

INFLUENCE OF DIFFERENT AMOUNTS
OF WHEAT MIDDINGS IN THE RATION OF
DAIRY COWS ON PRODUCTION RESPONSES

C. Acedo¹, L.J. Bush² and G.D. Adams³

Story in Brief

A feeding trial was conducted with lactating dairy cows to compare the nutritional value of rations containing different amount of wheat middlings. Concentrate mixes containing none, 20 percent or 40 percent middlings comprised 60 percent of the total ration, with alfalfa hay used as the forage component. The total rations, with 0, 12 or 24 percent middlings, were calculated to be isocaloric. There was a significant linear trend toward lower milk yield as the level of middlings in the ration increased. Fat content of the milk was not affected by treatment. An increase in concentration of rumen ammonia and blood urea was indicative of a change in efficiency of protein utilization by the cows as the proportion of middlings in the ration was increased.

Introduction

Wheat middlings (mids) are a by-product of the wheat milling industry composed of fine bran particles, shorts, germ, and the residue called "tail of the mill." Wheat mids contain about 18 percent crude protein (as fed basis) of which 71 percent or more is digestible, and no more than 9.5 percent crude fiber.

According to previous research, some wheat mids can be included in the concentrate mixture for dairy cows without deleterious effects on milk yield, fat test, or protein and dry matter intake. However, the earlier research on feeding wheat mids was done with cows consuming much lower amounts of concentrate than is common in dairy herds today. Little information is available on the effects of high concentrations of wheat mids in rations for dairy cows, particularly under current conditions of high milk production and concentrate intake.

The objective of this paper was to compare the effect of concentrate diets containing different levels of wheat mids on the production of lactating dairy cows.

Materials and Methods

Eighteen lactating cows (16 Holstein; 2 Ayrshire) from 7 to 8 weeks postpartum were used to compare a) none b) 20 percent and c) 40 percent wheat mids in the concentrate portion of a ration containing 60 percent concentrates. The

Graduate Student¹ Professor² Instructor³

three diets were formulated to contain essentially the same amounts of net energy (NE_l) and protein, with only a modest amount of difference in crude fiber content (Table 1). Each pound of mids replaced .65 lb of sorghum grain, .20 lb of cottonseed meal and .15 lb of corn grain to equalize NE of the diets. Concentrate mixes were pelleted. All cows had a two-week adjustment period before entering the trial. The concentrate to roughage (alfalfa hay) ratio was 60:40 for all cows in the trial. Cows were fed concentrate and hay separately, with sufficient amounts provided to allow for a small amount of weighback by each cow.

Table 1. Ingredient composition and calculated analysis of concentrate mixtures

Item	Concentrate		
	Control	20% Mids	40% mids
Ingredients, % as fed			
Corn	30	27	24
Sorghum grain	41	28	15
Wheat mids	--	20	40
Soybean meal	10	10	10
Cottonseed meal	10	6	2
Molasses, liquid	7	7	7
Dicalcium phosphate	1	1	1
Salt	1	1	1
Calculated analysis, as fed			
Net energy (NE _l), Mcal/lb.	.74	.74	.74
Total protein, %	15.6	15.7	15.8
Crude fiber, %	3.1	3.8	4.4

A switchback design was used with three five-week experimental periods. The cows were divided into four groups (blocks) based on date of freshening. Each cow was assigned to one of six feeding sequences with the same number of cows per sequence.

Milk yield was recorded daily for each cow and samples for fat test were taken at four consecutive milkings each week during the entire trial. Cows were fed both alfalfa hay and concentrates in individual stalls, and amount of concentrate and hay refusals were recorded daily. Samples of hay and of the three concentrate mixes were taken weekly and analyzed for protein and dry matter. Solubility of nitrogen in the feeds in a .15 N NaCl solution was determined on samples taken periodically throughout the trial. At the end of each period, samples were taken for determination of blood urea and rumen ammonia concentrations approximately three hours after concentrates were fed.

Results and Discussion

Milk yield of cows fed rations containing wheat mids was lower than that of cows fed the control ration (Table 2). Although the yield of cows fed the concentrate ration containing 20 percent mids did not differ greatly from the controls, there was a significant ($P < .05$) linear decrease in production as the percentage of wheat mids increased in the ration. These results differ from those of researchers at the University of Florida who observed slightly higher milk yields when wheat mids comprised 12.5 and 25 percent of the total ration on a dry basis (Van Horn, 1982).

There was no consistent effect of ration treatments on milk fat percentage. Average fat test for all three treatment groups was below the breed average despite the fact that the dry matter intake from grain was only slightly above 60 percent of the total intake. When milk yields were expressed as 4 percent fat-corrected milk, the linear decrease in yield with increasing percentage of mids in the concentrate was not evident. The FCM yield of cows fed the 40 percent mids concentrate was not significantly different ($P < .05$) from the control, reflecting the slightly higher fat test of cows fed this concentrate mixture.

Intake of both grain and hay was similar for all three treatment groups, indicating no problem with acceptability of a concentrate mixture containing 40 percent wheat mids. Pelleting has been noted to alleviate palatability problems otherwise encountered with mixes containing a high percentage of wheat mids.

Table 2. Responses of cows fed experimental rations

Item	Concentrate		
	Control	20% Mids	40% Mids
Feed intake, lb/day			
Grain DM	27.0	26.3	27.0
Hay DM	17.7	17.4	17.8
Total DM	14.7	43.7	44.8
Total protein	7.7	7.5	7.7
Milk yield			
Milk, lb/day	67.7 ^a	65.2 ^{ab}	64.6 ^b
Fat, %	3.3 ^a	3.2 ^b	3.4 ^{ab}
FCM, lb/day	60.3	57.3	58.5
Rumen ammonia, mg/dl	10.1 ^a	15.9 ^b	16.1 ^b
Blood urea, mg/dl	16.4 ^a	17.6 ^{ab}	18.4 ^b

^{ab} Means not sharing a common superscript differ ($P < .5$).

Solubility of nitrogen in wheat midds has been observed to be greater than for many other feed ingredients. However, values for solubility of nitrogen in a NaCl solution determined for the three concentrate mixes in this experiment did not differ greatly (22.9, 25.8 and 25.2 of total nitrogen for the control, 20 percent and 40 percent wheat midds mixes). A more critical evaluation of the potential for protein in the different mixtures to be degraded in the rumen is needed, possibly by means of the in vivo dacron bag procedure. Concentration of ammonia in the rumen fluid and urea in blood plasma 3 hours after concentrate feeding indicated that protein in the rations containing wheat midds was degraded more rapidly than that in the control ration (Table 2). In our diets, midds provided approximately 0, 14 and 28 percent of the total dietary protein. There was a significant ($P < .05$) linear trend toward a higher concentrations of rumen ammonia and blood urea as the percentage of wheat midds in the ration increased. Thus, it appears that utilization of protein in rations may be less efficient as wheat midds are added. This is consistent with the trend toward lower milk yield and may limit the amount of wheat midds that can be used in concentrate mixtures for lactating dairy cows.

Literature Cited

VanHorn, H.H. 1982. Dairy Production Notes. Florida Coop Ext. Service.