrum until day five contains a higher concentration of lipids, proteins, and dry matter all of which are essential for the newborn (Table 3).

Table 3. Average values of bovine colostrum components analysed in the first 5 days after calving

Days	IgG conc. on the brix scale, %	SCC $\times 10^3$ cells/mL	Fat %	Protein %	Solids %	Lactose %	Casein %
Day 1	35	7 662	8.89	12.55	26.41	3.09	10
Day 2	21	2 244	5.74	4.03	14.72	3.93	5.99
Day 3	12	171	5.90	3.88	14.68	4.42	3.87
Day 4	10	159	4.27	3.86	13.53	4.26	3.05
Day 5	10	79	4.08	3.75	13.22	4.16	3.03

The study evaluates colostrum quality in dairy cattle over the first five days after calving, focusing on immunoglobulin (Ig) concentration (Brix %), somatic cell count (SCC), fat, protein, solids, lactose, and casein content.

**Immunoglobulin concentration (Brix %)-** Ig concentration decreases significantly from 35% on day 1 to 10% on day 5. This trend is expected, as colostrum transitions into normal milk, leading to a dilution of immunoglobulins. The sharpest decline occurs between day 1 (35%) and day 2 (21%), suggesting that the best passive immunity transfer occurs within the first 24 hours.

**SCC levels drop significantly over the five days,** indicating a reduction in immune activity as the milk normalizes. A high SCC on day 1 is normal in colostrum due to its immune cell content.

**Fat percentage -** Starts high at 8.89% on day 1 and decreases to 4.08% on day 5. This gradual decline reflects the transition from colostrum to mature milk, which has a lower fat content.

A higher fat percentage in early colostrum is crucial for energy supply to newborn calves.

**Protein content -** Declines from 12.55% on day 1 to 3.75% on day 5. A significant reduction is seen after day 2 (4.03%), reinforcing the importance of early colostrum feeding. Proteins, especially casein and immunoglobulins, are vital for passive immunity and gut development.

**Solids content -** Starts at 26.41% on day 1 and declines to 13.22% on day 5. The sharpest decrease happens between day 1 (26.41%) and day 2 (14.72%). Solids include proteins, fats, lactose, and minerals, essential for neonatal nutrition.

**Lactose content -** Increases from 3.09% on day 1 to 4.16% on day 5. Unlike other components, lactose gradually increases as colostrum transitions to mature milk. This makes sense physiologically, as normal milk has a higher lactose content to support energy metabolism.

*Casein content* - Decreases from 10% on day 1 to 3.03% on day 5. Casein is a major milk protein that influences digestion and calcium absorption. The sharpest decline occurs after day 2 (5.99%), showing that early colostrum is richer in proteins necessary for the newborn calf. The best colostrum quality is on day 1, with high IgG (35 Brix), fat, protein, and solids. Colostrum rapidly transitions into normal milk, with significant drops in IgG, protein, fat, and SCC after day 2. Feeding colostrum within the first 24 hours is crucial for passive immunity and calf health.

#### 4. Conclusions

Using a portable refractometer in bovine farms by veterinarians will facilitate correct and early decisions regarding the quality of the first colostrum administered to newborn calves. To enhance passive transfer and reduce calf illness and mortality, farmers must be made aware of the significance of storing and administering colostrum at the right times.

Physico-chemical parameters of colostrum have much lower values on the fifth day, except the lactose content, which varies inversely proportional to the fat, protein, dry matter, and casein content.

Monitoring cow colostrum quality after the first milking is critical to understanding its nutritional value and prospective applications. According to studies, IgG levels drop dramatically after the first 24 hours postpartum, therefore, only the first milking is adequate for passive immunity transfer. By day 3-5, colostrum has transformed into regular milk, rendering it less helpful for newborns.

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