Dairy Calf Nutrition and Respiratory Disease

Inadequate calf nutrition is a factor in disease susceptibility\(^1\). Inadequate nutrition contributes to decreases in average daily gain and increases in mortality rates, especially during times of environmental stress\(^2\). Although a clear link between calf feeding strategies and the incidence of bovine respiratory disease complex (BRDC) has not been demonstrated\(^3\), ensuring adequate calf nutrition is important to calf health, dairy profitability, and may decrease the incidence of BRDC.

**Digestive Tract Development**

Calf nutrition can be considered in three phases; the pre-ruminant, transitional, and ruminant phase. The pre-ruminant phase occurs during the first 2-3 weeks of life when the calf is mostly ingesting milk or milk-replacer. The transitional phase begins when the calf ingests starter feed and the rumen develops the ability to ferment and absorb the nutrition from dry feeds. The ruminant phase occurs at weaning when the calf obtains all her nutrients from dry feeds. Supporting the transition from pre-ruminant to ruminant animal is essential to maximize daily gain and improve calf health.

**Pre-Ruminant Nutrition**

Within the first 24 hours of life calves should be fed 4-6 quarts of high quality colostrum to support immune function\(^4,6\). A recent study found that batch heat treatment of colostrum at 140°F for 60 minutes can be successfully conducted on commercial dairy farms by farm staff to decrease colostrum microbial counts while maintaining colostral IgG concentrations. This process significantly decreased or eliminated bacterial organisms including *Mycoplasma bovis, Listeria monocytogenes, E. coli, Salmonella enteritis*, and — of significant importance — *Mycoplasma paratuberculosis* (the bacteria that causes Johne’s disease\(^7\)). For the next 2-3 weeks calves will primarily feed on milk or milk replacer. Whole milk generates increased weight gain in calves compared to milk replacer\(^8,9\), but the decision to feed whole milk instead of milk replacer should be based on the ability to pasteurize milk of consistent quality. Whole milk should be pasteurized before feeding to calves to prevent spread of diseases, such as the *Mycoplasma* species involved in Johne’s, mastitis, and possibly BRDC\(^10-14\). If biosecurity and consistent milk quality are concerns, high-quality milk replacers (up to 30% crude protein and 15-20% fat) are a good source of nutrition for calves\(^15-17\).

The most important factor in feeding milk or milk replacer is fully supporting calf growth. Calves should be fed biologically appropriate amounts of milk solids, either as milk or milk replacer. In the past, calves have been fed restricted quantities of milk (8-15% body weight per day) to stimulate ingestion of starter solids\(^18\). Recent research demonstrates that conventional restricted milk diets result in lower growth rates\(^19,20\), less milk production\(^21,22\), and may contribute to disease susceptibility\(^9\).

Milk solids should be fed at a rate of 1.5% calf weight per day during the first week of life, and 2.0% solids per day from the second week until the week before weaning\(^18\). This recommendation translates into feeding milk at roughly 20% of calf body weight per day under thermo neutral conditions\(^18\). The nutritional needs of calves will increase in extreme weather\(^21,23\). Feeding milk at the accelerated rate reflects the amount of milk a calf would consume if naturally left to feed from her dam\(^24\).
In calves, a higher plane of nutrition has been shown to improve immune function and the scientific literature, although limited, is suggestive of reduced disease incidence associated with accelerated feeding\textsuperscript{25}. Whether accelerated feeding will translate into actual improvements in health has not been documented through controlled research. Anecdotal evidence from producers that have implemented enhanced early nutrition programs suggests that those calves may be more resistant to early-life scours and respiratory disease, and that calves that do become sick are able to recover more quickly without major impacts on growth rate during illness. However, more controlled research on all aspects of immune development and calf health still is needed. New-born calves do not have the ability to ferment and obtain nutrition from solid feed. The rumen must develop fermentation capabilities, and for the first two months of life calves on a restricted milk diet are incapable of receiving adequate nutrition from starter grain\textsuperscript{19,26}.

**Transitional Phase Nutrition**

In addition to adequate milk or milk replacer, calves should also have free access to high quality starter grain (18\% or more crude protein) and water\textsuperscript{27}. Early consumption of starter is important to stimulate rumen development\textsuperscript{18,28}, and free access to water improves the rumen’s ability to obtain nutrition from starter\textsuperscript{29}. Calves receiving adequate milk will consume less starter grain than calves on restricted diets\textsuperscript{30}, but still require starter grain to make a smooth transition to ruminant phase. Young calves may also benefit from the fiber provided in a small amount of forage\textsuperscript{31}. This fiber can be found in “complete” starters that retain some unprocessed plant material or by supplementing pelleted starter with small amounts of chopped grass or legume hay\textsuperscript{18,32-34}.

**Gradual Weaning to Ruminant Phase**

The incidence of pneumonia peaks at weaning age around six weeks\textsuperscript{35}. Limiting stress at the time of weaning is beneficial in reducing the incidence of BRDC\textsuperscript{36}, and gradual weaning is one way to limit stress. Post-weaning growth is dependent on a calf’s ability to eat and digest adequate amounts of dry feed. Since calves on accelerated milk diets eat less starter grain, stimulating starter grain consumption prior to weaning results in optimal weight maintenance after weaning. When milk availability is reduced by half a week to ten days prior to weaning, calves increase their consumption of solid feed and experience less weight loss when milk is completely eliminated\textsuperscript{20,26}. The age that calves are weaned should reflect their ability to eat around 2 lbs (1 kg) starter grain per day at weaning\textsuperscript{18}.

**Further reading and internet resources:**

Drackley, K. L. Feeding for Accelerated Growth in Dairy Calves

http://www.cvm.umn.edu/dairy/prod/groups/cvm/@pub/@cvm/documents/asset/cvm\_33549.pdf


http://www.uwex.edu/ces/dairynutrition/documents/2008dubuqueconferenceproceedings.pdf#page=71

The “Cost-Benefit of Accelerated Liquid Feeding Program for Dairy Calves” computer model

http://www.uwex.edu/ces/dairymgt/tools/documents/Accelerated.pdf

Economics of Accelerated Calf Growth. Webinar, June 20, 2011:

http://www.calfandheifer.org/news/66786

http://www.youtube.com/watch?v=QgTO4QtEids

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