



# **A Review on Epidemiology, Economic Importance and Common Causes of Dairy Calf Morbidity and Mortality**

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## **Abstract**

Different management and environmental factors were reported to affect significantly, calf morbidity and mortality which include colostrum feeding, housing, calving assistance, production system, herd size, season and hygiene of micro- environment. A range 15 to 25% pre weaning calf morbidity and mortality is typical on many tropical dairy farms. It is often as high as 50% indicating very poor calf management. Diseases of the new born calf and neonatal calf mortality are major causes of economic losses in livestock production. Calf diarrhea is the commonest disease in young calves and is the greatest single cause of death. Calf pneumonia is the most common of all the diseases of the Weaned calves and causes the highest loss in this age group, both in terms of mortality and reduced growth rates. Among the potential risk factors evaluated for their association with the occurrence of calf health problems; risk factors associated with diseases occurrences and death indicating, calf housing hygiene, floor conditions, farm size and sex as potential risk factors.

**Keywords:** calf, morbidity, mortality, epidemiology

## **1. Introduction**

About 12 to 14% of the world population is estimated to live on dairy farms or within dairy farming households (FAO 2010). The increasing human population coupled with increasing demand for food security is a serious challenge for developing countries like Ethiopia. Over 85% of the Ethiopian population depends on subsistence agriculture (mainly crop and livestock production) for their livelihood. Thus, agriculture is the foundation of the country's economy and the major contributing sector to food security.

Agriculture in the form of smallholder dairy production can aid the achievement of Millennium Development Goal 1 which seeks to eradicate extreme hunger and poverty through regular income, channeling dairy profits towards education and empowerment of women who are marginalized in the rural areas (UNDP, 2012).

Different management and environmental factors were reported to affect significantly, calf morbidity and mortality which include colostrum

feeding, housing, calving assistance, production system, herd size, season and hygiene of micro-environment. The mode of passive transfer in neonates varies with the type of placenta and in the case of neonatal calves; it is based on an immediate postpartum ingestion of antibody rich colostrum (Tizard, 1995). The age of the calf is the most important factor affecting morbidity and mortality, approximately 75% of the mortality in dairy animals occur in the first month of their life (Heinrichs and Radostits, 2001).

Mortality rate in dairy calves varied from a low of approximately 2% to high of 20% with mortality on individual farm varying from 0- 60% (Radostitset *al.*, 2007). African countries report a wide range of calf mortality between 3% and 47% during the first year of life, the majority of deaths occurring in the first 3 month of life (Zuret *al.*, 2005). A few studies conducted on calf mortality 0-1 years in Ethiopia show mortality that range from 3.6 to 30.7% (Wuduet *al.*, 2008; Feredeet *al.*, 2014). The calf mortality represents an irrefutable and irrevocable financial source of economic loss to the dairyman due to loss of the present value of the calf and loss of genetic potential for herd improvement (Hossainet *al.*, 1992).

A successful dairy farm operation requires that a large percentage of cows wean a live healthy calf every year. Rearing healthy dairy calves to weaning time requires maximizing the calf's level of immunity against disease while minimizing its exposure to infectious agents (Godden, 2008). However, among the factors that have been hindering success of dairy industry, morbidity and mortality of calves is the one, that causes major concern (Achaet *al.*, 2004). Phiri (2008) also noted that morbidity and mortality are important causes of economic losses on dairy farms worldwide. In spite of advancement made in dairy husbandry practices, clinical medicine and diagnostic techniques, the morbidity and mortality rates of dairy calves are still unacceptably high even on many advanced dairy farms in developed countries (Mee, 2008).

## **2. Literature Review**

### **2.1. Management of Calves**

The major factor which may predispose young farm animals to infection include: insufficient or no colostrum immunity, overcrowding and poor hygiene which increase transmission of organism, naïve immune system in neonates and stress factors such as cold ambient temperature and frequent mixing of animals (Quinn *et al.*, 2002), calf nutrition and calf vaccination status (Smith, 2009).

Management of calves is very important in approaching a problem of neonatal death losses and because of infectious agent are almost always present at some exposure level, the underlying them is to minimize the level of pathogen exposure and stress on the calf ( Smith, 2009). In well managed dairy herd calf mortality usually does not exceed 5% from birth to 30 days (Radostitset *al.*, 2007). The first weeks of life are critical to the growth and long term performance in a dairy calf (Smith, 2009). The emphasis is on insuring that the new born are born in a clean environment as well as barns, confinement pens and paddocks used as parturition areas must be clean and preferably have been left vacant for several days before the pregnant cow placed (Radostitset *al.*, 2007).

### **2.2. Colostrum**

Calves are born with no immunity against disease. Until they can develop their own natural ability to resist disease through exposure to disease organism in their surroundings they depend entirely on the passive immunity acquired by drinking colostrum from their dam. Colostrum is the thick; creamy-yellow sticky milk first produced by cows initially following calving and contains the antibodies necessary to transfer immunity on to their calves. It is essentially milk reinforced with blood proteins and vitamins. It has more than twice the level of total solids than in whole milk, through boosted levels of protein and electrolytes. It also contains a chemical

allowing newborn calves to use their own fat reserves to immediately provide additional energy (Moran, 2012). Many studies demonstrated the importance of high level of serum immunoglobulin in reducing the risk of morbidity and mortality in calves (Gebremdhin, 2014; Konjitet *et al.*, 2013; Feredeet *et al.*, 2014).

### **2.3. Epidemiology of calf morbidity and mortality**

A range 15 to 25% pre weaning calf morbidity and mortality is typical on many tropical dairy farms. It is often as high as 50% indicating very poor calf management (Radostits *et al.*, 2007). Major diseases in dairy calves have multifactorial etiology, resulting from interactions between the calf, infectious agent, management and environmental factors. Age of calf is the most important factor affecting mortality. Approximately 75% of mortality, in dairy animals less than one year of age, occurs in the first month of their life. In all cases (mortality, morbidity and calf diarrhea), younger calves under three months of age were at higher risk as compared to older calves (Wuduet *et al.*, 2008).

Differences in susceptibility of calves to diseases are often observed among different breeds. Taurine breeds and their crosses are generally more susceptible to diseases in tropical climates. The occurrence of diarrhea and other calf diseases found to be higher in cross breed. Ingestion and absorption of enough quality and quantity of colostrum is a critical determinant for the health and survival of neonatal calves. Leaving the newborn dairy calf with the cow is no guarantee that the calf will obtain sufficient colostrum and a high proportion fail either to suck early or to absorb sufficient immunoglobulins from ingested colostrum (Mansour *et al.*, 2014).

Housing has a significant effect on the health of the calves, with unclean barns predisposing calves to pneumonia. On most dairy farms, calves are taken from the maternity area soon after birth and placed in the calf-rearing barn. This is due to stressed and calving cows shed bacteria at a much

higher level than their unstressed peers. Pre-weaned calves that share the housing facility with adult cows, sick cows or recently weaned calves have a much greater risk of exposure to pneumonia and fecal pathogens. Calf to calf contact increases the number of pathogens in the environment (Moran, 2012).

### **2.4. Economic Importance of Calf morbidity and mortality**

Diseases of the new born calf and neonatal calf mortality are major causes of economic losses in livestock production. As Feredeet *et al.* (2014) and Wuduet *et al.* (2008), conclude in their study magnitude of calves morbidity and mortality were much higher than economically tolerable level and could affect the productivity of dairy farms through mainly decreasing the availability of replacement stock. Neonatal calf mortality in the first month of age is accounted to be 80-85% of the total mortality and is particularly high in the third week of life (Singh *et al.*, 2009). A dairy farm management system should employ strategy that will reduce calf mortality and improve calf performance by controlling diseases (Radostits *et al.*, 2007).

### **2.5. Major Causes of calf morbidity and mortality**

#### **2.5.1. Calf Diarrhea**

Calf diarrhea is the commonest disease in young calves and is the greatest single cause of death (Bekeleet *et al.*, 2009). Neonatal calf diarrhea remains the most common cause of morbidity and mortality in pre-weaned dairy calves Worldwide. This complex disease can be triggered by both infectious and non-infectious causes. The four most important enteropathogens leading to neonatal dairy calf diarrhea are Colibacillois, Salmonellosis, Rotavirus and Coronavirus infections, and Cryptosporidiosis (Meganicket *et al.*, 2014).

## Colibacillois

All calves become colonized within a few hours of birth with many varied strains of *E. coli*. This constantly changing population of organism inhabits the calf's intestine for life and is entirely normal and healthy (Quinn *et al.*, 2002). Some strains of *E. coli* have the ability to adhere to the intestinal wall and produce toxins that cause scours. An example of this *E. coli* K99, which is referred to as an enterotoxigenic *E. coli* K99 (ETEC). This strain is capable of causing disease in calves of less than one week age (Abraham *et al.*, 1992).

## Salmonellosis

The organism *Salmonella* Dublin or *Salmonella typhimurium* are the main cause of salmonellosis in calves. *Salmonella typhimurium* DT104 has been recognized as highly pathogenic to calves, resulting in a high incidence of mortality has a wide range of antibiotic resistance and is capable of rapidly developing new resistance patterns (Bernadette, 1999).

## Bovine Rotavirus infection

Disease caused by Rotavirus is usually seen only in young animals, 1 to 8 weeks of age, but only rarely during the first week of life. Infection by Rotavirus leads to the destruction of epithelial cells of the apices of villi in small intestine. With virulent strain of Rotavirus, the loss of enterocytes exceeds the ability of the intestinal crypts to replicate; hence, the villi height is reduced with a consequent decrease in intestinal absorptive area and intestinal digestive activity leading to diarrhea (Quinn *et al.*, 2002).

## Bovine Corona virus infection

Bovine coronavirus is a component of the acute diarrheal complex of neonatal calves, a very common and serious economic problem in dairy and beef operations. The disease occurs in farm and ranch calves 1 day to 3 or more weeks old (Quinn *et al.*, 2002).

## Cryptosporidiosis

*Cryptosporidium parvum* is the most common species found in calves and man, and it is transmitted readily to several new born species of mammals by the fecal oral route (Scott *et al.*, 1995). Infection with *Cryptosporidium* is more commonly reported in calves less than 1 month age, and affected calves may shed large numbers of infective oocysts in the feces. While infection is generally self-limiting, fatalities associated with Cryptosporidiosis have been reported (Trotz-Williams *et al.*, 2005).

### 2.5.2. Calf Pneumonia

Although calf pneumonia can affect pre-weaned calves, this is the most common of all the diseases of the Weaned calves and causes the highest loss in this age group, both in terms of mortality and reduced growth rates and accounts for about 15% of calf mortality from birth to 6 month of age (Heinrichs and Radostits, 2001). In calves pneumonia is usually caused by *Pasteurellamultocida*, *Pasteurellahemolytica*, *Staphylococcus epidermis*, *Streptococci*, *Pseudomonas aeruginosa*, *Corynebacterium payogenes*, *Mycoplasma*, Pestivirus and Herpesvirus (Mushtaquet *et al.*, 2013).

### 2.5.3. Omphalitis

Localized inflammation or infection of the contents of the umbilical cord external to the body wall is referred to navel ill (omphalitis). 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.*, *Bacteroidesspp*, *F. necrophorum* and *Klebsiella spp.* Navel ill can lead to septicemia, arthritis, and fever, which cause 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 antiseptics ((Lorenz *et al.*, 2011).

#### 2.5.4. Other Causes

Other diseases in calves including arthritis, bloat, parasitic gastroenteritis, and parasitic pneumonia in grazing calves; arthropod parasites and nutritional diseases (like inadequate intake of energy, protein, vitamins, and minerals) are also reported (Heinrichs and Radostits, 2001).

### 3. Conclusion and Recommendations

Calf diarrhea and calf pneumonia were the predominant calf health problems of the farms involved in this review. Among the potential risk factors evaluated for their association with the occurrence of calf health problems; risk factors associated with diseases occurrences and death indicating, calf housing hygiene, floor conditions, farm size and sex as potential risk factors. Therefore, based on the above conclusion the following recommendations are forwarded.

- ❖ Greater attention should be given to risk factors associated with disease occurrences and death.
- ❖ Implementation of improved cross breed calf management practices such as allowing calves to take adequate and quality colostrum within 24 hours of birth.
- ❖ There should be education to create awareness about disease of calves as well as way of transmission for smallholder dairy farmers.

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