

IP1

Use of competition statistics for genetic evaluation of longevity

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IP2

Use of competition statistics for genetic evaluation of longevity

- Longevity of sport horses of large economic importance
- Management of young horses important for longevity
- To what extent is longevity inherited?
- Direct and indirect measures of longevity to be used?
- Usefulness of competition statistics to measure longevity?



IP4

What do we mean with longevity?


- Longevity is an expression of the durability of the horse
- Longevity is an expression of such health and mental quality of a sport horse that it may be able to compete in sport for many years
- To what extent may number of years in competition be used to reflect longevity?



IP3

Use of competition statistics for genetic evaluation of longevity - previous studies

- French study by Ricard & Fournet-Hanocq
- no. of years in showjumping: heritability of 0.18
- Trotting statistics show genetic variation in no. of years in competition (Arnason)
- Lifetime performance based on competition statistics
- an indirect measure of longevity?



“Risk” of early culling previously studied in relation till health status at Riding Horse Quality Tests of 4-year old SWB horses

| Orthopedic status | | | “Other medical” status | | |
|-------------------|---------------|------|------------------------|---------------|------|
| Score | No. of horses | Risk | Score | No. of horses | Risk |
| ≤5 | 81 | 1.49 | ≤7 | 134 | 1.01 |
| 6 | 151 | 1.22 | 8 | 482 | 1.11 |
| 7 | 342 | 1.17 | 9 | 829 | 1.00 |
| 8 | 590 | 1.00 | 10 | 350 | 0.97 |
| ≥9 | 651 | 0.76 | | | |

Orthopedic status at age of 4 predicts longevity!

“Risk” for early culling in relation to conformation

| Total score | No. of horses | Risk | Extremities score | No. of horses | Risk |
|-------------|---------------|------|-------------------|---------------|------|
| ≤32 | 88 | 1.20 | ≤5 | 67 | 1.32 |
| 33-34 | 204 | 1.04 | 6 | 357 | 1.00 |
| 35-37 | 696 | 1.00 | 7 | 918 | 0.79 |
| 38-40 | 653 | 0.95 | ≥8 | 465 | 0.73 |
| ≥41 | 166 | 0.64 | | | |

Good conformation incl. correct legs important for longevity!

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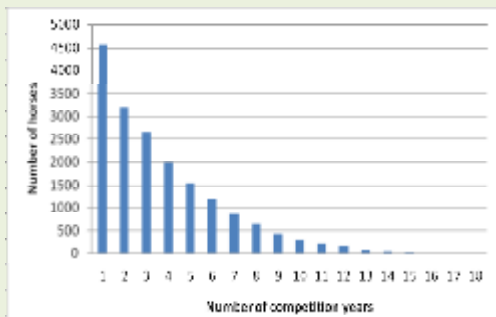
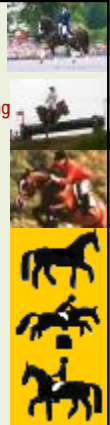
Present research on use of competition data – PhD study by Åsa Braam, SLU

- Usefulness of available competition data for prediction of longevity in SWB riding horses?
- Factors affecting length of competition life
- Use of number of competition years for genetic evaluation of longevity
 - Testing of genetic models
 - Estimation of heritabilities and genetic correlations



Data of the SWB used

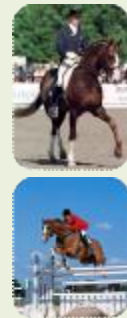
- Competition years
 - Male horses born 1967-1991, not used in breeding
Approved stallions and mares may be used in breeding instead of competing
 - Records from 1971-2006 by 17,892 horses
- Performance
 - Riding Horse Quality Test (RHQT) of 4-year olds
 - Records from 1973-2007 by 18,240 horses
 - Competition results
 - Accumulated “upgrading points”
 - up to five years of age
 - lifetime points
 - Records from 1961-2006 by 37,718 horses



Due to the skewed distribution records were transformed with a 10-logarithm to approach normality

Effect of disciplines

- Horses with successful results in more than one discipline had longer competition career

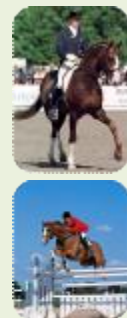


Effect of disciplines

| | Average number of competition years | Accumulated upgrading points |
|-------------------|-------------------------------------|------------------------------|
| Dressage | 3.08 | 88 |
| Show jumping | 3.31 | 84 |
| Eventing | 1.76 | 4 |
| Two disciplines | 4.47-4.77 | 51-77 |
| Three disciplines | 6.41 | 85 |
| Total | 3.69 | 81 |

Effect of disciplines

- Horses with successful results in more than one discipline had longer competition career
- Positive effect of an all-round training of young horses, or...
- trying out more disciplines takes time?
- Most talented horses in dressage and show jumping competed in only one discipline



Effect of disciplines

| | Competition years | Accumulated upgrading points |
|---|-------------------|------------------------------|
| Successful results from more than one discipline up to 6 years of age | 5.39 | 99 |
| Other horses | 3.58 | 80 |



All-round training seems positive!



Factors to consider in analyses of number of competition years

- Birth year of the horse
 - competitions have changed by time
 - all horses compared with horses of the same opportunities
- Age at first successful competition
 - Early start provides the opportunity for a longer career
- Sports talent of the horse
 - Better horses given opportunity for a longer competition career



Test of models for genetic analysis

- Mixed linear animal models (BLUP)
 - I: Birth year + Animal
 - II: Birth year + Age + Animal
- Age=Age at first successful competition

Results

Variances and heritabilities for number of years in competition

| Model | Genetic variance (σ_a^2) | Error variance (σ_e^2) | Heritability |
|-------------|-----------------------------------|---------------------------------|--------------|
| I (BY) | 0.0183 | 0.0889 | 0.17 |
| II (BY+Age) | 0.0077 | 0.0844 | 0.08 |

Considerable genetic variation, but half of it is attributed age at first start!



Results

Genetic correlations between competition years and performance at different ages

| Model | Jumping 4 years result (RHQT) | Gaits 4 years result (RHQT) | Up to 5 years of age | Lifetime points |
|-------------|-------------------------------|-----------------------------|----------------------|-----------------|
| I (BY) | 0.64 | 0.31 | 0.44 | 0.62 |
| II (BY+Age) | 0.71 | 0.30 | 0.63 | 0.78 |

Positive genetic relationship between talent and no. of competition years!



Interpretation of the genetic analysis

- The genetic variation, when adjusted for age at first successful start, is considerable
 - Range in Breeding Values of 1.2 years (30% of the mean no. of competition years) among stallions with > 10 progeny
- Present system for estimation of breeding values for performance is based on lifetime competition results
 - supports longevity of horses in competition
- Genetic evaluation for longevity is possible and adds valuable information for evaluation of stallions



Remaining issues

- Present results refer to horses with at least 10 years opportunity of competing
 - How accurate would results be if also younger horses are included? Survival analysis to be applied
- Present analysis does not consider non-competing horses
 - Some horses may not compete because of poor health or talent
 - Addition of % of registered male foals not competing may add further valuable information
- Although no. of competition years is a good measure of longevity it would be desirable to also know the genetic causes of variation in longevity

Use of competition statistics for genetic evaluation of longevity - summary and conclusions

- Number of competition years increases with participation in two or more disciplines at young age
- Age at first successful competition influences number of competition years
- Genetic correlations between longevity in sport and performance are positive at both young age and in lifetime



Use of competition statistics for genetic evaluation of longevity - summary and conclusions

- Age at first successful competition reflects both management and genetic talents of the young horse
- Age needs to be adjusted for together with birth year
- Further studies will focus on effects of including also young horses and % of registered foals becoming competition horses for prediction of longevity
- Genetic evaluations for longevity by using available statistics is an opportunity to better fulfil the breeding objectives of producing durable sport horses!



Thank You!



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