



AARHUS  
UNIVERSITY  
DEPARTMENT OF ANIMAL SCIENCE

**Eating Quality of bull calves fed only  
grass or herbs match that of  
concentrate-fed veal calves**

**M. Therkildsen, S.K. Jensen & M. Vestergaard\***

# Background (I)

- The rules/regulations for organic farming in Denmark require:
  - that bull calves are raised outdoor at least 6 months a year
  - that animals are fed at least 60% roughage of the total diet
- These rules are a constraint for an organic production of beef based on the bull calves born in the organic dairy herds:
  - extra labor costs
  - expected lower growth rate
  - difficulties in raising bull calves outdoor
  - possibly lower meat quality and
  - lack of sufficiently high organic premium payment for the carcass

# Background (II)

- Thus, the bull calves are sold for conventional fattening
- Consequently, supply of organic beef from young cattle is very limited
- In order to achieve the necessary higher payment for beef from organic-raised young cattle, it is important that consumers 'like' the beef from grass- and herb-fed young cattle
  - **Can we add some extra value or health-beneficial properties ?**



# Objective

- The present experiment aimed at elucidating the effect of purely grass or herb feeding of bull calves for 8 weeks prior to slaughter on colour, fatty acid composition, vitamin content and eating quality of the meat in comparison with meat from traditional rosé veal calves fed a concentrate-based diet
- **How big a change can we make in n6 : n3 ratio of the meat?**

# Material and Methods (I)

- Twelve Holstein bull calves raised on a concentrate-corn silage-based TMR until the age of 8 months
- From 8 to 10 mo. of age bulls were fed either purely:
  - grass (Grass, n=6)
  - herb-based green feed (Herbs, n=6)
- After two weeks of adjustment the diet consisted of fresh grass or herbs only, which was cut daily and offered every morning
- Bull calves were housed in two similar pens (5 m<sup>2</sup> per calf) of 6 animals
- A calf (trt: Herbs) suffered from chronic pneumonia and was excluded from the data
- The experimental period lasted for the final 6 weeks
- Feed intake was recorded daily per pen

# Material and Methods (II)

- Calves were weighed twice at the beginning of the experimental period and twice at the end of the period
- Calves were fed until transported for 1 h to a commercial slaughter plant (Danish Crown, Aalborg, Denmark)
- At the day of slaughter six carcasses from traditionally 9-10 months old rosé veal calves (Holstein bull calves) were identified at the slaughter house and included as a control group (Con)
- Analyses of FA and vitamins in two muscles
- Sensory evaluation on two muscles (LD as steak) and SM as roast (both prepared to 63°C internal temperature)

# Housing conditions

Start of experiment



# Grass and herbs swards as fed to the calves

Danish name	English name	Latin name	Grass	Herbs
			% in sward	
Lancet-vejbred	English plantain	<i>Plantago lanceolata</i>		56.4
Bibernelle	Salad burnet	<i>Sanguisorba minor</i>		4.6
Esparsette	Sainfoin	<i>Onobrychis viciifolia</i>		6.1
Hvid stenklover	White melilot	<i>Melilotus alba</i>		5.7
Alm. røllike	Yarrow	<i>Achillea millefolium</i>		3.9
'Ukrudt'	'Weeds'		14.0	18.4
Hvidkløver	White clover	<i>Trifolium repens</i>	2.4	4.3
Almindelig rajgræs	Perennial ryegrass	<i>Lolium perenne</i>	83.6	0.7

NB: The proportion of white melilot and 'weeds' increased in the orts from Herbs, indicating less dietary preferences for these.



# Composition of feeds

(higher nutrient value of Grass than of Herbs)

	Grass	Herbs
Dry Matter (DM), %	13.5	12.9
<b>Kg DM/Scand Feed Unit*</b>	<b>1.13</b>	<b>1.37</b>
Fill Unit/Scand Feed Unit*	1.23	1.55
NDF, % of DM	46.3	39.2
Ash, % of DM	10.8	10.9
Crude protein, % of DM	19.9	18.1
<b>Digestible Organic Matter, %</b>	<b>77.2</b>	<b>67.7</b>

\*Scand Feed Unit = 7.89 MJ of NE

# Feeding during the final week of experiment



**Grass**



**Herbs**

# Feed intake per pen (6 weeks before slaughter)

Feeding	Grass	Herbs
Number of calves	6	6*
Fresh feed, kg/d	51	61
DMI, kg/d	6.9	7.8
Kg DM/SFU	1.13	1.37
NEI, Scand Feed Units/d	6.1	5.7

\*One calf from Herbs had a very low ADG (420 g/d) and was probably not eating as much as the other 5, which contributes to the overall 7% lower NEI on Herbs compared with Grass. This calf was excluded from the meat quality analyses

# Performance and carcass quality of Grass- or Herbs-fed calves compared with concentrate-fed bull calves (Con)

Feeding	Grass	Herbs	Con	<i>P</i> -value
Number of calves	6	5	6	
Age at slaughter, d	299	299	< 305	n.s.
ADG (6 wks), g/d	987	969	~ 1300	n.s.
LW at slaughter, kg	363	365	~ 390	n.s.
Carcass weight, kg	178	185	197	0.10
Dressing, %	49.0	50.7	~ 50.5	0.09
EUROP Conform.	2.7 <sup>a</sup>	2.9 <sup>a</sup>	3.7 <sup>b</sup>	0.004
EUROP Fatness	1.7	1.8	2.2	n.s.
Lean/fat color	3.0	2.8	3.0	n.s.



# pH and temperature of carcass

Feeding	Grass	Herbs	Con	<i>P-value</i>
Number of calves	6	5	6	
pH 2 h pm	6.63	6.62	6.65	n.s.
Temp 2 h pm, °C	34.4	33.5	35.0	n.s.
pH 72 h pm	5.86	5.82	5.92	n.s.
Temp 72 h pm, °C	<b>2.3<sup>a</sup></b>	<b>2.5<sup>a</sup></b>	<b>2.8<sup>b</sup></b>	<b>0.002</b>

<sup>a,b</sup>values with different superscript are significantly different (P<0.05)



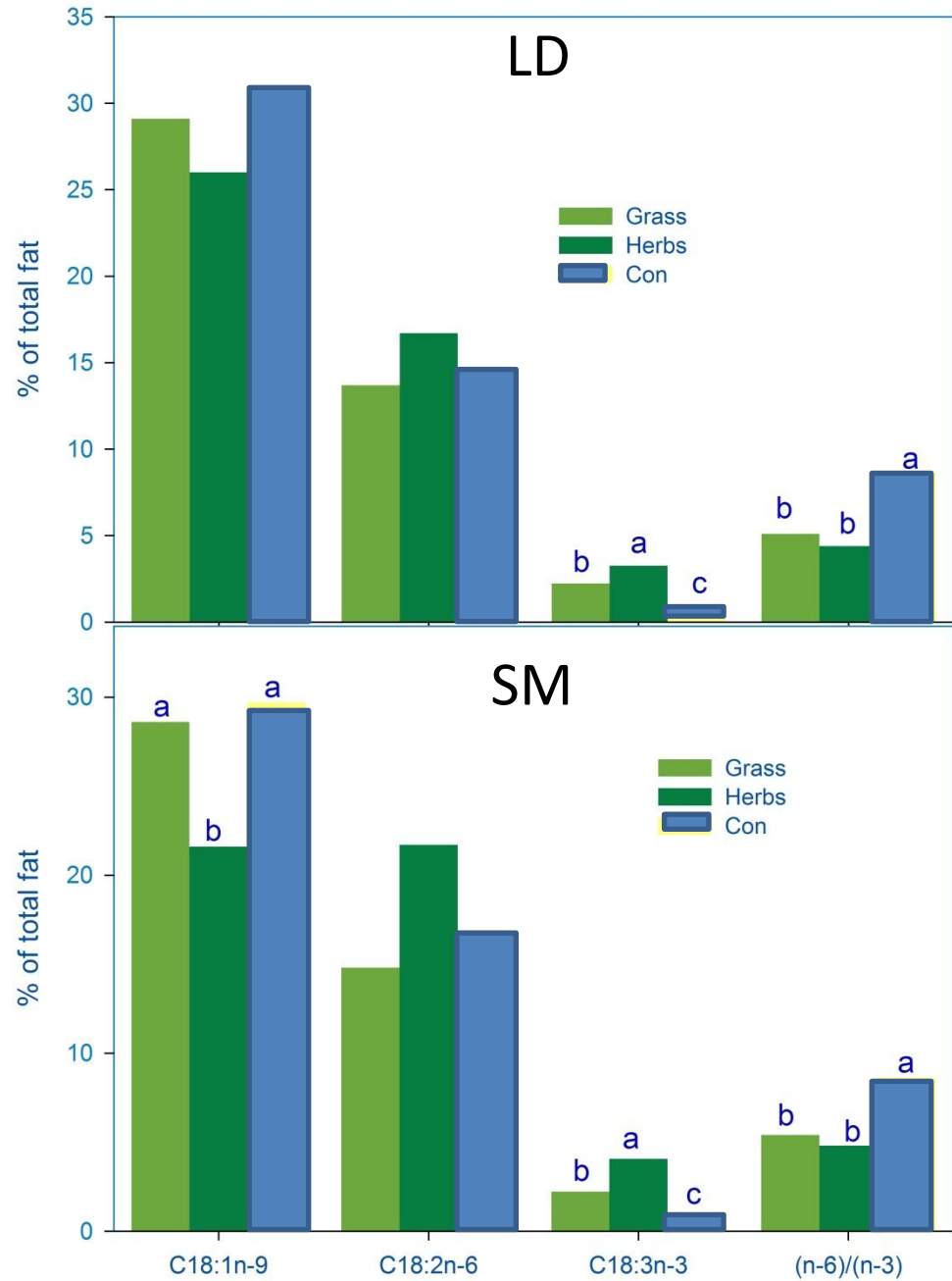
# Eating quality (*M. Longissimus dorsi*)

Feeding	Grass	Herbs	Con	P-value
<i>M. longissimus dorsi</i>				
Odour				
Meat	6.3	7.6	6.5	0.16
Acidic	5.2	5.2	5.3	0.82
Sweet	3.5	3.5	3.5	0.99
Metal	4.8	5.0	4.5	0.29
Flavour				
Meat	<b>7.1<sup>a</sup></b>	<b>8.2<sup>b</sup></b>	<b>7.2<sup>a</sup></b>	<b>0.03</b>
Acidic	<b>6.2</b>	<b>6.4</b>	<b>5.8</b>	<b>0.08</b>
Sweet	4.3	4.2	4.2	0.97
Metal	4.6	4.9	4.5	0.48
Texture				
Hardness at 1 <sup>st</sup> bite	6.0	5.3	7.0	0.19
Juiciness	<b>7.7<sup>a</sup></b>	<b>8.3<sup>b</sup></b>	<b>7.5<sup>a</sup></b>	<b>0.014</b>
Tenderness	6.6	7.5	5.6	0.29

# Eating quality (*M. semimembranosus*)

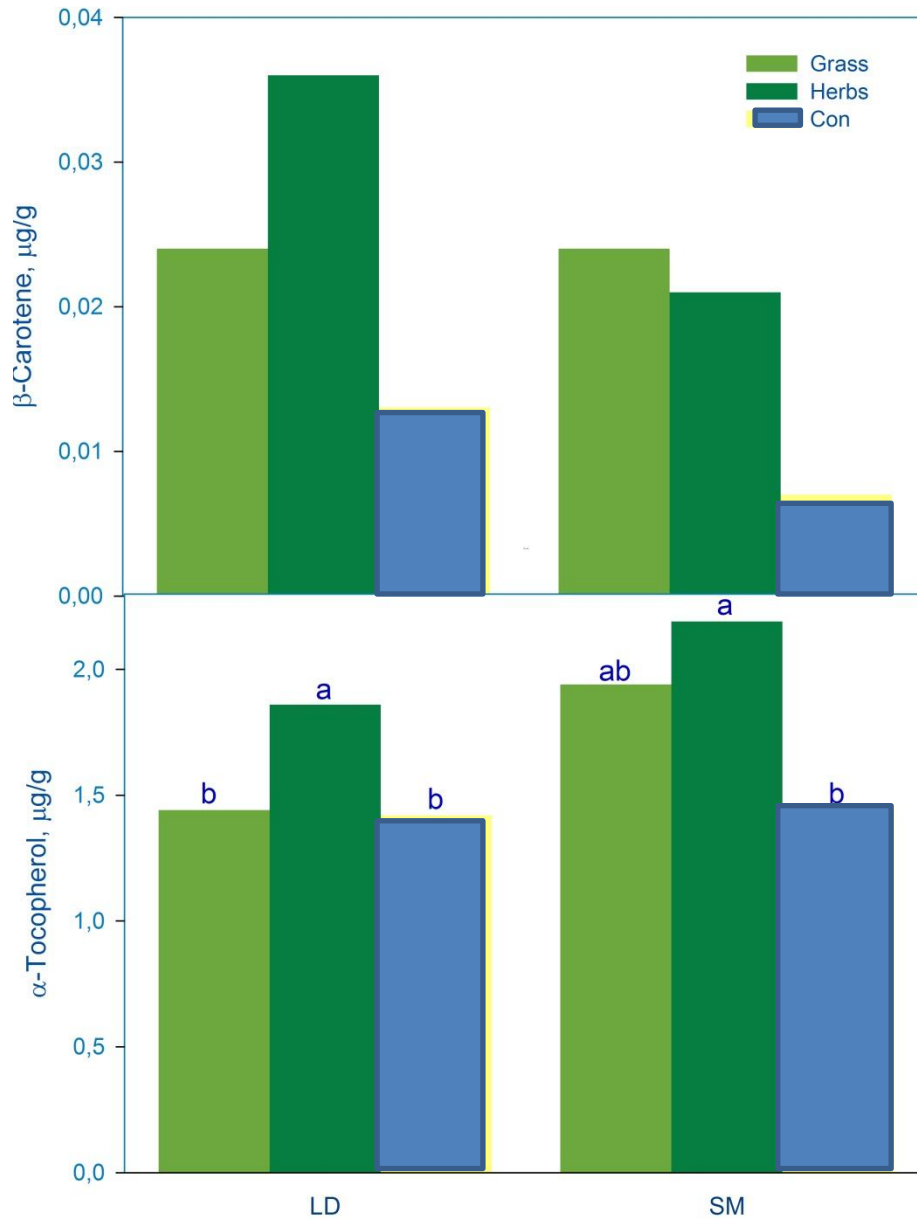
Feeding	Grass	Herbs	Con	P-value
<i>M. semimembranosus</i>				
Odour				
Meat	4.6	4.8	4.4	0.13
Acidic	4.2	3.9	4.0	0.42
Sweet	3.5	2.9	3.2	0.21
Metal	2.5	2.5	2.1	0.16
Flavour				
Meat	<b>6.1</b>	<b>5.8</b>	<b>5.5</b>	<b>0.07</b>
Acidic	5.9	6.0	6.5	0.30
Sweet	3.4	3.2	3.0	0.19
Metal	4.1	4.2	4.5	0.70
Texture				
Juiciness	5.9	6.5	6.9	0.40
Tenderness	8.0	7.8	7.5	0.84

# Fatty acids in two muscles (LD and SM)





# $\beta$ -carotene and $\alpha$ - tocopherol in two muscles (LD and SM)



# n6 : n3 ratio and carcass fatness in veal/beef

	Present study		Fisker et al. 2012		French et al. 2000		Fraser et al. 2009	
Feeding	Conce ntrates / straw	Grass/ Herbs	Grass silage 60%/ grain 40%	Pasture	Fresh grass	Grass silage ad lib + 4 kg conc.	Perma- nent pasture	Semi- natural rough grazing
Period	7 mo.	2 mo.	7 mo.	5-6 mo.	3 mo.	3 mo.	3 mo.	3 mo.
<b>n6: n3 ratio</b>	<b>8.6</b>	<b>4.4- 5.4</b>	<b>2.4- 4.4</b>	<b>1.9- 2.4</b>	<b>2.3</b>	<b>3.6</b>	<b>1.0</b>	<b>1.0</b>
EUROP fatness	2.2	1.7-1.8	1.2-2.2	1.0-1.2	3.9	4.0		

# Conclusions

- The present experiment shows that there are no drawbacks in finishing young bull calves for 6 weeks on purely grass sward or purely herb-based sward in comparison with concentrates when it comes to meat and eating quality
- The meat of grass- and herbs-fed calves has similar colour and sensory profile
- Herbs has a positive effect on the 'health-related' quality as herbs increase the content of vitamins A and E, linoleic and  $\alpha$ -linolenic acid and improves the n-6 :n-3 ratio





**Thank you for your attention**