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Nutrient Digestibility of Condensed Algal Residue Solubles in Beef Cattle Fishing Diets

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Summary with Implications

Condensed algal residue solubles (CARS) were evaluated in finishing cattle diets. Six treatments were evaluated (2 × 3 factorial arrangement), CARS inclusion in the diet at 0, 5, or 10% of diet dry matter with 0 or 20% wet distillers grains. The remainder of the diets consisted of 57.5–87.5% dry rolled corn, 7.5% sorghum silage and 5% supplement. Increasing wet distillers grains in the diet had no effect on dry matter and organic matter intake but decreased dry matter and organic matter digestibility. Increasing CARS inclusion in the diet resulted in lower dry matter and organic matter intake with no effect on dry matter and organic matter digestibility. Replacing up to 10% dry rolled corn with CARS in diets with or without wet distillers grains had little effect on digestibility of finishing beef cattle diets.

Introduction

Feeding algae to animals is not a new idea, as algae has been used in animal diets dating back 60 years; however, until recently, heterotrophic algae have not been available. A condensed algal residue solubles (CARS; Veraferm, Veramaris, Delft, The Netherlands) product is being commercially produced (Blair, NE) from heterotrophic algae as a co-product from producing n-3 fatty acids for aquaculture and the pet food industry. This CARS product is available for use in the cattle industry. CARS was fed in a 100 d safety study where cattle fed between 2.5 and 5% CARS had similar HCW, ADG, and DMI, with lower F:G than control cattle (*2019 Nebraska Beef Cattle Report*, pp. 82–84). CARS now has expert-affirmed GRAS (generally recognized as safe) status, but this trial was completed prior to that, thus all cattle were euthanized and composted at the completion of the trial. With limited research done on this product, the objective of this study was to evaluate the digestibility of CARS at different inclusion levels, with and without wet distillers grains, in finishing cattle diets.

Table 1. Diet composition (DM basis) for finishing cattle fed 3 levels of CARS with 0 or 20% WDGS

	0 CARS[1]		5 CARS[1]		10 CARS[1]	
Item, %	0 WDGS[2]	20 WDGS[2]	0 WDGS[2]	20 WDGS[2]	0 WDGS[2]	20 WDGS[2]
WDGS	-	20	-	20	-	20
CARS	-	-	5	5	10	10
DRC	87.5	67.5	82.5	62.5	77.5	57.5
Sorghum Silage	7.5	7.5	7.5	7.5	7.5	7.5
Supplement[3]	5.0	5.0	5.0	5.0	5.0	5.0
FGC	1.264	2.824	1.844	3.134	2.404	3.134
Limestone	1.690	1.670	1.690	1.660	1.680	1.660
Tallow	0.125	0.125	0.125	0.125	0.125	0.125
Urea	1.540	-	1.260	-	0.710	-
Salt	0.300	0.300	-	-	-	-
Trace mineral	0.050	0.050	0.050	0.05	0.050	0.050
Rumensin	0.016	0.016	0.016	0.016	0.016	0.016
Vitamin ADE	0.015	0.015	0.015	0.015	0.015	0.015
Nutrient Composition, %						
DM	77.0	59.0	73.0	56.6	69.4	54.6
OM, % DM	98.1	97.3	96.3	95.5	94.5	93.7
CP, % DM	12.81	12.98	12.83	13.77	12.10	14.53
Fat, % DM	3.72	5.19	4.26	5.69	4.77	6.18
Na, % DM	0.15	0.18	0.68	0.71	1.33	1.36
S, % DM	0.11	0.22	0.15	0.26	0.19	0.30

[1] Treatment, % CARS, (DM basis); CARS = condensed algal residue solubles

[2] Treatment, % WDGS, (DM Basis); WDGS = wet distillers grains plus solubles

[3] Supplement targeted Rumensin at 330 mg/animal daily; Elanco, Greenfield, IN) and Vitamin A-D-E premix contained 1500 IU vitamin A, 3000 IU vitamin D, and 3.7 IU vitamin E per g.

Procedure

A digestibility study was conducted utilizing 6 steers in a 6 × 6 Latin square design to evaluate the effects of inclusion of condensed algal residue solubles (CARS). Treatments were set up as a 2 × 3 factorial arrangement with 2 levels of wet distillers grains (0 or 20% WDGS), and 3 levels of CARS (0, 5, and 10% on a DM basis). The remainder of the diets consisted of 57.5 to 87.5% dry rolled corn, 7.5% sorghum silage and 5% supplement on a DM basis (Table 1). Supplement consisted of limestone, vitamin A-D-E, beef trace minerals, urea in the 0% WDGS diets, and fine ground corn as the carrier.

Cattle were fed *ad libitum* with feed delivered twice daily. Each period was 21 days in length consisting of 16 d adaption and a 5 d collection period. On d 10–21 of

Table 2. Main effects of condensed algal residue solubles (CARS) inclusion on digestibility of cattle finishing diets

	TREATMENT, % CARS				*P*-value		Contrast	
Item	0	5	10	SEM	CARS	CARS*WDGS	Lin	Quad
DM								
Intake, lb	18.4[a]	17.9[a]	16.0[b]	0.69	0.03	0.41	0.01	0.39
Digestibility, %	75.7	74.2	73.9	1.41	0.52	0.82	0.29	0.67
OM								
Intake, lb	18.0[a]	16.9[ab]	15.1[b]	0.69	0.01	0.55	< 0.01	0.63
Digestibility, %	77.3	75.8	76.0	1.29	0.57	0.87	0.41	0.51
NDF								
Intake, lb	4.4[a]	4.1[a]	3.6[b]	0.16	< 0.01	0.39	< 0.01	0.62
Digestibility[1], %	41.1	48.6	38.9	1.97	0.01	< 0.01	0.65	< 0.01

[a-b] Values within rows with similar superscript are not different ($P > 0.05$)

[1]NDFD interaction of CARS level by distillers grain inclusion shown in Figure 1

Table 3. Main effects of wet distillers grains plus solubles (WDGS) inclusion on digestibility of cattle finishing diets

	WDGS			*P*-Value	
Item	0 %	20 %	SEM	WDGS	CARS*WDGS
DM					
Intake	16.9	18.0	0.60	0.16	0.41
Digestibility, %	76.7[a]	72.5[b]	1.25	< 0.01	0.82
OM					
Intake, lb	16.2	17.2	0.59	0.17	0.55
Digestibility, %	78.2[a]	74.6[b]	1.14	< 0.01	0.87
NDF					
Intake, lb	3.5[a]	4.6[b]	0.14	< 0.01	0.39
Digestibility[1], %	42.1	44.3	1.61	0.34	< 0.01

[a-b] Values within rows with similar superscript are not different ($P > 0.05$)

[1]NDFD interaction of CARS level by distillers grain inclusion shown in Figure 1

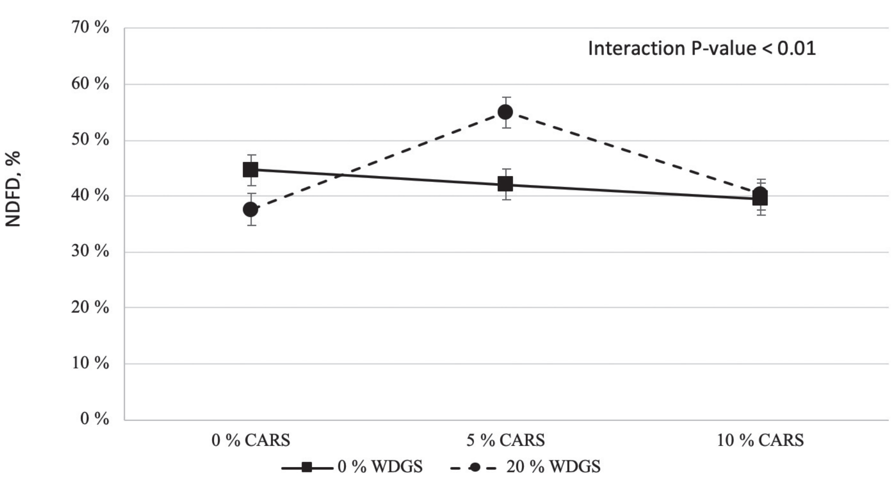

Figure 1. NDF Digestibility interaction on condensed algal residue solubles (CARS) and distillers inclusion (WDGS).

each period, 5 g of TiO_2 in a 100 ml mixture of distillers solubles was top dressed on the feed at each feeding for a total of 10 g of TiO_2 dosed daily. On d 16–21 fecal grab samples were collected 4 times/d and composited into 1 d samples. Feed samples and fecal grab samples were freeze dried, ground through a 2-mm screen, composited, and analyzed for neutral detergent fiber (NDF), organic matter (OM), and TiO_2 concentration for total fecal DM output. Digestibility data were analyzed as a Latin Square using the mixed procedure of SAS (SAS Inst., Cary, N.C.) with period, WDGS inclusion, CARS inclusion, and the interaction between WDGS and CARS as fixed effects and steer as a random effect.

Results

For the main effect of CARS, a linear decrease was observed for DM intake (DMI; $P = 0.01$; Table 2), with 0 and 5% CARS having similar DMI at 18.4 and 17.9 lbs respectively, and 10% CARS having lower DMI at 16.0 lbs. Similarly, a linear decrease was observed for both OM intake (OMI) and NDF intake (NDFI; $P \leq 0.01$) as CARS increased from 0 to 10% in the diet. CARS has a high Na content, which may limit intake and affect DM digestibility (DMD) at higher inclusions. There were no statistical differences observed for DMD ($P = 0.29$) however we observed a numerical difference of 1.8 percentage units between the 0 CARS and 10 CARS treatments. Similarly, no significant difference was observed for OM digestibility (OMD; $P = 0.41$), however we observed a numerical reduction of 1.3

percentage units as CARS increased from 0% to 10% in the diet. The only statistical difference between steers fed 0% CARS and 5% CARS was NDF digestibility (NDFD; $P = 0.01$) suggesting that CARS has a similar feeding value as dry rolled corn at 5% inclusion.

For the main effect of WDGS, no differences were observed for DMI or OMI ($P \geq 0.16$; Table 3). Steers fed 0% WDGS had greater DMD ($P < 0.01$) at 76.7% compared to 72.5% for steers fed 20% WDGS. Similarly, steers fed 0% WDGS had greater OMD ($P < 0.01$) at 78.2%, compared to 74.6% for steers fed 20% WDGS. Steers fed 20% WDGS had greater NDF intake at 4.6 lbs per day ($P < 0.01$) compared to 3.5 lbs for steers fed 0% WDGS.

A CARS by WDGS inclusion interaction was observed for NDFD ($P < 0.01$). Steers fed 5% CARS and 20% WDGS had a NDFD of 55.0%, which was greater than the rest of the treatment diets that ranged from 39.5 to 44.7% NDFD (Figure 1). Due to the soluble nature and the low NDF content of CARS, it is difficult to get good estimates of NDF intake and NDFD. No other interactions were observed for CARS by distillers grain inclusion ($P \geq 0.39$).

Conclusion

Results indicate decreased DMI and OMI as CARS inclusion increased in the diet, however, this had no effect on DMD or OMD. This would agree with performance results when cattle were fed 0, 2.5, 5, and 7.5% CARS (*2019 Nebraska Beef Cattle Report*, pp. 82–84). Replacing up to 5% corn with CARS in finishing cattle diets with wet distillers grains at 0 or 20% diet DM, appears to have little effect on DMI, DMD, OMI or OMD. Further research is needed to determine the optimal inclusion of CARS in finishing cattle diets on performance, carcass characteristics, and fatty acid profiles of beef.

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