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The effects of body condition score and nutrition of triplet-bearing ewes in late pregnancy

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ABSTRACT

At day 128 (P128) of pregnancy, triplet-bearing Romney ewes were allocated to either a 'Control' or 'ad-libitum' ('Adlib') nutritional regimen until P142. Both nutritional regimens included ewes of body condition score (BCS): 2.0, 2.5 and 3.0. During the nutritional period the post grazing masses were 807.9 ± 58.5 and 1254 ± 61.1 kg DM/ha for the Control and Adlib regimens respectively. At P142 Control ewes had lighter ($P < 0.05$) live weight and lower ($P < 0.05$), condition score and backfat depths than Adlib ewes. Neither ewe nutritional regimen nor BCS affected ($P > 0.05$) lamb live weight or indices of colostrum uptake. There was no effect ($P > 0.05$) of ewe nutritional regimen on lamb survival. Lambs born to BCS2.5 ewes had lower survival ($P < 0.05$) than BCS3.0 lambs and BCS3.0 lambs tended ($P = 0.09$) to have greater survival than BCS2.0 lambs. BCS3.0 ewes weaned a greater total weight of lamb ($P < 0.05$) than BCS2.5 ewes. There were no ($P < 0.05$) interactions between ewe nutritional regimen and BCS for any of the lamb traits measured. In conclusion, the data indicates triplet-bearing ewes can be managed under controlled grazing conditions with post grazing masses of approximately 800 kg DM/ha to day 142 of pregnancy without affecting lamb performance. The present study also suggests farmers should aim to have their triplet-bearing ewes at a body condition score of 3.0 prior to late pregnancy to achieve higher levels of performance.

1. Introduction

The number of lambs weaned per ewe bred has increased in New Zealand over the past 30 years (Anon., 2012) with an increase in lambing percentage being associated with an increase in the proportion of triplet-bearing ewes (Amer et al., 1999). The nutritional requirements of triplet-bearing ewes in late pregnancy are greater than that of their single- and twin-bearing counterparts (Nicol and Brookes, 2007). In spring lambing flocks this increased feed demand in late pregnancy occurs in winter, a period of reduced pasture growth in New Zealand (Matthews et al., 2000). Therefore knowledge of how late into pregnancy, triplet-bearing ewes can be nutritionally restricted without affecting their performance, or that of their offspring to weaning is of value.

A series of studies have examined pastoral-based feeding regimens for multiple-bearing ewes in mid- and late-pregnancy (Morris et al., 1993a; Morris and Kenyon, 2004; Everett-Hincks et al., 2005; Corner et al., 2008, 2010; Kenyon et al., 2011, 2012a,b). In summary, the results indicate that multiple-bearing ewes can be offered controlled pastoral conditions to at least day 136 of pregnancy with little impact on the ewe or her offspring, if the ewes are subsequently offered ad libitum pastoral conditions in very late pregnancy, and in lactation.

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Body condition score is a subjective measure of soft tissue, predominantly fat, in the lumber region and is used as an indicator of body reserves or the 'nutritional well-being' of adult ewes (Jefferies, 1961; Russel et al., 1969; Russel, 1984; van Burgel et al., 2011). It may be expected that under conditions of nutritional stress, ewes of greater body condition would have the ability to buffer nutritional restriction and ensure their performance and that of their lambs is maintained. Indeed, it has been reported that ewes of greater body condition score can display improved lactational performance (Hossamo et al., 1986; Atti et al., 1995), their lambs are more likely to survive (Kleemann and Walker, 2005; Everett-Hincks and Dodds, 2009) and are heavier at weaning (Gibb and Treacher, 1980; Hossamo et al., 1986; Alvarez et al., 2007) than ewes of low body condition.

Therefore, the present study aimed to examine the potential interaction between ewe nutrition in late pregnancy and ewe body condition score on triple-bearing ewe and lamb performance to weaning. It was hypothesised that the performance of triplet-bearing ewes and their offspring would be reduced when ewes were managed under controlled grazing conditions until approximately one week prior to the start of lambing. Further, the impact of controlled grazing conditions would be less in ewes of greater body condition score.

2. Materials and methods

2.1. Experimental design and animals

Seventy-two days (P72) after the start of the breeding period, 197 triplet-bearing Romney ewes (mixed aged 3–5 years) were selected from a commercial flock for the present study after pregnancy diagnosis. Breeding had begun on 1st May 2011. Ewes were selected based on ewe body condition score (BCS2.0 $n = 65$, BCS2.5 $n = 69$, BCS3.0 $n = 63$). All ewes had been grazed with post-grazing herbage masses of less than 1000 kg DM/ha from breeding until P72 as part of the larger commercial flock.

At P80 ewes were transferred to the research site. On P83, ewes were given an anthelmintic (Bionic Capsule, Merial/Ancare NZ Ltd., which releases albendazole and abamectin over 100 days) and subsequently managed with a target post-grazing herbage masses of less than 1000 kg DM/ha until P128. At P128, ewes were allocated to either a 'Control' or 'Ad libitum' ('Adlib') nutritional regimen for the following 14 days (P128–P142). Each nutritional regimen included ewes from each of the three BCS groups: BCS2.0 (Control $n = 32$, Adlib $n = 33$), BCS2.5 (Control $n = 35$, Adlib $n = 34$) or BCS3.0 (Control $n = 32$, Adlib $n = 31$). Within the three body condition score groups ewes were randomly allocated to the two nutritional regimens.

The Control nutritional regimen aimed to ensure pre-grazing herbage masses of approximately 1200 kg DM/ha and post-grazing masses of less than 1000 kg DM/ha. Adlib post grazing covers were managed to ensure covers were above 1200 kg DM/ha. Previous studies indicate that intake and live weight gain of multiple-bearing ewes is restricted at ryegrass white clover herbage masses below 1200 DM/ha (Morris et al., 1993a,b; Morris and Kenyon, 2004; Kenyon et al., 2011, 2012a,b). The total area of the study was 26.0 ha. At P142, the nutritional regimens were merged and all ewes offered ad libitum feeding conditions until P146. At P146 ewes were randomly allocated to one of five paddocks for lambing.

Twenty four hours after lambing, ewes and their lambs were moved to post-lambing paddocks, and during lactation were offered ryegrass white clover masses above 1200 kg DM/ha. All ewes lambed over a 19-day period (25 September 2011 to 13 October 2011) and the study was completed 80 days (L80) after the mid-point of lambing (2 October). Ewes and their lambs were randomly allocated to one of three post-lambing paddocks. During lactation ewes and their lambs were managed via rotational grazing to ensure herbages masses were maintained above 1200 kg DM/ha.

The study was conducted at Massey University's Keeble Farm, 5 km south of Palmerston North, New Zealand (40° south, 175° east) during the period August–November 2011 with approval from the Massey University Animal Ethics Committee.

2.2. Animal measurements

Body condition scores (Jefferies, 1961, scale 0–5.0 including half units) of ewes were recorded at P72, P114, P128, P142 and L80 by a single experienced operator. Live weights of ewes were recorded within one hour of removal from their paddocks (unfasted) at P83, P114, P128, P142 and L80. Back fat depth of ewes was measured (12th rib midline) via ultrasound on P83, P125 and P142. At P83, a further ultrasound pregnancy scanning was undertaken to confirm the number of foetuses carried.

A random co-hort of 95 (BCS2.0 Control $n = 18$, Adlib $n = 19$: BCS2.5 Control $n = 13$, Adlib $n = 15$: BCS3.0 Control $n = 14$, Adlib $n = 16$) ewes were blood sampled (10 mL) via jugular venepuncture (heparin, Becton Dickinson Vacutainer Systems, USA) on P131 and P139. All blood samples were placed on ice before centrifugation. Plasma concentrations of b-hydroxybutyrate (BOHB) and nonesterified fatty acids (NEFA) and glucose were analysed using a Hitachi modular chemistry analyser. Glucose was analysed using an enzymatic (hexokinase) method using Glucose/HK reagents (Roche Diagnostic GmbH, Mannheim, Germany). NEFA was analysed by way of an enzymatic colour test using NEFA C reagents (Wako Chemicals GmbH, Neuss, Germany). BOH was analysed using D-3-hydroxybutyrate reagents (Randox Laboratories Ltd., Co. Antrim, United Kingdom).

All lambs were tagged, identified to their dam and their sex, birth weight and birth-rank were recorded within 12 h of birth regardless of category (dead vs. alive). Further live weights were recorded at L19 and L80. Presence of the lamb at L80 was used as a proxy for survival to weaning.

A random cohort of 237 lambs from live triplet litters were blood sampled at 24–36 h of age via jugular venipuncture (BCS2.0 (Control $n = 45$, Adlib $n = 35$), BCS2.5 (Control $n = 39$, Adlib $n = 39$) or BCS3.0 (Control $n = 36$, Adlib $n = 43$) (serum, Becton Dickinson Vacutainer Systems, USA)) to determine indices of colostrum uptake (glucose and gamma glutamyl transferase (GGT)). Post collection blood samples were placed on ice before centrifugation at $1000 \times g$ for 15 min. The serum samples were frozen at −20 °C until analysed. Plasma was analysed for glucose (Roche Diagnostics, Basel, Switzerland) and GGT activity (Roche Diagnostics).

2.3. Herbage mass and quality measures

Ewes were moved as required to ensure they grazed herbage masses within the desired pre- and post-grazing targets. The pre- and post grazing herbage mass was recorded each time ewes were moved during P82–P141 and during P143–P146. Herbage mass was determined immediately prior to the beginning of lambing (P146) and weekly during lactation. Herbage mass was recorded with a rising plate metre (Ashgrove Pastoral Products, New Zealand, 50 readings per paddock) with a standard calibration (herbage mass = (158 × average metre reading) + 200, Hodgson et al., 1999).

2.4. Statistical analysis

Complete ewe and lamb data was collected from 161 triplet-bearing ewes (BCS2.0 Control $n = 30$, Adlib $n = 28$: BCS2.5 Control $n = 27$, Adlib $n = 27$: BCS3.0 Control $n = 23$, Adlib $n = 26$) out of the original 197 ewes. The non inclusion of data from the remaining 36 ewes was due to 4 ewes giving birth to twins (BCS2.0 Control $n = 0$, Adlib $n = 0$: BCS2.5 Control $n = 1$, Adlib $n = 1$: BCS3.0 Control $n = 1$, Adlib $n = 1$), 12 ewes being removed from study due to either ill health or death (BCS2.0 Control $n = 1$, Adlib $n = 2$: BCS2.5 Control $n = 1$, Adlib $n = 2$: BCS3.0 Control $n = 2$, Adlib $n = 4$) and incomplete ewe-lamb data being collected from 20 ewes (BCS2.0 Control $n = 1$, Adlib $n = 3$: BCS2.5 Control $n = 6$, Adlib $n = 4$: BCS3.0 Control $n = 6$, Adlib $n = 0$).

Ewe live weight, body condition score and back fat depth in pregnancy were analysed using a mixed model allowing for repeated measures (SAS v9.1, SAS Institute Inc., Cary NC, USA). The models used included date of lambing as a covariate and fixed effects of measurement time, nutritional regimen and BCS group and their two- and three-way interactions.