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Molasses-based supplement improved the metabolic status of late-pregnant ewes bearing multiple fetuses

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ABSTRACT

Metabolizable energy requirements rise dramatically at late gestation in ewes bearing multiple-fetuses; consequently, prolific ewes may suffer pregnancy toxemia and fetal intrauterine growth restriction. The present objectives of this study were to examine in ewes bearing ≥2 fetuses, the effects of dietary supplementation with a molasses-based product from 90 d of pregnancy until lambing on dams' metabolic status and perinatal lambs' performance. Fifty Afec-Assaf ewes, genetically bred to achieve multiple-fetus pregnancies, and bearing at least 2 fetuses were included in the study. The ewes were divided into two groups according to predicted number of fetuses, lambing time, parity number, and body weight (BW). The control group (CTL) was fed solely a basal diet; the treatment group (MLS) was fed the same diet supplemented with the molasses-based product ENERGILASS Sheep 15, in free-choice tubs. Blood samples were collected weekly. Average litter sizes were 3.06 and 3.19 for CTL and MLS groups, respectively. Fetal survival rates at birth differed insignificantly ($P > 0.05$) at 0.82 and 0.84 in the CTL and MLS group, respectively, and the survival rate of lambs until weaning was insignificantly 6.8% higher in the MLS than in the CTL group ($P > 0.05$). The CTL ewes lost 0.40 body condition score units from 90 d of pregnancy until lambing compared with only 0.15 by the MLS ewes ($P < 0.05$). The average concentration of glucose in plasma during the last 3 wk of pregnancy was 17.3% higher in MLS than in CTL ewes (59.1 vs 50.4 mg/dL, respectively; $P < 0.01$), whereas the BHBA concentrations were 30.9% lower (0.67 vs 0.97 mmol/L, respectively; $P < 0.03$) and NEFA concentrations were 30.0% lower in the MLS than in the CTL ewes ($P < 0.007$). During the last 3 wk of pregnancy glucose concentrations were ≤50 mg/dL in 37/70 and 16/72 of the CTL and MLS blood samples, respectively ($P < 0.0002$). Also, BHBA concentrations ≥1.4 mmol/L were found in 19/70 and 6/72, respectively, of the CTL and MLS blood samples ($P < 0.003$). In conclusion, molasses-based product supplementation to prolific ewes from 90 d in pregnancy until lambing greatly improved the metabolic status of dams but with minor effects on perinatal survival and growth of lambs, suggesting that the extra nutrients consumed were prioritized to dams rather than to the components of the gravid uterus.

Abbreviations: BW, body weight; PT, pregnancy toxemia; DM, dry-matter; ME, metabolizable energy; BCS, body condition score; BHBA, beta-hydroxybutyrate; NEFA, non-esterified fatty acids; CRL, crown rump lengths; GI, G index.

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1. Introduction

Inappropriate nutritional management at late pregnancy in prolific sheep can lead to pregnancy toxemia (PT) in the ewe and to intrauterine growth restriction (IUGR) of the growing fetuses (Wu et al., 2006). Pregnancy toxemia (PT) is the most frequent metabolic disorder of ewes in late pregnancy when carrying more than 1 fetus (Henze et al., 1998; Sargison, 2007), and it is a major cause of economic loss to the sheep industry (Scott et al., 1995). It has been estimated that the frequency of PT in Afec-Assaf ewes carrying 1 or 2 fetuses is only 5/100 whereas that in similar ewes carrying ≥3 fetuses it is as high as 19/100 (Zamir et al., 2009). About 60% of fetal growth takes place in the last part of gestation (Twardock et al., 1973), when approximately 33–36% of the ewe's circulating glucose is directed into the feto-placental unit (Hay et al., 1983).

As the number of fetuses increases, the metabolic demands of the gravid uterus increase and thereby affect the profile of maternal plasma metabolites. In our previous study (Moallem et al., 2012) we clearly demonstrated the increased susceptibility of ewes carrying multiple fetuses to hyperketonemia, which is the main indicator of PT. Concentrations of BHBA and NEFA in plasma were, respectively, 3.7 and 2.1 times higher in ewes carrying 4 fetuses than in those carrying 1 fetus (Moallem et al., 2012). Also, concentrations of glucose in blood were moderately lower and concentrations of insulin were far lower in ewes carrying ≥3 fetuses than in those carrying 1 or 2 fetuses. Although nutrition appears to be the most critical factor affecting maternal and fetal metabolism in late-pregnant ewes, little information is available to date on the feeding requirements of highly prolific ewes carrying ≥3 fetuses. Therefore, feeding strategies should be developed to meet the increased nutritional requirements of such ewes. The restricted rumen capacity in ewes carrying multiple fetuses limits their feed intake; therefore, additional supplementation of those ewes during late pregnancy should be based on use of high-density energetic supplements. Thus, the objectives of the present study were to examine the effects of molasses-based product dietary supplementation of late-pregnanct ewes carrying multiple fetuses, on the metabolic status of dams and *peri*- and postnatal survival and growth of lambs.

Table 1
Ingredients of basal diet and chemical composition of the basal diet and ENERGILASS Sheep 15.

Ingredients – g/kg DM	Basal diet	ENERGILASS Sheep 15[a]
Corn, ground	112.3	
Barley, rolled	49.9	
Wheat grain, rolled	20.9	
Rapeseed	23.9	
Sunflower meal	15.0	
Wheat bran	37.4	
Corn silage	246.1	
Oat hay	246.5	
Clover hay	235.6	
Urea + ammonium sulfate	1.5	
Salt + limestone	9.1	
Sodium sulfate	0.7	
Oil	0.7	
Vitamins and minerals	0.2	
Chemical composition[a]		
ME[b] (MJ/kg DM)	10.3	
Crude protein (g/kg DM)	134	155
Crude fat (g/kg DM)		52
Crude fiber (g/kg DM)		21
NDF[c] (g/kg DM)	408	
ADF[d] (g/kg DM)	180	
Calcium (g/kg DM)	8	16
Phosphorus (g/kg DM)	5.5	9
Magnesium (g/kg DM)		4
Potassium (g/kg DM)		41
Manganese (mg/kg DM)	33	410
Selenium (mg/kg DM)	0.1	3.6
Zinc (mg/kg DM)	110	1650
Ferrum (mg/kg DM)	22	
Iodine (mg/kg DM)	0.6	
Cobalt (mg/kg DM)	1.1	
Vitamin A (IU/kg DM)	9000	124470
Vitamin D3 (IU/kg DM)	22000	12474
Vitamin E (IU/kg DM)	1800	968

[a] The ENERGILASS Sheep 15 chemical composition is according to manufacturer's information.
[b] Metabolizable energy.
[c] Neutral detergent fiber.
[d] Acid detergent fiber.