Determination of milk urea nitrogen for the Egyptian cattle fed the summer and winter diets.

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Abstract: Milk urea nitrogen (MUN) equilibrates with and is proportion to blood urea nitrogen. So, it is an excellent indicator of urea nitrogen status in dairy cows. The objective of this study was to determine the MUN during the summer (with a temperature range of 35-40˚C) and winter (with a temperature range of 18-22˚C) seasons. Forty hetero- parity lactating cattle twenty of each cows and buffaloes, at different stages of lactation were used to collect milk samples. All animals received the diet consisting of concentrate, fodder, and rice straw as 2:1:1 on DM basis. The fodder was berseem(*Trifolium alexandrium*) and rayana corn(*Zea mays mexicana*) in the winter and summer, respectively. The dietary crude protein was 11.38 and 8.97 % and the dietary gross energy was 3.86 and 3.83 Mcal/kg DM for the winter and summer diets, respectively. The results indicated, milk protein content was 3.06 and 3.18 % and MUN was 24.57 and 28.00 mg/dl for cows, while milk protein was 3.96 and 2.67 % and MUN was 19.60 and 28.03 mg/dl for buffaloes during the winter and summer seasons, respectively .This study revealed that the heat- summer significantly (P<.05) increased MUN of lactating buffaloes and this phenomenon needs further studies. [Journal of American Science 2010;6(12):382-384]. (ISSN: 1545-1003).

Keywords: dietary protein, cow, buffaloes, milk urea nitrogen.

1. Introduction

Milk urea nitrogen is the major single contributor to milk non – protein – nitrogen. Milk urea is derived primarily from blood urea which is produced from excess ruminal ammonia and amino acids catabolism in the liver (De Peters and Ferguson, 1992). In the mammary gland, urea diffuses into and out of the mammary gland cells, equilibrating with urea in the blood. Because of this process, milk urea nitrogen (MUN) equilibrates with and is proportional to blood urea nitrogen. This equilibration allows MUN to be an excellent indicator of urea nitrogen status in dairy cows (Roseler et al.1993)

Several studies have shown an association between MUN and fertility reporting that increasing MUN levels appear to be negatively related to dairy cow fertility and are associated with a lower risk of detectable pregnancy at herd checks (Butler et al .1996) and Rajala – Schultz et al . (2001) .

MUN concentrations provided a reliable estimate of dietary crude protein content, and provided an accurate prediction of urinary – nitrogen – excretion (Ciszuk and Gebregziabher, 1994, Kohn, et al. 1997, Jonker, et al. 1998, Froidmont, et al. 2003, Nousiamen, et al. 2004 and Huhtanen, et al .2008) .

Concerning the factors affecting the MUN in cattle, it could be reported that dietary concentrations of crude protein and the value of ruminal protein balance (PBV) were the main nutritional factors influencing MUN. It is of interest to define PBV by the difference between the ruminal degradable protein (RDP) supply and microbial requirements of RDP (Nousiamen, et al .2004 and Huhtanen et al .2008).

The purpose of this study was to determine the MUN concentrations for lactating cattle fed the summer and winter diets in Egypt.

2. Material and Methods

Forty hetero –parity lactating cattle, twenty of each cows and buffaloes, at different stages of lactation were used to collect milk samples during the winter and summer months, in the Atfih village of the Helwan governorate.

The day of winter months (January and February) was with a temperature range of 18-22˚C, while it of the summer months (June and July) was with a temperature range of 35-40˚C. All animals received the same diet consisting of concentrate, green fodder, and rice straw at 50:25:25 (on DM basis), respectively. The green fodder was berseem (*Trifolium alexandrium*) and rayana corn *(Zea mays mexicana*) for the winter and summer, respectively .Drinking water was available ***ad. lib.*** The chemical composition of feed ingredients is shown in Table 1. The analytical methods were performed according to A.O.AC., 1995.

All animals were milked individually twice daily .For each animal ,milk yield was daily recorded .Milk samples were taken biweekly and frozen at -18˚C until analysis for the milk protein and urea by the infra red spectro photometry (Foss 120 Milko Scan, Foss Electric, Hillered, Denmark) according to A.O.A.C., 1995.

The dietary crude protein content, dietary gross energy, and the average of the daily milk yield are shown in Table 2. The gross energy was calculated by the equation suggested by Blaxter, 1968, as follows:
Gross energy (Mcal/ Kg DM)= 4.15 CF+ 5.65 CP + 9.40 EE + 4.15 NFE.
Dietary CF,CP,EE,and NFE were calculated on the basis of contents illustrated in Table 1.

Analysis of variance was conducted according to Snedecor and Cochran, (1982). Since, four replications of a 2 ×2 factorial arrangement of groups were used . The applied model was:

$$y_{ijk} = \mu + A_i + D_j + W_k + (AD)_{ij} + E_{ijk}$$

whereas, y_{ijk} is an observation, μ is a population mean, A_i is effect of animal type (cow or buffalo), D_j is an effect of diet (summer of winter diet), W_k is an effect of sampling time (biweekly), $(AD)_{ij}$ is an interaction effect between animal and diet, and E_{ijk} is a residual error. The differences among means were tested using Tukey test according to the same reference.

3. Results

Data of Table 2 clearly indicated that the CP content of the summer diet (8.97 %) decreased by 20 % of that for the winter diet (11.38 %). It is a reliable result attributing to having the winter fodder (berseem) CP (13.8 %) as three times of that of the summer fodder (rayana corn) (4.15 %).

Also, it could be reported that both diets contained equal calories. The winter diet had 3.86 Mcal/kg DM, and the summer diet had 3.83 Mcal/kg DM.

Milk protein and milk urea nitrogen

Data of Table (3) indicated that milk of lactating Baladi cows contained 3.06 and 3.18 g protein / 100 ml milk for cows fed the winter and summer diets, respectively. The data showed, also, the average of milk protein content was 3.96 and 2.67 % for buffaloes fed berseem and rayana corn during the winter and summer, respectively. Statistically, non significant difference (P > .05) was noticed between the cows averages, while a high significant variance (P<.05) was detected between the buffaloes means.

Obviously, the values of milk urea nitrogen (MUN) have taken the same trend of milk protein contents for lactating Baladi cows during the winter and summer (24.57 vs. 28.00 mg/ dl, respectively) .However, there was a high significant difference between the MUN averages (19.60 and 28.03 mg/ dl milk) of lactating buffaloes during the winter and summer, respectively.

Table 1. The chemical composition of feed ingredients

Ingredients	DM %	Contents on DM basis %				
		CF	CP	EE	NFE	Ash
Concentrate[1]	93.49	15.23	14.10	04.08	53.14	13.45
Berseem	18.00	27.40	13.80	02.60	42.04	14.16
Rayana corn	23.26	25.47	04.15	03.42	52.82	14.14
Rice straw	91.80	34.20	03.50	01.40	52.47	08.43

1Concentrate feed mixture

Table 2. Dietary CP ,Dietary gross energy ,and milk yield

Item	Diets			
	winter		summer	
Dietary CP %	11.38		08.97	
Gross energy Mcal/Kg DM	03.86		03.83	
Item	Cattle			
	Cows		Buffaloes	
	winter	summer	Winter	Summer
Milk yield Kg/h/d	05.55	05.21	06.90	5.7

Table 3. Milk protein and milk urea nitrogen of lactating cattle fed winter and summer diets .

Item	Cows Diet		Buffaloes Diet		SE
	winter	summer	winter	summer	
Milk protein content %	3.06^{cb}	3.18^{ab}	3.96^{a}	2.67^{d}	0.47
Average %	3.12		3.31		0.095
Milk urea nitrogen (mg/dl)	24.57^{cb}	28.00^{ab}	19.60^{d}	28.03^{a}	3.45
Average (mg/dl)	26.28		23.82		1.23

a,b,c,d means in the same row with different superscripts differed significantly at (P ≤ 0.05) .

4. Discussion

First of the all, it could be reported that buffaloes not cows exposed to heat – stress when an ambient temperature ranged from 28 to 44°C (Ross Cockrill, 1974). In the present work, the summer was with a temperature range of 35-40°C.

The significance increasing of MUN for buffaloes may possibly be related to a change in the acid – base balance caused by the heat- stress. Also, MUN increasing in buffalo milk can reflect adverse effects on the buffalo fertility and on the nitrogen emission during the hot summer in Egypt.

5. Conclusion

The heat – summer had an adverse effect only on the lactating buffaloes not cows, whereas, their MUN significantly increased ($P \leq 0.05$) by ≈ 40% in the summer comparing with that in the winter.

6. Comment

In our opinion an additional research is needed to explain why MUN level was high for buffaloes in the summer and to decrease this level - may be - by the DCAD tool or by the urease inhibitors tool . DCAD means the dietary- cation – anion – difference .

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