INFLUENCE OF LONG-TERM PROGESTERONE ON FEED EFFICIENCY AND BODY COMPOSITION IN MATURE RAMBOUILLET EWES

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Impact Statement

Mimicking progesterone concentration for least 70 d of using a controlled internal drug-releasing device (CIDR) did not appear to alter feed efficiency or calculated body composition of mature Rambouillet ewes. However, pregnancy in the sheep lasts for almost 145 days, and perhaps exposing ewes to progesterone for a longer period of time may be necessary to observe the effect of progesterone on feed efficiency and body composition in ewes treated with long-tern progesterone.

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SUMMARY

The objectives of this study were to evaluate the effects of long-term progesterone (P4) treatment on changes in feed efficiency, BW, and body composition in mature Rambouillet ewes. Thirty, multiparous, 5- and 6-yr-old Rambouillet ewes were stratified by age and metabolic BW and assigned randomly to receive long-term P4 administration using controlled intravaginal releasing devices (CIDR) or no P4 (CIDRX; CIDR backbone only). Initially, ewes were synchronized for estrus using a 7 d CIDR and $PGF_{2\alpha}$ protocol. All ewes exhibited estrus within 72 h after $PGF_{2\alpha}$. Twelve d after estrus (d = 0), each ewe received either a CIDR (n = 15) or a CIDRX (n = 15). Every 2 wk thereafter, the CIDR or CIDRX was removed from each ewe and replaced with a new CIDR or CIDRX for 126 d. Individual feed intake was recorded using the GrowSafe units beginning at d 0 following a 3-wk adaptation period. Ewes were fed a mixed grass hay diet ad libitum that met the nutrient requirements for maintenance. BW for each ewe was collected every 2 wk when CIDR or CIDRX were replaced. Back fat (BF) and rib-eye area (REA) were measured for each ewe every 28 d using ultrasonography. Data reported herein represent the first 70 d of the experiment. BW, RFI, BF, and REA did not differ (P > 0.10) between CIDR- and CIDRX-treated ewes. Calculated estimates of muscle mass (kg), intra-muscular fat (kg), empty body weight (kg), empty body weight dry matter (%), empty body weight fat (%), empty body weight protein (%), carcass weight (kg), carcass weight dry matter (%), carcass weight fat (%), and carcass weight protein (%) did not differ (P > 0.10) between CIDR- and CIDRX-treated ewes. BW or body composition in mature Rambouillet ewes.

INTRODUCTION

Recently, Swartz et al. (2014) showed that P4 concentrations were greater in Rambouillet ewes selected for high reproductive rates (HL) than in ewes selected for low reproductive rate (LL) during pregnancy. In their study, nutrient intake and TDN did not differ between lines of ewes. However, the total kg of TDN consumed per ewe per kg of lamb born was 24% greater in LL line ewes than in HL ewes. The physiological mechanism appeared to be related to greater concentrations of progesterone (P4) between d 60 and d 120 of gestation in HL ewes than in LL ewes.

We hypothesized that long-term, systemic P4 concentrations may be related to increase in feed efficiency and changes in partitioning of nutrients. The objectives of were to evaluate the effects of long-term P4

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treatment, independent of the influence of the placenta and fetus, on changes in feed efficiency, BW, and body composition in mature Rambouillet ewes.

PROCEDURES

Thirty, multiparous, 5- and 6-yr-old commercial Rambouillet ewes from the Montana State University, Red Bluff Research Ranch flock in Norris, Montana were used for this study. Ewes were adapted to the GrowSafe system for 3 wk. Treatments were: 1) long-term P4 maintenance using CIDR (CIDR; n = 15) or 2) no long-term P4 maintenance using a CIDR backbone (**CIDRX**; n = 15). Ewes were synchronized for estrus using the 7-d CIDR and $PGF_{2\alpha}$ Twelve d (d = 0) after estrus each CIDR-treated and CIDRX-treated ewe received a CIDR or CIDRX, respectively. This event was the beginning of the feeding trial and d 0 of the experiment. P4 concentrations in each ewe were maintained by replacing a CIDR every 14 d with a new CIDR.

Body weights of each ewe were recorded every 14 d and estimates of BF and REA were obtained by ultrasonography every 28 d beginning at d 0.

Feed intake data reported herein represent the first 70 d of the experiment. Ewes were given ad libitum access to mixed grass hay, water, and mineralized salt blocks. The chemical composition is given in Table 1. The chemical composition of the mixed grass hay on an as fed basis met the NRC (NRC, 2006) nutrient requirements for maintenance of a 132 lb adult ewe.

Daily intakes were computed for each of the ewes from the feed intakes derived from the GrowSafe Data software. Residual feed intake (**RFI**) was calculated for each ewe using standard calculations for RFI (Redden et al., 2013).

Estimates of body composition muscle mass (lb) and intra-muscular fat (lb) were calculated from BF, REA and BW based on regression equations reported by Silva et al. (2006) for mature ewes.

Data for BW, RFI, BF, and REA at 70 d were analyzed by ANOVA for completely randomized design using PROC ANOVA of SAS.

RESULTS AND DISCUSSION

Body weight, RFI, BF and REA did not differ between CIDR- and CIDRX-treated ewes by 70 d of the experiment (Table 2). Likewise, calculated estimates of body composition did not differ between CIDR- and CIDRX-treated ewes by 70 d of the experiment.

The objectives of this study were to evaluate the effects of long-term P4 treatment on changes in feed efficiency, BW, and body composition in mature Rambouillet ewes, independent of placental and fetal functions. We found that maintaining P4 concentrations in ewes using P4-containing CIDR did not influence feed efficiency, BW, and body composition relative to ewes whose P4 concentrations were not constantly maintained during the first 70 d of this experiment. Furthermore, maintaining P4 concentrations did not alter calculated estimates of muscle mass, intra-muscular fat, empty body weight, carcass weight; percentages of empty body weight as dry matter, fat, and protein; and, percentages of carcass weight as dry matter, fat, and protein compared to ewes in which P4 concentrations were not constantly maintained.

Our hypothesis that long-term maintenance of P4 concentrations would alter feed efficiency by altering metabolic processes of ewes was developed from the work of Swartz et al. (2014). They reported that nutrient intake and TDN did not differ during gestation in ewes from lines selected for high (HL) and low (LL) reproductive rates. However, the total lbs of TDN consumed per ewe per lbs of lamb born was 24% greater in LL line ewes than in HL ewes. The only endocrinological difference

between ewes of these lines was that systemic concentrations of P4 were greater in HL ewes than in LL ewes between 60 and 120 d of gestation. Essentially one could interpret this to mean that the increase in efficiency of nutrient utilization in HL ewes during gestation was the result of increased concentrations of P4 between d 60 and d 120 of gestation.

The results reported in the present study include only 70 d of maintenance of P4 concentrations. The lack of differences in feed efficiency, BW, and body composition could be related to the duration of maintenance of P4 concentrations. In this regard, one has to take into account that CIDRX ewes were exhibiting regular estrous cycles accompanied natural increases in P4 from the start of the experiment through the end of the breeding season (approximately the end of January). In the study by Sarda et al. (1973), P4 concentrations in pregnant ewes did not markedly increase until after d 80 to 90 of gestation. Furthermore, Swartz et al. (2014) reported that P4 concentrations did not differ between HL and LL ewes on d 30 and 60; a time frame that corresponds to this study for CIDR- and CIDRX- treated ewes. This may indicate that P4 concentrations must be maintained for longer than 60 to 70 d in order to cause a change in metabolism in sheep. In fact, feeding melengesterol acetate (**MGA**), a synthetic progestin, to beef heifers required at least 57 d to affect an increase in ADG, marbling score, and tenderness relative to these characteristics in heifers not fed MGA (Busby et al., 2002).

To our knowledge this is the first study that evaluated the effects of long-term P4 treatment on feed efficiency and body composition in ewes. In conclusion, it appears that maintaining P4 concentrations for 70 d does not affect feed efficiency and body composition in ewes. Furthermore, it remains to be determined as to whether maintaining P4 concentrations for greater than 70 d up to 126 d will alter feed efficiency and body composition in ewes.

REFERENCES

Busby, D., D. Loy, and G. Rouse. 2002. Effect of MGA on performance, sexual behavior, carcass quality and tenderness in mixed-sex pens of cattle. Beef Research Report. http://lib.dr.ia.state.edu/beefreports_2001/9 (Accessed 11 March 2015).

NRC. 2007. Nutrient requirements of small ruminants. Natl. Acad. Press. Washington D.C. p. 246.

Redden, RR., L.M.M. Surber, A.V. Grove, and R. W. Kott. 2013. Growth efficiency of ewe lambs classified into residual intake feed intake groups and pen fed a restricted amount of feed. Small Rumin. Res. 114: 214-219

Sarda, I. R., H. A. Robertson, and T. C. Smeaton. 1973. Sequential changes in plasma progesterone levels in the ewe during the estrous cycle, and during pregnancy in intact and ovariectomized sheep. Can. J. Anim. Sci. 53: 25-34.

Swartz, J.D., J.G. Berardinelli, J.M. Thomson, M. Lachman, K. Westveer, M.R. Herrygers, R.W. Kott, P.G. Hatfield, and C.J. Yeoman. 2014. Temporal patterns of intake, energy-related metabolites, metabolic hormones, progesterone concentrations, and lambing rates in Rambouillet ewes selected for high and low reproductive rate. Proc. West. Sect. Amer. Soc. Anim. Sci. 65: 98-101.

Table 1. Chemical composition of mixed grass hay diet[1]

Item	Mixed Grass Hay diet
Nutrient analyses, %	
DM	86.2
CP[2]	7.5
TDN[2]	60.2

[1] Ewes had free access to the mixed grass hay diet.
[2] CP and TDN are based on a percentage DM basis.

Table 2. Body weight (BW), residual feed intake (RFI), back fat depth (BF), and rib-eye area (REA) in Rambouillet ewes that received a P4-containing controlled intravaginal releasing device (CIDR) or a CIDR backbone (no P4; CIDRX) for 70 d

	Treatment			
Item	CIDR	CIDRX	SEM	*P*-value
n	15	15		
BW, lb	130	129	17	0.87
RFI, lb/d	0.06	-0.17	0.51	0.23
BF, in	0.07	0.08	0.004	0.56
REA, in^2	0.04	0.04	0.001	0.78