Ruminal acidosis

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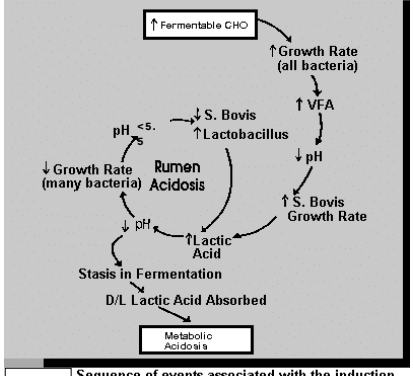
Acute Lactic Acidosis



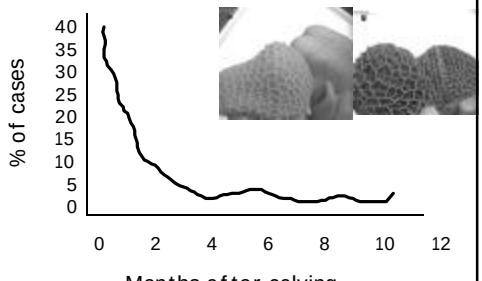
Sequence of events associated with the induction of acute ruminal lactic acidosis

If there is too much nonfiber carbohydrates or if it breaks down too fast:

- ↓ rumen pH
- ↓ fiber digestion
- ↑ Acidosis
- ↑ Low milk fat
- ↑ off-feed

Healthy rumen ↑ performance

Occurrence of rumen acidosis postpartum

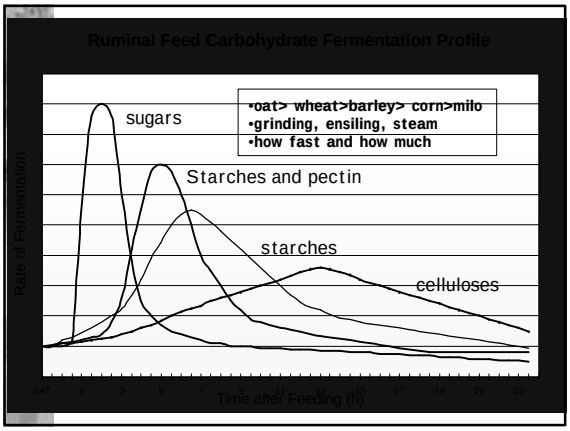


Milk protein: nutritional acidosis

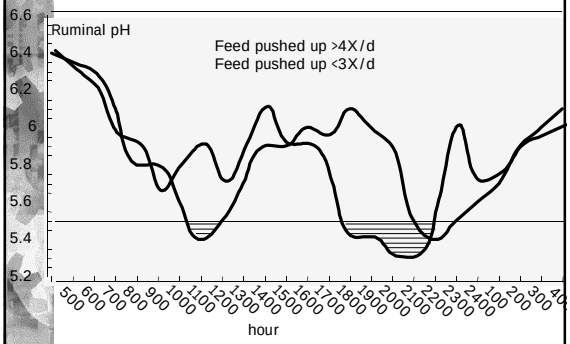
Variable	Days postpartum	Control	Acidic
Protein, %	15	3.92	3.35
	45	3.28	2.90
	90	2.94	2.65
Casein, %	15	3.47	2.33
	45	2.56	2.07
	90	2.32	1.95

Gentile et al, 1986

Ruminal Feed Carbohydrate Fermentation Profile



Feed Availability

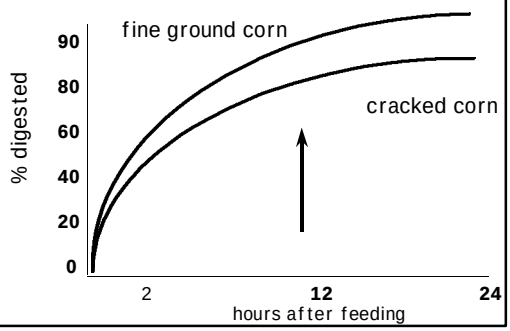


Ruminal availability (%) of protein and starch

	Cracked	Chick cracked	Fine ground	Steam flaked
Protein	37	45	53	29
Starch	45	53	65	75

Lykos and Varga, 1995

Rate of ruminal starch digestion of corn



When Is Fine Too Fine and Coarse Too Coarse When Processing Grain?

Signs Too Coarse:

- High intake
- Poor performance
- See seed or starch in manure

Signs Too Fine:

- Acidosis
- Sorting of grain
- Depressed DM intake

Grain particle sizes

Number 4	> 4500	Whole and coarse
Number 8	> 2200	Cracked corn
Number 16	> 1100	Ground corn
Number 30	> 600	Pig feed
Pan	< 550	Powder

What is the correct grain particle size to feed?

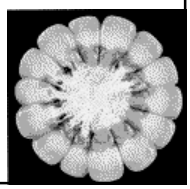
- Type of forage fed:
  - As corn silage increases in the ration, silage moisture increases, or as particle length decreases, the particle size of corn should increase.
- Forage particle length:
  - 8 to 10 % of TMR particles on top box of PSU separator (>3/4")
- Amount of NFC:
  - If NFC> 38% of diet DM, particle size of corn needs to be increased
- Method of feeding the grain:
  - Conventional vs TMR

Processing and amount fed

- If corn is ground more finely, can less be fed in the total ration? YES
  - If the corn is more digestible less grain will supply the same amount of starch for the cow to use
  - It is necessary to adjust the amount of grain in the diet when switching from coarsely rolled or cracked corn to finely processed corn to prevent acidosis, off- fed problems, milk fat-protein inversions, and laminitis.
  - Finely processed or steam flaked corn will have 10 to 15 % more net energy for lactation (NEl) than coarsely rolled or cracked corn.

Factors affecting availability of starch in the rumen

- Ability to measure particle size distribution
- Density of corn, ie test weight
- Level of DMI
- Type and level of forage



Particle size distribution of corn

	Callison et, 2001	Lykos and Varga, 1995
	Mean particle size, mm	
Fine ground	1.2	0.69
Medium ground	2.6	2.58
Coarse ground	4.8	4.31

Mean particle size $\leq$ 1mm needed to maximize total tract digestibility of corn

Hybrids of corns differing in the texture of the endosperm

	Dent	Flint
Starch, %	68	67.1
CP, %	10.7	12
Density, g/cm^3	1.29	1.36
Surface area, m^2/g	0.13	0.07
Ruminal starch dig, %	61.9	46.2

Philippeau et al, 1999

The floury endosperm has a thinner protein matrix than the horny portion and therefore a lower CP content in the floury than in the horny portion. Greater concentration of floury endosperm with soluble proteins are more readily digested, others have vitreous endosperm with insoluble proteins and are more resistant to digestion. High moisture fermentation results in proteolysis and an increase in the solubility of endosperm proteins, increasing rate of starch digestion

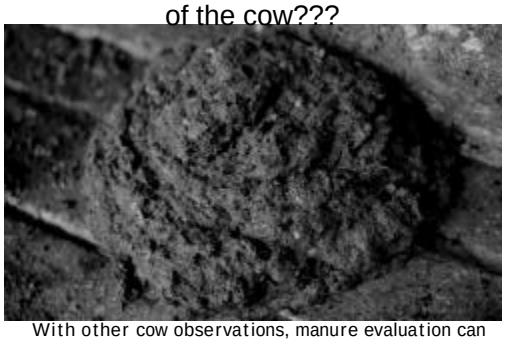
Level of feeding on ruminal starch digestion

Effect of corn processing on milk production

Lykos, Varga and Casper, 1997	cracked	HMC ground
DMI, kg/d	26	26.3
Milk, kg/d*	42.5	45.6
Fat, %	3.5	3.4
CP, %*	2.83	2.89
F:P ratio	1.24	1.18
Urea N, mg%*	16.2	13.7
Bacterial N g/d*	387	420
NDF dig, %	58	57

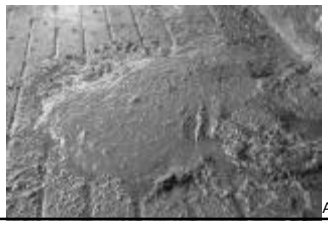
Dann and Varga, 1999	cracked	steam-flaked (360 g/l)
DMI, kg/d	21	20.5
Milk, kg/d*	43	45
Fat, %*	3.5	3.3
CP, %	2.9	2.85
F:P ratio	1.21	1.16
Urea N, mg% *	17	15
NDF dig, %*	43	35

What about the other end of the cow???



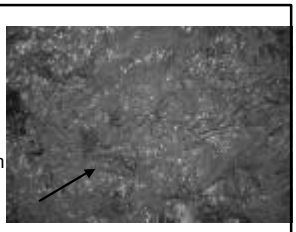
With other cow observations, manure evaluation can help diagnose areas for improvement in both ration formulation and management

Microbial fermentation in the rumen or hindgut produce the same products. These products influence how manure looks. If a great deal of fermentable carbohydrate reaches the hindgut, then diarrhea may occur due to an extensive hindgut fermentation



Adapted from M.B. Hall

Mucin casts represent damage to the walls of the hindgut, possibly caused by low pH from an extensive hindgut fermentation. If the gut is damaged, the cow secretes mucin or fibrin to cover the area. These casts may be found in manure of any consistency.



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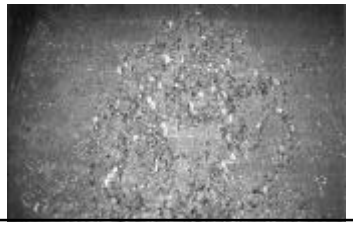
To evaluate fecal particle size and undigested feed, use the kitchen strainer (do not return it to the kitchen).

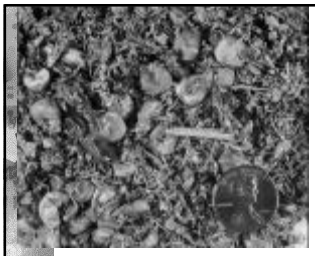
A strainer that is 7 inches in diameter and 4 inches deep works well.

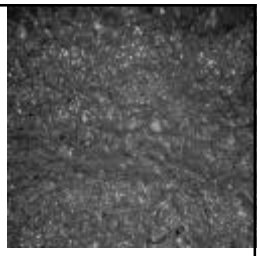
Disposable coffee cups work well for sample collection.

In a pen of cows, collect a number of samples from individual cow pies to give a fair representation of the variety in the group. This may be 3 - 6 samples per pen of 100 cows. Identify the samples

With water flowing gently but in a steady stream from a hose, rinse a single sample onto the screen, and rinse gently but thoroughly until the water flows clear. The remaining material gives a clear view of large particles and undigested feed in the manure.

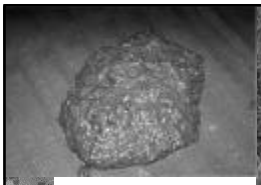


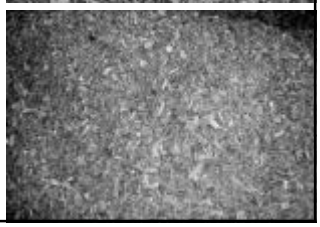




Whole kernels of corn in the manure often mean that the grain in the corn silage was not properly processed ie, ground too coarsely, corn silage not stewed long enough in bunk or silo, corn silage harvested too dry, or there was insufficient consumption of physically effective fiber.

Undigested ground grain (≤ ¼ inch) and long fibers in manure can indicate fast rate of passage





Remember cows can sort out fiber that is > 2" in length in a TMR

Evaluating if cows are sorting

Difference between top pan of TMR and top screen of refusals should be less than 10%

Ration - 18% Top Sieve

Refusals - 46% Top Sieve

Manure should be consistent within a group of cows that are receiving the same ration

If it is not it suggests that the cows are sorting their feed, either aided by poor mixing or by the cow herself

Watch cows as they eat

Testing TMR OR Weigh Backs

USE THE 1-2-3 RULE

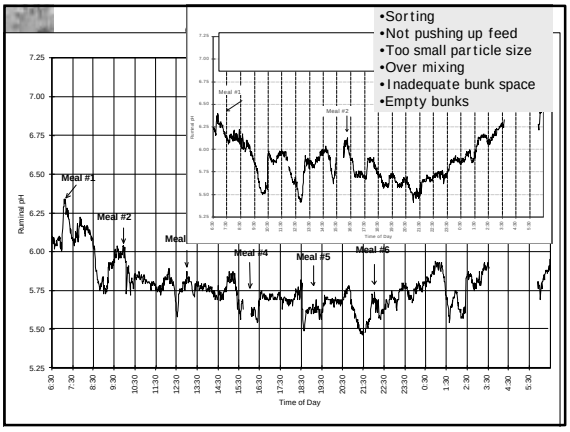
1: +/- one unit of crude protein

2: +/- two units of ADF

3: +/- three units of dry matter

TMR: CALCULATED VS TESTED TMR

WEIGH BACK: TESTED TMR VS ORTS

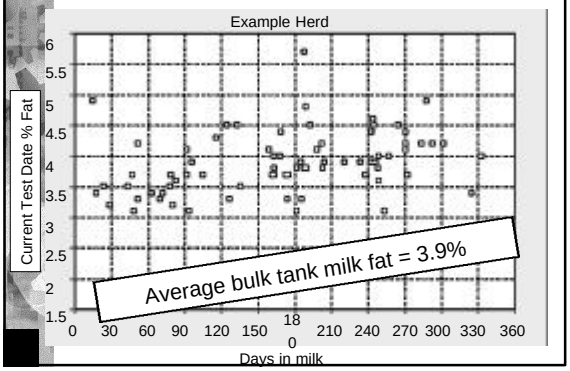


Milk fat test

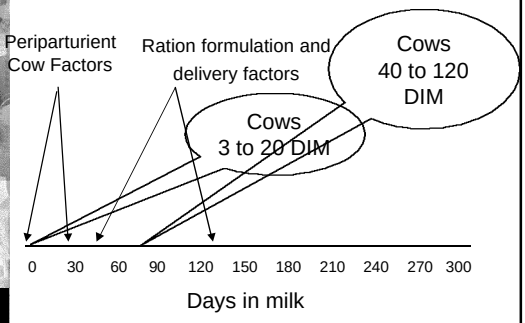
- Milk fat depression
  - Weight gain
  - Excessive grain intake (>2.5% of BW) and/or fat
  - Fat test < 3.0%
  - Protein % higher than fat
  - Primary cause due to abnormal rumen function
- Low milk fat test
  - Thin cows
  - Low DMI
  - Fat test 2.5 to 3.2%
  - Protein to fat ratio near normal (0.88; f:p 1.14)
  - Low peak milk yield
  - Generally cows < 120 DIM
  - Shortage of energy or ration imbalance
- Herds with normal milk fat test can have ruminal acidosis

Milk fat <0.4 point below milk protein

Milk fat 1 full point below herd average



Two Groups at Risk of Acidosis



Summary Points

1. Subacute ruminal acidosis is a common problem in intensively managed dairy herds
2. Clinical signs may include reduced DMI, diarrhea, lameness, low milk fat test, rumen stasis, etc.
3. Two groups of cows at special risk are fresh cows and high intake cows.
4. Many factors can be evaluated to track the problem: source of and particle size of grain, milk fat%, fat to protein ratio, particle size of TMR, what cows are eating, assessment of manure

THANK YOU