Liquid Gold: The Vital Role of Colostrum in Livestock Health

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ABSTRACT

Colostrum, often referred to as "liquid gold," is the first and most essential source of nutrition for newborn livestock. Packed with antibodies, essential nutrients and growth factors, colostrum plays a crucial role in ensuring early immunity, energy supply and overall survival. The timing, quantity and quality of colostrum feeding can significantly impact the health and productivity of young animals, making proper management a key aspect of livestock farming. This article explores the science behind colostrum, its benefits for different species, best practices for feeding and solutions for common challenges faced by farmers. By understanding and prioritizing colostrum management, livestock owners can enhance the well-being of their animals and improve long-term herd performance.

INTRODUCTION

For newborn livestock, the first few hours of life are the most critical. Born with an underdeveloped immune system, these fragile young animals rely entirely on one essential source of nourishment and protection—colostrum. Often referred to as “the first raw milk” or "liquid gold," colostrum is the thick, yellowish first milk produced by the mother immediately after giving birth. Unlike regular milk, it is densely packed with antibodies, proteins, energy and essential nutrients that provide newborns with immunity, strength and protection against diseases. Colostrum is not just food but it is the first and most crucial immunity, a newborn receives. It contains immunoglobulins (IgG, IgA, IgM), white blood cells and growth factors that help fight infections, support gut

development and boost overall survival rates. However, the benefits of colostrum depend on three key factors like timing, quality and quantity. The composition of colostrum in various species is presented in table 1, adapted from Puppel *et al*. (2019).

Table 1: Chemical composition of colostrum from different species

Species	Chemical composition (g/Kg)		
	Fat	Protein	Lactose
Bovines	36	130	31
Sheep	124	130	34
Goat	90	80	25
Pig	72	180	24
Horse	7	191	46
Rabbit	47	135	27
Dog	78	138	16

Christiansen *et al.* (2010) asserted that variations in the fundamental composition of bovine colostrum and mature milk (table 2) provide valuable insights into the distinct biological functions of these two substances. Research shows that newborn animals must receive colostrum within the first 6 to 12 hours after birth, as their ability to absorb antibodies declines rapidly (Ahmadi *et al.* 2016; Playford and Weiser, 2021). Poor colostrum intake can lead to failure of passive immunity (FPI), leaving young animals susceptible to infections, stunted growth and high mortality rates. The importance of colostrum is well-known among experienced farmers and veterinarians, yet challenges such as poor maternal instincts, weak newborns, disease transmission and colostrum shortages often arise. Understanding how to properly manage colostrum feeding whether through natural suckling, bottle feeding, or supplementation is vital to ensuring the health and productivity of livestock. This article explores the science behind colostrum, why it is essential for newborn livestock, best practices for colostrum feeding and solutions to common challenges faced by farmers. Whether you are raising cattle, sheep, goats, pigs or horses, mastering colostrum management is one of the most effective ways to set your animals up for a healthy and productive life.

Table 2: Fundamental composition (%) of bovine colostrum and mature milk

Component	Colostrum	Milk
Protein	14.56	3.3
Fat	5.35	4
Lactose	2.03	4.8
Mineral	1.2	0.65

Nutritional and Immunological Importance of Colostrum

Colostrum is far more than just the first milk but it is a powerhouse of essential nutrients and immune-boosting compounds that give newborn livestock the best possible start in life. Unlike regular milk, colostrum is packed with antibodies, proteins, energy and growth factors that help newborns build a strong immune system, regulate body temperature and develop properly (Pandey *et al.* 2011).

Immunoglobulins (Ig) are mono- or polymeric proteins composed of two light and two heavy polypeptide chains linked by disulfide bonds in a Y-shaped structure. They play a crucial role in passive immunity, with IgG, IgM, and IgA being the primary immunoglobulins in cattle colostrum. IgG, which accounts for 65–90% of total colostrum immunoglobulins, is further divided into two isotypes, IgG_1 and IgG_2, with a colostral ratio of 35:1. While IgG_1 is passively transferred, IgG_2 undergoes selective transfer, leading to its higher concentration in colostrum than in serum. The absorption of these immunoglobulins is time-

dependent, with uptake from the small intestine peaking shortly after birth and ceasing around 24 hours postpartum. Failure of passive transfer (FPT) can lead to increased calf mortality, morbidity, and economic losses. Additionally, colostrum provides essential nutrients, including fat and protein, which support energy metabolism and muscle development, compensating for the newborn calf's limited energy reserves (Puppel *et al*. 2019).

Beyond immunoglobulins, colostrum contains biologically active proteins with antimicrobial properties, including lysozyme, lactoferrin, and lactoperoxidase. Lysozyme exhibits bactericidal activity in most bodily fluids, while lactoferrin binds iron, limiting bacterial growth, though its effectiveness varies with environmental pH. Studies suggest lactoferrin supplementation improves calf recovery rates and reduces mortality. Lactose, the primary carbohydrate in colostrum, serves as an energy source essential for organ function and neural development. Colostrum also contains significantly higher mineral concentrations than milk, with elements such as calcium, phosphorus, selenium, and iodine being particularly vital for calf growth. However, their concentrations decline over time postpartum. The high mineral content contributes to the bitter taste of colostrum, and deficiencies can lead to developmental disorders, including muscular dystrophy and poor growth (Puppel *et al*. 2019; Polidori *et al*. 2022).

Timing and Quantity of Colostrum Feeding

The timing and quantity of colostrum feeding are crucial for the survival and health of newborn animals. Colostrum, the first milk produced by the mother, is rich in immunoglobulins, growth factors and essential nutrients that provide passive immunity and support early development. The absorption of maternal antibodies through the gut lining is most efficient immediately after birth but declines rapidly within the first 24 hours. This makes early colostrum feeding vital for ensuring adequate immune protection and growth.

The composition of colostrum undergoes dynamic changes with each passing hour, leading to a gradual decline in its biological and nutritional value over time. Time is a critical factor in the administration of colostrum to neonatal calves, as its prompt provision immediately after birth (within 0.5–1 hour) is essential for maximizing passive immunity transfer. The efficiency of immunoglobulin absorption from colostrum decreases by approximately one-third within six hours after birth, by two-thirds within 12 hours, and is further restricted by the development of an intestinal barrier after 24 hours (Puppel *et al*. 2019).

Different species have specific colostrum intake recommendations based on their body weight and physiological needs. Calves should receive at least 10% of their body weight in high-quality colostrum within the first six hours, ideally about 3–4 Liters. Lambs and kids require around 50 millilitres per kilogram of body weight within the first few hours, followed by additional feedings to ensure they receive at least 200 millilitres per kilogram in the first 24 hours. Piglets need about 10–12 millilitres per feeding, with multiple feedings within the first day to ensure sufficient intake. Foals should consume at least 1.5 to 2 Liters of good-quality colostrum within the first six hours to establish adequate passive immunity. Ensuring proper timing and quantity of colostrum feeding is essential for reducing neonatal mortality and promoting healthy growth across livestock species (Godden *et al*. 2019).

Methods of Colostrum Feeding

Colostrum can be administered to newborn animals using different methods depending on

the species, the health of the newborn, and the availability of maternal colostrum. The most natural and effective method is direct suckling from the mother, which allows the newborn to consume colostrum in a natural manner while also benefiting from maternal bonding and warmth. However, in cases where the newborn is weak, unable to suckle, or if the mother rejects the offspring, alternative feeding methods must be used to ensure adequate colostrum intake. Bottle feeding is a commonly used method, especially in calves, lambs, kids and foals, when natural suckling is not possible or when it is necessary to measure the exact volume of colostrum intake. This method ensures controlled feeding while still allowing the newborn to suckle naturally, which helps stimulate digestion. For bottle feeding, a clean nipple bottle is used, and colostrum is provided in small, frequent feedings to mimic natural nursing behavior.

In situations where newborns are too weak to suckle, tube feeding is an effective alternative. A soft, flexible oesophageal tube is carefully inserted into the stomach and colostrum is delivered directly. This method ensures that weak or sick neonates receive the required amount of colostrum within the critical absorption window. While tube feeding is highly effective, it requires proper technique to prevent injury or accidental aspiration into the lungs. In some cases, colostrum may also be administered via intravenous (IV) or subcutaneous routes, particularly when dealing with critically weak or premature neonates that cannot tolerate oral feeding. This is usually done under veterinary supervision using colostrum-derived plasma or commercial colostrum supplements to provide passive immunity. Regardless of the method used, ensuring that newborns receive high-quality colostrum within the first few hours of life is crucial for their immune protection, survival and long-term health. The management of colostrum feeding has been reviewed in detail by Godden *et al*. (2019).

Colostrum Quality and Testing

The quality of colostrum plays a vital role in determining its effectiveness in providing passive immunity and essential nutrients to newborn animals. High-quality colostrum contains a high concentration of immunoglobulins, particularly IgG, which helps protect against infections during the early stages of life. In addition to immunoglobulins, good colostrum is rich in energy, proteins, vitamins and minerals that contribute to the growth and development of neonates. Factors such as the mother's health, nutrition, parity and the time of colostrum collection can influence its quality. Ideally, colostrum should be harvested from healthy mothers within the first few hours after birth, as its antibody concentration declines over time. The goat colostrum should have the best nutrient composition, compared to bovine or sheep colostrum, but even this depends on the feeding plan (concentrated dry feed or fodder) (Ahmadi *et al.* 2016).

Testing colostrum quality is essential to ensure that newborns receive adequate immunity. One of the most common methods for assessing colostrum quality is the use of a colostrometer, which measures the specific gravity of colostrum. Higher specific gravity indicates a higher concentration of immunoglobulins, suggesting better quality. A colostrum sample with a reading above 50 mg/mL of IgG is considered high-quality and suitable for feeding. Another widely used tool is the Brix refractometer, which estimates the total solid content of colostrum. A Brix reading of 22% or higher generally indicates good-quality colostrum. These tests help farmers and veterinarians determine whether colostrum is suitable for feeding or if supplementation is needed.

In cases where natural colostrum quality is poor, alternative strategies such as colostrum pooling, pasteurization, or the use of commercial colostrum replacers may be necessary. Pooling colostrum from multiple healthy mothers can help balance variations in quality, while pasteurization can reduce bacterial contamination without significantly affecting antibody content. Colostrum replacers, formulated with high IgG content, serve as a substitute when natural colostrum is unavailable or inadequate. By ensuring proper testing and management of colostrum quality, livestock producers can significantly improve neonatal health, reduce disease risks and enhance the overall productivity of their herds (Puppel *et al*. 2019; Costa *et al*. 2023).

Difficulties in Colostrum Feeding

Colostrum feeding in livestock can present several challenges, which, if not properly addressed, can compromise the health and survival of newborn animals. One of the primary difficulties is inadequate maternal colostrum production, which can occur due to poor maternal nutrition, first-time motherhood, or health issues such as mastitis. In such cases, the newborn may not receive sufficient colostrum to develop strong immunity, making them vulnerable to infections. Additionally, variations in colostrum quality, including low immunoglobulin levels or bacterial contamination, can further reduce its effectiveness. Another common challenge is the inability of newborn animals to suckle effectively. Weak, premature, or stressed neonates may lack the strength or coordination to nurse from their mother. This can be seen in cases of dystocia (difficult birth), where the newborn is exhausted or injured, preventing proper colostrum intake. In multiple-birth species like sheep, goats, and pigs, competition among littermates can also result in some offspring receiving less colostrum than others, increasing the risk of disease in weaker individuals.

Environmental factors can further complicate colostrum feeding. Harsh weather conditions, particularly extreme cold, can reduce a newborn's ability to suckle due to hypothermia. In cold climates, immediate intervention is needed to warm the newborn and ensure it receives colostrum in time. Similarly, in intensive farming systems, improper management practices, such as delayed separation of mother and offspring or poor hygiene during colostrum collection and feeding, can lead to disease transmission or inadequate colostrum absorption. Technical challenges in artificial colostrum feeding methods, such as bottle or tube feeding, can also arise. Improper feeding techniques may lead to aspiration pneumonia if the colostrum enters the respiratory tract instead of the stomach. Furthermore, colostrum storage and preservation issues, including bacterial growth in improperly stored colostrum, can compromise its quality and pose health risks to newborns. Addressing these difficulties through proper management, timely intervention, and the use of colostrum supplements or replacers, when necessary, can significantly improve neonatal survival rates and overall livestock productivity.

CONCLUSION

Colostrum is truly "liquid gold" for newborn livestock, providing essential antibodies, nutrients, and growth factors that support early immunity, strength, and survival. Without it, newborns face a high risk of infections, poor growth, and even death. Since their ability to absorb immunoglobulins declines rapidly, colostrum must be fed within the first 6 to 12 hours after birth. Ensuring high-quality colostrum—rich in antibodies and nutrients—is equally crucial, and farmers can assess its effectiveness using Brix refractometers or colostrometer. When natural colostrum is unavailable or insufficient, colostrum replacers and supplements can serve as life-saving alternatives. Beyond survival, proper

colostrum feeding enhances long-term productivity, leading to better growth, improved reproduction, and higher milk production. However, challenges such as poor maternal instincts, difficult births, and disease transmission require proactive management. By ensuring timely colostrum intake, farmers can reduce mortality, strengthen herd health, and improve farm efficiency. In livestock farming, a strong start leads to a thriving herd, making colostrum management one of the most critical factors for success.

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