Effects of different forage-containing rations on metabolic parameters and milk yield in the peripartum of Holstein cows

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ABSTRACT: To evaluate the forage effects on performance and metabolic parameters, 24 Holsteins were randomly fed one of the diets containing a forage mixture with majority of alfalfa hay (AH), alfalfa silage (AS), or corn silage (CS) during the peripartum period. Milk production and dry matter intake (DMI) were recorded daily; body weight (BW) was measured and blood/urine samples were collected on day –21, 1, and 15 relative to parturition. The diets did not affect prepartum and postpartum BW changes and milk production. During the prepartum, DMI for cows fed hay was higher than for cows fed silages. During the postpartum, DMI was the highest for cows fed diet AH, followed by cows fed diets CS and AS. The diets did not affect serum glucose, Ca, P, and K concentrations. Serum blood urea nitrogen (BUN) concentration for cows fed diet CS was lower than for cows fed diet AS. Cows fed diet AH had the highest alkaline phosphatase (ALP) activity. Serum cation-anion difference (SCAD) for cows fed AS was lower than for cows fed CS. Serum Ca concentration was not correlated with SCAD and ALP values, but Ca : P ratio was negatively correlated with serum K concentration. The diets did not influence urine pH and urine cation-anion difference (UCAD) value. Urine Ca concentration and Ca : P ratio for cows fed CS were higher than those for cows fed AS. Urine pH was positively correlated with urine K concentration and UCAD value. In conclusion, the forage type did not affect prepartum performance. Silage, regardless of the kind, was advantageous over hay during the postpartum.

Keywords: hay; silage; forage; periparturient period; metabolite; cow

Until the last two decades, the dry period has been considered as a nonprofitable resting period and dry cows have been fed diets based solely on low quality forages. In fact, because the peripartum cows have to cope with rapid growth of fetus, activation of the mammary gland, termination of gestation, and involution of the uterus, nutrient density should therefore be increased during the periparturient period (Grummer, 1995). Failures to ease metabolic transition via acclimation of the rumen to lactation diets, replenishment of body reserves, and enhancement of immune potency (Goff and Horst, 1997a) increase vulnerability of dairy cows to postpartum health problems (Curtis *et al*., 1985; Correa *et al*., 1993) which occur as a complex and compromise profitability by lowering the lifetime milk yield and increasing the culling rate (Erb *et al*., 1985; Grohn *et al*., 1998).

Forages are important constituents of typical dry cow diets because of the importance of optimal rumen function to minimize the occurrence displaced abomasum (Cameron *et al*., 1998), acidosis (Nocek, 1997), laminitis (Nocek, 1997) and parturient paresis (Curtis *et al*., 1984, 1985). On the other hand, increasing the amount of forage compromises dry matter intake (DMI) and energy intake by limiting the rumen fill (Forbes, 1996). Forage type (hay versus silage) and silage kind (alfalfa versus corn) influence ruminal fermentation and chewing behavior due to differences in fiber structure and nutrient composition (Galyean and Goetsch, 1993).

The incidence of parturient paresis ranges from 5 to 10% and increases a risk for displaced abomasum, retained placenta, ketosis, and mastitis by 7.2, 4.0, 23.6, and 5.4-fold, respectively (Curtis *et al*., 1985) due to compromised muscle tonicity

(Jorgensen *et al*., 1998), apolipoprotein B synthesis (Oikawa and Katoh, 2002), and immune potency (Kehrli and Goff, 1989), respectively. Moreover, hypocalcemia adversely affects milk production and postpartum reproductive efficiency and culling decision (Grohn *et al*., 1998). Forage source is also linked to calcium homeostasis. The Ca and K levels are high in forage-based diets, particularly in legume forages. Because of higher cationic property, dietary K is more significant than Ca in relation to occurrence of parturient paresis (Goff and Horst, 1997b). It occurs as a result of a failure to restore normal blood Ca concentration at the onset of lactation. In subclinical and clinical cases, blood Ca concentration decreases by 30 and 60%, respectively. Parathyroid hormone is responsible for promoting Ca mobilization from bone to blood. Vitamin D is additionally responsible for regulating the Ca absorption from the gastrointestinal tract. The sensitivity of bone and kidney to parathyroid hormone and vitamin D stimulations involves in Ca homeostasis. Acid-base status of the cow determines this sensitivity and excessive dietary K level is the major factor causing metabolic alkalosis (Goff and Horst, 2003a). Formulation of rations via inclusion of anionic salts or feeding corn silage in the prepartal diets reduces metabolic alkalosis or induces metabolic acidosis, which consequently promotes Ca mobilization from bones. Thus, the prepartal diet with a negative dietary cation-anion difference value (DCAD) ((Na + K) – (Cl + S)) is an essential for prevention of parturient paresis (Oetzel, 2000; Goff and Horst, 2003b). However, there are some limitations associated with the feeding of anionic salts, which include palatability and difficulty of adding enough anionic salts to correct cationic diets (Thilsing-Hansen *et al*., 2002). The objective of this experiment was to evaluate the effects of forage source without provision of anionic salts on performance and metabolic parameters during the periparturient period.

MATERIAL AND METHODS

Animal, diet and management. Twenty-four nonlactating multiparous Holsteins in late gestation were housed in a tie-stall facility and utilized from four weeks prior to the anticipated parturition date through the first two weeks of subsequent lactation. Cows were grouped according to projected calving date and parity and then assigned randomly to one of the three peripartal diets containing different types of forage mixture with majority of alfalfa hay (AH), alfalfa silage (AS), and corn silage (CS) after a week of adjustment period. Gestation periods were 12.3 ± 6.3, 8.3 ± 4.7, and 7.8 ± 3.9 (mean ± standard deviation) days longer than projected for cows fed diet AH, AS, and CS, respectively.

Isocaloric and isonitrogenous peripartal diets were formulated to meet or exceed nutrient requirements recommended by the National Research Council (NRC, 2001). On a dry matter basis, forage : concentrate ratios were 60 : 40 and 40 : 60 in the prepartal and postpartal diets, respectively. Ingredient and nutrient composition of concentrate and forage portions of the diets are shown in Table 1. To balance the energy and protein level of total mixed ration (TMR), soybean meal and limestone were partially replaced by corn grain in the concentrate mixture for cows fed diet CS (1.0 and 1.3 kg for soybean meal during the prepartum and postpartum periods, respectively). Also, 1.6 and 1.3% more limestone during the prepartum and postpartum periods were added to the ration for cows fed CS to provide equal Ca percentage.

Dry matter contents of roughages and concentrate were determined bi-weekly to adjust their proportions in the TMR. Cows were fed *ad libitum* twice per day at 08.00 a.m. and 16.00 p.m. hours to receive 5% orts and had free access to water at all times during the experiment. Also, cows were milked twice per day at 07.00 a.m. and 15.00 p.m. hours.

Sample collection and analytical procedure. Amount of feed offered and refused and milk produced were recorded daily. Forages and concentrate mixture were collected monthly, dried for 48 h in a 60°C forced air oven, and then ground to pass through a 1-mm screen. Monthly composites of forages and concentrate were analyzed for CP using the micro-Kjeldahl method (AOAC, 1990) and NDF using the filter bag technique (Mertens, 1999). The energy, Ca, P, and DCAD contents were estimated from tabular values (NRC, 2001).

Two individuals evaluated body condition score (BCS) by using a numerical range of one to five (0.25 intervals) with a BCS of one being emaciated and of five being obese at the beginning of the experiment (Edmonson *et al*., 1989). Average BCS was 3.21, 3.11, and 3.47 with standard error of 0.16 for cows fed diet AH, AS, and CS, respectively. Body weights (BW) were measured at 07.00 a.m. hours on d 21 prior to expected calving date and on d 1 and 15 postpartum. Thus, the liquid loss of cows at

Table 1. Ingredient and nutrient composition of concentrate mixture and forage of the experimental diets

Concentrate (% of DM)			
Barley	40.00	Sunflower meal	14.25
Wheat	5.00	Molasses	5.00
Corn	5.00	Limestone	2.50
Wheat bran	10.00	Dicalcium phosphate	2.50
Soybean meal	7.50	Salt	0.65
Cotton seed meal	7.70	Vitamin-Mineral premix[1]	0.10
Nutrient			
Energy (NE_L/kg DM)[2]	1.72	Ca (%)	1.27
Crude protein (%)	18.92	P (%)	1.07
Neutral detergent fiber (%)	23.93		
Forage (% of DM)			
Item	AH	AS	CS
AH	60.0	–	–
AS	–	60.0	–
CS	–	–	60.0
Grass hay	35.0	5.0	20.0
Wheat straw	5.0	35.0	20.0
Nutrient			
Energy (NE_L/kg DM)[2]	1.26	1.14	1.56
Crude protein (%)	12.4	11.3	9.0
Neutral detergent fiber (%)	54.7	51.8	55.6
Ca (%)	1.42	1.17	0.47
P (%)	0.29	0.22	0.21
DCAD (mEq/kg DM)[2]	+283.8	+250.3	+156.6

[1]Per kg contains: 10 000 000 IU Vitamin A; 2 000 000 IU Vitamin D; 30 g Vitamin E; 50 g Mn; 50 g Zn; 50 g Fe; 10 g Cu; 0.8 g I; 0.2 g Co; 0.15 g Se; and 0.1 g Mg (TOP_VIT 62 VM, Topkim Co., Istanbul, Turkey)

[2]Calculated values [(%Na × 435) + (%K × 256)] – [(%Cl × 282) + (%S × 624)] (NRC, 2001)

birth and the effect of these losses on body condition, blood and urea parameters had been tried to be seen.

On the day BW was measured, cows were bled at 07.00 a.m. hours via puncture of the coccygeal vein. About 10 ml of blood samples were drawn into additive-free vacutainers and kept at room temperature. Serum was obtained after centrifugation at 3 000 g for 15 min at 20°C. Aliquots were kept at –20°C until laboratory analyses for glucose, blood urea nitrogen (BUN), total protein, creatine, Ca, P, Na, K, and Cl as well alkaline phosphatase (ALP) activity using commercial kits (DDS®, Diasis Diagnostic Systems Co., Istanbul, Turkey). Moreover, spot urine sample was obtained at 07.30 a.m. hours on day 1 and 15 postpartum. After determination of pH, samples were stored at –20°C for analyses of glucose, creatine, Ca, P, Na, K, and Cl.

Statistics. Based on an assumption that the alpha error was 0.15 at the beta error being 0.85, eight cows per group were needed to have a statistical significance when the plasma Ca level was 0.5 mg/100 ml higher at parturition. The ANOVA was conducted using the Mixed Procedure of SAS with repeated measures in time as a subplot (SAS, 1998). The effect of forage source on production and metabolic responses was tested using the following linear model:

$Y_{ijk} = \mu + B_i + TRT_j + \text{Error } A + T_k + (TRT \times T)_{jk} + \text{Error } B$

where: Y_{ijk} = response variable
μ = population mean, B_i = group (i = 1 to 8)
TRT_j = treatment (j = AH, AS, or CS)
Error A = whole plot error
T_k = time (k = d or wk relative to parturition)
$(TRT \times t)_{jk}$ = treatment j and time k interaction
Error B = subplot error

Because there was no difference in initial BCS, the covariate term was omitted from the linear model. Cow nested within dietary treatments were the random error term for all data analyses. Also, orthogonal contrasts were constructed to determine the effects of forage type (AH vs. average of AS and CS) and silage kind (AS vs. CS). Pearson's correlation coefficients between blood and urine metabolites were determined using the Corr Procedure. Effects of forage source on response variables were considered to be significant at $P < 0.05$. There were therefore no time and time by diet interaction effects unless mentioned.

RESULTS AND DISCUSSION

Performance parameters

Performance parameters are shown in Table 2. Cows fed silages had higher BW than cows fed hay. However, BW did not differ by the silage kind. Expectedly, BW changed over time, but changes in BW during the prepartum and postpartum periods were not affected by the diets. Average BW was 546, 493, and 478 kg on day –21, 1, and 15 relative to calving date, respectively. There was no diet effect on birth weight of calves. During the prepartum period, DMI (both as kg/d and percentage of BW) for cows fed hay was higher than for cows fed silages. Cows did not experience DMI depression as parturition approached. During the postpartum, cows fed hay consumed less DM than cows fed silages. Moreover, DMI (kg/d) for cows fed diet CS was higher than for cows fed diet AS. However, DMI for cows fed hay was higher than for cows fed silages when DMI was expressed as percentage of body weight. In this case, DMI as percentage of BW for cows fed diet CS was also higher than for cows fed AS. There was no diet effect on milk production. Expectedly, milk production increased by 16% during the second week of lactation (18.2 kg/d) as compared with that during the first week of lactation (15.7 kg/d).

To meet the nutrient requirement for physiological changes, concentrate was added to the rations. Grain supplementation improves energy balance and eases metabolic transition as cows approach parturition and reduce BW loss and increase milk production as lactation progresses (Dann *et al*., 1999; McNamara *et al*., 2003). Unlike in the present experi-

Table 2. The effects of forage source on peripartum performance parameters

Parameters	Diets			SEM	Contrasts[1]	
	AH	AS	CS		average of AS and CS	AS vs. CS
BW (kg)[2]	478.8	528.6	509.8	12.2	0.01	0.26
BW lost prepartum (%)[3]	–11.2	–10.2	–10.9	1.9	0.81	0.80
BW lost postpartum (%)[4]	–2.5	–2.7	–3.5	1.4	0.62	0.72
Calf weight (kg)	37.0	37.4	38.8	3.3	0.79	0.77
DMI prepartum (kg)	16.4	13.8	14.1	0.3	0.01	0.68
DMI prepartum (% of BW)	3.2	2.5	2.4	0.0	0.01	0.38
DMI postpartum (kg)	15.6	15.8	18.0	0.4	0.74	0.01
DMI postpartum (% of BW)	3.4	3.2	3.5	0.0	0.03	0.01
Milk yield (kg)	16.7	17.6	16.4	0.6	0.68	0.12

[1]Contrasts: H vs. S = diet containing alfalfa hay versus average of diets containing alfalfa silage and corn silage; CS vs. AS = diet containing alfalfa silage versus diet containing corn silage
[2]Time effect ($P < 0.001$)
[3]Change = [((BW on day 0 – BW on day –21) × 100)/BW on day 0]
[4]Change = [((BW on day 15 – BW on day 0) × 100)/BW on day 0]

ment, DMI depression is typical during late gestation in other experiments (Grummer, 1995). Feeding prepartum cows different forage types and silage does not affect performance parameters as long as the ration is well balanced (Nocek *et al.*, 1983). The impact of forage source as compared with NDF level on performance is less pronounceable (Briceno *et al.*, 1987). Differences in DMI during prepartum and postpartum could be related to NDF digestibility (Hoffman *et al.*, 1998) and amount of forages and amount of straw present (West *et al.*, 1997; Dewhurst *et al.*, 2000), but not to grass hay present (Fischer *et al.*, 1994). Although DMI differed during the periparturient period in the present study, the lack of effects on milk production could be related to digestibility of forage sources. In agreement with the present experiment, (Keys *et al.*, 1984) reported no difference in calf weight between cows fed diets containing corn silage, gross legume silage, and concentrate at the ratios of 75 : 25 : 0, 49 : 16 : 35, and 50 : 50 : 0 and a linear increase in milk production with increasing the proportion of corn silage. Broderick (1995) reported no difference in milk yield response in spite of higher DMI for cows fed solely alfalfa hay than for cows fed solely alfalfa silage. No differences in postpartum DMI, BW loss, and milk production were reported in early lactating cows fed diet containing corn silage only, 50% hay crop silage, and 50% corn silage (English *et al.*, 1983).

Blood and urine parameters

Table 3 summarizes the effect of peripartal diets on blood metabolites. The diets did not affect serum glucose, Ca, P, and K concentrations and Ca : P ratio. There was no difference in serum BUN concentrations between cows fed hay and silages. However, serum BUN concentration for cows fed diet CS was lower than for cows fed diet AS. Serum total protein concentration was higher and serum creatine concentration was lower for cows fed hay than for cows fed silages. However, they did not differ by the silage kind. Cows fed diet AH had the highest ALP activity, followed by cows fed diets CS and AS. Both serum Na and Cl concentrations for cows fed silages were higher than for cows fed hay and they did not differ by the silage kind. Serum cation-anion difference (SCAD) for cows fed hay and silages did not differ, but it was lower for cows fed AS than for cows fed CS.

Serum glucose, BUN, creatine, Ca, Na, and Cl concentrations and ALP and SCAD values changed during the periparturient period. Average serum concentration was 60.4, 67.9, and 57.9 mg/100 ml for glucose; 12.1, 15.2, and 10.8 mg/100 ml for BUN; 0.90, 0.93, and 0.80 mg/100 ml for creatine; 9.45, 8.65, and 9.20 mg/100 ml for Ca; 142, 145, and 141 mEq/ml for Na; and 99, 101, and 95 mEq/l for Cl and average value was 35.2, 41.6, and 31.0 U/l for ALP and 47.7,

Table 3. The effects of forage source on peripartum blood parameters

Parameters	Diets			SEM	Contrasts[1]	
	AH	AS	CS		average of AS and CS	AS vs. CS
Glucose (mg/100 ml)	64.2	62.0	60.0	2.2	0.24	0.46
BUN (mg/100 ml)	11.8	16.0	10.3	1.0	0.47	0.01
Total protein (mg/100 ml)	7.8	7.2	7.0	0.2	0.01	0.40
Creatine (mg/100 ml)	0.8	0.9	0.9	0.0	0.04	0.82
Ca (mg/100 ml)	9.3	9.0	9.0	0.1	0.11	0.96
P (mg/100 ml)	4.7	5.0	5.1	0.3	0.48	0.82
Ca : P	2.1	2.0	1.8	0.1	0.28	0.42
ALP (U/ml)	43.0	28.0	36.7	2.2	0.02	0.08
Na (mEq/l)	141.0	143.0	144.0	1.0	0.08	0.18
K (mEq/l)	4.7	4.8	4.7	0.0	0.96	0.36
Cl (mEq/l)	96.2	99.4	99.3	0.8	0.02	0.69
SCAD (mEq/l)[2]	49.7	48.3	49.8	0.5	0.38	0.03

[1]Contrasts: H vs. S, CS vs. AS

[2]Serum cation-anion difference [(Na + K) – Cl]

49.1, and 51.0 mEq/l for SCAD on day –21, 1, and 15 relative to calving date, respectively.

Serum BUN concentration was negatively correlated with total protein (–0.35) and positively correlated with serum creatine concentration (0.45). Also, serum total protein concentration was positively correlated with serum Ca concentration (0.36) and negatively correlated with serum creatine concentration (–0.58). Interestingly, there was no correlation between serum Ca concentration and SCAD value and between ALP activity and other blood parameters. Serum P concentration was positively correlated with serum K concentration (0.43). Serum Ca : P ratio was negatively correlated with serum K concentration (–0.35). Expectedly, serum Cl concentration was negatively correlated with SCAD value (–0.51).

The effect of the peripartal diets on urine parameters is summarized on Table 4. There was no diet effect on urine creatine, P, Na, and Cl concentrations and urine cation-anion difference (UCAD) value. Although there was no diet effect, urine pH for cows fed hay tended to increase, whereas that for cows fed silages tended to decrease during early lactation. Urine glucose concentration was higher and urine K concentration was lower for cows fed hay than for cows fed silages. However, they did not differ by the silage kind. Urine Ca concentration and Ca : P ratio for cows fed CS were higher than for cows fed AS and they did not differ by the forage type. As lactation progressed, serum Na decreased from 46.6 to 22.6 mEq/l, whereas serum K increased from 202 to 249 mEq/l on day 1 and 15 postpartum, respectively.

There were correlations between urine parameters. Urine pH was not correlated with urine Ca and P concentrations, but it was positively correlated with urine K concentration (0.43) and UCAD value (0.41). There was no correlation between urine Ca : P ratio and other urine parameters. Expectedly, urine K was positively correlated with UCAD value (0.80).

In this experiment, none of the cows suffered from parturient paresis and other postpartum health problems although all diets were cationic. Other studies investing forage effects also showed no adverse effects of forage source on health status in heifers fed silage-based diets (alfalfa versus corn silages) (Grieve *et al*., 1980; Sauer *et al*., 1980) and in cows fed diets containing different proportions of corn silage, gross legume silage, and concentrate (Keys *et al*., 1984). Nocek *et al*. (1986) fed to cows diets consisting of forage only (50% alfalfa silage and 50% corn silage), forage plus grain mixture with high Ca content (1.73%), or forage plus grain mixture with low Ca content (0.35%) during the prepartum and then switched to diets consisting of 50% grain and 50% corn silage or 50% grain, 25% corn silage, and 25% alfalfa silage during the postpartum. Despite a lack of differences in production parameters, all cows experienced hypocalcemia at varying degree, but it was noted that the inclusion of 50% alfalfa silage during the dry period increased the incidence of parturient paresis. In a similar experiment, however, (Belyea

Table 4. The effects of forage source on peripartum urine parameters

Parameters	Diets			SEM	Contrasts[1]	
	AH	AS	CS		average of AS and CS	AS vs. CS
PH	7.9	8.8	9.0	0.0	0.27	0.14
Glucose (mg/100 ml)	2.4	1.7	1.5	0.2	0.02	0.45
Creatine (mg/100 ml)	95.7	78.6	89.0	10.7	0.43	0.48
Ca (mg/100 ml)	1.5	1.4	2.6	0.5	0.52	0.09
P (mg/100 ml)	3.0	2.7	2.9	0.2	0.91	0.37
Ca : P	0.5	0.4	0.9	0.7	0.51	0.06
Na (mEq/l)	36.9	34.1	32.8	10.8	0.84	0.83
K (mEq/l)	200.0	246.0	231.0	18.0	0.09	0.66
Cl (mEq/l)	50.1	58.1	47.4	12.3	0.89	0.52
UCAD (mEq/l)[2]	187.0	222.0	216.0	18.0	0.13	0.89

[1]Contrasts: H vs. S, CS vs. AS

[2]Urinary cation-anion difference = [(Na + K) – Cl]

et al., 1975) reported that increasing the proportion of corn silage increased the incidence of ketosis and parturient paresis.

In the present experiment, a sharp increase in serum glucose on day 1 postpartum indicates metabolic stress, which could be due to increased epinephrine, glucagon, or both (Grummer, 1995). A lack of forage source effect on plasma glucose concentration was also reported by Smith *et al*. (1976), who fed to cows corn silage (18.2 kg/day) plus alfalfa hay *ad libitum*, corn silage (18.2 kg/day) plus alfalfa silage *ad libitum*, and corn silage *ad libitum*. Similarly to serum glucose concentration, a change in BUN concentration during the periparturient period is expected due to hormonal changes and nutrient partitioning. Due to differences in rumen degradable protein contents, forage type and silage kind influence protein utilization and BUN (Hristov and Broderick, 1996). Dhiman and Satter (1997) fed to cows diet consisting of a forage : grain ratio of 50 : 50 with different proportions of alfalfa and corn silages and reported that DMI (% of BW) increased and ruminal ammonia concentration decreased with increasing the proportion of corn silage. Serum creatine concentration may indicate utilization of body protein reserves and expectedly, it was the highest at the parturition. Lower serum creatine concentration during postpartum than during prepartum could be related to utilization of body reserves to support milk production. Calcium and P concentrations of the cows in this experiment were within the physiological limit even at the onset of lactation (Larsen *et al*., 2001). It was reported that except for Ca, other mineral concentrations (Na, K, and Cl) (Bjorkman *et al*., 1994) were not different even between paretic and healthy cows. Serum Na and Cl concentrations were the highest, whereas ALP activity and serum Ca concentration were the lowest at the parturition. Serum ALP activity is an indicator for osteoblast and osteoclast functions. The ALP activity was affected by the diets, but values were within the physiological range (Lappetelainen *et al*., 1993). However, no correlation between ALP activity and serum Ca or P concentration and a negative correlation between the ALP activity and serum Ca : P ratio may suggest that the serum Ca : P ratio could be a better indicator than Ca and P concentrations alone. In agreement with the present experiment, feeding to cows diets containing silages without anionic salt was shown not to influence the blood acid-base status (Belyea *et al*., 1975; Lukaszynski, 1987). Urine pH for all cows was in alkaline character. Urine parameters were not affected by the diets. Although anionic salt was not utilized in this experiment, urine parameters were in agreement with the results reported by Won *et al*. (1996).

CONCLUSION

In this study, the effects of alfalfa hay, alfalfa silage, and corn silage plus concentrate supplement without anionic salt on production and metabolic parameters were investigated in peripartum cows. Except for DMI, the forage source did not influence BW changes during the prepartum and postpartum periods, calf weight, and milk production. There was no effect of forage source on blood and urine acid-base status and serum Ca and P concentrations. Although there was an inverse correlation between serum K concentration and Ca : P ratio, ALP activity was not correlated with other blood metabolites. In conclusion, the forage type (hay versus silage) did not affect prepartum performance. However, regardless of the kind, feeding of silage was advantageous over feeding of hay during the postpartum.

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ABSTRAKT:

Vliv různých dávek objemného krmiva na ukazatele metabolismu a na dojivost v peripartálním období dojnic holštýnského plemene

K hodnocení vlivu objemného krmiva na užitkovost a na ukazatele metabolismu během peripartálního období byla podávána náhodným způsobem 24 dojnicím holštýnského plemene jedna ze směsných krmných dávek-diet, které obsahovaly směs objemných krmiv s převládajícím podílem vojtěškového sena (AH), vojtěškové siláže (AS) a kukuřičné siláže (CS). Produkce mléka a příjem sušiny (DMI) byly evidovány denně; tělesná hmotnost (BW) byla zjišťována a vzorky krve/moči odebírány 21. den před porodem a 1. a 15. den po porodu. Směsné krmné dávky-diety neovlivnily prepartální a postpartální změny BW ani produkci mléka. Během prepartálního období byl DMI vyšší u krav, které dostávaly seno, než u krav krmených silážemi. V průběhu postpartálního období byl zaznamenán nejvyšší DMI u krav, které dostávaly dietu s převahou AH, následovaly dojnice na CS a AS. Použité diety neměly vliv na sérové koncentrace glukózy, Ca, P a K. U dojnic, které dostávaly dietu s převahou CS, jsme zaznamenali nižší sérovou koncentraci dusíku močoviny v krvi (BUN) než u dojnic na dietě AS. Dojnice na dietě s převahou AH vykazovaly nejvyšší aktivitu alkalické fosfatázy (ALP). Sérová diference kationtů a aniontů (SCAD) byla nižší u dojnic na AS ve srovnání s dojnicemi s dietami s převahou CS. Mezi sérovou koncentrací Ca a hodnotami SCAD a ALP nebyl zjištěn žádný vztah, ale negativní korelace byla zaznamenána mezi podílem Ca a P a sérovou koncentrací K. Podávané diety neovlivnily hodnotu pH v moči a hodnotu rozdílu kationtů a aniontů v moči (UCAD). Koncentrace Ca a podíl Ca a P v moči dosahovaly vyšších hodnot u krav na dietě s převahou CS než u dojnic na AS. Hodnota pH v moči byla v pozitivní korelaci s koncentrací K a hodnotou UCAD v moči. Závěrem lze říci, že druh objemného krmiva neovlivňoval prepartální užitkovost. V postpartálním období bylo výhodnější podávání siláží bez ohledu na druh než zkrmování sena.

Klíčová slova: seno; siláž; objemné krmivo; peripartální období; metabolity; dojnice

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