

Use of Biochemical Indicators to Evaluate The Nutritional Status of Lactating Cows

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ABSTRACT: Nutrient requirement is important to the animal, especially to cope with the physiological demands. Tropical countries face many problems of feeding management associated with animal production. Protein, energy and minerals (calcium and phosphorous) are found in the blood and milk which can be collected in a simple manner and used to detect the nutritional status of the animal. These blood and milk constituents could be reliable biochemical indicators associated with production states of animals. The objective of this research is to study the correlation between dry matter intake with milk production, levels of blood calcium, phosphorous, protein, and milk calcium, phosphorous and protein and also urinary allantoin. Twelve lactating cows were divided randomly into 3 groups according to milk production. Group I, II and III produced 15 l,

10 l and 5 l of milk per day respectively. All animals were fed concentrate and elephant grass at a level calculated for a cow producing 10 l of milk per day as recommended by NRC (1988). Results showed that group I, II and III consumed respectively 14.97; 14.13 and 13.68 kg dry matter. There were deficiencies of calcium and phosphorous intakes in group I (4.81% and 6.76%) but not in the other groups. Milk production decreased in group I (38.6%) as compared to group II, while production in group III increased by about 37.50%. Blood calcium and phosphorous concentrations increased in group III (12.6 % and 6.35 %). There was significant correlation between dry matter intake and milk production ($r=0.7$) but protein intake and urinary allantoin was not highly correlated.

Key Words: Biochemical Indicators, Allantoin, Nutritional Status

Introduction

Feed evaluation is important for judgment of the efficiency of ration utilization. Feed consumption has to be managed in such a way as to make a proper balance between nutritional status and production.

Research showed that feed supplementation can give the positive results, but the response to the animal can be different due to different background of nutritional status.

Feed evaluation through the metabolic parameter such as blood protein and mineral and also allantoin in urine as biochemical indicators can detect the nutritional status. Metabolic result is transported through the blood and milk product and excreted by the urine.

Materials and methods

Twelve lactating cows (+425 kg BW) were used in this study. They were randomly divided into 3 groups according to milk production. Group I, II and III produced 15, 10 and 5 l/day respectively. All animals were fed with concentrate and elephant grass given the same amount as calculated for cows producing 10 l of milk per day according to requirements. This study lasted for 8 weeks and the following parameters measured, such as feed consumption; milk production, and protein, also allantoin in the urine. Blood was sampled from the jugular vein and milk was collected in the morning and afternoon. Blood calcium and phosphorous concentrations were measured using a diagnostic kit (Merk Diagnostic clinic; Fick et al., 1979), while milk protein detection used the Formal titration method. Blood protein was analysed with Kit. Milk calcium and phosphorous were analysed by

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spectrophotometry. Urine allantoin was detected the method developed by Larson (Hawk, P.B., 1944).

All data were analysed by linier regression model (Steel and Toriie; 1991) using the equation :

$$Y = a + b x$$

Y = dependent variable
a = intercept

x = independent variable
b = slope of the line

Results and Discussion

Data on feed consumption and milk production are presented in Table 1.

Table 1. Intake and milk production of lactating cows fed concentrate and elephant grass in different milk production levels

Parameters	I	II	III
Intake : (kg DM/d)			
- Concentrate	7.05	7.05	7.05
- Elephant grass	7.93	7.89	6.64
- Protein	2.16	2.16	2.03
- Calcium (g/d)	58.06	57.88	52.13
- Phosphorous (g/d)	36.55	36.42	32.17
Milk prod. (l/d)			
- 1st week	14.80	9.00	3.90
- 8th week	8.95	9.13	5.50

I = produced 15 l milk/d
II = produced 10 l milk/d
III = produced 5 l milk/d

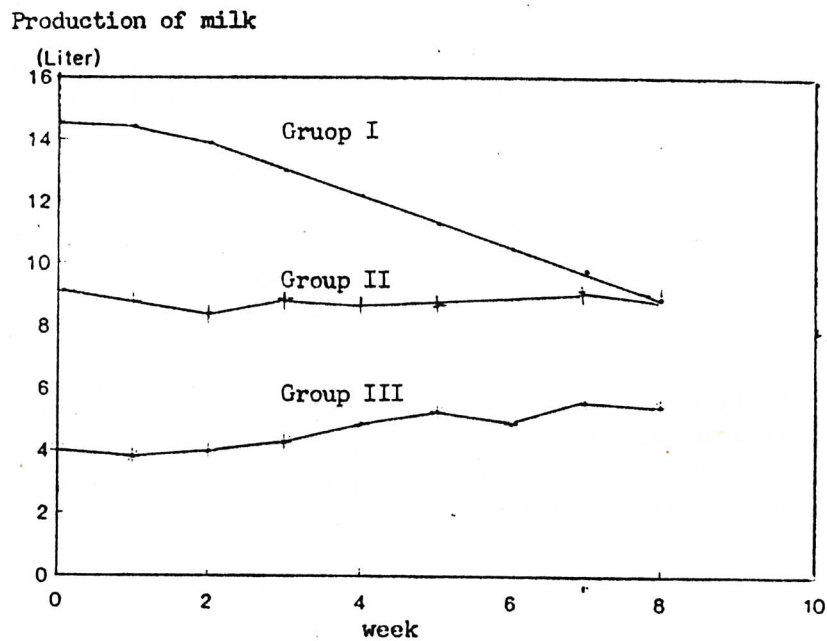


Figure 1. Milk production during eight weeks

During this study, calcium requirement in group I was not enough to support production, but still in average levels in blood and milk. From the body weight we can see there were a losing of weight because of the calcium, phosphorous and protein degradation to support the nutrient deficiency.

Sutardi (1981) reported that cows in the tropics can consume 1.5 times more than the value recommended by NRC. Dry matter intakes from group I was less than the NRC recommendation, while group III was more. The results showed that milk production in group I was 38.6% lower while in group III 37.5% higher than that of group II.

Examining the data, the decreasing percentage of group I was equal to the increasing percentage of group III.

Milk protein, calcium, phosphorous dan fat concentration in all groups showed values within the normal range. This study reveals that milk minerals (Ca, P) and milk nutrients (Fat & protein) can not predict the nutrient status of the animal. Bone minerals may be a better indicator of nutrient status. The data also showed that there was a lowering nutrient excretion in group I through milk production, while in group III the opposite was observed.

Table 2. Concentrations of calcium, phosphorous, Fat and Protein of milk and their total excretion through the milk, of lactating cows fed concentrate and elephant grass at different milk production levels.

Parameters	I	II	III
Concentration :			
- Calcium (mg/100 ml)	181.14	178.50	180.00
- Phosphorous	98.25	101.00	123.50
- Fat (%)	4.30	4.10	4.60
- Protein (%)	3.63	3.53	3.45
Total excretion (gr/d)			
- Calcium	16.21	16.29	9.90
- Phosphorous	8.78	9.20	6.79
- Fat	3.85	3.22	1.90
- Protein	3.25	3.22	1.90

Table 3. Concentrations of blood calcium, phosphorous, protein and urine allantoin excretion of lactating cows of milk production levels.

Parameters	I	II	III
Concentration (mg/100 ml)			
- Calcium	11.30	11.53	12.63
- Phosphorous	5.85	5.98	6.35
- Protein	9.00	9.10	10.20
Urine allantoin (g/d)	0.34	0.58	1.03

Table 3 showed that the levels of Blood calcium, phosphorous and protein was within normal values. Tillman et.al. (1989) reported that the average blood calcium concentration is 8-12 mg/100 ml. Swenson (1977) also reported that normal blood protein concentration is 6.9 - 7.8 mg/100 ml. There was a higher blood concentration protein in group I,II dan III compared to the normal value. Low protein consumption can make the body protein degradation so that protein absorbed through the gut and filled to the blood (Gayton, 1983).

Urine allantion excretion of group I showed that very low, while group III was high. Liang et. al. (1993) found that urine allantion in cows under basal condition was 0.59 g/d. This value is comparable with the value for group II.

Conclusion

Milk production is influenced by dry matter intake. Blood calcium and phosphorous, and milk calcium and phosphorous can not predict mineral status of lactating cows.

The prediction of mineral status of lactating cows can not be based on blood Ca, P and milk Ca, P.

Little correlation was observed between urine allantion and milk production however urine allantion has not been biochemically related to milk production.

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