Indian Farmer
Volume 10, Issue 05, 2023, Pp. 256-259
Available online at: www.indianfarmer.net
ISSN: 2394-1227 (Online)

Popular Article

OPEN ACCESS

Advances in calf management

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Received:11/05/2023 *Published:22/05/2023*

Introduction

Effective management of newborn calves is crucial for minimizing death loss and improving overall health outcomes on cattle farms. If a calf catches any disease, it results in a negative economic impact on the farm, and in future the diseased calf may never reach its full genetic potential. Hence, death of valuable calves leads to loss of genetic potential for herd improvement. Studies indicate that more than 50% of calf mortality occurs within the first 24 hours of birth, and about 75% within the first week. This high mortality rate can result in a shortage of replacement heifers, necessitating the procurement of new animals and increasing herd replacement costs.
Perinatal mortality, which refers to calf deaths within the first two days of birth, is primarily linked to dystocia. Gastrointestinal disorders and pneumonia are the main causes of mortality during the first month of a calf's life. Adequate colostrum intake for newborn calves and good-quality feed for growing calves, combined with a sanitary and temperature-controlled environment, are essential. Improper housing and nutrition can lead to stress, compromising the immune system. Therefore, housing and feeding management play critical roles during this period. Giving due consideration to perinatal programming, management practices, and nutrition is vital. It is also worth noting that proper management during early life has a significantly greater impact on future milk production than sire selection, with three to seven times more influence. Therefore, prioritizing calf management is paramount on cattle farms to reduce death loss and promote optimal health. This involves addressing perinatal mortality, ensuring proper housing and nutrition, and implementing appropriate management practices. Such efforts can contribute to minimizing economic losses, preserving genetic potential, and enhancing overall herd improvement.

Assessment of the newborn calf and calf resuscitation

Over seventy years ago, Dr Virginia Apgar developed a simple method to evaluate the vitality of a new born infant, known as Apgar score (Apgar, 1953). This method was quickly adapted by veterinarians also and was performed within minutes of calving with only a stethoscope and a clock. Many advancements are seen in the field of assessment of newborn calves, for example, the researchers at University of Guelph developed a VIGOR score to check health of calves (Murray, 2013). VIGOR scoring is based on appearance, pulse, grimace, activity, and respiration (Apgar Score). VIGOR is an acronym that stands for visual appearance, initiation of movement, general responsiveness, oxygenation and rates (heart rate and respiration rate). Checking for visual appearance includes the degree of meconium staining and swelling of tongue or head and protrusion of tongue. Other input categories include time to initiation of selective calf movements such as sitting, standing attempts, suckling, head shaking, tongue withdrawal after a pinch, and eye blinking. Mucous membrane colour, heart and respiration rates are additional clinical signs that are assessed and assigned scores ranging from 0 to 3. The higher the score, the more vigorous the calf. A calf should normally lift its head, attain sternal recumbency and attempt to stand and to stand spontaneously, on average, 3, 5, 20 and 60-90 minutes after birth, respectively (Lorenz *et al*., 2011). Some calves suffer from milk asphyxia immediately after birth. Cold water can be poured over the head of such calves for stimulation. Once a patent airway has been established, the at-risk calf should be placed in sternal recumbence. Sometimes, these first aid measures are not effective. Therefore, there should be provision of mechanical ventilation. Doxapram can be used in some cases of foetal asphyxia. Buffer solutions containing sodium bicarbonate have also been used to improve the acid-base status in acidotic perinatal calves (Lorenz *et al*., 2006).

Navel Disinfection

Immediately after birth, navel should be dipped in 7 per cent iodine-based solution. For better results, navel should be dipped in teat dip cup immediately after birth and again within 12 hours to

keep infection rate as low as 5 per cent. Sprays are also used for disinfection, but they are not as effective as dip cups since sprays do not cover the entire surface. If more than 5 percent of calves develop navel infections, the calving pen and calf facility need some deep cleaning, maternity pen hygiene needs to be improved and navel disinfection may need to occur more quickly after birth. Repeated cord dipping with chlorhexidine is also proved to be effective.

Colostrum feeding

Earlier, farmers would let the dam nurse their calves as soon as they were born. But it has been proven that calves are unable to nurse adequate amounts of colostrum from their dam within the first few hours of life. Calves left to suckle their dam are 2.4 times more likely to receive insufficient antibodies and as a result might not receive adequate immunity. That is why hand-feeding is recommended so that a dairy farmer knows how much colostrum an individual calf receives. Calves that do not readily consume colostrum can be fed using an oesophageal feeder. Colostrum should be fed within 15 minutes of calving @ 1/10th of body weight and buffalo calves @ 1/15th of body weight. It is currently recommended that normal sized dairy calves (Holstein-Friesian) are given either 3 litres of good quality colostrum within 2 hours of birth by oesophageal tube OR at least 3 litres within 4 hours and a total of 4 litres within 12 hours from birth by nipple feeding. Stomach tube can be used for colostrum feeding if more volume is required to be fed. If lesser volume is to be given, then nipple bottle can be used.

Lactation number, breed of cow and length of the non-lactating period (if less than 3 weeks) influence volume and Ig concentration of colostrum in dairy cows. The quality of colostrum can be determined using a colostrometer. Superior quality colostrum contains greater than 50 mg/ml of immunoglobulins. The colostrum should be tested at a fixed temperature, ideally room temp of 22ºC – not body temp or direct from the refrigerator. There should be no froth on the colostrum. The colostrometer should be floated in the colostrum and left for one minute before taking a reading.

Pasteurization of colostrum has also been adapted on dairy farms in the last few decades. It decreases colostrum bacteria counts with minimal damage to Ig, vitamins A and E, and β- carotene. Only good quality colostrum should be pasteurised. The standard recommendation is to heat colostrum for 60 minutes at 60˚C. Above 62˚C, levels of antibodies are significantly reduced and colostrum can thicken and coagulate, making it more difficult to feed. This can lead to failure of passive transfer and greater susceptibility to scours.

Feeding whole milk/milk replacer

Earlier, dairy calves have been fed milk or milk replacer to an amount of approximately 10% of the calf's body weight (BW) per day. Milk from the cows´ first milking after calving is often called transition milk and contains more antibodies and nutrients than in later lactation and thus is better at protecting the calf from scours. Hence, a combination of colostrum during the first day of life and pasteurized transition milk during the next 3-5 days is strongly recommended. Calves may be started on a milk replacer when 2 to 4 days old, but the switch from whole milk to milk replacer should be gradual.

The current trend in calf rearing focused essentially on growth performance using whole milk (WM) or calf milk replacers (CMR) of high nutritional quality. This is because many recent studies suggested that nutrient intake from WM or CMR during the preweaning period improves future milk yield. Now, calves are fed elevated levels of milk (~20% of birth weight by volume) to improve health, growth rates, feed efficiency, and lifetime production. Even though it is not as cost effective as feeding less volume of milk, many farmers are adopting this strategy using WM. One of the reasons is that WM is easily available on farm and the nutrient balance of CMR significantly differs from that of WM. Compared with most commercial CMR, WM has higher energy content and contains bioactive components such as enzymes, hormones, and growth factors.

Milk Replacer (MR) composition is very different from WM in terms of energy, protein and minerals. MR is high in lactose as compared to whole milk. A major advancement in milk replacer feeding is that the recent MR are made rich in protein (up to 32%). This is sometimes referred to as the accelerated feeding program. The two most used ingredients to replace milk sources of protein are the soluble wheat gluten protein and concentrated soy protein. Milk replacers should contain a minimum of 18 to 22% crude protein, 10 to 22% crude fat, and less than 0.5% crude fibre. Some studies have also shown that increasing the fat content in MR can affect growth and performance of calves. It is also proven now that the growth performance of calves could be increased by feeding milk replacer with pellet diet, which may have been associated with changes in the diversity or abundances of rumen bacteria, especially bacteria from the phylum Firmicutes (Liu *et al*., 2020).

Calf Starter

Calf starter should be fed to calves starting at four days of age. Early feeding of calf starter as per the requirement of the calf is good for rumen development. This is because the fermented end

product (butyrate) is essential for growth of ruminal papillae. Feeding calves with restricted amounts of liquid feed and starter mixtures containing carbohydrates which are rapidly fermented to butyric and propionate acids accelerates rumen development. Calf starter should be high energy (75 % TDN) and must contain 16 -20 per cent DCP. Calves can be weaned once they consistently consume 1 kg of concentrates per day. This level of intake can usually be reached at an age of 5 to 6 weeks if access to palatable starter and water is available ad libitum (Molano *et al*., 2020).

Calf Housing

Calves should ideally be sheltered inside for at least a month after birth as cold, wet calves will put their energy into staying warm rather than growing. Calves can be moved outdoors at 3–4 weeks old but should still always have access to covered shelter. A barn with separate pens is necessary. The rule of thumb is 10–12 calves per pen, with an extra pen specifically for sick animals. Space requirement per calf ranges from 1.5 to 2 sq. metres. Calves must be kept in groups according to their size and age to minimize bullying.

Pens should be constructed with three solid walls using sheet metal or untreated plywood, with one end open to allow good ventilation and the removal of gases and ammonia from urine. Ideally the floor should be coarse gravel, sand or small stones and have adequate drainage. Bedding should be straw, untreated bark or sawdust and should be 300mm deep or more. Deep bedding allows the calf to build up a layer of heat within the bed and minimise heat loss. A scoring system to evaluate the sufficiency of bedding, called "Nesting score" (NS), has been developed. It is a simple visual evaluation of the visibility of the rear leg of a calf lying down in the bedding.

NS1 – Entire rear leg is visible NS2 – Rear leg partially visible

NS3 – Rear leg completely obscured by bedding

European regulations also establish requirements for housing and management of calves to preserve their health and welfare: individual pens are allowed until eight weeks of age, minimum space requirements are fixed, all housed calves must be inspected at least twice daily, calves must not be tethered all the time, they have to be free of lying, standing and take care to themselves in a clean place with adequate and comfortable bedding

Castration and Dehorning

Castration of male calves in early life (before 3 months of age) is less stressful to calves than castration performed later, when testicular size is dramatically increased. A number of methods may be used, including the open surgical technique, the use of rubber rings, and the Burdizzo method. Calves castrated surgically initially exhibit more agitation than calves castrated with rubber rings, but both groups resume normal behaviour soon after the operation. Dehorning early in life is also less stressful than when performed later, when horns have increased in size. Horns are mostly a problem for the feeding period (ie, horned calves require more bunk space), and they may cause bruising in pen-mates. Such problems are best managed by polled breeding or early dehorning.

Deworming and Vaccination

Deworming should be started from the first week of calf. A single oral dose of 10 g piperazine is recommended for the calves preferably in the first week of life. Deworming should be done every month for first 6 months, thereafter once in three months.

Indian calves must be vaccinated for FMD, HS, BQ, Brucellosis and Anthrax. For Brucellosis, strain 19 and RB51 are the approved *B. abortus* vaccines strains most commonly used to protect cattle against infection and abortion. Now, efficacy of DNA vaccines, subunit vaccines and vector vaccines are being tested on mice to see if they can be used in cattle. The improvement of the existing *B. abortus* vaccines and the creation of new attenuated vaccines by deletion or complementation of some genes is being done to find a safer and more efficient substitute for the known *B. abortus* vaccines (Dorneles *et al*., 2015). Similar progress has been reported in development of new anthrax vaccines. In the currently available vaccines for anthrax (Anthrax Vaccine Absorbed and Anthrax Vaccine Precipitated), PA is the predominant immunogen. To achieve a more defined vaccine, the recombinant expression of PA (rPA) has been pursued (Williamson and Dyson, 2015).

Conclusion

By prioritizing calf management, farmers can minimize economic losses, preserve genetic potential, and improve overall herd productivity. The significant influence of proper management during early life on future milk production emphasizes the long-term benefits of investing in calf health. Continued research and advancements in calf management practices will further enhance the well-being and productivity of newborn calves on cattle farms.

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