

An Overview of Subacute Ruminal Acidosis (SARA) in Dairy Cattle

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Abstract

In dairy cows, disproportion in lactic acid producing and lactic acid utilizing bacteria promote the occurrence of subacute ruminal acidosis (SARA). Differences in volatile fatty acid (VFA) absorption rate and expression of genes involved in VFA metabolism, intracellular pH regulation in rumen epithelial cells and in situ carbohydrate digestibility in the rumen may exist in lactating dairy cows with a higher or reduced risk of SARA. Hygienic feed management and feeding strategies must strike a balance between ruminal buffering and the formation of volatile fatty acids from carbohydrate fermentation. In present review, we will discuss cause, consequences and prevention of SARA in order to reduce economic losses to dairy farmers.

Introduction

The output of dairy cows has improved dramatically during the previous few decades. With this development, nutrient requirements also increased. To accomplish it, farmers fed cows with high grains diet in large amount, which affect the health of cow. This type of feeding strategies can cause metabolic disorder followed by affecting the ruminal pH and indirectly on the health of animals. In SARA, ruminal pH is decreased for few hours per day up to pH= 5-5.5 due to accumulation of VFAs and inadequate buffering action of rumen. Survey reported that incidence of SARA is between 19% and 26% in early and mid-lactation respectively in dairy cows. SARA generally results from diets low in digestible fiber or rich in simply fermentable carbohydrates (Aschenbach et al., 2011). SARA affected cows exhibited decreased rumen motility, depression, loss of body condition score (BCS), diarrhea, reduced milk production, inflammation, liver abscesses in and laminitis (Alzahal et al., 2007). Fermentation profile may also have affected in SARA due to increase in the total concentration of VFA and acetic to propionic acid ratio and consequently that has been shifted towards propionic and butyric acids (Dieho et al., 2016). SARA in lactating cattle affects the body condition score (BCS).



Etiology of SARA

Major cause of SARA includes nutritional causes such as has high concentrate diet and low crude fibre, long forage particle and inadequate buffering mechanism. Due to this, imbalance in lactic acid producing and lactic acid utilizing bacteria may occur. Lactic acid would be accumulating in rumen and cause laminitis. Volatile acid production would be more and reduces the rumen pH. Along with VFA and proton transportation, VFA absorption involves the exchange of other ions such as Na⁺ and HCO₃⁻ with the metabolism of VFA in epithelial tissue which can regulate intracellular pH and VFA absorption (Aschenbach *et al.*, 2011). Rumen pH is also affected by acid production from organic material fermentation. Longer chewing time (eating and ruminating) enhances saliva production in animals. Saliva contains inorganic buffers like as sodium bicarbonate, neutralizes the organic acids formed during rumen fermentation.

Consequences of SARA in dairy cow

Decreased feed intake

Increases in rumen fluid osmolality in SARA-affected cows limit feed intake and also impair bacterial fermentation of fibre and starch. Grain-induced SARA has been demonstrated in several studies to generate a rise in acute phase proteins in the blood, which is an indication of inflammation. The cow's feed intake is reduced as a result of inflammation in numerous organs (Andersen *et al.*, 2000).

Milk composition

Supplementation of buffering substances to the high-concentrate diet re-established a higher ruminal pH and prevented the drop in milk-fat content. Milk fatty acid could indicate the occurrence of acidosis and give an indication of the origin of acidosis (Colman, *et al.*, 2013). There is significant association between milk Fat: Protein ratio and ruminal pH parameters, which detect SARA in dairy cows.

Metabolic Acidosis

Acetic acid reaches the peripheral circulation among the volatile fatty acids, but butyric acid is converted mostly in the rumen wall into hydroxy-butyric acid, which can lead to an alimentary form of ketosis. In the liver, propionic acid is converted to glucose (Da-cheng *et al.*, 2013).

Laminitis

In SARA, ruminal epithelium damages, allowing for the absorption of histamine and endotoxins, which disturb normal circulation and induce inflammation in the hoof, resulting in the condition known as laminitis (Warnick *et al.*, 2001).

Diagnosis

SARA in dairy cow can be diagnosed by body condition score, clinical examination, rumen fluid



sampling and milk sampling. There were no changes in blood parameters. Due to ruminal ulcers and hyporexia, blood examination may reveal leukocytosis with neutrophilia resulting from stress, as well as anaemia and a decrease in packed cell volume. SARA also diagnosed by rumen pH measurement, rumen fluid sampling and analysis, feces and urine sampling and analysis and milk sampling, blood sampling, clinical examinations and analysis (Hernández et al., 2014).

Prevention

SARA can be prevented by nutritional strategies. Chemical buffers are introduced to feed rations on a regular basis and helps in avoiding acidosis (Garry, 2002). Addition of sodium bicarbonate to the feed per day increased milk output during SARA. Total mixed ration feeding also reduces the occurrences of SARA. Yeast cultures have been recommended for inclusion in feed rations. Although maximum products have a mixture of living and dead yeast, recorded research reveals that the inclusion of yeast has various impacts. *Lactobacillus plantarum*, *Enterococcus faecium* and *Saccharomyces cerevisiae*) lowered diurnal ruminal acidosis with increased corn silage digestion (Nocek and Kautz, 2006).

Conclusions

When grain feeding is excessive, the short-term gains are out weighed by the long-term gains. One of the most critical parts of SARA prevention is adequate ruminal buffering, which includes both dietary and endogenous buffers. This is achieved by providing physical fibre that cannot be separated from other diet components, as well as the proper cation-anions ratio in the diet. Feed additives and supplements can provide an extra layer of protection against SARA.

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