SUBCLINICAL METABOLIC DISORDERS IN PERIPARTAL DAIRY COWS IN HUNGARY IN 2005

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ABSTRACT

Feed intake often fails to meet the requirements of high yielding cows, especially some weeks prior to and after parturition which may induce subclinical or clinical metabolic disorders. The losses due to metabolic disorders such as decreased milk production, reproduction failures, and management related diseases e.g. lameness, mastitis etc., emergency slaughters and death of diseased animals.

In order to reveal the subclinical metabolic disorders in high yielding dairy cows in the peripartal period, metabolic profile test was carried out at 69 large-scale dairy herds with the population of approximately 35.000 Holstein-Friesian cows, aged 5–6 years on average in Hungary in 2005. In this survey groups of cows were tested as following:

Group I: dry cows, 1–10 days prior to expected parturition (n=424);

Group II: cows 1–7 days after calving (n=377);

Group III: cows 8–30 days after calving, n=546);

Group IV: cows 31–90 days after calving (n=534).

The results of the study are comparable to the figures have been obtained in the previous 10 years and reported elsewhere (Brydl et al., 1997; 1998 and Könyves et al., 2001; Brydl et al. 2003). Likewise to screening data of the previous year's high incidence of energy imbalance, aciduria (subclinical acidosis), inadequate protein supply, carotene shortage, and inappropriate sodium and potassium supply was detected. In comparison with data of the previous years no substantial change was observed with respect to occurrence rate of metabolic disorders.

Keywords: dairy cow, peripartal period, metabolic disorders, malnutrition

INTRODUCTION

Remarkable genetic progress has been seen at the large-scale dairy farms in Hungary during the last decades and the milk production is more than 8000 kg in 305 days of lactation (Mészáros, 2007.). The average population number at the large-scale dairy units in Hungary is between 350 and 400 head of cows, ranging between 100 and 2000. Due to the ever-increasing genetic potential the nutritional demand of the cows are increasing and needs more sophisticated feeding strategy with improved feed quality. The upgrading genetic capacity, however, often does not meet with the nutritional intake and the welfare conditions of the cows. Feeding errors induce subclinical/clinical metabolic disorders some days/weeks prior to and especially after parturition with an increased rate of mortality, decreased production and reproduction failure.

Majority of the losses are caused by subclinical metabolic disorders. For early detection of subclinical cases 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). At the Faculty of Veterinary Science Budapest a comprehensive and complex metabolic profile test (MPT) was developed and it has been used since 1985 for monitoring the metabolic status of high yielding dairy cows at many 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; Jurkovich et al., 2002, Brydl at al., 2005) and attempts were made to draw conclusions of general merit and detect trends of changes.

The MPT is based not only on laboratory examinations of blood, urine, rumen fluid, pigmented hair and feed samples, but on the results of detailed farm visit as well. During the farm visits data were collected on the feed quality, the mode of feeding, the milk production, the parameters of reproduction, health status of the herd and the body condition and faces were scored in every cases.

The biological samples were taken from clinically healthy cows, assigned from various groups of cows randomly, 3–5 hours after the morning feeding. The groups differed in respect of daily milk yield, stage of lactation and gestation as well (3, 4, 5, 6, 7, 8, 17).

MATERIALS AND METHODS

In 2005 69 large-scale dairy units were screened for the presence and prevalence of subclinical metabolic disorders. These farms housed approximately 35 000 head of Holstein-Friesian 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=424);

Group II: cows 1–7 days after calving (n=377);

Group III: cows 8–30 days after calving, n=546);

Group IV: cows 31–90 days after calving (n=534).

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 carotene, 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 supply. 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 1.

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

Table 1. Occurrence of subclinical metabolic disorders

Subclinical	**Sampled groups of animals**			
metabolic disorders	Occurrence of metabolic disorders, %			
	I.	II.	III.	IV.
Increased fat mobilisation	11.1	4.5	3.1	0.9
Subclinical fat mobilisation syndrome	4.0	28.4	8.1	1.3
Subclinical ketosis	3.3	4.0	2.6	3.7
Subcl. f. m. syndrome+subcl. Ketosis	0.0	18.6	6.8	0.9
Energy imbalance all	**18,4**	**55,4**	**20,5**	**6,9**
Aciduria	59.6	63.5	45.0	29.8
– Acid load	51.3	57.4	41.5	28.9
– Imminent metabolic acidosis	8.3	6.2	3.5	0.9
Body condition score: >3,5	22.5	6.9	1.5	0.7
<3.0	5.9	18.0	48.4	68.5
Protein shortage	30.0	10.9	11.4	5.1
Protein surplus	26.4	50.4	45.1	68.0
Carotene shortage	63.7	84.1	76.4	57.9
Hypocalcaemia	0.2	2.7	0.5	0.2
Hypophosphataemia	6.6	24.1	15.2	12.2
Hypomagnesaemia	0.9	8.5	3.8	0.7
Hyperphosphaturia	11.6	22.3	23.3	17.3
Hyperphosphaturia with aciduria	10.1	18.5	11.9	7.9
Sodium shortage	34.2	38.6	12.9	7.5
Sodium surplus	16.4	19.8	46.3	55.0
N	424	377	546	534

The occurrence of fat mobilisation syndrome decreased with the progress of lactation. Highest incidence of subclinical ketosis was detected in Group II and IV. 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 (22.5%) of fat (over conditioned) cows. The rate of over conditioned 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 II.) 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 the ruminal pH has major effect on the multiplication of rumen flora and the production of volatile fatty acids which are the main sources of meeting the energy demand of ruminant. 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 overfeeding with protein was in the period around peak lactation (Group IV). Number of papers of the relevant literature proved the negative effect of protein overfeeding 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 carotene concentrations were detected in all groups of cows examined. 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 carotene preparations are the responsible factors of the low carotene status of cows.

In the present survey supplementation with sodium was inappropriate. The occurrence rate of hypocalcaemia was low. High incidence of hypophosphataemia and hyperphosphaturia was detected. Hypomagnesaemia 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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