BRIEF COMMUNICATION: The influence of a herb and legume sward on maternal behaviour and lamb colostrum intake and thermoregulation

P.G. HUTTON, P.R. KENYON*, M.K. BEDI, P.D. KEMP, K.J. STAFFORD, D.M. WEST and S.T. MORRIS

Institute of Veterinary, Animal and Biological Science, Massey University, Private Bag 11-222, Palmerston North 4442, New Zealand
*Corresponding author: p.r.kenyon@massey.ac.nz

Keywords: herb; legume; lactation; thermoregulation; colostrums.

INTRODUCTION

Nutrition of the ewe in late pregnancy is known to affect colostrum production, lamb live weight, survival to weaning (Kenyon & Webby, 2007; Kerslake *et al*., 2009), and maternal behaviour (O'Connor *et al*., 1985). Kenyon *et al*. (2010) reported that offering a mixed herb sward containing chicory, plantain and red and white clover in late pregnancy and in lactation improved Romney lamb survival and total weight of lamb weaned per ewe when compared to ewes on unrestricted ryegrass/white clover pasture. In a follow up study, Hutton *et al*. (2011) reported Romney lambs born to ewes grazing the herb mix tended (P = 0.06) to have higher survival. The apparent positive effect of the herb mix on lamb survival is not known. Therefore the aim of the present study was to determine whether ewes grazing the herb mix improved maternal behaviour post lambing or whether lambs born to ewes which grazed the herb mix had improved thermoregulation or indices of colostrum intake.

MATERIALS AND METHODS

This experiment utilised the same animals as those previously reported in Hutton *et al.* (2011). The design was a 2 x 2 factorial using two ewe pregnancy ranks (twin v. triplet) and two ewe herbage treatments; a traditional ryegrass and white clover sward mix (Rye-W/C) (tetraploid perennial ryegrass (*Lolium perenne*) cv. 'Grasslands Stirling' (AR1) and white clover (*Trifolium repens*) cv. 'Tribute') and a Herb mix (chicory (*Cichorium intybus*) cv. 'Choice', plantain (*Plantago lanceolata*) cv. 'Ceres Tonic', red clover (*Trifolium pratense*) cv. 'Grasslands Sensation' and white clover (*Trifolium repens*) cv. 'Grasslands Tribute'). A total of 44 twin-bearing and 42 triplet-bearing mixed-aged Romney ewes, that were a maximum of 140 days pregnant (P140), were allocated to one of the two herbage treatments with as 22 twin-bearing and 20 triplet-bearing ewes grazing the Rye-W/C mix and 22 twin-bearing and 22 triplet-bearing ewes grazing the Herb mix. Ewes and lambs remained on these treatments until the end of the study. Herbage masses from P140 were above 2,000 kg dry matter (DM)/ha throughout the study ensuring intake was not limited (Hutton *et al*., 2011). The data for ewe and lamb live weights, herbage mass, botanical composition and herbage quality have been reported previously (Hutton *et al*., 2011). The experiment was conducted in September to December 2008 on Keeble Farm, Massey University, Palmerston North.

Ewe and lamb measurements

The behaviour of each ewe was assessed during tagging within 12 hours of birth using a maternal behaviour score system (scale 1 to 5, where 1 = Ewe flees and 5 = Ewe stays close; O'Connor *et al*., 1985). An 8 mL blood sample was randomly collected by jugular venipuncture (Lithium heparin, Becton, Vacutainer Systems, USA) from complete litter sets of lambs, 24 to 36 hours after birth (Rye-W/C Twin n = 16, Rye-W/C Triplet n = 15, Herb Twin n = 22, Herb Triplet n = 24). Samples were placed immediately on ice until they were centrifuged at 1,000 g for 15 minutes. The plasma was removed and frozen at -20ºC. The plasma samples were analysed via radioimmunoassay for Immuno-globulin G (IgG) (Standard direct ELISA assay), gamma-glutamyl transferase (GGT) activities using a kit (Roche Diagnostics Ltd, Mannheim, Germany), and glucose concentrations by a hexokinase assay (Roche Diagnostics Ltd, Mannheim, Germany).

At between 24 and 36 hours of age, a total of 86 lambs (Rye-W/C Twin n = 24, Rye-W/C Triplet n = 16, Herb Twin n = 20, Herb Triplet n = 24) were subjected to indirect open circuit calorimetry (McCutcheon *et al*., 1983; Kerslake *et al*., 2009). The lambs head was placed in a plastic hood, which was sealed around the neck with a collar. The lamb was acclimatised for 12 minutes to an environmental temperature that ranged from 6 to 8ºC. During this time rectal temperature and oxygen consumption measurements were taken over three successive four-minute periods to obtain a stabilised metabolic rate for base heat production. At the end of 12 minutes, chilled water (artificial rain, 1°C) was applied through sprinklers at 1.08 L/min and cold air was passed over the lamb by a fan positioned behind the animal at 1.0 m/s. After 20 minutes cold air was passed over the lamb at 1.5 m/s, and after another 20 minutes at 2.0 m/s.

Rectal temperature and oxygen consumption measurements were taken at four minute intervals for a maximum of 88 minutes or until the lamb reached maximal heat production. Maximal heat production was assumed to have been met when the rectal temperature of a lamb declined at the rate of 1°C per 20 minutes and there was no further increase in the consumption rate of oxygen (Alexander, 1962). To facilitate heat loss and to encourage heat production to reach a maximum, all lambs with a birth weight above 4 kg had the wool removed from their back and sides leaving a wool depth of 3 mm. Maximal heat production (watts) was calculated from oxygen consumption (litres per hour) using the following formula.

Maximal heat production = Oxygen consumption x 20.46 / 3.6

A total of eight lambs failed to reached maximal heat production during the 88-minute measurement period (Rye-W/C Twin n = 3, Rye-W/C Triplet n = 2, Herb Twin n = 0, Herb Triplet n = 3). In this study the time and causes of lamb deaths were not recorded.

Statistical methods

All measurements on ewes and lambs were subjected to analysis of variance using the Generalised Linear Model procedure from the statistical package Minitab (Minitab, 1998). The main effects of birth rank, nutritional treatment and two-way interactions between these effects, where appropriate, were tested. All non significant interactions (P >0.05) were removed and are not reported here. The maximal lamb heat production, if it occurred within the 88-minute period, was multiplied by birth weight to calculate a total heat production (watts). Log_e transformations were used for lamb IgG concentrations and square root transformations for GGT concentrations to ensure normal distribution of the data.

RESULTS AND DISCUSSION

Maternal behaviour score (Mean ± standard error of the mean: 3.3 ± 0.2 versus 3.3 ± 0.2 for ewes in the Rye-W/C and Herb treatments respectively), lamb thermoregulation and two of the indices of colostrum intake, IGG and glucose did not differ (P >0.05) between ewe nutritional treatments (Table 1). However, triplet born lambs from the Herb mix group displayed a greater (P <0.05) GGT concentration than triplet born lambs from the Rye-W/C group (Table 1). In combination, these results suggest that neither ewe behaviour nor lamb thermoregulation or colostrum uptake are responsible for any improvement in lamb survival that might occur with grazing on the Herb mix. Therefore some other mechanism(s) must be responsible. Kenyon *et al*. (2010) suggested the upright structure of the Herb sward may have provided shelter to the newborn lambs as shelter is known to improve lambs survival (Pollard, 2006). In ewes from the same study, Hutton *et al.* (2011) reported greater milk yield in Herb treatment ewes one-week post lambing and reported that at three weeks of age, lambs born to ewes on the Herb mix where 1 kg heavier. It is therefore possible that milk

TABLE 1: Mean ± standard error of the mean for lamb summit metabolic rate, and the concentration of circulating immune-globulin G (IgG), glucose and gamma-glutamyl transferase (GGT) in the plasma of 24- to 36-hour-old, twin and triplet lambs born on either a Ryegrass, White clover (Rye-W/C) sward or a Chicory, Plantain, White and Red clover (Herb) sward. Columns with letters in common or without superscripts, are not significantly different (P <0.05).

Effect	Number of lambs	Summit metabolic rate (W/kg)	Number of lambs	Indices of colostrum uptake		
				IgG[1] (g/L)	Glucose (mmol/L)	GGT[1] (iu/L)
Herbage type						
Rye-W/C	37	14.9 ± 0.6	31	1.9 ± 0.1 (122)	4.8 ± 0.3	35 ± 3[a] (1,367)
Herb	41	14.3 ± 0.6	46	1.8 ± 0.1 (84)	4.8 ± 0.3	43 ± 2[b] (2,186)
Birth rank						
Twin	41	14.7 ± 0.6	38	1.8 ± 0.1 (89)	4.5 ± 0.3	39 ± 2 (1,676)
Triplet	37	14.5 ± 0.6	39	1.9 ± 0.1 (118)	5.1 ± 0.3	39 ± 2 (1,877)
Interaction						
Rye-W/C x Twin			16			38 ± 4[ab] (1,620)
Rye-W/C x Triplet			15			31 ± 4[a] (1,141)
Herb x Twin			22			40 ± 3[ab] (1,732)
Herb x Triplet			24			47 ± 3[b] (2,639)

[1]Back transformed means in parenthesis.

intake of the lambs, which is their sole source of energy and water, is greater in lambs born to ewes on the Herb mix without a change in apparent colostrum production/intake and may explain any improved survival. However, further work is required verify this.

ACKNOWLEDGEMENTS

We acknowledge the funding by Massey University and Beef and Lamb New Zealand. Also thanks to the National Research Centre for Growth and Development for the partial funding of P.R. Kenyon.

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