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SUB ACUTE RUMEN ACIDOSIS (SARA) IN DAIRY COWS

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Introduction

To achieve full genetic potential of a dairy cow her rumen should remain healthy. For attaining this situation her ration should consist of 40% roughage and 60% concentrate on a dry matter basis. Paddy straw in Kerala costs Rs.10 to 12 /kg (each bundle weighs around 350 gm and cost Rs.3-4). Most of the farmers feed only 3 bundles a day, a few farmers may give a small quantity of grass also. Since the dry matter content of grass is 16-20% during wet season and 25% during dry season, in most cases average dry matter intake from roughage in our cows are around 1.2 to 2 kg only.

The sale of compounded feed produced by organised sector in Kerala stagnates at 6.5 lakh tonnes/annum for the last 3 years. According to 2003 census we have 7 lakh dairy cows and a reduction of 35% is anticipated in the current year census which works out to 4.5 lakh cows. Presuming 6 litres/ cow/ day and 500 gm of feed per litre of milk produced, our total requirement of compounded feed for milk production can be estimated at 4.92 lakh tonnes/year. While taking into consideration feed produced by unorganised sector and feed ingredients sold through local markets the requirement of compounded feed in the State is sufficiently met with. On the other hand it will be reasonable to state that most of our animals are fed on excess compounded feed which is the cause of majority of present day problems in dairying.

To maintain high production, feed should contain sufficient protein and at least 20% of grain or other carbohydrate supplement or part of the non-structural carbohydrate should be replaced with bypass fat. Most of the farmers feed 6-8 kg of concentrate feed to the dairy cow, a few farmers supplement the ration with rice gruel or maize powder or wheat bran.

High concentrates reduces chewing as well as re-chewing. The pH of the rumen is determined by a balance between VFA production, its absorption, buffers in the rumen, passage of feed and removal of H ions produced. .Rumen is buffered over a range of pH.5.7 to 7.3 by phosphates and bicarbonates in saliva as well as bicarbonates formed in rumen fermentation.

The situation under which rumen evolved i.e., when the ruminants were fed only on roughage, carbohydrates are the most limiting factor for microbial growth. Therefore, the cell machinery of the microbes is built around the premise that energy will be the first limiting nutrient. In the present day situation when we feed more of concentrates there are situations when energy is in surplus. The rumen bacteria do not have any mechanism to limit uptake of extra carbohydrates. In order to maintain their cell machinery in equilibrium the bacteria should get rid of excess energy. One such mechanism is energy spilling and those bacteria that cannot spill energy will have a low survivability (Russel and Wilson, 1998). Another method is to store extra energy either as intracellular polysaccharide (Cheng. et al., 1973) or extra cellular polysaccharides (Costerton et al., 1974). The extra cellular polysaccharides are the slime that is associated with feed lot bloat.

Yet another method is to shift the fermentation pathway. Some rumen bacteria such as Streptococcus bovis can shift from producing acetates and propionates to lactate. Lactate production reduces energy available for microbial growth compared to acetate and propionates. But in the presence of soluble carbohydrates these bacteria can produce large amounts of lactic acid. (Russel and Wison, 1998) In such situation some bacteria produce D-lactic acid by a different pathway called methylglyoxal shunt. Methyl glyoxal is extremely toxic to bacteria as well as the host animal.

For proper growth of bacteria, along with energy, ammonia is also needed. When rice gruel alone is fed even when sufficient roughage is also made available, acidosis can result due to shortage of ammonia.

Healthy Rumen

A healthy rumen is one which digests fibre to the maximum, with maximum dry matter intake providing 80% of energy needed by the cow and 50 to 90% of protein. Concentrates are fermented faster than roughage. When non-structural carbohydrates are more, more of VFA is produced reducing rumen pH. Low pH reduces fibre digesting microbes. The rumen environment of a high producing cow is considerably different from the environment under which most rumen microbes and the host animal evolved. Thus our assumption of healthy rumen may not exist in the present day cows.

SARA

When the rumen pH remains at 5.2 to 5.5 for at least 3 hours a day it can lead to SARA. Some scientists limit the threshold at pH.5.8. Cows having SARA show depressed DM intake, less liking for concentrates, reduced fibre digestion, diarrhoea, reduced immunity and laminitis.

SARA is a syndrome. Scientists had been focusing the study of rumen acidosis in rumen alone till recently. In acidosis the absorption capacity of papillae is impaired by rumenitis. Rumen epithelial cells are not protected by mucus and so they are vulnerable to chemical damage by acids. A low rumen pH ends up in rumenitis which is the fundamental lesion in SARA, leading to delayed, chronic health problems.

Bacteria that colonize inflamed rumen papillae and endotoxins leak into portal circulation (barrier of rumen epithelia is reduced) leading to liver abscess. In experimentally induced SARA, by feeding excess grain, increased free bacterial endotoxin could be demonstrated in rumen fluid and in acute cases serum amyloid -A(SAA) and haepatoglobin in peripheral blood was found. Bacterial endotoxin is a component of cell wall of gram negative organisms released at their death. This happens during low acidity in the rumen.

From the liver bacteria can enter general circulation and may colonize lungs, heart-valves, kidney or joints, resulting in pneumonia, endocarditis, pyelonephritis, arthritis and other chronic inflammatory conditions often detected in post mortem. Caudal venacava syndrome can cause bleeding from nostril and death due to massive pulmonary haemorrhage. The endotoxins can damage the capillaries of the corium of the hoof, causing bleeding.

During dry period when the cow receives less of concentrates concentration gradient across rumen papilla is less, so also length of rumen papilla (Concentration gradient depends on milk production). The rumen papilla increases in length (surface area) for enhanced absorption of VFA, when the concentrate quota is gradually increased. Therefore, enhanced feeding during early lactation with out allowing sufficient time for adaptation also can lead to SARA. This signifies the importance of care in feeding during transition period. To improve buffering action sufficient roughage should be ensured in transition period.

Symptoms of sub-clinical rumen acidosis

- Reduction in ruminal pH.
- Rumen stasis or hyper-motility.
- Reduced rumination.
- Considerable variation in daily feed intake.
- Dung varies in consistency within the same herd, in some animals firm, in some others loose.
- Appearance of mucin and fibrin casts in dung.
- Undigested fibre particles more than 2 cm in length and ground undigested grains in dung.
- Poor body condition.
- Dehydration
- Laminitis

When grains escape rumen digestion it can undergo fermentation in large intestine producing VFA, gas formation and diarrhea. Mucin casts shed in faeces are indication of damaged epithelia in large-intestine. This is apparently similar to the damage caused by grain overload in equines.

Some of the symptoms mentioned above can be due to other reasons also. Confirmatory diagnosis is only by checking pH of rumen contents. Samples drawn by probang are often contaminated

with saliva and not dependable. Puncturing rumen is an effective method but possibility of abscess formation is there. More over rumen pH fluctuates between meals and time of fluid collection is critical. Usual time is 5 to 8 hr after feeding, when the contents are most likely to be acidic.

In hot humid climate rumen activity is less and heat stress reduces rumination. Further, animals stand for a long duration on concrete which increases the incidence of laminitis.

In humid climate presence of aflatoxin in feed ingredients is quite possible. A healthy rumen can detoxify up to 80% of the toxin and that is the main reason for fixing higher tolerance levels of the toxin for cattle. In a roughage deficient diet a healthy rumen is a mirage.

Feeding more grain is not an economic proposition. Fermentation in the hind gut is an indication of overall reduction of digestibility of the ration. Both starch and fibre escape digestion resulting in less available nutrients. It is true that increased grain is necessary to meet extra energy needed for milk production. However when concentrate levels are increased to the point that fiber needs are not met, the tabular TDN and ME levels used to formulate a ration becomes meaningless. In other words in the pursuit of providing the cow more energy, violation of the rules of formulating a balanced ration reduces the amount of energy that the ration may provide.

Prevention

Lactation rations should have 21% DM of ADF and 28% NDF. Of this at least 75% NDF (21%NDF) should be from roughage. The level of non structural carbohydrate should not exceed 40% of the total ration.

A cow can produce 100-150 litres of saliva rich in bicarbonates. Therefore, any factor that reduces saliva production increases the risk of acids .Dry pelleted feed should be offered to the cow at least 3 times a day with out soaking in water.

The interval between feeding concentrate and roughage may be reduced as much as possible. Moisture in concentrate feed reduces saliva production. Offer roughage at least three times a day in sufficient quantity. Chopped forage need less saliva during chewing. Alfa Alfa fodder has very good inherent buffering capacity.

Bicarbonate added @1% in the ration is helpful in controlling acidity. A combination of sodium bicarbonate and magnesium oxide in the proportion of 2:3 is found to be more beneficial in controlling acidity. Purified, processed skeletal remains of sea weed have 3.5 times more buffering action compared to sodium bicarbonate. Commercial preparations with sea weed are available. Avoiding heat stress and providing plenty of cool drinking water are also of help in preventing acidity. Complete feed unless soaked to contain 40% moisture can cause segregation of grain portion and selective feeding which may lead to acidosis.

Suggestions to improve fodder production

On energy basis alone green grass can be paid at the rate of Rs. 2 to 2.5 and fodder maize Rs.3 to 4/kg. The primary milk societies if prompted to purchase these fodders at Rs.3 and Rs.4.5 respectively and supply the member farmers at a subsidy of Rs.1 /kg for a period of one year the State will have sufficient green fodder as many of the dry land could be converted to fodder and uncultivated paddy land during off season into fodder maize. 68% of animals are owned by marginal farmers who cannot afford to have grass. The State could think of introducing fodder and concentrate mix made into blocks weighing 10-15 kg to maintain these marginal farmers who are infact the back bone of livestock industry.

Conclusion

Quantity of compounded feed available in Kerala market appears sufficient to meet the requirements of our dairy farmer; on the other hand there is a severe shortage in dry as well as green roughage. In a national survey conducted in USA 23% of the herd of dairy cows are found to be positive for sub acute rumen acidosis. Although no such survey reports are available with our dairy cows, symptoms found in majority of high producing cows points to high incidence of SARA, leading to digestive problems, lowed immunity and higher risk of aflatoxicosis. The disease could be addressed by effective feeding management, especially fodder/ fibre. Immedi-

ate attention is therefore suggested for augmenting fodder cultivation in the State.

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