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Abstract
One hundred twenty medium-framed steers were fed one of six high (90%) concentrate rations: control (0), 5, 10, or 15% pelleted wheat middlings (WM) replacing the concentrate (dry rolled corn) and 5 or 10% pelleted WM replacing the roughage (chopped alfalfa hay). Increasing WM replacement of the concentrate increased both dry matter (DM) intake and feed/gain ratio linearly, without influencing daily gain or final weight. WM replacement of the roughage decreased DM intake linearly, but it ha d no effect on daily gain, final weight, or feed efficiency . The data indicate that WM could replace only 5% of the concentrate without reducing cattle performance, but complete (100%) or partial (50%) replacement of the roughage with WM had no adverse effect on cattle performance.

Keywords
Cattlemen's Day, 1995; Kansas Agricultural Experiment Station contribution; no. 95-357-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 727; Beef; Wheat middlings; Beef cattle; Performance; Feedlot

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WHEAT MIDDLINGS IN HIGH CONCENTRATE FINISHING RATIONS: CATTLE PERFORMANCE [1]

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Summary

One hundred twenty medium-framed steers were fed one of six high (90%) concentrate rations: control (0), 5, 10, or 15% pelleted wheat middlings (WM) replacing the concentrate (dry rolled corn) and 5 or 10% pelleted WM replacing the roughage (chopped alfalfa hay). Increasing WM replacement of the concentrate increased both dry matter (DM) intake and feed/gain ratio linearly, without influencing daily gain or final weight. WM replacement of the roughage decreased DM intake linearly, but it had no effect on daily gain, final weight, or feed efficiency. The data indicate that WM could replace only 5% of the concentrate without reducing cattle performance, but complete (100%) or partial (50%) replacement of the roughage with WM had no adverse effect on cattle performance.

(Key Words: Wheat Middlings, Beef Cattle, Performance, Feedlot.)

Introduction

In 1991, 11.0% of the flour milled in the United States was produced in Kansas, yielding about 700,000 tons of mill feeds. Wheat middlings (WM) are byproducts of flour milling comprising a mixture of small particles of bran, germ, and the aleurone layer of the wheat kernel. Although WM are used commonly as a feed source for livestock, very little information is available concerning their nutritive value when added to high concentrate, feedlot rations. In an earlier trial, we found that pelleted WM could replace about 10% of the corn without reducing the rate and efficiency of gain of finishing steers (KAES Report of Progress 497, page 21). We know of no published studies that have determined the potential value of WM as a roughage source in beef cattle finishing rations.

Our objectives were to determine the effects on cattle performance of WM fed as a replacement for either the concentrate or roughage components in finishing rations for feedlot steers.

Experimental Procedures

One hundred twenty medium-framed steers averaging 805 lb were blocked by weight and randomly allocated from each block to one of six treatment groups of 20 steers (four replicates of five steers per pen). The treatments consisted of the following high concentrate rations (81.5% dry-rolled corn, 10% chopped alfalfa, 6% supplement, and 2.5% molasses on a DM basis): control; 5, 10, or 15% pelleted (.25 inch) WM replacing the concentrate; and 5 or 10% pelleted WM replacing either 50 or 100% of roughage. Daily NE_g intakes were estimated from the NRC NE_g values of the dietary ingredients. After a 12-day adaptation to the rations, the steers were weighed on 2 consecutive days, and the average was used as the initial weight. Final weights

[1]The pelleted wheat middlings were provided by ADM Milling Co., Shawnee Mission, Kansas.

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were determined in the same manner. At the termination of the trial (112 days), steers were slaughtered at Iowa Beef Packing, Emporia, Kansas, and standard carcass measurements were made at 24 hours postslaughter by Kansas State University personnel.

Data were analyzed using the SAS GLM procedure. The feedlot performance and carcass data were analyzed as a Randomized Complete Block design using orthogonal contrasts (linear, quadratic, and cubic) for specific treatment comparisons. Terms in the fixed effects model included the main effects of block (steer weight) and level of WM as a concentrate or roughage replacement.

Results and Discussion

The WM were from a single source and had the following composition (DM basis): 19.0% crude protein, 44.3% NDF, 10.7% ADF, 23.2% starch, .14% calcium, 1.2% phosphorus, and 1.0% potassium.

The effect of replacing the concentrate component with WM on performance and carcass characteristics in the feedlot steers is presented in Table 1. Both DM intake ($P<.01$) and feed/gain ratio ($P<.05$) increased linearly with increasing levels of WM in the ration. DM intake increased 9.2% and feed/gain ratio increased 10.1% for steers fed the 15% level of WM compared to controls. Daily gains and final weights were not influenced by WM replacing corn. Estimated daily NE_g intake increased ($P<.01$) in a linear manner as WM replaced concentrate. The 10 and 15% replacements increased NE_g intake by 9.4 and 7.1%, respectively, compared to the control ration. In Figure 1 are the observed daily gains and those predicted from the daily NE_g intakes:

$$LWG = 13.91 \times NE_g^{0.9116} \times W^{-0.6837}.$$

Observed daily gains for steers fed the 10 and 15% levels of WM were 10.8 and 7.8% less than predicted gains, respectively. No statistical differences were detected in hot carcass weight, backfat depth, quality grade, or dressing percentage as WM replaced concentrate. Marbling score increased ($P<.01$) in a linear manner with increasing levels of WM.

The effect of replacing the roughage component with WM is also presented in Table 1. Intakes of both DM and NE_g were decreased ($P<.05$) in a linear manner with increasing levels of WM. This reduction in energy intake did not affect ADG because of the linear increase in nutrient digestibilities observed with increasing replacement of the roughage component with WM (see page 22 of this report). Final weight, ADG, and feed/gain were not affected by replacing the roughage with 5 or 10% WM. No liver abscesses were observed.

In summary, wheat middlings could replace only 5% of the concentrate in the finishing rations without reducing cattle performance, but complete (100%) or partial (50%) replacement of the roughage in finishing rations with wheat middlings did not affect growth performance of steers in this study.

Table 1. Effects of Replacing either the Concentrate or Roughage Components with Pelleted WM on Performance and Carcass Characteristics in the Feedlot Steers[a]

		Middlings for Concentrate			Middlings for Roughage			Probability[b]	
Item	Control	5%	10%	15%	5%	10%	SE	C	R
Initial wt, lb	869	862	877	877	869	869	7.14	NS	NS
Final wt, lb	1,210	1,217	1,224	1,217	1,215	1,199	10.74	NS	NS
ADG, lb	3.11	3.17	3.09	3.13	3.11	2.95	.09	NS	NS
DM intake, lb/day	21.6	22.0	23.4	23.6	20.9	19.6	.48	L**	L**
Feed/gain, DM basis	6.9	7.0	7.6	7.6	6.8	6.6	.22	L*	NS
NE, intake, Mcal/day	8.5	8.6	9.3	9.1	8.3	7.5	.30	L*	L**
Hot carcass wt, lb	758	750	750	750	747	736	5.93	NS	L*
Backfat depth, in.	1.30	1.31	1.34	1.27	1.28	1.30	.03	NS	NS
Marbling score[c]	5.3	5.5	5.4	6.2	5.6	5.5	.26	L**	NS
Quality grade[d]	8.3	8.4	8.6	8.6	8.5	8.5	.09	NS	NS
Dressing %	62.5	61.7	61.3	61.6	61.4	61.0	.43	NS	L*

[a]Values are least square means, and SE is the pooled standard error of the mean.
[b]C = replacement of concentrate, R = replacement of roughage, and L = linear effect of WM addition. NS = not different, *P<.05, and **P<.0l.
[c]Slight = 4, small = 5, and modest = 6.
[d]Choice = 8.

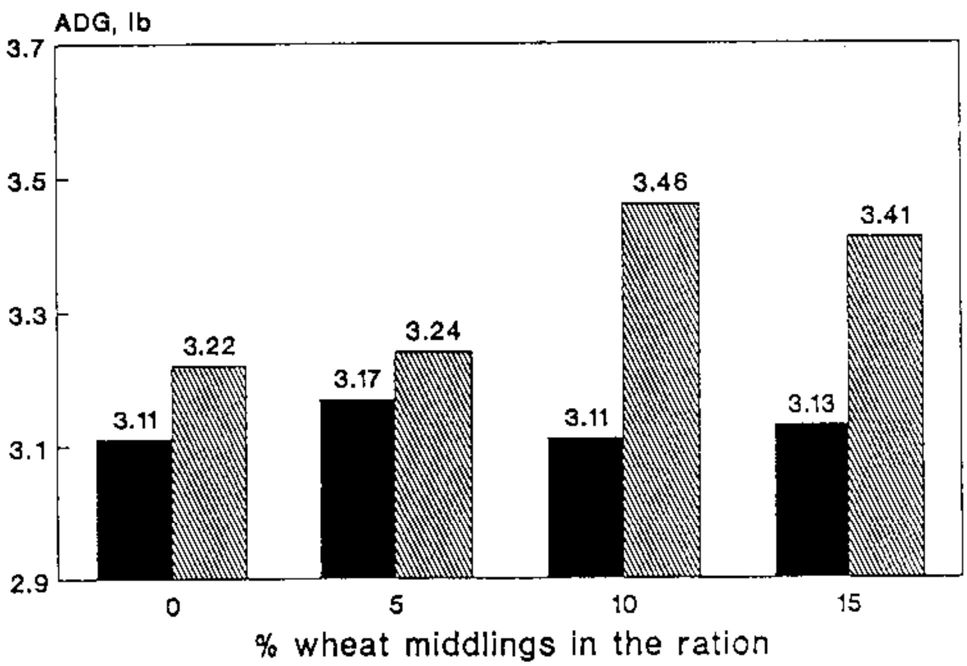

Figure 1. Effect of Replacing the Concentrate Component of Finishing Rations with WM on Observed ADG (■) and ADG Predicted from Daily NE_g Intake