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The Effects on Ruminal pH, Feed Intake and Digestibility When Using Wet Corn Gluten Feed to Adapt Cattle to Finishing Diets

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Summary

A 33-day grain adaptation trial was conducted comparing wet corn gluten feed (WCGF; Sweet Bran®, Cargill) fed at decreasing levels (87.5% to 35%) to a traditional grain adaptation with decreasing forage (45% to 7.5%; CON) to test the effects on ruminal pH, dry matter intake (DMI) and in situ *DM digestibility. Steers adapted by decreasing WCGF had greater DMI than CON (P < 0.01). During adaptation, DMI increased and ruminal pH decreased across both treatments. Steers adapted using WCGF had greater* in situ *DM digestion than steers adapted using CON. Diets containing WCGF had greater DM digestibility than diets containing forage, whether incubated in either CON or WCGF fed steers. Decreasing WCGF inclusion instead of forage is a viable method for adapting feedlot cattle to high-concentrate diets.*

Introduction

Wet corn gluten feed (WCGF; Sweet Bran, Cargill) is a low starch, high energy feed that has much greater energy than alfalfa hay (70 vs. 24 NE_g Mcal/cwt). Furthermore, feeding WCGF as a substitute for roughage during grain adaptation may reduce the incidence of sub-acute and acute acidosis because the total starch of the diet is decreased. Therefore, the objectives of the current study were to 1) determine if decreasing the level of WCGF and increasing corn is a preferred method for grain adaptation determined by DMI and ruminal pH measurements when compared to a traditional adaptation diet using forage, and 2) evaluate digestibilities of diets within the adaptation period and between treatments.

Procedure

A metabolism trial was conducted using eight ruminally fistulated steers (641 ± 42 lb). Steers (four/treatment) were adapted to finishing diets across four adaptation diets followed by the finisher. The study consisted of five periods of 5, 7, 7, 7 and 7 days, with the last 7 days on finishing diet. Dietary treatments, grain adaptation and respective days are shown in Table 1. The CON adaptation contained 5% supplement and 5% molasses with levels of alfalfa hay decreasing from 45% to 7.5% and increasing corn levels (DM basis). The WCGF adaptation had supplement and alfalfa hay at 5% and 7.5% of the diet, respectively, with WCGF decreasing from 87.5% to 35%, while corn increased (DM basis). Steers were fed once daily at 0800 and feed refusals were collected and dried to calculate DMI. Continuous intakes were recorded (from load cells on suspended feed bunks) every six seconds and averaged each minute for the entire 33 days on experiment. Steers were placed in stanchions four days of each week where intake and pH were recorded. The four days correspond to the first and last two days of each adaptation diet when submersible pH probes were recording. Dacron bags (50 µm pore size) containing both the CON and WCGF adaptation diets for that period (eight/steer) were incubated 24 hours in each steer during each period to determine DM digestibility (DMD). Sweet Bran was freeze dried, while AH was ground (2.00 mm), and DRC was ground to simulate a masticate grind (6.35 mm). Supplement was replaced by DRC in the *in situ* bags. One steer (CON treatment) was removed due to acidosis after the third adaptation diet, but data were included through period 3.

All data were analyzed as a 2 x 5 factorial using the MIXED procedure of SAS (SAS Inst. Inc.). Day was a repeated measure for pH and intake data**.** The period x adaptation x day interaction could not be tested because the same days in each

Table 1. Dietary treatments used for evaluating two grain adaptation methods (DM basis).

Days fed	1-5	6-12	13-19	20-26	27-33
Adaptation	1	2	3	4	Finisher
CON[1]					
DRC[2]	45.0	55.0	65.0	75.0	82.5
Alfalfa hay	45.0	35.0	25.0	15.0	7.5
Molasses	5.0	5.0	5.0	5.0	5.0
Supp[4]	5.0	5.0	5.0	5.0	5.0
WCGF[1]					
DRC[2]	0.0	13.13	26.25	39.38	52.5
WCGF[3]	87.5	74.38	61.25	48.13	35.0
Alfalfa hay	7.5	7.5	7.5	7.5	7.5
Supp[4]	5.0	5.0	5.0	5.0	5.0

[1]Adaptation treatments where CON = decreasing forage and increasing corn as steers go through adaptation periods; WCGF = decreasing Sweet Bran and increasing corn as steers go through adaptation periods.
[2] DRC = dry-rolled corn.
[3] WCGF = wet corn gluten feed (Sweet Bran).
[4] Dry supplement formulated to provide 90 mg/head/day of tylosin and 300 mg/head/day monensin; WCGF treatment formulated to provide 150 mg/head/day of thiamine.

adaptation (adaptation 1) were not collected for pH or intake.

Results

No period x adaptation treatment interactions occurred ($P > 0.60$); therefore, main effects of adaptation treatment and period (adaptation diet) are presented. Table 2 expresses the main effects of adaptation treatment on intake and pH. Steers adapted using WCGF had greater ($P < 0.01$) DMI than those adapted with CON (21.78 vs. 16.14 lb.). WCGF steers consumed more meals per day ($P < 0.01$) and tended ($P = 0.07$) to spend more time eating than CON-fed steers. However, intake rate didn't differ across treatments ($P = 0.25$). Average ruminal pH, minimum pH and maximum pH were lower for WCGF steers ($P \leq 0.01$) compared to the CON. The magnitude of pH change was not different between the two adaptation treatments ($P = 0.29$). Ruminal pH variance was greater ($P < 0.05$) for WCGF cattle (0.077 vs. 0.057) compared to CON-fed steers. Time and area below pH 5.6 were increased ($P < 0.05$) for WCGF compared to CON adaptation systems. Time and area below pH 5.3 were not different between the two treatments ($P > 0.17$).

Day within each adaptation diet was evaluated (data not shown). Days 6 and 7 are the last two days on a lower grain adaptation, and day 1 and day 2 are the first two days on the next grain adaptation. These four days were pH collection days in the stanchions, whereas DMI was recorded all seven days. DMI increased ($P < 0.02$) with each day during each adaptation period but the number of meals/day did not differ. Total time spent feeding and intake rate decreased as steers progressed through adaptation ($P \leq 0.01$). The pH measurements were not significant by day ($P > 0.29$), indicating that concentrate transitions were not severe pH changing events for the rumen environment.

Intake and pH differences for the main effect of adaptation periods are presented in Table 3. Intake increased as steers were adapted to the finishing ration ($P = 0.01$) for both CON and WCGF, while meals/day, time spent eating and intake rate were not different ($P > 0.19$). Average ruminal pH, minimum pH and maximum pH decreased ($P < 0.05$) as cattle were adapted to finishing diets. Variance and magnitude of change did not change ($P > 0.81$). Time and area below a pH of 5.6 increased ($P < 0.04$) as steers were adapted to finishing ration, but no effects on time and area below a pH of 5.3 were observed ($P > 0.16$)

In situ DM digestibility (Table 4) had no treatment by incubation diet interactions ($P > 0.18$) for adaptation periods 1 and 2, such interactions were observed for periods 3 and 4 and the finishing period ($P < 0.01$). Steers adapted using WCGF had greater *in situ* DM digestion than steers adapted using CON. Diets containing WCGF were more digestible than diets containing forage whether inserted in either CON or WCGF fed steers. The ruminal environment during the first two periods produced the same digestibility when higher amounts of forage were being fed. As corn concentration increased (periods 3, 4 and

(Continued on next page)

Table 2. Effects of grain adaptation on intake and pH across trial.

	WCGF	CON	*P*-value
Intake			
DMI, lb/day	21.78	16.14	< 0.01
Meals/day	6.25	4.96	< 0.01
Total time, minute	467.00	412.00	0.07
Intake rate, %/hour	17.86	16.51	0.25
Ruminal pH			
Average pH	5.84	6.28	< 0.01
Maximum pH	6.50	6.84	0.01
Minimum pH	5.35	5.79	< 0.01
pH change	1.16	1.06	0.29
pH variance	0.077	0.057	0.05
Time < 5.6, minute	321.0	113.0	< 0.01
Area < 5.6[2]	50.9	18.2	0.02
Time < 5.3, minute	44.4	17.1	0.17
Area < 5.3[2]	5.0	2.5	0.42

[1] Adaptation treatments where CON = decreasing forage and increasing corn as steers go through adaptation periods; WCGF = decreasing Sweet Bran and increasing corn as steers go through adaptation periods.
[2] Area under curve (magnitude of pH < 5.6 or 5.3 by minute).

Table 3. Main effect of adaptation time[1] on intake and pH.

Adaptation:	1	2	3	4	Finisher	*P*-value
Intake						
DMI, lb/day	16.23	18.84	20.22	22.24	22.13	0.01
Meals/day	5.98	5.09	5.45	5.50	5.99	0.19
Total time, min	456.00	435.00	437.00	439.00	430.00	0.99
Intake rate,%/24hr	14.35	16.83	17.89	18.91	17.94	0.20
Ruminal pH						
Average pH	6.29	6.06	5.99	5.95	5.98	0.05
Maximum pH	6.89	6.79	6.62	6.55	6.50	< 0.01
Minimum pH	5.93	5.51	5.51	5.45	5.45	< 0.01
pH change	1.03	1.13	1.16	1.12	1.11	0.91
pH variance	0.06	0.07	0.06	0.07	0.07	0.81
Time < 5.6, min.	29.99	214.65	345.58	244.48	249.87	0.04
Area < 5.6[2]	4.33	33.77	27.41	48.76	58.53	0.03
Time < 5.3, min.	5.99	31.84	14.10	48.75	53.11	0.16
Area < 5.3[2]	1.53	4.67	2.52	2.87	7.10	0.36

[1]Adaptation 1 fed for five days, while adaptations 2, 3, 4 and finishing were fed for seven days each.
[2]Area under curve (magnitude of pH < 5.6 or 5.3 by minute).

Table 4. *In situ* **DM digestibility for either treatment diet when incubated in steers on the two different treatments,**

Diet consumed	CON[1]		WCGF[1]		Treatment[2]	Diet[3]	Interaction[4]
Diet incubated	CON[5]	WCGF[5]	CON[5]	WCGF[5]	*P*-value	*P*-value	*P*-value
Adaptation							
1	53.5	69.6	51.5	66.9	0.55	< 0.01	0.76
2	54.6	65.3	52.3	60.6	0.46	< 0.01	0.18
3	49.6	61.6	69.7	65.8	0.01	0.16	0.01
4	48.5	57.4	64.7	66.8	0.05	< 0.01	< 0.01
Finisher	37.3	45.9	62.8	64.6	< 0.01	< 0.01	0.01

[1] Adaptation treatments where CON = decreasing forage and increasing corn as steers go through adaptation periods; WCGF = decreasing Sweet Bran and increasing corn as steers go through adaptation periods.
[2] Treatment *P*-value = significant differences between what steers consumed.
[3] Diet *P*-value = significant differences between incubation of *in situ* bags.
[4] Interaction between treatment diet and incubation diet.
[5] *In situ* incubation of each treatment during the adaptation period the steers were consuming that ration.

finishing), *in situ* DM digestibility was greater in steers fed WCGF compared to steers fed the CON. Therefore, either digestibility was improved, or the *in situ* methodology is influenced by the rumen environment of CON fed steers.

Decreasing WCGF inclusion instead of forage is a viable method for adapting feedlot cattle to high-concentrate diets based on greater DMI. However, pH was lower for cattle adapted with WCGF instead of forage. One steer did experience acidosis on the CON (forage adaptation) system, but no challenges were observed with steers adapted using WCGF. Steers consuming WCGF likely had decreased pH because their DMI was greater than steers fed CON.

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