

A comparison of beef breed bulls for beef production & carcass traits

"Future cattle production"-seminar Viikki Campus 23.08.2013 Maiju Pesonen

Outline of the presentation



- Beef production in Finland
 - Numbers, reasons & "goals"
- Data collected from four biggest slaughter houses
 - Growth figures
 - Carcass quality
- Three experiments with beef breed bulls
 - Cross breeding
 - Growth, carcass & beef quality
- Opportunities & conclusions



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Beef production in Finland 82,6 milj. kg



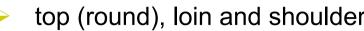
Consumption 93 milj. kg/year. From last year beef production has declined 5 %

	% slaughtered	Carcass weight, kg	% t	otal production	
<u>Bulls</u>					
Dairy	82	331		79	
Beef-dairy crossbreds	5	372		6	
Beef breed	13	394		15	
<u>Heifers</u>			-		
Dairy	58	228		56	
Beef-dairy crossbreds	17	242		17,5	
Beef breed	25	253		26,5	
Cows					
Dairy	88	271		86	
Beef	12	332	od Pesea	14 rch Finland Maiju Pesonen	

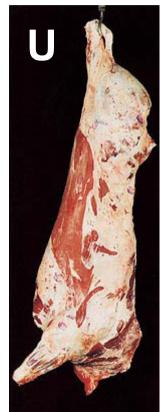
EUROP-classification

- Carcases are classified by assessment of conformation
- Conformation is determined by a visual appraisal of shape









- The carcass price:
- Weight
- Conformation
- Fat class



- 15 conformation classes
- Dairy breed carcasses mainly in O and P
- Beef breed origin should aim for above R-





Five EUROP fat classes

Fat class 1: no fat cover

Fat class 2: slight fat cover

Fat class 3: average fat cover, except the round and shoulder

Fat class 4 most areas of flesh covered with with fat, >2-4mm fat, <2mm

Fat class 5 carcass covered



- ✓ Fat is determined by visual assessment of external fat cover.
- ✓ Fat classes 2 (2/3) & 3 (1/3) are prefered

Carcass quality is a comercial concept which indicates the value of the carcass



Beef quality is an eating experience

Carcass quality

- Killing out %
- Conformation
- Fat cover
- Yield (quantity of saleable product)

Beef quality

- Shear force (indicates tenderness)
- Meat & fat colour
- pH
- Marbling = IMF%
- Palatability (texture, juiciness, flavour)
- Wholesomeness (nutritional quality, chemical & microbiological safety)

Beef breed bulls in carcass data collected from abbtoirs



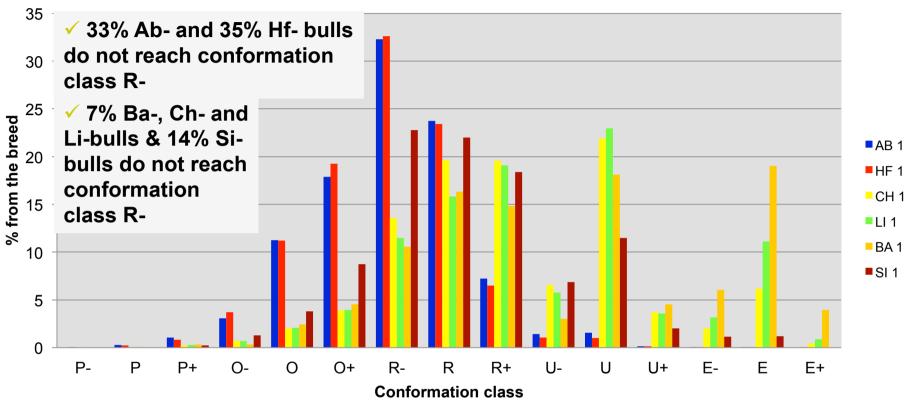
- The experiment data set has carcass information from <u>21 643</u> beef breed bulls (sire & dam same breed, age 365-660 d)
- Atria, HkAgri, Snellman, Saarioinen (2007-2011)

		Ab	Ba	Ch	Hf	Li	Si
Number of animals	n	4068	344	4421	6329	4335	2152
Age at slaughter	d	571	570	552	572	571	565
Days on feed (220 d)	d	351	350	332	352	351	345
Net gain (from birth 16 kg)	g/d	619	663	724	618	660	686
Slaughter weight	kg	368	399	413	368	391	402
EUROP-conformation class	1-15	6,9 (R-)	10,3 (U-)	9,3 (R+)	6,9 (R-)	9,7 (U-)	8,3 (R)
EUROP-fat class	1-5	3,3	1,8	2,2	3,2	2,2	2,3

- The shortest growing up period and the highest net gain in ch bulls
- Hf and ab bulls had the lightest carcass weights and the lowest net gains
- The best conformation scores for ba and li-bulls, following with Ch
- Ba has the least fat, following with Ch, Li and Si

EUROP conformation classes within breeds

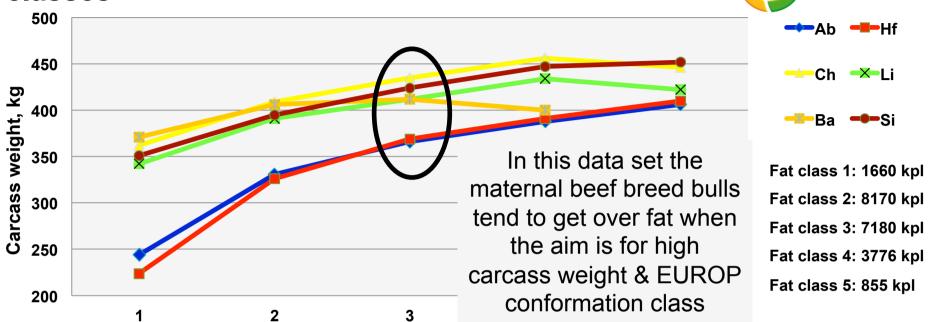




- √ 33% Hf-bulls, 32% Ab-bulls are in conformation class R-
- ✓ 23% Hf-bulls, 24% Ab-bulls are in conformation class R
- √ 6% Hf-bulls, 7% Ab-bulls are in conformation class R+
- ✓ 2% Hf-bulls, 3% Ab-bulls are in conformation class U- & U

✓ 54 % Ch-, 46% Li-, 42% Ba- and 63% Sibulls in conformation class R
✓ 33% Ch-, 33% Li-, 26 %- Ba and 20% Sibulls in conformation class U
✓ 8% Ch-, 15% Li-, 24% Ba- and 2 % Si-bulls in conformation class E

Beef breed bulls' carcass weight in different fat classes



Breed	Carcass weight kg, in fat class 3	Carcass weight kg, in conformation class R-	Carcass weight kg, in conformation class O+
Ab	366	376	350
Hf	369	379	345
Ch	435	369 (U- 441)	292
Li	412	352 (U 414)	317
Ва	412	350 (E- 419)	325
Si	424	381 (R+ 422)	344

Fat class

Commercial cuts in the experiments



- The cut yield reveals commercial value of the carcass
- In the commercial cut the right side of the carcass was divided to fore- and hind quarter
- 8 primal cuts
- Fore quarter: rib, chuck & blade, clod, neck
- · Hind quarter: tenderloin, flank, sirloin, rump & top silverside
- The primal cuts were cut to commercial cuts:
 - Trimmed tenderloin
 - Trimmed loin
 - Entrecote
 - Inside round
 - Outside round
 - Corner round
 - Roast beef

- N0 –selection (< 12 % fat)
- N2 –selection (< 20 % fat)
- N3 –selection (30 % fat)
- N5 –selection (10 % fat; includes tendons, membranes, connective tissue)
- N6 –selection (70 % fat)
- Bones



The most valuable cuts

trimmed tenderloin, loin and entrecote (10,00 – 18,90 €/kg)

Valuable cuts

outside-, inside- & corner round & roast beef, N0 (4,30 – 6,70 €/kg)

Less valuable cuts

N2- & N3-selections (2,10 - 2,90 €/kg)

Low value cuts

N5- & N6-selections and bones (-0,04 – 0,34 €/kg)

Beef breed carcasses should be to have better than average conformation

Experiment 1: Growth and carcass traits (concentrate level 37-41% in DM)

8 animals/breed	Breed				
	Hf	Ch x Hf	Ch		
Age, d	577	568	559		
Days on feed, d	394	385	376		
Slaughtering age, m	18,9	18,9	18,8		
Starting weight, kg	254	289	312		
Final weight, kg	764	827	865		
Carcass weight, kg	414	476	507		
Daily gain, g/pv	1300	1391	1476		
Net gain, g/pv	729	861	937		
Killing out %	54,1	57,6	58,6		
Conformation, EUROP	R (7,9)	U- (10,3)	U+ (12,4)		
Fat class, EUROP	3,8	2,9	2,9		

Experiment 1: Carcass yield and the share of valuable cuts



8 animals/breed				
	Hf	Ch x Hf	Ch	
Bones, kg	73,8	84,4	91,0	
Meat yield, kg	340,2	391,6	416	***
Share from the carcass we	eight, %			
Bones	17,8	17,5	17,8	
Meat (without bones)	82,2	82,5	82,2	
The most valuable cuts	5,6	5,9	6,3	***
Valuable cuts	42,0	46,0	48,2	***
Less valuable cuts	22,2	21,0	19,4	*
Low value cuts	30,3	27,1	26,0	***
Value, €/kg	3,08	3,28	3,39	***

[✓] The outcome of the purebred terminal breed was the best

[✓] The crossbred were closer to the terminal breed

Experiment 2: Growth and carcass traits (concentrate level 29-36 % in DM)



8 animals/breed		Breed	
	Ab	Li x Ab	Li
Age, d	525	546	561
Days on feed, d	345	385	353
Slaughtering age, m	17,2	17,9	18,4
Starting weight, kg	285	276	325
Final weight, kg	705	718	732
Carcass weight, kg	391	399	439
Daily gain, g/pv	1224	1152	1154
Net gain, g/pv	726	679	785
Killing out %	55,5	55,5	60,0
Conformation, EUROP	(R-) 7,37	(R+) 9,13	(E-) 13,25
Fat class, EUROP	3,75	3,25	2,14

Experiment 2: Carcass yield and the share of valuable cuts



8 animals/breed				
	Ab	Li x Ab	Li	
Bones, kg	71,9	71,4	73,4	
Meat yield, kg	319,4	327,3	365,4	***
Share from the carcass we	eight, %			
Bones	18,2	17,8	16,6	**
Meat (without bones)	81,6	82,1	83,3	**
The most valuable cuts	5,9	6,2	6,7	***
Valuable cuts	41,9	45,3	51,8	***
Less valuable cuts	24,3	22,9	19,8	***
Low value cuts	27,9	25,5	21,6	***
Value, €/kg	3,15	3,35	3,62	***

[✓] The outcome of the purebred terminal breed was the best

The crossbred were closer to the terminal breed

Fatty acid composition



- According to our experiment the intra muscular fat of <u>hereford</u> turned out to have more healtier n-6/n-3-fatty acid ratio than charolais
- The experiment showed that <u>low concentrate level in bulls' diet had</u> <u>favorable effects on the fatty acid composition of the beef</u> in terms of human nutrition (contrate level 20 % vs. 50 % in DM with or with out rapeseed meal)
- Lower contrate level improved the ratio of omega-6/omega-3 fatty acids and reduced the amount of oleic acid in intra muscular fat.
 - As the forage level gets higher in the diet lower (=better) the ratio of omega-6/omega-3 –fatty acids in the imf (Daley et al. 2010).
- In this experiment the only effect of rapeseed meal on the fatty acid composition was on palmitic acid. The diet which had rapeseed 0,5 kg/d in DM lowered the amount of palmitic acid.

Beef quality traits were evaluated



8 days aging time at + 4 °C

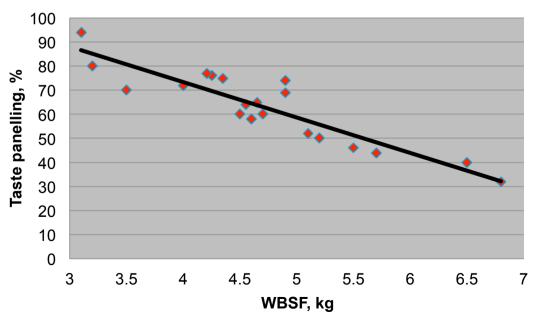
After 8 days:

- Drip loss
- Shear force (WBSF) measurements from loin samples (thickness1,5 cm, core temperature + 70 °C)



Scale (shear force kg/cm²):

- ➤ <u>Tender beef</u> 4,20 - 11,30 (9,4)
- Normal beef11,31 16,80
- ➤ Tough beef 16,81 26,00





Marbling was evaluated with a scale of 0-5





8 animals of each breed	Breed				
	Hf	Ch x Hf	Ch		
Marbling					
Loin	1,5	1,25	0,88		
Entrecote	1,19	0,69	0,56		
Drip loss (loin), %	0,49	0,54	0,76		
Shear force, kg/cm ²	10,0 (9,24-10,76)	10,5 (9,74-11,3)	11,9 (11,1-12,76)		
8 animals of each breed	Ab	Li x Ab	Li		
Marbling					
Loin	1,56	1,25	0,66		
Entrecote	1,34	0,94	1,25		
Drip loss (loin), %	0,78	0,93	0,88		
Shear force, kg/cm ²	13,2 (6,5 - 27,9)	11,3 (9,5 - 13,6)	12,1 (8,3 - 19,2)		

Sensory evaluation made by the taste panel



- Meat research institute's taste panel consists 4-6 experts
- Wet aging for 8 days
- Scale 1-7 (tenderness, juiciness, taste)
- Total points: 3 21
 - Bad 3,0 9,0
 - Normal 9,1 14,0
 - **>** Good 14,1 18,0
 - Very good 18,1 21,0



- 1,5 cm thick pieces from loin
- Rolling grill
- Internal temperature + 68 °C

8 animals of each breed	Breed		
	Hf	Ch x Hf	Ch
Sensory evaluation			
Tenderness	6,1	5,6	5,2
Juiciness	5,6	5,3	5,2
Taste	5,8	5,5	5,5
Total	17,5 ***	16,4	15,9
8 animals of each brred		Breed	
	Ab	Li x Ab	Li
Sensory evaluation			
Tenderness	5,5	5,6	5,6
Juiciness	5,7	5,2	5,4
Taste	5,7	5,5	5,7
Total	16,9	16,4	16,7

Days on feed and carcass weight



- Long fattening periods affect negatively conformation and beef eating quality
- Steady, good growth is advantageous for good quality final product (good carcass conformation, palatability of beef)
- Very large carcass weights (over 480 kg) are unfavorable for the eating quality of beef & valuable cuts are too large
- Beef eating quality decreases after 20-24 months of age in bulls (tenderness, colour)
 - Amount of connective tissue increases + the crosslinking in the connective tissue = toughness increases
 - Aging does not cure the problem
 - Mechanically tenderize (minced meat)



- ✓ Systematic crossbreeding of maternal- and terminal beef breeds improves EUROP-carcass quality and palatability of beef
 - Breed can have a major effect on beef eating quality (tenderness, juiciness, taste)
 - ✓ The goal of every beef producer should be to seek for a first class product = tasty & tender beef

