Update on Regional Extension Programs

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METABOLIC PROFILE RESEARCH UPDATE

Research was conducted to evaluate the relationship between dietary intake and various parameters of the metabolic profile. Blood samples were collected at the morning feeding during 3 wk before and 3 wk after calving (N=4129 dairy cows) in 8 Holstein herds in the summer and winter, as well as in 8 Jersey herds in the summer. The samples were refrigerated, processed, and stored at -20 °C until laboratory analysis. On the day of sampling, total mixed ration samples were collected for subsequent analysis. Associations were tested by logistic regression (pregnancy at 90 [**P90**] and 150 days in milk (**DIM**) [**P150**]), correlation analysis (dietary and metabolic profile concentrations), and analysis of variance (days to first service [**DFS**] and days open [**DO**]). Herd records were collected and health events were extracted from herd records including dystocia, still births, twins, retained placenta, hypocalcemia, ketosis, and mastitis. Cows that were over-

Table 1. Mean and SD ration composition during the prepartum period.

Variable	Winter Holsteins		Summer Holsteins		Summer Jerseys	
	Mean	SD	Mean	SD	Mean	SD
P	0.38625	0.06589	0.347778	0.04868	0.445	0.12286
DM	56.625	6.97705	54.85556	5.13423	53.61	7.89774
CP	15.15	1.18442	14.6	1.63018	15.26	1.45082
Adj. Prot	15.025	1.28702	14.28889	2.04539	15.18	1.60333
Sol. Prot.	38.5125	7.257	36.61111	4.65657	39.72	6.31379
RDP	69.275	3.62127	68.3	2.32648	69.87	3.15667
ADF	27.875	2.51779	27.54444	25.7	25.89	6.14373
NDF	41.425	3.46894	40.4	5.54256	38.32	6.85578
Ash	10.2625	1.55833	10.85556	2.52543	10.58	1.24704
Ca	1.29875	0.27247	1.296667	0.35408	1.58	0.44021
Mg	0.38625	0.06323	0.411111	0.07737	0.44	0.18233
K	1.54125	0.3943	1.4288889	0.23872	1.732	0.51166
Na	0.189125	0.07249	0.134778	0.06699	0.1535	0.06668
Fe	443	268.44845	553.1111	241.4014	402.9	79.13905
Mn	91.875	36.56867	98.7778	36.43754	94.7	45.44851
Zn	93.125	35.89046	99.55556	27.31351	114	53.15596
Cu	23	6.78233	27.33333	12.22702	24.5	8.33
TDN	63.9	4.20912	63.87778	5.479	65.6	4.4292
NEL	0.664286	0.05192	0.663333	0.06403	0.685	0.05017
NEM	0.651429	0.0623	0.65	0.08109	0.678	0.06546
NEG	0.385714	0.05855	0.385556	0.0735	0.408	0.05808
NFC	29.87143	3.35147	31.47778	4.77566	32.79	6.1209

conditioned or under-conditioned and evidence of lameness was noted at sampling.

The mean and standard deviation (**SD**) for the ration composition by season for the Holsteins and for summer sampling for the Jerseys are shown in Table 1 for the prepartum period and Table 2 for the postpartum period.

The time of sample collection was categorized into weeks relative to calving (D 0) with wk -3 from D -24 to D – 18; wk -2 from D -17 to D -11; wk -1 from D -10 to D -4; wk 0 from D -3 to D 3; wk 1 from D 4 to D 10; wk 2 from D 11 to D 17; and wk 3 from D 18 to D 24. Pearson correlation coefficients were determined between serum values for magnesium (Mg), potassium (K), calcium (Ca), sodium (Na), and phosphorus (P) and the mineral level in the prepartum or postpartum ration associated with the herd of origin, season, and day relative to calving. Pearson correlation coefficients between serum urea and albumin concentration and ration concentration of adjusted protein, soluble protein (**SP**), rumen degradable protein (**RDP**), and crude protein (**CP**) were determined. Correlations were calculated for the individual weeks of wk -3, -2, -1, 1, 2, and 3; for the combined prepartum period of wk -3, -2 and -1; for the combined postpartum period of wk 1, 2, and 3; and over the entire period except week 0.

For serum urea, the highest correlation coefficients were with ration CP ($P < 0.0001$), particularly during the prepartum period. Although serum albumin was significantly correlated with SP, RDP, and CP; the correlations were not strong, ranging from 0.15 to -0.06. Serum Ca and ration Ca,

Table 2. Mean and SD ration analyses during the postpartum period.

Variable	Winter Holsteins		Summer Holsteins		Summer Jerseys	
	Mean	SD	Mean	SD	Mean	SD
P	0.4225	0.03196	0.42125	0.03314	0.467	0.07319
DM	54.225	3.39779	55.125	5.89619	56.31	6.38356
CP	17.8	0.53436	16.8	0.65027	17.53	0.80422
Adj. Prot	17.0375	0.53436	16.8	0.65027	17.53	0.80422
Sol. Prot.	36.5125	3.61956	35.5875	1.72746	36.29	2.18604
RDP	68.25	1.81265	67.775	0.86644	68.14	1.07311
ADF	23.475	2.59216	22.775	1.56821	21.72	1.47784
NDF	34.45	2.53659	33.6	33.05	32.61	2.36711
Ash	8.875	1.02085	9.325	1.61842	8.64	0.95242
Ca	1.22375	0.27959	1.16375	0.38497	1.148	0.22885
Mg	0.40625	0.05097	0.37125	0.02416	0.39	0.04216
K	1.5575	0.1353	1.57	0.19864	1.699	0.17673
Na	0.346125	0.11877	0.4	0.13517	0.3436	0.07435
Fe	308.875	68.36757	339	129.1798	311.2	69.08578
Mn	77.25	30.79773	66.125	13.81963	60.6	22.13695
Zn	88.125	20.08153	78.875	13.3142	75.1	21.60478
Cu	23.875	7.98995	21.375	6.04595	22.2	7.05219
TDN	71	2.69921	71.175	2.03523	72.54	1.42299
NEL	0.74625	0.03159	0.74875	0.02475	0.765	0.0178
NEM	0.75375	0.03815	0.7575	0.02765	0.778	0.02044
NEG	0.47875	0.03357	0.48	0.02449	0.496	0.01713
NFC	34.9875	3.06288	35.575	3.386	36.21	2.99683

were correlated over all weeks (excluding wk 0), for wk -2, wk -1, wk 3, prepartum and postpartum with the highest correlation of 0.155 occurring in wk -2. Ration and serum K concentrations were correlated over all weeks (excluding wk 0), wk 1, wk 2, and postpartum. Over all Mg was correlated; however, serum Mg in the postpartum period, combined or by individual week, was not correlated. The correlation was approaching significance ($P < 0.102$) by week 3, although the correlation was low (0.086). In the prepartum period, Na tended to have a slightly negative correlation (-0.04, $P < 0.097$) and overall the correlation was negative ($P < 0.0001$); however postpartum as a group or by individual week correlations between ration and serum concentrations were not significant.

Ration and serum P concentrations were correlated for all time periods evaluated, although the highest correlation was 0.166. Previously we reported to this group that when serum from Holstein cows within the transition period were evaluated for P on a week by week basis (week zero = -3 d prepartum to 3 d post calving), week 1 was the only week where serum P values differed (Lager et al., 2011). This would mean that P levels decrease around 10 d postpartum. There was not an effect of number of lactation. Further, our group collected samples from summer and winter to provide seasonal analysis and it was discovered that P levels are impacted by season.

CONCLUSION

The metabolic profile is a useful tool that has evolved over time. This evolution or adaptation is necessary to account for changes in feeding management and animal genetics. The key is ensuring that the reference values match the stage of lactation. From this evaluation, it is apparent that correlations do exist between ration nutrients and some parameters analyzed as part of the metabolic profile; however, during the transition period evaluated these correlations although significant aren't strong, which may be related to the changes in nutrient composition which occurs during this 6 wk period. Because of the prevalence of disease within the periparturient period, a reference profile based on mid-lactation cows limits the interpretation of data from cows within the transition period. Due to the number of ration manipulations frequently occurring during this period some analytes may not be reflective of the current nutrition program and over interpretation should be avoided. There is certainly a need to understand the fluctuations that occur in serum biochemical analytes over the course of a lactation, especially within the transition period. With recent data displaying an impact of breed and season on the metabolic profile as well as the documented variability within the transition period, it may be necessary to account for each factor as well as be cognizant of when a sample is collected to be sure that the results received will be of value.

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