



Well-being, health and fertility – how does the drinking allowance influence calf rearing?

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MATERIAL AND METHODS

Calf housing and feeding systems



Breed: German Holstein

Water, Supplementary feeds (hay, trough feed) **ad libitum**

	Farm 1	Farm 2	Farm 3
Group housing	Whole box with straw litter		Lying area with straw, concrete floor
Number of calves per group	max. 15	max. 23	max. 15
Max. age difference	2 weeks		2.5 weeks
Max. allowance of calf milk replacer feed (CMR-feed)	8 / 10 l from 10 th to 28 th DL	8 / 10 / 12 l from 15 th to 49 th DL	12 / 14 / 16 l l from 19 th to 49 th DL
Weaning period	from 29 th to 70 th DL	from 50 th to 65 th DL	from 50 th to 70 th / 90 th DL
Concentration of the CMR-feed	155 g Milk replacer per l water	160 g Milk replacer per l water	165 g Milk replacer per l CMR-feed

DL = day of life



MATERIAL AND METHODS

Data acquisition and evaluation



Data acquisition

Drinking behaviour, health, fertility

- 2 farms with allowance of CMR-feed 8/10/12/14/16 l per day
- Management programs from automatic feeders (GEA, Holm & Laue),
 - Data from 1188 calves
- Herd management program: „Herde“ of dsp datensoft GmbH



Behaviour

- 2 farms with allowance of CMR-feed 8/10/12 l per day
- Video recording: Monitoring system VisoTech



Data evaluation

- Coding of behaviour: interact (Mangold international)
 - Data evaluation so far: 10.766 hours from 21 calves in 2 farms
- Statistical analysis: Excel 2016 program, Microsoft
- Level of statistical significance: based on $p < 0,05$ (t-Test)



CMR-feed = Calf milk replacer feed



RESULTS



➤ Drinking behaviour, health and fertility

RELATIONSHIPS BETWEEN DRINKING BEHAVIOUR AND HEALTH AND FERTILITY

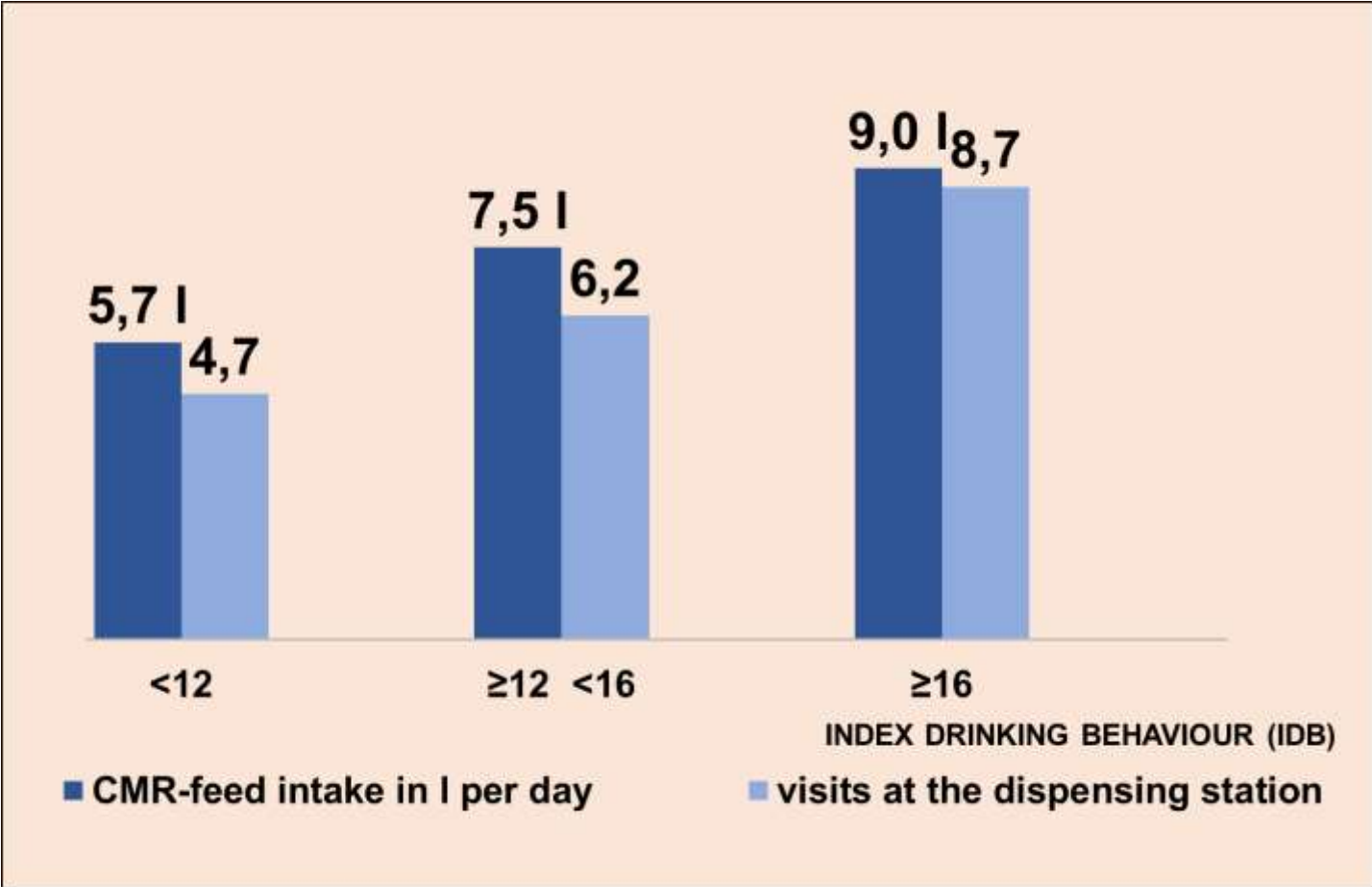


Index Drinking Behaviour (IDB)

$$\text{IDB} = \text{CMR-I} + \text{NV}$$

- Average values up to the 49th Day of Life, 8 / 10 / 12 l allowance of CMR-feed (Farm 2)
- CMR-I = Intake of CMR-feed in liters per animal and day
- NV = Average number of visits at the dispensing station of the automatic feeder per animal and day (with and without entitlement)
- **Dimensionless Index**
- **Range: 5,0 to 40,0**
- **IDB-classes: < 12 ≥ 12 <16 ≥ 16**

DRINKING BEHAVIOUR

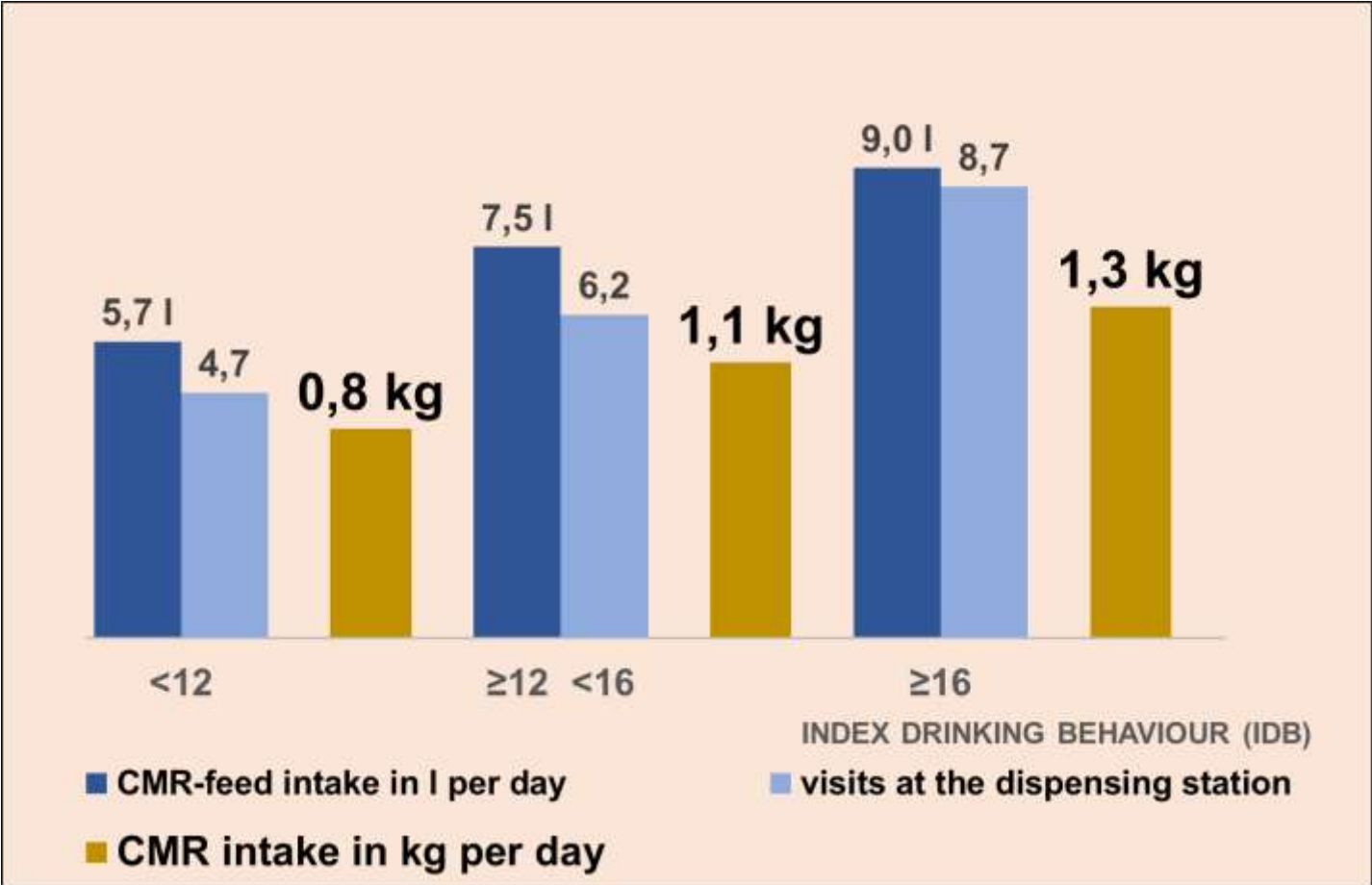


Number of calves

IDB-class	n
< 12	437
≥ 12 <16	606
≥ 16	106

significance: all diff.: $p \leq 0,001$

DRINKING BEHAVIOUR

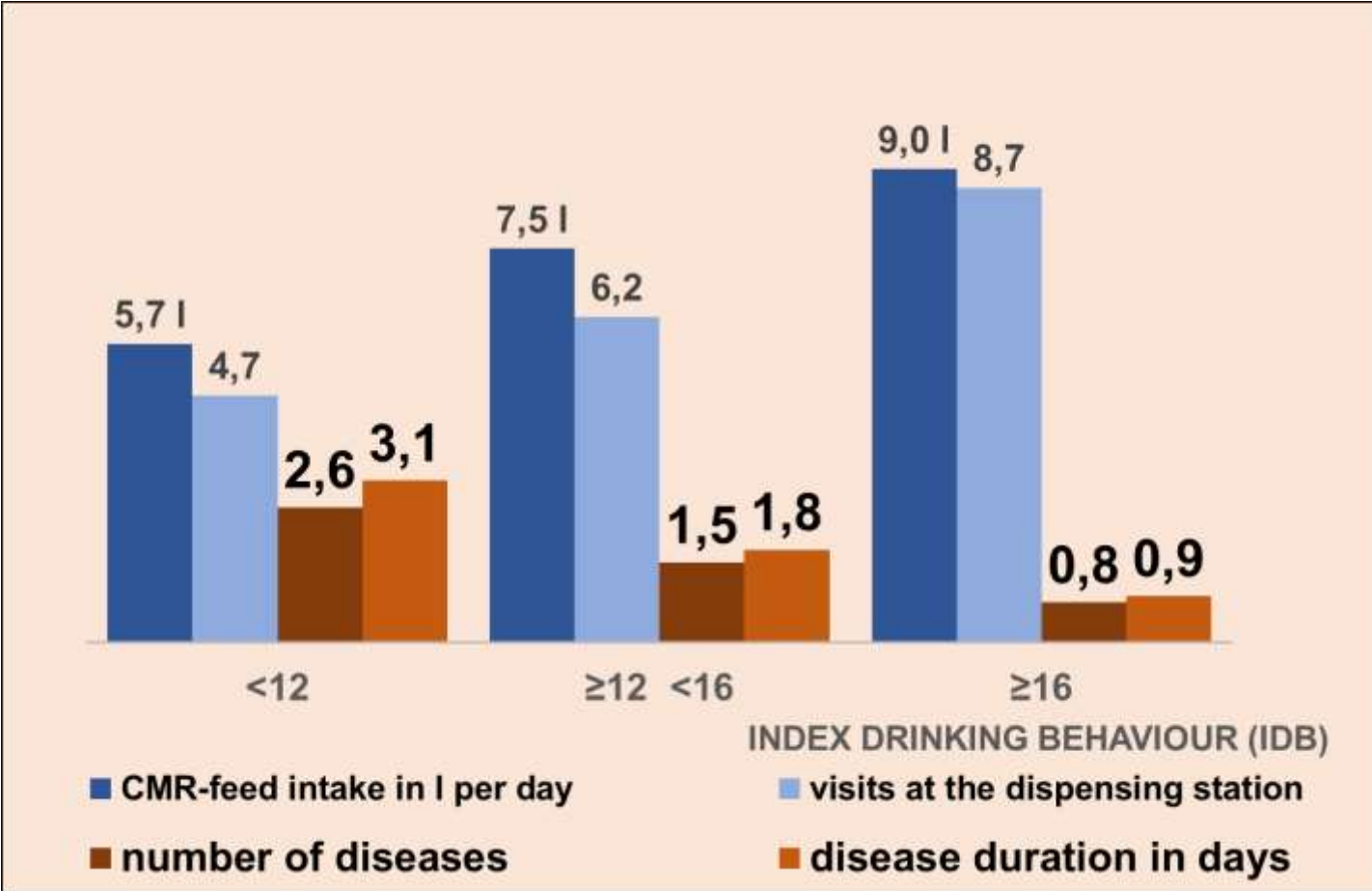


Number of calves

IDB-class	n
< 12	437
≥ 12 <16	606
≥ 16	106

significance: all diff.: p ≤ 0,001

RELATIONSHIPS BETWEEN DRINKING BEHAVIOUR AND HEALTH UNTIL SEXUAL MATURITY

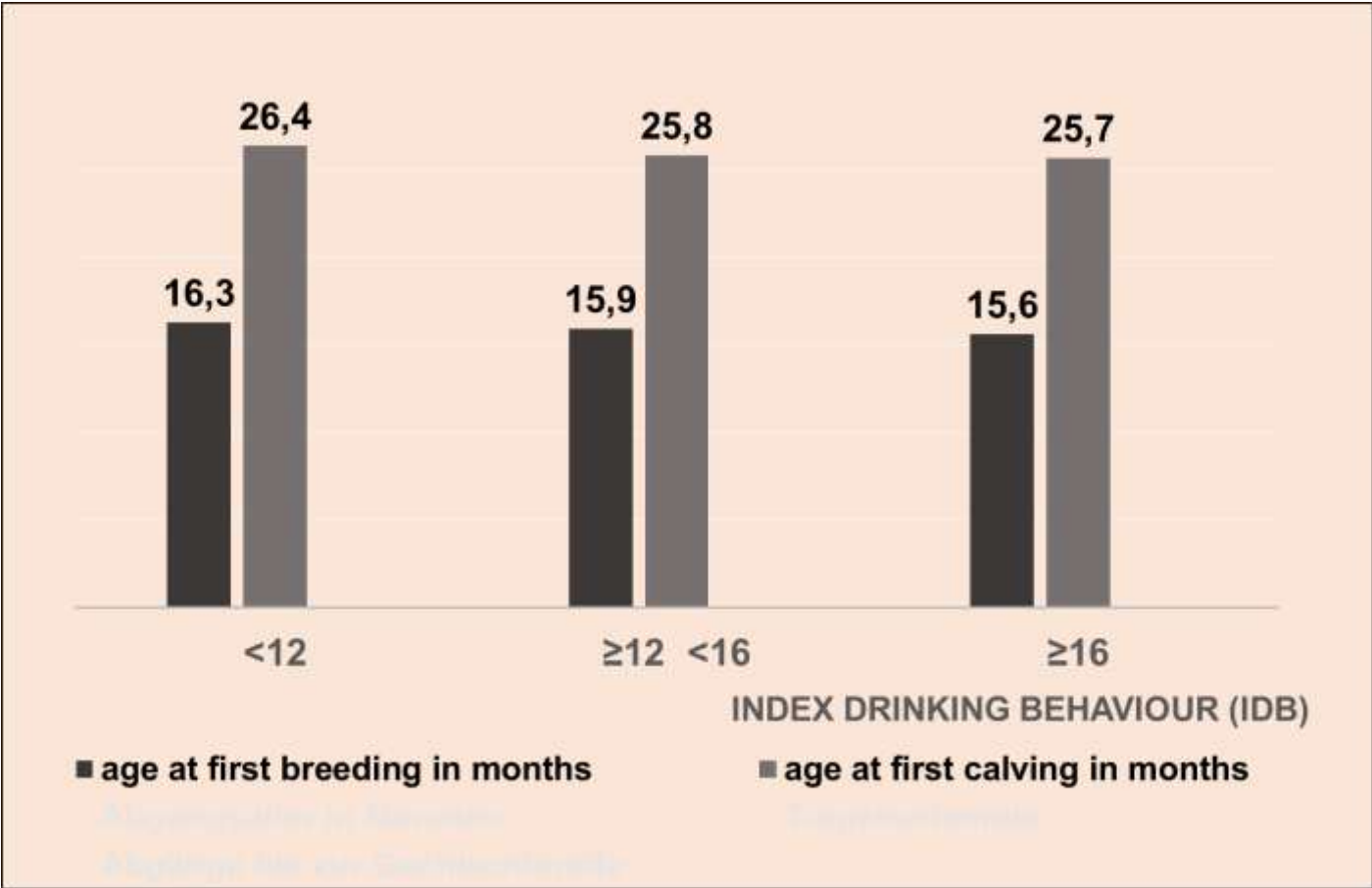


Number of calves

IDB-class	n
< 12	437
≥ 12 <16	606
≥ 16	106

significance: number and duration of diseases: $p \leq 0,001$

RELATIONSHIPS BETWEEN DRINKING BEHAVIOUR AND FERTILITY



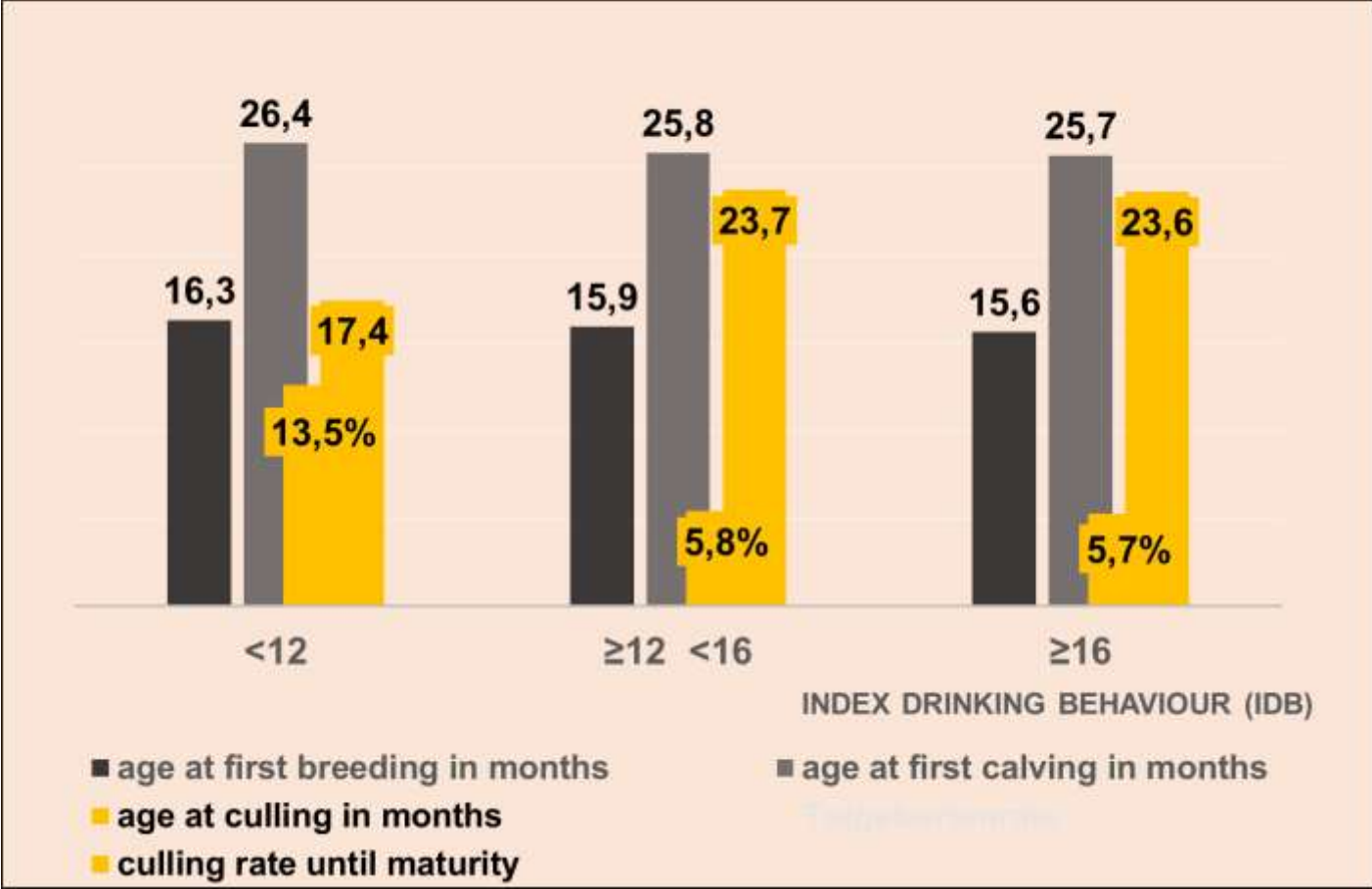
Number of calves

IDB-class	n
< 12	323
≥ 12 <16	496
≥ 16	93

significance: AFB, AFC: <12 vs. ≥ 12 <16, ≥ 16, p ≤ 0,04

AFB= age at first breeding
AFC = age at first calving

RELATIONSHIPS BETWEEN DRINKING BEHAVIOUR AND FERTILITY AND HEALTH



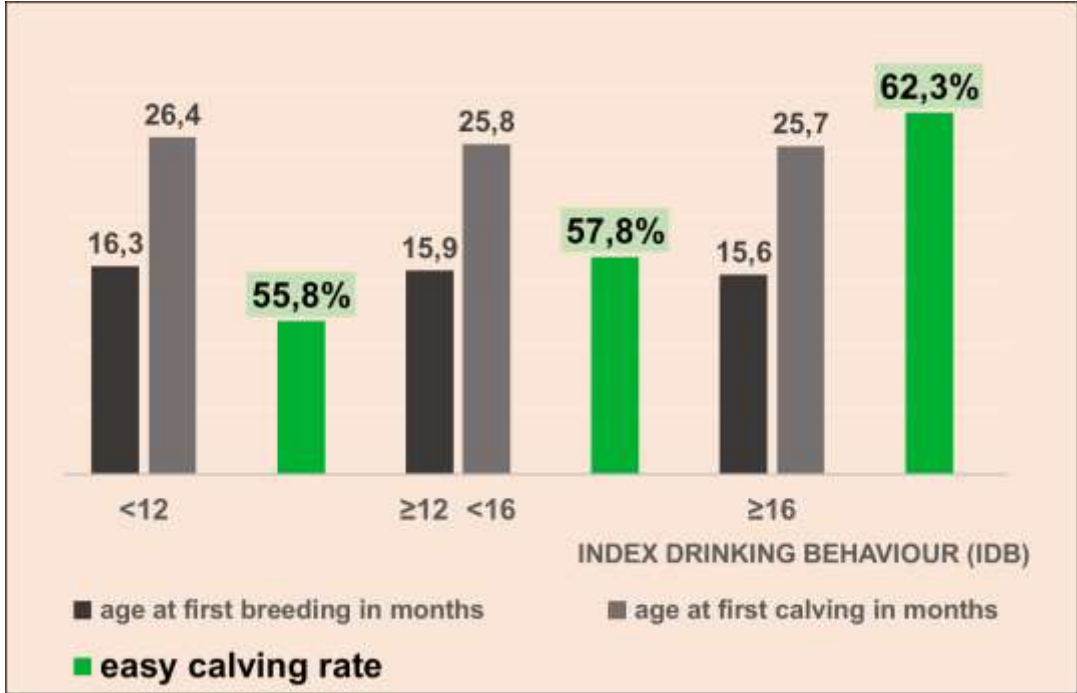
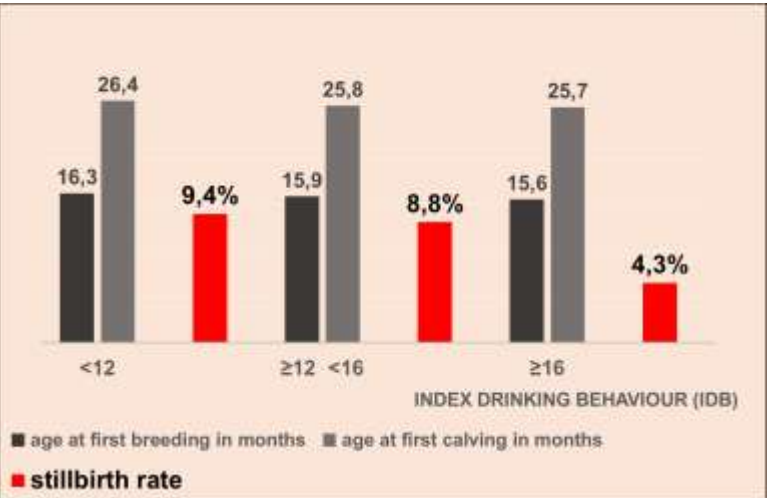
Number of calves

IDB-class	n
< 12	323
≥ 12 <16	496
≥ 16	93

target value: <7% (Steinhöfel, 2011)

significance: age at culling: <12 vs. ≥ 12 <16, ≥ 16, p ≤ 0,04

RELATIONSHIPS BETWEEN DRINKING BEHAVIOUR AND FERTILITY AND HEALTH



Number of calves

IDB-class	n
< 12	323
≥ 12 <16	496
≥ 16	93

easy calving: without help

Relationships between parameters of drinking behaviour (CMR-feed intake and visits at the dispensing station)

IDB-classes: < 12 ; $\geq 12 < 16$; ≥ 16

and health and fertility:

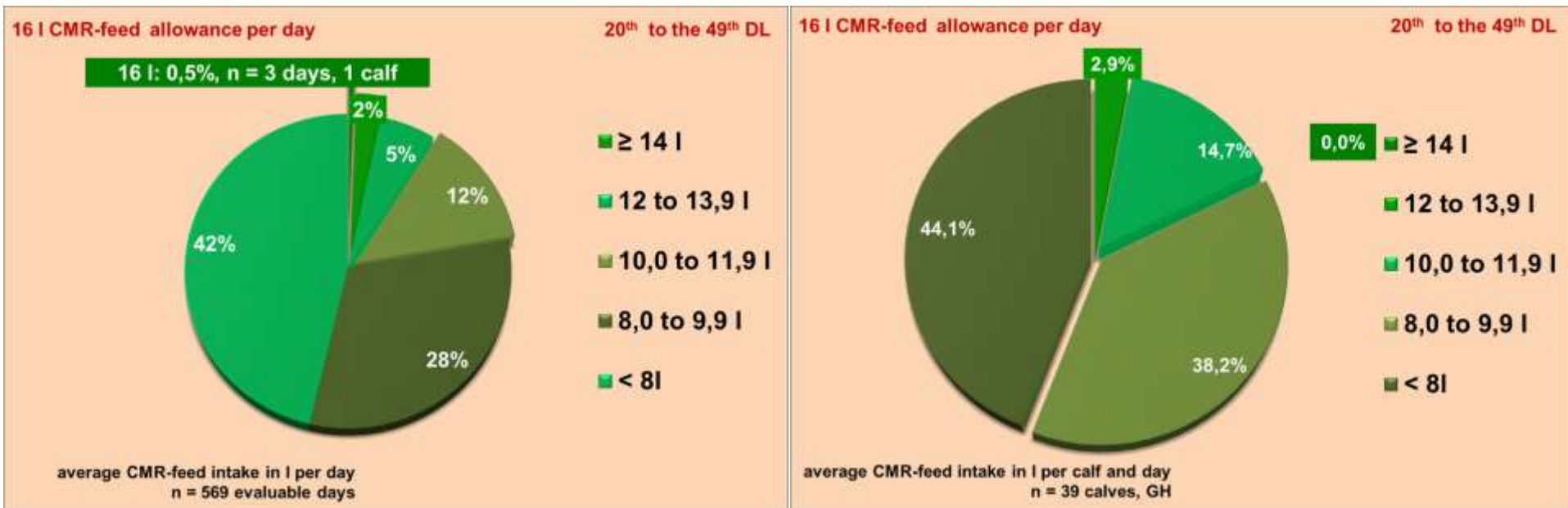
- significant: Number and duration of diseases until sexual maturity
 Age at first breeding and calving
 Age at culling
- trends: Calving behaviour
 (easy calving or stillbirth rate)



➤ Allowance of CMR-feed – milk feeding plan

INTAKE OF CMR-FEED

16 l allowance up to 49th DL



**With an allowance of 14 l CMR-feed per day
with at least 160 g CMR per l CMR-feed
up to the 49th day of life,
the calves' drinking needs are covered**

MODEL CALCULATION

Beginning of the weaning period



Calculation

- 16 l allowance of CMR-feed (ACMR) **up to 49th day of life (DL)**
- vs.
- 14 l allowance of CMR-feed (ACMR) **up to 28th day of life (DL)**
 - **Increase in feed intake (supplementary feeds) from the 8th week of life**

References:



MODEL CALCULATION

Beginning of the weaning period



Calculation:

- **16 l allowance of CMR-feed (ACMR) up to 49th Day of Life (DL)**
- VS.
- **14 l allowance of CMR-feed (ACMR) up to 28th Day of Life (DL)**

Basis for comparison:

CMR-feed intake from 39 calves with 16 l allowance of CMR-feed

- CMR-feed concentration: 165 g CMR per l CMR-feed
- CMR-feed intake from 28th up to 49th Day of Life
- **Top-20 : the best 20 % calves with highest daily intake**

MODEL CALCULATION

Beginning of the weaning period

16 l allowance of CMR-feed **up to 49th DL** vs.

14 l allowance of CMR-feed **up to 28th DL**



	TOP 20 - BASIS FOR COMPARISON		MODEL CALCULATION			
Maximal allowance	16 l up to 49 th day of life		14 l up to 28 th day of life			
	Average CMR-feed intake per day		CMR-feed allowance per day			
Age in days	l CMR-feed	kg CMR	l CMR-feed			
28	13,0	2,1	14,0	14,0	14,0	14,0
29	12,0	2,0	13,6	13,7	13,8	13,9
31	14,3	2,4	12,8	13,1	13,3	13,7
34	10,7	1,7	11,6	12,2	12,5	13,4
36	12,5	2,1	10,8	11,3	12,0	13,2
40	11,3	1,6	9,2	10,4	11,0	12,8
49	12,9	2,1	5,6	7,7	8,8	11,9
Average 28th- 49th DL	11,8	1,9	9,8	10,7	11,3	12,9
Weaning in l per day	0,40		0,40	0,30	0,25	0,104
Weaning age in days	90		62	75	85	162

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MILK FEEDING SYSTEM: **Age of weaning** according to the intensity of weaning

14 and 12 l allowance up to 49th DL



Weaning in l per day	0,65	0,55	0,45	0,40	0,35
Weaning age in days	71	75	81	84	89
Day of Life	CMR-feed allowance in l per day				
49	14,0				
50	13,4	13,5	13,6	13,6	13,7
51	12,7	12,9	13,1	13,2	13,3
68	1,7	3,5	5,5	6,4	7,4
71	0,0	1,9	4,1	5,2	6,3
75		0,0	2,3	3,6	4,9
81			0,0	1,2	2,8
84		11th to 12th Week of Life		0,0	1,4
89				0,0	

Weaning in l per day	0,65	0,55	0,45	0,40	0,35
Weaning age in days	68	71	76	79	84
Day of Life	CMR-feed allowance in l per day				
49	12,0				
50	11,4	11,5	11,6	11,6	11,7
51	10,7	10,9	11,1	11,2	11,3
68	0,0	1,6	3,5	4,4	5,4
71		0,0	2,1	3,2	4,3
76			0,0	1,2	2,6
79				0,0	1,5
84		10th to 11th Week of Life			0,0



SUMMARY

Milk feeding system

- **maximal CMR-feed allowance**
 - 14 l CMR-feed, at least 12 l CMR-feed per day
 - up to the 49th Day of Life resp. to the end of the 7th week of life
- **Weaning period**
 - Start on the 50th Day of Life
 - 0,45 to 0,40 l CMR-feed per day
- **Weaned**
 - from 75th to 85th Day of Life
 - resp. 11th to 12th Week of Life



➤ Allowance of CMR-feed and well-being



NORMAL BEHAVIOUR

- **Resting and activity behaviour**
- **Feed intake**
- **Other activities**

Comparison with the natural behaviour of calves in the mother-bonded rearing

- Primarily in suckler cow husbandry
- Representations by the authors
 - WALKER, 1962, SAMBRAUS & BRUMMER, 1978
 - BOGNER ET AL., 1984, PORZIG ET AL., 1991

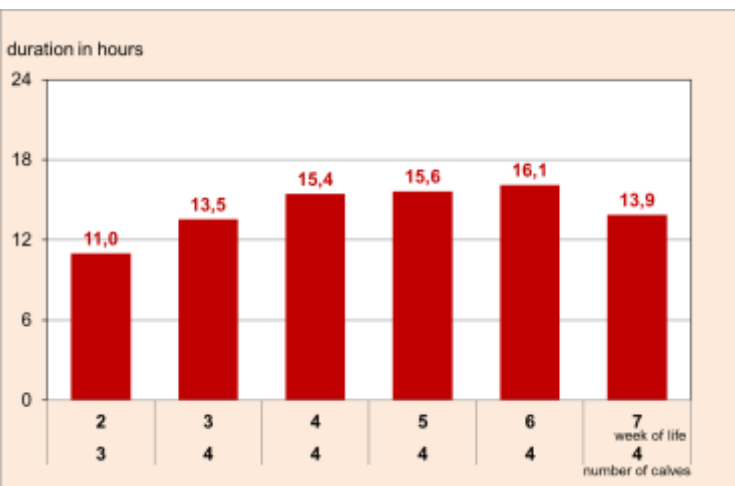
Evaluation: 3rd to 07th week of life resp. 21st to 49th day of life

- Maximal CMR-feed allowance (ACMR)

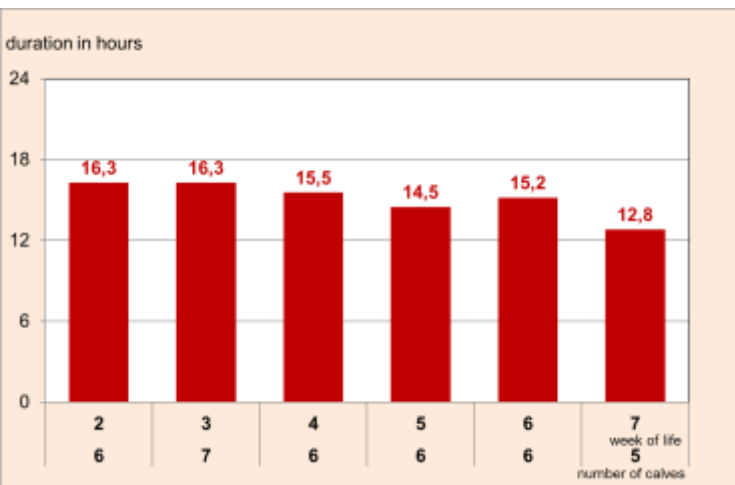
RESTING AND ACTIVITY BEHAVIOUR

8 / 10 / 12 | CMR-feed allowance (ACMR)

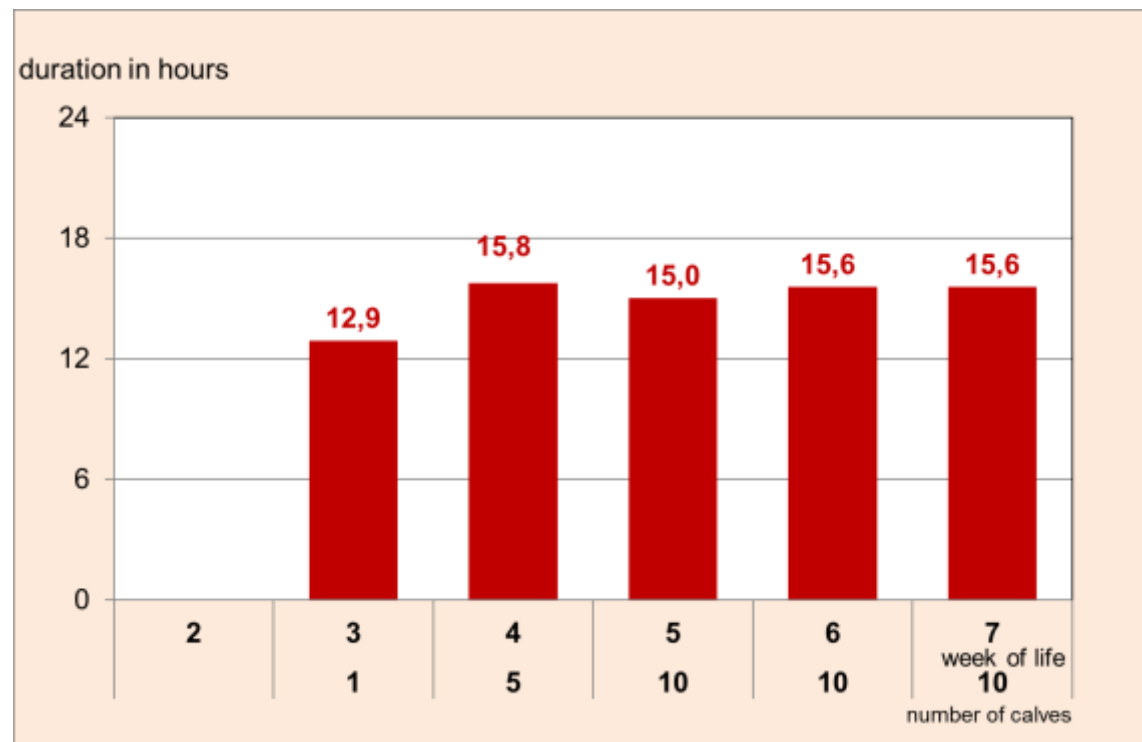
up to 28th resp. 49th DL



ACMR: 8 | to 28th DL



ACMR: 10 | to 28th DL



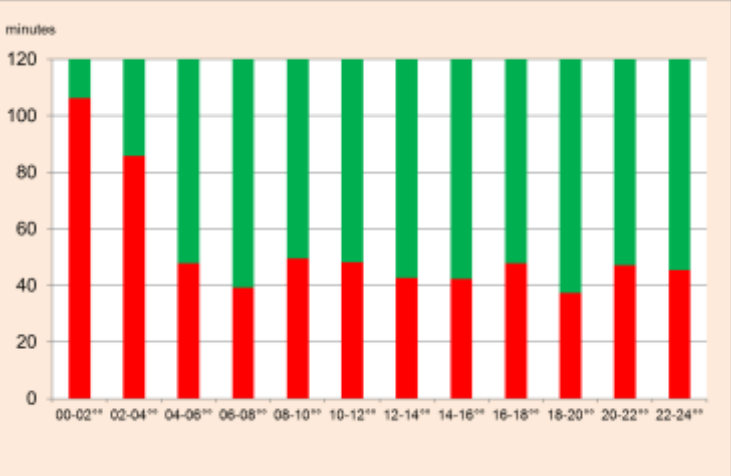
ACMR: 12 | to 49th DL, n = 10 calves

Resting times total in hours per day

RESTING AND ACTIVITY BEHAVIOUR

8 / 10 / 12 l CMR-feed allowance (ACMR)

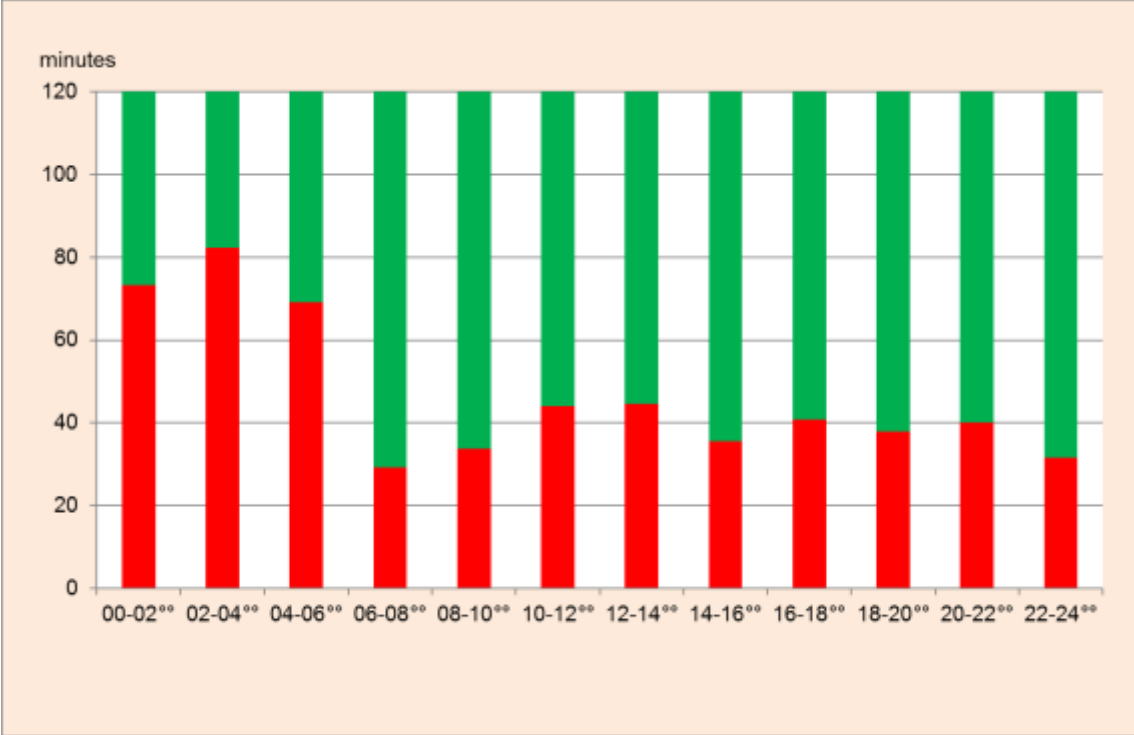
up to 28th resp. 49th DL



ACMR: 8 l to 28th DL, n = 4 calves



ACMR: 10 l to 28th DL, n = 7 calves



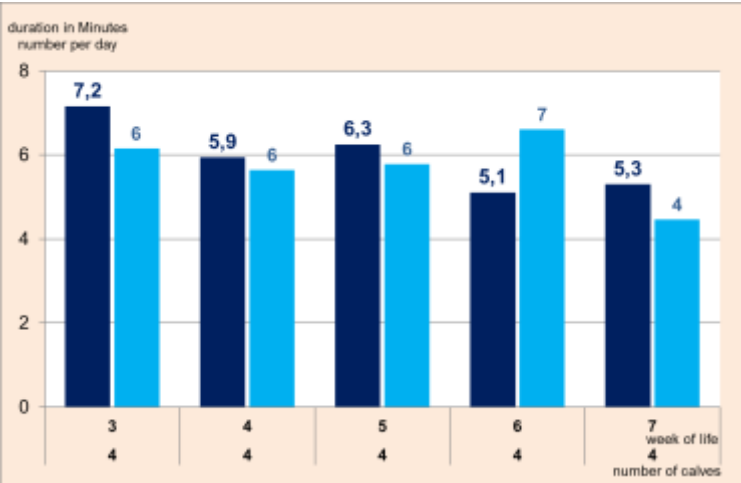
ACMR: 12 l to 49th DL, n = 10 calves

activity
resting

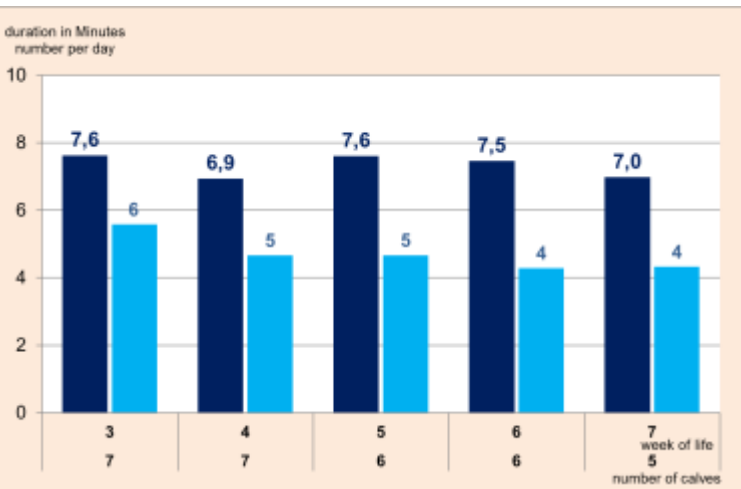


FEEDING BEHAVIOUR

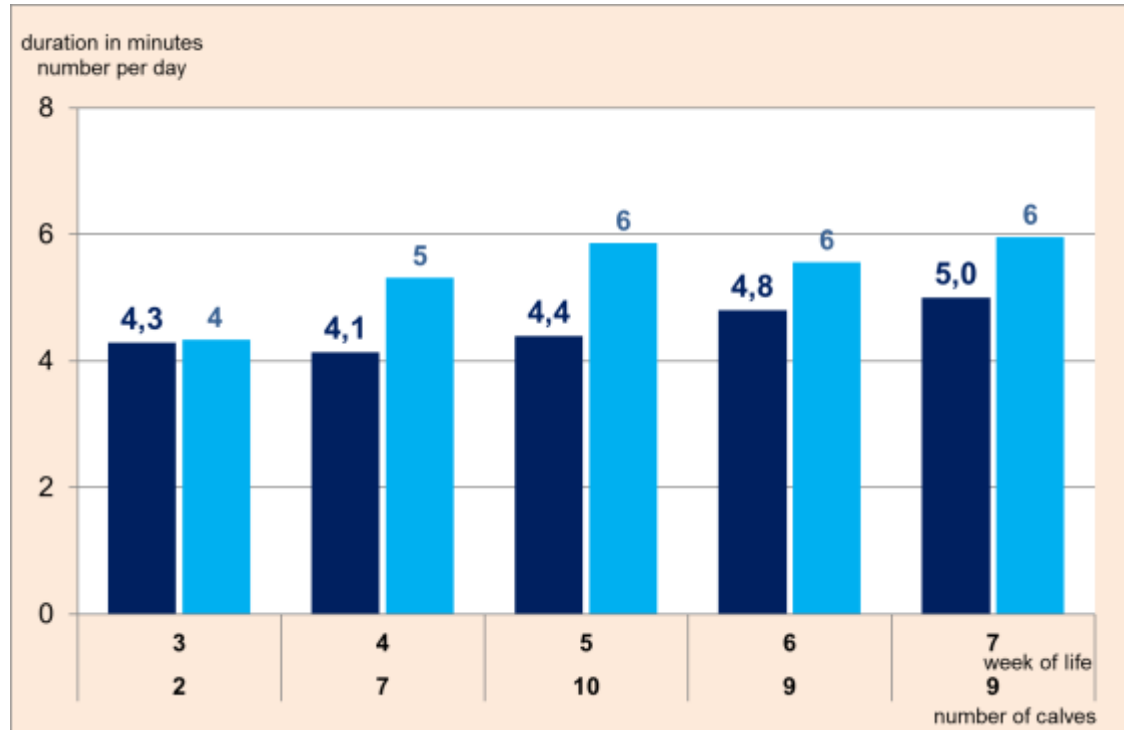
8 / 10 / 12 | CMR-feed allowance (ACMR) up to 28th resp. 49th DL



ACMR: 8 | to 28th DL



ACMR: 10 | to 28th DL

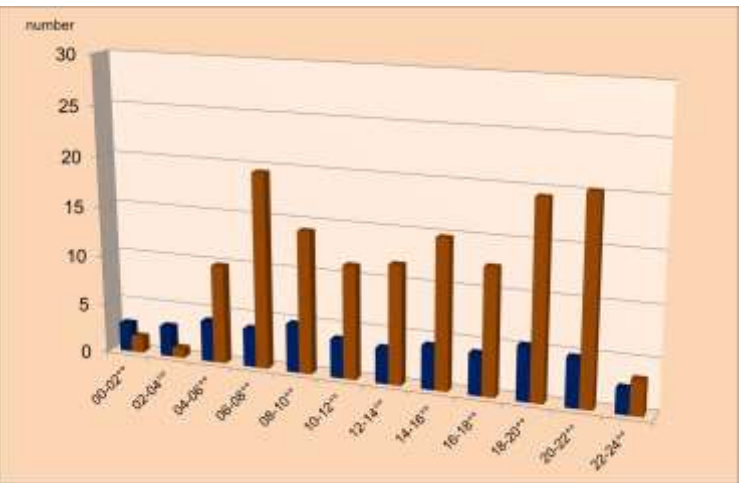


ACMR: 12 | to 49th DL

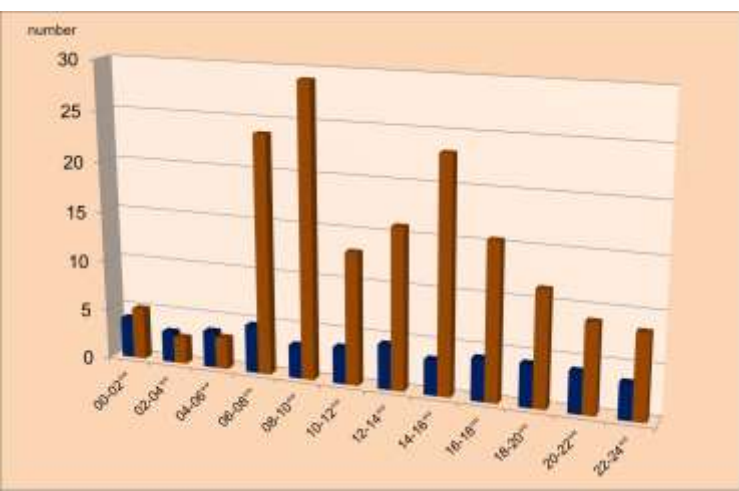
CMR-feed intake in min per session Number of sessions with intake per day

FEEDING BEHAVIOUR

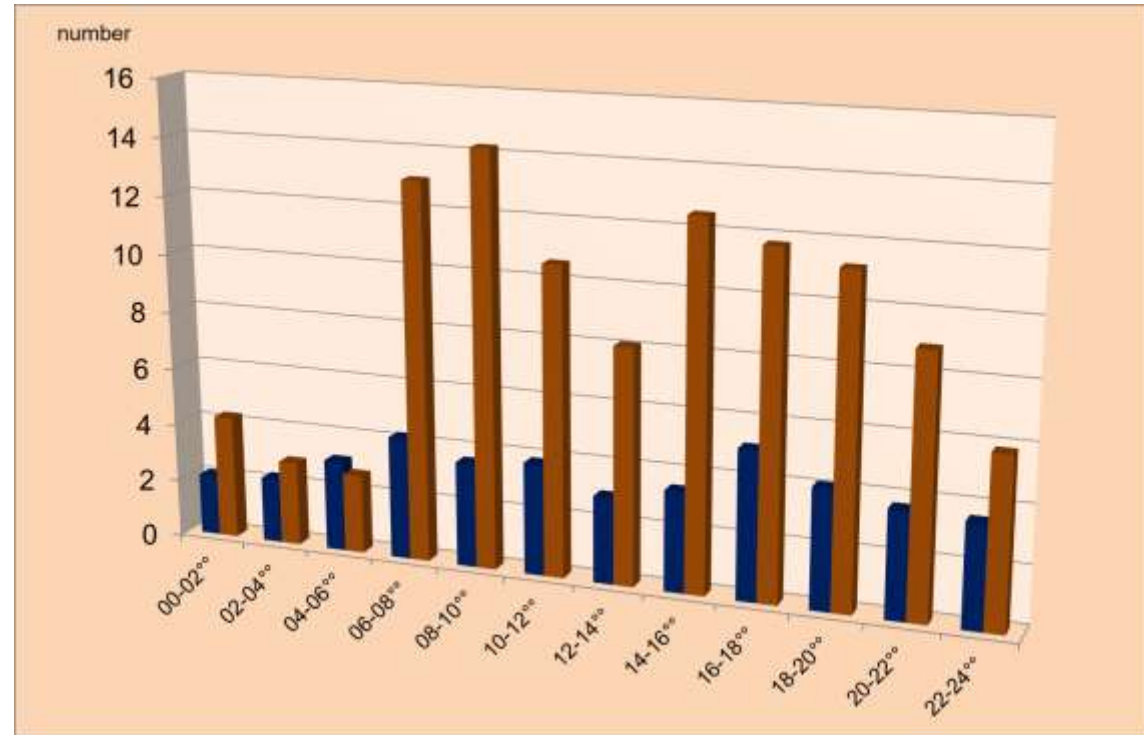
8 / 10 / 12 | CMR-feed allowance (ACMR) up to 28th resp. 49th DL



ACMR: 8 | to 28th DL, n = 4 calves



ACMR: 10 | to 28th DL, n = 7 calves



ACMR: 12 | to 49th DL, n = 10 calves

Number of feed intakes
Number of CMR-feed intakes
during the day

ACTIVITY BEHAVIOUR

12 I CMR-feed allowance (ACMR)

up to

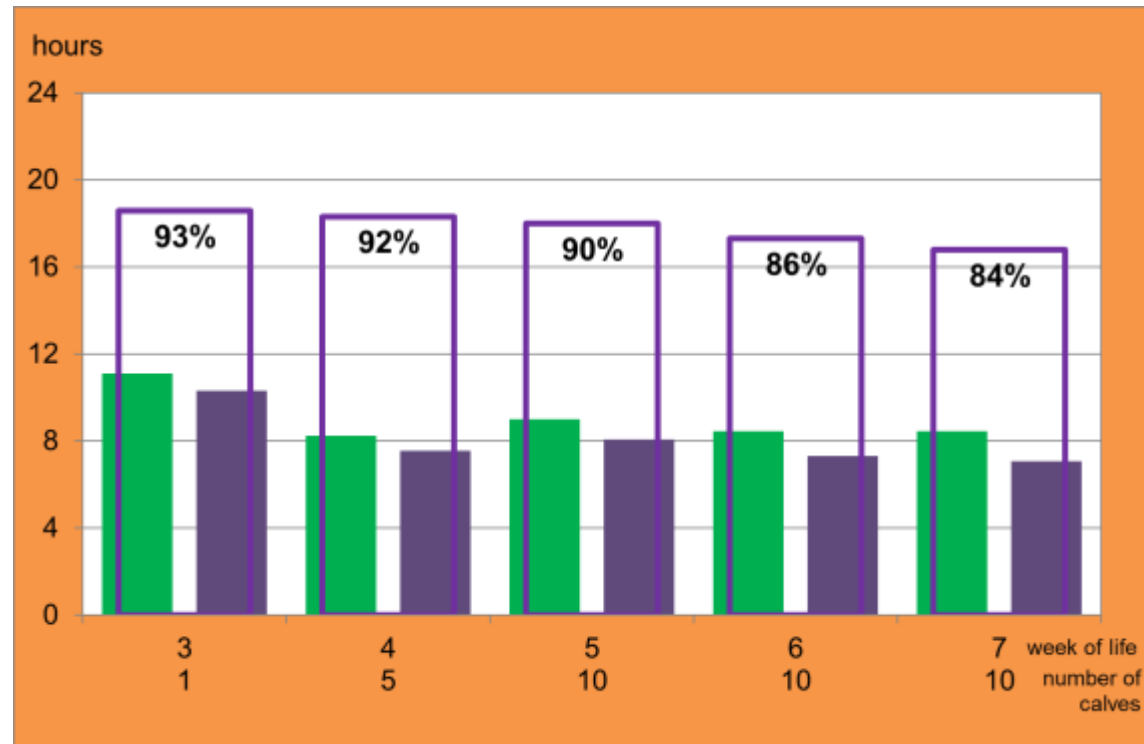
49th DL



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Other activities

- Game and social behaviour
 - Calf-calf-contacts
 - Cross licking
 - Romp
 - Head butts
 - fighting games
 - Playing with toys
- exploratory behaviour
 - Lick, sniff objects
- Elimination behaviour
- Water intake



ACMR: 12 I to 49th DL

Activity time per day in hours

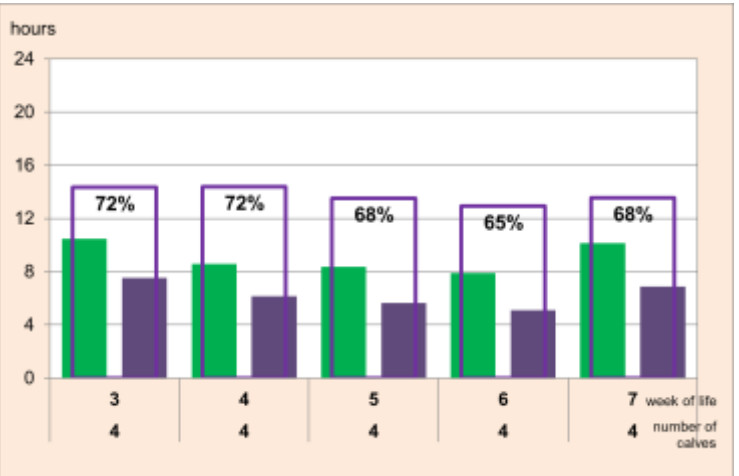
Other activities per day in hours

Rate of other activities

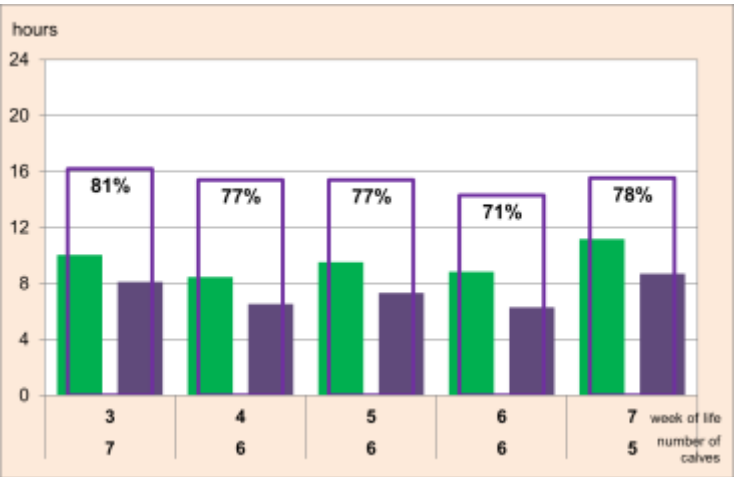
27

ACTIVITY BEHAVIOUR

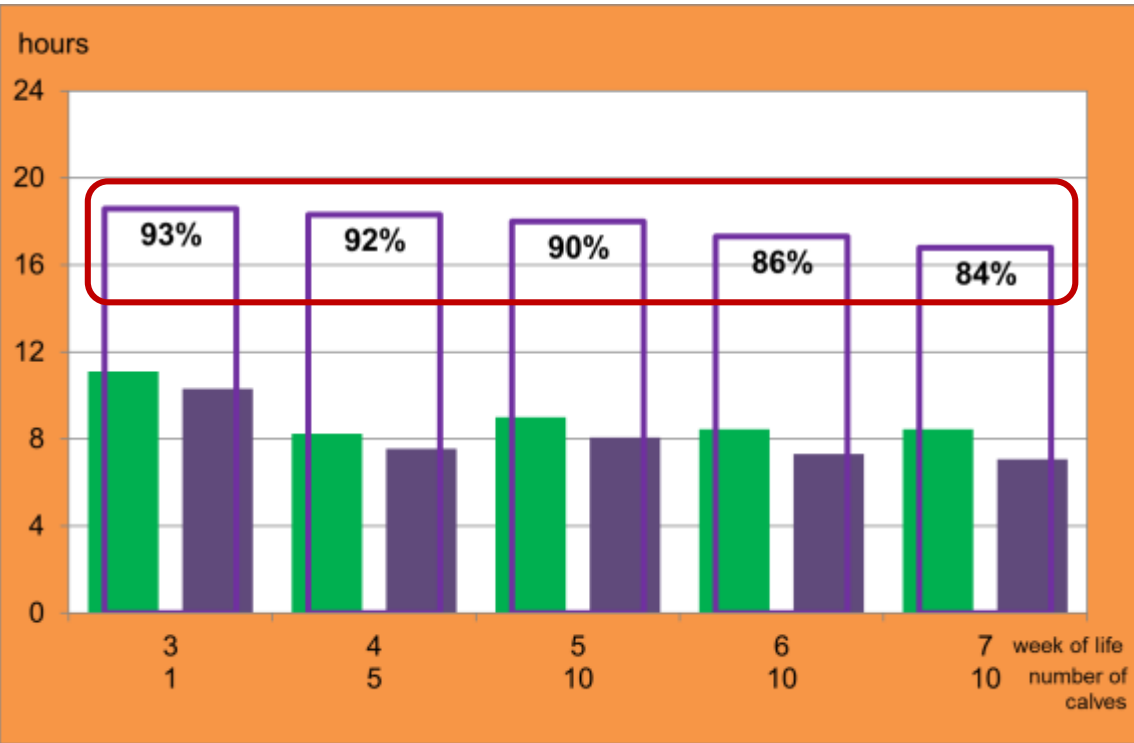
8 / 10 / 12 | CMR-feed allowance (ACMR) up to 28th resp. 49th DL



ACMR: 8 | to 28th DL



ACMR: 10 | to 28th DL

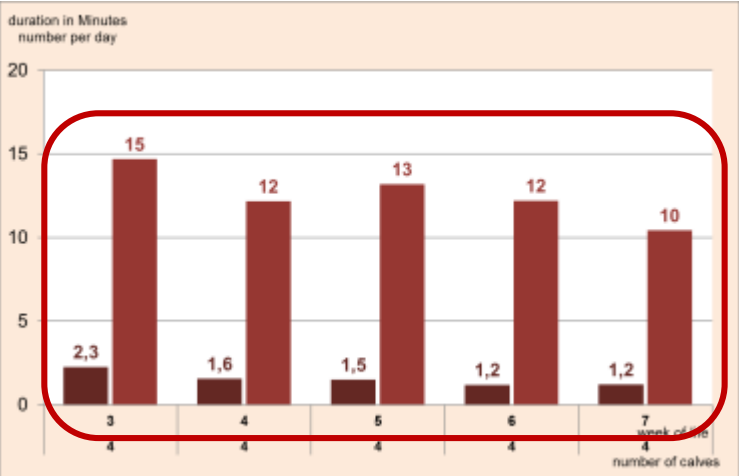


ACMR: 12 | to 49th DL

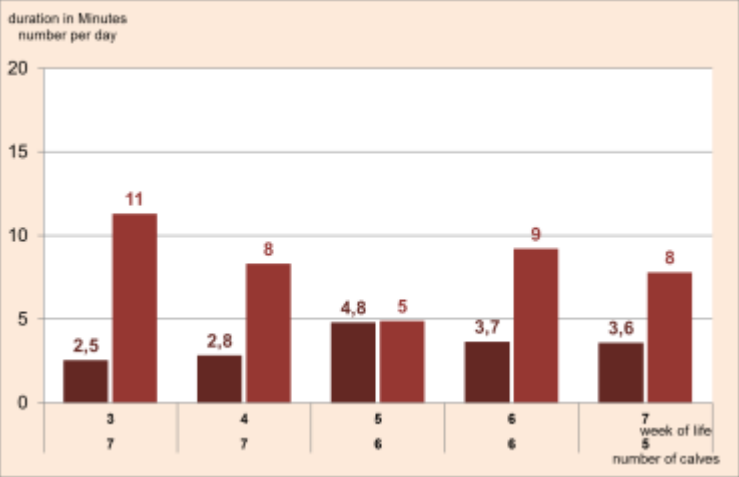
Activity time per day in hours
Other activities per day in hours
Rate of other activities

DEVIATIONS FROM NORMAL BEHAVIOUR

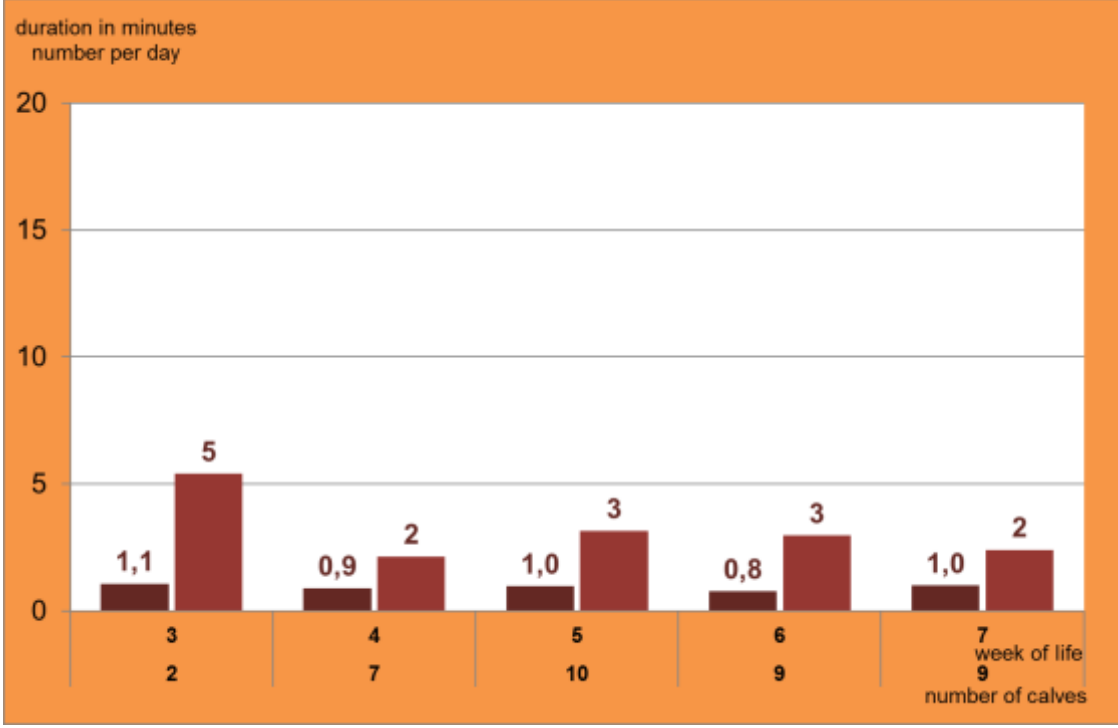
Visits without entitlement 8 / 10 / 12 | CMR-feed allowance (ACMR) up to 28th resp. 49th DL



ACMR: 8 | to 28th DL, n = 4 calves



ACMR: 10 | to 28th DL, n = 7 calves

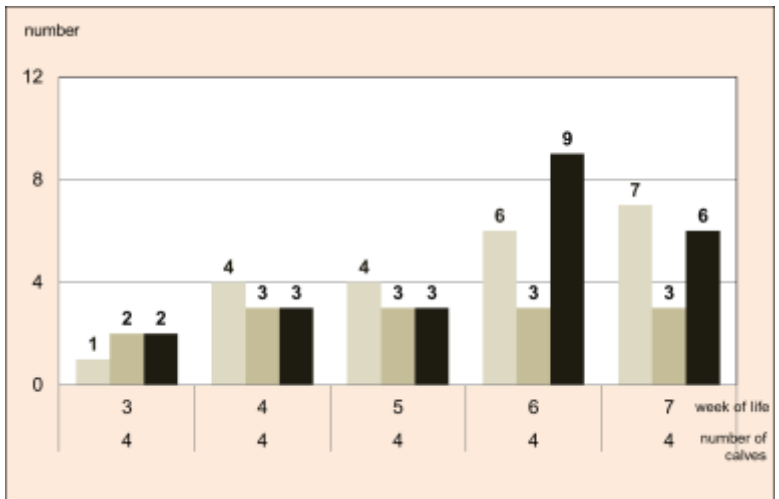


ACMR: 12 | to 49th DL, n = 10 calves

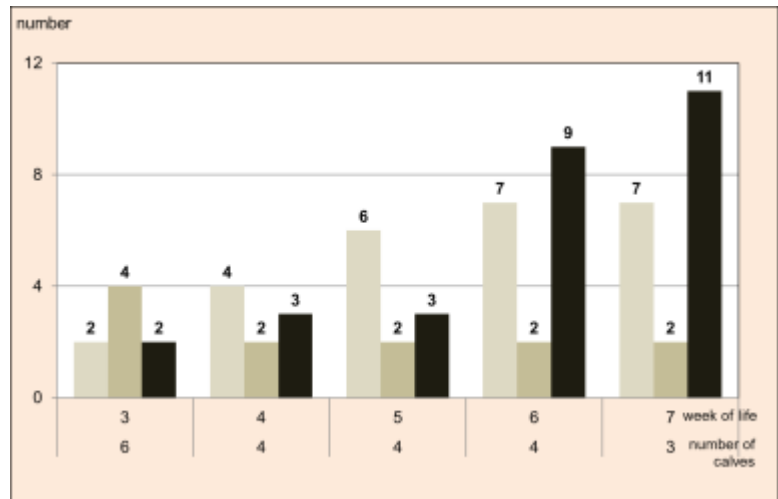
Number of visits without entitlement
Duration of visits without entitlement

DEVIATIONS FROM NORMAL BEHAVIOUR

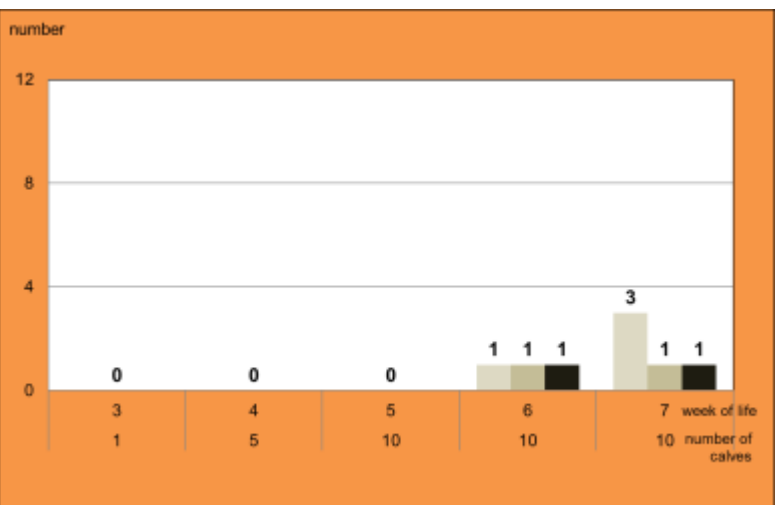
Cross-sucking, Genotype GH,
8 / 10 / 12 | ACMR up to 28th resp. 49. DL



ACMR: 8 | to 28th DL



ACMR: 10 | to 28th DL



Number of days with cross-sucking activities
Number of cross-sucking calves per week
Max. number of sucking sessions per day

ACMR: 12 | to 49th DL



SUMMARY

Normal behaviour up to the 49th day of life

- Resting and activity
- Feed intake
- Other activities
(Locomotion, exploration, elimination, gaming and social behaviour, water intake)

Regardless of the CMR-feed allowance and the beginning of the weaning

- Resting: 15 to 16 hours per day
- Daily rhythm in the duration and frequency of the periods of rest and activity
 - Main activity times in the morning, afternoon and evening

Differences depending on the CMR-feed allowance and the beginning of the weaning

- Share of other behaviour in the activity time
 - Indicator of well-being
 - Goal: more than 85 %



SUMMARY

Deviations from normal behaviour up to the 49th Day of Life

Visits at the dispensing station of the automatic feeder without entitlement

- max. 1 to 2 per animal and day
- Duration: each less than 1 min

Cross-sucking

- German Holstein: few individual calves
- possibly exclude them from breeding

Reduction in number and duration by at least 12 l CMR-feed allowance up to 49th day of life



CONCLUSIONS



CONCLUSIONS

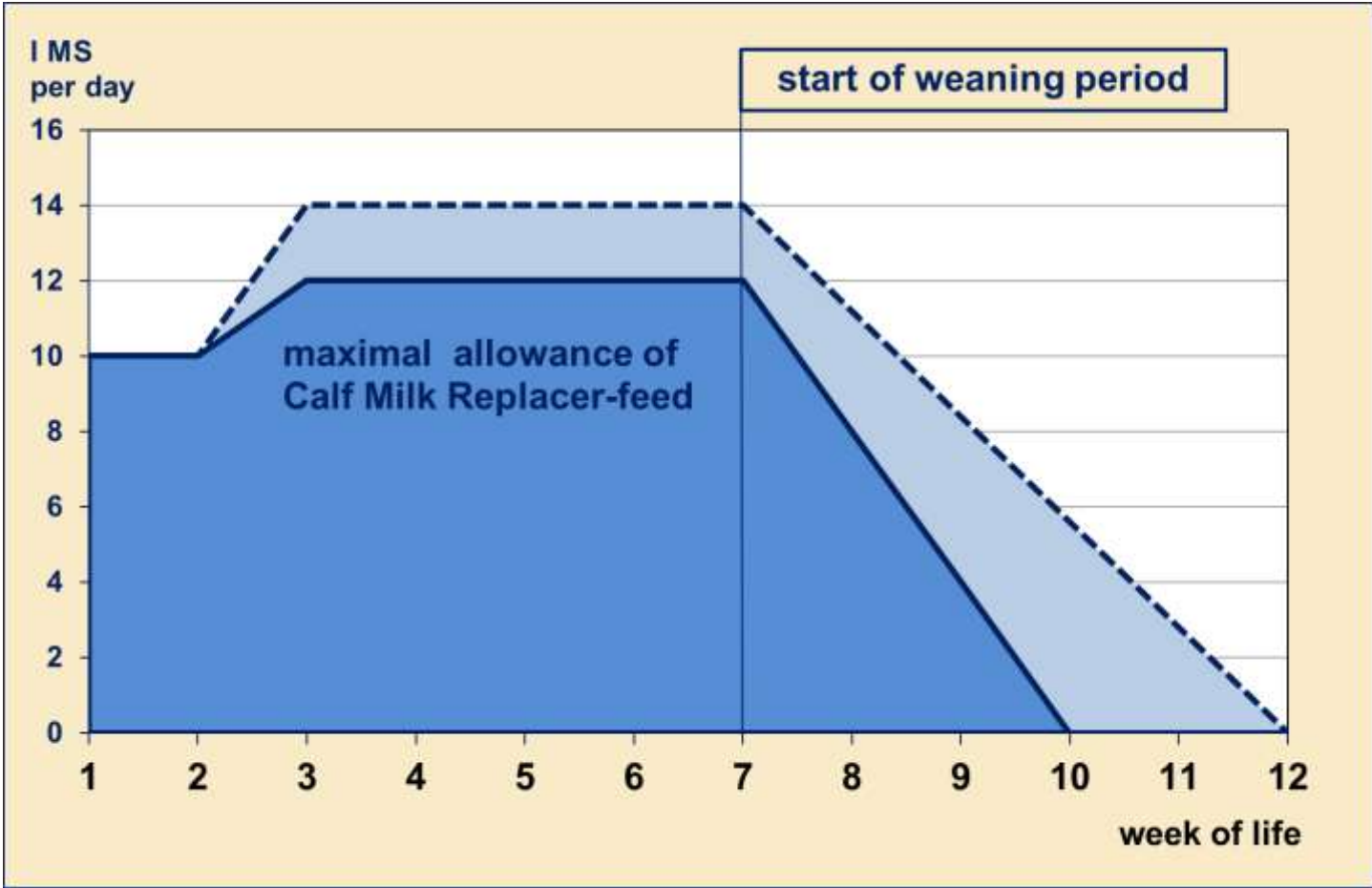
Recommendations for intensive calf rearing, German Holstein

- **Water and supplementary feeds** (hay, trough feed) **ad libitum**
- **Individually housed to 21st day of life:**
 - At least 10 l mixed colostrum/whole milk to 14th Day of Life
 - At least 12 l whole milk or CMR-feed from 14th Day of Life
- **Keeping in groups from 21st day of life :**
 - At least 12, better 14 l CMR-feed per calf and day
 - Weaning period from 50th day of life
- **Weaning**
 - Maximal allowance of CMR-feed 12 l: from 70th day of Life
 - Maximal allowance of CMR-feed 14 l: from 85th day of Life

CONCLUSIONS



Milk feeding system for intensive calf rearing, German Holstein





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Thank you for your attention!