NURTURE RESEARCH CENTER™

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Research Report

Feeding Calves for Optimal Growth Using Amino Acids – An Update to Our AmNeo™ Technology

Compared to poultry and swine nutrition, dairy calf nutrition is behind the curve with respect to embracing precise diet formulation. Milk replacers for calves today are formulated and scrutinized based on crude protein (CP) content, but what calves require are the specific building blocks that make up protein, amino acids. The National Research Council's Nutrient Requirements of Dairy Cattle (2001) does not currently specify amino acid requirements for dairy calves, yet poultry and swine nutritionists have been formulating diets for amino acid requirements for over 20 years. The concept of ideal proteins and amino acid balancing using synthetic amino acids have allowed the poultry and swine industries to improve feed efficiency, reduce wasted nutrients, and minimize feed costs. Even dairy nutritionists formulate cow rations to optimize amino acids provided to the cow for maximum milk yields with lesser CP in the diet. It only makes sense to understand how amino acid formulation fits into dairy calf nutrition.

Pre-weaning calves receive nearly all of their daily protein intake from milk or milk replacer, and without a fully-functional rumen, essentially all of the amino acids required for growth will come from the liquid diet. Complete milk proteins (casein plus whey) are considered ideal because when correcting for digestibility, the amino acid profile matches the amino acids deposited in lean tissue growth. However, milk protein components can have different amino acid profiles which may be limiting in certain essential amino acids.

Amino acid nutrition is a balancing act. Simply supplementing synthetic amino acids that are known to be limiting will not do the trick. Lean tissue growth requires supply of a specific sequence of amino acids in the correct proportions in order to optimize growth (Figure 1). Additionally, ingredient composition of complete feeds will dictate how much of any synthetic amino acid needs to be added.

Most published amino acid requirements for calves were evaluated in the 1970's and 1980's using veal calves over a month of age that were not fed calf starter. Almost 20 years ago, we jumped into this arena and began calf research to address this knowledge gap. We have been formulating our milk replacers based on a series of trials we conducted in calves fed milk replacer and starter from approximately 2 days of age through weaning at 4 to 6 weeks of age. Our research-proven concept of amino acid balancing is called AmNeo.

Balancing for amino acids allows for more ADG at a lower concentration of CP in the milk replacer. This allows for more efficient use of dietary protein while reducing milk replacer costs and the cost per unit of body weight gain. The first trials that we published were in conventional 20 and 22% CP milk replacer feeding programs. In those studies, calf weight

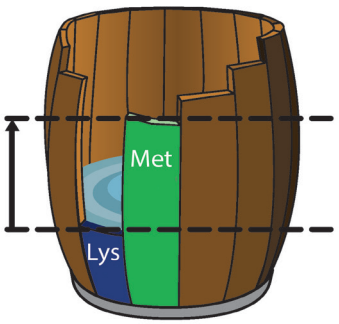


Figure 1a.
The Liebig barrel analogy illustrates limiting essential amino acids result in "gaps" in the diet that limit growth.

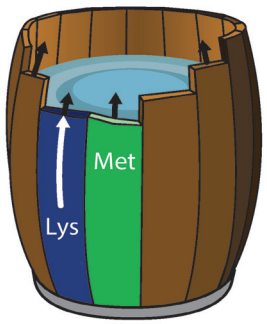


Figure 1b.
Black arrows indicate other amino acids can be supplied in small amounts to further increase performance without additional crude protein.

Figure 2. Average daily gain from 0 to 4 weeks of age.

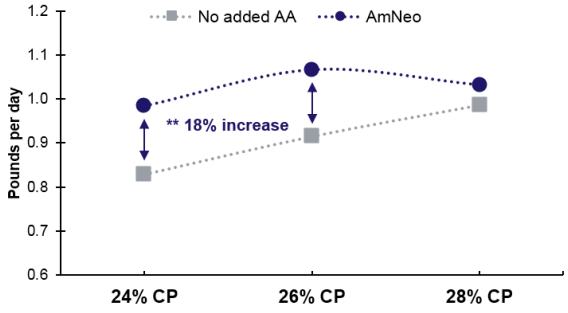


Figure 3. Impact of AmNeo-balanced milk replacer feeding rate on 28 d weight gain.

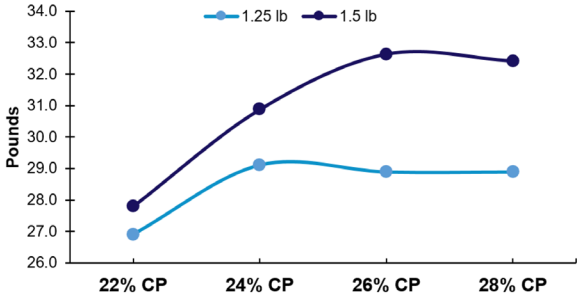
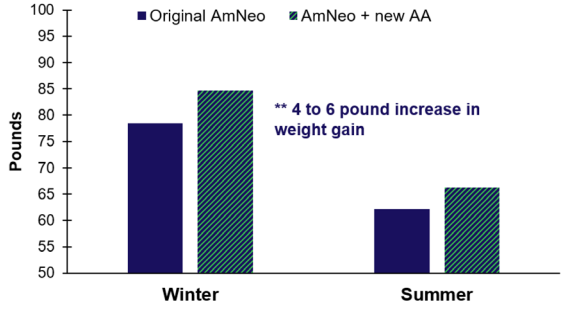


Figure 4. Total weight gain from 0 to 8 weeks of age.



gain supported by a 22% CP milk replacer without added amino acids was achieved in calves fed a 20% CP milk replacer with added amino acids. These studies illustrated that supplemental amino acids increased ADG by approximately 10% in conventional feeding programs (20% CP, 20% fat milk replacer fed at 1 pound of powder daily). Similar results were observed with higher planes of nutrition when calves fed a 24% CP powder with supplemental amino acids at 1.5 pounds of powder grew at similar rates to calves fed a 28% CP powder without supplemental amino acids (Figure 2). In this trial, supplemental amino acids increased ADG by over 15%.

We took the amino acid balancing concept further with research addressing the optimum amino acid to energy ratio in milk replacers (Figure 3), another practice used in poultry and swine nutrition. Here the diets were balanced for amino acids and fed to calves receiving starter, typical of how calves are managed on US dairy farms. Figure 3 shows that if we feed 1.5 pounds of milk replacer, we need to feed a higher protein milk replacer to maximize ADG compared to feeding less milk replacer (1.25 pounds of powder). Other university research groups have also shown that CP in milk replacer should increase with increasing feeding rate to optimize lean tissue growth (Blome et al., 2003; Bartlett et al., 2006), but starter was not fed in these trials.

Figure 5. Average daily gain from 0 to 8 weeks of age.

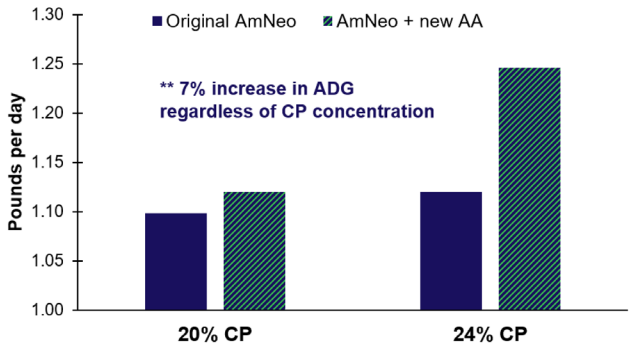
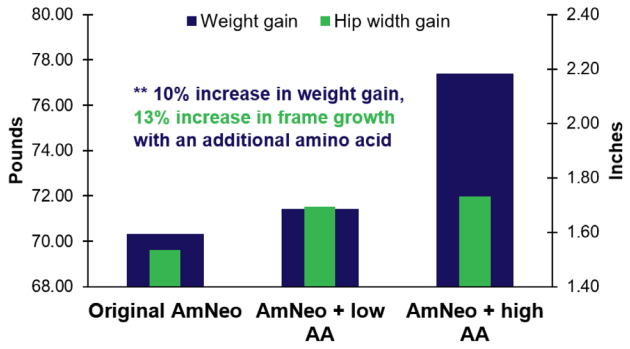


Figure 6. Growth from 0 to 8 weeks of age.



Our amino acid concentration recommendations have also been validated in expert-reviewed research from other laboratories. A study from China (Wang et al., 2012) confirmed that the relative proportions of lysine, methionine, and threonine outlined in our published research was appropriate for calves fed milk replacers where 50% of the protein was supplied by soy protein concentrate. Additionally, New Zealand researchers found calves fed whole milk (4.4% fat, 3.5% protein) supplemented with our recommended levels of amino acids reached 200 pounds of body weight 8 days sooner than calves fed milk without supplemental amino acids (Margerison et al., 2013). This experiment also followed heifers through their first lactation and observed that heifers supplemented with amino acids in whole milk produced 1,275 pounds more fat-corrected milk than heifers not supplemented with amino acids.

As more synthetic amino acids have become commercially available and more cost-effective to include in formulas, we have continued to investigate additional limiting amino acids in milk replacer-fed calves. In several recent trials, we have identified 2 other amino acids that improve ADG 8% and frame growth 20% above what our current AmNeo formulation achieves. Using a new amino acid, we observed a 7 to 8% improvement in ADG (4 to 6 pounds; Figures 4 and 5) during summer and winter trials. Feed efficiency also increased 5 to 7% in these studies using a 24% CP, 17% milk replacer fed at 1.5 pounds of powder daily. Using another limiting amino acid added to our original AmNeo formula, total weight gain to 8 weeks of age increased 10% (7 pounds) and frame growth increased 13% (Figure 6). When combined with the original AmNeo formula, calves supplemented with additional synthetic amino acids in milk replacer gained approximately 10 additional pounds of body weight and achieved more frame growth by weaning without the added cost of additional crude protein.

Our company has invested years of resources to address this area of precision formulation in calf milk replacers. We have also validated this research through the expert review process and have published our findings in U.S. research journals used by the industry and universities, which is unique to our company.

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