EXTENSION

BEEF CATTLE RESEARCH UPDATE
Britt Hicks, Ph.D., PAS
Area Extension Livestock Specialist
December 2025

Assessment of Forage Inclusion Strategies as a Means of Reducing Liver Abscesses in Finishing Feedlot Cattle

The average incidence of liver abscesses within beef cattle feedlots ranges from 12 to 32%;[1, 2] but can be as high as 95%.[3] Liver abscesses in feedlot cattle are a cause of decreased performance and reduced carcass value which have been estimated to decrease returns by $20 to $80 per animal.[2] Feeding greater levels of roughages in finishing diets can decrease the incidence of liver abscesses. However, daily gains and feed efficiency are also reduced.

Tylosin phosphate (Tylan, Elanco Animal Health) is an antibiotic that is commonly fed to feedlot cattle to decrease the incidence of liver abscesses. However, general concern that in-feed application of medically important antimicrobials increase antimicrobial resistant pathogen threats to human health remain. Hence, alternative strategies to control liver abscess that maintain or improve cattle performance, efficiency, health, and welfare are warranted. Studies looking at the timing of tylosin inclusion within the finishing period suggest that the greatest risk of liver abscess development is in the early stages of finishing.[4, 5] The typical range for roughage inclusion in finishing diets is 8% to 10% of dry matter (DM).[6]

Canadian researchers hypothesized that greater inclusion of forage in the diet early in the finishing phase would decrease the incidences of liver abscesses and prevent performance losses without tylosin inclusion. Thus, a study evaluated different strategies of forage inclusion in finishing beef cattle diets and their effects on growth performance, carcass quality, and liver abscesses as compared with a typical finishing diet with or without tylosin.[7] In this study, 360 sixty yearling crossbred beef steers (882 lb initial weight) were used in a 175-day finishing experiment which was split into 4 different feeding periods. The first period consisted of 49 days, and the last 3 periods consisted of 42 days each. The steers were stratified by weight and randomly allocated across 24 pens, which were randomly assigned to 1 of 4 dietary treatments (15 steers/pen, 6 pens/treatment). The treatments included: (1) positive control (+CTRL) fed a diet (7.5% forage on a diet DM basis) with tylosin (10 grams/ton) fed throughout the entire finishing phase; (2) negative control (−CTRL; control diet without tylosin) fed throughout the entire finishing phase; (3) a strategy with decreasing forage (DECR) where forage concentrations in the ration decreased from the first to second period and again from the second to the third period, but did not change from the third to the fourth period (15%, 9%, 3%, and 3% of diet DM, respectively) without tylosin; and (4) a strategy with increasing forage (INCR) where forage concentrations in the ration remained static for the first 2 periods (91 days) then increased every 42-day period (3%, 3%, 9%, and 15% of diet DM, respectively) without tylosin.

The effect of the forage inclusion strategies on feedlot growth performance are shown in Table 1. The +CTRL steers had greater average daily gain (ADG, 3.79 vs. 3.59 lb/day), shrunk total body weight (BW) gain (668 vs. 634 lb), and a tendency for greater final BW (1550 vs. 1515 lb), than INCR steers. In high-grain finishing diets, increases in the forage content of the diet can result in greater dry matter intake (DMI) in feedlot cattle steers to help meet their energy needs.[8] Thus, as expected, a diet × period interaction was observed for DMI (period intake not shown in table), but it did not differ among treatments over the full study. DECR steers, who were fed the high forage diets (15% and 9%, respectively) had greater DMI than INCR steers (fed the 3% forage diet) during periods 1 and 2. As the 2 experimental treatments switched diets, it would be expected that INCR steers would have greater DMI than DECR steers in periods 3 and 4, however, this was not the case.

Table 1. Effect of forage inclusion strategy in the diet of finishing feedlot steer on growth performance parameters

	Treatment[1]				
Item	−CTRL	+CTRL	DECR	INCR	P-value
Initial shrunk BW,[2] lb	884	875	882	884	0.38
Final shrunk BW, lb	1550	1555	1544	1515	0.07
Shrunk BW gain, lb	668[ab]	675[a]	664[ab]	633[b]	0.05
ADG, lb/day	3.79[ab]	3.84[a]	3.77[ab]	3.59[b]	0.05
DMI, lb/day	25.6	25.4	25.4	24.9	0.53
Gain:Feed	0.155	0.155	0.154	0.153	0.97

[a,b]Means within a row without a common superscript differ (P ≤ 0.05).
[1]Treatments: −CTRL = negative control, 7.5% forage inclusion, no tylosin; +CTRL = positive control, 7.5% forage inclusion, contains tylosin at 10 grams/ton; DECR = decreasing forage inclusion treatment, decreasing forage inclusion levels in periods 1 - 4, 15%, 9%, 3%, and 3%, respectively; INCR = increasing forage inclusion treatment, increasing forage inclusion levels through periods 1 - 4, 3%, 3%, 9%, and 15%, respectively.
[2]Shrunk BW = BW x 0.96.
Adapted from Paterson et al., 2024.

The effect of forage inclusion strategy on carcass characteristics and liver abscesses are shown in Table 2. Carcass weights tended to be lower for INCR steers compared with the other treatments (P = 0.07). The INCR steer carcasses had lower rib fat thickness and yield scores (P = 0.04) than −CTRL steers. No significant differences were observed in the percentage of total (P = 0.17) or severe liver abscesses (P = 0.88) between treatments. However, the percentage of steers with minor liver abscesses tended to be less (P = 0.055) for +CTRL (51.8%) and DECR (51.8%) compared with −CTRL (62.2%) and INCR (64.3%).

Table 2. Effect of forage inclusion strategy in the diet of finishing feedlot steer on carcass characteristics and liver abscesses

	Treatment[1]				
Item	−CTRL	+CTRL	DECR	INCR	P-value
Carcass characteristics					
Carcass weight, lb	946	937	942	922	0.07
Dressing percentage,[2] %	60.7	60.2	60.4	60.2	0.41
Rib fat, in	0.67[a]	0.62[ab]	0.64[ab]	0.56[b]	0.04
Ribeye area, in^2	14.1	14.3	14.1	14.3	0.74
Marbling score	492	479	474	467	0.43
Yield score	3.82[a]	3.62[ab]	3.75[ab]	3.45[b]	0.04
Liver score[3], % of steers					
Abscessed livers	62.2	51.8	51.8	64.3	0.17
Minor abscesses[4]	40.2[a]	24.7[b]	25.3[b]	38.1[a]	0.06
Severely abscessed[5]	22.0	25.9	26.5	26.2	0.88

[a,b]Means within a row without a common superscript differ (P ≤ 0.05).
[1]Treatments: −CTRL = negative control, 7.5% forage inclusion, no tylosin; +CTRL = positive control, 7.5% forage inclusion, contains tylosin at 10 grams/ton; DECR = decreasing forage inclusion treatment, decreasing forage inclusion levels in periods 1 - 4, 15%, 9%, 3%, and 3%, respectively; INCR = increasing forage inclusion treatment, increasing forage inclusion levels through periods 1 - 4, 3%, 3%, 9%, and 15%, respectively.
[2]Dressing percentage was determined by dividing carcass weight by the BW at the end of the study after shrink correction (4%). Kidney, pelvic, and heart fat are not included in the carcass weight.
[3]Liver scores were classified as clear, minor, or severe, adapted by the Elanco Liver Check System (Elanco Animal Health, Greenfield).
[4]Percentage of liver abscess classified as minor.
[5]Percentage of liver abscess classified as severe.
Adapted from Paterson et al., 2024.

The results of this study showed that greater dietary concentrations of forage earlier in the finishing phase, with a subsequent decline thereafter, has the potential to decrease the proportion of minor liver abscesses similar to typical finishing diets including tylosin, without affecting growth performance or carcass quality. These researchers concluded that these data suggest that the timing of forage inclusion is more detrimental to performance and carcass characteristics than minor liver abscesses.

---

[1] Brink, D. R., S. R. Lowry, R. A. Stock and J. C. Parrott. 1990. Severity of Liver Abscesses and Efficiency of Feed Utilization of Feedlot Cattle. J. Anim. Sci. 68: 1201-1207. Available at: https://doi.org/10.2527/1990.6851201x.

[2] Brown, T. R. and T. E. Lawrence. 2010. Association of liver abnormalities with carcass grading performance and value. J. Anim. Sci. 88: 4037-4043. Available at: https://doi.org/10.2527/jas.2010-3219.

[3] Nagaraja, T. G., and K. F. Lechtenberg. 2007. Liver abscesses in feedlot cattle. Vet. Clin. North Am. Food Anim. Pract. 23:351-369. Available at: https: //doi.org/10.1016/j.cvfa.2007.05.002.

[4] Müller, H. C., C. L. Van Bibber-Krueger, O. J. Ogunrinu, R. G. Amachawadi, H. M. Scott, and J. S. Drouillard. 2018. Effects of intermittent feeding of tylosin phosphate during the finishing period on feedlot performance, carcass characteristics, antimicrobial resistance, and incidence and severity of liver abscesses in steers. J. Anim. Sci. 96:2877–2885. Available at: https://doi.org/10.1093/jas/sky166.

[5] Walter, L., M. Brown, G. Vogel, J. Hagenmaier, N. Pyatt, B. Holland, A. Word, K. Wesley, P. Defoor, and C. Maxwell. 2018. Evaluation of the strategic use of Tylan® to control liver abscess condemnation in finishing beef cattle. J. Anim. Sci. 96(Suppl. 3):405–406. (Abstr.).

[6] Samuelson, K. L., M. E. Hubbert, M. L. Galyean, and C. A. Löest. 2016. Nutritional recommendations of feedlot consulting nutritionists: The 2015 New Mexico State and Texas Tech University survey. J. Anim. Sci. 94: 2648-2663. Available at: https://doi.org/10.2527/jas.2016-0282.

[7] Paterson, T. J., E. O'Hara, R. J. Gruninger, G. B. Penner, H. A. Lardner, E. Stephens, W. Yang, K. A. Beauchemin, T. A. McAllister, and G. O. Ribeiro. 2024. Assessment of forage inclusion strategies as a means of reducing liver abscesses in finishing feedlot cattle. Appl. Anim. Sci. 40:279-296. Available at https://doi.org/10.15232/aas.2023-02481.

[8] Galyean, M. L., and P. J. Defoor. 2003. Effects of roughage source and level on intake by feedlot cattle. J. Anim. Sci. 81(Suppl. 2):E8–E16. (Abstr.).