GENETIC PARAMETERS OF TYPE TRAITS SCORED AT ADULT AGE IN ITALIAN HEAVY DRAUGHT HORSE

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LINEAR TYPE EVALUATION FOR IHDH HORSE

Twice in life, i.e. at about 6 mo. and 30 mo. of age

- 11 linear type traits evaluated
- Data used for animals' genetic evaluation
- Combination of 5 traits in a TSI used for selection of meat and draught activities

- 14 linear type traits evaluated
- Additional overall score and body measurements (i.e., withers height, heart girth and cannon bone circumference)
- Mandatory for final admission of candidate stallions and mares to the stud book

ITALIAN HEAVY DRAUGHT HORSE BREEDERS ASSOCIATION

Forms for linear type evaluation of young foals and the mare

Date:__/__/____ Foal name: _____ Sex: ___ Birth date:__/__/____ Microchip:_____

Sire: Name _____ SB id _____ Mare: Name _____ SB id _____

Calving ease code: [0] [1] [2] [3] Mating: [N] Natural Assisted [W] Wild [A] Artificial Insemination AI Certificate no.:_____

Owner: _____ Owner ID Code: _____

Coat of Foal: _____

Head _____ Particularities _____

Fore lt. _____ Fore rt. _____

Rear lt. _____ Rear rt. _____

Condition Score of Mare: LEAN ☐ MEDIUM ☐ FAT ☐

Condition Score of Foal: VERY LEAN ☐ LEAN ☐ MEDIUM ☐ FAT ☐ VERY FAT ☐

LINEAR TYPE TRAIT EVALUATION		*Foal*	*Mare*
1	Head size and Expression		
2	Temperament		
3	Frame size		
4	Fleshiness		
5	Bone incidence		
6	Thorax depth		
7	Fore diameters		
8	Rear diameters		
9	Lenght of upper line		
10	Direction of upper line		
11	Hind legs side view		

FINAL MORPHOLOGICAL JUDGEMENT
(Females only)

[U] *Unfair* [F] *Fair* [F+] *Fair +* [G] *Good* [VG] *Very Good* [E] *Excellent*

JUDGEMENT FOR MALES [K] [R] [D]

Notes and/or cause for no-admission to stud book

_____

_____

CLASSIFIER: _____ ID no. _____

ITALIAN HEAVY DRAUGHT HORSE BREEDERS ASSOCIATION

Form for linear type evaluation of Mares and Stallions

Date:__/__/____ Name: _____ SB id _____ Microchip:_____

Sex: ___ Birth date:__/__/____

Sire: Name _____ SB id _____ Mare: Name _____ SB id _____

Coat of Foal: _____

Head _____ Particularities _____

Fore lt. _____ Fore rt. _____

Rear lt. _____ Rear rt. _____

Owner: _____ Owner ID Code: _____

LINEAR TYPE TRAIT EVALUATION		*Score*
1	Head size and Expression	
2	Temperament	
3	Frame size	
4	Fleshiness	
5	Bone incidence	
6	Thorax depth	
7	Fore diameters	
8	Rear diameters	
9	Lenght of upper line	
10	Direction of upper line	
11	Hind legs side view	
12	Fore feet	
13	Rear feet	
14	Hind legs back view	

BODY MEASURES

Withers height	Cannon Bone circumference	Thorax girth

FINAL MORPHOLOGICAL JUDGEMENT

F	F+	G	VG	E
Fair	*Fair +*	*Good*	*Very Good*	*Excellent*

Notes and/or cause for no-admission to stud book

_____

_____

CLASSIFIER: _____ ID no. _____

RATIONALE

Evaluation on 6 mo. old foals

- Population performance testing of yearly products
- Speed up genetic trend for selected traits
- Costly and time consuming (i.e., about 800 foals/yr)

Evaluation on 30 mo. old animals

- Less subjects evaluated (450 animal/yr), less males and genetic evaluation later in life
- Could become interesting because of the shortage in funding

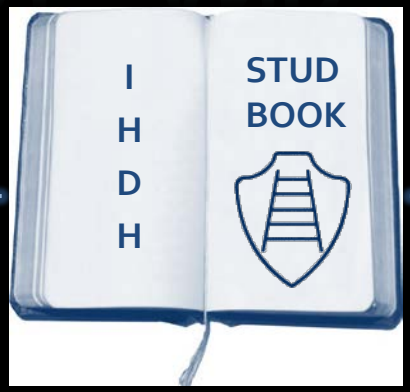
AIM OF THE STUDY

Challenge of using linear type scores at 30 mo. rather than those obtained at 6 mo.

- Analysis of heritability of type traits scored at adult age
- Analysis of genetic correlations among the traits scored at 6 and at 30 months of age

MATERIAL AND METHODS

9,648 Scores at 30 mo. of age



17,467 Scores at 6 mo. of age

Data editing

Final dataset 5,374 records

- 4,724 Females
- 650 Males

Final dataset 11,218 records

- 7,418 Females
- 3,800 Males

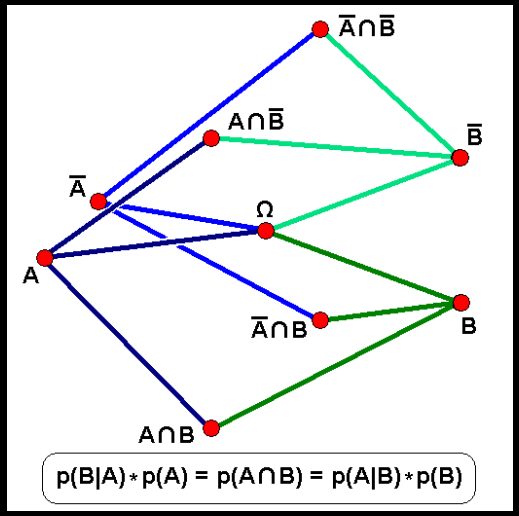
16,592 total records
13, 286 animals (3,306 shared)
18,281 animals in pedigree file

MODEL

Effects accounted:

- stud-(group) x evaluation yr. x classifier for 6 mo. foals (1229 levels), and 30 mo. animals (1698 levels) - FIXED
- stud-(group) for 6 mo. foals (905 levels), and 30 mo. animals (405 levels) - FIXED
- age of 6 mo. foals at scoring (9 classes: ≤2,…,≥10 months of age), and of 30 mo. animals (5 classes: ≤27,……,≥48 months of age) - FIXED
- age of the mare at foaling for 6 mo. foals (5 classes: ≤4,…..,≥10 yr. of age) - FIXED
- sex (2 levels) - FIXED
- Permanent environmental effect (13,286 levels animals of which 3,306 in common) - RANDOM
- Animal additive genetic (18,281 levels in pedigree file) - RANDOM

MODEL IMPLEMENTATION



Bayesian approach

- Gibbs sampling algorithm applied to run bi-variate analysis for traits scored at 6 or 30 mo. of age using "gibbs3f90" (Misztal, 2008)
- Unique Gibbs sampler chain with a length of 990,000 point, discarding the first 90,000 as burn-in and carrying out statistics on 3,000 samples (one every 300 interval point)
- The posterior means and corresponding lower and upper bounds of the 95% highest posterior density (HPD 95%) were computed for all heritability estimates and correlations

DESCRIPTIVE STATISTICS

Trait	Score	
	6 mo.	30 mo.
Head Size & Expression	3.2 ± 0.6	3.0 ± 0.6
Temperament	3.3 ± 0.5	3.3 ± 0.5
Frame Size	3.3 ± 0.6	3.2 ± 0.7
Fleshiness	3.5 ± 0.6	3.3 ± 0.5
Bone Incidence	2.7 ± 0.5	2.9 ± 0.4
Thorax Depth	3.5 ± 0.5	3.5 ± 0.5
Fore Diameters	3.1 ± 0.6	2.9 ± 0.7
Read Diameters	3.4 ± 0.6	3.4 ± 0.6
Lenght of Upper line	3.2 ± 0.4	3.3 ± 0.5
Direction of Upper line	2.9 ± 0.3	2.8 ± 0.4
Hind legs side view	2.8 ± 0.4	2.6 ± 0.5
Fore Feet		3.2 ± 0.5
Rear Feet		3.0 ± 0.4
Hind legs back view		2.9 ± 0.3
Overall Score		2 .0± 0.8

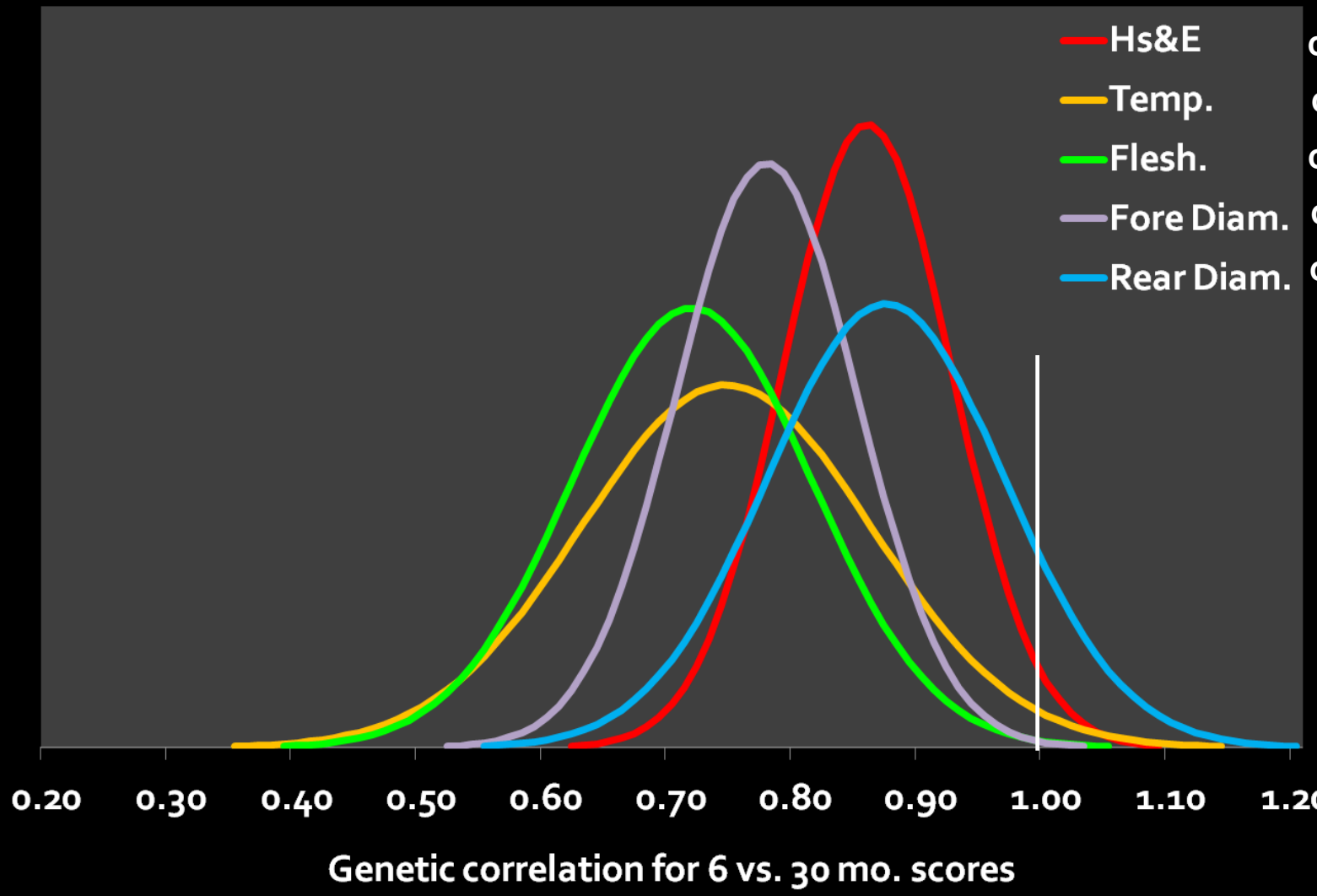
HERITABILITY FOR TRAITS SCORED AT 6 MO.

Trait	Mean	HDP 95%		h^2 threshold with P > 0.95
Head Size & Expression	0.318	0.267	0.369	0.275
Temperament	0.182	0.137	0.227	0.144
Frame Size	0.316	0.265	0.367	0.273
Fleshiness	0.296	0.239	0.352	0.248
Bone Incidence	0.175	0.128	0.221	0.136
Thorax Depth	0.148	0.105	0.191	0.112
Fore Diameters	0.330	0.277	0.383	0.286
Read Diameters	0.263	0.212	0.314	0.220
Lenght of Upper line	0.117	0.070	0.164	0.078
Direction of Upper line	0.329	0.277	0.380	0.286
Hind legs side view	0.022	0.010	0.033	0.012

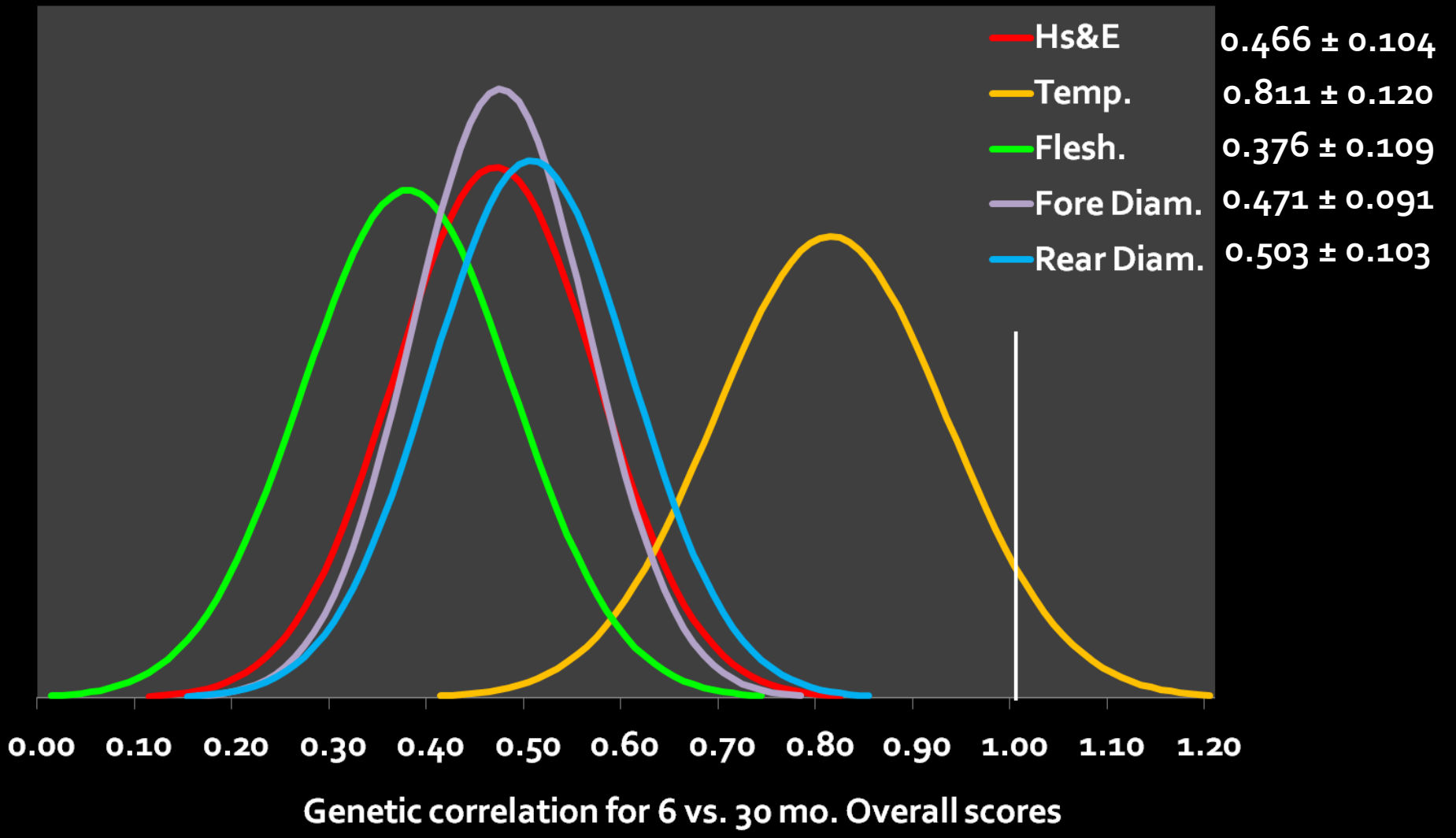
6 VS.30 MO. H^2

Trait	Score at 6 mo.	Score at 30 mo.
Head Size & Expression	0.318 ± 0.026	0.292 ± 0.037
Temperament	0.182 ± 0.023	0.175 ± 0.037
Frame Size	0.316 ± 0.026	0.316 ± 0.040
Fleshiness	0.296 ± 0.029	0.218 ± 0.037
Bone Incidence	0.175 ± 0.024	0.117 ± 0.037
Thorax Depth	0.148 ± 0.022	0.152 ± 0.038
Fore Diameters	0.330 ± 0.027	0.249 ± 0.036
Read Diameters	0.263 ± 0.026	0.199 ± 0.033
Lenght of Upper line	0.117 ± 0.024	0.121 ± 0.032
Direction of Upper line	0.329 ± 0.026	0.087 ± 0.034
Hind legs side view	0.022 ± 0.006	0.065 ± 0.039
Fore Feet		0.053 ± 0.018
Rear Feet		0.054 ± 0.015
Hind legs back view		0.059 ± 0.019
Overall Score		0.244 ± 0.041

GENETIC CORRELATIONS (6 VS. 30 MO.)
MARGINAL POSTERIOR DENSITIES



GENETIC CORRELATIONS (6 VS. OS 30 MO.) MARGINAL POSTERIOR DENSITIES



CONCLUSIONS

- Heritability values similar comparing scores at 6 or 30 mo. of age
- Good genetic correlation between scores at 6 and 30 mo. of age
- Low genetic correlations between scores at 6 mo. and overall score at 30 mo. of age
- The use of 30 mo. score seems technically feasible for genetic improvement of IHDH

THANK YOU FOR YOUR ATTENTION

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