

Review Article

Challenges due to early calf mortality in dairy industry of Pakistan and strategies for improvement

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Abstract

This article is specifically related to the mortality occurring during the early months of life in calves. New born calves are more susceptible to diseases and infections. Period from birth to weaning is very critical because of following reasons; Active immunity develops at the age of 60 days, new born calf need required quantity of colostrum having adequate amount of immunoglobulin within 12hrs, calf need readily available carbohydrates and need environment that can maintain their body temperature soon after birth. Some suggestion about strategies to control early calf mortality are presented as; clinical examination of the neonate is similar as done in adult animals but some additional careful examination is also needed, which involve congenital defects and diseases. There is a great risk that neonate may face infectious disease, dehydration and death. So the clinical examination and treatment should be done carefully and as early as possible. There is a great importance of supportive therapy to control mortality in calves that involves fluid therapy, electrolytes and energy. For a profitable dairy business biosecurity measures, prophylactic measures and nutrition should be a part of dairy management particularly in context of early calf mortality.

Key words: Calf, Mortality, Dairy industry, strategies

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Economic Impact

In Pakistan cattle and buffalo are important sources of dairy product and animal protein. Due to rapidly increasing population, the demand of quality animal protein is also increasing. Challenges like early calf mortality are not only causing losses in terms of milk and beef production, but also resulting in low genetic potential due to disruption in breeding plans. Early calves death result in loss of quality sires for breeding and females for herd replacement. Diseases of newborn calf and calf mortality are the major causes of economic losses in livestock production [1].

Causes of early calf mortality

In the dairy industry of Pakistan, the most important causes of calf mortality are diarrhea and pneumonia [2]. Environment and management conditions on the farm favor the occurrence of these diseases. There is a relationship between the calf housing, management at the farm, environment, parasites, and bacterial infections with calf mortality. Mainly the causes of calf mortality can be divided into; infectious, non-infectious, management and miscellaneous causes

1. Infectious causes

Various infectious agents are capable of causing diarrhea in the neonatal calf which includes rotavirus, coronavirus, enteropathogenic *E. coli*, Salmonella species and Cryptosporidium [3]. Viruses, bacteria and fungal infections are the infectious causes of calf mortality. The major causes of calf mortality reported worldwide are diarrhoea (scours) and respiratory diseases [4,5]. The highest mortalities are reported during the first 30 days of life and this extends up to the first 3 months of life [6,7]. Early calf mortalities are usually associated with both infectious and non-infectious causes [8].

1.1 Navel-ill

Navel ill is a condition in which the Navel portion of the calf is infected, by bacteria's contamination of umbilicus following parturition [9]. In calves umbilical infections are very common. The umbilical cord consists of the amniotic membrane, the umbilical veins and arteries and the urachus. When amniotic membrane breaks up at birth umbilical vein and the urachus close, but they remain outside the umbilicus for

some time. The drying period of umbilicus varies from 1-8 days. If after birth umbilicus is infected, it may result in omphalitis, omphalophlebitis or omphaloarthritis. The bacteria involved in these conditions are *E. coli*, *Proteus* spp., *Staph.* spp., *Bacteroides* spp, *F. necrophorum* and *Klebsiella* spp. Navel ill can lead to septicemia, arthritis, and fever, which causes the failed transfer of passive immunity. Prevention of 'navel ill' is based on good maternity pen hygiene, reducing calf residency time in unhygienic calving pens, ensuring adequate early intake of good quality colostrum and navel antisepsis [10].

1.2 Rotavirus

Rota virus resides in the epithelial cells of the small intestine in calves. It causes diarrhea in calf and shed in the faeces up to three weeks in early life. The virus resides and replicate in the cells of epithelium at the tip of villi in the small intestine and causes desquamation of the cells which are replaced by cuboidal epithelial cells. These cuboidal epithelial cells are in turn replaced by flattened squamous cells. Leucocytes are in filtered in the stroma of villi [11]. Death is mainly due to dehydration [12].

1.3 Corona virus

Calves are infected with Bovine Corona Virus by both the oral and respiratory routes. Virus replication occurs in the surface epithelial cells, particularly in those on the distal half of the villi in the lower small intestine. Infected cells slough off and the absorptive capacity of the gut is severely diminished by the loss in surface area. The decrease in digestive and absorptive capacities leads to diarrhoea, with water and electrolytes loss. In severe cases, diarrhoea may lead to dehydration and death may occur due to acute shock and heart failure [13].

1.4 Escherichia coli

Escherichia coli is a gram negative bacterium that colonizes the small intestine and produces an enterotoxin that causes hyper-secretion of fluid into the intestinal lumen resulting in diarrhea, dehydration and death in the first month of life. These enterotoxigenic *E. coli* are shed into the environment by infected animals in the herd and are transmitted to the newborn calves through oral, respiratory system and naval cord soon after birth

[14]. Calves which have not enough amounts of immunoglobulins are highly susceptible to colibacillosis.

1.5 Salmonella and cryptosporidium

Cryptosporidium is an intestinal protozoan parasite that commonly infects dairy calves in the first month of life [15] Salmonella is a gram negative, rod and motile bacteria. Salmonella is most common and of great importance in young animals. These produce gastroenteritis with nausea, vomiting and diarrhea

1.6 Pneumonia

In calves pneumonia is usually caused by *Pasteurella multocida*, *Pasteurella hemolytica*, *Staphylococcus epidermis*, Streptococci, *Pseudomonas aeruginosa*, *Corynebacterium payogenes*, Mycoplasma, Pest virus and herpes virus (2). There are two types of pneumonia i.e. proliferative and exudative. Environmental factors that predispose the calves to pneumonia are mainly transportation, temperature extremes, crowding and poor ventilation [16].

Diagnosis of infectious agents

For the diagnosis of rota and corona virus, electron microscopy is used [17]. But in Pakistan due to economical issues electron microscopy is not applicable. So other methods such as immune-diffusion, complement fixation test (CFT), neutralization immunofluorescence, virus isolation, fluorescent antibody technique, hemagglutination, agar gel precipitation (AGPT) are used to detect rota and corona viruses in faeces of effected calf. However, ELISA and Latex agglutination tests are most commonly used now a day for the detection of viruses.

In case of bacterial infections isolation, of the particular sample, for example *E. coli* and salmonella from nasal discharge and lung tissue from pneumonic calves is done. For cryptosporidium fecal smear is made, stained with methylene saffrainin and examined under microscope.

2. Noninfectious causes

2.1 Colostrum /immunoglobulins

Early colostrum feeding has three important characteristics nutritive, laxative and prophylactic. Colostrum feeding is actually immunoglobulins

feeding. It has three types of antibodies, IgG (70-80%), IgM (10-15%) and IgA (10-15%) [18]. The absorption efficiency of colostrum is 30% in first 12 hours. The immunoglobulin concentration of 10g per liter of blood plasma should be achieved in first 12 hours. In small intestine an absorptive competition occurs between the immunoglobulin and intestinal germs for the occupation of intestinal receptors. If pathogenic bacteria occupy the receptors then hypo-gamma-globulinemia occurs in calves, which result in decreased passive immunity and make the calves more prone to different diseases. So there is high morbidity and mortality due to diarrhea, pneumonia etc in immune deficient calves [19].

2.2 Season

Season of calving has a great impact on the absorption of immunoglobulin's in calves. A search was conducted to study the effect of season on the absorption of immunoglobulins. It showed that in temperate areas the serum IgG concentrations were lowest in winter born calves and increased during the spring and early summer [20].

2.3 Parturition problems and parity

About 50 percent of calves are lost during parturition due to dystocia. Actually mal-presentations are the causes of dystocia for example breech presentation. Incidence of dystocia is higher when calf is male (58%) and lower when calf is female (43%) [21]. Parturition problems decreased with age and parity of the cow, the amount of colostrum available and concentration of colostrum immunoglobulin's increases. It results in better immunity development [22].

2.4 Hypothermia

Calves are more sensitive to ambient temperature changes than the young ones. The critical temperature for the newborn is about 13°C. Hypothermia causes peripheral damage to exterior tissues. Calves are usually resistant to temperature changes, however the prematurely born calves have deficiencies in their thermoregulation mechanism. To avoid from hypothermia the calves need special housing projecting from wind and wet.

2.5 Sex and birth weight of calf

Immunoglobulins absorption is less in male (20.69 mg/ml) than female (25.12). So female has better

immunity than male, resulting in high mortality in male as compared to female [23]. There is a competition between the immunoglobulin's and intestinal germs for the receptors [24] due to these competition male calves will face more immunodeficiency as compared to female calves. The birth weight has a significant effect on mortality. Higher the birth weight less will be mortality.

2.6 Poor mother-young relationship

The primary cause of hypothermia, less passive immunity, starvation is poor mothering. In extensive farming system, there are more chances of calf death due to poor mothering. The reasons for poor mothering might be genetic, birth trauma or nutrition. If the animals are growing in group system, there will be less chances of poor mothering. Vaginal stimulation and release of oxytocin due to suckling are important in establishing maternal behavior.

3. Management and miscellaneous factors

There are different factors related to the management which have a great importance in the calf mortality. Those factors include; calf housing, poor ventilation, overcrowding, poor cleaning and improper or no disinfection practices at the farm. All these factors make the calf prone to different diseases, especially respiratory diseases. Miscellaneous factors include; tympani and milk indigestion, arthritis and abscesses, etc [25].

Measures for improvement

Naval disinfection and removal of mucous from the mouth and nose reduces mortality in calves. Environmental conditions have a great effect on calf survival. Bad weather conditions impart a stress on newborn calves, while overcrowding resulted in the spread of infectious problems. So calving location and calving seasons are important management issues.

Strategies to Control early calf mortality

Prepartum care

Keeping in mind that a healthy mother gives birth to a healthy progeny, we should care for the mother so that a healthy calf can be produced. There is some nutritional management in the dry period. Dams are offered supplements like vitamins

premixes and minerals so that the deficiency of these elements can be avoided in mother as well as in calf. Some problems relating to the deficiency of minerals are retained placenta (Vit. E and Selenium deficiency), dystocia (difficult birth), hypocalcaemia (Ca deficiency). These conditions might result in dead calf or reduced immunity which makes the calf prone to scour, navil-ill, *E. coli* etc.

Keep the dam in calving pen one month before the calving. Any type of stress should be avoided during this period. Just after calving offer the calf colostrums and remove the calf from calving pen and keep in calf pen. In another case, calf can be injured by mother or contaminated by faeces. Before colostrums feeding udder of dam should be washed using standard antiseptics.

Some management issues such as; enough intake of good quality colostrum within the first 12 hours of life, housing and good hygiene to minimize disease transfer, providing clean drinking water and developing appropriate feeding protocols to encourage early rumen development. Good record keeping is also important so one can more easily identify [26].

Newborn Care

After parturition, full attention should be paid to the calf. Just after parturition disinfect the navel cord with iodine tincture solution and ligate it, help the calf in breathing by cleaning nose and mouth. Separate the calf from the mother and provide the calf with the dry resting area. Six inches deep bedding material is recommended to prevent the calf from a physical trauma. Calves are separated and kept in a calf pen to prevent the spread of diseases. An adequate quantity of colostrum (antibodies) is required for the calf immunity to develop. This is a way of passive immunity development, while active immunity develops after 60 days. From the 3rd day of life start providing the calf with milk replacer. There are two critical points to be considered for the milk replacer one is concentration and second is the temperature.

Conclusion

It is very important to control calf mortality to run a profitable dairy industry. Up till many researches are conducted to study the different causes of calf mortality so that these causes should be minimized

so that economic losses can be minimized. For a profitable dairy business biosecurity measures, prophylactic measures and nutrition should be a part of dairy management. Early calf mortality not only decreases our milk and meat production, but also lower genetic reservoirs by creating problems in breeding programs. Still there is need to investigate the improved measure for control of early calf mortality, particularly considering the practices of dairy industry of Pakistan.

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