# Effect of Ad Libitum vs. Limit Feeding Program at Receiving on Morbidity and Performance of Feedlot Calves

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**Summary with Implications**

*A two-phase study was conducted to determine the effects of two different feed delivery strategies during the receiving period of feedlot calves. Calves were fed either by limit-feeding at approximately 75% of ad libitum, or ad libitum feed offerings for the 30-d receiving period to determine effects on health and performance. During the receiving period, average daily gain and total weight gained was increased for the ad libitum treatment. No differences between ad libitum and limit-fed treatment groups were observed in either feed to gain or morbidity rates. During the second phase of the trial, a subset of calves was followed through finishing to observe the effect of the receiving strategies on the finishing period performance. At slaughter, no significant differences were observed between calves that were received on a limit-fed diet or fed ad libitum.*

## Introduction

Despite advancements in both vaccine technology and antibiotic therapy, bovine respiratory disease complex (BRD) remains the primary health challenge for cattle feeding operations in the United States. Consistently, those operations that struggle with BRD, do so during the period immediately following arrival of calves. As a rule, most of the morbidity and mortality observed occur in the first 30 to 60 days on feed. This naturally lends the question of how to address what appears to be an underlying systemic issue, independent of vaccine protocol design, that may help address and mitigate the occurrence of BRD during the receiving period. The strategy of limit feeding calves during the early receiving period has been proposed as one strategy to mitigate BRD risk nutritionally, but limited data support the use of such strategies, with most evidence being purely anecdotal. The objective of this study was to evaluate limit feeding as a receiving protocol to determine impact on pull rates, receiving performance, and overall finishing performance.



## Procedure

### *Experiment 1*

Steers originating from the Northern Plains (n = 704) were received at the Eastern Nebraska Research Extension and Education Center (ENREEC) feedlot in October of 2021 over a period of two weeks. Arrival processing protocol consisted of a commercial modified live 5-way viral vaccine with *Mannhemia haemolytica* and *Paseurella multocida* (Vista Once; Merck Animal Health, Omaha, NE), commercial 7-way clostridial with *Haemophilus somnus* (Vision 7 Somnus; Merck Animal Health, Omaha, NE), injectable dewormer (Dectomax; Zoetis Inc., Kalamazoo, MI), and placement of identification ear tags. Steers were processed at arrival and assigned randomly to pen and treatment; 16 calves were assigned to each pen to allow for adequate bunk space in both the limit-fed and ad libitum treatment groups. Pens were assigned randomly to treatment in a paired fashion to ensure that shared water tanks provided equal exposure to pathogen load across treatments. The treatments used in this study were ad-libitum feed delivery or limit-fed feed delivery of a single receiving diet consisting of 36% grass hay, 30% dry rolled corn, 30% Sweet Bran (Cargill, Inc., Blair, NE), and 4% supplement (DM basis). Calves on the limit-fed treatment were adapted to the diet upon arrival and limited to 2.2% of arrival body weight for the 30-day receiving period. Calves fed ad libitum were allowed to consume without restriction and diet was delivered according to bunk call. Calves were fed once daily in the morning; Steers were checked for health by a trained pen rider approximately 2 hours after feed delivery to allow for blinding to treatment by the animal health team. Calves were deemed a BRD case if they were pulled by the pen rider and subsequently met criteria for treatment upon presentation through the chute in the hospital (depression, anorexia, increased respiratory rate and/or effort, and rectal temperature greater than 103.5° F). At 28 d on feed, calves were limit-fed at 2% of BW for 5 days to equalize gut fill and subsequently weighed off the receiving portion of the trial by weighing two consecutive days prior to feeding. The average two-day weight was used as the final weight for the receiving trial, and the initial weight for the finishing trial. Pen was the experimental unit for statistical analysis.

### *Experiment 2*

A subset of 222 steers in 14 pens were stepped up on finish ration after a 28-day receiving to evaluate potential carry-over effects on performance during finishing. The step-up period consisted of 5 step up ration over 23 days, and then a common finish ration consisting of 40% high moisture corn, 40% Sweet Bran (Cargill, Inc., Blair, NE), 15% corn silage, and 5% supplement. Steers were maintained in the same pen that they were housed in for the receiving phase. Cattle were implanted with Revalor IS (Merck Animal Health, Madison, NJ) at 40 d on feed and re-implanted at 130 d on feed with Revalor 200 (Merck Animal Health). Cattle were fed Optaflexx (Elanco Animal Health, Indianopolis, IN) during the last 28 d of the feeding period. All groups were harvested at a single time point at an average of 220 d from receiving. Hot carcass weight (HCW) and liver abscess score were collected at harvest; fat thickness (FT), longissimus muscle (LM) area, and marbling score were recorded after a 48-hour chill.

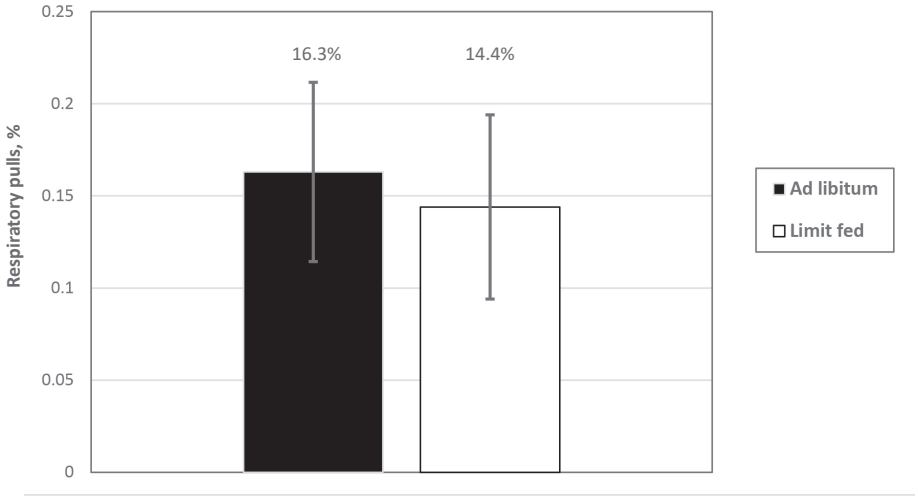


Fig. 1. Morbidity rates for ad libitum and limit-fed calves during the 28 day receiving period. Error bars represent the 95% confidence interval for incidence rate.

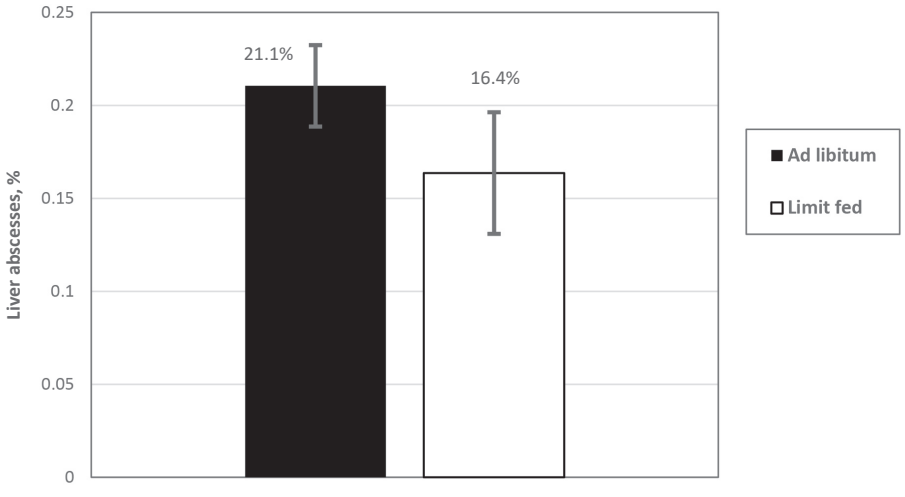


Fig. 2. Liver abcess incidence rate at harvest; error bars represent the 95% confidence interval for incidence rate of liver abscessation. P = 0.29.

## Results

### *Experiment 1*

Dry matter intake (DMI; $P < 0.01$), average daily gain (ADG; $P < 0.01$) and ending body weight ($P < 0.01$) were lower for the limit-fed treatment compared to ad libitum due to the limitation of intakes as designed (Table 1). Intake averaged 70.1% for limit-fed versus ad libitum whereas ADG was 72.6% for limit-fed compared to ad libitum. Because both DMI and ADG were decreased by similar amounts, F:G was not affected ($P = 0.28$). Numerically better F:G was observed for limit-fed cattle versus ad libitum but this 3.4% difference was not significant ($P = 0.28$). Morbidity rates for BRD were not statistically different due to treatment during the receiving period (ad libitum morbidity 16.3%; limit-fed morbidity 14.3%; $P = 0.58$, Figure 1), which may be due to statistical power. Mortality for the receiving period was 0.84% (3 hd) for the limit-fed treatment group, and 0% for the ad libitum treatment group, due to low mortality rates analysis was unable to be performed.

### *Experiment 2*

When followed to harvest, there were no differences ($P > 0.18$) in ADG or DMI between treatments (Table 2). While not statistically different, there was a 2.2% increase in ADG for steers that were limit fed during the receiving period, which allowed HCW and final BW to be similar ($P = 0.39$) between the two receiving treatments. Carcass characteristics were also similar; where fat thickness ($P = 0.90$) and LM area ($P > 0.74$) did not differ between steers received with an ad libitum or limit-fed program (Table 2). No statistical difference ($P = 0.29$) in the rate or severity of liver abscess occurrence was noted. Incidence rate of liver abscesses in the ad libitum fed treatment was 21.05% with 3.7% incidence of A+ abscesses, LF treatment showed an incidence rate of 16.36%, and a 3.7% incidence of A+ abscesses (Figure 2).

## Conclusion

Differences in intake and gain between receiving treatments did not affected DMI, ADG or F:G during the finish period. The strategy of limit-feeding new feedlot arrivals in order to decrease the incidence rate of BRD is not supported by these data. Discussions around the usefulness of limit-feeding as a management tool for BRD center around two questions: 1. Does limit-feeding have a mechanistic role in prevention of BRD (i.e., does it prevent calves from getting sick?); and/or 2. Does limit-feeding play a role in the selection bias of calves pulled by pen riders to be diagnosed as BRD and treated? This study was designed to evaluate question 1 by blinding pen riders to treatment and performing evaluations of health status away from feeding time. The lack of significant difference between treatments would lend us to conclude that limit-feeding on arrival does not play a mitigating role in the mechanism of development of BRD.

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**Table 1: Receiving period performance for ad libitum or limit fed calves during the 28- day receiving period.**

| | Ad Libitum[1] | Limit-Fed[1] | SEM | *P*-Value |
|---|---|---|---|---|
| Pens, (steers), n | 22 (352) | 22 (352) | | |
| Initial BW, lb | 577 | 577 | 3.2 | 0.89 |
| End BW, lb | 665 | 638 | 4.2 | < 0.01 |
| Gain, lb | 86 | 62 | 1.8 | < 0.01 |
| DMI, lb/d | 15.7 | 11.0 | 0.10 | < 0.01 |
| ADG, lb | 2.80 | 2.03 | 0.058 | < 0.01 |
| F:G[2] | 5.62 | 5.43 | - | 0.28 |

[1] AD = ad libitum fed calves at receiving, LF = limit-fed calves at receiving for first 38 days with intake targeted at a maximum of 2.2% of receiving body weight.

[2] F:G analyzed as G:F, the reciprocal

**Table 2. Finishing performance of cattle received using either an ad libitum or limit-fed receiving protocol. Performance is for days 42 to 221.**

| | Ad Libitum[1] | Limit-Fed[1] | SEM | P-Value |
|---|---|---|---|---|
| Pens, (steers), n | 7 (109) | 7 (107) | | |
| Initial BW, lb | 665 | 638 | 4.2 | *< 0.01* |
| Final BW[2], lb | 1450 | 1430 | 7.9 | *0.39* |
| DMI, lb/d | 24.2 | 24.3 | 0.14 | *0.21* |
| ADG, lb | 4.01 | 4.10 | 0.049 | *0.18* |
| F:G[3] | 5.76 | 5.68 | - | *0.42* |
| HCW, lb | 927 | 921 | 5.1 | *0.39* |
| FT, in | 0.74 | 0.75 | 0.02 | *0.9* |
| LM area, in[2] | 14.9 | 14.9 | 0.16 | *0.74* |

[1] AD = ad libitum fed calves at receiving, LF = limit-fed calves at receiving for first 38 days with intake targeted at a maximum of 2.2% of receiving body weight.

[2] Final BW calculated from HCW utilizing a 64% standard dress.

[3] F:G analyzed as G:F, the reciprocal