Evaluation of nutritional status of dairy cows based on milk analysis results

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ABSTRACT

Milk composition data, milk fat percentage (g/100ml), milk protein percentage (g/100g) and milk urea content (mg urea/dl) of 50,000 individual milk samples of cows under milk recording were used to evaluate nutritional status of dairy cows on Croatian farms. Analysis of average values of milk components indicates that most of the animals (60%) had a ration well balanced in energy and fibre, but ration protein deficiency could be a major characteristic of nutrition of considerable number (61.5%) of cows. Using milk analysis results it is possible to estimate major problems in dairy cow nutrition, predict and prevent possible metabolic and reproductive disturbances.

Key words: Nutritional status, Milk fat, Milk protein, Milk urea.

Introduction

Milk composition depends greatly on ration composition – changes in concentration and ratio of fibre and energy in ration affect milk fat percentage and protein percentage (Tamminga, 2001) and milk fat to milk protein ratio, thus making this milk components a possible indicator of ration composition. Also, milk urea content could be used as an indicator of dietary crude protein concentration (Broderick and Clayton, 1997) and energy to crude protein ratio (Godden et al., 2001). In Croatia there are 77,000 cows under milk recording, and since 2002 Central laboratory for milk control besides milk fat, protein content and somatic cell count offers milk urea analysis and provides dairy farmers with necessary milk composition data to monitor nutritional status of their herds. Dairy cow nutrition in Croatia has specific characteristics caused by the farm structure (herd size), breed structure, level of knowledge in nutrition, use of traditional feeds and other factors. Based on milk composition analysis this paper attempts to point out possible errors in nutrition.

Material and methods

Milk composition data, for 50,000 random individual milk samples of entire population of cows in the state, were collected during year 2004. Average size of farms is 9 cows per herd, population consists of 78% Simmental, 19% Holstein and 3% of other breeds. Milk fat and protein content was determined by infrared spectrophotometry method and milk urea content by enzymatic method. All samples were preserved with azidiol. Classes of cows according to milk protein content and milk fat/protein ratio and according to milk protein and urea content are reported in table 1 and 2, respectively.

For statistical analysis the SAS/STAT package was used (SAS Institute Inc., 2000).
eter protein content in ration could be deficient for 49.58% of animals (C1, B1, A1 figure and table 2, less than 15 mg urea/dl), in excess for 9.57% of animals (A3, B3, C3 figure and table 2, more than 30 mg urea/dl/) and adequate for 40.85% of animals (A2, B2, C2 figure and table 2, 15-30 mg urea/dl). If milk urea content and milk protein content are both taken as parameters about 20.32% of animals (B2 figure and table 2) could have ration adequate in energy and proteins, 6.52% excess of proteins in ration (A3, B3 figure and table 2) and as much as 61.5% (A1, B1, C1, C2 figure and table 2) could be suffering from protein deficiency.

These milk composition data are in agreement with our expectations and current nutritional practices on dairy farms. Generally farmers themselves produce energy rich feeds (corn silage,

Table 1. Classes of cows according to milk protein content and milk fat/protein ratio.

| Classes | Protein (%) | Fat/protein ratio |
|---------|-------------|------------------|
| C1      | ≤ 3,20      | ≤ 1,10           |
| C2      | 3,21 – 3,80 | ≤ 1,10           |
| C3      | ≥ 3,81      | ≤ 1,10           |
| B1      | ≤ 3,20      | 1,11 - 1,50      |
| B2      | 3,21 – 3,80 | 1,11 - 1,50      |
| B3      | ≥ 3,81      | 1,11 - 1,50      |
| A1      | ≤ 3,20      | ≥ 1,51           |
| A2      | 3,21 – 3,80 | ≥ 1,51           |
| A3      | ≥ 3,81      | ≥ 1,51           |

Results and conclusions

Results of the analysis indicate that 60.34% of animals (classes B1, B2, B3, figure and table 1) had a milk fat/protein ratio 1.1-1.5, which could be taken as optimal (Babnik et al., 2004), 9.83% (classes A1, A2, A3, figure and table 1) had milk fat/protein ratio greater than 1.51 which could indicate energy deficiency and fibre surplus in ration, and 29.83% (classes C1, C2, C3, figure and table 1) had milk fat/protein ratio less than 1.1 indicating fibre deficiency and energy surplus. According to milk fat/protein ratio and milk protein content, 29.78% of animals (class B2 figure and table 1) could have a balanced content of energy and protein in ration.

Based on milk urea content as a single parameter protein content in ration could be deficient for 49.58% of animals (C1, B1, A1 figure and table 2, less than 15 mg urea/dl), in excess for 9.57% of animals (A3, B3, C3 figure and table 2, more than 30 mg urea/dl/) and adequate for 40.85% of animals (A2, B2, C2 figure and table 2, 15-30 mg urea/dl). If milk urea content and milk protein content are both taken as parameters about 20.32% of animals (B2 figure and table 2) could have ration adequate in energy and proteins, 6.52% excess of proteins in ration (A3, B3 figure and table 2) and as much as 61.5% (A1, B1, C1, C2 figure and table 2) could be suffering from protein deficiency.

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Table 2. Classes of cows according to milk protein and urea content.

| Classes | Protein (%) | Urea (mg/dl) |
|---------|-------------|--------------|
| C1      | ≤ 3,20      | ≤ 15,00      |
| C2      | ≤ 3,20      | 15,01 - 30,00|
| C3      | ≤ 3,20      | ≥ 30,01      |
| B1      | 3,21 – 3,80 | ≤ 15,00      |
| B2      | 3,21 – 3,80 | 15,01 - 30,00|
| B3      | 3,21 – 3,80 | ≥ 30,01      |
| A1      | ≥ 3,81      | ≤ 15,00      |
| A2      | ≥ 3,81      | 15,01 - 30,00|
| A3      | ≥ 3,81      | ≥ 30,01      |

Figure 1. Percentage of cows per classes according to milk protein content and milk fat/protein ratio

Figure 2. Percentage of cows per classes according to milk protein and urea content.
wheat) on their own land which makes them easily available. Protein feeds have to be purchased on relatively high prices which causes their low content in ration and thus protein underfeeding of most animals. Result of these nutritional practices can be observed on milk control results.

Analysis of nutritional status of dairy herds in Croatia based on milk composition data can suggest that considerable number of cows (49.58-61.5%) has a protein deficient rations, and 60% of animals has ration balanced in fibre and energy. Based on milk composition analysis ration quality and balance can be estimated and corrected and milk quality improved. Taking into consideration that this method could be a good diagnostic tool when properly used, and that it is easily available to dairy farmers and causes small extra costs, it is expected that it will be more widely applied than it is at the present.

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