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Review Article

Neonatal & Young Calf Managemental Strategies under Changing Climatic Scenerio

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Abstract

Neonates are very much susceptible during adverse climatic condition, due to its poor thermoregulatory mechanism. Nutrition and management of the cow during the dry period may have a profound effect on the survival, health, and growth of newborn calves. The proper management of energy intake to control body condition from late lactation until calving minimizes the potential for harmful effects of nutrient deprivation or over conditioning. The production levels and the performance of calves in herd are greatly affected by genetic and environmental factors. In addition, the neonatal performance are known to be important for continuity of the herd and the survival for livestock enterprises. During periods of heat stress, take necessary measures to ensure cows and heifers are kept cool. Alleviate heat stress by providing constant access to water, shade and proper ventilation. For cows, measures including provision of an enriched, more easily digestible ration as well as sprinklers over feeding areas can help ease heat stress. For calves, good colostrum management becomes even more important during heat stress.

Keywords: Colostrum; Comfort Zone; Neonates; Prenatal & THI.

Introduction

Neonates are newly born one of livestock species like calves, lambs, kids etc are very much susceptible during adverse climatic condition, due to its poor thermoregulatory mechanism (Singh et al., 2015). The production levels and the performance of calves in herd are greatly affected by genetic and environmental factors. In addition, the neonatal performance are known to be important for continuity of the herd and the survival for livestock enterprises. In animal production, calf birth weight takes part in substantial yield properties. Calf birth weight is one of the important factors for a successful cattle breeding due to its strong relationship with vitality, growth performance, fertility and milk yield. Birth weight that is showing the growth in prenatal period is affected by genetic and environmental factors such as gender, birth type, maternal age, care and feeding at gestation period, dry removal time of mother before birth, temperature, humidity and cold stress (Collier et al., 1982; Wolfenson et al., 1988; Akdag et al., 2011).

Birth weight that is showing the growth in prenatal period is affected by genetic and environmental factors such as gender, birth type, maternal age, care and feeding at gestation period, dry removal time of mother before birth, temperature, humidity and cold stress (Akçapýnar and Ozbeyaz,1999; Avendano-Reyes et al., 2006; Collier et al., 1982; Wolfenson et al., 1988; Akdag et al., 2011). It is reported that, since there is morbidity and mortality risk for calves having low birth weight, high birth weight is necessary for

vitality (Nardone et al., 1997). One of the most prominent problems in production performance of animals is the changes in temperature and ambient temperature. There are studies emphasizing that heat stress is maximal at lactation period because of excess metabolic heat production in dairy cattle (Bryant et al., 2007; Collier et al., 1982; Rodriquez et al., 1985; West et al., 1990). However, the prospect of dairy cattle's to be sensitive to heat stress in other periods of production cycle should be considered.

In herd management, management of the cows in dry period is neglected in many dairy cattle enterprises. However, it is known that the dry period, which is in the last trimester of pregnancy, is the stage when the fetus development rate is at maximum and birth weight of the fetus is determined. Several studies were conducted to show the effects of heat stress on birth weight by modifying climate conditions (shade, sprinkle, fan, etc.) in dry period for dairy cattle (Avendano-Reyes et al., 2006; Collier, 1982; Wolfenson et al., 1988). Climate conditions such as ambient temperature, relative humidity, wind velocity and temperature- humidity index (THI) are used for the identification of heat and cold stress (Donelly, 1982; Davis 2003). It is reported that; in dairy cattle's milk yields are not affected in the situations temperature-humidity index (THI) is equal or lower than 72 but affected by 75 or higher values (Buffington et al., 1981). It is reported that cold stress does not affect animals much in contrast of heat stress (Jordan et al., 1968; Hiranoko et al., 1969; Rutter et al., 1971, 1972; Bryant et al., 2007).

It is said that "good animals are raised not purchased". It is impossible to purchase good quality animal regularly, so one has to raise its own calves properly to make a good herd. Calves are the future of the dairy farm, and it is essential for future success to provide adequate and consistent care for each and every calf (Singh et al, 2014). Calves attempt to maintain a constant body temperature regardless of the outside temperature, and within a certain temperature range called the thermoneutral zone (calves can accomplish this without expending extra energy). The boundaries of the thermoneutral zone are not constant and are not determined by the outside temperature alone. They are affected greatly by the effective ambient temperature experienced by the calf, which depends on air movement, moisture, hair coat, sunlight, bedding, and rumination. Many of these factors can be influenced by the housing and environment in which the calf is placed. Each of these factors affects temperature regulation, and the impact may differ in summer and winter.

Impact of Heat Stress on Calves

The term 'Heat stress' refers to the stress of hot weather, not the estrous or heat cycle. It is an inevitable part of life during the summer for dairy farmers in India.

The severity of heat stress experienced by an animal depends on a number of factors. The key ones include:

- The actual temperature and humidity
- The length of the heat stress period
- The degree of night cooling that occurs
- Ventilation and air flow
- The size of the calf
- The level of milk production and dry matter intake prior to the heat stress (higher producing animals will experience greater effects of heat stress)
- Housing – type, ventilation, overcrowding, etc.
- Water availability
- Breed
- Coat color (lighter color coats absorb less sunlight)
- Hair coat depth

Adverse Effect of Heat Stress

In comparison to adult animals, calves may be better able to cope with warmer temperatures due to their large surface area relative to their body weight and also due to the much smaller amount of heat generated by calves compared to cows. Obviously, cows produce an increased amount of heat due to the digestion of fibrous feedstuffs and the metabolic activity required to support high levels of milk production. However, Extreme heat can negatively influence a cow's ability to produce high quality colostrum and can also negatively affect a calf's ability to absorb IgG from colostrum. Favorable environmental conditions are vital to promoting calf health, minimizing disease risk and mortality, subsequently encouraging growth rates. during heat stress cows exhibit reduced feed intake, decreased activity, increased respiratory rate, and increased peripheral blood flow in sweating. When heat stress is experienced close to calving an additional negative side effect is impaired transfer of maternal IgG's to colostrum i.e. decreased transfer of maternal IgG to colostrum, meaning colostrum from these cows tends to be of lower quality. colostrum of cows exposed to high air temperatures had lower mean concentrations

of IgG and IgA, lower mean percentages of total protein, casein, lactalbumin, fat, and lactose, lower contents (grams per liter) of short and medium chain fatty acids, lower energy, lower titratable acidity, and higher pH. Thus, high air temperatures during late pregnancy and the early postpartum period markedly affected the composition of colostrum from primi-parous dairy cows (Collier et. al.1982; Robinson et. al., 1999; Tao et al., 2012). Calves attempt to maintain a constant body temperature regardless of the outside temperature, and within a certain temperature range—called the thermoneutral zone—calves can accomplish this without expending extra energy. The boundaries of the thermoneutral zone are not constant and are not determined by the outside temperature alone. They are affected greatly by the effective ambient temperature experienced by the calf, which depends on air movement, moisture, hair coat, sunlight, bedding, and rumination. Many of these factors can be influenced by the housing and environment in which the calf is placed. Each of these factors affects temperature regulation, and the impact may differ in summer and winter.

When we think of effects of the environment on calves, cold stress is often the more common concern, especially in more temperate climates. However, soaring summer temperatures, hot sun, and high humidity can cause heat stress in calves and heifers just as in the milking herd. These factors may affect calves many months of the year if they are in areas closer to the equator. Reduced feed intake and increased maintenance energy needs coupled with lowered immunity can lead to poor growth, higher susceptibility to disease, and in extreme cases death.

The mortality rates in heat stressed calves is significantly higher than calves under cooled environment, due to the colostrum quality and absorption. The physiological response viz. rectal temperature, respiration rate, pulse rate & heart rate in calves will be higher during heat stress condition.

Calf Management during of Heat Stress

Alleviate heat stress by providing constant fresh plenty of water, shade proper bedding, ventilation. For cows, measures including provision of an enriched, more easily digestible ration as well as sprinklers over feeding areas can help ease heat stress. For calves, good colostrum management becomes even more important during heat stress. When colostrum quality is questionable then colostrum replacers are a practical alternative to ensure calves receive the amount of IgG required for immune protection.

Protective Measures against Heat Stress

- Trees are an excellent natural source of shade for the calves and cools the surrounding air.
- Solar radiation is a major factor in heat stress can be blocked by use of properly constructed shade structures. Besides these some of the protective measures are
  - Avoid overcrowding
  - The air flow over the cow housing area should be 4-5 mph.

Air Temperature Reduction Measures

The evaporative cooling pad (corrugated cardboard or similar material) and a fan system which uses the energy of air to evaporate water is a more economically feasible method to cool the micro-environment. Several cooling measures may be utilized to get rid of heat stress are mentioned below:

- Fine mist injection apparatus
- The cooler at very high rates. This system is effective in arid climates.
- High pressure foggers
- Misters

The Impact of Cold Stress on Calves

Calves are more susceptible to the negative effects of cold stress than cows and more mature heifers. The range of temperatures where calves use no additional energy to maintain body temperature, or thermoneutral zone (TNZ), ranges from about 55°-70°F, varying slightly due to age and other factors. In general, for every 1°F drop in temperature below the TNZ maintenance requirements of the calf increase by 1 percent. Calves are especially susceptible to the negative effects of cold due to having a larger surface area to body mass ratio than more mature animals, resulting in more body heat loss with the larger surface area. Cold stress causes calves energy to be used for maintenance rather than being utilized elsewhere in the body. In more mature animals, fat can be mobilized to make up for this energy deficit, while calves, are born with low body fat reserves and excess energy must be supplied to avoid negative energy balance.

Cold stress decreases the rate and delays the absorption of immunoglobulins from colostrum, though net absorption of colostral immunoglobulins is generally not affected. Calves exposed to cold conditions also have a higher percentage of neutrophils and decreased percentage of

lymphocytes compared to calves housed in TNZ and heat-exposed conditions between 03 and 14 days of exposure. This could be indicative of a delay in the development of the immune system in the cold-stressed calves. Any delay in the immune system, be it the rate of absorption of colostral immunoglobulins or development of lymphocytes, puts calves even more at risk than they naturally are at this early period of life. The more noticeable consequences of cold stress on calves, however, may be the decreased average daily gains. Unless adequate supplemented energy is provided, the energy used for growth in TNZ conditions will be used for maintenance.

Calves Management During Winter Season

There are several feeding and housing strategies to consider when raising pre-wean calves during winter season. The critical temperature for newborn calves is 48°F versus 32°F for older calves. When cold stress takes effect on calves, there is an increase in the calf's energy requirement for maintenance. Cold stress causes calves to divert energy away from growth and immune function to fight the effects of being cold. Additional energy must be added to the ration as well as housing strategies must be used to help combat the effects of cold stress and as a result maintain a calf's desired growth rate of 1.5 pounds per day.

- *Housing Strategies*

Dry, Clean, Dust free Housing: Calf housing has to be clean, dry and free of dust. Proper bedding increases insulation from the earth or concrete underneath the calf. Bedding when added to a hutch or pen has to be clean free from soil, pathogens and mold etc. Bedding materials which include sand, straw, corn stalks, paper, wood shavings, paddy straw and sawdust have to be dry. Once the bedding is already placed in the hutch or pen, use the "knee-drop" to test for dampness. You should be able to remain on your knees for 15 seconds or longer without having damp knees. Calves can lose heat rapidly if bedding is wet. Don't forget, as more energy is used for maintenance, less will be available for growth and immune functions. Provide calves a place to lie down away from drafts. Dry plentiful bedding provides an insulating stable air environment and will encourage calves to lie down decreasing body heat loss.

- *Birth Protocol*

All year round, following the appropriate calving protocols is essential for the health of both the cow and calf. More specifically to winter, calves should be kept clean, dry and warm in the first two hours after birth and then moved to a calf hutch or cold housing. Calf jackets are also helpful to keep calves warm during extreme winter. Calf jackets should be laundered regularly especially between calves. Bedding: Calves should be provided a clean and dry place to live, which is deep and allows calves to nestle down into bedding to reduce body heat loss.

- *Calf Coats or Body Cover*

In colder winters, waterproof calf coats or body cover made up of gunny bags can also help decrease cold weather stress. Calf coats should be dry and cleaned regularly. Don't forget that a calf's coat should be dry and clean as it is its barrier to the environment and insulation. Newborn calves should have ample time to dry before being moved in a hutch and these have to be located in dry areas.

- *Feeding Strategies*

Calves should be fed the same volume, the same amount of solids, the same time of day and at the same temperature at every feeding.

- *Fat content:* Due to the fact that calves are born with very little fat on their bodies, calves should receive a ration containing at least 20% fat to maintain their body temperature.
- *Feeding times:* In order to increase the feed intake of calves, the number of times fed or the amount fed may need to be adjusted. For example, increase the number of feedings per day from two to three while keeping the amount fed per calf the same.
- *Calf starter:* Provision of high quality, free choice starter to calves for utilization of additional energy and to aid in rumen development. Starter provides another source of energy for calves.
- *Water:* Water is essential for maintaining body fluids, rumen development, digestion, and eliminating waste. Calves should consume 10% of body weight in water daily. Since milk intake does not substitute for water, provide supplemental water.

Future Prospects

Substantial efforts are needed to identify specific genes associated with tolerance and sensitivity to adverse climatic conditions for the neonates. Further research is required for Identification and evaluation

of new, superior and cost effective housing design suitable for different local conditions based on locally available resources and field research is needed to determine the technical feasibility of practices developed from laboratory studies or tests that involved limited number of calves. Laboratory and field experiment must be coordinated to validate laboratory results and to avoid restricted geographic applicability of field results.

Conclusions

Prompt and careful managerial practices must be adopted to reduce the mortality rates in neonates during adverse climatic condition. Nutrition and management of the cow during the dry period may have a profound effect on the survival, health, and growth of newborn calves. The proper management of energy intake to control body condition from late lactation until calving minimizes the potential for harmful effects of nutrient deprivation or over conditioning. Dry cow diets should be supplemented with vitamins and minerals to improve the quality of colostrum. The colostrum and milk quality are changed during severe heat stress condition, which finally affect the health status, survival and growth performance of calves. Environmental modification through provision of shade, splashing of water, misting, fogging during heat stress and proper bedding, housing and dietary manipulation during extreme winter significantly reduces adverse effect of climatic variable and promotes survival of fundamental stock.

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