International Journal of Science, Environment and Technology, Vol. 7, No 1, 2018, 112 – 115

ISSN 2278-3687 (O)
2277-663X (P)

Popular article

AMELIORATION OF STRESS IN PERI-PARTURIENT DAIRY ANIMAL BY FEED FORTIFICATION WITH MICRONUTRIENTS

***Dr. Avishek Paul[1], Dr. Pankaj A Patel[1], Dr. Ratanti Sarkhel[2] and Dr. Dilip Kumar Mahato[1]**

[1]Division of Physiology and climatology, Indian Veterinary Research Institute, Izzatnagar, Bareilly, U.P., India-243122

[2]Division of Biochemistry, IVRI, Izatnagar, Bareilly, U.P., India-243122

E-mail: avi.vety@gmail.com (**Corresponding Author*)

Abstract: Extensive metabolic stress in periparturient cows occur due to the augmented metabolic and physiological changes, concurrent with immunosuppression during this period. During transition period, decreased energy status overstress the post parturient diseases in dairy cattle. Negative energy balance and oxidative stress during transition period could result in the incidence of various metabolic disorders. Supplementation of periparturient animals with essential Vitamins and microminerals mainly Vitamin E, selenium along with high energy diet helps to overcome the metabolic stress and decreases chances of post parturient complications.

Keywords: Periparturient cows, Immunosuppression, Vitamin E, Selenium.

Introduction

Dairy Cattle are an integral part of agriculture worldwide, providing many products in addition to milk for the human population. The income that a dairy cow generates comes from her milk production and sale of offspring. The efficient production of these products is of utmost importance and high reproductive performance is absolutely crucial to this.Biological adjustments to support dramatic production increase occur within the cow. Obviously factors that influence each of these income streams (e.g., cattle genetics, nutrition, environmental management and herd health) can affect the overall profitability of a dairy herd.

The transition period is defined as the stage in the lactation cycle where the cow undergoes a transition from being pregnant and non-lactating to the beginning of lactation after parturition. The duration of the dry period varies according to management strategies and has been divided into the “far-off” (generally the first 4 to 6 week after dry off) and the “close-up” (generally the last 3 week before expected parturition). The length of the transition period encompasses the last 3 week of the dry period (from the close-up) until 3 week after parturition.Nutrient demands for support of fetal growth and initiation of milk synthesis are

*Received Dec 20, 2017 * Published Feb 2, 2018 * www.ijset.net*

increased during the transition period. In contrast, this period is characterized by a 30% reduction in dry matter intake (DMI) at 5 to 7 day pre-partum followed by a steady increase from 0 to 21 (but also after it) days postpartum. Plasma NEFA (Non-esterified fatty acid) increases slightly around 2 week before parturition and the concentration increases dramatically around and after parturition. The increase in nutrient demand, the drastic changes in endocrine status and the decrease in DMI during late gestation influence metabolism (in particular the metabolism of lipid). Adipose tissue, liver, gut, and mammary gland are key components of the adaptations that dairy cows experience to achieve the necessary balance to adapt to the onset of lactation.

The transition period is considered the most important phase during the lactation cycle since a successful transition can effectively determine a profitable lactation. However, immunosuppression during this period leads to increased susceptibility to invading pathogens and the incidence of health problems during this time relative to the rest of the lactation cycle is significantly greater. In addition, the transition period is where the risk for mammary infections, displaced abomasum, milk fever, ketosis, retained fetal membranes and metritis is at a peak. Besides infectious diseases it is also important to mention that a high susceptibility for metabolic disorders occur during this time and these can be also responsible for pro-inflammatory cytokine raise with consequent negative effects.

Energy Balance in the peri-parturient Cow

In general, animals attempt to achieve energy equilibrium regardless of physiological and environmental circumstances using the available energy in the diet and the tissue reserves. In the case of dairy cows during transition, as mentioned before, there is a marked decrease in DMI which in turn limits the consumption of dietary energy, and has a negative impact on the energy balance equilibrium. At the same time, nutrient demands for fetus needs and for mammary gland development as well as for initiation of milk synthesis are increased aggravating the energy balance status. After parturition, as milk production increases, the energy needed for milk production increases resulting in a stage of negative energy balance (NEB). To meet the energy requirements of this period, dairy cattle rely on mobilization of adipose and muscle tissue. This period of NEB lasts until the yield of milk starts to decline (6 – 10 week after parturition) and the energy from the DMI becomes sufficient to meet the cow's requirements. The degree of NEB that cows experience most likely would be a function of the milk yield since high producing dairy cows would require a greater amount of energy for lactation. A period of severe NEB, where extended mobilization of adipose tissue

has occurred, could result in the incidence of metabolic disorders such as ketosis and fatty liver.

Role of Vitamins and Minerals supplementation during peri-parturient period

Oxidative stress during transition period is also believed to contribute to the increased disease risk. Changes in the metabolic profiles associated with moving from the dry period to calving to early lactation may increase the production of reactive oxygen radicals causing oxidative stress. Oxidative stress occurs when the reactive oxygen radicals overwhelm the antioxidant defense mechanisms. Immune cells are extremely sensitive to oxidative stress because their cell membranes contain polyunsaturated fatty acids which are oxidized by the reactive oxygen radicals resulting in more reactive oxygen radicals. Several trace minerals and vitamins are essential for an effective antioxidant defense system.

Selenium and Vitamin E: Selenium and vitamin E are complementary in allowing the cow to handle immune system challenges. Both selenium and vitamin E are required to optimize the effectiveness of neutrophils when attacking and destroying invading bacteria. Chemotatic migration of neutrophils towards invading organisms was reduced by a selenium deficiency in goats. The complementary nature of selenium and vitamin E in reducing the incidence and severity of mastitis was clearly shown by Smith *et al.,* (1984). Several trials have shown that selenium supplementation of selenium deficient diets reduced the incidence of retained placentas in dairy cows. Often, if dairymen suspect a deficiency, they wonder whether selenium should be given by injection rather than feeding due to variation in feed intake by individual cows. Reduced concentrations of vitamins A and E, and Zn, are also observed at calving, which also can have negative effects on the immune system.

Copper: Copper is important to the antioxidant system because it is part of the copper-zinc superoxide dismutase enzyme. This enzyme helps convert superoxide radicals to hydrogen peroxide in the cell. Copper deficiency can occur in diets normally considered adequate because of high levels of antagonists such as sulfur, iron, and molybdenum which reduce bioavailability. Harmon (1998) reported that fed heifers diets that were marginally copper deficient (6-7 mg Cu/kg diet) had 60% infected mammary glands at calving compared to 36% in heifers fed copper adequate diets (20 mg Cu/kg diet).

Zinc: Zinc is essential as a cofactor for over 80 enzymes, many of which are needed for the synthesis of DNA or RNA. Thus zinc may impact immune function because of its essential role in cell replication and proliferation. Zinc is also required for the synthesis of metallothionein, a metal binding protein that may scavenge hydroxide radicals. Severe zinc

deficiency in calves has been shown to impair immunity. Plasma zinc concentrations normally decrease in dairy cows at calving, but usually return to normal within 3 days. The exact role this has in the increased incidence of disease postcalving has not been investigated.

Conclusions

Analyses of vitamin E and Se, but not of vitamin A and Zn, in blood samples taken from dairy cows during the mid-dry period can be used as a tool to evaluate the need for extra supplementation of vitamin E and Se during the peri-parturient period. Daily oral supplementation of dairy cows with RRR-α-tocopheryl acetate in the periparturient period is preferential in terms of increased plasma vitamin E status of cows. More studies are needed to clarify the complex interactions between nutrition and immunity during the peri-parturient period in dairy cattle.

References

[1] Smith, K.L., Weiss, W.P., Hogan, J.S. and Hoblet, K.H. 1990. Relationships among Selenium, Vitamin E, and Mammary Gland Health in Commercial Dairy Herds1. Journal of dairy science, 73(2), 381-390

[2] Bell, A.W. 1995. Regulation of organic nutrient metabolism during transition from late pregnancy to early lactation. Journal of animal science, 73(9), 2804-2819.

[3] Chew, B.P. 1996. Importance of antioxidant vitamins in immunity and health in animals. Animal Feed Science and Technology, 59(1-3), 103-114.

[4] Brzezinska-Slebodzinska, E., Miller, J.K., Quigley, J.D., Moore, J.R. and Madsen, F.C. 1994. Antioxidant status of dairy cows supplemented prepartum with vitamin E and selenium. Journal of dairy science, 77(10), 3087-3095.