ABSTRACT Buffalo Newsletter

ŞEKERDEN, Ö.; AVŞAR Y.K. *Milk Composition, Rennet Coagulation Time, Urea Content of Anatolian Buffaloes Milk (Ilıkpınar Village of Hatay Province) - II. The Relationships Between Milk Constituents and Various Milk Properties.* Buffalo Newsletter (2012) 27: 22-27

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

## II. The Relationships Between Milk Constituents and Various Milk Properties

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**Abstract:** The objectives of this study were to investigate the relationships among milk composition, renneting time, urea concentration, acidity, density and pH of Anatolian's Buffaloes milk. As a total of 115 individual milk samples from 53 Anatolian buffalo cows that calved in 2004 and 2005 on days of their lactations 30±15, 60±15, 90±15, 120±15, 150±15, 180±15, 210±15, 240±15 and 270±15 in 8 units of Ilıkpınar Village were collected in morning milkings for June, September, December and March. Samples were analysed for total dry matter, fat, protein, ash, density, pH, acidity, renneting time and urea content. Data were classified according to the following environmental factors: lactation stages: 1 (30±15, 60±15, 90±15 days): 2 (120±15, 150±15, 180±15 days): 3 (210±15, 240±15, 270±15 days); 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. Means and correlation coefficients for the characteristics investigated were calculated.

**Key Words:** Anatolian buffalo, milk, coagulation, renneting, urea

## 1. Introduction

It is established fact that reducing protein concentration (80 gr/kgFCM and lower) diminishes milk yield and its fat percentage (1, 2) and that increasing milk yield leads to a decrease in milk fat and protein concentrations (3, 4). Milk coagulation properties (rennet coagulation time, firming time and firmness of clot) are well known important criteria for cheese production. These properties (rennettability) can be affected by genotype (5, 6), season, lactation order, lactation stage and feeding (7). Moreover, they change throughout the lactation depending on milk yield, protein and fat concentrations. These properties are found best at the beginning and the end of lactation. Piironeen et al. (8) reported that protein content affected milk coagulation considerably, which increased as the lactation stages progressed, and that any negative alterations in milk composition had a clear effect on milk coagulation time. Milk coagulation properties also differ significantly from one unit to another. It is most likely that differences are due to feeding and management factors (6). Povinelli *et al.* (5) found that titratable acidity and protein content had a significant effect on milk coagulation ability. pH has a negative influence on milk coagulation ability and the effect increases to a significant degree as lactation progresses (8).

Milk urea concentration can be used as a tool to monitor crude protein and energy intake (9). It is related to the rate of protein-energy in ration and crude protein intake (10, 11). In order to use milk urea concentration as a tool to identify any imbalances related to feeding, food intake and ration composition together with other factors and levels of their effect have to be determined and taken into consideration while interpreting urea concentration (12). These factors can be ordered as follows: sample collection season, analyze method used, live weight of animal, parity and milk yield of cow (13). Roy *et al.* (14) reported that milk urea concentration increased significantly in Murrah Buffaloes as the control day milk yield increased. As the lactation number increased, a significant reduction occurred in milk urea concentration. However, lactation stage did not have significant effects on urea and protein concentrations of milk.

The objectives of this study were to investigate relationships among milk composition, renneting time, urea concentration, acidity, density and pH of Anatolian Buffaloes milk.

## 2. Material and Methods

The material of the study were formed by 115 milk samples from 53 Anatolian buffalo cows of Ilıkpınar Village of Kırıkhan District of Hatay Province in 8 units that calved in 2004 and 2005. Milk samples were collected from the morning milking for June, September, December and March. The cows were on 30±15, 60±15, 90±15, 120±15, 150±15, 180±15, 210±15, 240±15 and 270±15 days of their lactations. Samples were analysed for total dry matter, fat, protein, ash contents, pH, density, rennetting time and milk

urea content. Protein and fat contents were determined by Formol Titration (15) and Gerber Methods (16) respectively. Rennet coagulation time was determined by recording time from the addition of enzyme to milk to appearance of first clot using Berridge Method (17). Milk urea content determined with diacetyl monoxime by Photometric Method, as described in Merck handbook (18).

The means and correlation coefficients of the characteristics were calculated. SPSS programme (standard version, SPSS Inc.) were used in the statistical analysis.

## 3. Results

Correlation coefficients between milk yield and milk constituents contents are given in Table 1.

**Table 1. Correlation coefficients between milk yield and milk constituent contents.**

| Variables measured | | Correlation coefficient (r) |
|---|---|---|
| Morning milk yield | Daily milk yield | 0.737** |
| TDM % | Morning milk yield | -0.030 |
| " | Daily milk yield | -0.232* |
| " | Fat % | 0.675** |
| " | Protein % | 0.660** |
| " | Ash % | -0.408** |
| Fat % | Morning milk yield | -0.028 |
| " | Daily milk yield | -0.202* |
| " | Protein % | 0.596** |
| " | Ash % | -0.338** |
| Protein % | Morning milk yield | 0.052 |
| " | Daily milk yield | -0.204* |
| " | Ash % | -0.495** |
| Ash % | Morning milk yield | -0.104 |
| | Daily milk yield | 0.084 |

*P <0 .05, **P < 0.01

Relationships among the rennet coagulation time with composition, pH, density, titratable acidity and urea content of milk are shown in Table 2a and Table 2b.

**Table 2b. Relationships between various variables**
**Table 2a. Relationships between various variables**

| Coagulation time | | Urea content | | Density | |
|---|---|---|---|---|---|
| Variables | Correlation coefficient | Variables | Correlation Coefficient | Variables | Correlation Coefficient |
| Morning milk yield | 0.238* | Morning milk yield | -0.069 | Morning milk yield | -0.138 |
| Daily milk yield | 0.038 | Daily milk yield | -0.118 | Daily milk yield | -0.165 |
| TDM % | 0.320** | TDM % | 0.084 | TDM % | -0.247* |
| Fat % | 0.293** | Fat % | -0.046 | Fat % | -0.247* |
| Protein % | 0.447** | Protein % | -0.058 | Protein % | -0.256* |
| Ash% | -0.273** | Ash % | -0.143 | Ash % | 0.210* |
| Density | -0.049 | Density | -0.015 | pH | 0.027 |
| pH | -0.022 | pH | 0.050 | Titratable acidity | 0.367** |
| Urea | 0.035 | Titratable acidity | 0.002 | | |
| Titratable acidity | 0.094 | | | | |

*P < 0.05, **P < 0.01

| Titratable acidity | | pH | |
|---|---|---|---|
| Variables | Correlation coefficient | Variables | Correlation Coefficient |
| Morning milk yield | -0.159 | Morning milk yield | -0.055 |
| Daily milk yield | -0.323** | Daily milk yield | 0.127 |
| TDM % | 0.171 | TDM % | -0.339** |
| Fat % | 0.205* | Fat % | -0.358** |
| Protein % | -0.029 | Protein % | -0.291** |
| Ash % | 0.098 | Ash % | -0.280** |
| pH | -0.394** | | |

*P < 0.05, **P < 0.01

## 4. Discussion

As can be seen in Table 1, there was a significant relationship between morning and daily milk yields. There are negative significant correlations between daily milk yield with TDM, fat and protein percentages. These result were confirmed by the following literature (19, 20, 21). There were negative relationships between TDM with fat and ash contents and positive relationships between fat with protein concentrations and TDM with fat and protein contents. In other words, as ash content increased, TDM content decreased. Fat content was adversely affected by the increase in ash content and the increase in TDM and protein contents positively. Protein content increased as fat and TDM contents increased. However, Roy *et al.* (14) reported that protein concentration did not change significantly. Milk component concentrations have negative relationships with production characteristics, and changing component contents only by genetic selection is not possible. However, there are significant correlations between milk yield and fat, protein and TDM yields. It suggests that genetic selection has to be directed towards increasing fat, protein and total not fat dry matter yields. Under selection programs in which milk yield is taken into consideration, fat and protein yields also increase, but fat and protein concentrations decrease.

As can be seen in Table 2a and Table 2b, as daily milk yield and pH increase, titratable acidity is affected negatively. In parallel to increase in fat rate, titratable acidity rises. In the literature it is reported that titratable acidity rises together with a decrease in urea content of milk (22). Whereas feeding level is influent on the urea content of milk (23, 24).

There were significant negative relationships between pH and all of the milk constituents. As pH increased, the amount of milk constituents decreased. Relationship between milk yield and pH was found insignificant. Piironen et al. (8) reported that protein percentage had a positive effect on pH, and the effect enhanced as lactation stage progressed.

Density reduces as TDM, fat and protein contents increase. Similarly, as ash content rises density also increases. Relationships between density with milk yield and pH were not significant. Despite the fact that there is positive correlation between TDM content and density of milk, the negative correlation found in the study was due to increase in fat percentage of TDM content.

Time laps from the addition of rennet to the appearance of first clot get longer as TDM, fat and protein percentages increase, whereas as ash content increases it becomes shorter. Likewise, the studies (5, 6, 7) supported that there were positive relationships between rennet coagulation time with protein and fat contents. Negative alterations related to milk composition were reported to have clear effects on milk coagulation properties and alterations in protein content related to production season result in rennet coagulation properties of milk (8). In this study, relationship between milk coagulation time and pH was not significant. The study (8) supported this findings and state that as lactation stage progressed the effect increased significantly. Relationships between milk urea concentration with none of milk constituents, milk yield, density, pH and titratable acidity were not significant statistically. Correlation between urea content and milk yield was found to be negative and not significant as opposed to the literature (13, 14).

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