

CHAPTER IV

RESULTS

The concentration of ruminal VFA during monensin administration

The ruminal VFA composition, the total concentration and the ratio of acetate to propionate between control group and the group treated with monensin are presented in Table 1.

In the control group, the total concentrations of VFA during 8 weeks of the course of experiment were not significantly different from those of the first week of the experiment. However, the concentration of individual VFA for acetate decreased from 71.63 ± 2.45 mole/100 mole in week 1 to 69.20 ± 2.96 mole/100 mole in week 3 ($P < 0.01$), while the concentration of butyrate increased significantly ($P < 0.05$) from 9.30 ± 1.02 mole/100mole in week 1 to 11.60 ± 2.24 mole/100 mole in week 3. The concentration ratios of acetate to propionate in the control group did not change throughout the course of experimental period.

In the group treated with monensin, the concentration of acetate decreased throughout the experimental period. The significant decrease was apparent at week 2 (67.28 ± 3.37 mole/100mole, $P < 0.01$) and week 3 (67.90 ± 4.18 mole/100mole, $P < 0.05$) as compared to that of the first week after monensin administration (69.42 ± 3.60 mole/100mole). There was an increase in the concentration of propionate through the period of study. The concentrations of propionate in week 2 (20.40 ± 3.14 mole/100mole, $P < 0.05$), week 4 (21.02 ± 2.05 mole/100mole, $P < 0.05$) and week 8 (21.37 ± 2.32 mole/100mole, $P < 0.05$) were higher than that of the first week ($19.14 \pm$

2.85 mole/100mole) after monensin administration. Changes in the concentrations of butyrate, valerate and total VFA were not apparent. The concentration ratio of acetate to propionate reduced at week 2 (3.38 ± 0.60) and week 4 (3.25 ± 0.43) ($P < 0.05$) in comparison to that of the first week (3.71 ± 0.65) in the same group after monensin administration (Table 1).

In comparison of the mean values between the control group and the group treated with monensin, the concentration of acetate in animals treated with monensin was lower than those of the control animals throughout the period of experiment. The significant level ($P < 0.05$) was apparent at week 4 of the experiment. The concentrations of propionate in the group treated with monensin at week 4 and week 8 of the experiment (21.02 ± 2.05 mole/100mole and 21.37 ± 2.32 mole/100mole, respectively) were significantly higher ($P < 0.01$ and $P < 0.05$, respectively) than those of the control group (16.93 ± 1.61 mole/100mole and 18.05 ± 1.48 mole/100mole, respectively) in respect to the similar period of study. The total VFA concentration in animals treated with monensin (136.17 ± 27.41 mM at week 3 and 150.17 ± 27.41 mM at week 4 of the experiment) were higher than those of the control animals (106.30 ± 24.25 mM and 110.66 ± 28.34 mM in the respective weeks). There were significantly higher ($P < 0.05$) in the ratio of acetate to propionate in the group treated with monensin at week 2, 4 and 8 of the experiment (3.38 ± 0.60 , 3.25 ± 0.43 and 3.36 ± 0.57 , respectively) than those of the control group (4.04 ± 0.52 , 4.25 ± 0.52 and 4.00 ± 0.43 , respectively).

The plasma glucose concentration, mammary blood flow and mammary glucose uptake

Arterial and venous plasma concentrations of glucose, arteriovenous concentration difference of glucose, extraction ratios of glucose of mammary gland, mammary blood flow and haematocrit in the control group and the group treated with monensin are shown in Table 2.

The concentrations of glucose in both arterial and mammary venous blood in both groups did not alter throughout the experimental periods. The plasma glucose arteriovenous differences were not different between the control and the monensin treated groups. Mammary plasma flow and blood flow were maintained at a constant rate throughout experimental periods in both groups. The mammary uptake of glucose was not affected either in the control or in the treated group throughout the course of experiment.

Milk yield and milk composition

Daily milk yield and milk composition for milk lactose, fat and protein are shown in Table 3.

During the course of experiments either in the control animals or the animals treated with monensin, daily milk yield and composition were unchanged. However, in the group treated with monensin changes in the percentage of milk yield showed the positive responses in week 3 and week 4 after monensin administration (3.3% and 2.7% respectively). At week 4 of the experiment, milk yield of the group treated with

monensin (10.18 ± 2.96 kg/day) was significantly higher ($P < 0.05$) than that in the control group (7.15 ± 1.79 kg/day).

Milk allantoin concentration and allantoin excretion

The milk allantoin concentration and milk allantoin excretion, which reflected the ruminal microbial activities, are shown in Table 4. Concentrations of milk allantoin remained constant throughout the course of study in both groups. Changes in the percentage of the concentration of milk allantoin in the control group were similar to those of the monensin treated group. However, there was a declining pattern of those changes in the treated group. Milk allantoin excretion in the treated group at week 1 (5.71 ± 1.75 mmole/day) was significantly different ($P < 0.05$) from that of week 8 after monensin administration (5.06 ± 1.97 mmole/day). In the control group, the excretions were constant through the period of study. The allantoin excretions of the group treated with monensin at week 1, 2, 3 and 4 of the experimental periods (5.71 ± 1.75 , 5.40 ± 1.41 , 5.52 ± 1.66 and 5.63 ± 2.08 mmole/day, respectively) were higher ($P < 0.05$) than those of the control group (4.07 ± 0.44 , 3.96 ± 0.73 , 3.96 ± 0.81 and 3.72 ± 0.76 mmole/day, respectively)

Table 1 The ruminal VFA compositions, the total concentration and the ratio of acetate to propionate in the control group and the group treated with monensin.

	Elapsed time from monensin treatment					
	1 st wk	2 nd wk	3 rd wk	4 th wk	6 th wk	8 th wk
Individual VFA(mol/100mol)						
Acetate:						
Control	71.63±2.45	70.77±3.00	69.20±2.96**	71.26±3.46	70.91±1.93	71.77±1.20
Treatment	69.42±3.60	67.28±3.37**	67.90±4.18*	66.98±3.48 [†]	68.84±4.04	68.01±4.26
Propionate:						
Control	18.36±1.74	17.72±1.65	18.41±2.28	16.93±1.61	18.42±1.60	18.05±1.48
Treatment	19.14±2.85	20.40±3.14*	20.16±2.91	21.02±2.05* ^{††}	19.97±3.51	21.37±2.32* [†]
Butyrate:						
Control	9.30±1.02	10.78±2.30	11.60±2.24*	11.04±2.79	9.87±1.41	9.44±1.33
Treatment	10.71±1.71	11.54±1.94	11.17±3.22	11.09±2.36	10.48±1.88	9.97±2.25
Valerate:						
Control	0.71±0.16	0.72±0.17	0.80±0.19	0.77±0.18	0.80±0.17	0.74±0.12
Treatment	0.73±0.19	0.78±0.16	0.77±0.27	0.91±0.29	0.70±0.38	0.75±0.39
Total VFA(mM):						
Control	104.15±25.03	111.30±20.92	106.30±24.25	110.66±28.34	127.69±23.31	112.10±18.00
Treatment	111.56±21.05	143.77±43.24	136.17±27.41 [†]	150.12±38.76 [†]	128.27±24.47	141.95±46.66
C2/C3 ratio:						
Control	3.94±0.53	4.04±0.52	3.82±0.61	4.25±0.52	3.87±0.40	4.00±0.43
Treatment	3.71±0.65	3.38±0.60* [†]	3.44±0.63	3.25±0.43* [†]	3.60±0.78	3.36±0.57 [†]

Values are means ± SD (n=7).

P-value by paired *t*-test with respect to the first week in the same group,

(** *P*<0.01, * *P*<0.05)

P-value by unpaired *t*-test with respect to the similar period of experiment

between control and monensin treated groups, (^{††}*P*<0.01, [†]*P*<0.05)

Table 2 Arterial plasma concentration of glucose, plasma glucose A-V difference, mammary extraction ratio, mammary glucose uptake, mammary blood flow and haematocrit in the control group and the group treated with monensin.

	Elapsed time from monensin treatment					
	1 st wk	2 nd wk	3 rd wk	4 th wk	6 th wk	8 th wk
MBF(ml/min):						
Control	3201±1046	3227±1043	4547±2011	3772±1643	3559±1203	3605±720
Treatment	4191±950	4344±1269	4796±2401	4711±1859	4049±657	4069±2160
Haematocrit (%):						
Control	28.3±2.3	29.6±3.2	29.1±3.1	29.1±3.0	29.5±3.0	29.1±2.7
Treatment	31.7±1.6	31.1±1.6	30.4±2.3	30.4±2.0	30.6±1.6	29.5±2.9
[glu] _a (mM):						
Control	3.54±0.19	3.24±0.24	3.30±0.33	3.29±0.31	3.36±0.24	3.38±0.25
Treatment	3.27±0.54	3.09±0.44	3.33±0.28	3.18±0.33	3.16±0.30	3.20±0.42
A-V dif(mM):						
Control	0.90±0.37	0.93±0.49	0.74±0.31	0.53±0.22	0.82±0.19	0.82±0.31
Treatment	0.82±0.23	0.62±0.26	0.75±0.17	0.62±0.30	0.77±0.23	0.67±0.20
Extraction ratio(%):						
Control	25.4±10.2	28.3±13.3	22.5±10.0	16.0±7.0	24.6±6.0	24.4±9.6
Treatment	25.2±6.1	20.4±8.8	22.3±4.7	19.2±8.4	24.6±7.4	20.7±4.9
Glucose uptake(μmole/min):						
Control	1991±7736	2200±1792	2244±1303	1471±1021	2054±901	2173±1019
Treatment	2287±627	1930±1099	2500±1614	2023±1168	2149±649	1865±1071

Values are means ± SD(n=7). Abbreviation: MBF, Mammary blood flow; [glu]_a, Arterial plasma glucose concentration; A-V dif, Arteriovenous difference of glucose. *P*-value by paired *t*-test with respect to the first week in the same group, (* *P*<0.05) *P*-value by unpaired *t*-test with respect to the similar period of experiment between control and monensin treated groups, (†*P*<0.05)

Table 3 Milk production and compositions in the control group and the group treated with monensin.

	Elapsed time from monensin treatment					
	1 st wk	2 nd wk	3 rd wk	4 th wk	6 th wk	8 th wk
Milk yield (kg/day):						
Control	7.57±1.59	7.64±1.87	7.44±2.12	7.15±1.79	7.34±2.77	6.91±2.50
Treatment	9.95±3.00	9.91±3.03	10.23±3.01	10.18±2.96 [†]	9.69±3.25	9.35±3.37
% changed :						
Control	-	0.36±8.12	-2.79±12.6	-5.52±16.1	-5.39±17.0	-10.9±13.2
Treatment	-	-0.37±8.12	3.30±9.69	2.70±9.65	-3.56±7.27	-7.44±9.51
Milk composition						
Protein(gm%):						
Control	3.46±0.43	3.51±0.39	3.54±0.39	3.47±0.48	3.45±0.41	3.41±0.43
Treatment	3.54±0.25	3.50±0.38	3.49±0.26	3.44±0.33	3.44±0.23	3.75±0.80
Fat (gm%):						
Control	4.54±1.43	3.55±1.06	3.64±1.33	4.56±1.42	4.63±1.67	5.53±1.14
Treatment	4.09±1.51	3.13±1.09	3.61±1.53	3.52±1.84	3.42±1.43	4.27±2.12
Lactose (gm%):						
Control	4.19±0.36	4.11±0.16	4.19±0.50	4.09±0.25	3.96±0.51	3.95±0.40
Treatment	4.37±0.36	4.20±0.21	4.22±0.34	4.05±0.71	4.18±4.13	4.26±3.33

Values are means ± SD (n=7).

P-value by paired *t*-test with respect to the first week in the same group, (* *P*<0.05)

P-value by unpaired *t*-test with respect to the similar period of experiment between control and monensin treated groups, ([†]*P*<0.05)

Table 4 Milk allantoin concentration and excretion in the control group and the group treated with monensin.

	Elapsed time from monensin treatment					
	1 st wk	2 nd wk	3 rd wk	4 th wk	6 th wk	8 th wk
Allantoin(μ mole/L):						
Control	551.15 \pm 88.80	529.66 \pm 74.88	546.07 \pm 69.65	530.44 \pm 71.46	542.06 \pm 64.12	529.44 \pm 56.19
Treatment	578.86 \pm 70.63	552.32 \pm 44.07	538.07 \pm 41.68	545.01 \pm 65.26	540.64 \pm 59.30	537.34 \pm 42.40
Percent change (%):						
Control	-	-3.48 \pm 6.5	-0.36 \pm 5.7	-3.27 \pm 6.3	-0.74 \pm 9.9	-3.04 \pm 8.0
Treatment	-	-3.58 \pm 11.9	-5.91 \pm 12.5	-5.28 \pm 10.0	-5.54 \pm 13.7	-6.36 \pm 9.5
Allantoin excretion(mmole/day):						
Control	4.07 \pm 0.44	3.96 \pm 0.73	3.96 \pm 0.81	3.72 \pm 0.76	3.85 \pm 1.05	3.55 \pm 0.95
Treatment	5.71 \pm 1.75 [†]	5.40 \pm 1.41 [†]	5.52 \pm 1.66 [†]	5.63 \pm 2.08 [†]	5.29 \pm 1.92	5.06 \pm 1.97*
Percent change (%):						
Control	-	-3.07 \pm 10.77	-3.12 \pm 13.96	-8.38 \pm 18.64	-6.07 \pm 19.19	-13.21 \pm 17.34
Treatment	-	-3.55 \pm 16.21	-2.43 \pm 17.58	-2.76 \pm 12.67	-8.43 \pm 17.34	-12.85 \pm 15.65

Values are means \pm SD (n=7).

P-value by paired *t*-test with respect to the first week in the same group, (* *P*<0.05)

P-value by unpaired *t*-test with respect to the similar period of experiment between control and monensin treated groups, ([†]*P*<0.05)