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RELATIONSHIPS OF CONCENTRATION OF SOME PLASMA CONSTITUENTS WITH MILK AND PHYSIOLOGICAL STATUS IN DAIRY GOATS

RELAZIONI TRA PARAMETRI EMATOCHIMICI E PRODUZIONE LATTEA NELLA CAPRA

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SUMMARY

1142 blood specimens were taken from Alpine goats of 15 herds in North Italy at different physiological status: near kidding, at the beginning of lactation, in the middle of lactation and at late lactation. The samples were analysed for: Hemoglobin, PCV, Glucose, NEFA, β-hydroxybutirrate, Triglycerides, Cholesterol, Total Protein, Creatinine, Ca, P inorg., Mg, and enzymatic activities ALP, ALT, AST, GGT and LDH. The possible causes for various changes in metabolic blood profile are discussed in relation to peculiar physiological «status» of goats (prepartum, partum, postpartum).

Key words: goats, metabolic profile, milk production.

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RIASSUNTO

Su 1142 campioni ematici prelevati da capre Alpine in 15 allevamenti del Nord Italia sono state analizzate le concentrazioni dei seguenti parametri: emoglobina, ematocrito, glucosio, NEFA, β-idrossibutirrato, trigliceridi, colesterolo, proteine totali, creatinina, Ca, P inorg., Mg, e le attività enzimatiche di ALP, ALT, AST, GGT e LDH. Le possibili cause di variazione nel profilo metabolico sono considerate in funzione al particolare stato fisiologico delle capre.

Parole chiave: capre, profilo metabolico, produzione latte.

Introduction

An early lactation peak in intensively bred dairy goats is of paramount importance in achieving high production and for paying back the costs of this kind of husbandry. The hematic tests are very useful in evaluating the fulfilment of alimentary plans especially during the end of pregnancy and early lactation as they are indicators of the metabolic status of the animals (1,4,14). The advantage of some hematochemical analysis in the early diagnosis of metabolic unbalances of alimentary origins is acknowledged by many nutritionists (3,4). This is based on the assumption that modifications of the hematic concentration of some parameters become evident when a disequilibrium between the alimentary input and the losses due to maintenance and production occurs. The determination of these parameters can disclose alimentary deficiencies or metabolic unbalances before losses of production or reproductive efficiency occur, in either an apparent or a clinically ascertainaible form. The metabolic profile in goats has been quite widely studied (7,13,15), but in literature there are few systematical observations of the variation due to the physiological status in late pregnancy and in lactation (5). The aim of the present research is to determine the relationship between hematochemical parameters and production in dairy goats at high production level, taking into account that although the physiological status represents one of the main factors affecting the variability.

Materials and methods

The research was carried out by taking blood samples from a representative number of animals belonging to 15 farms specializing in milk production. Altogether 1142 «*Camosciata delle Alpi*» subjects were utilized, from 2 to 5 years old. Among them 185 subjects were at the last

month of pregnancy, 376 at the beginning of lactation (7-30 dd from kidding), 429 in the middle of lactation (30-90 dd) and 153 at late lactation (90-205 dd). During the lactation the milk production had been recorded every 30 days and the fat and protein content had been determined by FossElectric Milkoscan 203. Hemoglobin and PCV immediately determintated on blood. The analytical determinations on plasma obtained from the jugular vein were carried out by a centrifuge analyzer (Multistat III from I.L.). The analytical methods are reported in preceeding publications (6,4,10). The enzymatic activities have been determined at 37° C. The preliminary screening of the data were carried out according to the IFCC (12) recommendations and the statistical analysis was carried out by using the MGLH procedure of Systat 5.

Results and discussion

The average registered milk production was about 2 litres per head/day for the goats at first lactation. The goats at further lactations achieved an average production of 3.4 litres per head/day during a 217 day period of lactation. The protein content in milk was 2.7% in first lactating goats and 2.6% in the others, while the fat content was 3.2% in both. In tables 1 the mean values in different physiological stages are reported. Minerals and glucose are the parameters least influenced by the physiological status in agreement with the findings of Lemand et al. (13). A high variability can be found for non esterified fatty acids, β-hydroxybutirrate and urea in the early phase of lactation and can be explained by the fact that the response of single subjects to the endocrine and metabolic stress common in this period is variable (8).

In fact the capability to convert alimentary supplies and body resources into milk constituents varies between subjects (16). Cholesterol shows a specific trend to increase at the onset of lactation, lasting until the end of lactation. On the contrary triglycerides decrease from the end of pregnancy to the beginning of lactation; they reach their minimum level in full lactation, then they rise in the late phase. A similar trend is shown by creatinine, although the initial decline appears more gradual, until the reaching of the minimum in full lactation. As this parameter is an index of the renal functionality, it can be related to the functionality variations of this organ during lactation. Urea shows a constant increase from the onset of lactation until the full lactation phase, then slightly drops in the last period (11). A particular trend occurs with the γ-glutamil-transferase enzyme (GGT) showing an increase in activity from

TABLE 1 - Mean hematological values in different physiological status.

Metabolites	Unit	Near Kidding	Early Lact.	Middle Lact.	End Lact.
PCV	%	29,30	25,50	24,40	-
Hemoglobin	g/dl	9,57	9,67	9,00	-
Glucose	mmol/L	2,62	3,06	3,12	3,16
Cholesterol	mmol/L	2,12	3,35	3,96	4,05
Triglycerides	mmol/L	0,44	0,28	0,25	0,31
NEFA	mmol/L	165	238	175	122
β-OB	mmol/L	212	336	256	311
Albumine	g/L	34,70	35,30	37,80	35,90
Creatinine	mmol/L	76,40	69,90	67,90	69,20
T. protein	g/L	70,10	79,20	81,60	84,30
Urea	mmol/L	7,07	7,61	9,30	8,32
Calcium	mmol/L	2,25	2,26	2,24	2,41
P inorg	mmol/L	1,85	2,56	1,97	1,67
Mg	mmol/L	1,00	1,05	1,06	1,07
AST (37°C)	U/L	82	114	121	117
ALT (37°C)	U/L	28	26	35	36
LDH (37°C)	U/L	555	611	520	640
AP (37°C)	U/L	480	149	468	217
GGT (37°C)	U/L	42	51	65	58

the beginning to the middle of lactation and a following gradual decline. The lactate-dehydrogenase (LDH) is lowest in the middle of lactation, while the alcaline phosphatase (ALP) is lowest when milk production is higher. The variation of calcium and magnesium is quite limited, while phosphorus shows a strong increase at the onset of lactation. The hematocrite (PCV) diminishes with the onset of lactation, but later remains almost unchanged until the end of lactation. Analysing the hematochemical parameters as a function of the age of the subjects, there are statistically significant differences for hematocrite, hemoglobin, glucose, β-hydroxybutirrate, GGT and for inorganic phosphorus. In general, goats at first lactation show higher mean concentrations for the parameters linked to the energetic metabolism, while lower mean values occur for the parameters of the proteic metabolism (9). The presence of simple relationships between hematic parameters and production is shown in tables 2 and 3. With a stepwise regression it was possible to determine that a group of parameters (β-hydroxybutirrate, NEFA, triglycerides) was able to account for more than 60% of the production variability (2).

TABLE 2 - Correlation coefficients between hematological and productive parameters at the beginning of lactation.

	R^2					
Metabolites	Milk	F test	% Fat	F test	% Protein	F test
β-HB	-		-0.33	***	-	
Cholesterol	0,38	***	-0.32	***	0.29	***
Glucose	-0.36	***	-		-	
AST	0.36	***	-0,21	***	-	
P inorg	-		0.26	***	-	

TABLE 3 - Correlation coefficients between hematological and productive parameters in the middle of lactation.

	R^2					
Metabolites	Milk	F test	% Fat	F test	% Protein	F test
Albumine	0,20	***	-0,28	***	-	
β-OB	0.30	***	-		-	
Calcium	0,28	***	0,16	***	-	
Cholesterol	0,54	***	0,26	***	-	
AST	0,36	***	-		-	
NEFA	0,37	***	-		-	
Triglycerides	-0,25	***	-		-	
GGT	0,30	***	-		-0,24	***

The existence of complex and multiple relationships between the different parameters taken into account is demonstrated by the analysis of the principal components as reported in Fig. 1, which shows the analysis carried out on data from the full lactation phase. The two components shown account for about 40% of the total variability of the sample.

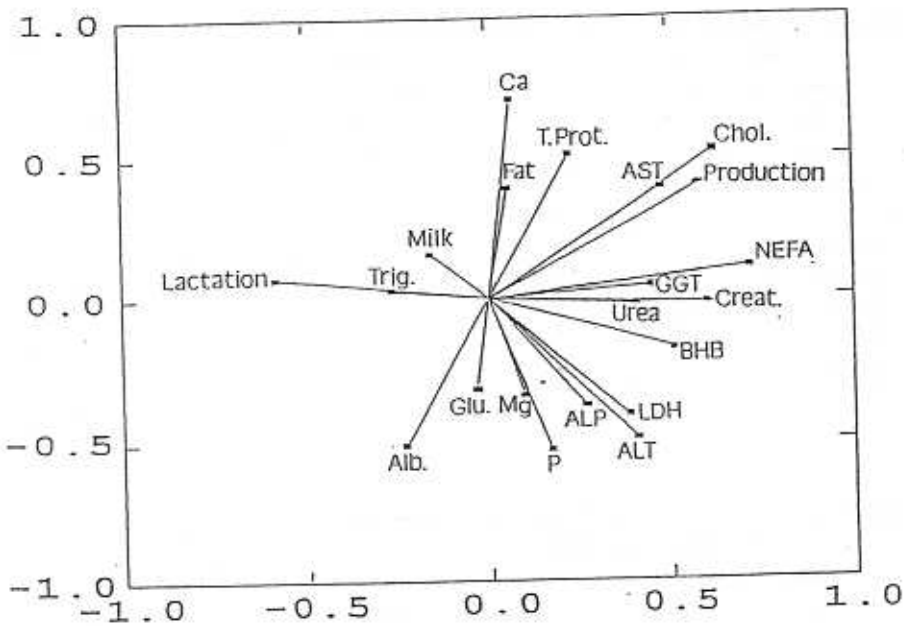

Figure 1

Conclusions

In this research we evidenced how the hematic parameters essencially change according to the physiological phase and with different amplitude. The relationships between hematic parameters and quanti-qualitative characteristics of the milk offer useful suggestions for the optimization of feeding and for the control of dismetabolic situation that can affect the production.

REFERENCES

1) Bas P., Bouquet G., Morand-Fehr P., Pion R., Sauvant D., Wolter R. - L'utilization des profils métaboliques en alimentation animale. Ed. INRA Paris-Grignon., (1980), 214.

2) Bauman D. E., Currie W. B. - Partitioning of nutrients during pregnancy and lactation: a rewiew of mechanism involving homeostasis and homeoresis. J. Dairy Sci., 63 (1980), 1514.

3) Biagi G., Della Croce G., Leto A. - Il profilo metabolico di base di un allevamento di capre di razza Saanen. Atti S.I.B.I.C.A., 2 (1985), 173.

4) Corti M., Cozzi D., Greppi G. F., Serrantoni M., Enne G. - Il profilo metabolico nella capra da latte durante la prima fase di lattazione: influenza dello stadio di lattazione e del fattore aziendale. Atti Simp. Int. Zoot. Milano, 22 (1987), 137.

5) Corti M., Greppi G. F., Serrantoni M., Enne G. - The effect of stage of lactation, parity and milk yield upon blood constituents in Alpine goats. Proc. World Conf. Anim. Prod., 6 (1988), 440.

6) Corti M., Greppi G. F., Serrantoni M., Ponti F. - Controlli ematici d'allevamento (CEA) in capre di razza Camosciata delle Alpi. Atti S.I.S. Vet., 40 (1987), 710.

7) Davies D. M., Sims B. J. - Survey to determine normal blood biochemistry and haematology in domestic goats. Ed. INRA Publ., Les Colloques INRA, 28 (1984), 427.

8) Dunshea F. R., Well A. B., Trigg T. E. - Relations between nonesterified fatty acid metabolism and body fat mobilization during chronic undernutrition in goats. Br. J. Nutr., 60 (1988), 633.

9) Dunshea F. R., Well A. B., Trigg T. E. - Relations between plasma nonesterified fatty acid metabolism and body fat mobilization in primiparous lactating goats. Br. J. Nutr., 62 (1988), 51.

10) Greppi G. F., Corti M., Rosi F., Nordio C. - Variazioni annuali dei parametri ematici della capra. Atti S.I.B.I.C.A., 2 (1985), 161.

11) Harmeyer J., Martens H. - Aspects of urea metabolism in ruminants with reference to the goat. J. Dairy Sci., 63 (1980), 1707.

12) I.F.C.C. - The theory of reference values. Part 1. The concept of reference values. Clin. Chim. Acta, 87 (1983), 459.

13) Lemand F., Andre F., Bas P., Estragnat L., Jaubert P., Morand-fehr P., Reyssiguer Y., Sauvant D., Wyers M. - Valeurs de certains paramètres biochimiques et hématologiques sanguins chez des chèvres laitières normales autour de la mise-bas. Bull. Tech. CRZV, Theix, 55 (1983), 22.

14) Morand-Fehr P., Sauvant D., Bas P., Rozeau P. - Paramètres caratérisant l'état nutritionel de la chèvre. Symp. sur la Chèvre des Pays Méditerrannées. Malaga, (1977), 195.

15) Ridoux R., Siliart B., Andre F. - Paramètres biochimiques de la chèvre laitières. I. Détermination de quelques valeurs de référence. Réc. Méd. Vét., 15 (1981), 357.

16) Sauvant D., Robert J. C., Legendre D., Ternois F., Hervieu J. - Relations entre les sécretions mammaires et les teneur en nutriments énergétique et azotés sanguins chez la chèvre au debut de la lactation. Reprod. Nutr. Devel., 2B (1986), 589.