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# Real Science | Lecture Series

Q&A REVIEW

## Three Strategies to Implement Today That Increase Milk Protein & Producer Profits

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*Presenter:* Dr. Mike Van Amburgh

**1. In CNCPS, sugar kd were reduced (~40%/h) from original versions and assigned to liquid passage rate, so ruminal digestibility of sugar can be less than a fast starch. So, does the model predict the bump in microbial protein synthesis with the added sugar you mentioned?** Hi. Good catch. Sugars were never supposed to be reduced to that level. They are being moved back to 60% per hour and could go higher but the data available suggests 60% per hour is a reasonable value. I am not sure how the values were decreased to 40% per hour, but we are fixing it.

**2. Any advice for grass-fed producers struggling with low fat and protein tests attributable to drought-stressed feed (low lignin, etc.)?** This is a good question. Low lignin or low cross-linking is a positive for higher digestibility, which means the rumen is emptying faster due to both digestion and passage. So one of the problems is keeping the rumen full of aNDFom. I think it is important to look at the overall NDF levels of the diet and do what is necessary to increase them or if on a pasture, supplement other feeds like beet pulp to increase the aNDFom and also the soluble fiber to increase rumen fill and improve fermentation efficiency. The aNDFom content of the diet on a low lignin diet should be at least 32% and as high as 35% to keep the rumen full and functioning effectively. The low fat and protein tests are likely because the rumen is not efficient and microbial yield is low and there is not enough retention of fiber to yield adequate acetate. Some fatty acid isomers might also be involved but the low rumen fiber fill is primary cause.

**3. Palmitic to oleic relation 1.5 :1 considers FA coming from corn silage?** No, the FA from corn silage is not considered here as that is mostly linoleic acid.

**4. So, you say that we want to increase protozoal protein formation in the rumen. But, don't protozoa grown on bacterial protein actually reduce MP from bacterial protein & reduce metabolizable supply of Met & Lys?** Good question. We have learned a lot about protozoa recently. In some diets they represent up to 20% of the microbial AA supply. Yes, they do predate bacteria, but they are also quite useful as they modulate pH, produce some ammonia, are the essential fatty acid reservoir for the animal and are higher in lysine than bacteria. The key is, we are not going to remove them, so we better make best use of them and in that case feed them well and get as many amino acids from them as possible. They are not preferentially retained in the rumen. They pass with the liquid and solids passage rate. We re-derived our protozoal passage rate equations for the new version of the CNCPS and the protozoa will flow 80% with liquid and 20% with solids passage.

**5. Could you comment on the AA requirements when the CP level of the diet is 14% to 15%?** As you approach the lower limit of CP intake, methionine and lysine are definitely first limiting. After that, then we need to consider histidine and possibly leucine. However, we are still working out those details. Using CNCPS v7, all EAA are described on a gram digestible AA per Mcal metabolizable energy which makes it very specific. These values won't work for models outside of CNCPS v7, but this gives you some idea of what might be next if you just multiply through the Mcals of intake energy and look at what is next limiting beyond methionine and lysine.

| AA | g AA/Mcal ME |
|---|---|
| Arg | 2.04 |
| His | 0.91 |
| Ile | 2.16 |
| Leu | 3.42 |
| Lys | 3.03 |
| Met | 1.14 |
| Phe | 2.15 |
| Thr | 2.14 |
| Trp | 0.59 |
| Val | 2.48 |

**6. Are animal protein blends less variable than sources like blood meal for digestibility?** Yes, as Weiss and St. Pierre suggest, diluting nutrient sources is one way to protect against variability. However, I believe it is still important to understand your source and make sure they are somewhat consistent on those blended ingredients. You can have several sources that are all poorly digestible and that hasn't solved your problem.

**7. Could the sugar effect on increasing fiber digestion that Hoover reported be mediated by anaerobic fungi as well as bacteria and protozoa? Not all anaerobic fungi can use starch?** Great question. Based on everything I know the answer is yes. However, the data are lacking. We need much better data on fungi and I don't know of anyone that is working on fungi at the level needed to best model them and include them in something like our nutrition model. We participated in a fungi study several years ago that didn't yield anything useful so someone needs to help us understand how to best study them.

**8. What are your recommendations for properly estimating body weights?** Weighing or taping 3rd or 4th lactation cattle between 80 and 200 days in milk is the best approach. Portable scales are relatively inexpensive at this point and tapes are even less expensive and you can find a few high school students to do this job once a year.

**9. What is the definition of early lactation (how many days in milk) in the Sniffed slide (slide 22)?** Up to 40 days in milk. Obviously, these are not set in stone and the fiber digestibility and other components of the diet will play a significant role here.

**10. Do you have any comments on the practice of feeding some green chop hay crop on a daily basis in climates that can afford this opportunity?** Green chop is excellent feed if managed correctly and harvested at the right stage. High in sugar and higher in digestibility if harvested at a lower NDF level than what you might ensile. Again, with higher digestibility forages, the key is feeding enough, keeping the rumen full and optimizing microbial yield and rumen health. The sugar can be as high as 15% and that would mean less starch needing to be fed and better rumen efficiency for microbial yield and DMI.

**11. Does source of positive DCAD matter in the lactating diet (sodium vs potassium)?** In this case potassium is the clear winner despite the cost.

**12. In monogastrics, Lysine is rationed according to energy intake, with the other amino acids rationed in ratio to Lysine req. In ruminants we are using Methionine, is there a reason why?** In the current version of the CNCPS, we worked out the methionine requirement first and were able to associate it with energy (e.g. 1.19 g methionine per Mcal ME) then bring in lysine. We agree with you the ideal protein approach could be used here and we have data on that but cannot use the approach with the current version of the model. When v7 is released, all of that is possible.

**13. Does the energy-protein ratio only consider the energy from carbohydrates? Doesn't the energy provided by dietary fat count?** We are using total ME, not just from carbohydrates. However, we know and data exist that says more carbohydrates and more propionate yield more glucose which drives insulin and IGF-I responses, which then drive more milk protein. With some of the work of Adam Lock and Joe McFadden, there are data suggesting certain fatty acids can stimulate an insulin response and we are working to better define that with both of those groups.

**14. You use ME vs. NE, why the difference in your ratios?** ME does not imply changes in milk fatty acids. NE implies we know the profile of fatty acids being synthesized and excreted. That is not easy to do and we decided that ME was much easier to work with and our data (still unpublished) suggests this approach works remarkably well. I showed the study from Andrew LaPierre where we balanced for all EAA on an Mcal of ME basis and challenged our values up and down on standard deviation from our optimums and the cows responded accordingly. Down one standard deviation and milk dropped. Up one std dev and there was no significant change in productivity. We have done other studies and the cows have agreed with the formulation.

**15. What have your findings been on the most effective RDP levels to maximize microbial AA flow?** We don't calculate RDP or better, we don't use it. We use rumen ammonia balance as our indicator of rumen N. **In CNCPS v6.55 we want rumen N balance to be 120%** to account for fluxes in concentration that occurs over the day. It is rare that any lactating cow diet is that low as most forages have plenty of ammonia to maintain that level, along with some soybean meal. As we refine our dietary nitrogen levels and decrease the amount fed, I am not as worried about RDP per se as I am making sure there are enough branched chain amino acids available for BCVFA production. The fiber bacteria have an obligate requirement for BCVFA to produce BCAA and if the true protein levels in the soluble/degradable pool get too low, I think this creates a deficiency in BCAA/BCVFA and this results in decreased fiber digestion and the downstream effects of that. I've seen this with diets high in RUP sources that also use canola meal as canola is less soluble than soybean meal. I've replaced a portion of the canola with soy and production increased not because of the MP difference as there was none, but because the rumen was deficient on soluble true protein for the fiber bacteria.

**16. Have you measured blood glucose levels to adjust sugar levels?** No, we never tried that. We do measure it just for information during the study, but our focus is simply making sure we have adequate rumen available starch and sugars.

**17. There is a lot of push back on bmr corn and producers are looking at other corn varieties-(enogen). Since everything discussed today hinges on fiber digestibility, where do you stand on this and what are your thoughts on the potential impact on milk protein production with this move?** The key is simply to select high digestible hybrids and varieties whether corn silage or some of the other forages and cocktail blends. What we have been doing is looking for forages with a large fast pool of NDF and a small uNDF. Usually a small uNDF results in a large fast pool in the three-pool system. The larger the fast pool, the greater the intakes and the more forage you can feed. Van Soest published a graph in his text that described the relationship between NDF digestibility and dry matter intake. The highest correlation with intake was the digestion at 12 h of fermentation and that is exactly what we are finding as do more work. The early time point degradation is the key to high forage diets and high intakes. The Irish pasture grasses are great examples. 50% NDF digestion at 12 hours and nearly 80% by 30 hours with a uNDF of 7 to 9%. It is difficult to emulate that here but moving in that direction with forage selection is the key to making this work.

**18. Do you treat lactose the same as sucrose in the diet?** No, lactose is more slowly digested in the rumen, although the microbes are adaptable. Sucrose digests more effectively and quickly than lactose. Jeff Firkins reviewed the data on lactose and microbes will increase their digestibility of it as they presented with more of the sugar, but it doesn't quite reach the same rate as sucrose. That doesn't mean it is not a useful sugar, just don't expect the same microbial yield.

We formulated for all essential amino acids as indicated in the table above. It was not just about lysine, but all EAA. As we are still learning how to effectively balance for all EAA on a gram basis, the data concerning what was actually consumed is not perfect, but for the most part we went up and down one standard deviation from the values in the table above. We are not relying on one AA, we are balancing for all EAA in that study.

| AA | g AA/Mcal ME |
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**20. When using MHA in CNCPS programs, are the goals for grams of methionine the same due to it not being a bypass methionine source?** Usually, we give it credit for about ¼ of the methionine and balance for ¾ using a rumen escape source to start. If that doesn't have the desired effect then we will increase the RPM. If the MHA is working correctly there should be an increase in microbial yield and that will improve the methionine supply.

**21. Protozoa are specifically retained in the rumen, basically engulfing bacteria and increasing recycling. What are your thoughts in this regard? Is this the right way to increase microbial yield and MP?** We just finished a study conducted in Ireland on high quality perennial ryegrass and the first paper is accepted in JDS by Dineen et al. What we found is the protozoa are not preferentially retained and they flow with the liquid passage at about 80% of their population and 20% is associated with the solids passage. We used this to reconfigure CNCPS v7 and rerun our omasal data sets and the protozoa lined up with the literature data with that partitioning. So no selective retention in that system.

**22. You mentioned Lys:Met ratio several times. That seems like a move backwards to the way we fed cows with the NRC. How can we integrate this with some of the work showing more complex relationships between Met, Lys and other AA?** I only mention that because in v6.55 of the CNCPS or the NRC we are not able to balance for all EAA yet. In the next iteration of the model we are going to be balancing for all EAA as indicated in question 4 and 18.

**23. If intakes are increasing and Milk Protein is not moving or yield, where would you expect the solution to be found?** Good question. I would look at what appears to be first limiting. I'd evaluate some digestibility of the protein sources or the fiber. I would also make sure that the cows are properly characterized. In these situations I have seen cows weighing 800 kg but diets formulated for a 650 kg cow. With that situation you cannot model what is first limiting at the gram level. BCS should also be analyzed to make sure it is increasing under those conditions. If not, then I go back to the intakes and make sure they are correct.

**24. Are all sugars the same? What specific types of sugars should we be feeding?** Dextrose, sucrose, maltose and fructose are the most efficient when available. Lactose works but is a little slower and not as efficient but good if cost effective. Charlie Sniffen has been pushing me to consider 6 carbon vs 5 carbon sugars but we haven't had the time to go chase that.