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Monitoring the Nutritional and Reproductive State of Dairy Cows Through the Presence of Urea in Milk

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ABSTRACT

The effects of farm, parity (PO) and month of parturition on milk production, percentage of fat and protein, somatic cell count (SCC), and milk urea nitrogen (MUN) concentration were assessed on four specialized dairy farms using 120 cows. Also, the effects of MUN on gestation rate (GR) and artificial insemination rate (AIR) in early lactation were studied. The parameters of production and milk quality were similar among farms and were not influenced by the month of parturition. Farm D presented the highest MUN concentration. Concentration of MUN, percentages of fat and protein and SCC were not influenced by PO. Cows with a value of MUN between 10.1 and 13.0 mg/dL had the highest AIR and GR between days 55 and 70 postpartum and after 70 days in milk. These data suggested that MUN concentration was a useful parameter to predict the nutritional and reproductive stages of dairy cows.

Key Words: dairy cattle, gestation, insemination, milk urea nitrogen, parturition order

INTRODUCTION

Concentration of milk urea nitrogen (MUN) has been used to monitor protein metabolism in dairy cows, and blood urea concentrations are a good estimate of the nutritional and reproductive status of cows (Roseler et al., 1993; Block et al., 1998). High levels of MUN usually reflect inadequate synchronism between the carbohydrates available to fermentation in the rumen and rates of degradable (RPD) and undegradability protein in the rumen (RUP) (Gustafsson and Carlsson, 1993). The basis for the usage of MUN as nutritional indicator is the high correlation between the MUN and blood urea nitrogen (BUN), due to the free diffusion of urea in the organic tissues (Moore et al., 1996/ Melendez et al., 2000).
According to Jordan and Swanson (1979), when the cows are fed with an excess of RPD during the beginning of lactation, the negative energetic balance (NEB) is severe due to the increase in energy intake to transform the excess of ammonia in urea in the liver. According to these authors, variations in the progesterone release rate may also be considered. The NEB, during the beginning of the postpartum period, may have residual effects during the 40 to 60 days necessary for the follicle development, possibly impairing the health of the

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pre-ovulatory follicle during the mating season (Butler and Smith, 1989).
The intrinsic factors such as lactation stage and milk production per lactation must be taken into account when assessing the MUN (Eicher et al., 1999). However, Faust and Kilmer (1996) stated that the lactation stage did not influence the MUN values.
Faust and Kilmer (1996) observed that the highest values of MUN were from cows in their 3rd and 4th lactation periods, and the lowest from older cows, concluding that the parturition order had a significant effect. Eicher et al. (1999) collected samples of milk from 418 clinically healthy cows, more than 30 days after parturition in 10 herds of cattle and stated that the influence of the number of parturitions in some models probably reflect the difference in managing and feeding in primiparous cows. This indicate the need to differentiate multiparous and multiparous in the assessments.
Differences in dry matter intake, adaptation of ruminal microorganisms and the ruminal capacity of absorption may contribute to modify the MUN concentration at different stages of lactation (Godden et al., 2001a; Rigolon et al., 2009). However, when controlling nutrition, Eicher et al. (1999) observed no association between the number of parity, stage of lactation and MUN concentration, thus suggesting that non-nutritional factors have little effect on the relationship.
This study aimed at assessing the effects of farms, parturition order and month of parturition on milk production, percentages of fat and protein, somatic cell count and milk urea nitrogen. The effects of MUN on the gestation period and the anestrous in the beginning of lactation, rate of inseminated cows (RIC), parturition – insemination interval and the number of inseminations on four dairy Farms were also studied.

MATERIALS AND METHODS

This work was developed on four dairy Farms, located in Carambei, State of Parana.
The Farms, nominated A, B, C and D, were under the dairy control of the Parana´s Holstein Cattle Breeders Association (APCBRH).
The data obtained from each Farm enabled the grouping of cows according to parity number and month of parturition to assess the milk production and quality and concentration of milk urea (MUN). Three groups were formed to look at the effect of parity number: Group 1 – animals of 1st parity; Group 2 – animals of 2nd parity; Group 3: animals of 3rd or greater parity. There were 35 heifers in group one, 30 cows in group two, and 55 cows in group three. The data were collected from July to December 2002. Animals were blocked in four different classes to look at the effect of MUN concentration: 1. animals with levels lower than 10.0 mg/dL; 2. animals with levels between 10.1 and 13.0 mg/dL; 3. animals with levels between 13.1 and 15.0 g/dL; and 4. animals with levels higher than 15.0 mg/dL.
The animals from each farm received a diet Total Mixture Feed complete in energy, protein and minerals, and according to their needs calculated based on NRC (2001). Table 1 shows the chemical composition of the diets offered to the animals.
The animals were mechanically milked three times a day, and the milk for the analyses was collected at the time of the milking in recipients with bronopol (2-brom-2-nitropropan-1,3-diol), a preservative.
The samples of milk were collected and sent, firstly, to the Analysis Program of Dairy Cattle of Parana from APCBRH, located in Curitiba – Parana, to determine the percentages of fat and protein and Somatic Cell Count (SCC). The percentages of fat and protein were determined by using the equipment Bentley 2000 (Bentley Instrument Inc., Chasca, Minessota, USA), which enabled the analysis of physical-chemical components by waves in the infrared band approved by IDF (1980). The SCC was determined and analyzed using an electronic counter (SOMACOUNT 500®) according to Souza et al. (2004) and Torii et al. (2004). Another sample containing a preservative (bronopol) was sent to the Technology Center for the Management of Dairy Cattle Raising (Clinic of Milk – ESALQ-USP, "Luiz de Queiroz College of Agriculture". Piracicaba, SP) for the analysis of urea that was determined using an infrared method (IR Fossomatic 4000 Milk Analyzer - Foss North America, Brampton, Ontario, Canada) according to Godden et al. (2001b).
Ingredient composition of the diets and the quantities supplied were obtained every 15 days throughout the experimental phase. Samples of feed ingredients fed to the cows were collected at feeding time and pooled on a 15-d basis. Feed samples were dried and ground for subsequent chemical analysis. The samples were placed in plastic bags, properly identified and sent to the

Analysis Laboratory of Food and Animal Nutrition of Maringa State University. Chemical analysis of crude protein (CP), calcium (Ca), phosphorus (P) and dry matter (DM) were determined according to AOAC (1984) and acid detergent fiber (ADF) Van Soest et al. (1991).

The cows were inseminated after a postpartum rest period of approximately 55 days. After applying the Ovsynch protocol, gestation was diagnosed after first breeding (coinciding with the period of 55 to 70 days after parturition), 25 to 30 days after insemination via transrectal ultrasound and confirmed by rectal palpation between the 45th and the 55th day of gestation. Reading of the ovaries was performed and a new protocol for synchronization and ovulation was initiated in case of non-gestation. Confirmation of gestation after second breeding this mating (between 71 to 180 days after parturition) was then performed from day 25 after insemination.

Data on milk production, percentages of fat, protein, lactose and total solids, SCC and MUN were tabulated and classified according to Farm, parity number and month of parturition. Main sources of variation were Farm (4 subclasses), parity number (1 to 3), and month of parturition (5 subclasses – August to December). The data were analyzed using the method of minimum squares, following a model that includes the fixed effects: Farms, parturition order and month of parturition.

The SCC was submitted to logarithmic transformation according to Sampaio (1998) for subsequent statistical analysis.

The data were analyzed using the software SAS (1992) and the means were compared through the Tukey Test at 5%. With the exception of the comparison of the MUN concentrations per band over the % of artificially inseminated cows (AIR), % of the cows in estrus, gestation rate and parturition – AI interval underwent a Kruskal-Wallis non-parametric test (Ayres et al., 2000).

Table 1 - Percent composition of feeds on the four farms assessed based on dry matter (%).

Ingredients	**Farms**			
	A	**B**	**C**	**D**
	% of DM			
Corn silage	43.59	46.51	45.65	43.94
Moist corn grain silage	4.63	-	-	-
Pre-dried rye grass silage	14.87	12.87	11.54	11.68
Cotton seed	-	-	8.0	7.0
Barley	16.03	19.55	-	-
Soybean grain hulls	1.78	1.78	6.67	8.24
Concentrated feed	17.36	17.36	26.48	27.48
Mineral-vitamin supplement [1]	1.50	1.50	1.66	1.66
Sodium bicarbonate	0.24	0.43	-	-
Total	100	100	100	100
	Chemical composition of feed (% of DM)			
Crude protein	14.82	14.85	16.80	15.89
Total digestible nutrients[2]	72.1	71.8	72.2	71.4
Acid detergent fiber	19.9	20.7	24.0	23.99
Calcium	0.58	0.59	0.60	0.61
Phosphorous	0.37	0.38	0.39	0.40

[1]Composition of mineral salt= Calcium 90 g, phosphorous 70 g, magnesium 80 g, copper 700 mg, zinc 5400mg, cobalt 50 g, iodine 180 g, selenium 40 mg, sulfur 20 g, sodium 200 g, manganese 500 mg, Vitamin A = 4.800.000 UI, Vitamin D3 = 48.0000, e Vitamin E = 24.000 UI.
[2]Total digestible nutrients obtained from NRC (1989).

RESULTS AND DISCUSSION

Data on dry matter intake (DMI), milk production (MP), 4% fat correct milk production (FCM), % of fat, % of protein, SCC and MUN are presented as means and standard deviations for each one of the Farms (Table 2).

In each farm, the DMI was different, varied from 19.5 to 21.5 kg/cow. Bargo et al. (2002) estimated an average intake of 21.9 kg of DM/day for Holstein cows, weighing 620 kg and producing 26.9 kg of milk per day, with 3.5% of fat, keep in pastures and receiving concentrate. According to these authors, the estimated consumption of dry matter through the equation from NRC (2001) was similar to the one determined using the external marker, chromium oxide (21.6 kg of DM/day). On the other hand, Silva et al. (2007), working with confined cows, observed that DMI estimated with chromium oxide varied from 16.0 to 16.4 kg/day/cow. These data were lower than to those registered in the present experiment, probably due to the level of milk production and the cow`s body weight, around 21.3 and 22.7 kg/milk/day and an average of 550 kg of body weight (CW).

Table 2 - Means and standard deviations for the variables, dry matter intake (DMI, kg) and (DMI, % CW), milk production (MP), FCM at 4% of fat, % of fat, % of protein, somatic cell count (SCC).

Variables	FARMS			
	A	B	C	D
DMI (kg DM)[1]	19.5	21.5	20.1	21.4
DMI (% CW)[2]	3.2	3.3	3.1	3.4
MP±SD (Kg)	33.53±1.49a	36.78±1.58a	35.41±1.84a	33.70±1.12a
FCM 4% fat[3]	28.41±1.45a	30.38±1.50a	28.88±1.62a	30.82±1.06a
Fat (%)	2.99±0.25	2.84±0.27	2.77±0.31	3.43±0.19
Protein (%)	2.79±0.04	2.91±0.04	2.86±0.05	2.75±0.03
SCC (x 10^3/mL)	135.33±111.4a	174.16±119.0a	193.03±137.6a	374.24±84.0a
Log10 SCC[4]	4.60±0.68a	4.75±0.65a	4.8±0.72a	5.28±0.73a

a, b, c, - Means followed by different letters, on the same line, differ among themselves ($p<0.05$),
[1]Dry matter intake estimated by the equation from NRC (2001):
(DMI = $((0.372 \times FCM + 0.0968 \times CW^{0.75}) X (1-e^{(-0.192 \times LW + 3.67)})$, being FCM = fat corrected milk 4% Fat, CW = body weight and LW = lactation weeks.
[2]Dry matter intake in relation to body weight,
[3]Fat corrected milk production (FCM) - 4% G= (0.4 x MP) + (15 x Fat x MP),
[4]Somatic cell count in logarithmic form.

Milk production, FCM at 4% of milk fat, % of fat and of protein were similar among the farms and were not affected by the month of parturition. This probably occurred because the cows were kept confined and received the same feed during the six months of the experiment (July to December), corresponding to the winter (July to September) and spring (September to December). The same behavior occurred with the data obtained by Carlsson et al. (1995) for the animals kept confined. In general, differences in MUN concentrations have been reported for cows on pasture (Vignon et al., 1978; Refsdal et al., 1985; Carlsson and Pehrson, 1993). The concentration of non-protein nitrogen (NPN) is variable as a function of the season and the level of nitrogenated fertilization on the herbage. In spring and early summer, forages have higher concentration of NPN than in the other seasons (Cecato et al., 2001). The lowest level of MP (33.53 kg/day) was found at farm A and the highest one at farm B (36.79 kg/day). However, they were not statistically different. The highest fat was observed at farm D (3.43%) and the lowest one at farm C (2.77%). The % of P in milk presented values varying from 2.75% at Farm D to 2.91% at farm B. For dairy cows on pasture, Vilela et al. (2006) observed daily mean yields of 15.54 and 19.15 kg of milk, for the cows supplemented with 3 to 6 kg/cow/day of concentrate. Silva et al. (2007), working with the confined cows, found 3.15% to 4.44% of Fat and 3.10 to 3.13% of P in the milk.

Crude protein concentrations of diets on Farm (Table 1) were 14.82, 14.85, 16.80 and 15.89% for farms A, B, C and D, respectively. Dietary concentration of CP on farms C and D were in agreement with values of 16 to 17% recommended by the NRC (1989) for the cows in early lactation (21 to 70 days of lactation). However, farms A and B had values of 14.82 and 14.85%, respectively, which were slightly under those recommended by the NRC (1989).

Table 2 shows the values of SCC in normal and after logarithmic transformation. Farm D had concentration of SCC that were significant higher than those on other farms. Farm A presented the lowest SCC and farms B and C were not significantly different. Sampaio (1998) toward that, when a really unstable answer was measured under different treatments, the instability increased as the mean value observed in the treatment

increased. Proportionality between the mean of the experimental group and its respective standard deviation was also observed.
Primiparous cows present a lower milk yield comparing to cows of three or more parturitions and cows at their second parturition. However, the yield of cows at second parturition was better than to those of three or more parturitions. The results of fat and protein in milk and SCC ($x10^3$/mL) did not present statistical differences in the observed values. Nevertheless, SCC in logarithmic form showed that the cows with more than two parities had values of SCC lower than those of the cows at first or second parity (P<0.05). However, even for these the cows, the values were well below the critical level leading to mastitis.

Table 3 - Means and standard deviations for the variables, milk production (MP), FCM for 4% of fat, % of fat, % of protein, SCC.

	Parturition Order		
	1	**2**	**3 or more parturitions**
MP (kg)	32.74 ±1.33c	37.61±1.64a	33.91b±1.07b
FCM - 4% fat	27.88b	31.91a	28.97ab
Fat (%)	3.01±0.23	2.99±0.28	3.03±0.18
Protein (%)	2.88±0.041	2.82±0.051	2.87±0.03
SCC (x 10^3/mL)	297.61±99.56	294.80 ±112.50	263.67±80.24
Log_{10} SCC[1]	4.83 ±1.13b	4.82± 1.10b	4.61± 1.13a

a, b, c – Means followed by different letters on the same line differ among themselves by the Turkey Test (p<0.05);
[1] Somatic cell count in logarithmic form.

There were no statistical differences (Figura 1) in MUN concentration among the parities but an increase in lactation tended to decrease the MUN. However, Broderick and Clayton (1997) observed that the concentration of MUN decreased with higher parity number, which agree with the tendencies observed in this study.
According to Alves (2001), the energy available in ingredients for the production of microbial protein increased of the production of protein in milk. If there was more energy available to the animal, more amino acids would be available to the glyconeogenesis, allowing them to be used in other functions, including the production of milk protein.
Farm D presented the highest value of MUN (P<0.05), different from the other farms. This variation was probably related to the differences in the nutritional and milking management, as observed when the data were available to all the four farms.

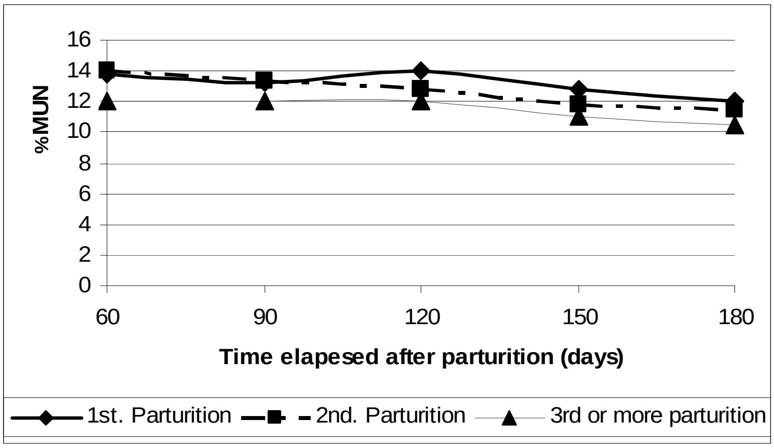

Figure 1 - Influence of the lactation stage in the concentration of urea in milk (MUN) in three parturition orders.

The average values of MUN on farms B and C were similar, but they were significantly lower than those on farms A and D. Although the latter registered the highest levels of MUN, these values were within the desirable parameters according to literature, i.e., between 12 and 18 g/dL (Blauwiekel et al., 1986; Roseler et al., 1993; Block et al., 1998).

The differences in gestation rates among the farms (Table 4). Farms A and D presented the highest gestation rates. Farms A and D also presented the highest levels of MUN, with an average value of 13.1 and 14.6 mg of MUN/dL, respectively. However, MUN between 12 and 18 mg/dL have been considered within normality by various authors (Blauwiekel et al., 1986; Roseler et al., 1993) although others (Carlsson and Pehrson, 1993; Block et al., 1998) found that values between 10 and 16 mg/dL would be more adequate.

In either of the above limits, the results fitted well as they did not cross 14 mg of MUN/dL. However, they were not sufficiently high enough to affect the gestation rate (Table 4).

Table 4 - Means and standard deviations for the diagnosis of gestation and urea nitrogen in milk (MUN) as function of the following variables: Farms and parturition order.

Variable	Farms			
	A	B	C	D
Gestation (%)	84±0.07a	59±0.01b	50±0.01b	81±0.07a
MUN (mg/dL)	13.13±0.61b	12.52±0.66a	11.14±0.76a	14.60±0.46c
	Parturition Order			
	1	2	3 or more parturitions	
Gestation (%)	71.8±0.081a	71.8±0.074a	62.5±0.077a	
MUN (mg/dL)	13.20±0.55a	13.37±0.67a	12.01±0.44a	

a, b, c – Means followed by different letters on the same line differ among themselves (p<0.05).

The parturition order did not influence the concentration of urea in milk, with no differences among the farms (P<0.05) (Table 4). Godden et al. (2001b) and Rajala-Schultz et al. (2001) also observed that the parturition order (1st, 2nd and 3 or more) did not affect the average concentration of MUN in cows. It probably happens when essential factors of nutritional management are perfectly controlled and no longer acting on MUN.

However, Broderick and Clayton (1997) observed that the concentration of MUN decreased with greater parity number, which agree with the tendencies observed in this study.

Farms A and D presented the highest values of urea in milk and also had the highest gestation rates, with values of urea in milk above 13 and 14 mg/dL, respectively. Farm D and A provided a diet with crude protein of 15.89 and 14.82%, respectively. The amount of protein provided by Farm A was slightly lower than the needs recommended by NRC (1989). Farms B and C presented the lowest gestation rates. The levels of protein provided to the animals were 14.85 and 16.8%, respectively.

Blauwiekel et al. (1986) reported that the excesses in urea were toxic for the spermatozoids and ovules when their levels were above 20 mg/dL, with possible reduction in the conception rates. According to Westwood et al. (1998), the consumption of high quantities of proteins or byproducts of its metabolism such as urea or ammonia might act on the hypothalamus-hypophysis-ovary axis, both directly and indirectly through the changes in the energetic metabolism. This could have a local effect in the reproductive handling as it alters the uterine environment and influences the survival or the function of the gametes or embryos (Elrod and Butler, 1993). Since there would be alteration in the cow's energetic metabolism, it would directly interfere on the production and release of hormones.

According to Alves (2001), low levels of MUN are due to a better balance in the proportions of energy and protein, with a lower release of ammonia and rumen and consequently decrease in the production of urea in the liver. However, excess of energy and little protein may lead to low rates of MUN and consequently affect the GP. An elevated concentration of urea in milk also means a non-balanced diet (Broderick and Clayton, 1997). Besides, the more urea in milk, the lower would be the concentration of true proteins, mainly casein (Westwood et al., 1998; Canfield et al., 1990; Godden et al., 2001a).

Ingredient composition of diets might have influenced the MUN concentration due to composition being different on each farm.
The diets presenting different degradabilities, for both starch and protein sources, might contribute for the resulted. The use of corn and barley as protein sources could be one of the factors responsible for the variation in the proportions of urea in milk since barley starch presented high degradability (81%) whereas corn starch presented a lower degradability rate (56%). Differences in synchronism between the supply of carbon chains and that of protein for rumen microorganisms would lead to differences in the efficacy of transformation of ammonia in microbial protein. Another possibility could be that higher quantity of concentrate was provided in the TMR (around 43%) on farm D, probably leading to excess of ammonia that was converted in the liver into urea as confirmed by Melendez et al. (2000).
These authors observed a peak in the ammonia concentration in the ruminal liquid when diets with starch source of low degradability and nitrogen of fast ruminal degradability were provided for the cows in the beginning of their lactation. According to Moore et al. (1996), the great difficulty in interpreting MUN was due to the inadequate quantities of carbohydrates ready to undergo fermentation in the diet which resulted in an increase of MUN due the difficulty for the rumen's micro organisms to capture the excess of ammonia. Also, the ruminal pH above six might affect the growth of certain ruminal microorganisms and, therefore, their capacity to capture ammonia, thus, resulting in high proportions of MUN.

Table 5 - Means and standard deviations for artificial insemination index, for variables Farm and parturition order.

Variable	**Farms**			
	A	**B**	**C**	**D**
Insemination	1.64±0.16b	1.80±0.26b	1.72±0.17b	1.48±0.12a
	Parturition order			
	1	2	3 or more parturitions	
Insemination	1.55±0.13a	1.81±0.18a	1.57±0.12a	

a, b, c – Means followed by different letters on the same line differ among themselves by the Turkey Test ($p<0.05$).

As can be seen from Table 5, the insemination rate did not statistically differ for parturition order. However, there were statistical differences among the farms, with farm D presenting the lowest number of inseminations and the highest mean of urea in milk. According to Rajala-Schultz et al. (2001), the value or urea in milk above 13 mg/dL alters the insemination rate.
The effects of MUN on the reproductive parameters are shown in Tables 6 and 7. The cows with MUN under 10.0 mg/dl presented the worst gestation rate when compared to the cows with MUN above 10.1 mg/dL. Other studies also concluded that a concentration too low in MUN is related to a low fertility in dairy cows (Gustafsson and Carlsson, 1993). The results for AIR and cows in anestrous showed that the levels of MUN under 10.0 mg/dl, between 13.1 to 15.0 mg/dL and above 15.0 mg/dL presented the highest anestrous rates and the lowest AIR, coinciding with low gestation rates in the postpartum period of 55 to 70 days (Table 6). Similar behavior has been also obtained by Carlsson and Pehson (1993), who observed that herds of cattle with low levels of MUN (<10 mg/dL) presented a longer interval between parturition and the 1st insemination. In the period immediately after parturition, the dairy cows start a negative energy balance (NEB). Most frequently NEB cause ketosis, affecting the hepatic function, which, because of intense lipid mobilization, leads to the formation of ketone bodies impairing the reproductive efficiency (González, 2000), as well as the efficiency to reconvert ammonia in urea (Strang et al., 1998).
The energy: protein balance, when modified, promotes a retard in the beginning of the ovary's activity, affecting the reproductive efficiency. High levels of urea in milk may indicate an energy deficiency in the diet which alters the function of the hypothalamus-hypophysis-ovary axis, causing anestrous in the animals, which leads to a decrease in the gestation rate as observed in the present work.

Table 6 - Effect of MUN concentration on the first mating (55 to 70 days after parturition).

Order	MUN (mg/dL)	Total # of cows	% of inseminated cows	% de cows in nestrous	Gestation rate
1	< 10.0	15	40.0	60.0	16.6
2	10.1 – 13.0	22	72.7	27.3	68.7
3	13.1 – 15.0	21	33.3	66.7	28.5
4	> 15.1	28	39.3	60.7	45.4
Contrast					
P (1 vs. 2)			0.0060	0.0001	0.0001
P (1 vs. 3)			0.0001	0.0013	0.0220
P (1 vs. 4)			0.0669	0.7995	0.0001
P (2 vs. 3			0.0001	0.0001	0.0001
P (2 vs. 4)			0.0001	0.0001	0.0003
P (3 vs. 4)			0.0002	0.0005	0.0021

Analyses performed with the non-parametric test of Kruskal-Wallis (Ayres et al., 2000).
P<0,05 depends on the level of urea in milk,
P>0,05 does not depend on the level of urea in milk.

Elrod and Butler (1993) observed conception rates of 87.7, 72.5 and 42.8% when MUN was lower than 9.9 mg/dL, 9.9 to 16 mg/dL and above 16 mg/dL, respectively. Still, the results obtained here showed good gestation rates (81.48%) with levels above 15 mg/dL. However, Hutjens and Barmore (1995) stated that values of MUN under 12 and above 16 reflected nutrition loss, higher feed cost, deleterious effects to the animals' health and reduction in the milk production.

The parturition order and level of milk production affected the milk urea nitrogen (MUN), body score and insemination rate. There was no effect of parturition order in the MUN, fat, protein and SCC, but animals of second parturition presented higher milk yield. The levels of milk yield did not influence MUN, MP, fat and protein.

The animals with MUN under 10.0 mg/dL presented the lowest gestation rates, although animals with urea between 10.1 and 13.0 mg/dL presented the highest gestation rates in the postpartum period of 55 to 70 days. After 70 days after parturition, the values of MUN above 10.0 mg/dL resulted in better gestation rates, while the ones under 10.0 mg/dL had the worst indices.

CONCLUSION

Milk production, FCM – 4% fat, % of fat and % of protein were similar among the farms and were not affected by the month of parturition. Cows in 2^{nd}parity produced significantly more milk than those ones of higher parity. However, when the FCM was corrected to 4%, only significant differences between the primiparous and multiparous cows at 2^{nd} parity were observed. No significant difference was observed for the concentrations of fat and protein among parities and farms. The SCC was similar among, the farms and all values were below 375 x 10^3 cells/mL. Parity only affected the SCC after logarithmic transformation. There were some differences among the farms for MUN. The values of MUN under 10 mg of N/dL resulted in the lowest GP and values between 10.1 and 14.6 mg of N/dL resulted in the highest GP. Concentrations of MUN tended to decrease with days of lactation for all paritities, and the GP was slightly superior on farms A and D when compared to the other farms. Number of parity had no affect on GP; farms A, B and C presented the same AIR but they were higher than that observed on farm D. The AIR was similar among parities.

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RESUMO

Avaliaram-se os efeitos de fazendas, ordem de parto (OP) e mês de parição sobre a produção de leite (PL), porcentagem de gordura, de proteína, contagem de células somáticas (CCS) e nitrogênio uréico no leite (NUL) de quatro fazendas leiteiras especializadas, totalizando 120 vacas em lactação. Estudaram-se, também, os efeitos do NUL sobre a taxa de gestação (TG) e taxa de inseminação (TIA) no início da lactação. Os parâmetros produtivos e de qualidade do leite foram semelhantes entre fazendas e não sofreram influência do mês de parição. A Fazenda D apresentou a maior taxa de NUL. A OP não influenciou a NUL, % de gordura, % de proteína e CCS. Os animais com NUL entre 10,1 – 13,0 mg/dL apresentaram as maiores TIA e TG, tanto nas fases de 55 – 70 dias como após 70 dias pós-parto. Conclui-se que o NUL é um parâmetro útil para monitorar o estado nutricional e reprodutivo de vacas leiteiras.

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