

# **Diagnosis of Rumen diseases**

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# Disorders in the pre stomach in cows

## „Indigestion“

(Rossow 1984)

alimentary rumen diseases	motility + transition disorders	diseases of the rumen wall
<ul style="list-style-type: none"><li>▪ <b>simply rumen dysfunction</b> (sudden changes of feed, ↓ feed intake)</li><li>▪ <b>Rumen acidosis</b></li><li>▪ <b>Rumen alkalosis</b></li><li>▪ Rumen rot</li><li>▪ Tympania</li><li>▪ Sanding up of rumen</li><li>▪ calfs indigestion</li></ul>	<ul style="list-style-type: none"><li>▪ damage by blunt foreign bodies</li><li>▪ damage of nervus vagus: Hoflund-Syndrome</li><li>▪ obstipatio omasi</li><li>▪ vomit of rumen fluid</li></ul>	<ul style="list-style-type: none"><li>▪ Traumatic reticulo peritonitis</li><li>▪ Ruminitis</li><li>▪ Parakeratosis</li><li>▪ Tumors + infectiousus granuloma</li></ul>

Acute rumen-acidossis	Chronic rumen acidosis			
	rumen - abomasum	Minerals	Energy metabolism	another organs
<ul style="list-style-type: none"> <li>Rumen stasis, ruminitis</li> <li>rumen fullness</li> <li>Hemo concentration</li> <li>Shock</li> <li>Dyspnoe</li> <li>Diarrhea</li> <li>Muscle tremor</li> <li>Laminitis/ recumbency</li> <li>Mastitis</li> </ul>	<ul style="list-style-type: none"> <li>anorexia</li> <li>Tympania</li> <li>Dislocation abomasi</li> <li>Caecum dilatation</li> <li>Hyperkeratosis</li> <li>Ruminitis-lever-abscess-complex</li> </ul>	<ul style="list-style-type: none"> <li>↑↓ Pi - emia</li> <li>↑↓ Ca -emia</li> <li>↑ K - emia</li> <li>↑↓ Pi - uria</li> <li>↑↓ Ca - uria</li> <li>Osteopathia</li> <li>Osteoporosis</li> </ul>	<ul style="list-style-type: none"> <li>Milk fat lack syndrome</li> <li>Cerebro-corticalnecrosis</li> <li>Ketosis</li> <li>Fattening syndrom</li> </ul>	<ul style="list-style-type: none"> <li>Laminitis</li> <li>Nephritis</li> <li>Urolithiasis</li> <li>Ammonium-elimination</li> <li>Immuno suppression</li> <li>Mastitis</li> </ul>

# S A R A

(Kleen et al. 2003)

- Clinical disorders in the flock
- ↓ dry matter intake
- condition loss
- Feces variations/Diarrhoe
- Laminitis
- Parakeratosis
- Ruminitis-Liver abscess- complex
- ↓ Milk fat
- ↑ cull
- Rummen pH:  $\leq 5,5$  in  $\geq 25\%$  cows  
 $\leq 5,8$  more the 5,5 h

- 
- **Urolithiasis**
  - **Cerebro Cortical Necrosis**
  - **Osteopathia - tendons tearing**
  - **Immuno depression**

(Lachmann and  
Seffner 1979)

## S A R A

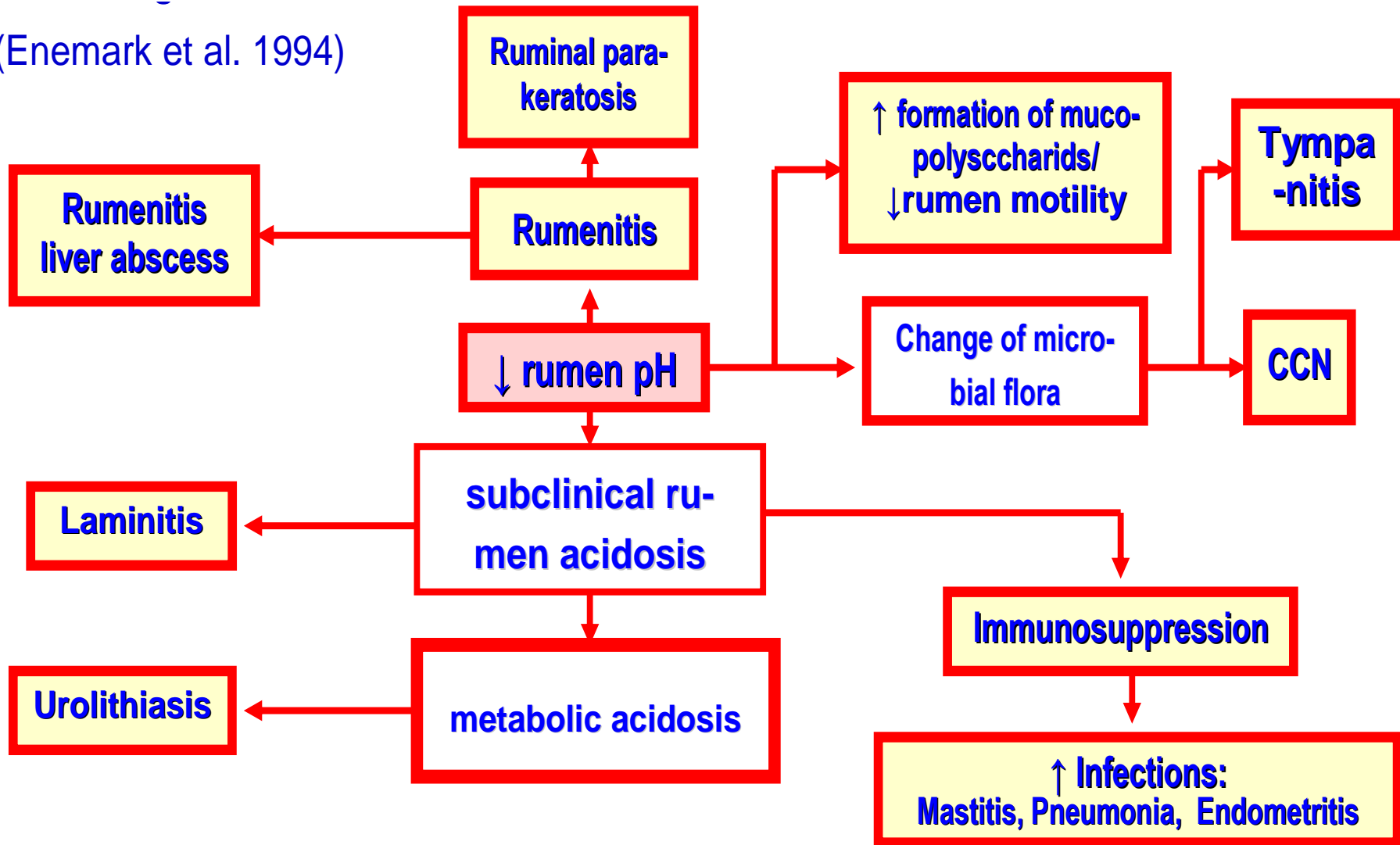
Subacute

Rumen

Acidosis

# Sub acute rumen acidosis

(Enemark et al. 1994)



# Rumen diagnosis

## indirect methods

- **feed analysis**

(physical effective rough fibres)

- clinic
- blood
- milk
- urine

## direct methods

- Rumen fistula (catheter)
- rumen puncture
- rumen sonde
- further parameters
  - exploratory rumen juice spectrum
  - acetat-propionat-ratio
  - cis-linolenic acid (CLA)
  - Vitamin B1, -B12
  - „Metabolom“ (amino acids)

# Diagnosis of rumen acidosis (Seemann and Spohr 2007)

all cows with rumen pH $\leq 5,8$	physiological	healthy correct	ill correct
sugar + starch	<25%	62	73
rough fibress	>16%	62	69
strukture rough fibres	>11%	71	68

# Indirect methods: feed analysis

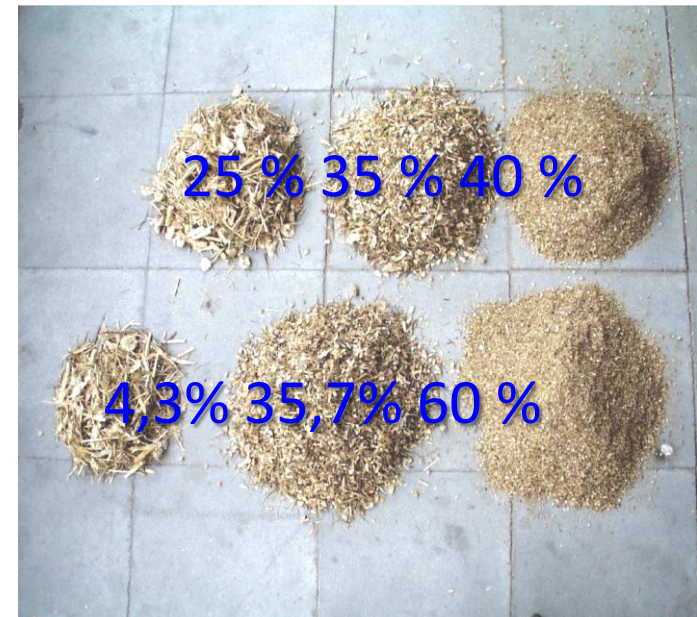
model for influence of rumen pH be peNDF

(Zebeli et al. 2012)

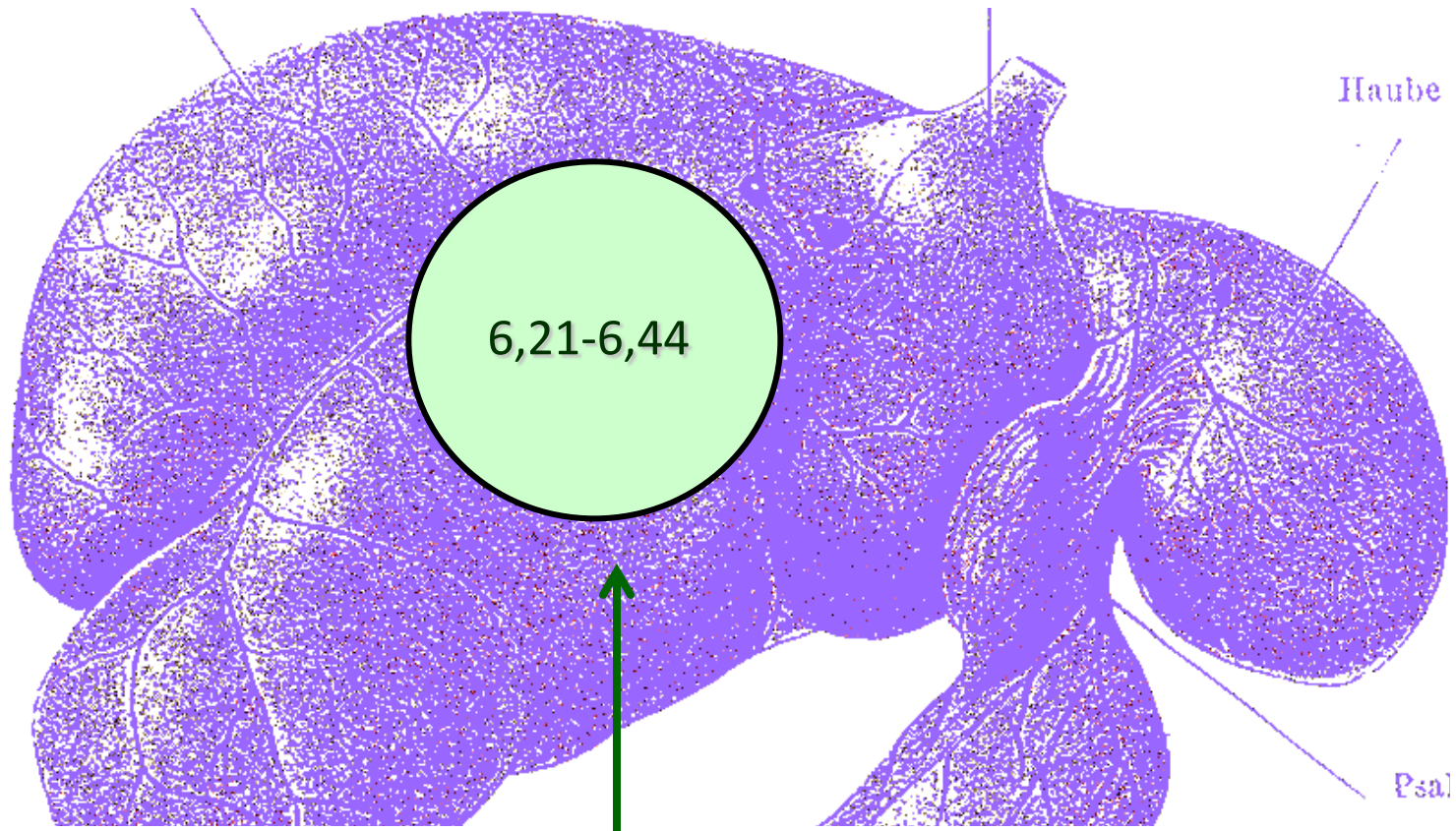
- 31 % peNDF >1,18mm resp.
- 18 % peNDF >8mm

ensure normal rumen conditions  
and sufficient  
supply structure

(Steingass et al. 2011)



# Indirect methods: feed analysis



## pH in optimal rumen condition:

- diurnal average 6,15

< 5,8 max. 5,5 h/day

Zebeli et al. (2012)

# Indirect methods: clinic

- feed intake
- rumen filling
- feces
- condition



no

pathognomonic  
symptoms

**C C N**

Osteopathia

**Sehnenabrisse**

Motility disorders

**Laminitis** - recumbency

↓ health of calvs

Fertility disorders

Kidney disorders - **Urolithiasis**

**Ruminitis lever absces complex**

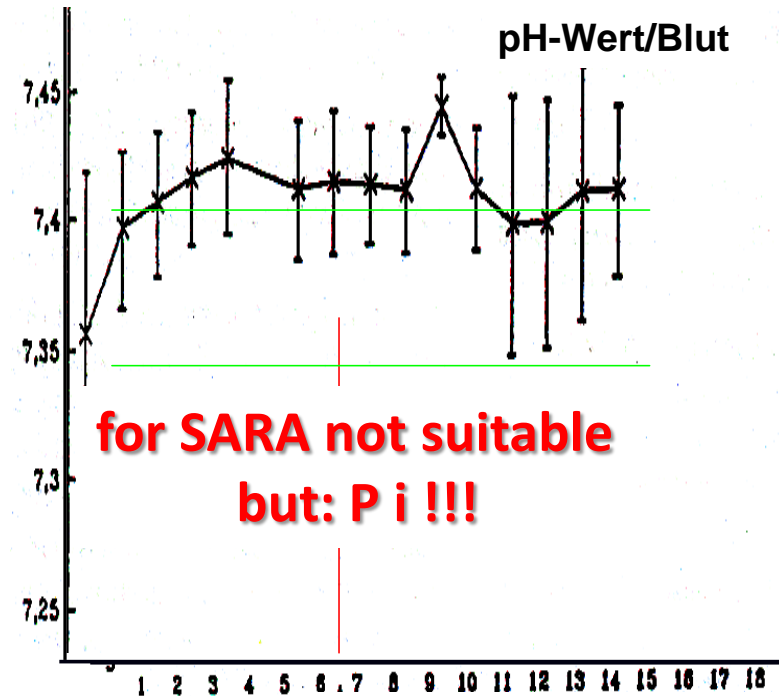
**Mastitis** / ↓ milk quality

**Immuno depression**

Lachmann and Seffner (1979)

# Indirect methods: Blood

Medium	pH-Wert			Elektrolyte u.a.	
Blood	+	Base Excess	pCO <sub>2</sub>	Pi Ca K	akut
Urine	+	NSBA		K Na Pi Ca	akut chronisch
Rumen Fluid	+	(TA)			akut chronisch
milk	(+)	(SHZ)		FEQ Fett Eiweiß	chronisch



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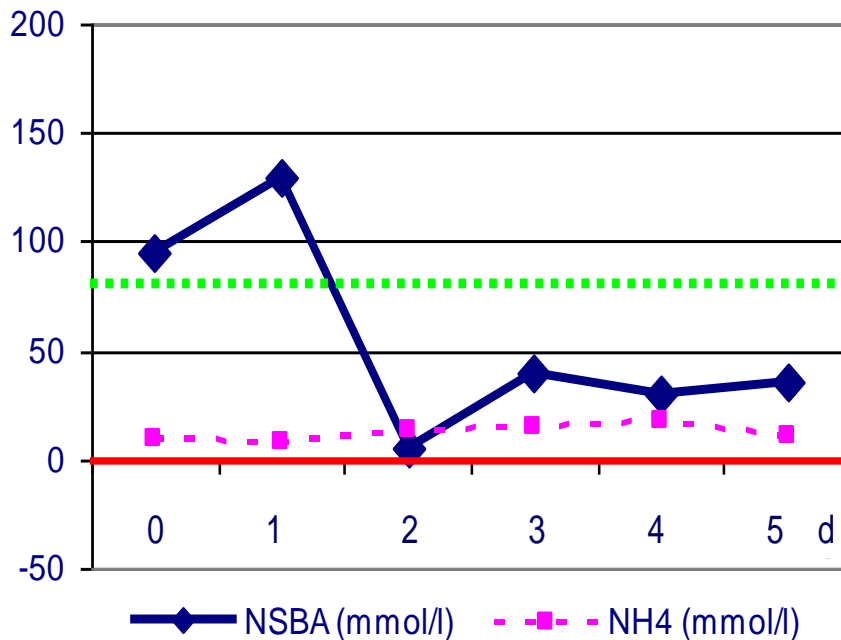
- pH
- (fraktional) **NABE**
- rel. density  
(Kreatinin)

NABE= **N**et-**A**cis-**B**ase-**E**xcretion

# Indirect methods urine

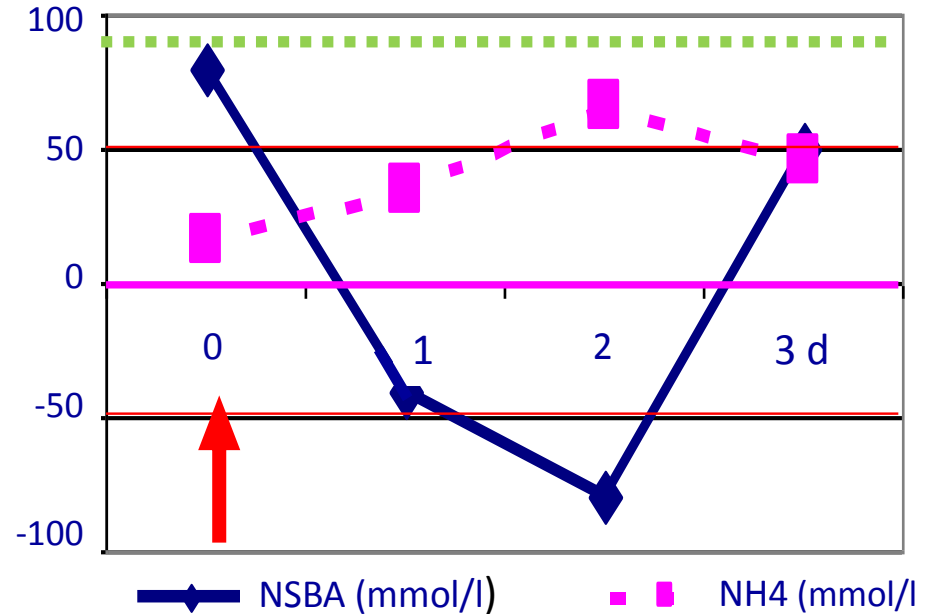
## Anorexia and „sugar“ influence on NABE

NSBA sowie  $\text{NH}_4$  bei 5 Tage fastenden Schafen

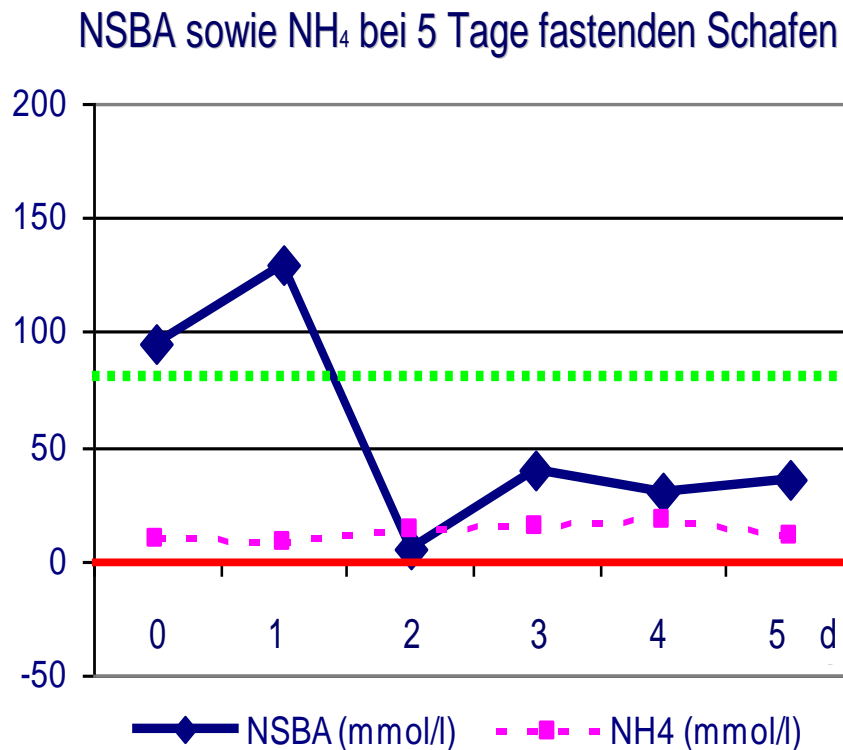


BSQ	4,8	1,8	0,8	0,6	0,5	0,8
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NSBA und  $\text{NH}_4$ -Konzentrationen im Harn bei Schafen mit Pansenazidose nach 10 g Zucker/kg KM per os ↑



# Indirect methods: urine



BSQ	4,8	1,8	0,8	0,6	0,5	0,8
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## conclusion - urine

low NABE, - pH values:

a) ↓ feed intake

b) rumen acidosis

normal NABE, - pH value:

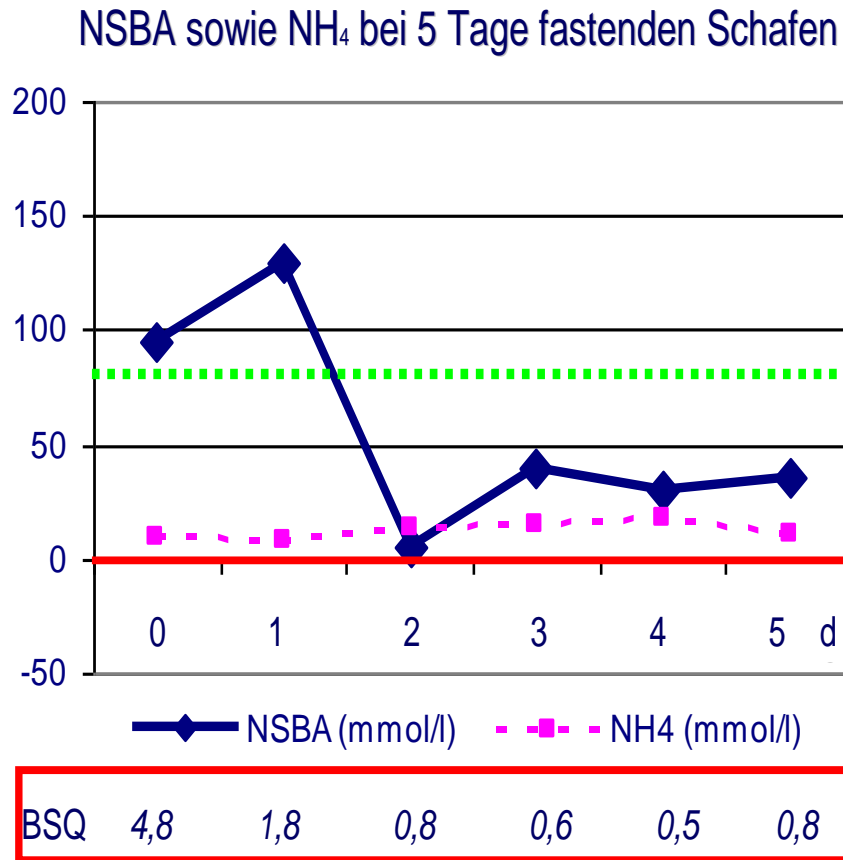
a) „normal ABB“ generally

b) normal rumen pH value

high NABE, - pH value:

a) alkalotic loading

# Indirect methods: urine



## conclusion - urine

normal NABE, - pH-value:



**normal  
rumen pH !**

# Indirect methods: Milk

FEQ

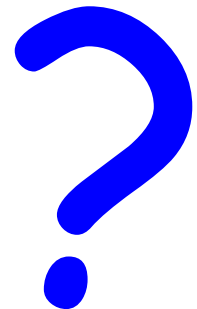
< 1,1

- rough fiber lack
- **rumen acidosis**



> 1,5

- Ketosis
- fatty liver

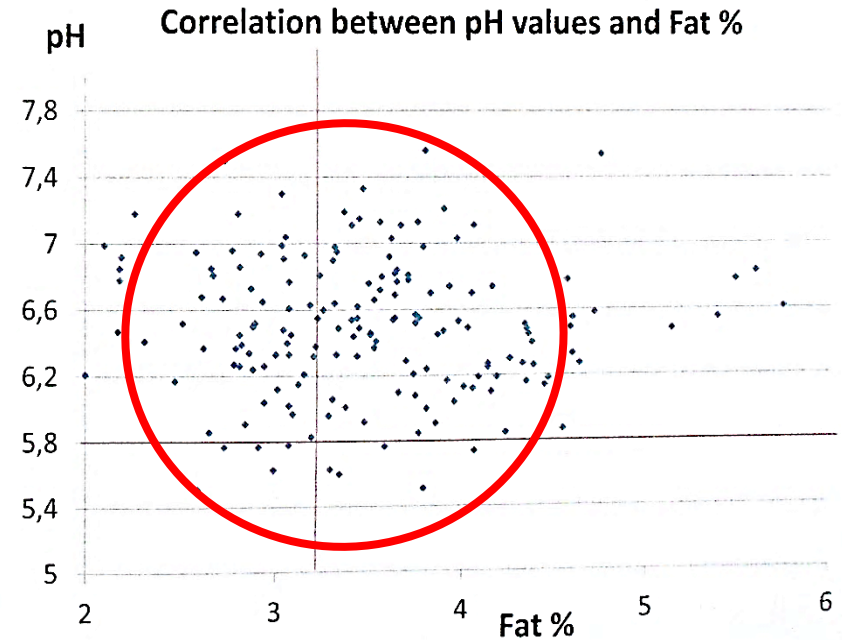
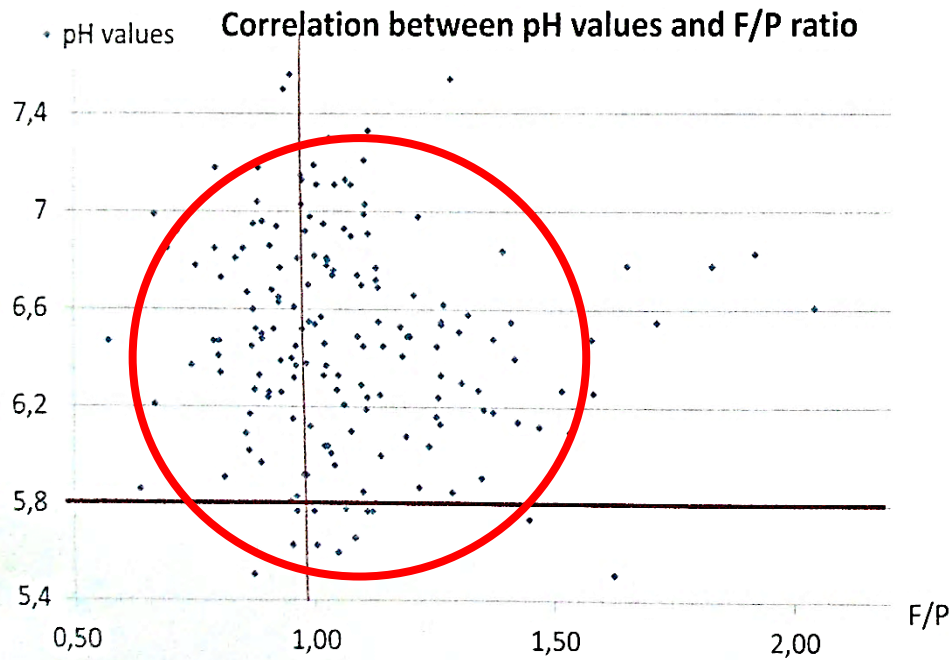


# Lessire et al. **Field investigation of subacute rumen acidosis prevalence in Walloon dairy herds.** Buiatrissima, Bern, 2013

## **Material and methods**

- 24 herds, 2197 cows
- $x=95/\text{herd}$
- 8879 kg milk/cow
- 164 HF + 10 BS sampled
- stomach tube Ruminator<sup>®</sup> (- 0.35)
- < 150 d in milk (DIM)
- **F/P ratio  $\leq 1.0$**
- **< 3.2% Fat**

# Lessire et al. Field investigation of subacute rumen acidosis prevalence in Walloon dairy herds. Buiatrissima, Bern, 2013



**„Conclusion:** In no herd, prevalence of SARA was > 25%.

**In this study F/P ratio < 1.0 or fat < 3.2% contribute poorly to SARA diagnosis.**

Regarding this results, flora inactivity seems far more common the SARA then tested herds in Wallonia. „

# Rumen diagnosis

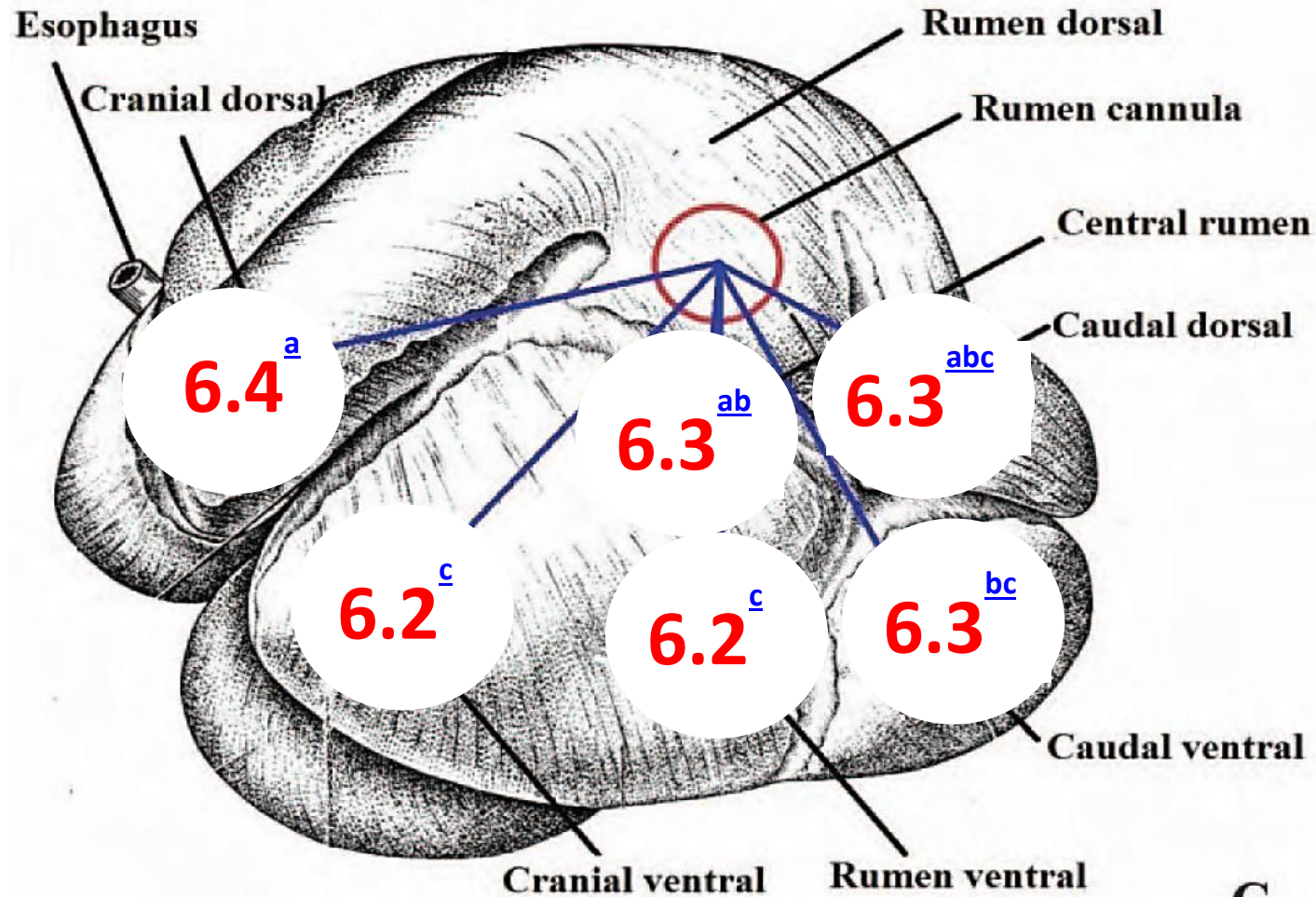
## indirect methods

- **feed** (physical effective rough fibres)
- clinic
- blood
- milk
- urine

## direct methods

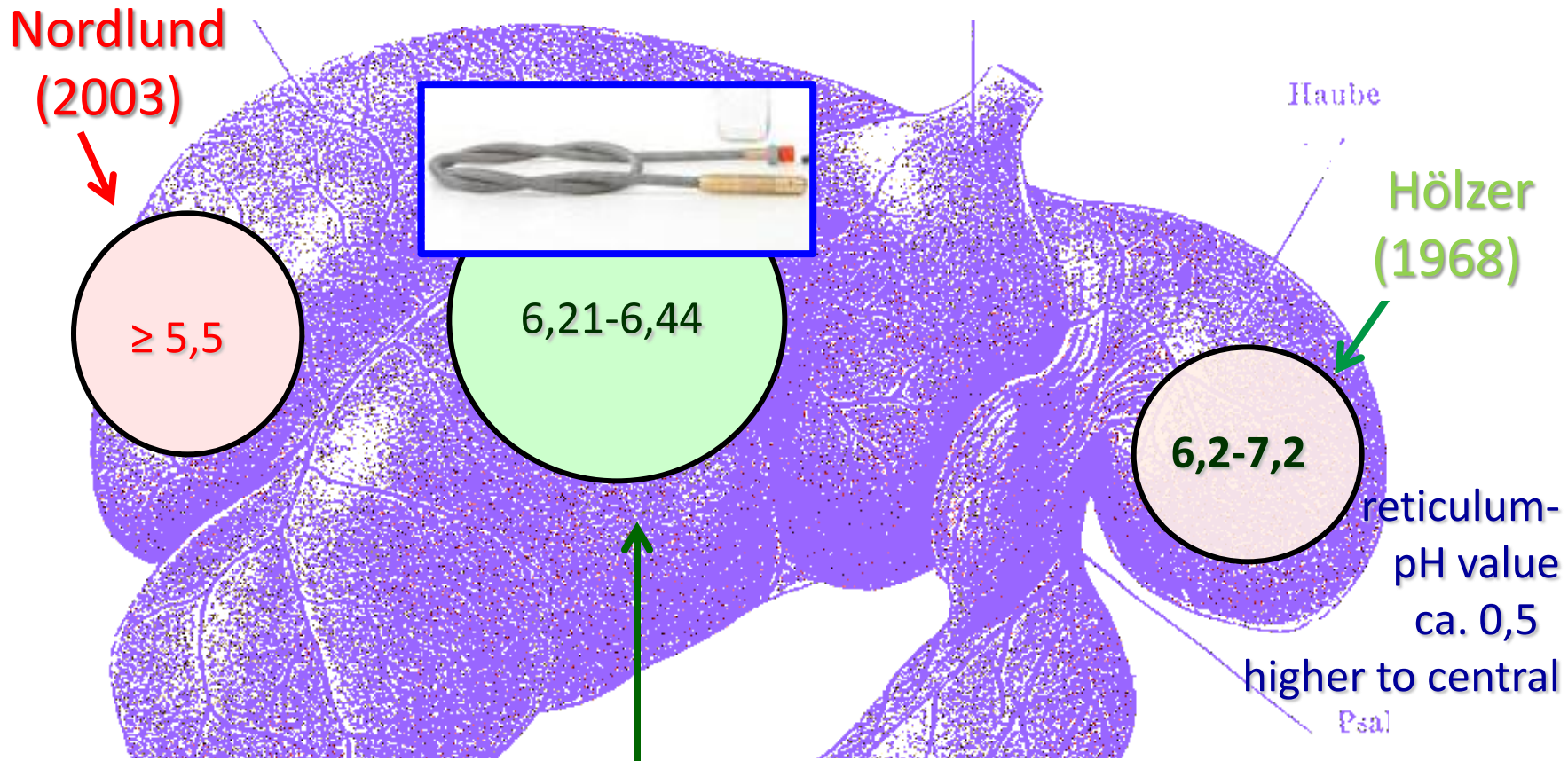
- Rumen fistula (catheter)
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- further parameters
  - exploratory rumen juice spectrum
  - acetat-propionat-ratio
  - cis-linolenic acid (CLA)
  - Vitamin B1, -B12
  - „Metabolom“ (amino acids)

**Rumen-pH** collected from the cranial dorsal (**CRD**), cranial ventral (**CRV**), central rumen (**CR**), ventral rumen (**RV**), caudal dorsal (**CAD**), and caudal ventral (**CAV**) cow rumen at approximately 5 to 6 h after morning feeding  
(SHEN et al. 2012)



	CRD	CRV	CR	RV	CAD	CAV
pH	6.36 <sup>a</sup>	6.32 <sup>ab</sup>	6.21 <sup>c</sup>	6.19 <sup>c</sup>	6.29 <sup>abc</sup>	6.25 <sup>bc</sup>

# direct methods: pH in rumen



pH value in optim. rumen condition:

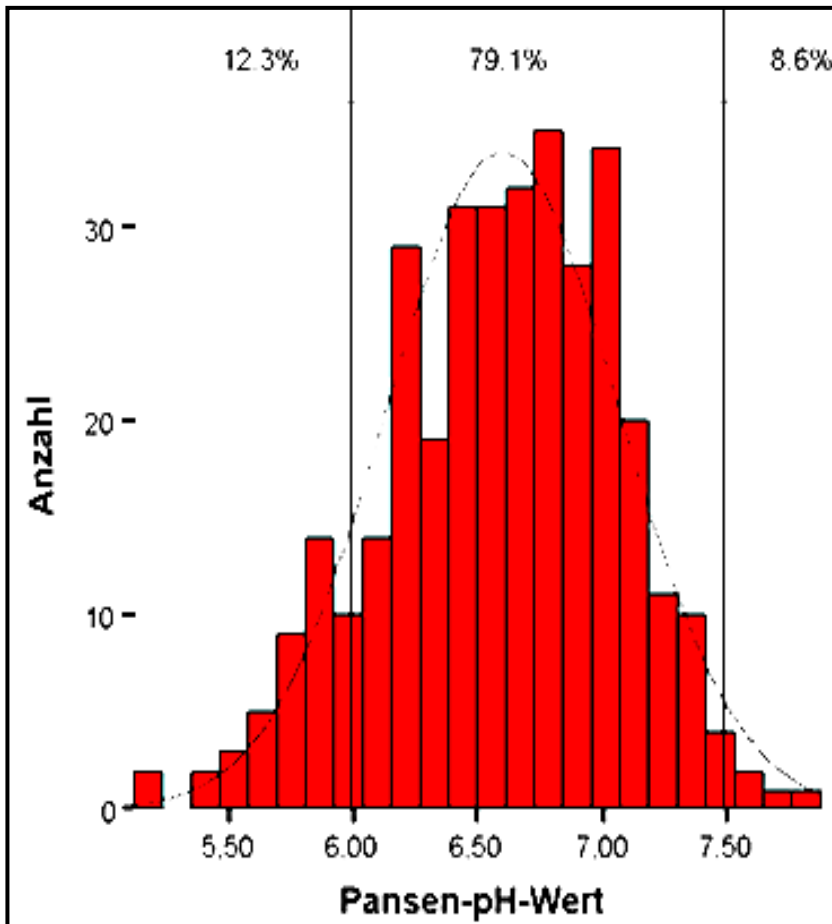
diurnal average 6,15

< 5,8 max. 5,5 h/day Zebeli et al. (2012)

# direct methods: pH in rumen

## 10 cows in 10 farms in low Saxonia

Kricziokat, Wittek, Fürll (2011, 2012)

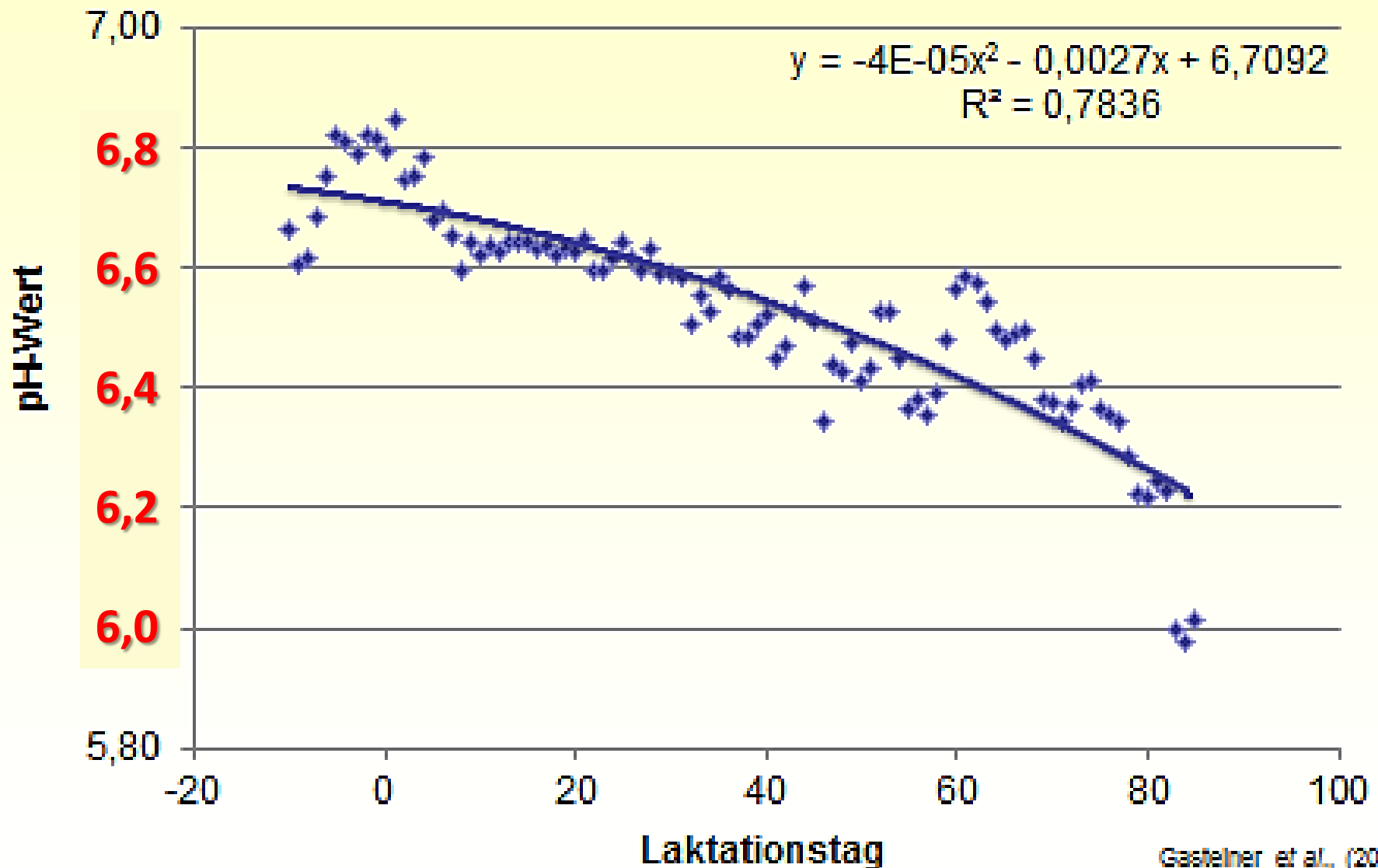


## 197 cows in 20 farms in Austria

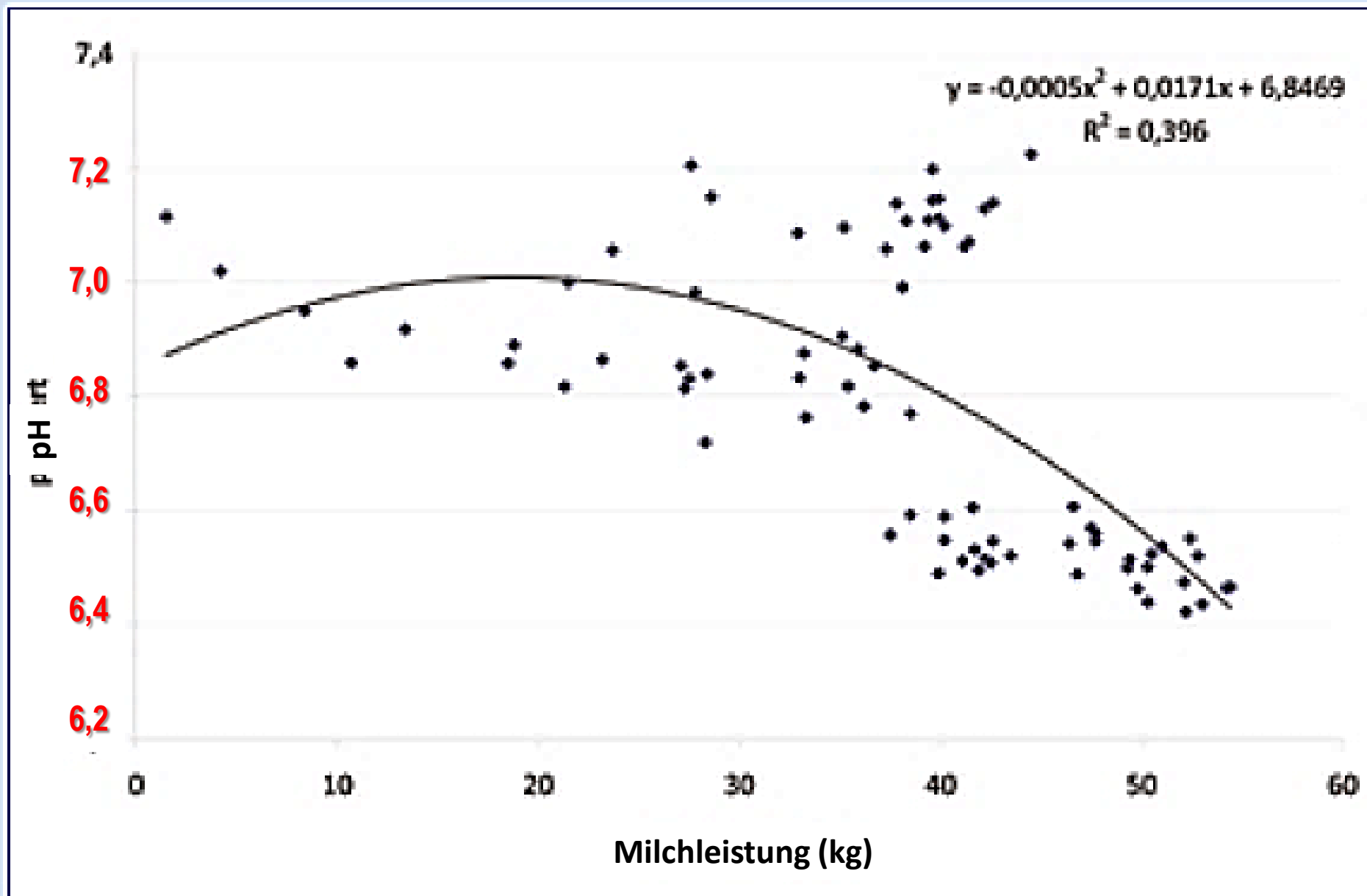
(Steiner, Wittek, 2013)

- 197 HF- bzw. Simm.-cows in early lactation
- 9000 - 11.000 kg Milk/a
- 36 - 39 kg/d
- rumen-pH  $6,81 \pm 0,25$
- lowest single value: 6,14

# Die Beziehung des pH-Wertes im Pansen zum Laktationstag



Gastelner et al., (2012)



**Abbildung 10:** Beziehung des pH-Wertes im Pansen zur Tagesmilchleistung (kg FCM).

# Rumen fermentation disorders

Staufenbiel (BBR, 2012):

„ In lactation sections with the highest risk for a (subacute) rumen acidosis (early lactation) are the most herds in balance or alkaline acid-base state“

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# exploratory rumen juis analysis

Nature of the rumen juice under physiological conditions and at typical pathological changes (sonde collection)

criterion

physiological

Rumen acidosis

Rumen alkalosis

small foamy tympania

color

odor

consistency

pH

Infusoria

estimate

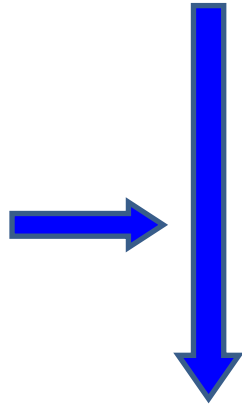
Methylene blue  
sample

Sediment  
activity time  
(SAT)



# Methylene blue-sample

blue colored methylen blue



colorless leuko methylen blue

## reference ranges:

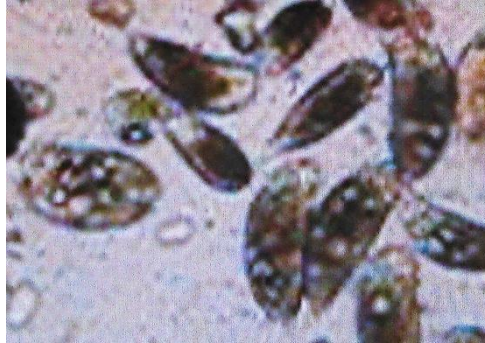
rich in concentrate feeding 1> <3 min

concentrate feeding at low <8 min

Very rapid discoloration (<1 min) with plenty of amylolytic bacteria.

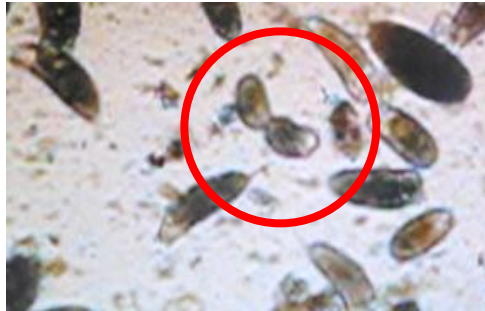
# Protozoas in rumen juice

large



plenty

medium



lively

small



mobile

# F/P ratio < 1.1

urine control

pH < 7,8;  
NABE < 83 mmol/l

pH 7,8-8,4  
NABE 83-217 mmol/l

rumensaft-  
analysis

rumen-pH Ø

pH < 5,5  
methylene blue <

pH 5,8-7,2  
methylene blue > 10'

pH 5,8-7,2  
methylene blue 1-10'

rumen-  
acidosis

simply dysfunction  
rumen fermentation disorders

Inanition  
rumen Ø



# Rumen diagnosis

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  - **„Metabolom“ (amino acids)**

## Compensation possibilities

1. Buffer in blood and in rumen
2. Elimination from rumen and blood
3. Adaptation of rumen mucosa
4. Methan synthesis
5. Glucose resorption im rumen  
(ca. 10%)
6. Feeding frequency
7. gradual change in diet

# Rumen fermentation disorders in cows – diagnostic possibilities:

## Take home message

### Indirect methods

- Significance of rough fiber incl. peNFD ✓
- Blood+ Milk unshure !
- urine: unshure, - but: **physiological pH = physiological rumen pH !**

### Shure diagnosis

- direct rumen juice analysis:

**pH, exploratory spectrum**

**Postulate:** diagnosis not only easy  
but safe ! ! ! ! ! ! ! ! ! !