Wheat Grain in Dairy Rations: An Economical Choice Overlooked

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❑ Abstract

Feeding wheat grain (WG) with uniquely extensive starch and protein fermentation patterns has conventionally, and not always insightfully, been introduced as a major cause of rumen acidosis, laminitis, and depressed DMI and milk fat. Such inaccurate beliefs combined with enormous human use have restricted WG effective feeding to dairy cows. Using 8 midlactation Holstein cows in a replicated 4 × 4 Latin square design with 4 periods of 14 days adaptation, finely and coarsely ground WG successfully replaced a half and all of barley grain at 10% and 20% of diet DM to maintain DMI and milk production. Cows on 10% vs. 20% WG had moderately improved energy intake, increased blood albumin and total proteins, a tendency for greater total tract NDF digestibility and reduced blood BHBA. WG inclusion rate did not interact with grain coarseness on any parameter. Findings suggest feasible major use of ground WG in dairy rations.

❑ Introduction

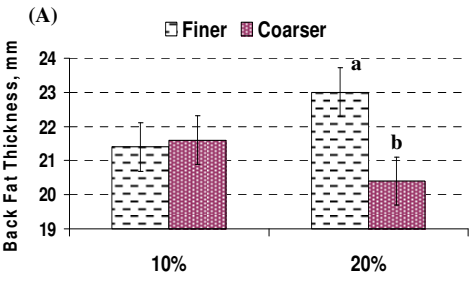
- WG has extensively and rapidly fermentable starch and proteins, likely causing rumen acidosis, laminitis and milk fat depression if fed improperly (1, 2, 3, 4).
- Consequently and due to its vast use by humans, WG has been overlooked and thus has scarcely been studied as a major ingredient for lactating dairy cows (1, 5, 6, 7).
- Prepartal WG increased blood glucose and calcium as well as milk production and decreased urine pH in periparturient Holstein cows and heifers (1).

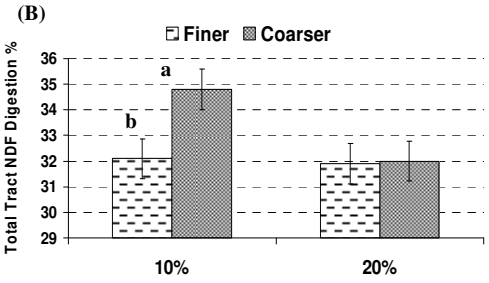
❑ Primary Objective

- To determine ground WG level and coarseness effects on feed intake, total tract nutrient digestion, blood metabolites and production of mid lactation cows.

❑ Materials and Methods

- Eight mid lactation Holstein cows (176 ± 8 days in milk; 554 ± 13 kg body weight; 3.12 ± 0.14 BCS; mean ± SE) used in a replicated Latin square design study with 4 periods of 21-d with 14 d of adaptation.
- Treatments were TMRs with either 10% or 20% WG ground either finely or coarsely with dietary forage to concentrate ratio of 47.5:52.5, delivered at 0900, 1600 and 2300 h, permitting 5-10% orts. Diets DM had 18.5% CP, 39.5% NDF and 1.6 Mcal/kg NE_L.
- Thus, WG level and grinding extent were compared in a 2 × 2 factorial arrangement.
- Particle size distribution of TMR was measured using Penn State Particle Separator (PSPS, Lammers et al., 1996).
- Cows were housed in 3×4 individual free boxes with concrete feed bunkers and metal water troughs at the Dairy Unit of the University of Zanjan Research Farm (Zanjan, Iran) under normal controlled ambient temperatures.
- DMI and milk production monitored during 7 sampling days.
- Data were analyzed using Proc MIXED of SAS Institute (2003); fixed effects: WG level, WG coarseness, the interaction; Random effects: period and cow.





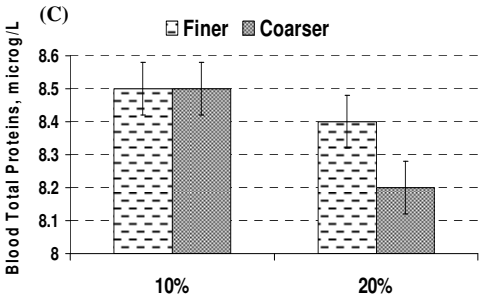


Table 1. Performance and metabolic parameters of cows fed diets with 10% and 20% ground wheat grain (WG).

	Diet WG			
Item	10%	20%	SE	*P* >
DMI, kg/d	19.9	19.4	0.2	0.001
Milk energy output,	17.6	17.5	0.3	0.67
Blood glucose, mg/dL	51	51.3	1.7	0.82
Blood total proteins,µg/L	8.5	8.3	0.1	0.03
Blood BHBA, mol/L	0.54	0.64	0.1	0.06
Fecal pH	6.71	6.77	0	0.1
NDF total tract digestion	33.5	31.9	0.8	0.07

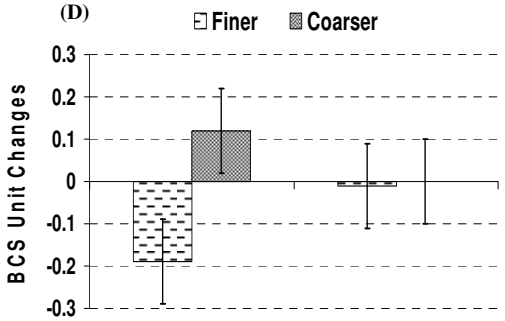


Figure 1. Back fat thickness (A), total tract NDF digestion (B), blood total proteins concentrations (C) and BCS unit changes (D) in cows fed either finely or coarsely ground wheat grain at either 10% or 20% of diet DM. Different superscripts indicate *P*<0.10.

❑ Results

- WG feeding did not affect DMI, milk properties namely energy output, total tract DM digestion, fecal and urine pH, blood glucose and globulins, and BW and BCS changes (*P* > 0.10; Table 1).
- DMI was greater with 10% instead of 20% WG in diet DM (*P* < 0.01).
- Blood total proteins were higher and total tract NDF digestibility tended to be lower with 20% vs. 10% WG (*P* < 0.10, Table 1, Figure 1).
- Coarser rather than finer WG increased total tract DM (70 vs. 64.6%, *P* < 0.01) and NDF digestion (33.4 vs. 32.0, *P* < 0.10).
- Blood BHBA tended to increase by increasing diet WG from 10 to 20% (*P* < 0.10).
- Back fat thickness tended to increase when finer and not coarser WG increased from 10% to 20% of diet DM (23.0 vs. 21.4 mm, *P* < 0.10, Figure 1 A).

❑ Take Home Messages

- Where economically competitive and commercially available, WG in simply ground forms is a viable and major dietary alternative for barley grain in mid lactation rations.

- Considering blood metabolites and DMI results, continuing research on effects of WG feeding both alone and in combination with other cereals in fresh and early lactation cows under negative energy balance is essential.

❑ Discussion and Conclusions

- Production data consistently support WG use safety in dairy rations at major levels.
- DMI data nullify the belief that ground WG adversely affects diet palatability, rumen fermentation and milk fat yield (2, 4)
- Regardless of particle size, ground WG successfully replaced a half and even all of dietary barley grain while maintained DMI, blood indicators of energy status, and milk energy output.
- Similar and even slightly greater DMI with adequately high milk fat and milk fat to protein ratio suggest safe WG impacts on rumen conditions and cow well-being.
- Relative rises in blood albumin and total proteins would likely suggest some effect of feeding 10% instead of 20% WG on hepatic protein metabolism, warranting research.
- BCS and body fat thickness (measured using ultrasound) data support the fact that BCS system visually scores a multitude of tissue regions only one of which is back fat.

❑ References

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