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Effects of sodium butyrate on productive performance, nutrient digestion and body immunity in late gestation of ewes

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1. Introduction

Late gestation is a very important period for pregnant ewes. Because of decrease of feed intake, there are many problems for nutrient metabolism

The purpose of this experiment was to study the effects of different levels of sodium butyrate on growth performance, nutrient apparent digestibility and body immunity during late gestation of ewes



2. Material and Methods

Sixty pregnant ewes of Hu sheep with similar age and body weight were randomly divided into 4 groups (n=15), and the basal diet was supplemented with 0 g/d (control group), 2.5 g/d (group A), 5 g/d (group B) and 7.5 g/d (group C) sodium butyrate for each sheep, respectively. The trial lasted from day 90 to day 15 before lamb birth. Feed intake and body weight were recorded and blood samples were collected at day 90 and day 15 before lamb birth. Three ewes in each group were randomly selected for digestion and metabolism test.



Table 1 Composition and nutrient levels of the basal diet

Ingredients	Content (%)	Nutrient levels	Content
Peanut seedling	14.5	CP (%)	13.25
Silage Corn	53.2	NDF(%)	24.62
Corn	9.1	ADF(%)	23.61
Bran	6.9	EE(%)	7.27
Soybean meal	8.5	Ca(%)	1.30
Corn DDGS	4.8	P(%)	0.70
Stone powder	0.9	ME/(MJ/kg)	9.68
NaCl	0.6		
NaHCO₃	1.0		
Premix	0.5		
Total	100.0		

3. Results

3.1 Effects of sodium butyrate on growth performance of ewes at late gestation (Table 2)

Items		Groups				P-value		
		Control	A	B	C	ANOVA	Linear	Quadratic
DMI/(kg/d)		1.68±0.08 ^b	1.70±0.08 ^b	1.93±0.08 ^a	1.74±0.09 ^a	0.047	0.232	0.181
BW/kg	Prenatal 60 d	79.00±0.98	81.50±4.02	78.10±2.28	83.38±1.20	0.527	0.454	0.616
	Prenatal 15 d	82.20±1.16 ^c	82.88±2.38 ^{bc}	88.00±1.52 ^a	87.13±0.43 ^a	0.032	0.011	0.617
	Postpartum 14 d	71.40±0.81	76.60±3.98	78.25±0.75	78.50±0.65	0.148	0.462	0.309
ADG/g	Prenatal 60 d— Prenatal 15 d	88.89±23.57 ^b	100.00±33.64 ^b	220.00±22.33 _a	83.34±26.64 ^b	0.006	0.410	0.016
	Prenatal 60 d— Postpartum 14 d	-97.97±10.50 ^b	-66.21±13.91 ^b	- 15.20±23.47 ^a	-65.88±10.09 ^b	0.020	0.057	0.019

The results showed that the dry matter intake (DMI) in group B was significantly higher than that of control group and group A ($P < 0.05$), but there was no significant difference between group B and group C ($P > 0.05$). The average daily gain (ADG) of ewes in group B was significantly higher than that of control group and group A ($P < 0.05$)

3.2 Effects of sodium butyrate on nutrient apparent digestibility of ewes at late gestation (Table 3) %

Items	Groups				P-value		
	Control	A	B	C	ANOVA	Linear	Quadratic
DM	60.24±2.67 ^b	59.78±2.43 ^b	72.13±2.15 ^a	69.84±2.39 ^a	0.002	0.001	0.731
GE	61.07±0.21 ^c	61.09±0.24 ^c	64.11±0.69 ^a	62.73±0.45 ^b	0.001	0.002	0.004
EE	52.36±2.43	54.49±3.01	56.22±2.40	56.20±3.90	0.773	0.334	0.723
CP	54.62±4.11 ^b	59.64±5.23 ^a	69.20±2.82 ^a	67.20±2.62 ^a	0.050	0.011	0.365
NDF	50.79±2.60 ^c	51.82±1.99 ^{bc}	65.02±3.56 ^a	59.96±2.69 ^{ab}	0.004	0.004	0.284
ADF	45.22±3.73 ^b	44.63±2.64 ^b	55.05±2.17 ^a	54.36±3.77 ^a	0.045	0.014	0.988
Ca	40.66±3.88	42.43±4.28	46.75±1.72	43.12±5.85	0.847	0.576	0.564
P	31.00±1.82	31.67±2.74	35.50±0.50	31.75±3.17	0.602	0.592	0.381

The apparent digestibility of dry matter, crude protein, gross energy and crude fiber in groups B was significantly higher than that in control group (P<0.05)

3.3 Effects of sodium butyrate on serum antioxidant indexes of ewes at late gestation (Table 4)

Items	Period	Groups				P-value		
		对照 Control	A	B	C	ANOVA	Linear	Quadratic
	Prenatal 60 d	145.49±6.99	157.89±6.10	156.39±5.23	157.81±6.32	0.449	0.218	0.389
SOD/(U/mL)	Prenatal 15 d	153.99±0.75 ^c	159.08±1.63 ^{bc}	172.27±2.47 ^a	164.62±2.90 ^b	<0.001	<0.001	0.008
	Postpartum 14 d	159.77±13.01 ^b	161.42±3.95 ^b	193.10±7.95 ^a	185.78±7.47 ^a	0.032	0.012	0.614
	Prenatal 60 d	3.12±0.32	4.05±0.63	3.21±0.42	3.91±0.29	0.340	0.434	0.795
MDA/(nmol/mL)	Prenatal 15 d	4.19±0.43	5.00±0.41	4.19±0.78	5.08±0.56	0.539	0.477	0.946
	Postpartum 14 d	5.53±0.72	3.59±0.72	4.77±0.63	4.91±0.50	0.241	0.823	0.130
	Prenatal 60 d	142.63±13.35	113.49±10.53	146.40±13.68	141.26±8.88	0.221	0.594	0.326
GSH-Px/(U/mL)	Prenatal 15 d	101.14±6.55 ^b	131.66±4.03 ^a	132.00±4.85 ^a	129.60±4.99 ^a	0.001	0.002	0.006
	Postpartum 14 d	108.69±15.04	114.86±8.86	129.94±9.96	117.6±12.72	0.647	0.443	0.448
	Prenatal 60 d	0.18±0.01	0.17±0.01	0.16±0.02	0.17±0.01	0.753	0.667	0.419
T-AOC/(mmol/mL)	Prenatal 15 d	0.15±0.01 ^b	0.16±0.01 ^b	0.19±0.01 ^a	0.16±0.01 ^b	0.003	0.041	0.020
	Postpartum 14 d	0.16±0.01	0.18±0.01	0.18±0.02	0.17±0.01	0.792	0.868	0.274

The level of SOD, GSH-Px and T-AOC at 15 day before lamb birth were significantly higher than those in control group.

3.4 Effects of sodium butyrate on serum immune indexes of ewes at late gestation (Table 5)

Items	Period	Groups				P-value		
		Control	A	B	C	ANOVA	Linear	Quadratic
	Prenatal 60 d	11.14±0.58	12.92±0.75	12.48±1.16	12.15±1.02	0.566	0.534	0.260
IgG/(mg/mL)	Prenatal 15 d	14.19±0.48 ^b	16.41±1.16 ^a	17.08±0.64 ^a	14.23±0.43 ^b	0.024	0.010	0.003
	Postpartum 14 d	10.76±0.79	11.94±0.73	13.29±0.73	10.89±0.91	0.130	0.631	0.286
	Prenatal 60 d	19.54±1.70	26.32±2.07	24.65±3.31	23.13±2.69	0.302	0.430	0.118
IL-2/(ng/L)	Prenatal 15 d	40.51±2.05 ^a	39.63±1.57 ^a	31.50±1.47 ^b	33.74±2.36 ^b	0.009	0.004	0.423
	Postpartum 14 d	25.52±2.41	28.72±2.57	31.12±2.67	25.01±2.02	0.280	0.936	0.073
	Prenatal 60 d	52.25±1.43	55.38±2.67	54.93±2.93	52.54±2.92	0.759	0.972	0.297
IL-4/(ng/L)	Prenatal 15 d	59.62±1.44	62.62±3.33	65.12±2.64	61.01±1.89	0.445	0.548	0.164
	Postpartum 14 d	57.09±1.47	56.87±2.26	54.08±1.97	54.76±1.56	0.585	0.253	0.810
	Prenatal 60 d	58.55±1.65	61.13±2.17	61.30±4.50	58.08±4.23	0.861	0.936	0.403
IL-6/(ng/L)	Prenatal 15 d	70.66±0.71 ^a	68.89±1.04 ^{ab}	63.62±1.34 ^c	65.34±1.50 ^{bc}	0.003	0.001	0.161
	Postpartum 14 d	59.62±2.16 ^a	58.98±1.56 ^a	50.98±1.88 ^b	51.21±1.89 ^b	0.005	0.001	0.822

At day 15 before lamb birth, IgG in group B was significantly higher than that in control group and group C (P<0.05); The serum level of IL-2 and IL-6 in groups B and C were significantly lower than those in control group and group A (P<0.05)

4. Conclusion

4.1 Dietary sodium butyrate supplementation at late gestation of ewes can increase feed intake, nutrient apparent digestibility and improve the body immunity.

4.2 The optimal supplemental level of sodium butyrate was 5 g/d per sheep.



Thanks for your attention!