Influence of long-term progesterone on feed efficiency and body composition in mature Rambouillet ewes[1]

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Abstract

Objectives of this study were to evaluate the effects of long-term progesterone (P4) treatment on changes in feed efficiency, BW, and body composition (BC) 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). Ewes were synchronized for estrus using a 7 d CIDR, prostaglandin $F_{2\alpha}$ (PG) protocol. Twelve d after estrus (d = 0), each ewe received either a CIDR (n = 15) or a CIDRX (n = 15). Every 2 wk the CIDR or CIDRX were replaced for 126 d. Individual feed intake was recorded using GrowSafe units. Ewes were fed a mixed grass hay diet ad libitum that met 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, REA and calculated estimates of BC did not differ ($P > 0.10$) between CIDR- and CIDRX-treated ewes. In conclusion, exposing ewes to P4 for a longer period of time may be necessary to affect feed efficiency, BW and BC.

Background

- Nutrition and metabolism are known to affect reproduction in livestock.
  - Nutritional status of ewes has been shown to interact with systemic progesterone (P4) concentrations and influence the maintenance of pregnancy (Parr et al., 1987).
- 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 (Figure 1).

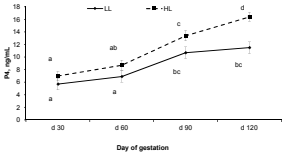

Figure 1. Least squares means of progesterone (P4) concentrations during gestation in Rambouillet ewes selected for high (HL; n = 20) and low (LL; n = 15) reproductive rate. Error bars represent ± SE of each mean. Line by d of gestation interaction; $P = 0.04$. Means with different superscripts differ ($P < 0.05$).

- More importantly, HL ewes require ~25% less total digestible nutrients to produce 1 lb than LL ewes, i.e., were ~25 more efficient!!
  - One could hypothesize that HL ewes were more efficient in partitioning nutrients into fetal growth and development.

Objectives and Hypothesis

- Our question was: does long-term progesterone treatment change feed efficiency, BW, and body composition in mature Rambouillet ewes?
- Objectives of this study were to evaluate the effects of long-term progesterone treatment on changes in feed efficiency, BW, and body composition in mature Rambouillet ewes.
- Our hypothesis was: long-term progesterone does not change feed efficiency, BW, and body composition in mature Rambouillet ewes.

Materials and Methods

- 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).
- Ewes were synchronized for estrus using a 7 d CIDR, prostaglandin $F_{2\alpha}$ (PG) protocol. All ewes exhibited estrus within 72 h after PG.
- Twelve d after estrus (d = 0), each ewe received either a CIDR (n = 15) or a CIDRX (n = 15).
  - Every 2 wks the CIDR or CIDRX was removed from each ewe and replaced with a new CIDR or CIDRX for 126 d.
- 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.
- 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.
- Daily intakes were computed for each of the ewes which were used to calculate individual residual feed intakes (RFI). Where RFI is the difference between dry matter intake and expected feed intake based on the herd.
- Estimates of body composition were modeled using regression equations reported by Silva et al. (2006) and Sanson et al. (1993) 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. The model included treatment (CIDR and CIDRX).
- Data for estimated body composition were analyzed by ANOVA using separate PROC MIXED models for repeated measures of SAS. The model included treatment (CIDR and CIDRX), day (ultrasound day), and the treatment by day interaction.

Results

Table 1. 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, kg	58.9	58.5	7.5	0.87
RFI, kg/d	-0.025	0.077	0.23	0.23
BF, mm	1.9	2.0	0.1	0.56
REA, mm^2	26.5	26.7	0.6	0.78

Results

Table 2. Muscle mass (M), intra-muscular fat (IMF), empty body weight (EMW), empty body weight dry matter (EBWDM), empty body weight fat (EBWF), empty body weight protein (EBWP), carcass weight (CW), carcass weight dry matter (CWDM), carcass weight fat (CWF), and carcass weight protein (CWP) of 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
M, kg	13.7	14.0	0.5	0.73
IMF, kg	1.9	2.0	0.1	0.61
EMW, kg	47.7	48.1	1.4	0.85
EMWDM, %	45.0	45.1	0.5	0.82
EBWF, %	17.4	17.7	0.9	0.85
EBWP, %	18.0	17.9	0.2	0.83
CW, kg	26.2	26.5	0.8	0.85
CWDM, %	49.8	50.0	0.4	0.84
CWF, %	17.9	18.2	0.9	0.84
CWP, %	19.7	19.6	0.2	0.85

Body weight, RFI, BF and REA did not differ between CIDR- and CIDRX-treated ewes by 70 d of the experiment (Table 1). Likewise, 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 did not differ between CIDR- and CIDRX-treated ewes by 70 d of the experiment (Table 2).

Conclusions

- 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.
  - P4 concentrations in pregnant ewes did not markedly increase until after d 80 to 90 of gestation (Sarda et al.,1973).
- 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.
- 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.

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