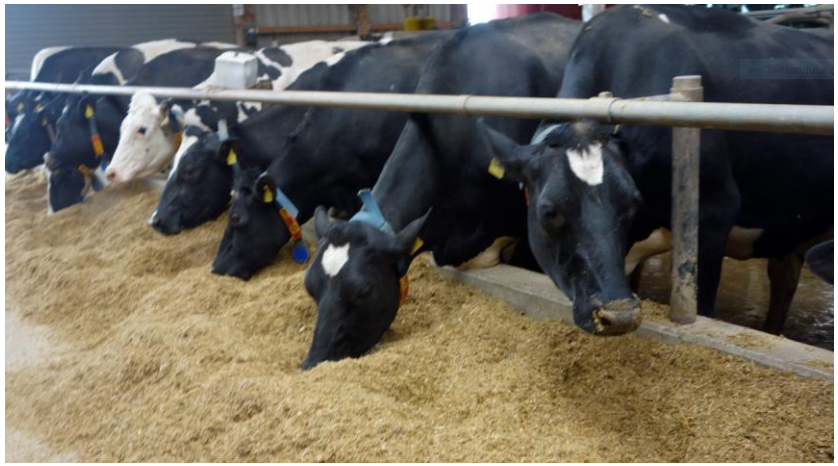
Euroopa Maaelu Arengu Põllumajandusfond: Euroopa investeeringud maapiirkondadesse

SARA Sub-acute Ruminal Acidosis- or/and SALGA Sub-acute Lower Gut Acidosis

ZCH TSM Ruminant

SARA prevalence
Animals on high concentrated diet

Early lactation cows11–29%
Mid-lactation cows 18–26%
(Kleen,2004, Tajik et al.,2009)



Netherlands > 35%
Italy > 30%
Germany > 20%

(Kleen et al 2013)

SARA the most economically important disease in dairy industry

Lost income cow/year calculated $400 - $475
(Stone 1999)

Visible :

- Reduced milk 2.7 kg/day,
- milk fat 0.3% pts & milk protein 0.12% pts

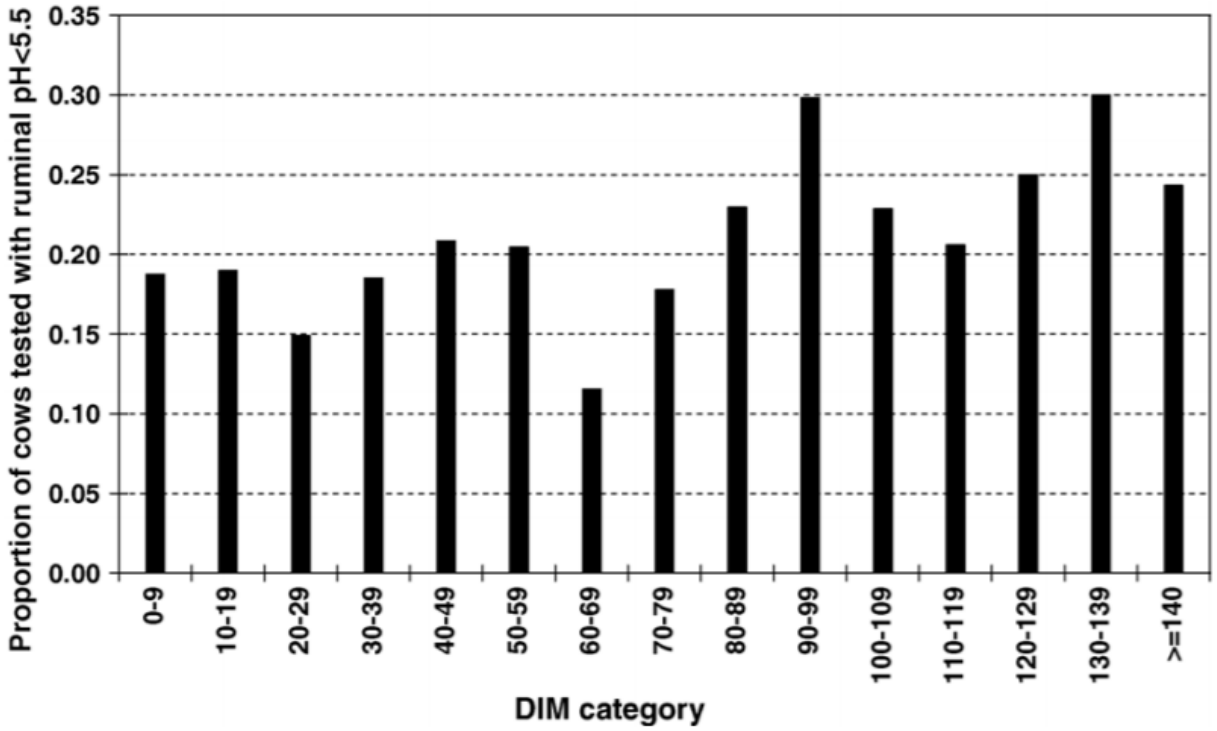
(Stone ,1999).

Not always visible :

- Irregular feed intake
- Feed intake depression
- Reduced in digestibility
- Gastrointestinal disruption
- Systemic inflammation
- Abscess in the liver
- Laminitis

SARA Prevalence MP / Cows

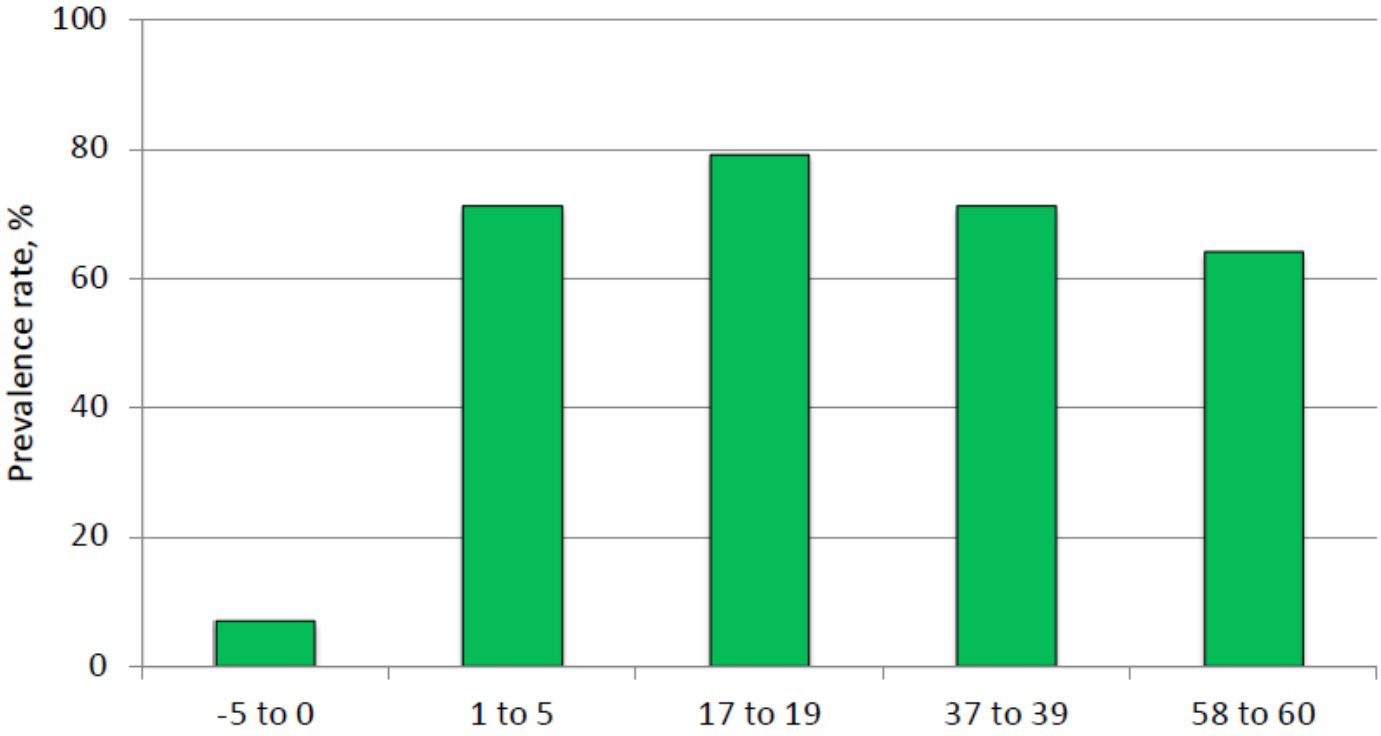
K.M. Krause, G.R. Oetzel / Animal Feed Science and Technology 126 (2006) 215–236



Risk of low ruminal pH (<5.5) by DIM from 662 cows from 55 herds. Samples were collected by Rumenocentesis 6-10 h post feeding in commercial dairy herds Wisconsin 2003-2006.

SARA Prevalence PP / First calving heifers

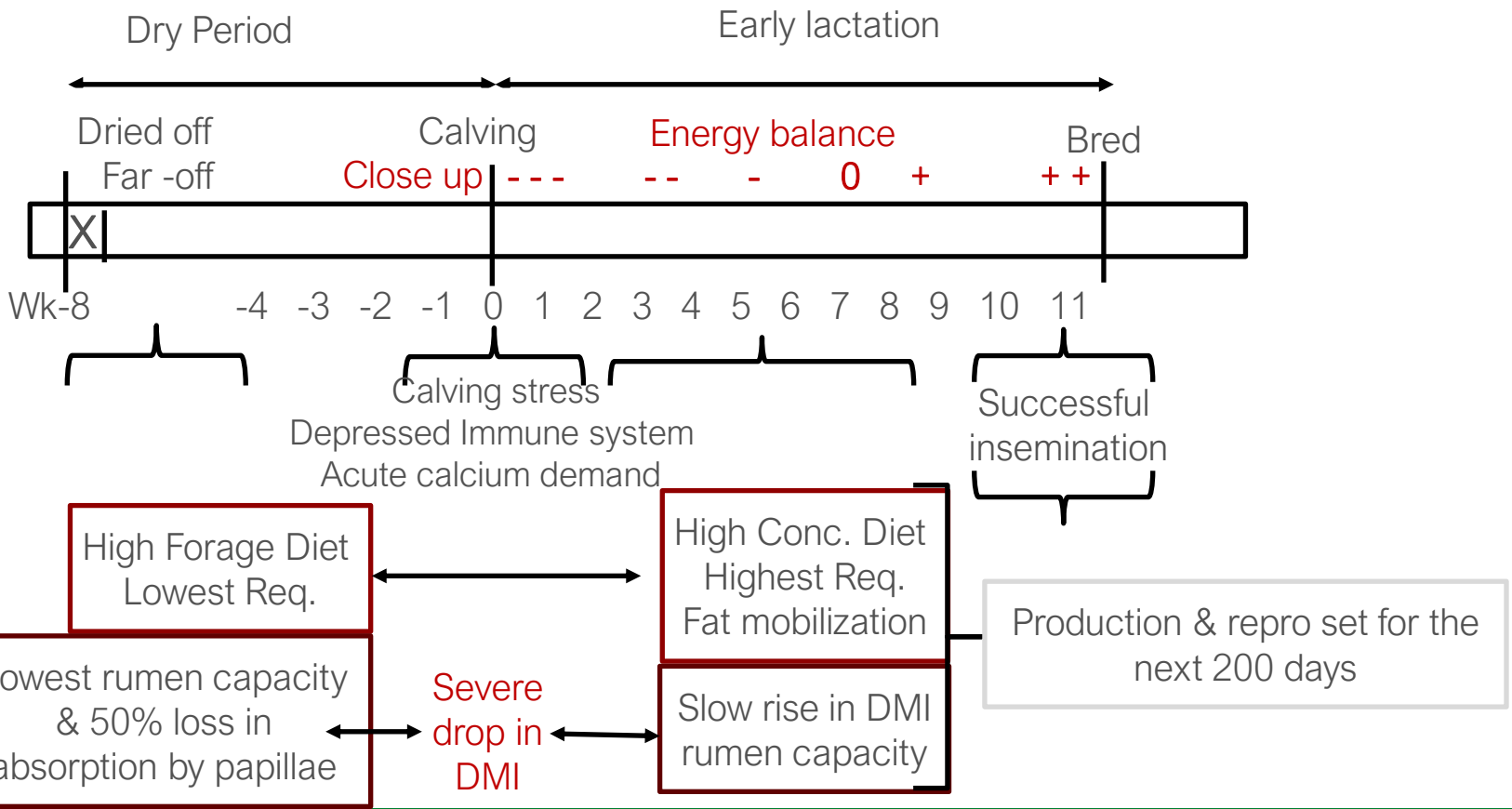
Low rumen absorptive capacity/ adaptation to HC diet



Adapted from Penner et al., 2007; JDS

Managing Cow in Critical Days

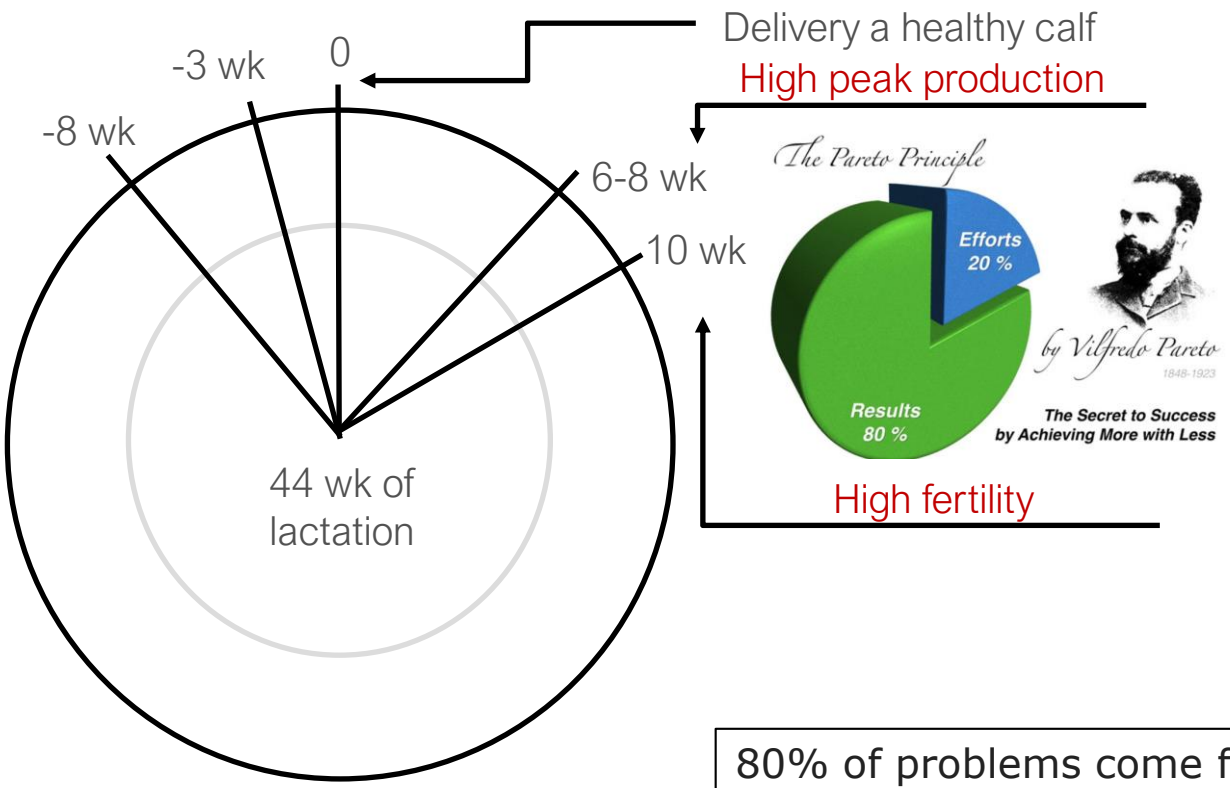
Transition



The Pareto Principle

44 + 10 = 54 calving interval

3 +10 = 13 crucial weeks



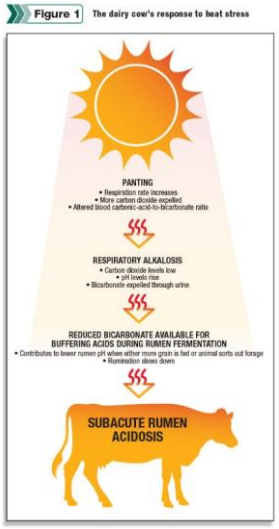
No milk fever
No retained placenta
Increase DMI
Limited BCS loss

No mastitis
No ketosis
No fatty liver
No DA

No metritis

80% of problems come from 20% of causes
80% results come from 20% of your effort

SARA
The effect of abrupt diet change

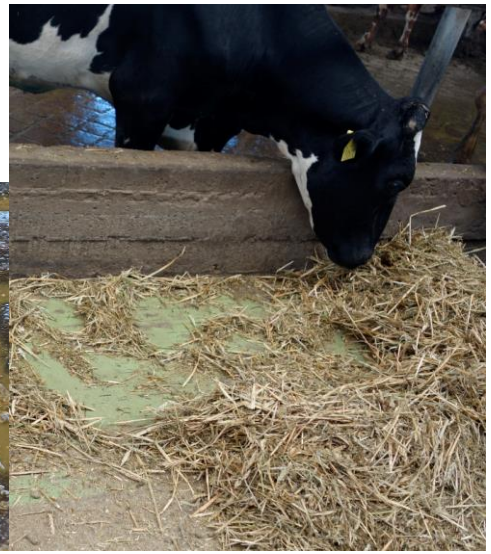


Often Pointed

1. Excessive intake of rapidly fermentable carbohydrates
2. Inadequate ruminal adaptation to a highly fermentable diet;
3. Inadequate ruminal buffering inadequate physical fiber…

When we look closer

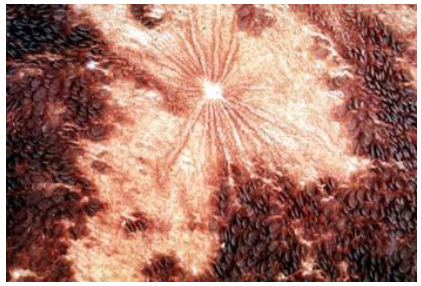
1. Overcrowding
2. Stress heifers with cows
3. Sorting



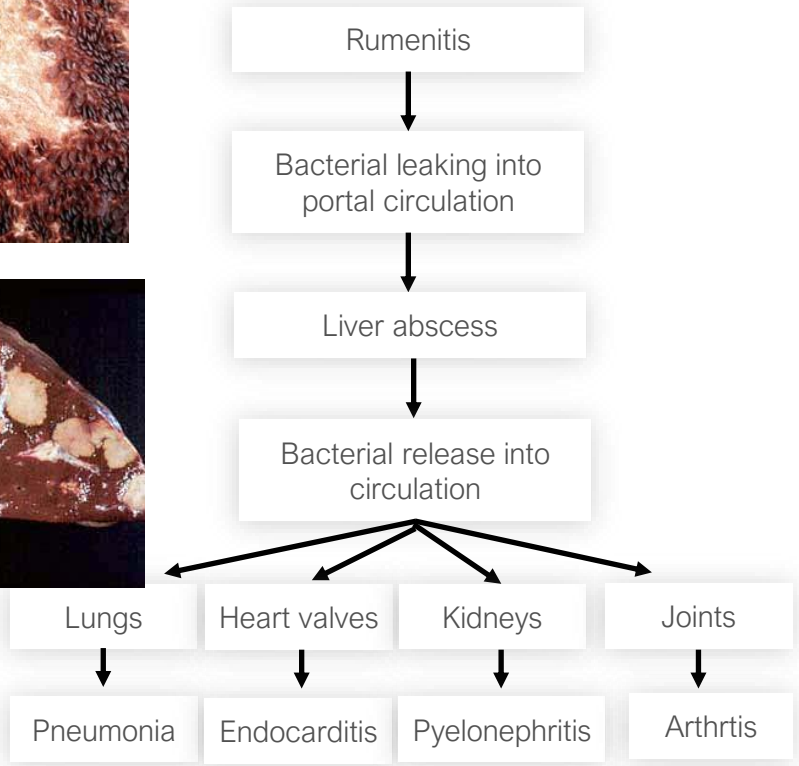
4. Grain processing
5. TMR mixing mistakes
6. Empty table syndrome
7. Feeding station problems

Post mortem findings in SARA

- Rumen papilla damage
- Rumen wall inflammation
- Rumen parakeratosis



- Multiple liver abscesses
- Gut damaged

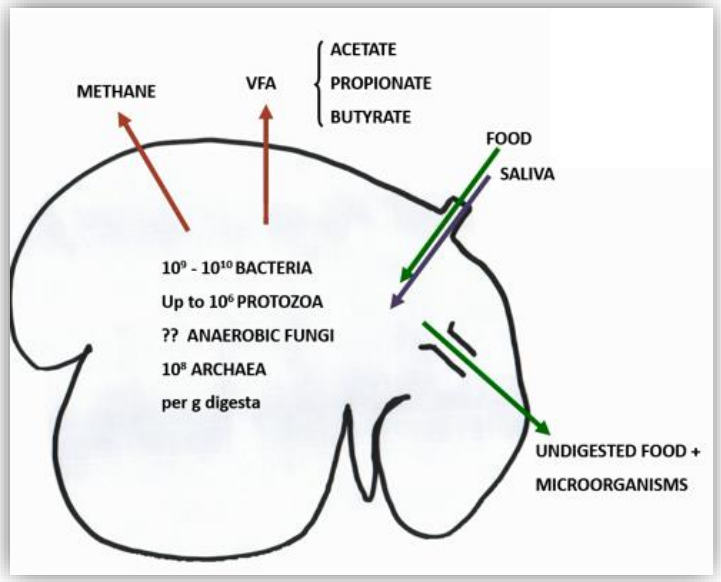


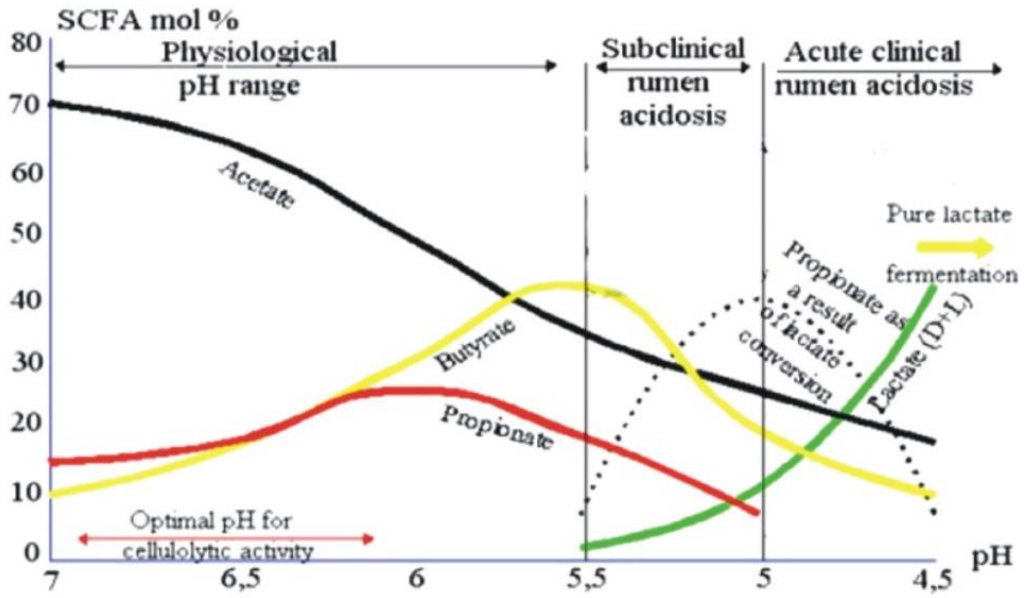
- Unexpected deaths

(Oetzel, 2007)

Rumen microbial population convert consumed feed into VFA & METHANE

Acidity coming from VFA accumulation over rumen buffer capasity /saliva, water and absorption/





Fermentation pattern and rumen environment in relation to pH (Dirksen 1984, Prosanth 2016)

Daily rumen pH pattern with proper rumen buffering system

The threshold value by Penner

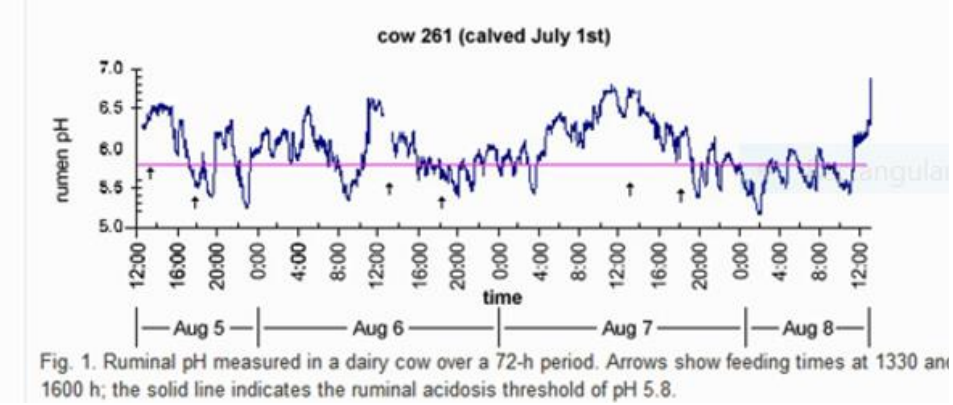
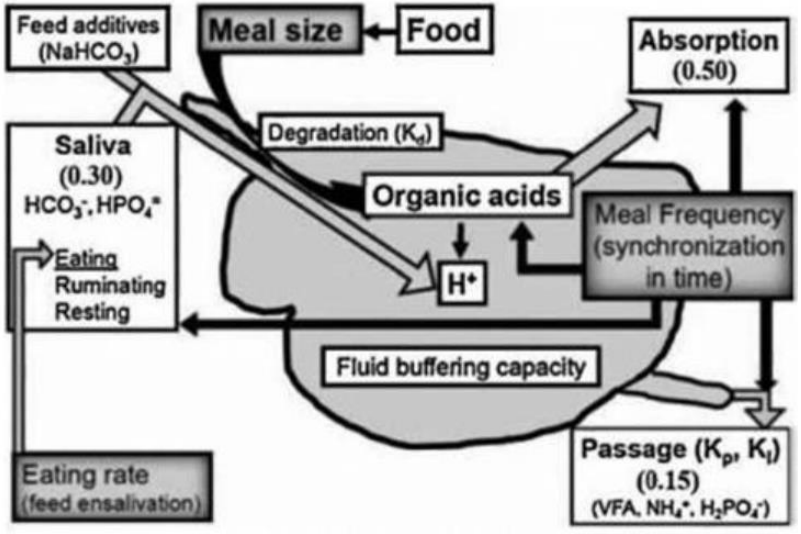


Fig. 1. Ruminal pH measured in a dairy cow over a 72-h period. Arrows show feeding times at 1330 and 1600 h; the solid line indicates the ruminal acidosis threshold of pH 5.8.

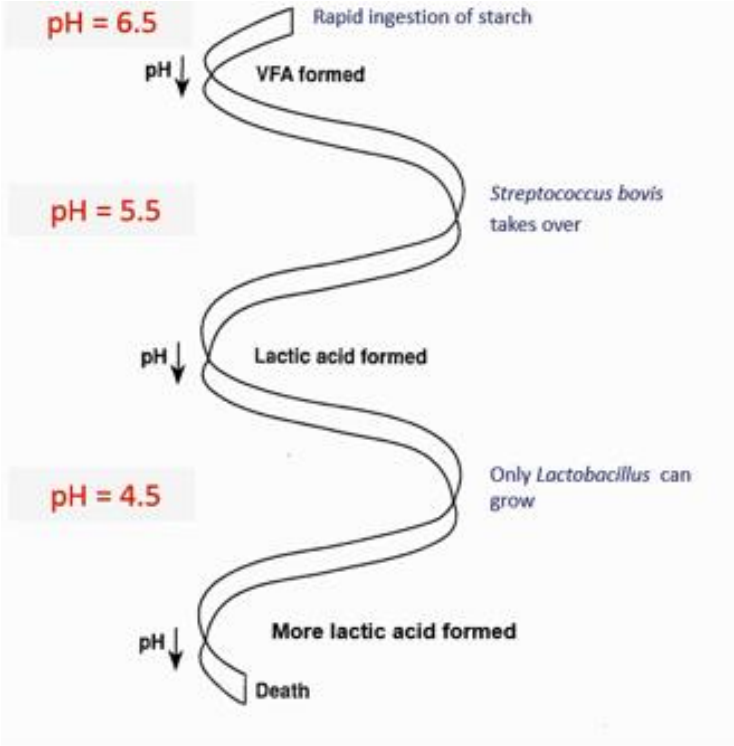
Penner et al.(2006) J Dairy Sci 89, 2132

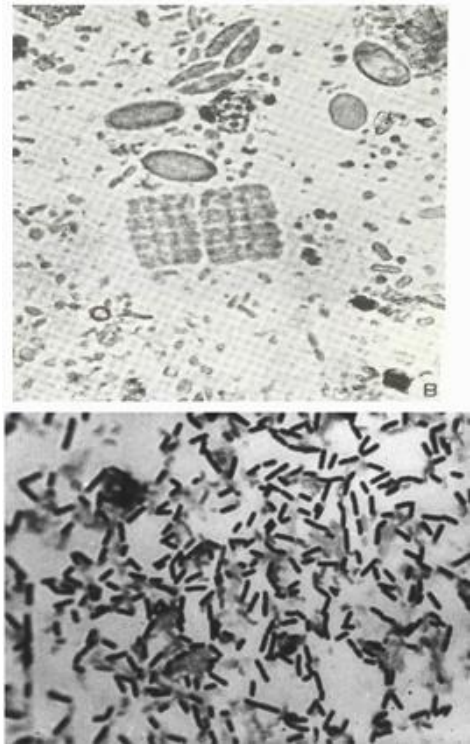


Gonzalez et al. 2012).

By rapidly ingested high amount of starch bbuffering system can easily get over the control

Lactic acidosis spiral

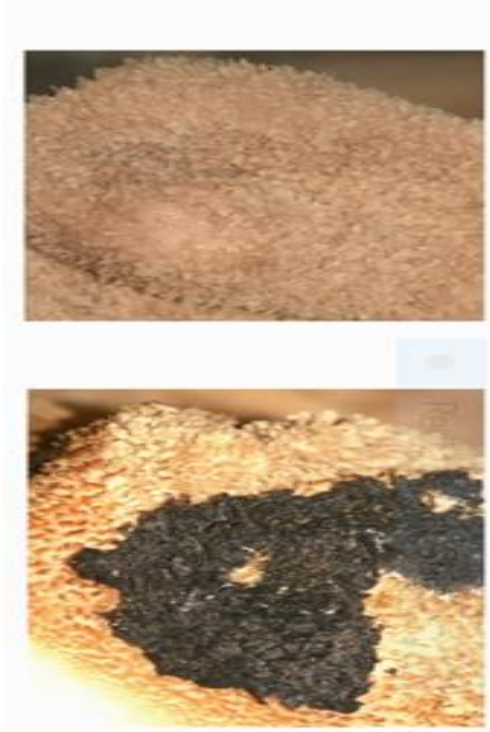


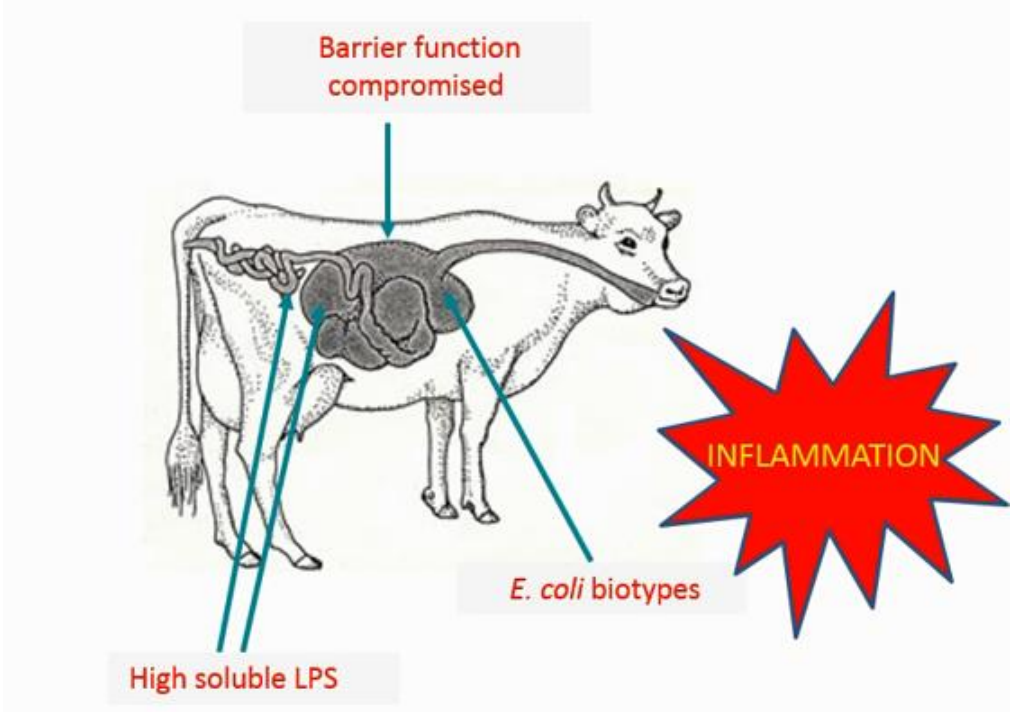


Drop of the rumen pH cause LPS toxines released

1/3 animals show post mortem rumen wall pathology _ necrotic inflammation

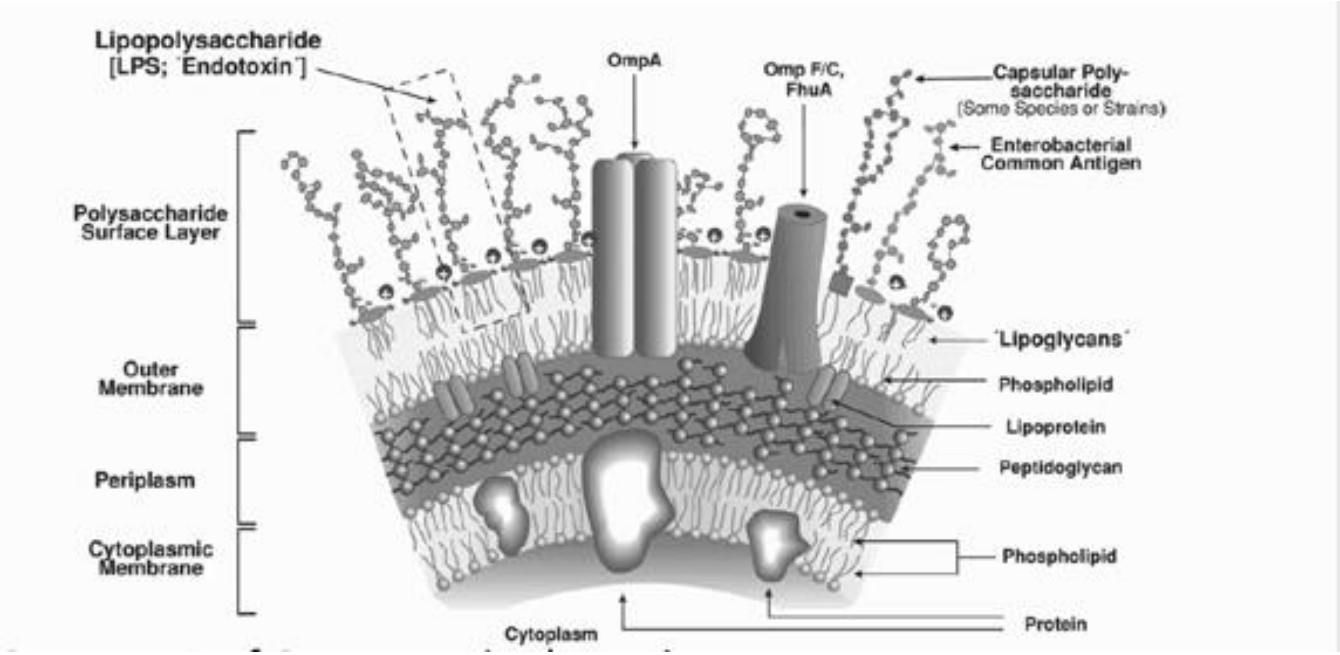
Loss of barrier function _ laminitis , liver abscesses





What is LPS (Lipopolysaccharide)

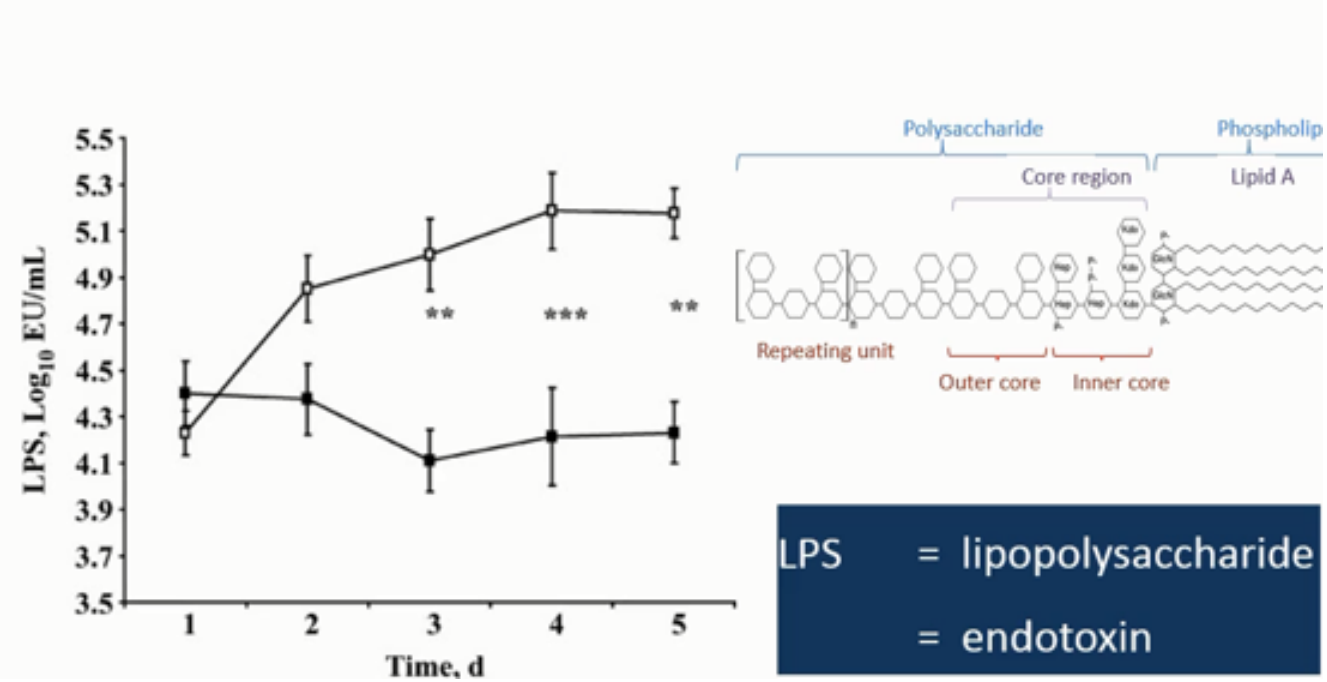
Component of gram negative bacteria released when cell lyse



Plaizier et al. 2012 Anim. Feed Sci. Tech. 172-9-21

Barley grain feeding

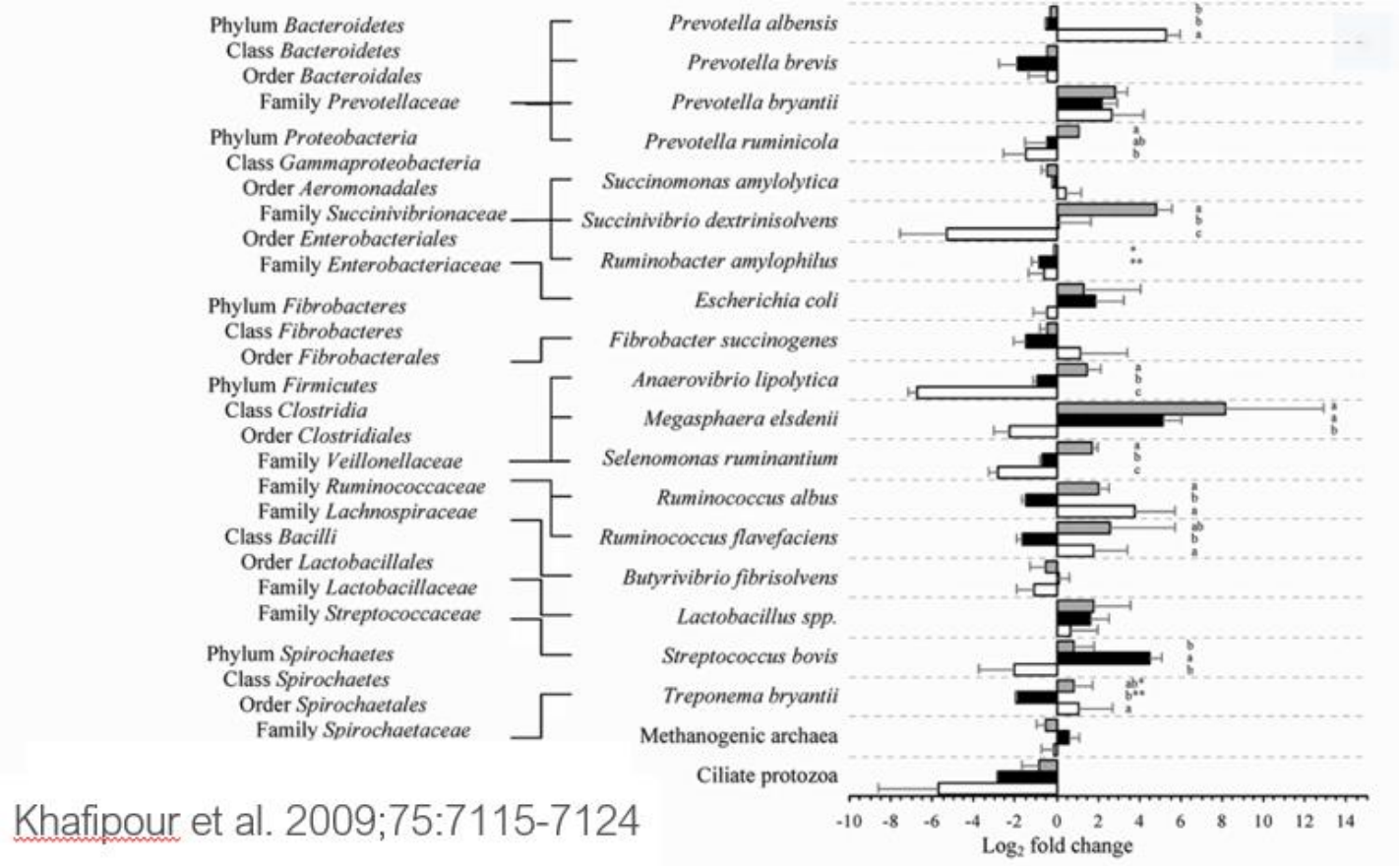
Soluble LPS concentration in the rumen of SARA induced cattle, causing inflammation increased significantly



Gozho et al. J Dairy Sci. 2007, 90

The rumen microbiome shift with SARA induced diet

Grey – middle / Black – severe/ White –alfalfa induced SARA



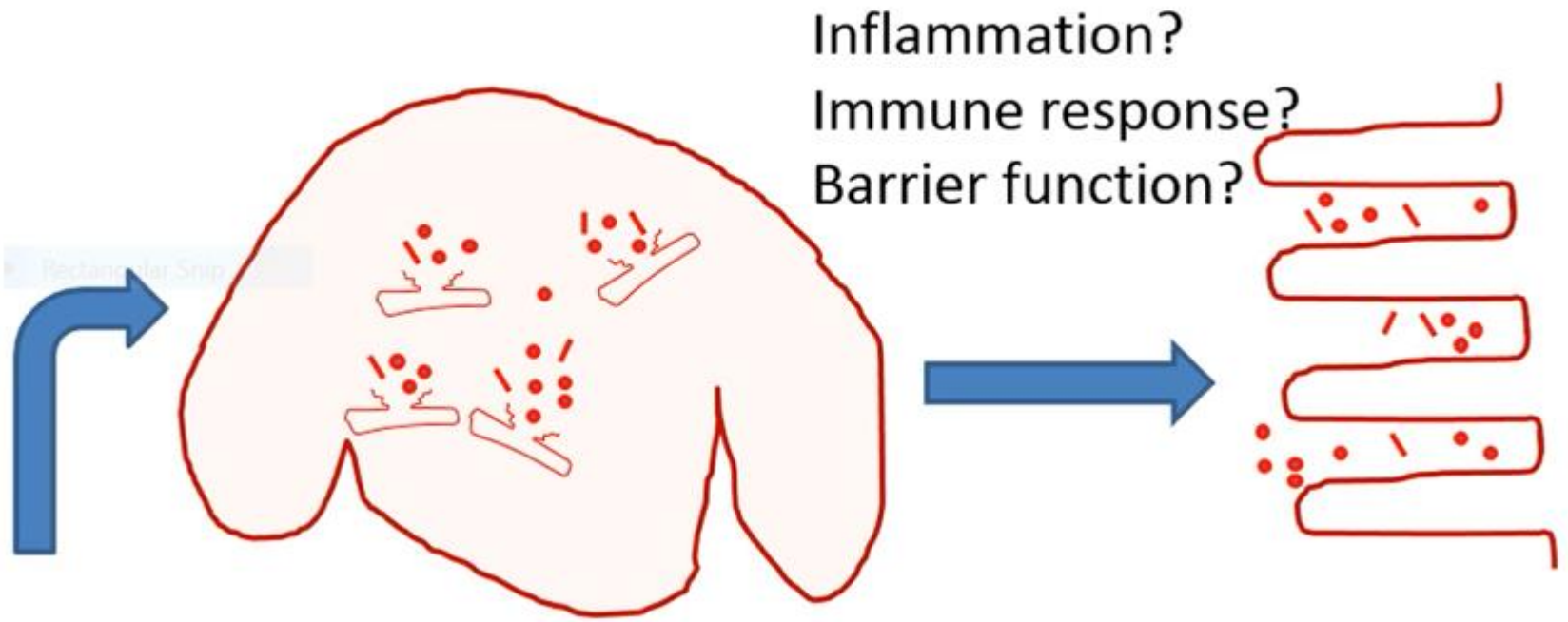
Khafipour et al. 2009;75:7115-7124

The rumen wall barrier function gets damage / SARA Trial UK 2012-2015

Rumen damage scours,

Animal and Feed Management and particle size

ON-FARM measurements
Feed characteristics?
Microbiology?
Inflammatory markers?
Immune response?



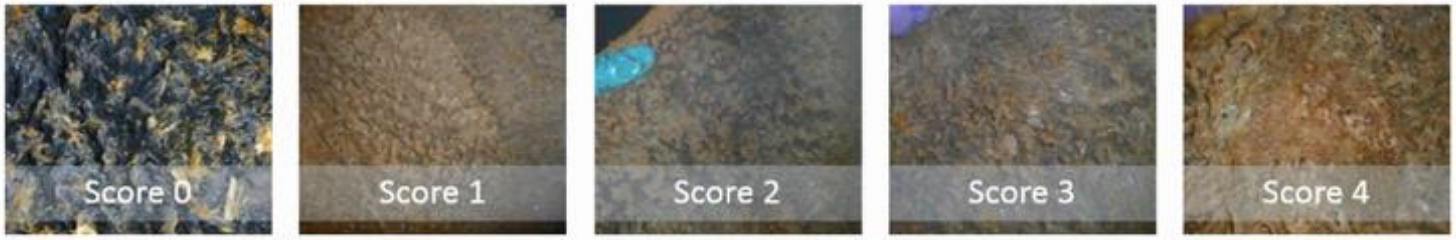
C.A. McCartney, R.C. Cernat (2015)

Post morten rumen wall evaluation inflammation papilla shape – scouring

Post-cooking appearance

0 = No blackened areas, 1 = very small blackened areas, 2 = small blackened areas, 3 = moderate blackened areas, 4 = large blackened areas

Papillae integrity



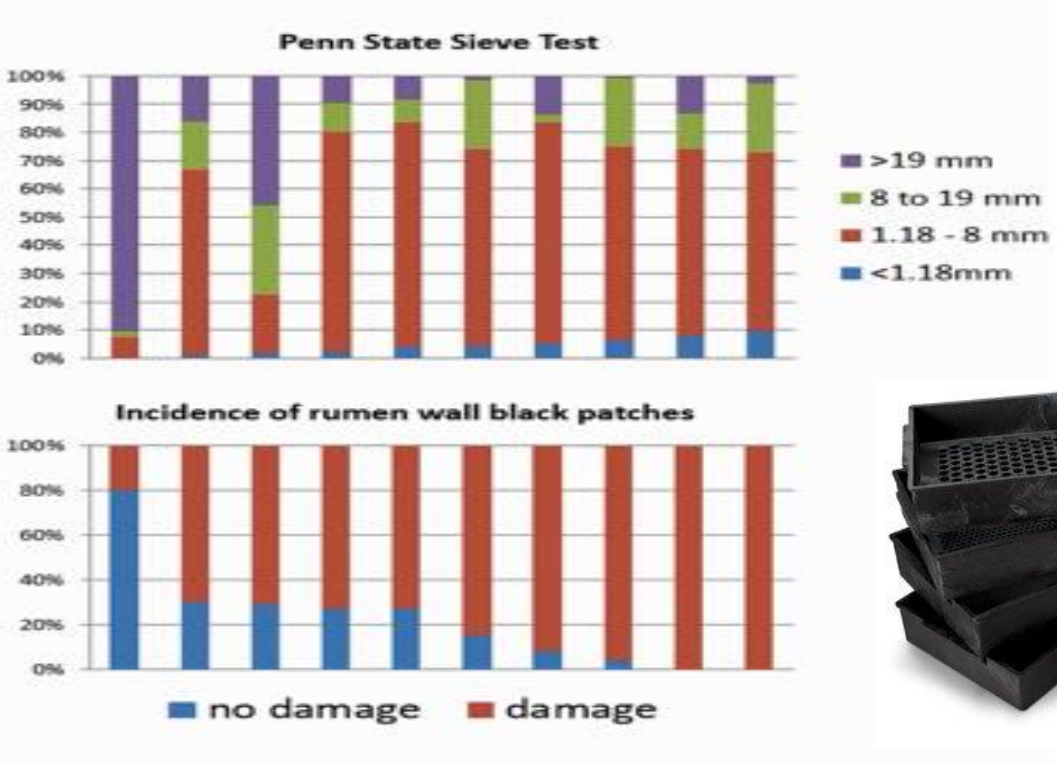
0 = No damage, 1 = small areas bare, 2 = larger areas bare, 3 = moderate areas of damage, 4 = large areas of damage.

C.A. McCartney, R.C. Cernat, H.H.C. Koh-Tan, H. Ferguson, E.M. Strachan, W. Thomson, T.J. Snelling, C.D. Harvey, I. Andonovic, C. Michie, N.N. Jonsson, G. W. Horgan, R.J. Wallace

Relation between particle size and incidence of black rumens SARA

7 different farms /diets _134 animals

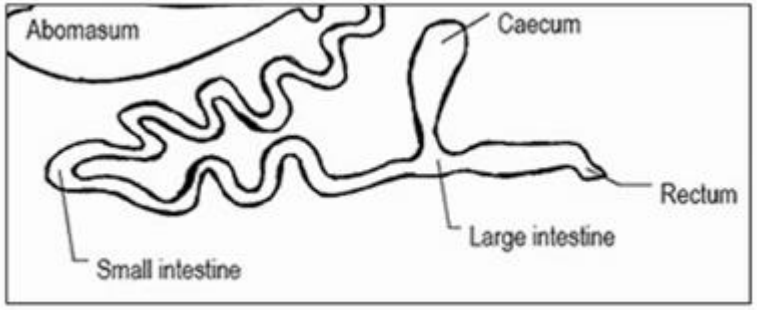
Findings : Particles below <8 mm causing rumen wall damage



LPS concentration in caecum was 10x higher then in the Rumen

Different farms

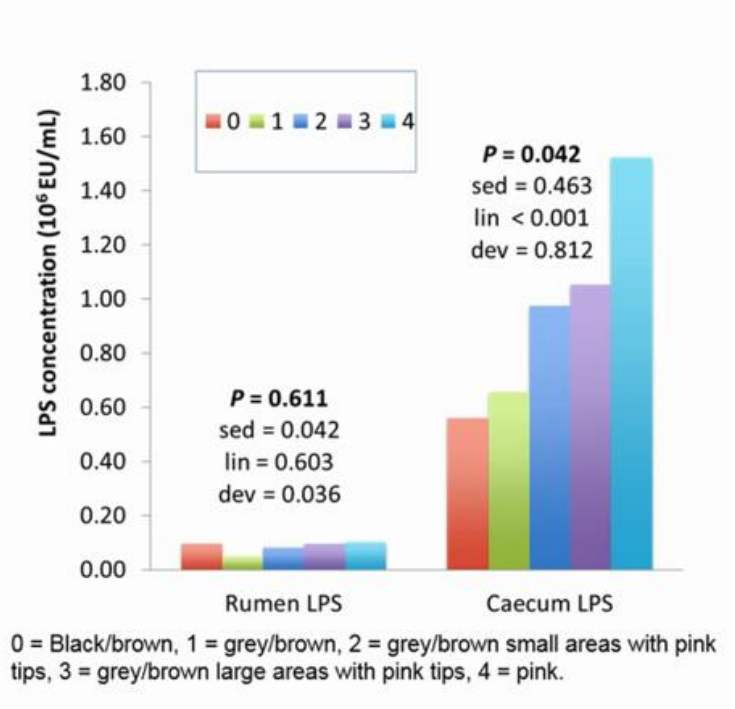
	Farm						
LPS (10^6 EU/mL)	BH1	BH6	BH7	BL2	BL6	s.e.d.	Sig.
Rumen	0.068	0.136	0.056	0.116	0.072	0.024	0.003
Caecum	0.624	0.125	0.879	0.537	1.976	0.208	<0.001



The hindgut is less capable then rumen of maintaining digesta pH during times of increased VFA production .
Gressley et al., 2011
The caecum wall is much thinner than the rumen wall.
Gressley et al. 2011 / J.Anim. Sci. 89 :1120-1130

Strong relation between hindgut LPS concentration and papillae damage in the rumen

Significant linear relation between LPS caeca and papillae damage in the rumen

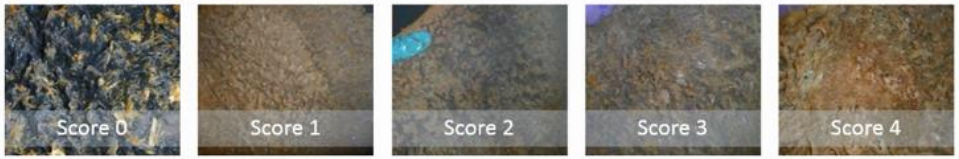


0 = Black/brown, 1 = grey/brown, 2 = grey/brown small areas with pink tips, 3 = grey/brown large areas with pink tips, 4 = pink.

Post-cooking appearance

0 = No blackened areas, 1 = very small blackened areas, 2 = small blackened areas, 3 = moderate blackened areas, 4 = large blackened areas

Papillae integrity

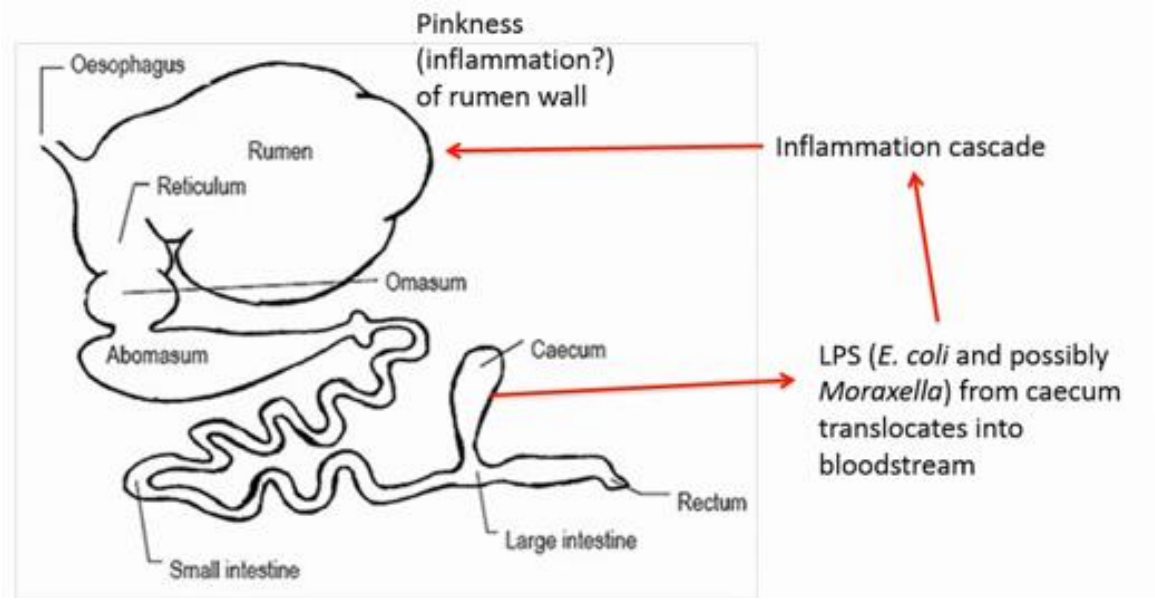


0 = No damage, 1 = small areas bare, 2 = larger areas bare, 3 = moderate areas of damage, 4 = large areas of damage.

Findings:
With excessive hindgut fermentation, toxines translocate into bloodstream and cause rumen wall inflammation

Translocation of LPS from hindgut can caused rumen inflammation

Moraxella LPS is 7x more lethal than E. coli LPS

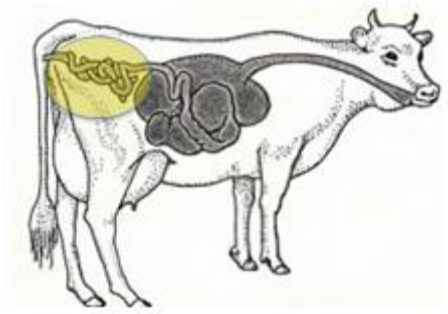


- **"The hindgut is less capable (than the rumen) of maintaining digesta pH during times of increased VFA production"** (Gressley et al., 2011)
- **The caecum wall is much thinner than the rumen wall**

Gressley et al.2011

Conclusion 1

There is a relation between Rumen inflammation and Lower Gut inflammation



Lower gut LPS is much higher than rumen LPS

Lower gut LPS is correlated with visible inflammation of the rumen wall

Lower gut microbiome differs from the rumen

SARA may originate in both the lower gut and the rumen

Critical
a. undigested grain in faeces

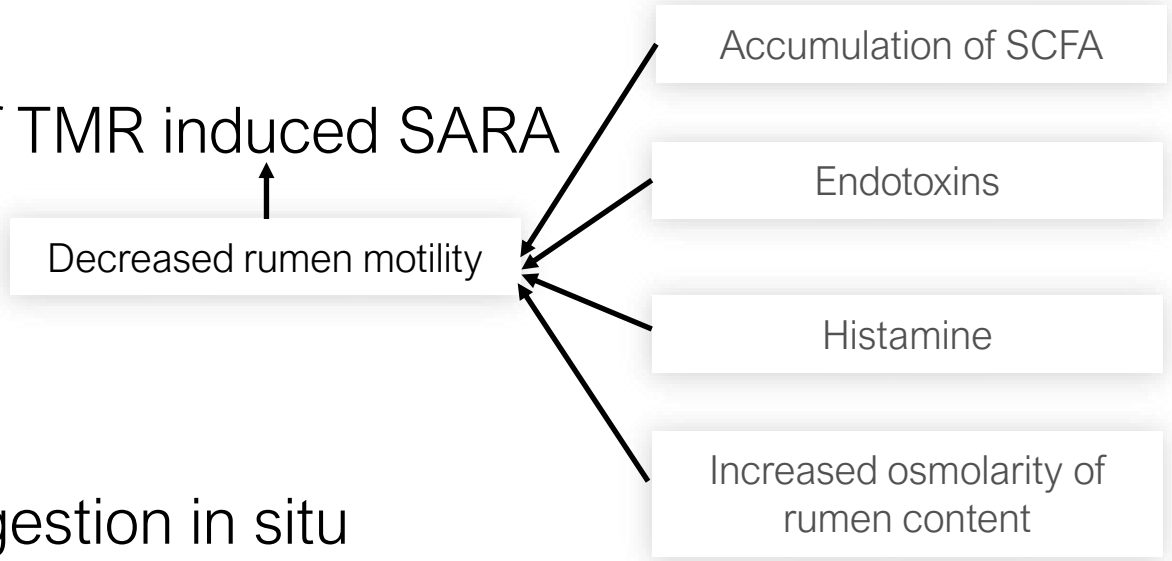
Faecal sieving. (above) Short fibre length and the absence of grains indicate good rumen function. (below) Long fibre length and the presence of undigested grains and fibrin casts (arrow) are common findings in cows suffering from SARA

- Intermittent diarrhoea
- Undigested material
- Fibrin casts
- Excessive faecal soiling (tail, udder, rump) / tail swishing

Grove-White 2004

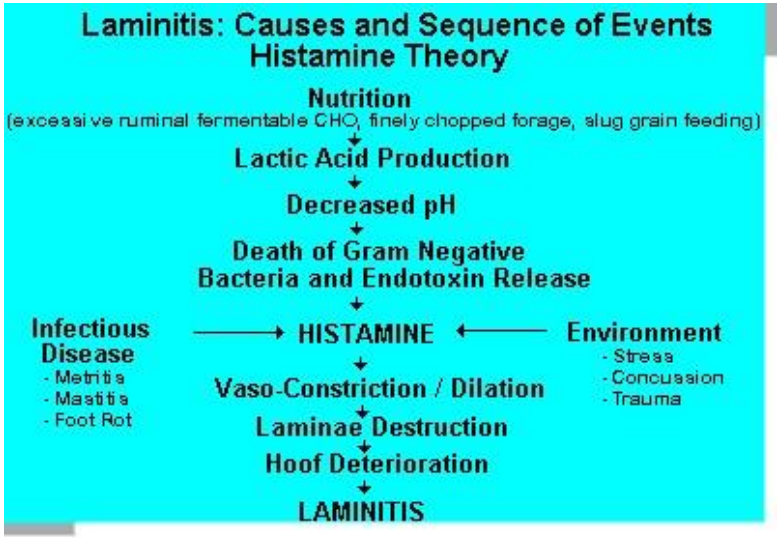
b. Increase of left over/ residuals on feeding table in the morning

- 25% decrease of TMR induced SARA
- Impaired fiber digestion in situ



Krajcarski-Hunt et al. 2002

Redness in the interdigital space
Cow how can not walk will not eat

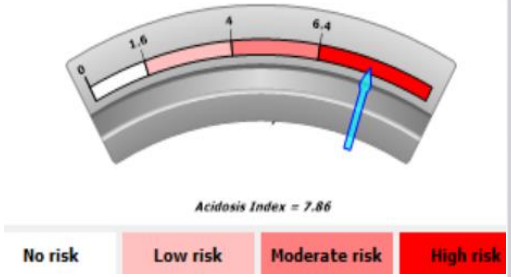


Noceck J.E. – The link between nutrition, acidosis, laminitis and environment

- Prevalence of more than 10% (Nordlund et al., 1995)

d. adoption to new /high-grain diet

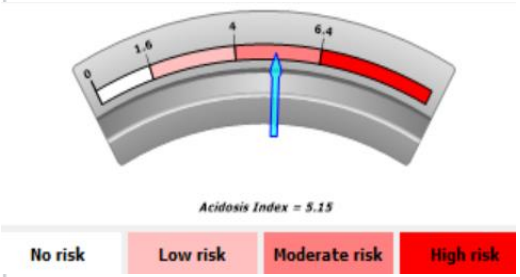
Animals on HC diet , Transition animals, Grazing or fed with fresh grass

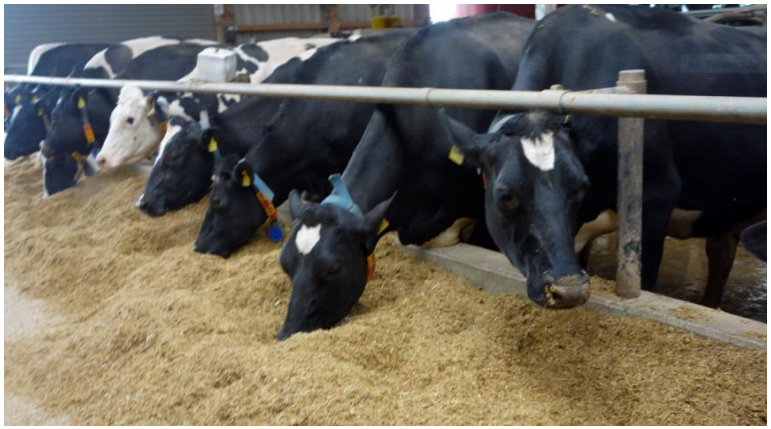


Effective fiber

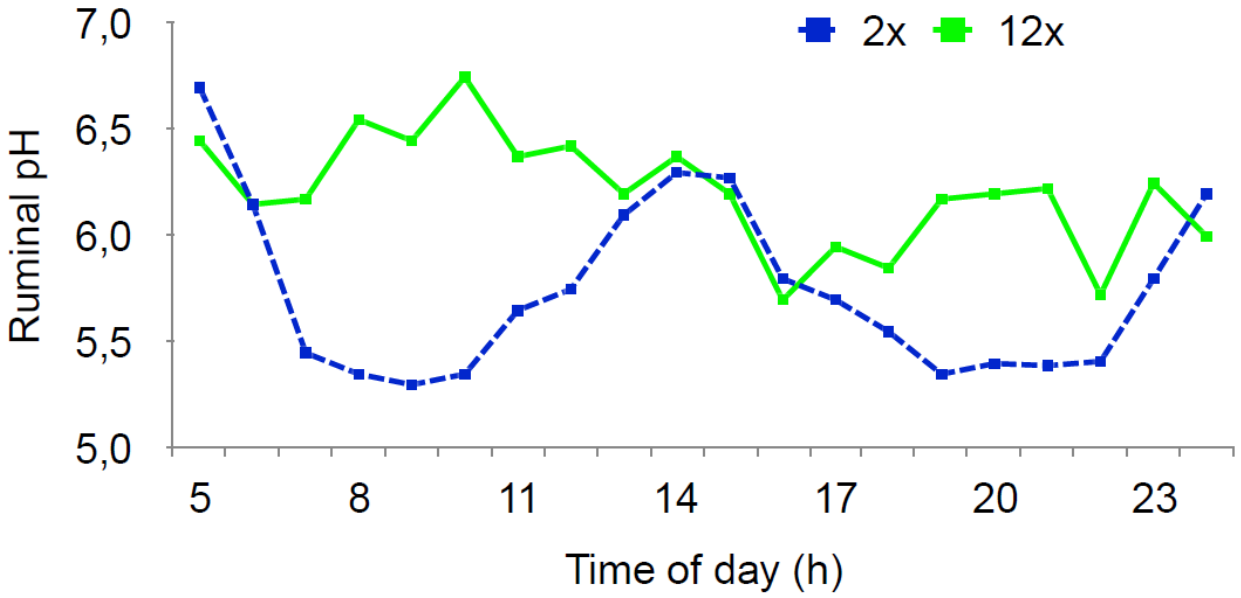
NDF>30%

ef. NDF >22%



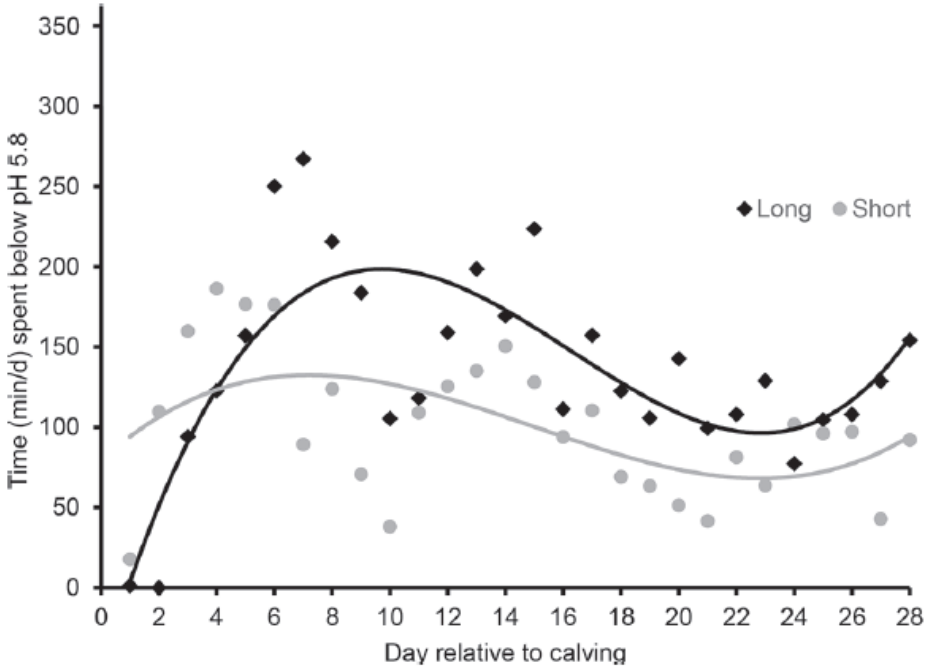


c. Proper diet formulation, proper mixing, excellent feed bank management
Frequent feed delivery/pushing up



French and Kennelly, 1990

e. Sorting strategy, with short cut straw 2.5 cm
The same with grass silage



9% of straw in the diet:

- Long = 5 cm
- Short = 2,5 cm

Cows on short treatment tended (P=0.1) to produce 76 kg more milk over the first 28 DIM

Coon et al., 2018

f. feed additives and buffers

- Microbials
  - Bacteria
  - Yeasts
    - Live yeasts
    - Dead yeasts
    - Yeast culture products

  → Modulatory effect on fermentation and microbiome

  Calsamiglia et al., 2012

- Phytogenic compounds → Alters starch degradation rate

  Jouany, 2006

- Buffering substances → Lower rumina pH??

  Hu and Murphy, 2005

- DCAD of >250 mEq/kg of diet DM

  S.M. Durge 2018

g. Farm managment

Feed sorting

Lack of coarse fiber & excess concentrates in the diet,

Rapid diet changes

Feed & water access

Regrouping _ overcrowding

Empty bunk syndrome

Feed delivery

Heat Stress