Session 9

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Effect of an energy restriction in Belgian Blue double-muscled cows on feed efficiency

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Two experiments (E1 and E2), using 20 and 13 Belgian Blue double-muscled (BBDM) cows, were conducted to investigate the effect of a quantitative energy restriction on feed efficiency. Cows were housed in tie stalls, divided in 2 groups and fed a restricted amount of maize silage, 0.5 kg daily of a premix and a fixed amount of urea. E1 consisted of two periods of 112 days. Cows were fed either 100 or 70% of their energy requirements during the first period (P1), and 100 or 130% during the 2nd period (P2). Weight change (ΔW) during P1, P2 and P1+P2 averaged -4.0, 9.1 and 5.1 kg for group 1, and –63.8, 82.8 and 19.0 kg, respectively, for group 2. Extra ΔW of group 2 was realized with a slightly lower net energy intake of 179.5 MJ. E2 consisted of a restriction period of 140 d (P1), where cows were fed at 100 or 80% of their energy requirements, followed by a 70-day re-alimentation period (P2), where maize silage was fed to appetite. Respective ΔW during P1, P2 and P1+P2 averaged -4.4, 83.8 and 79.4 kg (group1), and -45.5, 88.5 and 43.0 kg (group2). Total ΔW was higher for group 1 than for group 2 (P=0.026). Mean daily energy intake averaged 37, 64 and 46 MJ for group 1 vs. 29, 59 and 39 MJ for group 2. Intake was lower for group 2 than for group 1 during P1 (P<0.001) as well as during P1+P2 (P=0.016). However, feed efficiency was worse for group 2 than for group 1 during P1+P2 (P=0.046) so that energy restriction seems not appropriate for BBDM cows.

Background

- A cyclic weight loss and a restoration of body reserve tissue is often applied in beef cows to make maximum advantage of cheap feeds
- Vermorel e.a. (1976): adverse effect of an energy restriction on growth rate and feed efficiency in double-muscled bulls
- What about Belgian Blue double-muscled cows?
  - Less body fat, more lean meat (= less reserve tissue)
  - Lower intake capacity

Experimental design

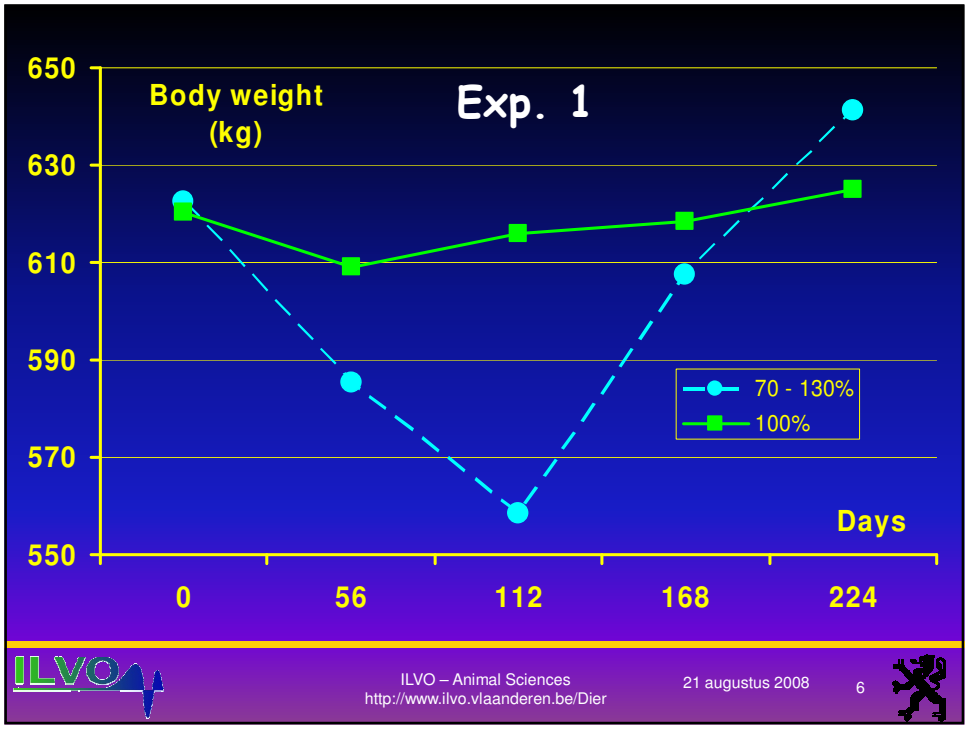
2 experiments: tie stalls; sawdust as bedding

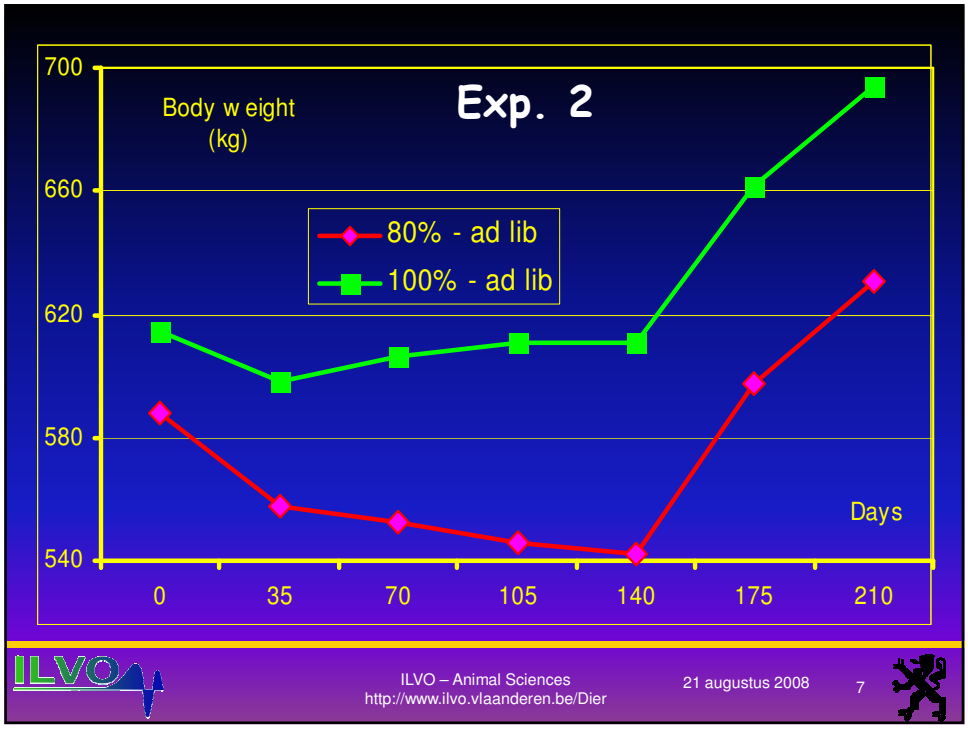
	Exp. 1	Exp. 2
Cows	2 x 10 BBDM	7 + 6 BBDM
	non-pregnant non-lactating	
Initial weight	621 ± 81 kg	602 ± 106 kg
Parity	2.2 ± 1.3	1.8 ± 1.1
BCS (0-5)	1.7 ± 0.4	2.0 ± 0.5
Treatments 1	100%; 2 x 112 d	80 vs. 100%: 1-140 d
2	70% 112 d; 130% 112d	141-210 d: ad lib
Diet	maize silage, 0.5 kg vit.-mineral premix, urea	
Stat. analysis	ANOVA	

Results — Body weight (kg; BW)

Feeding level (%)	100	70-130	100-a.l.	80-a.l.
Initial BW	620	622	615	588
BW end 1st period	616	558	610	542
Final BW	625	641	694	631
BW change (kg/d)				
1st period	-0.04	-0.57*	-0.03	-0.33*
2nd period	0.08	0.74*	1.20	1.26
Total experiment	0.02	0.09	0.38	0.21*

* P < 0.05





Daily intake

Feeding level (%)	100	70 - 130	100-a.l.	80-a.l.
Dry matter (kg)				
1 - 140 d	6.48	4.57*	6. 26	4.95*
141 - 210 d	6.57	8.23*	10.39	9.52
1 - 210 d	6.53	6.40	7.64	6.47*
NEL (MJ)				
1 - 140 d	39.9	27.6*	37.0	28.9*
141 - 210 d	40.5	51.1*	64.1	58.7
1 - 210 d	40.2	39.4	46.0	38.8*

* P < 0.05

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8

Feed efficiency ratio

Feeding level (%)	Control	Experim.		SD	P
Exp. 1 (224 d)					
g gain/kg DM	3.6	12.4		25.1	0.440
g gain/MJ NEL	0.6	2.0		4.1	0.439
Exp. 2					
Day 141-210					
g gain/kg DM	116	133		22	<0.001
g gain/MJ NEL	130	149		25	<0.001
Day 1-210					
g gain/kg DM	50	32	-36%	18	0.090
g gain/MJ NEL	57	36	-37%	21	0.093

Mechanisms involved

- Improved digestibility at lower feeding level (Fiems et al., 2007)
- Lower maintenance requirements
  - Lower heat production
  - Reduced organ size
- Endocrinological effects: GH, IGF

Mechanisms involved

- BW loss = also loss of protein: N excretion requires ATP (ornithine cycle)
- Reduced intake capacity of double-muscled animals so that they are unable to compensate the lower intake of the previous period
- Acute phase protein response: suboptimal health?
  - Yoshino e.a., 1993
  - Gruys e.a., 2005
  - Early e.a., 2006

  ⇨ starvation ⇨ haptoglobin ↗
  production of APP requires energy!

Conclusions

- It is at least possible and even efficient for BBDM cows to maintain BW by a feed restriction (70%) followed by a re-alimentation (130%; fluctuating level) compared to a constant level of 100%
- Overall feed efficiency was worse for cows fed below their energy requirements, followed by ad lib intake, indicating that an energy restriction below the requirements is not advisable in BBDM cows.