Metabolic analysis in small dairy farms

1. Basics of metabolic monito-ring in dairy cows
2. Metabolic analysis in small dairy farms

1. Basics of metabolic monitoring in dairy cattle

Goal: coordinated system of measures to

- **early diagnosis**
- **minimize and**
- **prophylaxis**

of metabolic disorders

↑ **animal concentration**

↑ **increasing performance**

↑ **technical progress**

„metabolic profil“, „Dispensairebetreuung“
Stoffwechselüberwachung, „metabolic tests“„

↑ **animal concentration**

↑ **increasing performance**

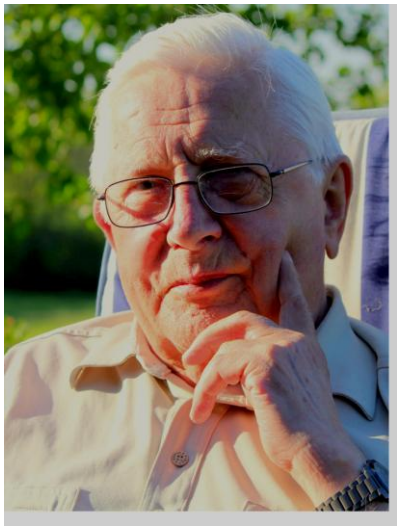
↑ **technical progress**

„metabolic profil“, „Dispensairebetreuung“
Stoffwechselüberwachung, „metabolic tests“„

- Payne Irland
- Kaneko Kalifornien
- Bogin Israel
- Lumbsden Canada
- Baumgartner
- Slanina Slowakei
- Jagos Tschechien
- Karsai, Brydl Ungarn
- Scherabrin Russland
- Jacbec Slowenien
- Rutkowiak Polen
- u.a.

TGL 34313: Metabolic monitoring in cattle production

Prof. Dr. Dr. hc. H. Gürtler

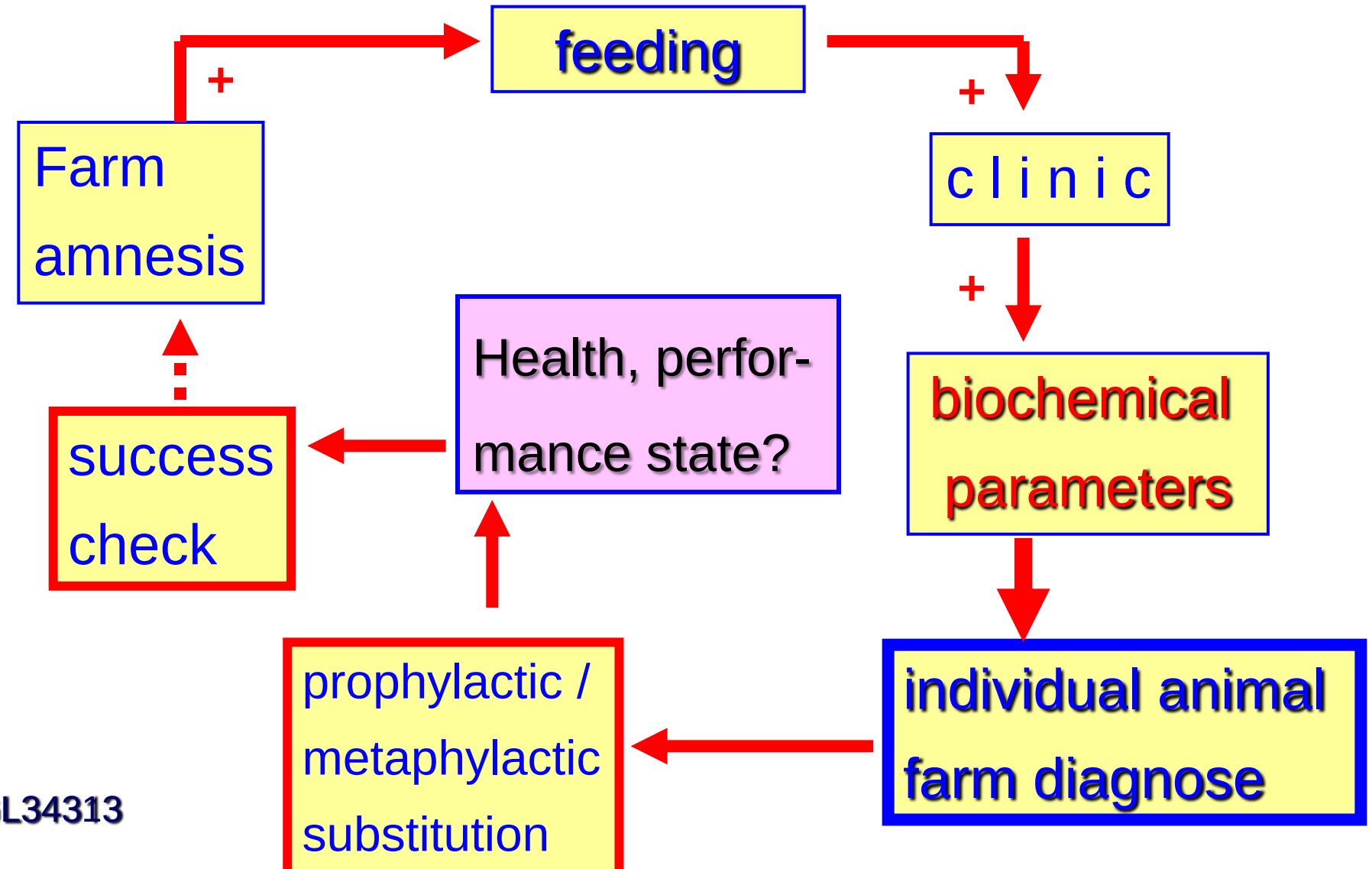


Prof. Dr. N. Rossow

Dr. habil. H. Seidel

"Coordinated system of measures for the early detection, diagnosis and management of metabolic disorders "

Metabolic monitoring (Gürtler 1976)



TGL34313

Health and performance analysis in dairy cows

steps

daily milk yield

⇓

control of milk ingredients

⇓

animal studies (urine, milk)

("Dry chemistry", "on-farm")

⇓

Monitoring of physical substrates

(Blood, urine, milk, among others)

Sensible approach - what to consider??

10 Basic rules for metabolic control

time, parameters, substrates, collection, group

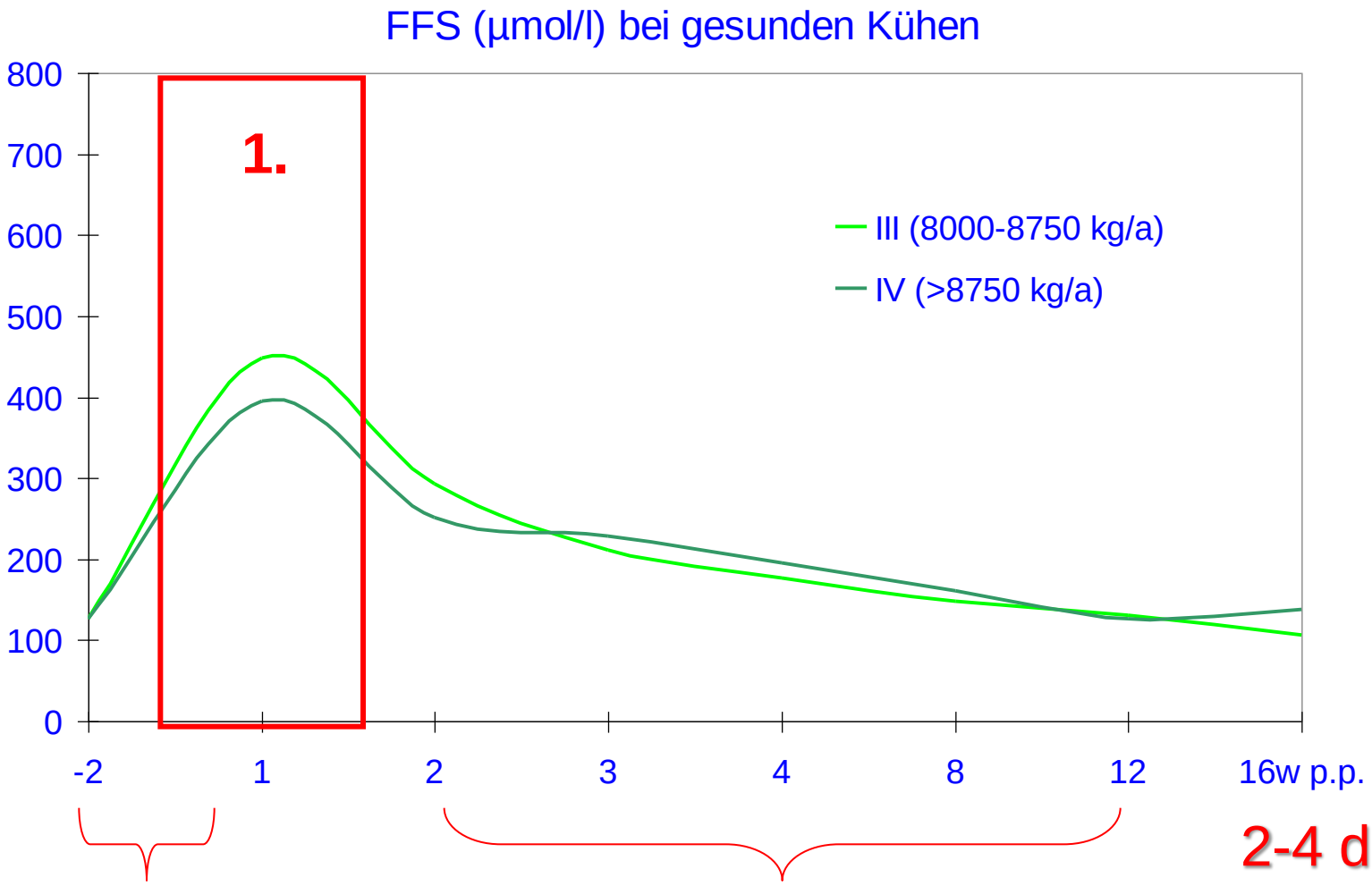
10 basic rules for metabolic control

1. For metabolic controls the most **heavily loaded** "indicator animals" (Cows 1 week ap / day 3 pp / pp 2-8 weeks) input.
2. Examine **no sick** animals for control.
3. The power group in the United stocks **10 animals sufficient**.
4. **Single animal analyzes** - preferably no "pooled samples"

5 samples (blood, urine, milk, hair, etc.) with **optimal information value**

6. **Information value** of individual parameters is via the parameter variety
7. Sampling and shipment to ensure the **stability parameter**.
8. For blood collection and transport **hemolysis** may occur.
9. Clear **sample label** / exclude confusion.
10. The analysis results are consistent with reference values **evaluate complex** (veterinarian, pet owners, animal feed consultants).

Control periods for metabolic studies



Fürll et al. Großtierpraxis 2, H 4: 28-39

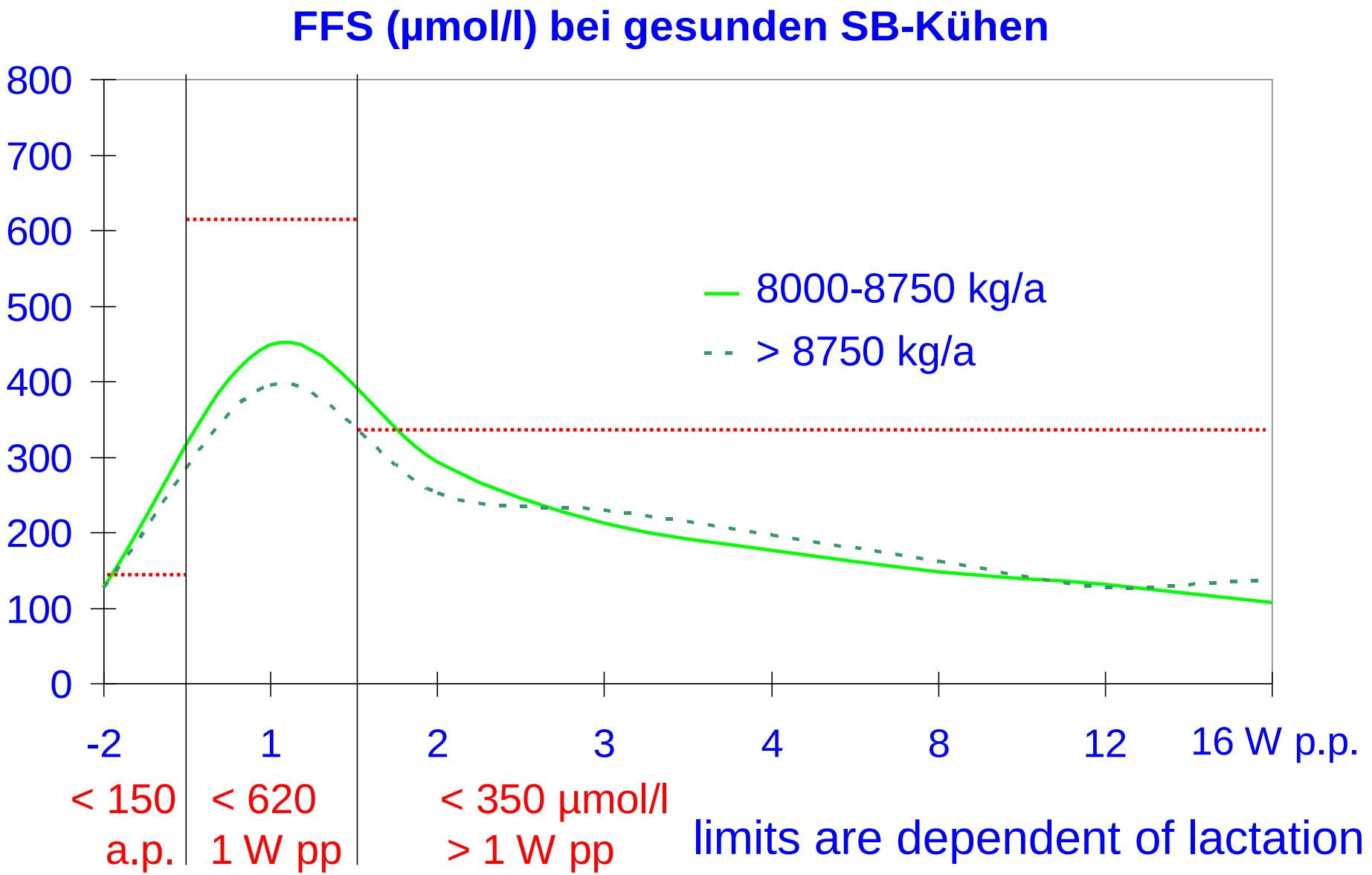
in **cows:**

2-4 day p.p.
2-1 week a.p.
2-8 weeks p.p.

Control periods for metabolic studies

	period		controls
phases of intense meta-bolic stress	1-2 weeks before calving		Energy metabolism and nuisances / fat mobilization / ketosis Parturient paresis hazard (acid-base balance)
	early lacta-tion	**2.- 4. day after calving**	Loads the dry period and birth (energy, liver, muscle metabolism) / predisposition to diseases in early lactation
		2 – 8 weeks after calving	highest milk yield and feed use: specific expression of rumen acidosis / -alkalosis, fat mobilization, ketosis, fertility Problems
	highest performance on the day	2 – 3 h after feeding	time highest digestive activity: control of acidosis / alkalosis, dietary ketosis
phases longest exposu-re for interfe-rence	end of - feeding periods, - lactation, - grazing, - indoors, - slaughter		control of - over- or under supply, - intermediaries interactions (usually in combination with the most intense metabolic stress)

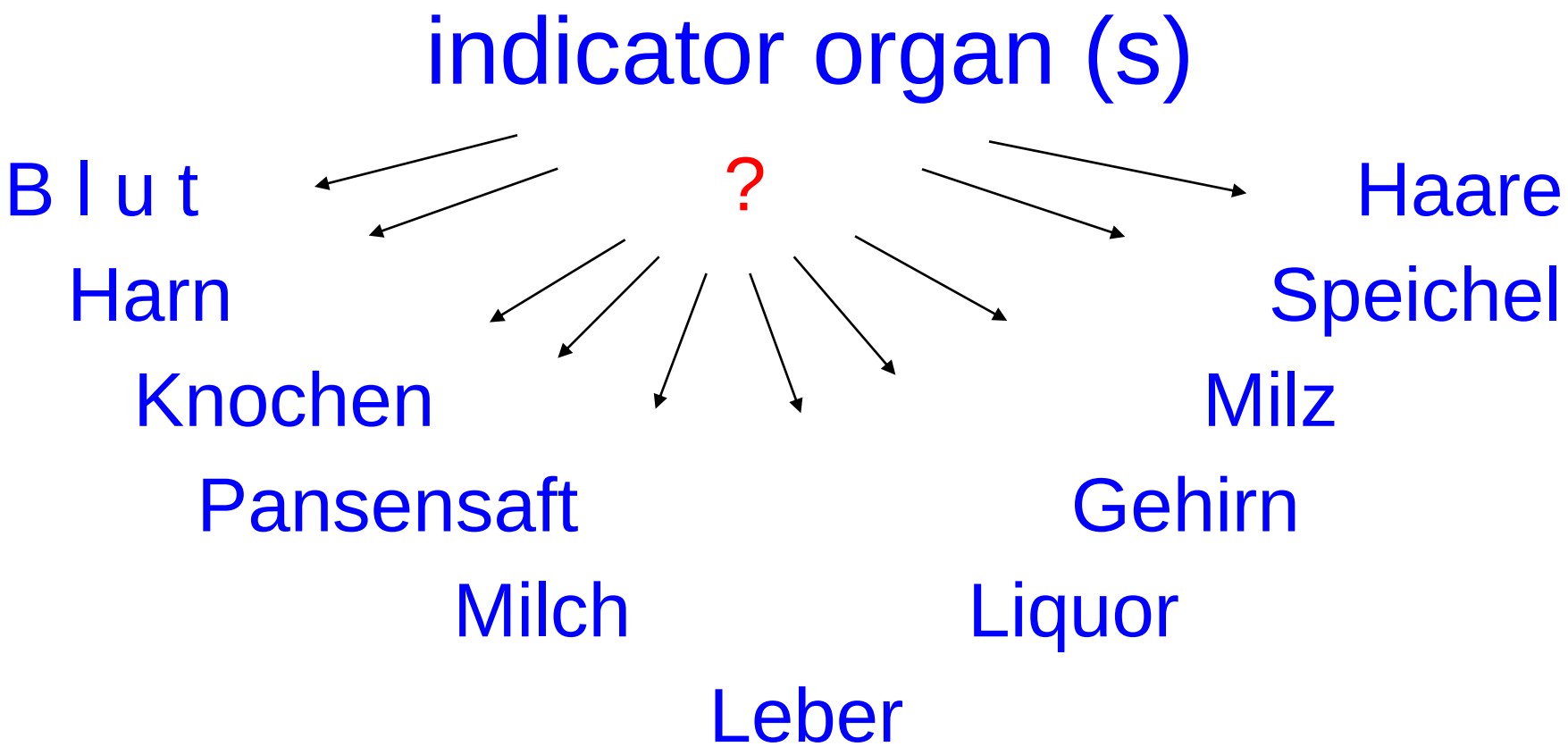
Normal values for FFA in cows



Parameters for metabolic studies

Para-meter	cate-goria	time p.p	normal values	Informations
FFS **Bilirubin**	A	1; 2-8	< 620[a]; < 150[b]; <350[c] µmol/l	**Lipolysis ← condition (BCS) ap, calving stress, energy ap / pp → diseases of fat mobilization syndrome, infertility**
BHB	B1	1;2-8	< 0,6 2 mmol/l	Lipolysis ← condition (BCS) ap, Energy supply ap / pp → "ketosis"
Urea	B1	1;2-8	2,5-5,0 mmol/l	Protein - energy supply → infertility
Choleste-rol	B1	1;2-8	> 2,0 mmol/l	Feed intake peripartal: 1 W pp > 2 mmol/l;4 W pp > 3 mmol/l; 8 W pp > 4 mmol/l
CK	B1	1;2-3	bis 200 U/l	acute endometritis, abomasal displacement
Se	B1	1;2-8	40-88 ng/ml	Se supply: infertility; defense; Ret.sec.
Cu	B1	1;2-8	8-32,8 µmol/l	Cu supply: infertility; defense; (Milk) yield
ß-Carotin	B1	1;2-8	> 4- [a];> 7 mg/l[c]	infertility; antioxidants
Pi (Ca)	B2		1,5-2,9 mmol/l	Acidosis, Milk fever, septicemia
Glucose	B2	1;2-8	2,2-3,3 mmol/l	FMS/Ketosis/ Insuline resistens
GGT	B2	1;2-8	< 50 U/l	lipolysis; fatty liver; insuline resistens
GLDH	B2	1;2-8	< 30 U/l	Liver (kidney) damages
fr. NSBA **Na,K/**urine	B2	1;2-8	80-220 mmol/l	Feed intake, acid-base balance; milk fever
	B2	1;2-8	>8-;150-300mmol/l	

Subrates for metabolic studies



Sampling

... all over,

but not

V. subcutanea

abdominis,

FFA + BHB ca. 30% ↓

sample transportation

- whole blood
- better serum
- for hematology EDTA tubes

circuits

- principle:

Measurement / stabilization within

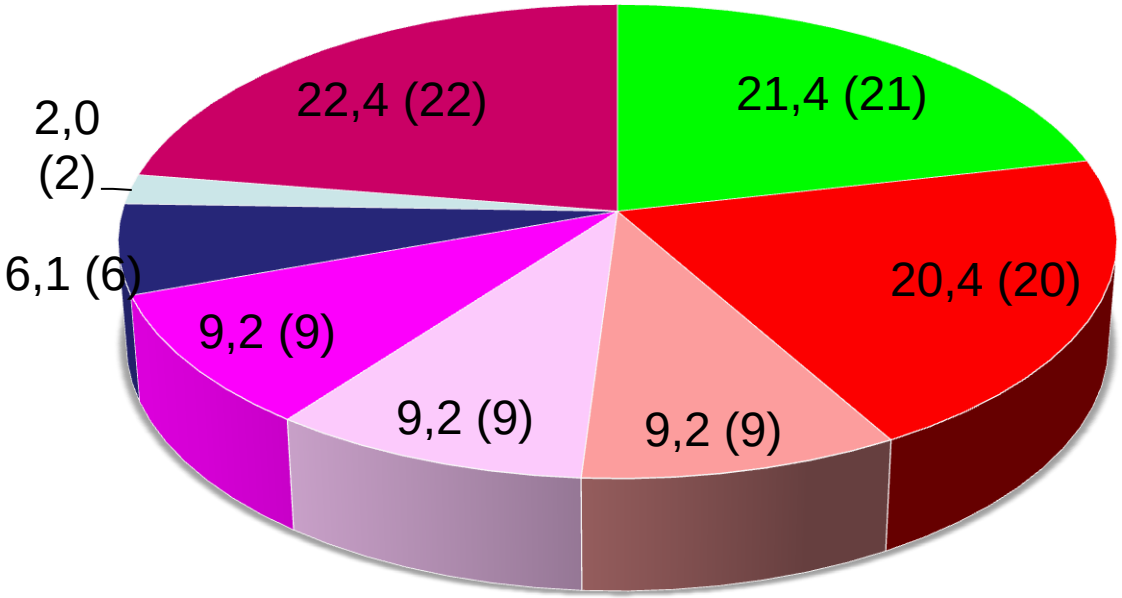
12 – 24 **h**

2. Metabolic analysis in small dairy farms

Characteristic of the practice structure

- 3 vets, 2 helpers
- 53 farmers / Farms
- 81% German Black Pied Holstein
- Milk production - 8718 kg / a
- 85% playpen; about 6 months / year on the pasture
- 56.6% of the farms - artificial insemination (AI) insemination index : 1,89
- Calving interval: 410 d at 58% of the establishments
- 89% of fodder analyzes; 75% ration
- Feeding 1.5 times / d; 58% of the establishments once
- Staple food component - 89% of the establishments grass and maize silage

Reasons for sample submissions (%)



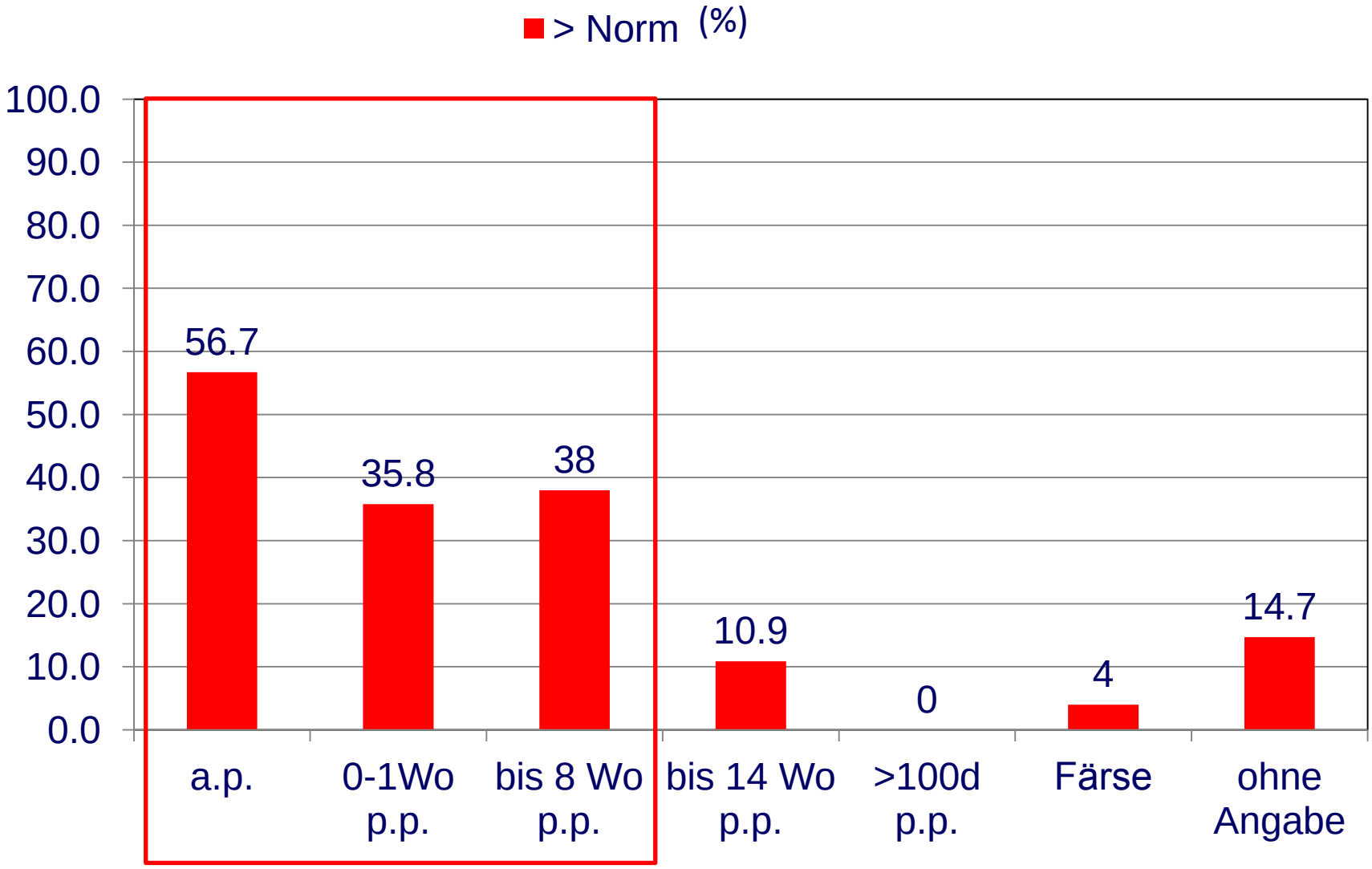
- metabolic status
- fertility problems
- milk fever
- ketoses
- udder problems
- diarrhea
- performance drop
- other

() absolute data

Most important parameters

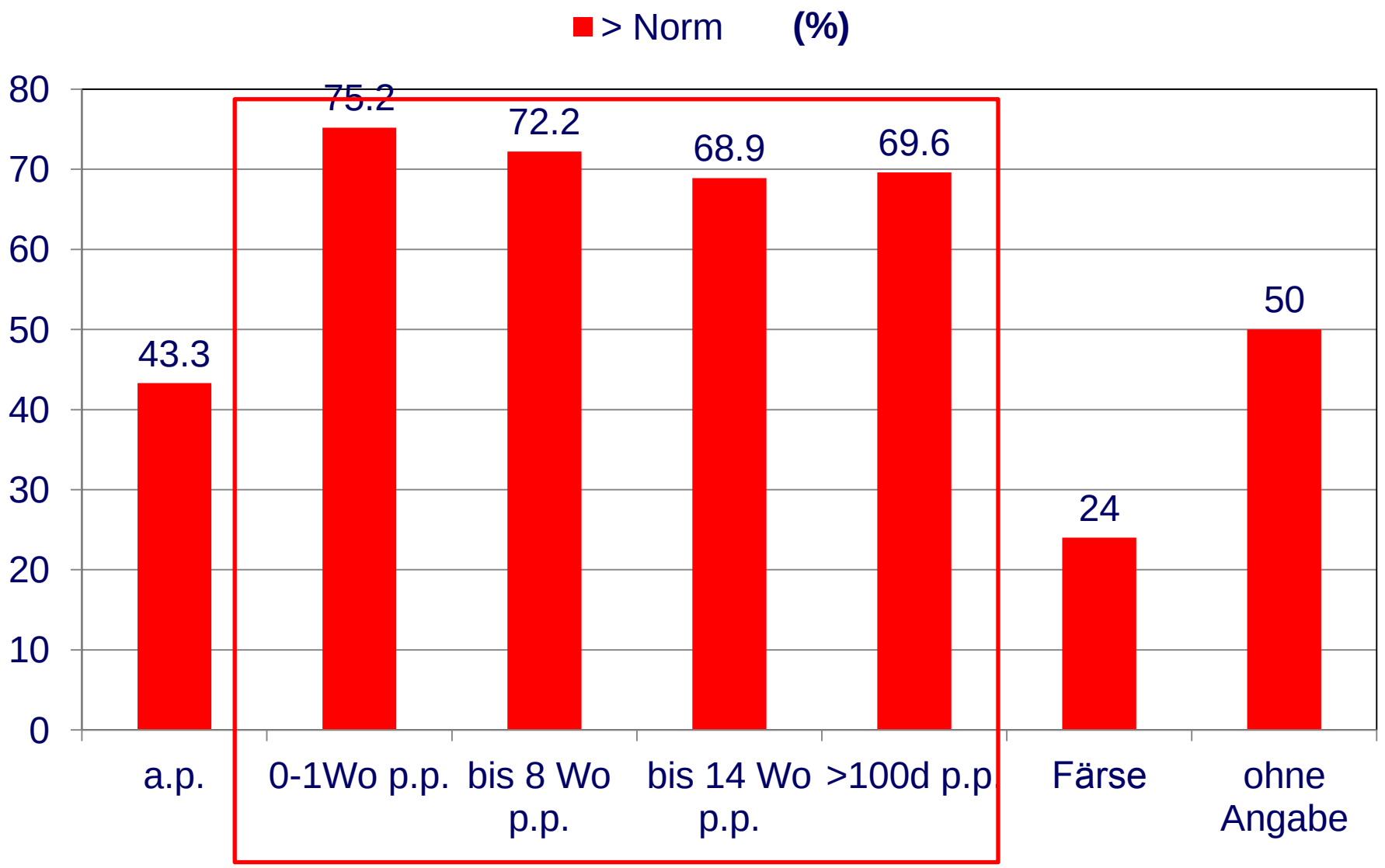
Standard Parameter n 700 - 800	Additional Parameter n 100 - 700
• FFA • BHB • Urea • Bilirubin • Ca • Pi • Se • Cu • ß-Carotin	• Cholesterol • GGT • GLDH • CK • AST • Fe • AP

FFA >normal - lactation period



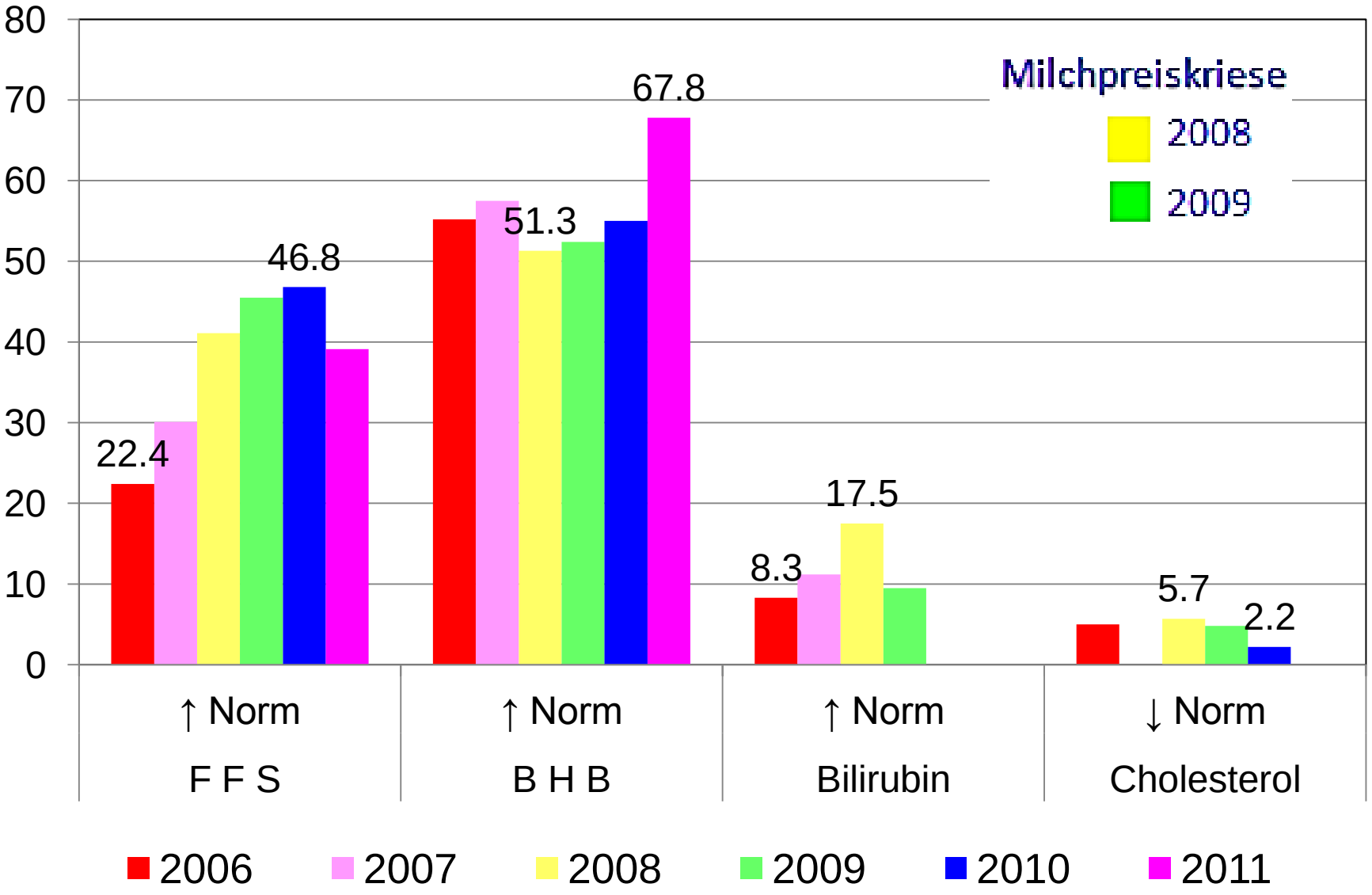
normal: a.p.: ≤ 150 µmol/l 1. Wo p.p. :10 - 620 µmol/l > 1. Wo p.p.: ≤ 350 µmol/l

BHB >normal – lactation period

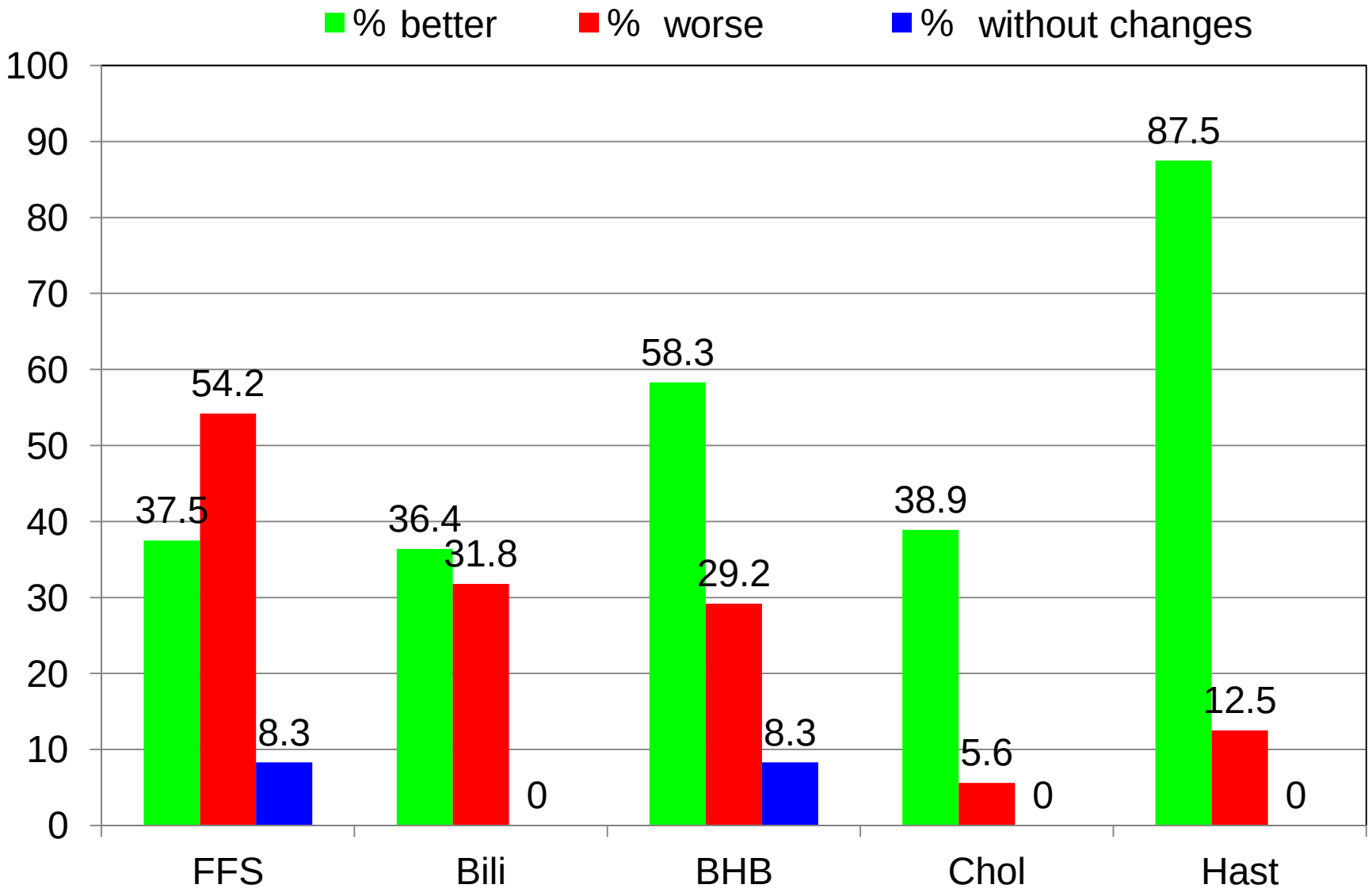


normal: ≤ 0,62 mmol/l

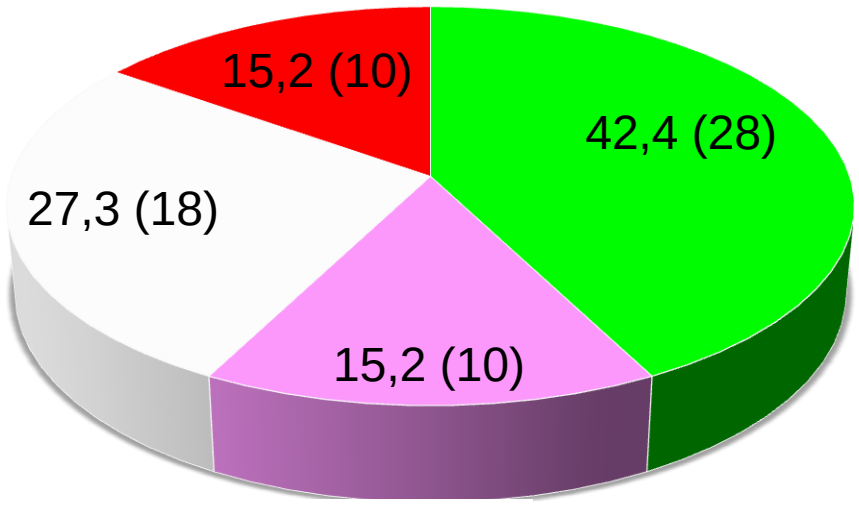
FFS-, BHB-, Bilirubin-, Cholesterol (%) <> normal



Changes in follow-up 2006 - 2011 (%)

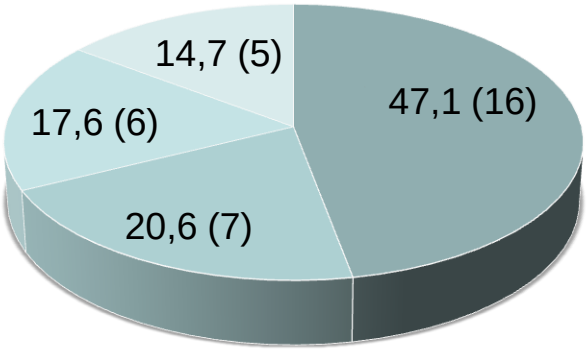


Changes after the sampling (%)



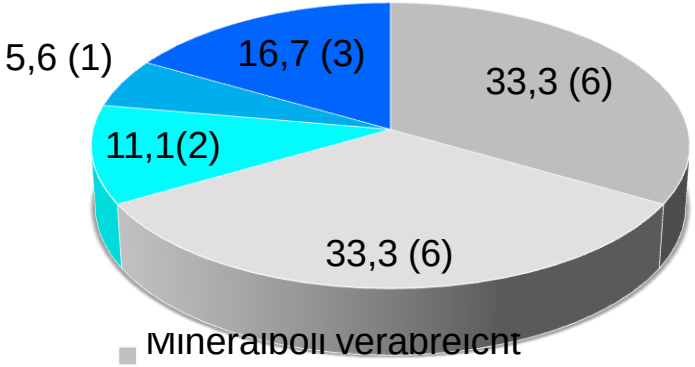
- changes in food
- injected selenium
- other
- no

Changes in food



- Mineralfutterveränderung
- Kraftfutterveränderung
- Grundfutterveränderung
- Sonstiges/nicht zuzuordnen

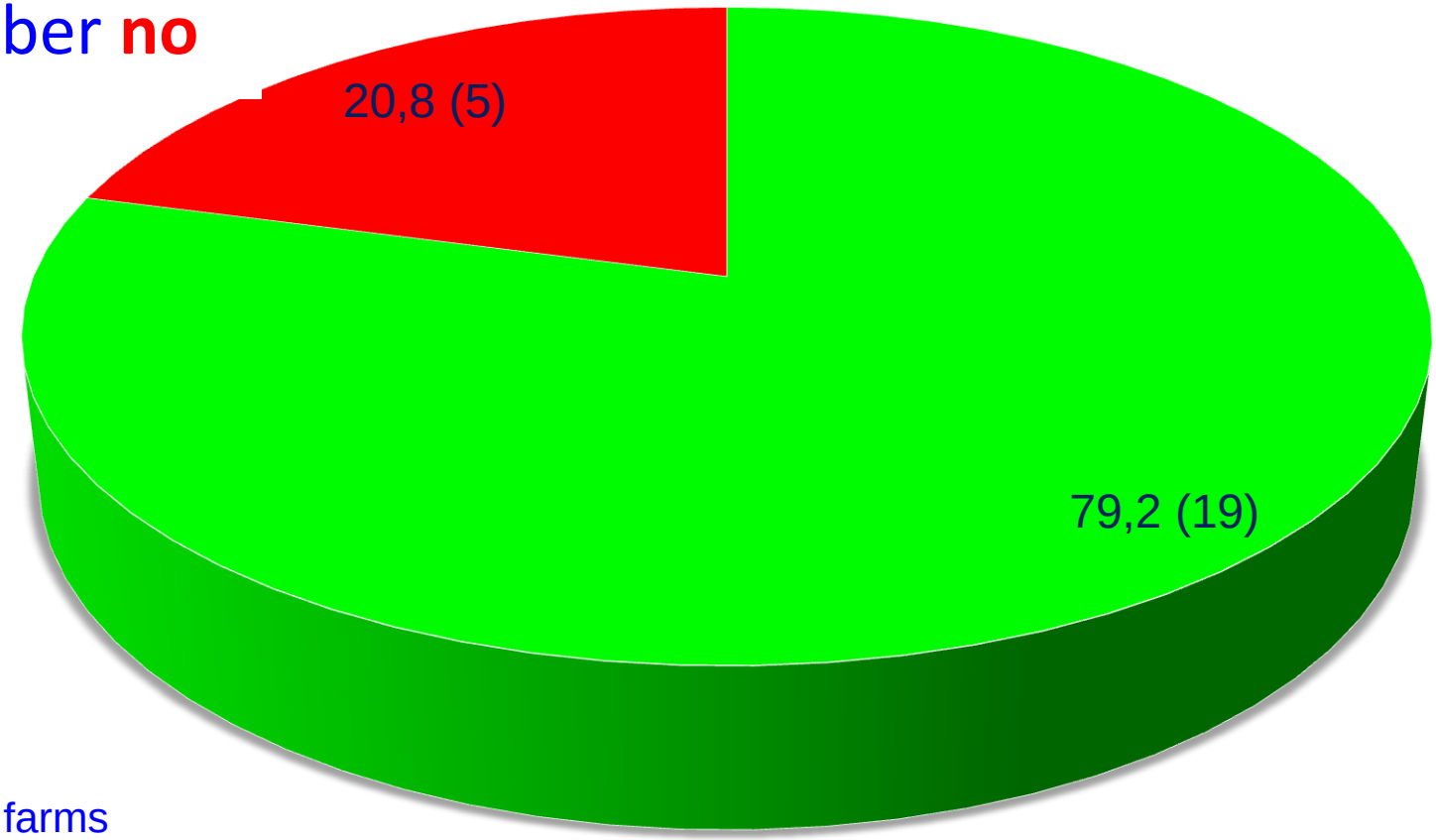
other



- Mineralboli verabreicht
- Sonstige Behandlung
- Veränderung Wasserversorgung
- Propylenglykolgabe
- Sonstiges

Companies with improving results (%)

- number **yes**
- number **no**



based on 24 farms

Betr.: 5 Blut-Proben aus dem Bestand: **, 150-13**

Vorbericht: Lipomobilisationssyndrom, Gebärparese

Entnahmedatum: 05.12.13, bearbeitet am: 09.12.13

	Zeit-punkt	Ca	Pi	Hst.	Chol	BHB	FFS	GGT	GLDH	AP	Se	Cu	ß-Car
Referenz-bereich/ Nr	Tagen	2,0-2,5 mmol/l	1,2-2,2 [a] 1,55-2,29 mmol/l	2,5-5,0 mmol/l	> 2,0 mmol/l	< 0,62 mmol/l	< 620[a] < 150[b] <350[c] µmol/l	< 50 U/l	< 30 U/l	45 - 150 U/l	40-88 ng/ml	12,5-32,8 µmol/l	> 4 mg/l
1	5 a.p.	2,61	2,02	3,49	2,30	0,65	114	15,4	12,2	59	50,9	10,8	8,2
2	1 a.p.	2,39	1,93	3,55	**1,80**	0,52	158	19,1	5,5	**25**	35,8	8,0	
3	8 a.p.	2,46	2,00	2,87	**1,97**	0,73	96	20,2	4,3	**25**	48,1	13,1	10,3
4	6 a.p.	2,38	1,84	3,36	2,37	0,83	122	22,3	6,1	**26**	45,2	11,4	
5	10 p.p.	2,40	1,51	3,37	2,33	0,91	518	25,6	16,4	**38**	39,1	14,2	
		obB	obB	obB	2x↓	3x↑	obB	obB	obB	**4x↓**	**+ / -**	obB	obB

a) < 1 Woche post partum; b) ante partum; c) >1 Woche post partum

Sehr moderate Veränderungen von Cholesterol und BHB, keine Hinweise auf LMS und GP.

Die AP ist extrem niedrig. Solche Kühe sind für GP (und Mastitis) prädisponiert. Hintergrund kann Altersfunktion sein; VitD3 ist dann Kandidat.

Se ist m.E. grenzwertig, Cu obB. Niedrige Se-Konzentrationen fördern die Entstehung von GP.

ß-Carotin obB.

example of one control

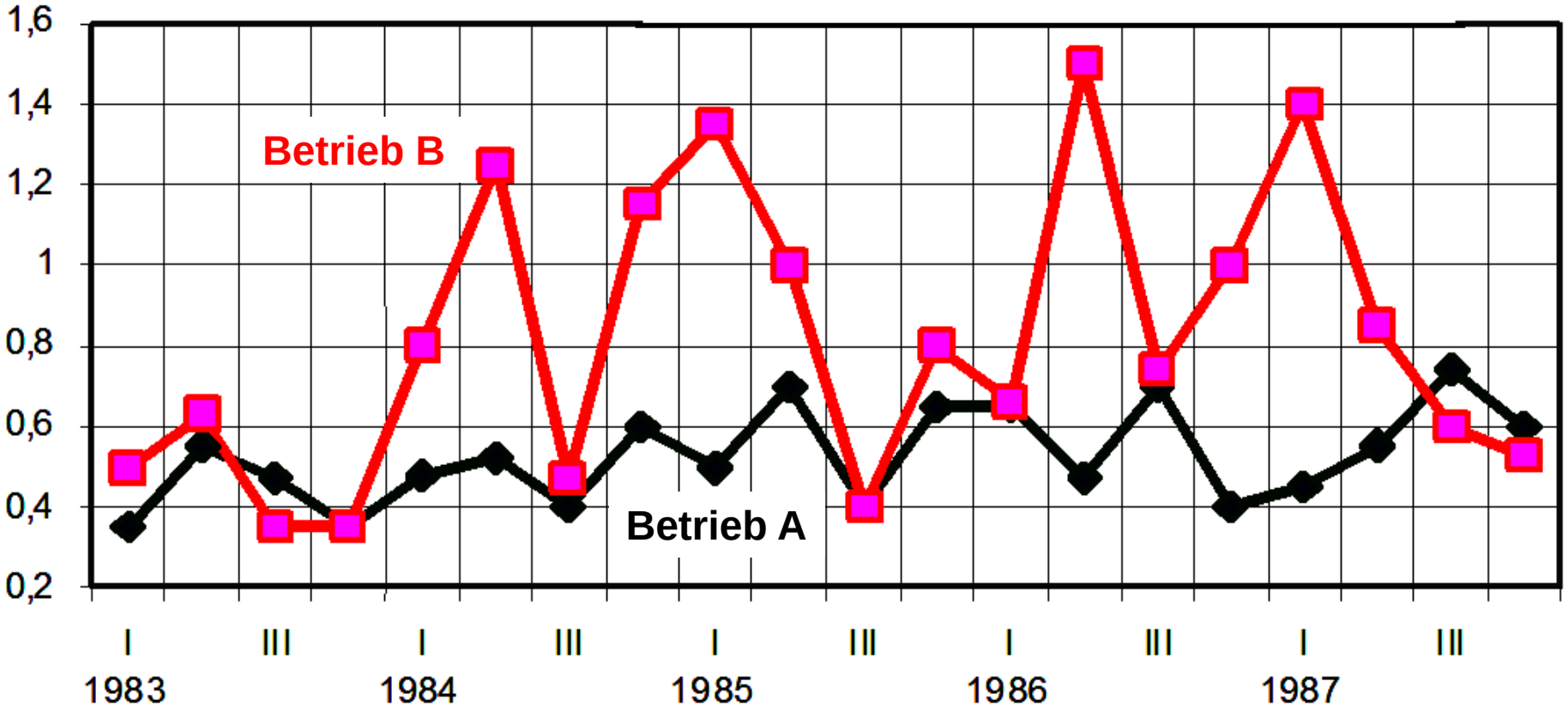
Check and measure alone

will not

suffice –

ß-0H-butyrate (mmol / l) in 2 dairy herds in each 10 cows during the year 1983 – 1987

(Fürll et al. 1995)



Ketosis accumulation of the exit of the winter in a dairy farm as a result of bad feed and poor quality:

Betrieb A: ZTZ 87,5 d, EBH: 66,0%,

Betrieb B: ZTZ 78,0 d, EBH: 53,5%

Check and measure alone

will not

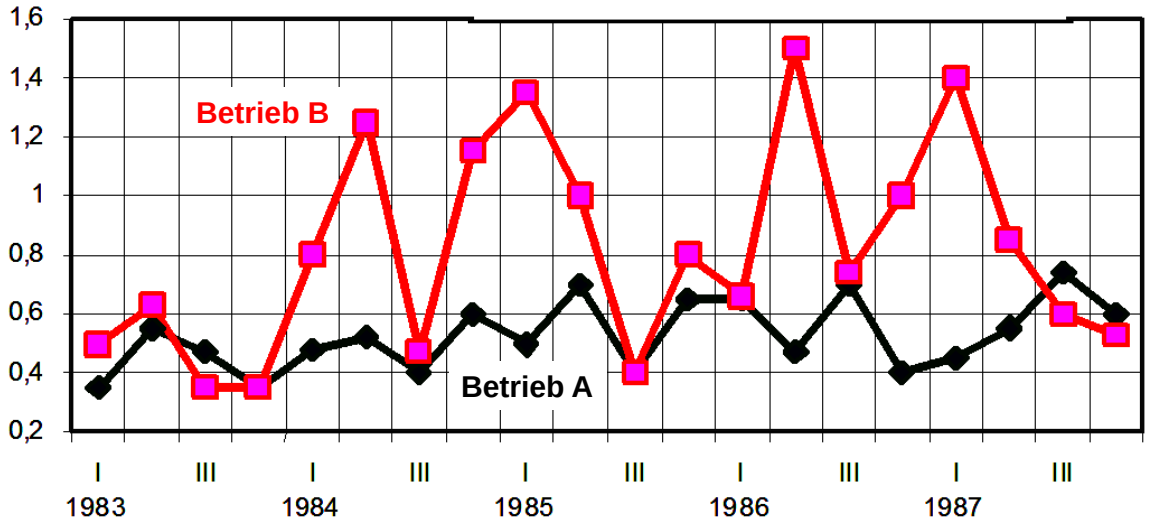
suffice –

without

changes

everything stays the same

ß-0H-butyrate (mmol / l) in 2 dairy herds in each 10 cows during the year 1983 – 1987 (Fürll et al. 1995)



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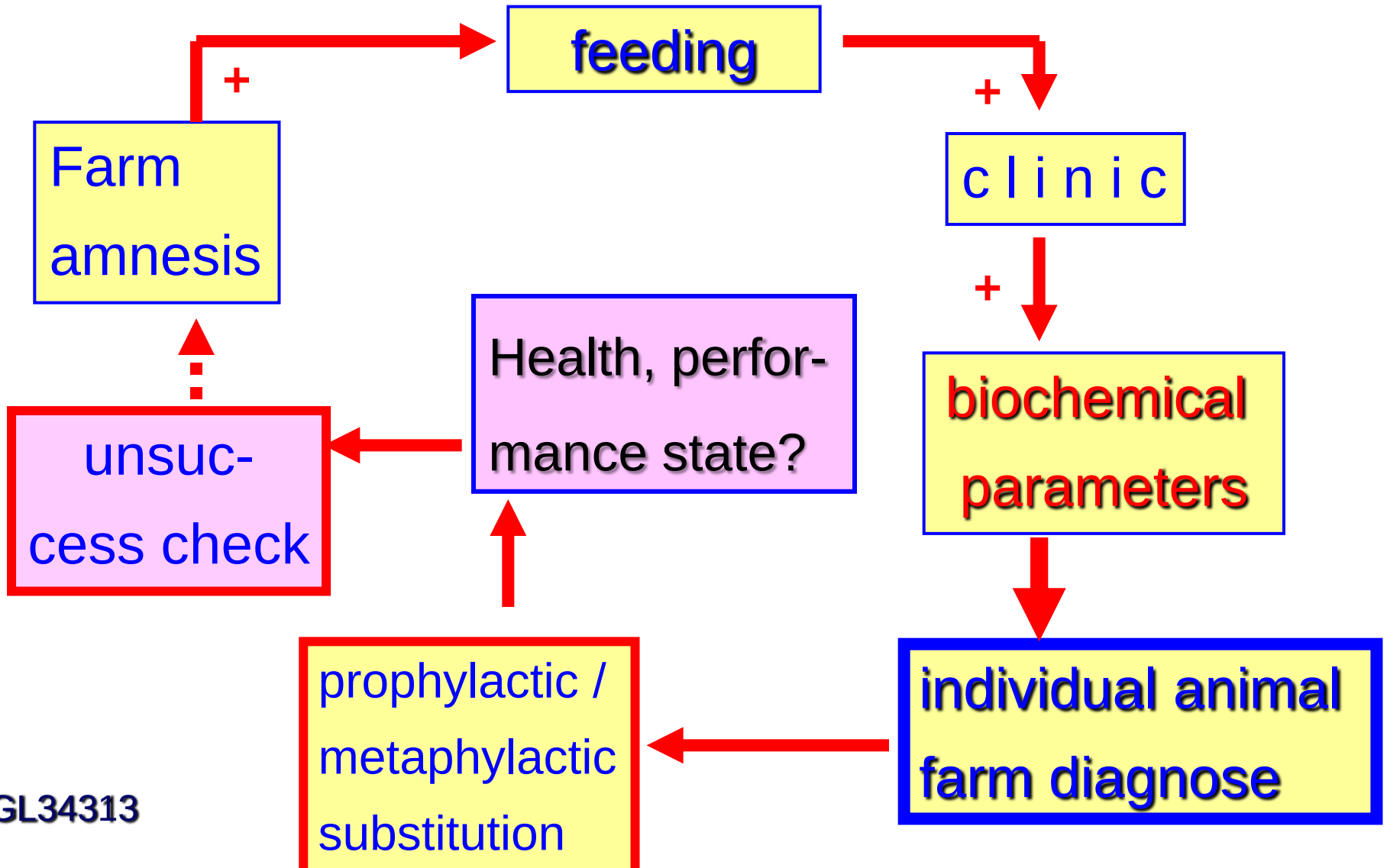
Metabolic monitoring (Gürtler 1976)



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Summary

Changes in lactation course:

40% too high lipolysis

~70% subklin. Ketosis in early / mid lactation

12-21% of Se deficient ap to 8 W pp

2-15% Cu deficiency

~43% CK / AST via standard in early lactation

50-80% ß-carotene deficiency

45% urea surplus in mid lactation

GGT / GLDH: Ø

Infertility

Improvement in 80% of the farms