Tropical and Subtropical Agroecosystems

SHORT NOTE [NOTA CORTA]

EFECT OF PERIPARTAL PROPYLENE GLYCOL SUPPLEMENTATION ON SOME BIOCHEMICAL PARAMETERS IN DAIRY GOATS

[EFECTO DE LA SUPLEMENTACIÓN DE GLICOL PROPILÉNICO SOBRE LOS PARÁMETROS METABOLICOS EN EL PERIPARTO DE CABRAS LECHERAS]

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SUMMARY

The effect of peripartal supplementation with diet enriched with propylene glycol on some biochemical parameters was studied on 60 Maltese multiparous goats, from 10th day prepartum to 40th day postpartum. Goats were divided into two groups of 30, homogeneous for age (3±1 years), milk yield of the previous lactation (2±0.5kg/head/day) and body condition score (2.25±0.5) and raised in two multiple boxes. The groups, called "Glycol" and "Control", received concentrate (0.7kg/head/day) and vetch hay (1.5kg/head/day). The hay of the Glycol group was integrated with 100mL/kg of the propylene glycol (Liqui-Beef®, San Marco-Italy). Blood samples were collected from 10th to 1st day prepartum and from 1st to 40th day postpartum for the determination of Glucose, Non Esterified Fatty Acids (NEFA), *β*-hydroxybutyrate (BHBA), Triglycerides, Total cholesterol, High Density Lipoprotein (HDL), Total protein, Urea and Creatinine, activities of Aspartate aminotransferase (AST), Alanine aminotransferase (ALT) and Creatine Kinase (CK). Data were analysed as a two-factor ANOVA with diet (Control and Glycol) and period (pre- and postpartum) as the main effects. As regards the energetic metabolism, "Glycol" group showed significant lower levels only during the prepartum period; specifically for BHBA (Glycol 0.28 mmol/l vs. Control 0.33 mmol/l; P=0.047), Triglycerides (Glycol 0.36 mmol/l vs. Control 0.50; P=0.043), Total cholesterol (Glycol 1.50 mmol/l vs. Control 1.66 mmol/l; P=0.07) and HDL (Glycol 0.79 mmol/l vs. Control 0.93 mmol/l; P=0.004). The parameters concerning hepatic functionality (AST and ALT) were significantly lower in the Glycol group during the prepartum (AST: Glycol 51.43 U/l vs. Control 62.00 U/l; P=0.006. ALT: Glycol 11.55 U/l vs. Control 14.21 U/l; P=0.005) as well as postpartum period (AST: Glycol 69.00 U/l vs. Control 74.28 U/l; P=0.008. ALT: Glycol 12.02 U/l vs. Control 15.05 U/l; P=0.005). The same trend was observed for the CK values (prepartum: Glycol 42.79 U/l vs. Control 62.63 U/l, P=0.004; postpartum: Glycol 77.70 U/l vs. Control 89.60 U/l, P=0.02). Peripartal use of propylene glycol enriched diet, improving the metabolic-nutritional *status* of the animals and consequently the productive performances (as previously observed), represents an interesting nutritional strategy for the economic benefits of dairy farms.

Key words: Dairy goats, Peripartal, Propylene glycol, metabolic profile.

INTRODUCTION

In the last 20 years goat world population increased around 50% (El-Ghani, 2004). In Italy, the actual goat consistency is nearly 1,200,000 of animals (Assonapa, 2008). Despite the world-wide importance of goats as providers of essential meat and dairy product, less research is performed on them than that on cattle and sheep. During the transition between late pregnancy and early lactation, dairy goats, like dairy cows, are under metabolic stress (Azab *et al*., 1999). Failure to counteract this stress compromises postpartum health and milk production (Stella *et al*., 2007). The identification of changes in the metabolism could provide some advantages to producers; for these reasons the study of metabolic profiles have been used to predict prepartum and postpartum metabolic problems, and for the diagnosis of metabolic diseases and the assessment of the nutritional status of animals (Balikci *et al*., 2007). Studies in dairy ewes indicate that the supplementation of propylene glycol during the close-up dry period and early lactation improved the metabolic condition, through the decreasing of BHBA and NEFA and the increasing of glucose concentrations (Chiofalo *et al*., 2005). Aim of the research was to study the effect of peripartal supplementation with diet enriched with propylene glycol on some biochemical parameters of Maltese goats.

MATERIALS AND METHODS

Animals and diets

Sixty Maltese multiparous goats, from 10th day prepartum to 40th day postpartum were divided into two groups of 30, homogeneous for age (3±1 years), milk yield of the previous lactation (2±0.5kg/head/day) and body condition score (2.25±0.5) and raised in two multiple boxes. Preliminarily, the animals, clinically healthy were subjected to anti-parasite treatment and to periodic health checks. The groups, called "Glycol" and "Control", received concentrate (0.7kg/head/day) and vetch hay (1.5kg/head/day). The hay of the Glycol group was nebulised with 100mL/kg of the propylene glycol (Moisture: 30%; Ash: 3.20%; Dextrose: 1.50% as fed) (Liqui-Beef®, Società San Marco-Italy).

Blood sampling

Blood samples were collected from 10th to 1st day prepartum and from 1st to 40th day postpartum. Each 5 days, in the morning while fasting, individual blood samples (10 mL) were taken from the jugular vein into a vacutainer. Blood samples were centrifuged (ALC 4237R) at 3500 × *g* for 15 min within two hours of drawing and the sera were frozen at –20 °C until analysis (A.S.P.A., 1999). The blood parameters were determined on each individual sample of serum by an automatic analyzer ILab300 Plus (Instrumentation Laboratory, IL Company, Lexington, MA, USA) using commercial kits (IL Company, Lexington, MA, USA; RANDOX Laboratories LTD., Crumlin, United Kingdom). The following energetic metabolism parameters were determined: Glucose, Non Esterified Fatty Acids (NEFA), Total Cholesterol, High Density Lipoprotein, Triglycerides, beta-hydroxybutyrate (BHBA). The protein metabolism parameters were the following: total protein, creatinine, blood urea nitrogen (BUN) and creatine kinase (CK); the hepatic functionality parameters investigated were the following: Aspartate aminotransferase (AST) and alanine aminotransferase (ALT).

Statistical analysis

Data were analysed as a two-factor ANOVA (SAS, 2001) with diet (Control and Glycol) and period (pre- and postpartum) as the main effects.

RESULTS AND DISCUSSION

As regards the energetic metabolism, during prepartum period (Table 1) the "Glycol" group showed significant lower levels for BHBA, Total cholesterol and HDL than the "Control" group, testifying a positive energetic balance (Hoedemaker *et al*., 2004). These parameters during the postpartum period (Table 2) showed significant higher values in the "Glycol" group, nevertheless this trend could be due to the higher milk production (Chiofalo *et al*., 2008) of the animals fed the propylene glycol.

The hepatic functionality (AST and ALT) together with the CK were significant lower in the "Glycol" group during the prepartum (Table 1) as well as the post partum period (Table 2); this could be related to the propylene glycol supplementation that could represent a proper way to rapidly decrease lipid mobilisation and excessive formation of ketone bodies, thereby reducing the risk of fatty liver and ketosis (Hoedemaker *et al*., 2004).

During the postpartum period (Table 2), significant higher values were observed for creatinine in the "Glycol" group; this could be due to the muscular protein mobilisation in order to produce energy during the early lactation phase (Bertoni, 1996) considering the higher milk yield observed for the animals of this group.

Table 1. Concentration of serum metabolites in goats sampled prepartum (- 10 days to – 1 day).

Serum metabolite	Control group		Glycol group		*P*
	Mean	S.D.	Mean	S.D.	
Energetic metabolism					
Glucose (mmol ·L^{-1})	2.86	0.32	2.79	0.26	0.38
Non Esterified Fatty Acids (mmol ·L^{-1})	0.18	0.02	0.17	0.05	0.37
β-hydroxybutyrate (mmol ·L^{-1})	0.33	0.11	0.28	0.07	0.04
Triglycerides(mmol ·L^{-1})	0.50	0.14	0.36	0.14	0.04
Total cholesterol (mmol ·L^{-1})	1.66	0.06	1.50	0.17	0.07
High Density Lipoprotein (mmol ·L^{-1})	0.93	0.05	0.79	0.08	0.004
Hepatic functionality					
Aspartate aminotransferase (U·L^{-1})	62.00	11.86	51.43	15.85	0.006
Alanine aminotransferase (U·L^{-1})	14.21	2.59	11.55	3.99	0.005
Protein metabolism					
Blood Urea Nitrogen (mmol ·L^{-1})	4.34	0.15	4.24	0.10	0.18
Total Protein (g· L^{-1})	58.80	1.62	55.13	2.83	0.05
Creatinine (μmol ·L^{-1})	61.68	3.73	60.20	5.72	0.36
Creatine Kinase (U·L^{-1})	62.63	16.72	42.79	16.09	0.004

Table 2. Concentration of serum metabolites in goats sampled postpartum (1 day to 40 days).

Serum metabolite	Control group		Glycol group		*P*
	Mean	S.D.	Mean	S.D.	
Energetic metabolism					
Glucose (mmol $\cdot L^{-1}$)	2.93	0.21	2.92	0.24	0.48
Non Esterified Fatty Acids (mmol $\cdot L^{-1}$)	0.25	0.07	0.30	0.17	0.09
β-hydroxybutyrate (mmol $\cdot L^{-1}$)	0.37	0.05	0.33	0.06	0.13
Triglycerides (mmol $\cdot L^{-1}$)	0.20	0.03	0.18	0.04	0.24
Total cholesterol (mmol $\cdot L^{-1}$)	1.92	0.27	1.87	0.17	0.35
High Density Lipoprotein (mmol $\cdot L^{-1}$)	1.23	0.19	1.18	0.11	0.29
Hepatic functionality					
Aspartate aminotransferase ($U \cdot L^{-1}$)	74.28	9.44	69.00	11.89	0.008
Alanine aminotransferase ($U \cdot L^{-1}$)	15.05	3.94	12.02	3.65	0.005
Protein metabolism					
Blood Urea Nitrogen (mmol $\cdot L^{-1}$)	5.27	0.87	5.25	0.85	0.48
Total Protein (g$\cdot L^{-1}$)	66.50	4.75	68.04	3.27	0.25
Creatinine (μmol $\cdot L^{-1}$)	53.26	5.06	58.17	4.62	0.04
Creatine Kinase ($U \cdot L^{-1}$)	89.60	23.24	77.70	16.81	0.02

CONCLUSIONS

Peripartal use of propylene glycol enriched diet, improving the metabolic-nutritional *status* of the animals and consequently the productive performances (as previously observed), represents an interesting nutritional strategy for the economic benefits of dairy farms.

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