

## OCURRENCE OF SUBCLINICAL METABOLIC DISORDERS IN LARGE-SCALE DAIRY HERDS IN HUNGARY IN 2001

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### **Abstract**

A study was conducted in 2001 to screen the incidence rate of subclinical metabolic disorders in large-scale dairy herds in Hungary. The screening involved 75 Holstein Friesian dairy farms and the data represent about 45 000 cows of 3-6 years of age. Clinically healthy cows, selected randomly from groups of dry cows 1-10 days prior to expected calving (Group I., n=454) and from postparturient cows 1-7 (Group II., n=360), 8-30 (Group III., n=580) and 31-90 days (Group IV, n=485) after calving and were subjected to a metabolic profile test.

Data of the present investigation are comparable to the figures we obtained in the previous 10 years and reported elsewhere (Brydl et al., 1997; 1998 and Könyves et al., 2001). Likewise to screening data of the previous years high incidence of energy imbalance, aciduria (subclinical acidosis), inadequate protein supply, carotene shortage, and inappropriate sodium-, copper- and zinc supplementation was detected among the groups tested. In comparison with data of the previous years no substantial change was observed with respect to occurrence rate of metabolic disorders

Key words: dairy cow, metabolic disorders, and malnutrition

Abbreviation key: MPT = Metabolic Profile Test, NEFA = Non Esterified Fatty Acids, AST = Aspartate Amino Transferase, GSH-Px = Glutation-peroxidase, NABE = Net Acid-BaseExcretion.

### **INTRODUCTION**

Genetic progress in large-scale dairy farms in Hungary has been considerable over the last decades. As a result 45 % of the registered cows produce over 7000 kg milk in 305 days of lactation. In 101 dairy farms the lactation milk yield of cows exceeds 8 000 kg/cow and in the best 7 farms the lactation milk yield is more than 10 000 kg/cow (Mészáros, 2001.). The average size of the large-scale dairy units in Hungary falls between 350 and 400 head of cows, ranging between 200 and 1 900. The ever-increasing milk production per se needs more sophisticated feeding strategy with improved feed quality. The upgrading genetic capacity, however, often is not paralleled with the improvement of meeting the nutrient and welfare requirements of the cows. Feeding failures induce subclinical/clinical metabolic disorders some days/weeks prior to and especially after parturition with an increased rate of mortality and decreased production.

Majority of the losses are caused by subclinical manifestations. For early detection of such disorders metabolic profile tests (MPT) have been developed and applied all over the world since the late sixties (Payne et al. 1970, 1972 and 1973; Sommer, 1975; Brydl et al. 1987). In our laboratory we established a comprehensive MPT at the end of eighties of the last century and have used it since for monitoring the metabolic status of high yielding dairy cows in big number of large-scale Hungarian dairy farms (Brydl et al., 1987, 1988 and 1989). For the last 10 years the data of the

MPTs were summarised annually (Brydl et al., 1997 and 1998; Könyves, 2001) and attempts were made to draw conclusions of general merit and detect trends of changes.

This paper discloses the results obtained in 2001. The goal of this analysis was to compare the last year's data with those obtained earlier to detect any shift in the general trend, to contribute to the understanding the manifestations of subclinical metabolic disorders and to give assistance for the development of preventive nutritional and management measures.

## **MATERIALS AND METHODS**

In the last year (2001) 75 large-scale dairy units were screened for the presence and prevalence of subclinical metabolic disorders. These farms housed approx. 45 000 lactating cows of 3-6 years of age. In this survey data of laboratory examinations (blood chemistry, chemical analysis of urine and hair samples) were analysed together with the actual feeding strategy (composition and quantity and quality of the daily ration), parameters of milk production and reproduction, body condition score and rate of morbidity and mortality of the farm in question.

The biological samples were taken from clinically healthy cows, selected randomly from various groups of cows with different physiological stage, 3-5 hours after the morning feeding. The groups differed in respect of daily milk yield, stage of lactation and gestation. In the present study the following groups were tested:

Group I.: dry cows, 1-10 days prior to expected parturition (n=454);

Group II.: cows 1-7 days after calving (n=360);

Group III.: cows 8-30 days after parturition (n=580);

Group IV.: cows 31-90 days after calving (n=485)

The energy metabolism was monitored by the measurement of blood glucose, aceto-acetic-acid and NEFA concentration. Subclinical fat mobilisation syndrome was diagnosed by the values of NEFA and AST activity. Subclinical ketosis was revealed by the values of glucose and aceto-acetic-acid in the blood samples. Non-bypass protein supply was monitored by the determination of urea concentration in the blood and urine samples. Concentration of total carothene, calcium, inorganic phosphorus, copper, and zinc was measured in blood samples. GSH-Px activity of red blood cells was determined in order to monitor selenium deficiency.

Acid-base metabolism was measured by the urinary pH and by the determination of NABE value in the urine samples.

## **RESULTS AND DISCUSSION**

Occurrence and prevalence of different forms of subclinical metabolic disorders is summarised in Table I.

It is seen that occurrence of different subclinical manifestations of energy imbalance was high around parturition, especially in the first week of lactation. Before calving (Group I.) and in the first 30 days of lactation (Group II. and III) the increased fat mobilisation (high NEFA) and subclinical fat mobilisation syndrome (high NEFA and AST) dominated.

The occurrence of fat mobilisation syndrome decreased with the progress of lactation. Highest incidence of subclinical ketosis was detected in Group II and III. In most of the cases the subclinical ketosis concurred with fat mobilisation syndrome. It might be supposed therefore, that subclinical ketosis in majority of the cases is the consequence of increased fat mobilisation and fat mobilisation syndrome. Increased fat mobilisation among cows before calving (Group I.) could be the consequence of the high rate (33,9%) of fat (overconditioned) cows. The rate of overconditioned cows

decreased, the rate of thin cows increased rapidly by the days of lactation. The other relevant causative factors of high incidence of energy imbalance could be the very high occurrence of aciduria (and its forms like acid load and imminent metabolic acidosis) in the examined period. The highest incidence of aciduria was detected in the first week of lactation (Group I.) when the energy imbalance was also at its highest rate. The prevalence and severity of subclinical acidosis decreased by the days of lactation, but it was still high in peak lactation (Group IV.).

Since the report of Dirksen (1970) it has been known well that the ruminal pH has major effect on the reproduction of rumen flora and the production of volatile fatty acids which are the main sources of meeting the energy demand of ruminant tissues. Thus optimal rumen fermentation is a key element of the energy balance of high producing dairy cows.

Our earlier data indicated strong correlation between aciduria and hyperphosphaturia. Excessive urinary excretion of phosphorus represents both financial loss to the dairy sector and environmental pollution to cope with (Könyves et al. 2001.).

Protein shortage was detected at its highest rate before calving. On the other hand protein surplus was also seen before calving. The most remarkable over supplementation with protein was in the period around peak lactation (Group IV). Number of papers of the relevant literature proved the negative effect of over feeding protein on the energy metabolism and reproductive performance of high producing dairy cows. The protein shortage at the same time is strong limiting factor of the milk production.

Low carothene concentrations were detected in all cow groups. Monodietic nutrition applied for the last ten years in most of the Hungarian large-scale dairy units, restricted opportunity of grazing and receiving freshly harvested green roughages together with the far too high price of the commercially available carothene preparations are the responsible factors of the low carothene status of cows.

**Table 1.** Occurrence of subclinical metabolic disorders

Subclinical metabolic disorders	Sampled groups of animals			
	Occurrence of metabolic disorders %			
	I.	II.	III.	IV.
Increased fat mobilisation	13.7	3.6	2.7	2.3
Subclinical fat mobilisation syndrome	7.3	29.7	12.6	3.3
Subclinical ketosis	0.4	1.1	1.3	1.8
Subcl. f. m. syndrome+subcl. ketosis	0.7	16.3	10.5	1.4
Energy imbalance altogether	22.0	50.8	27.2	8.8
Aciduria	63.2	66.9	46.7	37.3
Acid load	52.0	56.1	42.8	35.8
Imminent metabolic acidosis	11.2	10.8	3.9	1.5
Condition >3,5	33.9	16.7	4.6	1.6
Score <3.0	6.6	16.1	36.5	50.7
Protein shortage	34.6	11.1	12.1	6,6
Protein surplus	22.9	48.9	48.8	68.0
Carotene shortage	67.8	81.7	75.5	63.2
Hypocalcaemia	0.0	1.9	0.1	0.4
Hypophosphataemia	4,8	1.1	6.2	3.3
Hypomagnesaemia	0.0	0.5	0.0	0.0

Hyperphosphaturia	10.8	25.8	27.9	28.4
Hyperphosphaturia with aciduria	10.1	20.5	17.9	17.9
Sodium shortage	49.3	46.9	17.6	14.8
Copper shortage	19.8	14.3	11.1	9.2
Zinc shortage	8.6	19.0	18.5	12.9
Selenium shortage	0.2	0.0	0.0	0.0
n	454	360	580	485

In the present investigation supplementation with sodium-, copper-, and zinc was inappropriate in about 10 % of the cows tested. Hypocalcaemia occurred rarely. One reason could be that we sampled clinically healthy cows. In spite of hyperphosphaturia the hypophosphataemia was detected with low rate of incidence. Hypomagnesaemia and selenium shortage was seen only occasionally.

## CONCLUSIONS

- These data indicate the necessity of improving the feeding and management practice and implement further preventive measures.
- Screening of the metabolic status of high yielding dairy farms is a good tool for detecting metabolic disturbances in time and gives opportunity to counteract.

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