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Calf Note #88 – Feeding calves for health - Introduction

Introduction

Calf disease – particularly diarrhea and respiratory disease – has significant effect on the profitability of every calf raising enterprise. Calf raisers, including dairy farmers, veal growers, calf ranchers and others all deal with calves that are particularly susceptible to disease and then exposed to disease-causing pathogens (especially viruses and bacteria) when they are transported from farm to farm.

Underlying most of these strategies is the underlying assumption that most calves will begin life with inadequate passive immunity. Studies continue to show that >50% of shipped calves (calves that leave one farm to be raised at another) arrive at the final facility with <10 g of IgG/L of serum within the first few days of life. Therefore, many calf raisers have begun looking for means of supplementing the immune system until it is strong enough to protect the calf from pathogens in the environment.

Traditionally, we have relied on the use of antibiotics to reduce the effects of disease in calves. It is still quite common (in some parts of the U.S.), to include chlortetracycline or oxytetracycline/neomycin in the milk replacer and to aggressively treat outbreaks of respiratory disease or diarrhea with one or more antibiotic preparations.

We assume that the availability of antibiotics for subtherapeutic treatment (i.e., feeding) will be much more limited in the future. Therefore, alternatives to feeding antibiotics are required. It is important to note the difference between feeding antibiotics to improve growth and feed efficiency (subtherapeutic) and the treatment of disease. Antibiotics will continue to be available to treat disease. Their availability may be more limited, however.

Antibiotics in milk replacers is still quite common in some parts of the United States. Researchers that have evaluated antibiotics indicate that they improve animal growth and health (Morrill, Quigley). We evaluated the use of oxytetracycline/neomycin in milk replacers with a group of 120 purchased bull calves in 2001. Calves were assigned randomly to receive experimental CMR (Table 1) containing 0 or 200 g/ton (0.22 mg/kg) of oxytetracycline plus 400 g/ton of neomycin base (0.44 mg/kg). All CMR were formulated to contain 22% CP, 20% fat, 0.8% Ca, 0.7% P (air-dry basis) and to meet or exceed NRC requirements for vitamins and minerals.

Calves were fed CMR twice daily at approximately 0700 and 1600 h using individual nipple bottles. Calves were offered 454 g of CMR/d reconstituted in 3.8 L of water during weeks 1 to 8. The CMR were mixed in hot water (approximately 50°C) to disperse fat. Cool water was then added to bring temperature to approximately 39°C and the appropriate DM prior to feeding. Commercial textured calf starter (**CS**; Cargill Herd Builder, Cargill, Inc., Minnetonka, MN) was offered once daily for ad libitum consumption, and feed refusals were measured daily. Water was offered once daily for ad libitum consumption. Refusals of water were measured, and water intake was assumed to equal water offered minus water refused. No hay was fed. Hutches were bedded with straw throughout

the study.

Data in Table 1 shows that the inclusion of antibiotics in CMR improved animal performance. This is particularly interesting because overall mortality was very low in the study (2 calves in each treatment) and overall morbidity (number of veterinary treatments) was also quite low. Nonetheless, calves fed the diet containing antibiotics grew faster, were heavier at 56 days of the study, consumed more calf starter and were more efficient than calves fed control CMR.

TABLE 1. Least squares means of animal performance.

	Treatments[1]			
	Control	**Medicated**	**SE**	***P***
N				
Begin	60	60	…	…
End	58	58	…	…
Mortality, %	3.3	3.3	2.4	NS
BW, kg				
d 0	44.9	44.5	0.5	NS
d 28	49.1	50.8	0.7	0.10
d 56	68.8	73.5	1.3	0.01
ADG, g/d				
d 0-28	149	221	20	0.01
d 29-56	699	813	28	0.01
d 0-56	424	517	22	0.01
DMI, g/d				
CMR[3]	460	461	1	NS
Starter[3,4]	543	674	36	0.01
ADG:DMI, g/kg[3]	340	394	16	0.02

[1]Treatments: Control = no additives; Medicated = CMR containing oxytetracycline + neomycin.

[2]P = Probability of a significant effect of CMR formulation.

[3]Significant effect of week ($P < 0.01$).

[4]Significant week × CMR interaction ($P < 0.01$).

Most pathogens we culture on our facility are resistant to both neomycin and oxytetracycline. Although we did not culture fecal bacteria in this study to determine antibiotic sensitivity, there are significant data to suggest that most bacteria are resistant to these antibiotics.

We have to balance the benefits of including antibiotics in the diets of animals with the potential harm that widespread use of antibiotics might cause to others. If the use of antibiotics can spread antibiotic resistance to other pathogens (including important medical pathogens), then it is in everyone's best interest to limit or eliminate the unnecessary use of these drugs. In many parts of the world, subtherapeutic antibiotic use has been restricted or eliminated. Other legislatures (including those in the United States) are considering significant restrictions as well. Therefore, producers are facing the loss of a significant management tool with the restriction in use of antibiotics.

It is in this context that researchers have been looking for alternatives to antibiotics and new methods of feeding calves to reduce the potential for calves to get sick. What is a reasonable strategy in this effort? Well, consider that there are two primary sites of infection in young calves – enteric and respiratory. Other systems of the animal (reproductive, mammary, etc.) are not usually

major sites of infection and disease in young calves.

Considering enteric and respiratory disease, the most common source of disease is enteric infection. This is also the site where dietary intervention is most effective. Therefore, our focus will be on feeding practices to minimize the risk of enteric disease in calves.

Of course, proper nutrition is essential in keeping calves healthy. Formulation of diets to provide sufficient amounts of protein (including ruminally available and escape protein), energy (as fat and carbohydrates), vitamins, minerals and water is essential. However, in our current context, we will be focusing on "non-nutritional" or "extra-nutritional" strategies. These concepts must be incorporated into a feeding program in addition to the proper nutrition that is essential to the young animal.

Compounds that can be fed and have a non-nutritional effect on an animal have been called "nutraceuticals" or "functional foods". There is considerable debate in the regulatory community regarding the proper classification of these compounds. Are they foods? Are they drugs? There is a lot of confusion about this point and the Food and Drug Administration has attempted to clarify the differences as it relates to human and animal "nutraceuticals". With the passing of the "DSHEA" (dietary supplement health and education act), there is greater confusion, because dietary supplements that are sold for people with many claims related to health cannot be sold for use in animals for the same purposes.

The Food and Drug Administration has taken a strong stand related to the promotion and sale of nutraceuticals for animals. The following is an excerpt from an FDA publication that describes the position of FDA related to the use of "nutraceuticals" for animals. The specific references are to pets, but they are relevant to all animals. For the complete FDA publication, click here

> "Nutritional supplements for pets have been available for many years. These are products that provide a source of a recognized essential nutrient, such as calcium or vitamin A, and are intended to augment and ensure nutritional completeness of the diet. Labeling for nutritional supplements must follow the same rules as for other pet foods. If it claims to be a vitamin or mineral supplement, the label must bear guarantees for each vitamin or mineral in the product.
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> Before the advent of regulations governing the nutritional adequacy of pet foods, owners could not be assured that the foods they were feeding were complete, so some supplementation for "insurance" might have been prudent. However, with the availability of today's "complete and balanced" products, nutritional supplements are needed only in very rare circumstances. In fact, injudicious use of supplements runs a greater risk of causing dietary imbalances or toxicity than it does to actually improve the diet. Therefore, unless the pet is being fed a homemade diet that requires additional sources of certain nutrients, or unless a veterinarian diagnoses a medical condition that could benefit from supplementation, it is best not to give supplements to pets.
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> "Dietary supplements" describe a much broader range of products. Some provide essential nutrients, such as vitamins and minerals, but others contain substances that are not recognized as essential for the intended species (for example, vitamin C for dogs and cats, omega-3 fatty acids). Herbs, plant or organ extracts, enzymes, and a host of other substances are also often marketed as dietary supplements. The market for dietary supplements was boosted by passage of DSHEA. This law changed the way FDA regulated these products. Briefly, it said that FDA could not call a substance a

"drug" or "food additive" if it met the definition for a dietary supplement and was not already regulated as a drug or food additive. Thus, it shifted the burden of the manufacturer having to prove a product was safe before it went on the market to the FDA having to prove it was unsafe before it could be removed. This prompted a sizable increase in the number and range of dietary supplements available on the market today.

It must be noted that DSHEA only applies to human products, not pet products. Thus, some of the substances allowed for sale as human dietary supplements may not be legally permitted to be sold for animals. There is good reason for this, though. Although some of the supplements, such as herbal products, may have "thousands of years of history of safe use," this does not include history of use in animals. It is well known that animals may react very differently to substances than people, and even small doses can cause adverse effects. For example, aspirin and chocolate, both substances that are used by people every day without ill effect, can be toxic to pets and even cause death. Therefore, since it's not known what the true effects an herb or other supplement may have on pets, it's safest not to allow marketing for that use.

On a case-by-case basis, CVM has reviewed safety information for some substances and allowed them to be used in animal feeds (for example, L-carnitine in dog foods), even though they were officially "unapproved food additives." If included in a pet food or supplement, they must be properly declared on the label. If the substance is not an essential nutrient, the disclaimer "not recognized as an essential nutrient by the AAFCO (Dog or Cat) Food Nutrient Profiles" must also appear on the label.

The term "nutraceuticals" was coined to describe the increasing number of products offered for the prevention or treatment of disease but marketed under the guise of dietary supplements. The promise of a "safe" and "natural" remedy for disease is very appealing. However, since the product has not undergone the same testing for safety and efficacy as required for approved drugs, it's impossible to know whether the product works at all or is even unsafe.

Presently, these substances are drugs if the labeling bears claims to treat or prevent disease, or if the intended use as a drug can be established by other means. However, due to the large number of products on the market, it is sometimes difficult for FDA and State regulatory officials to effectively police them all. Therefore, the consumer should eye with scrutiny any claims that a dietary supplement or nutraceutical is useful for the treatment or prevention of disease, or promises that it will "improve" a condition or make the pet "healthier." As with any supplement, the pet owner should discuss use of a product for a pet with his or her veterinarian first.

Clearly, the FDA is taking a position that “nutraceuticals” considers that claims made to change “form or function”, then the product is a drug. Most, if not all of the “nutraceuticals” sold today that make claims to improve animal health, reduce disease, etc. are in violation of these rules. The FDA has published several articles related to their position on “nutraceuticals” – for example in the Nov/Dec 2000 issue of FDA Veterinarian and some information on regulatory activities in the March/April 2001 issue of FDA Veterinarian.

There are many classes of “nutraceuticals” available. Many are popular as human dietary supplements, for example St. John’s Wort, ginseng and condroitin . However, we will limit this discussion to those products/compounds that may have some utility in reducing the effects of disease in calves. Briefly, we can categorize these into:

- functional proteins

    - iron binding antimicrobial proteins (lactoferrin, transferrin)
    - immunoglobulins
    - defensins and bacteriocins
    - other proteins
- probiotics
- immune "stimulants"
- oligosaccharides
- others

There are many different other classes of compounds that may be considered "nutraceuticals" that will not be considered here, as they are not thought to be related to enteric disease.

To achieve the goal of reducing enteric disease, any compound must possess several attributes:

- it must survive processing, storage and handling of animal feeds
- it must not be degraded by temperatures typical of storage and feeding
- it must survive the rumen and/or abomasum of the animal (the rumen and abomasum if fed in dry feed, abomasum if fed in the milk or milk replacer)
- it must not be degraded by intestinal enzymes
- it must act while in the intestinal tract

In the next series of Calf Notes, we'll look at each of these classes of "nutraceuticals" to determine it's potential value to improve the health of calves.

Written by Dr. Jim Quigley (14 October, 2002)

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