

Milk Composition, Rennet Coagulation Time, Urea Content of Anatolian Buffaloes Milk (Ilıkınar Village of Hatay Province).

I. Environmental factors

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Abstract: The objectives of this study were to investigate determining environmental factors on composition, renneting time, urea concentration, acidity, density and pH of Anatolian Buffaloes milk. As a total of 115 milk samples from 53 cows that were calved in 2004 and 2005 in 8 units of Ilıkınar Village were collected in morning milkings in June, September, December and March. The cows were on their lactation days 30±15, 60±15, 90±15, 120±15, 150±15, 180±15, 210±15, 240±15 and 270±15. The milk samples were analysed for total dry matter, fat, protein, ash, density, pH, acidity, renneting time and urea content. Rennet coagulation time, urea, protein and fat contents were determined using Berridge, photometric, formol titration and Gerber methods, respectively. Data were classified as follows; lactation stages: 1 (30±15, 60±15, 90±15 days); 2 (120±15, 150±15, 180±15); 3 (210±15, 240±15, 270±15); calving year: 1 (2004), 2 (2005); calving season: 1 (January-May), 2 (September and October); month of samples collection: 1 (June), 2 (September), 3 (December), 4 (March); lactation order: 1 and 2 : 1, 3 and 4: 2, 5 and 6: 3. Effects of environmental factors on each variable were investigated separately and analysed using analysis of variance. Production mount on all the characteristics; calving year and lactation stage on most of the characteristics; lactation order on fat and protein contents; unit and calving season on some of the characteristics were found to be effective significantly.

Key Words: Buffalo, milk properties, variation sources

1. Introduction

It is a well established fact that there are several factors affecting milk composition. It varies from one genotype to another (1, 2). Feeding (3), lactation stage (4, 5, 6) production season (7, 8) and calving season (7, 9, 10, 11) have significant effects on fat, casein, protein and total dry matter (TDM). Lactation order also has important influence on milk yield and its constituent contents (4, 10) although Şekerden et al (5), reported that lactation order did not have an important effect on any milk component percentage in Anatolian buffaloes.

Milk coagulation properties [rennet coagulation time, firming time and firmness of clot] are very important to cheese production and can be affected by genotype (2, 12), season, lactation order, lactation stage and feeding (13). These properties change throughout lactation as milk yield, protein and fat concentrations change and are detected best at the beginning and the end of lactation. Lactation number does not have a significant effect on milk coagulation ability (12), whereas season has such an effect owing to the reduction in urea content of milk (14). Foltys *et al.* (15) determined that urea content of milk rises from 29.2 mg/100 g in winter to 36.07 mg/100 g in May; protein, fat and lactose contents decreased in the same period from 3.06% to 2.77%, 4.27% to 3.92%, 4.80% to 4.60%,

respectively. Feeding level is effective on urea content of milk (16).

Milk coagulation properties differ significantly from one unit to another. The differences are due most likely to feeding and management factors (12). Povinelli *et al.* (2) found that breed, herd and lactation stage had a significant effect on milk coagulation ability on five different dairy cattle breeds unlike the urea content. pH has a negative effect on milk coagulation ability (17).

Milk urea concentration can be used as a tool to monitor crude protein and energy intake (18) and is related to the rate of protein-energy in ration and crude protein intake (19, 20). In order to use milk urea concentration as a tool to identify any imbalances related to feeding, in addition to feeding related factors such as food intake and ration composition and other factors and their levels of effect have to be determined and should be taken into consideration to interpret urea concentration (21). These factors can be ordered as sample collection season, analysis method, live weight of animal, parity and milk yield of cow (22). Roy *et al.* (23) reported that a significant reduction occurred in milk urea concentration as the lactation number increased. However, lactation stage did not have significant effects on urea and protein concentrations of milk.

Hojman *et al.* (24) showed that milk urea level was higher in summer and increased with lactation number for adult cows. Relationships with milk urea content and crude protein, ruminal

digestive protein and fibre content of ration were positive, but the relationship between urea content and ration energy was negative.

The objectives of this study were to investigate effective environmental factors on milk composition, rennet coagulation time, urea concentration, titratable acidity, density and pH of Anatolian Buffaloes' milk

2. Material and Methods

The material of the study consisted of 115 milk samples from 53 Anatolian buffalo cows of İlkpinar Village of Kırıkhan District of Hatay Province in 8 units that they were calved in 2004 and 2005. Milk samples were collected from the morning milkings in June, September, December and March from the cows on lactation days 30±15, 60±15, 90±15, 120±15, 150±15, 180±15, 210±15, 240±15 and 270±15.

From the beginning of June 2004, milk samples were collected from all the buffalo cows in morning milkings monthly on milk control days of June, September, December and March. The samples were analysed for total dry matter, fat, protein, ash contents, pH, density, renneting time and milk urea content. Protein and fat contents were determined by formol titration (25) and Gerber methods (26), respectively. Rennet coagulation time was determined by recording time from the addition of enzyme to milk to the appearance of first clot using Berridge method (27). Milk urea content determined with diacetyl monoxime using photometric method, as

described in Merck handbook (28). Data were classified as follows; 30±15., 60±15, 90±15 days: 1st.; 120±15, 150±15, 180±15: 2nd.; 210±15, 240±15, 270±15: 3rd lactation stages. 2004: 1st, 2005: 2nd calving years; January-May period: 1st, September and October Months: 2nd calving seasons; June: 1st, September: 2nd, December: 3rd, March: 4th production months (samples collection months); 1st and 2nd : 1st, 3rd and 4th; 2nd, 5th and 6th: 3rd lactation order groups.

The effect of environmental factors on each characteristic were analysed separately using variance analysing technique. The means and correlation coefficients of each character were calculated. SPSS programme (standard version, SPSS Inc.) were used in the statistical analysis.

3. Results

Variance analysis are given in Table 1, 2 and 3.

4. Discussion

As can be seen in Table 1, morning milk yield was affected by unit ($P < 0.001$), production month (PM) ($P < 0.001$) and calving season (CS) ($P < 0.05$); daily milk yield was affected by unit ($P < 0.001$), PM ($P < 0.001$), lactation stage (LS) ($P < 0.01$) and calving year (CY) ($P < 0.05$) significantly. Differences in daily milk yield between CY can be explained by differences in feeding level during the year, year to year and unit to unit. As opposed to the literature (4, 10), the effects of lactation order (LO) on morning and daily milk yields

Table 1. Variance analysis for morning and daily milk yields, rennet coagulation time and pH

Variation source	f.d.	F			
		Morning milk yield	Daily milk yield	Rennet coagulation time	pH
Unit	7	11.400***	12.149***	1.193	2.841*
Production month	3	7.275***	8.531***	12.931***	3.246*
Calving season	1	6.516*	0.474	4.563*	0.066
Lactation stage	2	0.067	5.424**	10.049***	7.076**
Calving year	1	1.371	5.295*	13.169***	2.918*
Lactation order	2	1.915	1.360	0.972	1.699
Total N		115	115	115	115

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

Table 2. analysis for TDM, fat, ash contents and density

Variation source	f.d.	F			
		TDM	Fat	Ash	Density
Unit	7	0.997	0.644	0.781	1.508
Production month	3	6.017**	3.025*	19.797***	22.553***
Calving season	1	0.002	0.842	0.003	0.085
Lactation stage	2	3.611*	10.758***	4.610*	3.534*
Calving year	1	38.739***	46.880***	14.403***	35.519***
Lactation order	2	0.356	3.377*	0.805	0.740
Total N		109	109	107	107

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

Table 3. Variance analysis for titratable acidity, protein and urea contents

Variation source	f.d	F		
		Titratable acidity	Protein	Urea
Unit	7	5.497***	1.225	1.831*
Production month	3	4.898**	9.191***	6.081**
Calving season	1	1.758	5.425*	1.293
Lactation stage	2	9.687***	3.869*	0.689
Calving year	1	12.733**	110.153**	1.110
Lactation order	2	1.185	3.538*	1.223
Total N		115	109	100

*P < 0.05, **P < 0.01, ***P < 0.001

were found not significant in this study (Table 1).

As is clear from Table 2, PM (P < 0.01), LS (P < 0.05) and CY (P < 0.001) were influential on TDM content. The effects of PM and CY can be explained by feeding conditions since a pasture-based feeding in the Village was commonly employed. The literature also supported that PM (4, 7, 8) and LS (5, 6) effects on TDS were significant. However, the effect of lactation order effect on TDM content was found insignificant on Anatolian buffaloes in an earlier study (7).

PM (P < 0.05), LS (P < 0.001), CY (P < 0.001) and LO (P < 0.05) were influential on fat content significantly. The effects of PM and CY on fat can be explained by feeding level. The literature supported the significant effects of PM (7, 15) and LS (4, 5, 6) on fat content, except for one study (5) where the effect of LO on fat content was reported insignificant (4, 10) (Table 2).

Ash content was also affected by PM (P < 0.001), LS (P < 0.05) and CY (P < 0.001) (Table 2). PM (P < 0.001), CS (P < 0.05), LS (P < 0.05), CY (P < 0.001) and LO (P < 0.05) were found to be effective on protein content significantly. Alteration in milk fat and protein contents are related to feeding level and climatic conditions. Literature also confirms that PM (7, 8, 15), and CS (7, 9) are influential on protein content of milk. The significant effect of LO on milk protein content was also reported (4, 10), as opposed to

the findings of Şekerden *et al* (5). The milk yield varies due to LS and there are negative relationship between milk yield with fat and protein contents of milk. Protein and fat contents were highest at the beginning and end of lactation, and lowest during peak lactation associated with milk yield (1, 4, 11) (Table 3). Roy *et al* (23) reported that LS did not have a significant effect on milk protein concentration in Murrah buffaloes.

The pH of milk samples were affected by unit (P < 0.05), PM (P < 0.05), LS (P < 0.01) and CY (P < 0.05); the density was similarly affected by PM (P < 0.001), LS (P < 0.05) and CY (P < 0.001) significantly. PM (P < 0.001), CS (P < 0.05), LO (P < 0.001) and CY (P < 0.001) were effective significantly on RCT (Table 1). Literature reports that milk coagulation properties can be affected by production season and feeding level (12, 13, 14), LS (2, 12, 13); coagulation properties are well related to alteration in fat and protein contents at the beginning and end of lactation. However, the significant effect of LO on coagulation properties are reported by some researchers (13) whereas findings supporting our results were reported by the others (12).

In spite of literature indicating that milk coagulation properties vary from one unit to another significantly, this was found insignificant in our study since feeding was based mainly on village pasture, and supplement fodders were almost the same in every unit (Table 1). Titratable acidity was affected by unit (P < 0.001), PM (P < 0.01), LS (P < 0.001), CY (P < 0.01) at significant levels (Table 3). Similarly, urea content of milk was affected by unit (P < 0.05) and PM (P < 0.01) significantly (Table 3). It can be suggested that urea concentration was affected by only feeding level since both sample collection months and unit factors are related to feeding levels. It is reported that production season (14) and feeding level (15, 16, 24) are effective on milk urea concentration. It was also reported that milk urea concentration is affected by LO significantly (23, 24), but LS does not have an important effect on milk urea concentration (23) as was found in our study (Table 3).

5. References

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