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Feeding Management of Sick Animals

Smriti Shukla[1], Amangeet Parashar[2] and Gaurav Kumar[3]
[1]PhD student, Division of Physiology and Climatology IVRI, Izatnagar, Bareilly, U.P.
[2]Veterinary Surgeon Faridabad, Haryana Government, Haryana,
[3]PhD Scholar, Animal Physiology Division, NDRI, Karnal, Haryana
Corresponding Author Email Id: gauravyadav1725@gmail.com

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Introduction

Great advances have been made recently in the field of critical care nutrition. Although nutrition was once regarded as a supportive measure of low priority, it is increasingly being recognized as an important therapeutic intervention in the care of critically ill patients.

The influence of nutrition on the recuperation of veterinary patients is often overlooked, although the effects of nutritional status on recuperative ability are well known. Sick animals are treated with invasive medical methods, whereas the nutrition of such animals remains unchanged; the same feed is offered to healthy or sick animals.

Multiple research studies have demonstrated that the immune response of an animal is directly related to the nutritional state of the animal. A deficiency of calories, protein, minerals, or vitamins alters the production of inflammatory cytokines, adversely affects leukocyte function, and decreases host resistance to bacterial infections.

Assessment of Nutritional Status

Before initiation of dietary therapy, the large animal patient must be examined to determine its nutritional needs. Animals may be anorectic owing to systemic disease, or they may be dysphagic owing to a mechanical (foreign body, abscess, poor dentition) or neurologic (botulism, tetanus, viral encephalitis) disease. Assessment of the nutritional status of the patient should include a measurement of the body weight (BW) and body condition score (BCS) of the animal and biochemical tests.

Essential nutrients which help faster recovery from illness in livestock are protein, fats and carbohydrates (energy) and micro nutrients.

Rumen by pass protein or protected amino acids:

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Proteins are the major building blocks in the repair process and are important in maintaining the immune system. Protein requirements of the diseased and convalescing animals are usually higher than for the normal maintenance. An increased protein level promotes restoration of lean body mass and increases palatability during the post-operative period. Feeding of higher levels of good quality protein promotes wound healing.

Fats and carbohydrates:

These are excellent sources of energy, which is needed in larger amounts than normal for repairing the tissues affected by illness, injury or surgery and to fight infection. Increasing the fat level of the diet provides a more 'concentrated' food (calorie-dense) so that the animal can receive the higher levels of energy and other nutrients needed in a smaller amount of food. In most circumstances the amount of energy required per day is greater than the basal or maintenance energy requirement by the species. Fats and omega-3 fatty acids help to manage inflammation. Omega-3 long chain fatty acids help maintain joint mobility, skin health and digestion. In addition to protein and energy, certain minerals and vitamins have important roles to play in the healing process.

Micro nutrients:

Diets designed for diseased animals must have the correct balance of minerals and vitamins to avoid the depletion of body stores and provide those needed for the period of recovery. Zinc and potassium improve wound healing. Vitamin B complex improves digestive (microbial) efficiency.

There are several feed additives that can be administered including vitamin B-complex boluses, dried brewer's yeast, or live cell yeast / *Aspergillus oryzae*, or feeding sodium bicarbonate.

Besides, herbal metabolic modifiers, antioxidant blends, prebiotics, and probiotics, etc. are also commercially available which could also be used as supplements/additives to augment the digestive capability and thereby invigorating the animal. The synergistic antioxidant complex (vitamin E, vitamin C, taurine and lutein) helps neutralize free radicals produced during body metabolism and promotes good health.

Nutrient Requirements of Large Animals during Clinical Illness

Feeding of diseased animals should be based on their nutritional requirements while giving due importance to their natural diet and feeding behaviour. Further, adequate

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consideration should also be given to the frequency of feeding. Although it is generally accepted that sick animals have increased nutritional requirements, these requirements have not been quantified for specific disease conditions. Therapeutic nutrition is designed to provide adequate caloric intake during a period of hypophagia. Both overfeeding and undernutrition should be avoided when nutritional support is offered. Currently, the best estimation of energy and protein requirements for hypophagic ruminants is calculated from the animal's BW or they can be determined from the National Research Council (NRC) tables.

For calves, the resting energy requirement is approximated as DE (Mcal) = 0.07 BW (kg) and digestible protein as DP (g) = 3.5 BW (kg), which would equate to 3.50 Mcal (3500 kcal) and 175 g of protein for a 50-kg calf. These calculated values represent starting points for formulating dietary therapy, and adjustment based on clinical response or specific medical conditions may be necessary.

Vitamin and mineral requirements, also available from NRC tables, can usually be met if an enteral diet is formulated with commercial complete feed pellets or pelleted hay. Although B-vitamin deficiencies do not occur naturally in cattle, supplementation may be beneficial in large animals with gastrointestinal diseases that result in the disruption of the normal tract flora that produce B vitamins.

Oral Supplementation

Ruminants in particular may consume small quantities of fresh feed if it is offered frequently, whereas if the same quantity is offered in one feeding, it may be ignored after a few bites. Many dairy cows can be coaxed into eating hay if it is placed in the back of the pharynx by the clinician, and oropharyngeal stimulation may result in increased voluntary feed consumption. Fresh silage and dried brewer's grain frequently appeal to the hypophagic cow. Many sick ruminants benefit from grazing if grass is available.

Some diseases that may respond to dietary modification:

Animals that are ill may require special feeding. For instance, they may not be eating properly, and require smaller meals of good quality food. Certain conditions may be improved or managed by feeding an appropriate diet, a few examples are shown in the table below:

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CONDITION	DIET
Gastro - intestinal disease (Vomiting, diarrhoea)	Food may need to be withheld; bland food may need to be used.
Cardiac disease	Reduced sodium in the food Small regular meals
Kidney disease	Adjusted protein intake Unlimited water supply
Diabetes mellitus	Standardised energy intake Good quality food
Obesity	Reduced energy Exercise

Feeding Management in different clinical conditions

Rumen Acidosis

Rumen acidosis is a metabolic disease of cattle. Acidosis is said to occur when the pH of the rumen falls to less than 5.5 (normal is 6.5 to 7.0). Prevention is reducing the amount of readily fermentable carbohydrate consumed at each meal.

- This requires both good diet formulation (proper balance of fibre and nonfibre carbohydrates) and excellent feed bunk management.
- Feeding excessive quantities of concentrate and insufficient forage results in a fibre-deficient ration likely to cause sub-acute ruminal acidosis.
- Including long-fibre particles in the diet reduces the risk of sub-acute ruminal acidosis by encouraging saliva production during chewing and by increasing rumination after feeding.
- Dietary buffers such as sodium bicarbonate or potassium carbonate. Dietary anion-cation difference is used to quantify the buffering capacity of a diet.
- Supplementing the diet with direct-fed microbial that enhance lactate utilizers in the rumen may reduce the risk of sub-acute ruminal acidosis. Yeasts, *propionobacteria*, *lactobacilli*, and *enterococci* have been used for this purpose.
- Ionophore (eg, monensin sodium) supplementation may also reduce the risk by selectively inhibiting ruminal lactate producers.

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Bloat

Bloat is simply the build-up of gas in the rumen. This gas is produced as part of the normal process of digestion, and is normally lost by belching (eructation). Bloat occurs when this loss of gas is prevented. Passing a stomach tube is the best treatment for gassy bloat.

Fig. 1. Bloat condition in animal

- For frothy bloat, antifoaming agents i.e., linseed and turpentine oils should be used. Newer treatments such as dimethicone or polaxolene are easier to give as the effective dose is much smaller.
- Put onto a high fibre diet (hay or straw).
- Avoid grazing in pasture with high clover contents.
- Buffer feeding, as this will allow the rumen to adapt to the new diet.

Parturient paresis (milk fever)

Parturient paresis is an acute to per acute, afebrile, flaccid paralysis of mature dairy cows that occurs most commonly at or soon after parturition. It is manifested by changes in mentation, generalized paresis, and circulatory collapse. Treatment is directed toward restoring normal serum calcium levels as soon as possible to avoid muscle and nerve damage and recumbency. Recommended treatment is IV injection of a calcium gluconate salt, although SC route is also used. A general rule for dosing is 1 g calcium/45 kg (100 lbs.) body wt.

- Prevention of parturient paresis has been approached by feeding low-calcium diets during the dry period especially in last trimester of pregnancy.

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Fig. 2. Ketosis & milk fever management in lactating cattle

Ketosis/Fatty Liver Complex

- Cured by intravenous infusion of glucose, followed by the addition of energy in the form of grain to the diet
- Feed intake is depressed by about 20% around the time of calving the depression in feed intake around the time of calving was largely responsible for the liver fat build-up.
- Cows fed the high NFC diet were in positive energy balance during the last few weeks of gestation whereas cows fed the typical diet were in slightly negative energy balance.
- Concentrations of NEFA and BHBA in plasma and concentrations of hepatic triglycerides were lower for cows fed the high NFC diet.
- Restricting the DM intake of the cows before calving prevented a major decline in feed intake at calving, as is commonly seen in cows fed ad libitum.
- The degree of change in feed intake, not the actual amount of feed ingested, which triggers body fat mobilization at calving.
- Supplying monensin, to shift rumen microbe populations and fermentation toward greater propionate production.
- To reduce the incidence of not only ketosis, but also of displacement of the abomasum and retained foetal membranes
- Positive effects on ketosis incidence and lipid transport when niacin or rumen-protected choline are fed to dry and fresh cows.

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Retained Foetal Membranes, Mastitis

- Low dietary selenium or vitamin E is associated with a high incidence of mastitis and retained foetal membranes
- Supplementation with both Se and vitamin E (in the diet or via intramuscular injection) greatly reduced the incidence of both retained foetal membranes and mastitis in affected herds.

Udder Oedema

- Addition of sodium or potassium to the diet of cows before calving can increase the incidence of udder oedema in dairy cows.
- Increased severity of oedema in cows fed greater amounts of concentrate before parturition.
- Feeding anionic diets or diets with additional antioxidants have shown some promise in reducing udder oedema.

Fig. 3. Udder Oedema in advance pregnant cow

Constipation

Constipation results from impaired peristalsis or increased water absorption from the large intestine.

- The objective of dietary management is to provide a balanced diet with increased amounts of insoluble fibre (10-25% DM basis to effect).
- Animals should be fed 2-4 times a day.

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- Liquid paraffin or castor oil should be given for the treatment.

Diarrhoea

In Calves

- Death in calves with diarrhoea is mainly due to dehydration and acidosis
- Electrolyte (Na, K & Cl) solution to replace losses due to dehydration
- Bicarbonate and metabolizable bases (lactate, acetate propionate citrate and gluconate) acts as alkalinizing agent
- As they are metabolized to glucose and H ion is consumed
- Bicarbonate or citrate containing solution affect milk digestion
- Acetate containing solution allow correction of acidosis without depressing milk digestion
- Glucose and glycine increase Na and water absorption
- Milk replacers have poor digestibility as compared to milk in diarrhoea
- In weak calf's gut becomes atonic fluid in gut may ferment and cause bloat
- Calves with poor tolerance to milk as well as calves which refuse milk are gradually reintroduced to milk
- They may be offered high energy electrolyte solution @ 70-80 % of maintenance requirements
- Lactase activity is depressed in calves suffering from diarrhoea, intestinal resection and enteritis

Fig. 4. Calf scours

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To make rehydration fluid, mix six teaspoons of sugar and half a teaspoon of salt with 1 litre of clean, warm water. Give this as a drench (500 ml for sheep and goat) four times a day for 3 days. Larger animals require more fluid, 5% of body weight 2 times per day. Diarrhoea can result from numerous GI diseases. Primary causes of GI disease are numerous and include adverse reaction to food, infections (bacterial, parasitic, fungal, and viral).

- Animals with small-bowel diarrhoea usually benefit from a highly digestible diet, whereas those with large-bowel diarrhoea often benefit from prebiotics.
- Small, frequent meals (3-6 / day) should be offered.
- Probiotics are an additional tool available for management of small - or large-bowel diarrhoea. Probiotics are defined as nutritional supplements containing live, viable, beneficial bacteria in sufficient numbers to provide a health benefit.

Anaemia

Iron or copper deficiency (or both) is the major cause of hypochromic, microcytic anaemia. A folic acid and B_{12} (cobalamin) deficiency also produces anaemia. Rarely severe iron deficiency be corrected with diet alone. Most animals require a supplemental source of iron administered IM to correct severe iron deficiency and, depending on the underlying cause, may need to continue receiving a supplemental source of iron indefinitely. Remove the underlying cause i.e., haemorrhage, parasitism, consuming an unbalanced diet, or consuming too little of a complete and balanced diet then long-term supplemental iron may not be necessary. Folic acid and vitamin B_{12} are necessary to support normal cell division, and treatment for vitamin B_{12} deficiency usually requires parenteral administration of vitamin B_{12}. Vitamin B_{12} deficiency develops most commonly from intestinal malabsorption; however, it can also result from short-gut syndrome.

Fever

Fever increases energy requirements because of increased metabolic activity - a 1°F (0.5°C) rise causes an increase in caloric need of ~7 kcal / kg body wt. / day.

- A highly palatable diet should be fed in quantities that can be consumed easily, and the caloric content should be increased by feeding a higher fat diet.
- Because animals with fever generally have a decreased appetite, offering smaller meals more frequently with personal attention and encouragement may help stimulate intake.

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Cardiac Disease

Bovine high mountain disease, brisket disease, congestive heart failure is due to low level of sodium in diet. Vitamin B complex and small regular meals should be given in this case. Diuretics could be used which help in this condition.

Vesicular Stomatitis

Supportive care such as fresh, clean water with / without electrolytes and soft feed, such as silages, and fresh grasses, will decrease the anorectic period.

Laminitis

Supplementing diets of high-producing cows with biotin or zinc can reduce the incidence of laminitis lesions, presumably by strengthening the keratin bridges between wall and sole of the foot.

Hepatic Disease

Vitamin K is important in the management of animals with liver disease. The normal liver stores vitamin K, which may become significantly depleted in liver disease. B-complex vitamins are sometimes used in cases of fatty liver disease to supply cofactors of metabolism and to help stimulate the animal's appetite. Vitamin E and selenium are some-times used, as their anti-oxidant effects help protects the liver.

- A high energy, low-protein ration is essential during the treatment of fatty liver disease.
- If it survives, it should have access to hay and /or pasture while it recuperates.
- Oral potassium supplementation may be needed if body stores of potassium have been depleted by the illness.

Conclusion

A great deal of knowledge already exists on ways to improve animal health through nutrition, both directly by meeting known nutrient requirements. There are significant opportunities to improve animal health through application of this knowledge in the field, but a major challenge lies in promoting effective dissemination and motivating uptake. Animals are kept in a wide variety of socio-economic circumstances, and farmers therefore have different opportunities and motivations to improve animal health. Social science research to identify the most effective approaches for each situation would be of great benefit.