

# Ketosis in Dairy Cows

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Ketosis, or acetonemia, might well be called a problem of high production since prevention and control is more difficult with high milk production. Few animals are challenged to meet the metabolic demands that a high-producing dairy cow must adapt to during the early part of lactation. Common observations and experimental evidence show that cows may be in a negative balance for both protein and energy shortly after calving and for about the first 60 days of lactation. The following data on ketosis are taken from a summary of recent research published in the July 1968 issue of the *Journal of Dairy Science*.

## What Is Ketosis?

Ketosis is a metabolic disorder in which something goes wrong with the normal body processes and the cow becomes sick. There are no inflammatory organisms involved and the condition is not contagious. There seems to be a situation where the cow is temporarily producing more milk and thus requiring more feed nutrients than her feed intake provides. Nature may attempt to correct this situation by using body reserves of fat. When this occurs, some intermediary products of fat metabolism, called "ketone bodies," may build up in the system. These can be detected in the milk and urine and are indications of how serious the condition may be. Ketosis may even develop in average-producing animals when the energy needs exceed the energy intake.

Ketosis usually occurs more often in winter feeding, and three weeks after calving seems to be a very critical period for high-producing cows.

## Symptoms

The first symptom of ketosis is a loss of appetite—first for grain and then for silage, followed by a lack of interest in any feed. There appear to be two types of reaction. The most common one is a dull and listless condition and unsteadiness in the rear legs. Also, there are times when the affected animals may be quite nervous and easily excited. All this is followed by a drop in milk production. The breath may have a noticeable "sweet" odor due to the presence of acetone. Ketosis seems to occur more often in older animals, and some animals have a tendency to repeat. Ketosis is seldom a direct cause of death.

There is a wide variation in the severity of reaction to ketosis. Ketotic conditions have resulted when a high butyric acid, high-moisture silage was being fed. This

could be tied in with underfeeding. High protein feed also has been implicated. Primary ketosis is not accompanied by increase in body temperature. Temperature increases indicate other factors such as mastitis, metritis, retained placenta, or hardware may be present.

## Ketosis Tests

Several changes take place in the blood. One is a decrease in blood sugar and a second is an increase in what are called blood ketones. When these ketones reach a high level in the blood, they pass into the urine and the milk. To test for them, a small amount of urine is placed on a special powder and the appearance of a purple color indicates a positive reaction. If the test is negative, the cow is not apt to have clinical ketosis. In the case of a positive test reaction, more care is needed in interpretation. Other conditions which have affected the appetite may be present, in which case ketosis may be of a secondary nature.

A milk test for the presence of ketones is much easier to use. It is less sensitive than the urine test, but it is very practical and may give a more conservative and more accurate indication of the degree of ketosis present.

## Treatment

Over the years at least 25 different treatments for ketosis have been suggested. The fact that some cows may recover spontaneously without treatment makes evaluation of the treatments difficult.

The present most widely used treatments include the injection of sugar (glucose) into the neck vein or under the skin; injection of hormones (cortisone or ACTH); or oral administration of propylene glycol or sodium propionate. More recently, methionine deficiency has been considered, and injections of L-methionine have given good results in a limited number of cases.

It is difficult to say that any one of these treatments is the best since each has its advantages and disadvantages. Often they are used together to supplement each other. The use of sugar in the neck vein gives temporary benefit, but the injected sugar is used up in a few hours and there may be frequent relapses which require retreatment. The hormone injections are sometimes effective, but they are expensive and repeat treatments may be needed. The oral materials usually are given at the rate of 4 to 8 ounces night and morning for about 10 days. There is always some danger of getting the material in the lungs



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when drenching; also, this is not a one-shot treatment but must be given for several days.

All of the treatments are an attempt to increase the blood sugar and thus reduce ketones and fat mobilization. The oral materials are absorbed from the rumen and intestines and converted to blood sugar in the liver.

The treatment or combination of treatments which should be used is a matter for the veterinarian and the dairyman to decide, based on the individual situation. The dairyman can add to the treatment by giving a little special care such as feeding the best quality hay, feeding more often, and making the cow as comfortable as possible.

### Prevention

Obviously, prevention of ketosis would be more satisfactory than treatment if the methods involved were practical. At the present time no methods will insure 100 percent freedom from ketosis. Suggestions for reducing the incidence of ketosis can be made, however. Although there is disagreement regarding the basic cause of ketosis and the extent to which hormones are involved, most research workers agree that factors which would tend to balance feed intake with milk production without throwing the cow off feed would be beneficial.

In line with this reasoning, the following suggestions and comments regarding ketosis prevention are made:

✓ Do not have cows excessively fat at calving time. It appears desirable to have them in good condition, but excess fat means that more fat is burned at the time of stress, putting an extra load on the liver. Excess internal fat also may reduce feed intake.

✓ Keep the cows full of good quality roughage. This is just good dairy management, and it helps keep the balance between income and outgo. Picking out the best hay for borderline ketosis cows as well as feeding them more often may be helpful.

✓ Bring the cows up to full feed on concentrates as rapidly after calving as good judgment indicates. This will depend upon the individual cow, but most cows can be on full feed in 10 days. This also is an attempt to balance intake and outgo. Feeding a moderate amount of grain prior to calving also may be beneficial.

✓ Do not make abrupt changes in the ration. This refers to marked reductions in grain feeding at calving time as well as abrupt changes in the type of roughage, or in the proportions of roughage to concentrate.

✓ Avoid the feeding of large quantities of poor quality grass silage high in butyric acid during the ketosis susceptible period. There is nothing wrong with good quality grass silage, but bad-smelling silage high in butyric acid is less palatable, which reduces intake, and the butyric acid is a potential former of ketone bodies. Any poor quality silage should be avoided.

✓ Maintain a proper balance between roughage and grain. Although an all-grain ration might theoretically balance income with outgo more easily, the cow is not designed to handle this type of ration well. She should be fed liberally on grain but not more than she can handle safely. This amount will vary with the individual cows. When feeding grain heavily, feeding more often than twice a day may be helpful.

✓ Be sure that sufficient protein and minerals are fed to meet the needs of the cow. This is simply good management. A deficiency of these nutrients could be a contributing factor in ketosis. On the other hand, there is no good evidence that supplementation in excess of the cow's needs is helpful. This does not necessarily mean that any special supplements need to be purchased. It simply means to follow recommended feeding practices.

✓ Do not rely solely on molasses or sugar feeding to prevent ketosis. These materials are not absorbed as sugar but are fermented in the rumen. There is no evidence that molasses in moderate amounts is detrimental from the ketosis standpoint. It may improve the palatability of some feeds.

✓ The feeding of propylene glycol or sodium propionate at a level of 4 to 8 ounces per day starting before calving and continuing for about six weeks after calving may be helpful in problem herds. Feeding to selected cows rather than the whole herd seems most logical. These materials also can be fed in the grain as a follow-up treatment to prevent relapses or as a treatment of mild cases before the cow goes off feed. However, use of these preventive materials would not be practical in the average herd with only one or two cases each year.

✓ Provide facilities for adequate comfort, exercise, and ventilation. All general management practices which tend to increase the appetite and aid the comfort of the cow are desirable.

✓ There is some evidence to indicate that susceptibility to ketosis is inherited, but the fact that it appears to be closely related to high production makes selection away from it difficult and probably impractical.