Relationship Between Morbidity and Performance in Feedlot Cattle

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Summary

Five datasets from Canada, Oklahoma, Illinois, and Nebraska were used to determine the impact of bovine respiratory disease (BRD) on performance, with emphasis on dry matter intake (DMI) and feed to gain ratio (F:G). Data included pens and individually fed cattle. In general, cattle treated for BRD had lower DMI and average daily gain (ADG) with little to no effect on F:G. When BRD occured early in the feeding period (<30 days), little change in performance was observed.

Introduction

A common perception is that bovine respiratory disease (BRD) causes a depression in ADG and presumably feed efficiency. Pen level research supports the conclusion that cattle within pens treated for BRD have lower ADG compared to healthy pen mates and lighter carcasses when the pen is marketed at one time. These cattle also tend to be leaner and have less marbling. However, it is not clear when ADG is decreased whether DMI is impacted because individual DMI is not measured within feedlot pens. It is also unclear whether feeding those cattle treated for BRD longer would improve carcass weight and quality to match healthy pen mates. Likewise, whether the cause of decreased carcass quality is due to BRD or depressed ADG is unknown. It seems reasonable that cattle contracting BRD later in the feeding period would be more negatively impacted compared to steers contracting BRD at receiving or early in the feeding period. Therefore, the objective of this compilation of research is to determine the impact of BRD on ADG, DMI, and F:G of finishing cattle using both pen and individual feeding trials.

Procedure

Data from two commercial feedlots in Alberta, Canada (Western Feedlots) were obtained to evaluate impact of BRD on performance. Incidence of BRD across these lots varied from 0 to 70% throughout the entire feeding period. The effect of percentage of cattle in a pen treated for BRD on lot closeout DMI, ADG, and F:G were evaluated with n = 978 lots (276, 116 cattle) finished at two Alberta, Canada feedlots in 2007 and 2008. Lots in the dataset had 0 to 70% pen incidence of BRD, and all lots contained greater than 100 cattle. Lots were categorized by < 5%, 5-10%, 10-15%, 15-20%, 20-25%, 25-30%, 30-35%, or > 35% of cattle in the lot treated for BRD and analyzed for linear and quadratic response in lot performance as BRD incidence increased. A subset of these cattle (n = 33,074 cattle) had individual carcass data linked to individual steer within each lot so performance and BRD treatment could be matched with carcass data. The carcass data were used to evaluate effects of cattle being treated zero, one, or two or more times for BRD on linear and quadratic responses of cattle gain and carcass characteristics.

The effect of days on feed at BRD treatment on individual animal DMI, ADG, and F:G was evaluated with three datasets. Two datasets included individually fed growing (n = 900; 16% BRD treatment) and finishing (n = 987; 19% BRD treatment) cattle fed at the University of Nebraska–Lincoln ARDC Feedlot. Cattle were housed in confinement barns containing 30 cattle each with individual DMI collected using Calan gates. Each animal had access to an individual bunk and a common water source within barn. Individual cattle performance was also analyzed with a third dataset of 1,940 individual finishing cattle with 10% average incidence of BRD fed over four years at the University of Illinois-Urbana GrowSafe facility. Steers were housed on indoor slatted pens of 8-40 steers each with common bunks and water sources within pen. Categories in all three datasets included no treatment, BRD treatment < 30 days on trial, and BRD treatment > 30 days on trial. An individual animal could only be classified in one of the categories. Category priority was given to the treatment closest to completion of the trial. Initial BW was used as a covariate, and the random effects of dietary treatment within trial and pen effects also were accounted for. The categorical data were analyzed with the Proc GLIMMIX procedures of SAS (SAS Inc., Cary, NC). Feed efficiency (G:F) was used for statistical analyses, but has been converted to F:G in data summaries. Because of unequal replications within BRD categories, standard errors are reported by category instead of pooled errors. When appropriate (i.e., differences in significance are observed), initial BW was used as a covariate to correct for differences in performance due to lighter starting BW and isolate the impact of BRD on performance.

Results

When cattle were categorized for BRD incidence by lot in commercial feedlots, DMI and ADG of the lot were impacted ($P < 0.001$) by the percentage within the pen that had been treated for BRD (and presumably contracted BRD). This impact was independent of initial BW, which was used as a covariate. Table 1 illustrates that as more

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Table 1. Bovine respiratory disease (BRD) impact on performance when categorized by incidence at two commercial feedlots in Alberta, Canada that included over 276,000 head and 978 lots of cattle.

	Respiratory disease incidence within the lot[1]								*P*-Value[2]		
	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	> 35	*F-test*	Linear	Quadratic
Steers, n	19,938	36,195	44,056	46,382	47,010	34,374	22,088	26,073			
Lots, n	131	162	161	151	140	90	69	74			
Morbidity, %	3.1	7.6	12.6	17.5	22.3	27.5	32.4	42.3	<0.001	<0.001	<0.001
Initial BW, lb	620	610	617	622	614	612	602	612	0.05	0.08	0.60
DMI, lb/day	19.6	19.4	19.2	19.0	18.9	19.0	18.7	18.7	<0.001	<0.001	0.001
ADG, lb	3.50	3.45	3.46	3.39	3.40	3.40	3.35	3.39	<0.001	<0.001	0.03
F:G	5.61	5.64	5.55	5.64	5.57	5.59	5.59	5.53	0.03	0.08	0.53

[1]Respiratory disease incidence categorized by percent of cattle identified as morbid.
[2]*P*-value for F-test statistic and linear effect of BRD percentage within lots of cattle.

cattle within the pen get sick, DMI decreased linearly ($P < 0.001$; and quadratically). The decrease in DMI was about 1 lb less for cattle with 35% incidence compared to lots with less than 5% and most of this decrease in DMI occurred in pens that went from 5% or less to 15% or more BRD. Likewise, as BRD incidence increased within a lot, ADG decreased linearly ($P < 0.001$; and quadratically) with about a 0.10 to 0.15 lb/day lower ADG for lots with 30% or more of cattle treated compared to low incidences of BRD. While significant, the impact on F:G was sporadic and difficult to interpret. In general, no clear trend was observed for F:G.

A subset of these lots had individual carcass data matched with individuals within lots; however, individual DMI response is not possible as these are unknown in pen situations. A quadratic decrease ($P < 0.001$) in final BW and ADG was observed as BRD treatments increased (Table 2). A quadratic decrease ($P < 0.001$) was observed in HCW as number of BRD treatments increased with a 1.7 lb decrease for one treatment compared to none and an additional 26 lb decrease when cattle were treated two or more times compared to only once. Marbling, fat depth, USDA Choice, and USDA YG all decreased linearly ($P < 0.001$) as number of BRD treatments increased.

Table 2. Impact of respiratory disease (BRD) on individual BW, ADG, and carcass characteristics of 33,073 steers fed in commercial pens linked with carcass data by individual that is categorized by zero, one, and two or more treatments for BRD.

	Respiratory disease treatment[1]				*P*-value[2]		
	0	1	2+	SEM	F-test	Linear	Quadratic
Steers, n	30,911	1,823	339				
DOF[3], day	260.4	260.6	260.7	21.4	0.52	0.41	0.95
Initial BW, lb	630.8	632.6	640.3	29.3	0.10	0.04	0.34
Final BW, lb	1377.4	1374.6	1331.2	62.5	<0.001	<0.001	<0.001
ADG, lb	3.12	3.10	2.94	0.12	<0.001	<0.001	<0.001
HCW, lb	826.4	824.7	798.7	37.5	<0.001	<0.001	<0.001
Marbling[4]	516.8	503.0	489.8	13.0	<0.001	<0.001	<0.001
LM area, in^2	12.7	12.7	12.4	0.2	<0.001	<0.001	<0.001
Fat depth, in	0.42	0.40	0.37	0.03	<0.001	<0.001	0.49
USDA Choice, %	51.3	42.1	36.9	0.07	<0.001	<0.001	0.25
USDA YG[5]	3.17	3.10	3.04	0.11	<0.001	<0.001	0.74

[1]Respiratory treatment number that includes no treatments (0), 1 treatment, and 2 or more treatments (2+).
[2]P-value for F-test statistic and linear or quadratic effects of BRD treatment number.
[3]DOF is days on feed at the feedlot.
[4]Marbling score where 500 = small0.
[5]USDA Yield Grade.

Performance of individually fed cattle fed growing diets was impacted by BRD, but depended on the timing of disease onset. It should be noted that 139 of 900 head were treated for BRD prior to starting the growing period (i.e., sick during a receiving period prior to start) and DMI, ADG, or F:G were not impacted (Table 3). A small number of cattle were treated either in the first 30 days (3 of 900) or treated after the first 30 days (5

Table 3. Growing cattle performance of individually fed cattle categorized by respiratory disease incidence at UNL.

	Respiratory disease treatment[1]									
	None		Prior to Trial		< 30 dof		> 30 dof		*P*-value[2]	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Treatment	Initial BW
Cattle, n	753		139		3		5			
Initial BW, lb	608	5.5	604	6.8	612	30.7	587	23.8	0.69	
DMI, lb/day	14.7[b]	0.27	14.5[b]	0.31	14.2[b]	1.12	12.9[a]	0.87	0.10	< 0.01
ADG, lb	1.88[b]	0.065	1.84[b]	0.071	1.73[a,b]	0.232	1.29[a]	0.183	< 0.01	0.60
G:F	0.125	0.0028	0.124	0.0035	0.117	0.0155	0.080	0.012	< 0.01	< 0.01
F:G	8.00		8.06		8.55		12.50			

[1]Respiratory treatment history includes cattle that were not identified as sick (None), pulled and treated prior to finishing beginning (Prior to Trial), pulled and treated within the first 30 days on finishing diets (< 30 dof), and pulled and treated after the first 30 days on finishing diets (> 30 dof).
[2]P-value due to respiratory treatment history and the p-value for using initial BW as a covariate.

Table 4. Impact of respiratory disease on finishing performance and carcass characteristics of individually-fed cattle at UNL.

	Respiratory disease treatment[1]									
	None		Prior to Trial		< 30 dof		> 30 dof		*P*-value[2]	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Treatment	Initial BW
Cattle, n	799		160		9		19			
Initial BW, lb	816[b]	9.5	825[b]	10.4	758[a]	21.7	809[b]	16.9	0.01	
DMI, lb/day	22.0	0.23	22.3	0.28	21.4	0.78	21.3	0.58	0.22	< 0.01
ADG, lb	3.33	0.042	3.43	0.058	3.22	0.193	3.20	0.141	0.16	0.67
G:F	0.152	0.0013	0.154	0.0020	0.152	0.0072	0.155	0.0052	0.66	< 0.01
F:G	6.58		6.49		6.58		6.45			
Carcass Weight, lb	801	5.6	808	6.5	789	16.8	794	12.6	0.21	< 0.01
Fat Thickness, in	0.44	0.007	0.43	0.011	0.40	0.042	0.40	0.031	0.40	< 0.01
Marbling Score[3]	506	4.0	497	6.9	498	31.4	509	18.8	0.67	0.48

[1]Respiratory treatment history includes cattle that were not identified as sick (None), pulled and treated prior to finishing beginning (Prior to Trial), pulled and treated within the first 30 days on finishing diets (< 30 dof), and pulled and treated after the first 30 days on finishing diets (> 30 dof).
[2]*P*-value due to respiratory treatment history and the p-value for using initial BW as a covariate.
[3]USDA marbling score with 500 = small0

Table 5. University of Illinois performance data categorized by respiratory disease of steers with individual intake measured using the GrowSafe system.

	Respiratory disease treatment[1]									
	None		Prior to Trial		< 30 dof		> 30 dof		*P*-value[2]	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Treatment	Initial BW
Head	1748		46		66		80			
Initial BW, lb	731[b]	6.4	667[a]	13.9	690[a]	13.0	721[b]	11.1	< 0.01	
DOF, d [3]	165[a]	1.3	172[b]	2.4	170[b]	2.3	168[a,b]	2.0	< 0.01	
DMI, lb/day	23.0[b]	0.14	23.1[b]	0.36	23.4[b]	0.33	21.9[a]	0.28	< 0.01	< 0.01
ADG, lb	3.65[b]	0.019	3.62[b]	0.071	3.72[b]	0.062	3.43[a]	0.054	< 0.01	< 0.01
G:F	0.160	0.0009	0.159	0.0025	0.161	0.0023	0.157	0.0019	0.51	< 0.01
F:G	6.25		6.29		6.21		6.37			
HCW, lb	838[b]	2.8	838[b]	7.5	845[b]	6.8	819[a]	5.8	< 0.01	< 0.01
Fat thickness, in	0.50[b]	0.005	0.57[c]	0.021	0.50[b]	0.018	0.46[a]	0.016	< 0.01	< 0.01
Marbling score [4]	560[b]	2.7	554[a,b]	12.1	545[a,b]	10.3	531[a]	9.2	0.01	< 0.01

[1]Respiratory treatment history includes cattle that were not identified as sick (None), pulled and treated prior to finishing beginning (Prior to Trial), pulled and treated within the first 30 days on finishing diets (< 30 dof), and pulled and treated after the first 30 days on finishing diets (> 30 dof).
[2]P-value due to respiratory treatment history and the p-value for using initial BW as a covariate.
[3]DOF is days on feed at the feedlot.
[4]USDA marbling score with 500 = small0.

of 900). While a small number of observations are available, cattle treated after the first 30 days had depressed DMI, and ADG and greater F:G.

With 987 finishing cattle that were individually fed at UNL, there was no significant effect of BRD treatment history on DMI, ADG, or F:G ($P > 0.16$; Table 4). However, the 28 head treated during the feeding period had numerically lower DMI and ADG, but very similar F:G. It is unclear whether BRD incidence was too low to distinguish performance differences due to BRD treatment history. Carcass weight, fat depth, and marbling also were not affected ($P > 0.21$).

With 1,940 finishing steers with individual intakes from the University of Illinois, there was an impact of BRD treatment history on performance. Steers that were treated after 30 days on finishing diets had lower DMI ($P < 0.01$), lower ADG ($P < 0.01$), but similar F:G ($P = 0.51$) to steers never treated, treated during receiving, or treated during the first 30 days on feed (Table 5). No differences ($P > 0.10$) were observed for DMI, ADG, or F:G for steers treated the first 30 days of the feeding period, during receiving, or not treated for BRD. Carcass characteristics followed a very similar trend as performance with steers treated after 30 days on finishing diets having lower HCW, less fat thickness, and less marbling ($P < 0.01$) compared to steers either treated earlier than 30 days on feed or not treated for BRD.

Cattle that get respiratory disease are likely affected in terms of depressed DMI and ADG for a short period. If BRD occurs early, cattle can likely recover and little impact is observed even on DMI and ADG. Despite lower DMI and ADG, F:G is not impacted in finishing studies summarized but may be negatively impacted in growing situations.

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