Feedlot Section

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The treatment was successful, but the animal starved. This may be an extreme example but, in ruminants, one cannot divorce nutrition from therapy in sick animals. It might be useful to briefly review the chain of events which are nutritionally related to an infectious disease resulting in fever.

Fever can be defined as any condition of positive heat balance not due solely to food, exercise or environment. From a nutritional point of view, the important item is the increase in basal metabolism. Since the velocity of biochemical reactions follows van Hoff's law, basal metabolism should increase 10 to 20% per 1°C in body temperature. If so, then the use of nutrients for basal metabolism can easily double in a very sick animal. Since high fevers are usually accompanied by a decline or loss of appetite, the rapid decline in body stores is easily understood.

Since ruminants are geared nutritionally to the use of the end products of rumen fermentation, the effects of starvation on this fermentation must be understood. The primary effects of starvation were listed by Baldwin (1):

1. Fermentative activity and capacity decrease to 10-15% of normal.
2. Rumen protozoa dramatically decrease often to essentially zero.
3. Rumen bacteria numbers decrease to 10-25% of normal.
4. Balance between microbial species disrupted by differential death loss.

Each of the four changes is reflected in special problems for the sick animal and in the nutritional regime needed to restore rumen fermentation.

The loss of fermentation activity results in loss of the normal end products of fermentation needed for good nutrition. In addition to the obvious loss of energy and protein, the animal's normal supply of B-vitamins is removed. Since these vitamins are not stored, a vitamin deficiency develops very rapidly. If the animal is suffering from an infection, or an immunization is indicated, this loss of the vitamin B supply reduces the animal's ability to use its immune system. The overall impact of the major vitamin deficiencies on the depression in antibody response was listed by Miller (2) as follows.

Depression in Antibody Response

Severe	Moderate	None
Pantothenic Acid	Thiamin (B_1)	Vitamin D
Pyridoxine (B_6)	Biotin	Vitamin B_{12}
Pteroylglutamic acid	Riboflavin (B_2)	
	Niacin	
	Vitamin A	

The disappearance of the rumen protozoa results in special problems in restoring rumen fermentation. The protozoa are capable of reducing the rate of starch digestion and, thus, the rapid changes in rumen pH. They are also involved in efficiency of feed utilization. Thus, restoring normal rumen fermentation would be easier if the protozoa were present.

The great reduction in bacterial numbers not only results in vitamin B deficiencies, it also reduces the potential for cellulose digestion and the production of a supply of balanced amino acids for the restoration of nitrogen balance. Since the restoration of a normal level of rumen bacteria may require three to six days after intake is restored, the importance of this change on subsequent recovery of the animal can be seen.

The change in the balance of the microbial species presents several problems since the change is usually in favor of the least desirable ones. As a result of this change, the animal may suffer from a rapid build-up of lactic acid when feeding is resumed simply because the lactic acid producing bacteria now predominate.

In addition to the changes in the rumen, similar changes occur in the large and small intestines, particularly if an antibiotic has been indicated for treating the sick animal. In healthy animals, a balance between the microflora also exists in the lower digestive tract. This balance results in an ideal state of health. The predominating organisms are the

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Lactobacillus. When this balance is disturbed and the *Lactobacillus* numbers are reduced, undesirable organisms such as *E. Coli* predominate. This further complicates the disease problem by adding diarrhea to the troubles of the animal.

Suggested Nutrition During Treatment

The fact that the animal has little or no appetite at the height of its illness does not mean that we are totally helpless in the nutrition area. The vitamin deficiencies can be corrected through injections. The imbalance of microorganisms in the lower tract can be kept at a minimum by the use of probiotics. The tendency toward a very low rumen pH which favors acidosis can be altered by the use of antacids. The electrolite balance can be maintained through liquid therapy. In short, the digestive system can be maintained in as normal a state as possible so it can resume its functions when appetite returns.

Re-feeding the Ruminant

The initial interest of the sick animal in feed is usually a welcome sign to all concerned. It indicates the beginning of recovery. Unfortunately, it also frequently indicates the beginning of poor nutrition. Since the animal has been through a period of energy and protein deficiency, the natural urge is to supply rapidly available forms for the animal. If this takes the form of a high starch-highly soluble protein ration, it soon becomes the wrong ration in the wrong place at the wrong time. *Re-feeding a starved ruminant means re-starting rumen fermentation.*

Since rumen fermentation is primarily a cellulose fermentation, maximum emphasis should be placed on this area.

Some years ago, we introduced a ration formulation that includes a major portion of the technology which is currently available for re-starting a rumen fermentation. The ration and the use of ingredients looks like this.

The ration was formulated to meet several needs of beef during periods when intake is low or the animals are sick.

1. Protein - The ration provides 15-18% protein which is adequate to provide for the protein requirements of rumen micro-organisms and will aid in replacing protein loss due to stress.

2. Rumen Stimulants - The development of normal rumen function is a major factor in getting the animals back on feed. The ration includes alfalfa meal, molasses, yeast, bentonite and a highly digestible source of fiber all of which have been demonstrated to be important in the development and maintenance of good rumen fermentation.

3. Energy - The ration is highly digestible and will supply a good source of energy. The key to restoring the energy needs of the animal is, however, in restoring intake. Thus, the animal will not derive adequate energy from this formula to prevent weight loss.

4. Vitamins - Since normal rumen fermentation is necessary for the animal to produce its own water soluble vitamins and these vitamins cannot be stored, the ration provides a vitamin source to take care of needs until the animal is able to again produce its own. The supply of vitamins A and D may or may not be needed depending upon the prior history of the animal.

5. Bentonite - In addition to being a good pelleting aid, bentonite has been included to aid in control of scouring and in the re-establishment of rumen micro-organisms.

Ruminant Stress Formula

To be fed to beef and dairy animals that are sick, off-feed, recently trucked or weaned, or during stress periods which result in drastic reductions in intake. (Feed up to three pounds per head daily.)

Ingredient	Pounds per ton
1. Alfalfa Meal (DEHY)	200
2. Dry Molasses	200
3. Wet Molasses	100
4. Yeast	80
5. Citrus Meal, Beet Pulp or Soybean Mill Feed	500
6. 44% Soybean, Cottonseed or Peanut Meal	500
7. Corn	310
8. Bentonite	50
9. Deflourinated Phosphate	20
10. Limestone	20
11. Trace Mineral Salt	20

Add per ton: 10,000,000 units vitamin A, 900,000 units vitamin D, 2.0 grams Thiamine (B_1), 5.4 grams Riboflavin (B_2), 18.0 grams Pantothenic Acid, 3.6 grams Pyridoxin (B_6), 2.2 pounds Choline, 4.4 pounds vitamin C, and 4.4 milligrams vitamin B_{12}.

Summary

Handling the nutrition of ruminants during periods of stress or starvation due to disease or handling is primarily a problem of maintaining a fermentation. The process is more like making good wine than fattening a non-ruminant. The successful practitioner will treat the obvious deficiencies, medicate to reduce nutritional effects and restore fermentation as a means of restoring nutrition.

References

1. Baldwin, R. L. Effect of Starvation and Refeeding Upon Rumen Function. Proc. Preconditioning Seminar, Oklahoma State University. 1967. - 2. Miller, R. F. Nutrition and Infectious Diseases. Unnumbered paper.

Questions

1. One degree of fever increases basal metabolism by ____ percent.
2. Starvation reduces the numbers of ____ and ____ in the rumen.
3. The ____ vitamins play an important role in antibody response.
4. The role of probiotics is the restoration of ____ in the lower digestive tract.
5. The most important nutrient for cellulotic bacteria is ____ .

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