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From section on Calculating Protein

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The next time someone tells you horses that are being worked “need” to be fed X% protein feed, you can tell them it ain't necessarily so! Curious how this works out for classes with higher protein requirements? Let's take a look. We'll use the same bodyweight, look at calorie and protein requirements for late pregnancy, lactation and a 6 month old weanling. These are:

400 kg Mature Weight	Energy, Mcal/day	Grams Crude Protein/day
Pregnancy, last month	17.1	714
Lactation, first month	25.4	1228
6 month old weanling	12.4	541

We'll use the same hay, with a calorie density of 1.65 Mcal/kg and 8% protein.

Pregnancy

$$17.1 \text{ Mcal} / 1.65 \text{ Mcal/kg of hay} = 10.36 \text{ kg of hay (22.8 pounds)}$$

$$10,360 \text{ grams of hay} \times 0.08 = 829 \text{ grams of protein}$$

Lactation

$$25.4 \text{ Mcal} / 1.65 \text{ Mcal/kg of hay} = 15.39 \text{ kg of hay (33.9 lbs of hay)}$$

$$15,390 \text{ grams of hay} \times 0.08 = 1231 \text{ grams of protein}$$

Surprised hay alone works? Most people are. We don't even have to do the calculations for the weanling since if you look at the chart his energy needs are just about half of the lactating mare and the protein needs are less than half so whatever is adequate for her will automatically be adequate for him.

The suitability of any particular hay depends entirely on its analysis. This one happened to work out well (and no, I didn't pick those numbers to make it happen!). A hay with a higher Mcal/kg or lower protein level wouldn't.

Next, let's see what happens to the same mare if we are feeding her 5 pounds per day of a 14% Mare and Foal type feed. This is pretty common practice.

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Five pounds = 2.27 kg. If energy in the feed is 4.4 Mcal/kg, $2.27 \times 4.4 = 10$ Mcal from the grain. For the pregnant mare, we only need another 7.1 Mcal from hay.

$$7.1 \text{ Mcal} / 1.65 \text{ Mcal/kg of hay} = 4.3 \text{ kg of hay}$$

This mare is now getting just over 1% of her body weight as hay, considered acceptable. Let's see what happens to protein: (Calculations are weight fed in grams x % protein)

$$\text{Grain: } 2,270 \text{ grams} \times 0.14\% = 317.8 \text{ grams}$$

$$\text{Hay: } 4,300 \text{ grams} \times 0.08 = 344 \text{ grams}$$

$$\text{Total protein intake} = 317.8 + 344 = 661.8 \text{ grams of protein}$$

By substituting 5 pounds of a 14% protein mare and foal feed for an 8% protein hay, feeding the correct level of calories, this pregnant mare's diet went from more than adequate for protein to deficient

Read that again as many times as it takes for it to sink in! Going from diet of 100% moderate quality grass hay to a diet including a 14% protein mare and foal feed actually caused the diet to be protein deficient.