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COMPARATIVE STUDY REGARDING THE PROTEIN, ENERGY AND MINERAL PROFILES IN THE DIFFERENT CATEGORIES OF INTENSIVE AND HOUSEHOLD BRED CATTLE

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Abstract

In micro-farms or households where there are no veterinary health problems, it is recommended that the metabolic tests should be performed during periods when the metabolic strain is more intense, as they represent a method of monitoring the animals' health, especially during critical periods. A total of 52 cattle were divided into 5 groups according to their physiological condition, age category and health status. Total serum protein showed significantly higher values ($p<0.05$) in adult animals compared to the other age groups. Calves with digestive disorders had moderate hypoproteinemia, as a result of consecutive protein depletion, malabsorption and maldigestion syndrome from gastroenteritis, especially in the case of chronic ones, accompanied by an intake and improper use of ration proteins, respectively by mass elimination following intestinal protein loss. The mean blood glucose values did not differ significantly ($p>0.05$), the unitary response of the studied cattle categories being remarked. In the case of the mineral profile, the variations that appeared are mainly due to the different nutritional support, specific to the two breeding systems, but also to the different pathological conditions detected.

Key words*: cattle, metabolic profile, breeding system.*

INTRODUCTION

In cattle breeding, metabolic disorders initiate or favour the onset of distinct or intricate morbid entities that reduce the growth and exploitation efficiency. Due to this fact, the problem of metabolic disorders must be considered with special attention by practitioners.

The main purpose of this paper is to provide a comprehensive picture of the metabolic profile in cattle, which should contribute to the proper assessment of the main biochemical constituents' variations (LeBlanc, 2010).

In this context, the metabolic profile evaluation allows the study of the nutritional-metabolic integrity of the herds, thus establishing the laboratory diagnosis of the conditions with clinical or subclinical inapparent evolution, even in the incipient stage (Botezatu et al., 2014).

The detection of nutritional disorders must be done in the early stages, the metabolic profile introduction into the arsenal of diagnosis means, is an excellent tool for "group prognosis" (Patra et al., 2006; Whitaker et al. 1999). Therefore, the metabolic profile allows the evaluation of the nutritional-metabolic integrity of the livestock (Codreanu et al., 2012).

In addition to assessing and remedying nutritional-metabolic imbalances, metabolic tests also allow anticipating and even avoiding their occurrence, by applying appropriate measures.

MATERIALS AND METHODS

Metabolic tests were performed on cattle belonging to different age groups and physiological conditions, healthy and with different diseases, both from the intensive and household breeding systems. The aim was to ensure that the studied groups are homogeneous in terms of weight, clinical condition and performance of the production indices, in order to conduct a proper comparative study.

The selection criteria used were age categories (calves, youth and adults) and physiological status (pregnant, non-pregnant and lactating). The young cattle category was structured in

two groups: calves 1-3 months (n = 10) and youth 6-12 months (n = 11).
The adult cattle category was subdivided in three groups: pregnant in months VIII-IX - during the period of maximum metabolic load (n = 10), lactating (n = 10) - months I-II (maximum lactation period), adult cattle (n = 11) - not pregnant and not lactating.
In the appreciation of the metabolic profile for the 5 categories mentioned, the following biochemical investigations were performed: the main constituents of the energy profile: glycemia, lipids, cholesterol; the main constituents of the protein profile: total protein, albumin, globulins; the main constituents of the mineral profile: Ca, P, Ca/P ratio.

RESULTS AND DISCUSSIONS

Given the fact that blood, through its cellular and biochemical constituents, can be considered the mirror of an individual's health, in this study we opted mainly for extensive and thorough blood tests, aimed at dosing the constituents of the energy, protein and mineral profiles, in cattle raised and exploited in an intensive and household system, respectively.

The protein profile

The results regarding the protein profile for the 5 studied groups of cattle are presented in Table 1.
The investigation of the protein profile was performed by quantitative assessments at the plasma level. The plasma level of proteins and of the various protein constituents is influenced by the nutritional intake and conditioned by liver synthesis. Therefore, the quantitative changes of these proteins mean levels, are usually due to nutritional deficiency and insufficient hepatocyte synthesis (Calamari et al., 2007). It is also worth mentioning that in cattle, high proteinemia is not always correlated with high protein rations (Yuherman et al., 2017). For the evaluation of the protein profile in cattle, we considered it appropriate to dose the main constituents, namely the total protein, albumins and globulins. Laboratory determinations of the protein profile were performed, considering, first, the growth system and then each age group, physiological / pathophysiological condition (Knowlton et al., 2002).
Both total proteins and protein fractions have values that vary depending on the physiological status of the animals and the growth system. Thus, following the biochemical examinations performed, it can be mentioned that the cattle bred in the household system had higher average values of total proteins, compared to the ones bred in intensive growth system, with significant variations ($p<0.05$) in some age groups (calves 1-3 months, and non-pregnant adults). These higher values can also be attributed to the differences in the proper supply of these nutrients through feed. It is worth mentioning that the total serum protein showed significantly higher values ($p<0.05$) in adult individuals compared to other age groups. The three calves with digestive disorders (1 from the intensive breeding system and 2 from the household system) had moderate hypoproteinemia, because of consequent protein loss, the syndrome of malabsorption and maldigestion from gastroenteritis. These conditions are accompanied by an inadequate intake and use of protein in the ration and by mass elimination due to intestinal protein loss.

Table 1. Average values of the protein profile parameters in the studied groups of cattle, bred in intensive and household system

PARAMETER/ GROUP	PROTEINS (g/dL)		ALBUMINS (g/dL)		GLOBULINS (g/dL)	
	BREEDING SYSTEM		BREEDING SYSTEM		BREEDING SYSTEM	
	Intensive	Household	Intensive	Household	Intensive	Household
Calves 1-3 months	5.89 ± 1.2	6.16 ± 1.2**	2.77 ± 0.9	3.06 ± 1.1	3.12 ± 1.1	3.10 ± 1.3
Youth 6-12 months	6.28 ± 1.3	6.58 ± 1.4	2.94 ± 0.9	3.12 ± 1.2	3.34 ± 1.2	3.31 ± 1.4
Adults not-pregnant/not-lactating	6.66 ± 1.3	8.20 ± 2.4**	3.21 ± 1.2	3.85 ± 1.4	3.45 ± 1.2	4.35 ± 1.6
Pregnant	7.58 ± 2.1	7.83 ± 2.0	3.25 ± 1.4	3.61 ± 1.3	4.33 ± 1.8	4.22 ± 1.6
Lactating	7.25 ± 2.0	7.92 ± 2.1	3.53 ± 1.5	3.81 ± 1.3	3.72 ± 1.4	4.11 ± 1.5

***$p<0.05$ - significant differences*

The energy profile

The results regarding the energy profile for the 5 studied groups of cattle are presented in Table 2.

To carry out an in-depth study in terms of energy profile we considered it appropriate, to perform the dosage of blood glucose, cholesterol and total serum lipids. These metabolic investigations aim at highlighting and appreciating the possible changes in the different cattle categories, as well as their comparative assessment in terms of age and breeding system criteria (Codreanu et al., 2013).

Regarding the glucose levels, there were no significant differences identified between the mean blood glucose values obtained in adult cattle bred in the intensive system and those bred in the household system ($p > 0.05$).

Cholesterolemia increased slightly in adult cattle (both in intensive and household breeding system).

Regarding the serum values of total lipids, it is observed that in lactating cows and adults, both in intensive and household system, there was recorded a moderate increase compared to the values recorded in the other two categories.

The mineral profile

The results regarding the mineral profile for the 5 studied groups of cattle are presented in the Figure 1 synthetic graph.

Regarding the calcium levels, the category of lactating cows recognizes values obviously lower than those recorded in all the other studied categories. The mean values were 9.8 ± 2.0 mg/dL for the lactating cows bred in intensive system, and 9.3 ± 2.1 mg/dL in lactating cows bred in household system. The differences between the two systems are statistically insignificant ($p > 0.05$), but both of the results are significantly higher ($p<0.05$) when compared to the values recorded in the other categories of adults. This moderate "physiological hypocalcemia" is caused by the intense metabolic stress during this period.

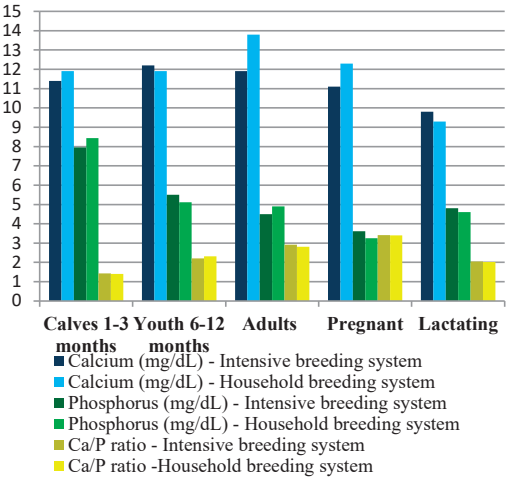

Figure 1. Graphic representation of the mineral profile average values comparative dynamics for the studied categories of cattle

Phosphoremia shows a significant decrease ($p< 0.05$) and obvious fluctuations in pregnant cows, the changes being more obvious in those exploited in the household breeding system, compared to the other categories.

Compared to calves and youth, the Ca/P ratio is higher in all 3 adult groups, physiologically exceeding the value of 2-2.5:1.

CONCLUSIONS

Regardless of the cattle breeding system, metabolic nutritional disorders initiate or favour the onset of distinct or intricate morbid entities that reduce the efficiency of cattle

Table 2. Average values of the energy profile parameters in the studied groups of cattle, bred in intensive and household system

PARAMETER/ GROUP	GLUCOSE (mg/dL)		CHOLESTEROL (mg/dL)		LIPIDS (mg/dL)	
	BREEDING SYSTEM		BREEDING SYSTEM		BREEDING SYSTEM	
	Intensive	Household	Intensive	Household	Intensive	Household
Calves 1-3 months	81.8 ±7.1	87.6 ± 7.2	131.6 ± 8.2	140.8 ± 8.4	288.8 ± 9.1	262.4 ± 9.0
Youth 6-12 months	74.6 ± 6.5	81.8 ± 7.7	142.8 ± 8.4	143.6 ± 8.4	242.8 ± 9.0	217.3 ± 8.8
Adults not-pregnant/not-lactating	69.4 ± 5.2	73.1 ± 6.5	92.9 ± 7.4	108.4 ± 7.6	238.3 ± 9.0	325.5 ± 9.2**
Pregnant	59.8 ± 4.9	58.1 ± 4.7	97.5 ± 7.5	86.8 ± 7.1	222.7 ± 8.9	279.4 ± 9.1
Lactating	72.2 ±6.4	77.4 ±6.4	93.4 ±7.4	103.6 ±7.6**	316.8 ±9.5	309.7 ±9.2

***p<0.05 - significant differences*

breeding and exploitation. The imperfections or deficiencies that may appear in the breeding technology can be detected in real time and combated by correcting the imbalanced factors. Also, the accuracy of the metabolic tests results allows the approach of an appropriate perspective in the case of the specific conditions, especially in case of entities that define the framework of "group pathology".

The components of the studied metabolic profiles (protein, energy and mineral) showed values that varied depending on the physiological state of the animals but also with the breeding system. In general, there were no significant differences ($p>0.05$) recorded between the mean values of the biochemical parameters, obtained in cattle belonging to the different categories, bred in the intensive and household system, an unitary response of the different age groups being observed regardless the breeding system.

Variations with statistical significance were recorded in pregnant and lactating cows, caused by the intense metabolic stress recorded during these periods.

In the other age categories, the variations appeared mainly due to the different nutritional intake (quantitative and qualitative), specific to the two growth systems, but also to the different pathological conditions detected with the investigations.

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