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Review Article

Improvement of Survival in Newborn Offspring

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ABSTRACT

A significant portion of the world protein requirement is met by ruminants (sheep, goat, cattle). This is to increase the number of offspring raised by decreasing losses with the number of newborn per root as well as raising the intended yield of the animal breeder. Neonatal mortality in ruminants has remained stubbornly unchanging since long years, and represents a significant loss of farm income and affects animal welfare. However, deaths that occurred shortly before birth and within the first postpartum period are defined as prenatal period deaths. Deaths observed in this period are at the highest level. Post-natal period deaths are deaths in the circuit from the weaning to the prenatal period. Environmental factors are more efficient in deaths in this period. In lambs, kids, calf most deaths occur in the neonatal period. Causes include starvation, injuries, infectious conditions and difficult birth, among others. Following birth, offspring are exposed to bacteria and pathogens that its immune system is unfamiliar with. Lamb and kid survival rate are the most important traits influencing income the herd. Therefore, a great deal of effort should be put toward the care of pregnant and newborns before, during, and after birth. Postnatal longevity is very important in the determination of the adaptation of newborns to the environmental conditions and the profitability of the enterprises. The newborns are essential without immune protection as maternal antibodies are not transported across the placenta. An important strategy for newborn receives adequate colostrum during the first two to three hours of life. Colostrum, is rich with the antibodies that provide protection, from diseases in early life until the calf's own immune system becomes functional. Mortality is now considered the most crucial indicator of welfare level; it was an important indicator of management quality. The first 7 days of life can be to a new-born animal. The neonatal mortality seen in the first few months constitutes 84% of the total mortality rate. Priorities in newborns management; minimize stress at birth, maximize passive immunity, to meet the nutritional needs and maintain animal health as can be sorted. Because of improving the survival of neonatal lamb, kids and calves are essential for the economically and long-term genetic improvement.

Keywords: Lamb, Kid, Calf, Survival, Welfare, Colostrum

INTRODUCTION

One of the management challenges most often encountered by sheep, goat and cow breeding is maintaining the survival and health of the newborn. Newborns survival rate is the most important trait influencing income in herd. The number of newborn per female is certainly an economically important trait in a commercial enterprise. The major cause of death for lambs varies between properties and seasons, but starvation, mismothering, exposure and difficult births are generally the largest causes. Following birth, the lamb or kid has exposed to bacteria and pathogens that its immune system is unfamiliar with. Poor lamb survival is also becoming increasingly important as an animal welfare issue (Brien *et al*., 2014).

Care and success in breeding, maintenance and feeding of breeding animals in the operation of dairy cattle have a significant impact on the profitability and success of that enterprise. The most important factor affecting profitability in dairy enterprises is the amount of calf and milk obtained from cattle per year. Calf yield is the most important yield in dairy enterprise and is the main source of milk yield. The calves are the breeders of the future. Therefore, the loss of calves also threatens the future of the dairy enterprise. On the other hand productivity of cattle, breeding period begins with the first calving. The newborn must be given a special care in order to adapt to the new environmental conditions. Even in developed countries, animals are reported to have lost up to 20% in reaching adult live weight.

Mortality in different animal species is a big problem facing the animal industry. Great economic losses due to this mortality occur leading to low profitability. Calves, lambs, and kids mortality is the most frustrating part of keeping cows, sheep and goats. After big efforts done, lamb and calves that die soon after arrival is such a terrible waste and a killer of profit. Mortality control is vitally important for farmers, not only to improve animal welfare but also to increase productivity. High mortality rates can be related to larger numbers of calves in a herd, employee performance, severe weather, and the neonatal period covering the first 4 weeks of life (Uetake, 2013).

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The number of lambs born per ewe is certainly an economically important trait in a commercial sheep enterprise. However, profitability is largely determined by the number of lambs sold per ewe. Therefore, a great deal of effort should be put toward the care of pregnant ewes and their lambs before, during, and after birth (Turkson, 2003; Vetter et al, 2010). Rearing healthy newborns requires a maximizing level of immunity against diseases and reducing exposure to infectious agents. In the first days of life, newborns are very susceptible to pathogens, and failures in any of management procedures consequently influence their survival and further growth (Relic *et al.*, 2014).

The main objective of the calf breeding program to reduce the death rate and the shortest possible time on the farm is weaning calves begin to consume roughage and concentrated feed. Newborn calves should be the two main targets. Firstly, the newborn must survive; secondly, it develops quickly as soon as possible. The highest risk of dying is during the first week of calves' life (Svensson *et al.*, 2006). The majority of calf deaths occurred within the first 24 h postpartum with 75% of the total occurring days 0 through 7 (Patterson *et al.*, 1987). Mortality rate also tends to increase with increasing herd size (Gulliksen *et al.*, 2009). The calf mortality rate can have a significant economic impact on the dairy farmer, and the appearance of sickness or death in the is certainly a welfare problem. Knowledge of the causes of death and factors influencing mortality are of the vital importance in identifying opportunities to improve the health status of calves. The neonatal calf mortality seen in the first few months constitutes 84% of the total mortality rate and is particularly prevalent in the third week of life of the frog. Since 25% of early-stage calf mortality is made up of low-yielding animals, there are several applications for control, but the procedures for herd health are more difficult 20% of calf mortality and 38% reduction in profitability in livestock farms.

An economic analysis examining proposed improvements to industry reproductive performance by Young *et al*. (2014) showed that increasing the survival of twin lambs would have the highest payoff to the sheep industry. Production losses due to lamb mortality are a major part of reproductive wastage in the sheep industry and have been estimated to be ~30% when pregnancy scanning rates are compared with weaning rates (Hinch and Brien 2014).

Mother-Newborn Interaction and Colostrum

Early mother-young interactions are also crucial to ensure that a strong bond is established between the mother and her neonate so that food is regularly supplied to the young. In ruminants, syndesmochorial placentation prevents the transmission of immunoglobulins in utero, and animals are born with a very low serum concentration of immunoglobulin G (IgG). Thus, in neonatal lambs, the acquisition of passive immunity by the early ingestion and absorption of maternal immunoglobulins from colostrum is critical for survival (Waelchli *et al.*, 1994; Nowak and Poindron, 2006). In domestic large animals, the placenta prevents transmission of immunoglobulins from the dam to the fetus in utero. The syndesmochorial placenta of the cow forms a syncytium between the maternal endometrium and the fetal trophectoderm, separating the maternal and fetal blood supplies and preventing the transmission of immunoglobulins in utero (Arthur, 1996). The primary functions of early maternal care are therefore to provide the newborns with colostrum to satisfy its metabolic needs and to protect it from aggression from the outside environment. The mother-young interactions that lead to successful suckling by newborns are the results of complex physiological, morphological, and behavioral changes that ensure extra-uterine survival at a time when the young is entirely dependent upon its mother for the provision of food (Nowak and Poindron, 2006). Newborns are born without antibodies to protect them against disease and only after they have received a good supply of antibody-rich colostrum will they have any protection against infection. Even after the early stage, newborns are very vulnerable to many diseases including gut and skin parasites. The proper development of fetuses and newborn requires the adequate transportation of nutrients across the placenta and mammary gland. The adequate transportation of nutrients also affects fetal ovarian development, postnatal growth, reproductive performance and metabolism (Mahboub et al, 2013). Ideally, maternal immunity should be transferred in utero to their fetuses so that they are brought into the world protected against microorganisms. However, placental barriers in the ruminants do not allow the passage of immunoglobulins from dams to neonates, and therefore the lamb has been to depend entirely on antibodies received via colostrum (Tizard, 1992).

Early ingestion of good quality colostrum is essential to both the early health and survival and also the long-term productivity of newborns. Colostrum is a special secretion of the mammary gland which has attributes far exceeding that of regular milk. The term colostrum is generally used to describe all the milk produced by cows up to 5 days after postpartum until it is acceptable for use by milk factories. However, more correct term for milk produced after the second milking post-calving is transition milk. It contains high levels of immunoglobulin (antibodies), macro and micronutrients, leukocytes (white blood cells), enzymes, growth factors and hormones. Generally, a calf should receive 5 to 6 % of its body weight as colostrum within the first six hours of life, and another 5 to 6 % of its body weight when the calf is 12 hours old. At birth, a calf has a poorly developed immune system. The placenta does not allow the transfer of antibodies, also known an immunoglobulin (Ig), from the mother to the fetus during pregnancy. Newborns have limited energy reserves and need rapid access to colostrum to maintain body temperature and survive, especially those born when it is cold. Colostrum is also the first source of Vitamin E for the lamb or kid. Colostrum also has laxative qualities and helps to eliminate fecal matter in the newborn's digestive tract. Newborns that do not receive colostrum have greater difficulty emptying the intestine of its content of dead epithelial cells and remnants of swallowed amniotic fluid called meconium than animals that receive colostrum. Animals receiving an inadequate amount of colostrum usually grow more slowly than animals that receive adequate amounts and the former often suffer from diarrhea (Sjaastad *et al.*,2003). Colostrum is produced just before parturition and contains dense nutrients as well as high levels of immunoglobulin, enzymes, hormones, growth factors and neuroendocrine peptides (Hadjipanayiotou, 1995). The blood IgG levels are influenced by two things 1) the number of maternal antibodies produced by the cow in the colostrum and 2) the ability of the calf to nurse and absorb the antibodies. Shortly after the birth of colostrum is important for good farm practices, such as reducing pathogens and ensuring hygiene, are obviously important and could overcome the problem of calves receiving inadequate colostrum from their dams. Every calf should receive colostrum from its dam or from another cow from the same farm as soon as possible after it is born, and certainly within the first six hours of its life. It is recommended that the colostrum is fed in the first four days following calf birth, ideally for a longer period of time, to provide immunity in the intestine. It should be administered at a rate of 10-12% of body weight per day and at least twice a day (Deaker and Fisher, 2002). The newborn calf is carried over the placenta, the maternal antibodies are essentially immune-protected, unlike the newborns of other species and the calf's own immune system is still developing. Protection is achieved, in particular, by taking the mother's blood, which is secreted in excess by the immunoglobulin during the first 48 hours of lactation. Of one of the immunoglobulin (lgG) produced in the first five days post-calving, 70% was collected at the first milking, 10% at the second and less than 5% in the third (Lacy-Hulbert et. al., 1996)

Factors Affecting Lamb, Kids and Calf Mortality

According to Hall (1998) major causes of young caves death or illness are: dystocia (calving difficulties), starvation due failures in colostrum management, hypothermia (exposure to coldness), metabolic disorders, infective diseases (scours i.e. enteritis and pneumonia), and trauma more than 50% of all newborn diarrhea occur in the first week and only 15% occur after the second week of life (Bendali *et al.* 1999). However, the highest prevalence of route virus is usually 2-4 weeks of age (Nourmohammadzadeh *et al.* 2011). Bacteria in newborn calves increase the risk of severe diarrhea and death (Fecteau *et al.* 1997). A second principal cause of calf death is respiratory disorders, including pneumonia, but colostral immunity normally protects the calf from developing pneumonia early in life (Donovan *et al.* 1998).

Diarrhea and respiratory diseases in newborn calves increase the risk of death (Gulliksen *et al.* 2009). However, in most cases, the cause of calf mortality is multifactorial, often due to a combination of dam factors, various infective agents, and no optimal housing and management. Among the factors reported to influence the risk of calf mortality are herd size, type of housing, personnel in charge of calf management, colostrum feeding regimen, sex, and time of separation from dam after calving (Simensen, 1982; Lance *et al.*, 1992). In order to prevent the loss of calves, it is necessary to show the growth and development of the breeds of the calves. Newborn calves must be given a special care in order to adapt to new environmental conditions. Following birth, the chances of surviving of calf the first few weeks of the critical period are significantly increasing.

Newborns have an immature immune system, since antibodies (Immunoglobulins - Ig's) do not cross the placenta in pregnancy (unlike in humans). Good quality colostrum rich in antibodies (particularly IgG) protect the calf from diseases early in life, before its own immune system starts working (Figure 1); it is also an important first source of nutrients (Anonymous, 2017a). Health and profitability of the calf begin prior to birth. Because the calf is especially susceptible to pathogens during the first few hours after birth, the calving environment is critical. In addition, preparing the dry cow for calving by proper nutrition and management will contribute significantly to the health of the calf after calving.

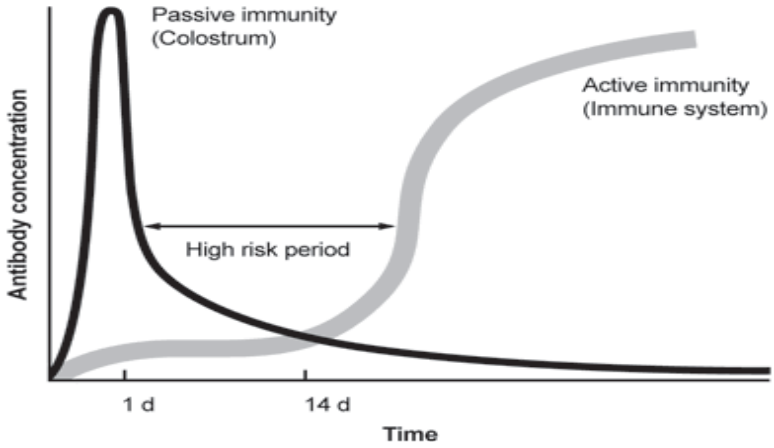

Figure 1. Calf immunity over time (Anonymous, 2017b)

Many lambs and kids could survive with better planning, good preparation, well- organized lambing/kidding routines and facilities, good stockmanship, possibly increased supervision and staffing numbers around lambing time and early recognition of problem newborns.

The main causes of mortality are related to trauma experienced during the birthing process and failure of neonatal adaptation to postnatal life. Dystocia also accounted for 19% of all lamb deaths (Armstrong, 2012). Birth weight, birth type, maternal nutrition, dam age, and sex all impact on survival (Hatcher et al, 2009). The single largest influence on the survival of in the first few days of life is their birth weight. Everett-Hincks and Dodds (2008) and many other studies have shown the optimum birth weight where lamb death risk to starvation-exposure and dystocia were lowest, and lamb viability and survival were highest.

Published reports estimate mortality rates of single born lambs range between 6 to 30%, with losses of twin lambs generally double that of singles in the same flock (Hatcher et al, 2009). There are numerous reasons for lower survival rates in multiple born lambs including the incidence of malpresentation, birthing difficulties, lower birth weights, larger surface area to lose body heat, smaller reserves of body fat and competition with its litter mate for colostrum and milk (Hatcher *et al.*, 2010). Nearly half of all pre-weaning deaths occur on the day of birth but this rate reduces significantly once the lamb is one week old (Dywer, 2003). Worldwide lamb mortality rates average from 9 to 20% (Mousa-Balabel, 2010)

Dam age also has an influence on mortality. Many researchers have highlighted decreased lamb survival from differently aged dams. They show impairments in the expression of maternal behaviour and when compared to older ewes, are slower to begin grooming their lambs after birth. Younger ewes show equivalent amounts of grooming behaviour over the first two hours after delivery and make a similar number of low-pitched bleats. Initial contact with her lamb allows the ewe to learn to respond appropriately, and she becomes less likely to prevent subsequent suckling attempts. (Dwyer, 2003). Older ewes have a higher potential for udder damage which can negatively affect lamb survival (Hatcher *et al.* 2010).

Table 1. Lamb deaths contributing factors, ultimate reasons for death and potential strategies to improve survival (Lambex, 2014).

Factors contributing lamb death	Ultimate reasons for lamb death	Strategies to address the contributing factor
Low birth weight	Inadequate nutrition Exposure Predation	Nutrition in pregnancy (particularly twins)
Ewes lacking the energy to complete birth process	Birth trauma Inadequate nutrition	Nutrition in pregnancy Feed on offer in lambing paddocks
Abandonment/mismothering	Inadequate nutrition Exposure Predation	Ewe condition at the point of lambing Feed on offer in lambing paddocks Breeding ewes with better maternal behavior Mob size and stocking rate at lambing
Poor ewe milk supply	Inadequate nutrition	Ewe condition at the point of lambing Feed on offer in lambing paddocks Grain feeding to increase colostrums supply
Predators	Predation	Fox control programs wild dog community action programs
Adverse weather conditions	Exposure	Sheltered lambing paddocks, paddock aspect in relation to prevailing winds

Newborn Welfare

Dairy calves are susceptible to serious welfare problems that may arise. These include poor health, social deprivation, abnormal and stress behavior; which arise from the environments and procedures they experience. Biosecurity, the prevention of introducing disease on to the farm, can be difficult when calves are sourced from different farms, but producers can decline to take calves from farms which consistently have low levels of passive immunity (Walker *et al.* 2012). Studies on the welfare of sheep and goats have developed slowly, due to some of their physiological peculiarities and their prevalent extensive production system. In fact, since sheep and goats are considered very rustic animals, their ability to cope with prohibitive environmental conditions and inadequate management practices, without harming their welfare and productive performance, has been often overrated (Sevi *et al.* 2009).

Care of calves is a high priority for the dairy industry. Animal welfare requirements apply to all calves born on a farm, whether they are destined for the milking herd. Many factors contribute to the well-being of calves on the commercial dairy including housing and environment; nutritional and health programs; handling and caretaker interactions; herd dynamics; and the common management practices of transportation, euthanasia, dehorning, and teat removal (Carolyn and Reynolds, 2008).

Table 2. Evaluating calf welfare (Reynolds, 2014).

Welfare requirements	Assessment approaches
Birth into a clean, dry thermal-neutral environment;	Observation during the assessment
An appropriate delivery assistance during dystocia (facilities for calm handling and restraint, trained operators, birthing equipment and supplies);	Observation during the assessment
Appropriate amount of clean colostrum soon after birth (primarily energy (fat), then immunoglobulins);	Observation of colostrum during the assessment, written protocol; worker training; colostrum testing records; records of calves tested for IgG transfer; body condition scores
Calm, friendly movement from birth area to housing	Protocols, training, observation
Housing that: *Allows calves to turn around and to be able to assume most resting postures; * Shelter from cold, heat, rain and snow; *Provides clean and dry bedding; *Prevents lesions on legs; *Interaction with other calves;	Observation during the assessment, calf hygiene scores, leg lesion scores, the ability of calves to see or touch other calves
Nutrition that maintains positive growth;	Body condition scores
Continual access to water;	Observation during assessment
Dry feed to develop rumen function;	Observation during assessment
A herd-health program that includes: *Disease prevention (sanitation, nutrition, ventilation, vaccines); * Identifying animals that get sick and treating them appropriately; *Euthanasia when necessary;	Written herd health plan (training programs, vaccination and treatment protocols), observation of calves for signs of disease or injury, body condition scores, euthanasia plan (method, training, records), mortality records
Pain management for dehorning and castration *Disbud less than 3 or 4 days of age; otherwise provide local anesthetic and post-procedure analgesia.	Protocols, training, observation remove of calves, observation of equipment and drugs, observation of procedure if possible.

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