CHAPTER IV

RESULTS

Effects of sodium carbonate supplementation on milk productions, feed intake, and water intake in crossbred Friesian cows.

The calculated nutrient compositions of experimental diets are shown in Table 7. All diets were similar in each composition. The least square mean values of , body weight, dry matter intake, dry matter intake per %body weight, milk yield, milk yield per dry matter intake, 4% fat corrected milk, water intake and water intake per dry matter intake in control group and two treatment groups are shown in Table 8. Cows fed with control diets had lower DMI and DMI/%BW ($P<0.05$) when compared with cows fed Na_2CO_3 supplementation in diet. Milk yield was increased ($P<0.05$) in animals with the high level of Na_2CO_3. MY/DMI ratio of the control group was higher ($P<0.05$) than those of two treatment groups. MY/DMI ratio was decreased by 14% and 4% in animals fed with 1% and 2% Na_2CO_3 supplementation, respectively. The values for 4%FCM, BW, WI, and WI/DMI were not affected by the Na_2CO_3 supplementation in the diets.

Table 7 The chemical analysis of nutrient compositions of experimental diets (dry matter basis)

	Dietary		
Nutrient (%)	control	1% Na_2CO_3	2% Na_2CO_3
CP	16.1	16.1	16.2
ADF	22.0	22.0	21.9
NDF	35.9	37.4	39.6
Na	0.17	0.58	0.96
K	0.75	0.73	0.74
Cl	0.48	0.48	0.48

During experimental periods, the average temperature and relative humidity were 25.52-35.47°C and 54.57-73.57%, respectively. The concentration of Na, K, and Cl in water were 0.0015%, 0.0001%, and 0.0027%, respectively.

Table 8 Least square means of body weight, feed intake, milk productions and water intake

	Dietary		
	control	1% Na_2CO_3	2% Na_2CO_3
BW (kg)	492 ± 27.7	497 ± 31.3	498 ± 26.5
DMI (kg DM/d)	13.8^{b} ± 0.17	15.6^{a} ± 0.20	15.9^{a} ± 0.16
DMI / %BW	2.81^{b} ± 0.08	3.17^{a} ± 0.08	3.19^{a} ± 0.08
MY (kg/d)	13.6^{b} ± 0.16	13.7^{b} ± 0.18	14.9^{a} ± 0.15
MY / DMI	1.00^{a} ± 0.01	0.86^{c} ± 0.02	0.96^{b} ± 0.01
4% FCM (kg/d)	12.4 ± 0.74	12.6 ± 0.74	13.2 ± 0.63
WI (l/d)	45.9 ± 3.48	45.9 ± 2.66	49.1 ± 2.80
WI / DMI (l/kg)	3.26 ± 0.27	2.97 ± 0.20	3.26 ± 0.22

^{abc} Least square means with different superscripts in a row differ significantly ($P<0.05$)

Effects of sodium carbonate supplementation on milk compositions

The least square mean values of total yield of milk composition, percentages of milk compositions and milk electrolytes were shown in Table 9. Animals fed with high Na_2CO_3 supplementation in the diets tended to increase total yield of milk compositions and milk electrolytes, these change shown no significant differences. There were no differences in milk compositions and electrolytes, but total solid and fat percentage tended to decrease when animals were fed with Na_2CO_3 supplementation in diet. The concentration of Na in milk increased (P<0.05) during feeding with 2% Na_2CO_3 in diet in comparison to the control.

Table 9 Least square means of milk compositions

	Dietary		
	control	1% Na_2CO_3	2% Na_2CO_3
Milk yield composition (kg/d)			
TS	1.63 ± 0.10	1.67 ± 0.10	1.82 ± 0.09
Fat	0.45 ± 0.04	0.46 ± 0.04	0.48 ± 0.03
SNF	1.16 ± 0.08	1.22 ± 0.08	1.34 ± 0.07
Protein	0.47 ± 0.03	0.50 ± 0.03	0.53 ± 0.03
Lactose	0.60 ± 0.05	0.63 ± 0.05	0.71 ± 0.04
Milk composition (%)			
TS	12.65 ± 0.24	12.57 ± 0.24	12.49 ± 0.21
Fat	3.52 ± 0.31	3.46 ± 0.31	3.46 ± 0.27
SNF	8.97 ± 0.11	9.16 ± 0.11	9.04 ± 0.09
Protein	3.74 ± 0.07	3.81 ± 0.07	3.72 ± 0.06
Lactose	4.55 ± 0.09	4.65 ± 0.09	4.62 ± 0.08
Na (mg%)	72.39 ± 6.04	77.50 ± 6.04	87.28 ± 6.89
K (mg%)	181.29 ± 15.00	181.22 ± 5.00	166.96 ± 17.10
Cl (mg%)	109.55 ± 6.56	115.20 ± 6.56	117.44 ± 7.48

[abc] Least squares means with different superscripts in a row differ significantly (P<0.05)

Effects of sodium carbonate supplementation on plasma Na, K and Cl concentrations

Effects of Na_2CO_3 supplementation on plasma electrolytes are shown in Table 10. No significant differences were observed in plasma concentrations of Na, K and Cl among treatments.

Table 10 The effects of sodium carbonate supplementation on plasma Na, K and Cl concentrations

	Dietary		
	Control	1% Na_2CO_3	2 % Na_2CO_3
Plasma electrolytes concentration (mmol/l)			
Na	137.0 ± 1.12	137.1 ± 1.12	137.2 ± 1.28
K	4.4 ± 0.14	4.3 ± 0.14	4.2 ± 0.16
Cl	96.5 ± 0.75	95.0 ± 0.75	95.2 ± 0.86

Value are mean±SE.

Effects of sodium carbonate supplementation on urinary and fecal Na, K and Cl concentrations

Urinary electrolyte:creatinine ratio and fecal electrolyte concentration are shown in Table 11. There were no differences in Na:creatinine ratio, Cl:creatinine ratio and fecal Cl concentration. Sodium carbonate supplementation increased significantly K:creatinine ratio and fecal Na concentration ($P<0.05$), while the fecal K concentration decreased significantly ($P<0.05$) in animals given 1% and 2% Na_2CO_3 as compared with the control.

Table 11 The effects of sodium carbonate supplementation on urinary and fecal Na, K and Cl concentrations

	Dietary		
	control	1% Na_2CO_3	2 % Na_2CO_3
Urinary electrolyte:creatinine			
Na:creatinine	5.34 ± 2.51	7.92 ± 3.44	8.63 ± 3.73
K:creatinine	24.77^{b} ± 2.68	34.25^{a} ± 2.16	33.78^{a} ± 2.25
Cl:creatinine	10.52 ± 1.57	11.01 ± 1.97	10.61 ± 1.99
Fecal electrolyte (%)			
Na	0.27^{b} ± 0.06	0.54^{a} ± 0.10	0.59^{a} ± 0.08
K	0.95^{b} ± 0.14	0.45^{a} ± 0.06	0.40^{a} ± 0.03
Cl	0.29 ± 0.03	0.38 ± 0.06	0.39 ± 0.04

Value are mean±SE.

^{abc} Means with different superscripts in a row differ significantly ($P<0.05$)

Effects of sodium carbonate supplementation on digestibility of nutrients

Table 12 shows the means value of the digestibility of DM, ADF, NDF, Na, K and Cl. The digestibility of Na and K were lower ($P<0.05$) in animals fed control diets than those of animals fed Na_2CO_3 supplemented diet. The digestibility of DM, ADF, NDF, and Cl were not affected by Na_2CO_3 supplementation.

Table 12 The effects of sodium carbonate supplementation on digestibility of nutrients

	Dietary		
	control	1% Na_2CO_3	2 % Na_2CO_3
Nutrients digestibility (%)			
DM	65.13 ± 1.56	66.87 ± 1.91	67.00 ± 2.87
ADF	59.40 ± 2.43	60.13 ± 3.80	61.45 ± 3.04
NDF	60.31 ± 1.79	61.72 ± 1.76	64.62 ± 2.31
Na	53.04^{b} ±10.93	69.76^{a} ± 6.72	81.40^{a} ± 1.72
K	55.85^{b} ± 7.24	80.30^{a} ± 1.68	82.46^{a} ± 1.44
Cl	78.79 ± 3.06	73.78 ± 4.03	73.80 ± 2.92

Value are mean±SE.

^{abc} Means with different superscripts in a row differ significantly ($P<0.05$)

Effects of sodium carbonate supplementation on pH and volatile fatty acid of rumen fluid

There were no affected on pH, concentrations for acetic acid, propionic acid, butyric acid, valeric acid, and total volatile fatty acid, among animals fed different diets (Table 13). Acetic acid per propionic acid ratio slightly increased by increasing Na_2CO_3 in the diets. However, C_2, C_3, C_5, total VFA, and C_2:C_3 ratio tended to increase, while C_4 tended to decrease when Na_2CO_3 dietary was increased.

Table 13 The effects of sodium carbonate supplementation on pH and volatile fatty acid of rumen fluid

	Dietary		
	control	1% Na_2CO_3	2% Na_2CO_3
pH	6.97 ± 0.12	6.91 ± 0.20	6.78 ± 0.19
VFA concentration (mmol/l)			
Acetic acid (C_2)	88.63 ±10.12	101.51 ± 9.31	103.11 ± 6.08
Propionic acid (C_3)	27.39 ± 2.53	28.20 ± 3.58	31.37 ± 3.98
Butyric acid (C_4)	17.02 ± 1.92	16.50 ± 1.65	16.32 ± 0.91
Valeric acid (C_5)	1.00 ± 0.04	0.90 ± 0.12	0.95 ± 0.10
Total VFA	133.99 ±11.71	149.01 ±12.23	151.67 ±10.08
C_2:C_3	3.35 ± 0.47	3.44 ± 0.28	3.48 ± 0.36

Value are mean±SE.