Locomotion as a New Trait: First Results from Denmark

Dorothee Boelling

Anders Fogh

Ulrik Sander Nielsen

Danish Agricultural Advisory Service
National Centre

Introduction

- Aim to improve mobility traits genetically

- Locomotion as a new (test) trait in DK

- 3 breeds: Red Danish, Holstein, Jersey

- Characteristics of the trait

- Calculation of genetic parameters (h^2, r_g)

- Summary and conclusion

Danish Agricultural Advisory Service
National Centre

Data Sets

Data from August 2004 to March 2007

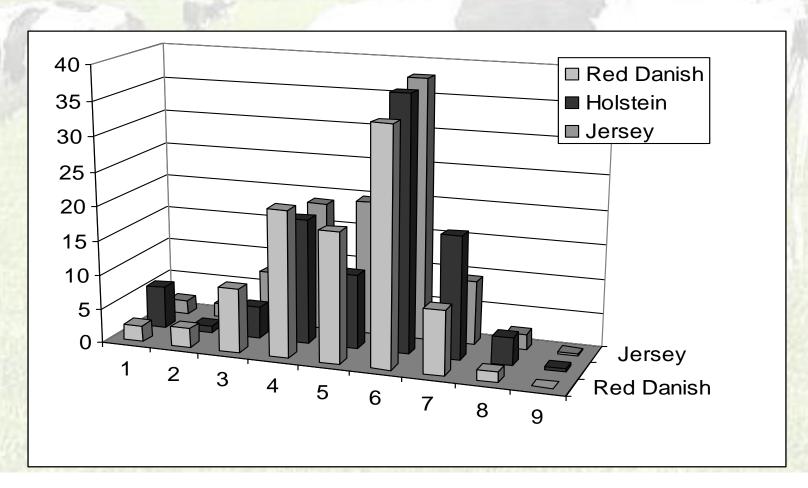|	Red Danish	Holstein	Jersey
Lactation 1	6,307	56,470	6,969
% of lin. class.	22.3%	36.9%	25.6%
Lactation 2-3	867	22,784	1,425

Danish Agricultural Advisory Service
National Centre

Locomotion Scoring System

	Movements of Legs	Lengths of Strides	Gait
1	lame		
2	very severe ab-/adduction	short	very uneven
3	severe ab-/add.	short	uneven
4	severe ab-/add.	medium	uneven
5	no ab-/add.	short	even
6	slight ab-/add.	medium	even
7	slight ab-/add.	long	even
8	no ab-/add.	medium	free and even
9	no ab-/add.	long	free and even

Distribution of Locomotion Score

Statistical Model

- Separate analysis for each breed

- Lame cows (Loc Score = 1) are excluded

- Correction to the same standard deviation within breed

- Animal model

- Pedigree is traced 5 generation back

Danish Agricultural Advisory Service
National Centre

Statistical Model

Y =   age at calving   fixed

+   month of calving   fixed

+   stage of lactation in months   fixed

+   inspector*year*month   fixed

+   herd   fixed

+   region*year   fixed

+   animal   random

+   residual   random

Danish Agricultural Advisory Service
National Centre

Heritabilities

	Red Danish	Holstein	Jersey
RLSV	0.13	0.17	0.16
RLRV	0.13	0.12	0.10
Foot Angle	0.13	0.12	0.11
Hocks	0.23	0.17	0.19
Bone Structure	0.18	0.24	0.16
Locomotion	**0.10**	**0.07**	**0.05**

Danish Agricultural Advisory Service
National Centre

Genetic Correlations between Locomotion and F&L Traits

	Red Danish	Holstein	Jersey
RLSV	**-0.77**	0.03	0.11
RLRV	**0.81**	**0.73**	**0.47**
Foot Angle	**0.52**	-0.10	0.38
Hocks	**0.41**	0.11	-0.11
Bone Structure	0.32	0.002	-0.04

Danish Agricultural Advisory Service
National Centre

Locomotion Scoring Systems

Locomotion

1   lame

2   ab-/add.

3   short strides

4   uneven gait

5

6   normal

7

8   locomotion

9

Danish Agricultural Advisory Service
National Centre

Locomotion Scoring Systems

Locomotion		Lameness0-1-2	
1	lame	0	clin. lame
2	ab-/add.	1	subclinically
3	short strides		lame
4	uneven gait		
5		2	normal
6	normal		locomotion
7			
8	locomotion		
9			

Danish Agricultural Advisory Service
National Centre

Locomotion Scoring Systems

Locomotion		Lameness0-1-2		Lameness0-1	
1	lame	0	clin. lame	0	lame
2	ab-/add.	1	subclinically	1	not lame
3	short strides		lame		
4	uneven gait				
5		2	normal		
6	normal		locomotion		
7					
8	locomotion				
9					

Heritabilities

	Red Danish	Holstein	Jersey
Feet&Leg diseases*	0.01	0.01	-

Heritabilities

	Red Danish	Holstein	Jersey
Feet&Leg diseases*	0.01	0.01	-
Lameness 0-1	0.01	0.01	0.01

Danish Agricultural Advisory Service
National Centre

Heritabilities

	Red Danish	Holstein	Jersey
Feet&Leg diseases*	0.01	0.01	-
Lameness 0-1	0.01	0.01	0.01
Lameness 0-1-2	0.05	0.04	0.06
Locomotion	0.10	0.07	0.05

Comparison of Scoring Systems

- **Locomotion Scoring**

  - Movement of legs
  - Length of strides
  - Evenness of gait

Comparison of Scoring Systems

- **Locomotion Scoring**

  - Movement of legs

  - Length of strides

  - Evenness of gait

- **Lameness Scoring**

  - Gait and length of strides

  - Leg support

  - Arching of the back

Danish Agricultural Advisory Service
National Centre

Genetic Correlations between Locomotion and Body Traits

Red Danish   Holstein   Jersey

Body Depth

Chest Width

Angularity

Top Line

Rump Width

Rump Angle

Danish Agricultural Advisory Service
National Centre

Genetic Correlations between Locomotion and Body Traits

	Red Danish	Holstein	Jersey
Body Depth			
Chest Width			
Angularity			
Top Line	0.27	**-0.22**	**-0.56**
Rump Width			
Rump Angle			

Danish Agricultural Advisory Service
National Centre

Summary

- Breed differences

- h^2 lower than for other body conformation traits, but higher than for diseases

- Genetic correlation high to RLRV across all breeds

- No correlations to other body traits, except for Top Line

Danish Agricultural Advisory Service
National Centre

Conclusion + Outlook

- Data collection easier than for diseases, but more difficult than for linear type traits

- Consider Locomotion as a trait signaling F&L diseases

- Use as a management tool

  (like temperament, milkability)

- Calculate correlation to Feet&Leg diseases

- Decision how to use it in future breeding work

Danish Agricultural Advisory Service
National Centre