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▶ **To cite this version:**

Suzanne Harari, Severine Deretz, Bernard Dumont Saint Priest, Eric A. Richard, Anne Ricard. Blood analysis parameters genetically associated with longevity of jumping horses. 14th International Havemeyer Foundation Horse Genome Workshop, May 2024, Caen, France. . hal-04650033

HAL Id: hal-04650033
https://hal.inrae.fr/hal-04650033

Submitted on 16 Jul 2024

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BLOOD ANALYSIS PARAMETERS GENETICALLY ASSOCIATED WITH LONGEVITY OF JUMPING HORSES

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The project aims to find criteria genetically associated with **functional longevity** of sport horses, defined as the time spent in competition corrected for the level of performance.

A specific protocol has been set up to measure new phenotypes, including blood parameters, in young horses prior to their competition career, sired from stallions with extreme functional longevity.

MATERIALS & METHODS

DATA - 2018 to 2022

Blood samples were taken from **952 Selle Français**
59 blood parameters were measured

Large competition data (232 861 horses)

↓

EBV for functional longevity

Extreme negative → Unfavorable (U) 62 stallions

Extreme positive → Favorable (F) 85 stallions

2 to 4 years old horses

Large genetic difference

362 offspring (38 %)

590 offspring (62 %)

8 groups of parameters :
- Bone and joint
- Cytokine
- Endocrinology
- Hematology (red blood cells, white blood cells)
- Kidney function
- Liver function
- Oxidative stress
- Protein

METHOD

1. Estimation of the heritability of each variable (y) using an univariate mixed model.

$$y = Xb + Zu + e$$
$$V(u) = A\sigma_u^2$$

u is the vector of random animal additive genetic value
A is the relationship matrix constructed from ancestors up to 6 generations (n=10,280)

2. New standardised variables corrected for fixed effects : age, sex, weight, date and place ($X\hat{b}$).

$$y_c = y - X\hat{b}$$

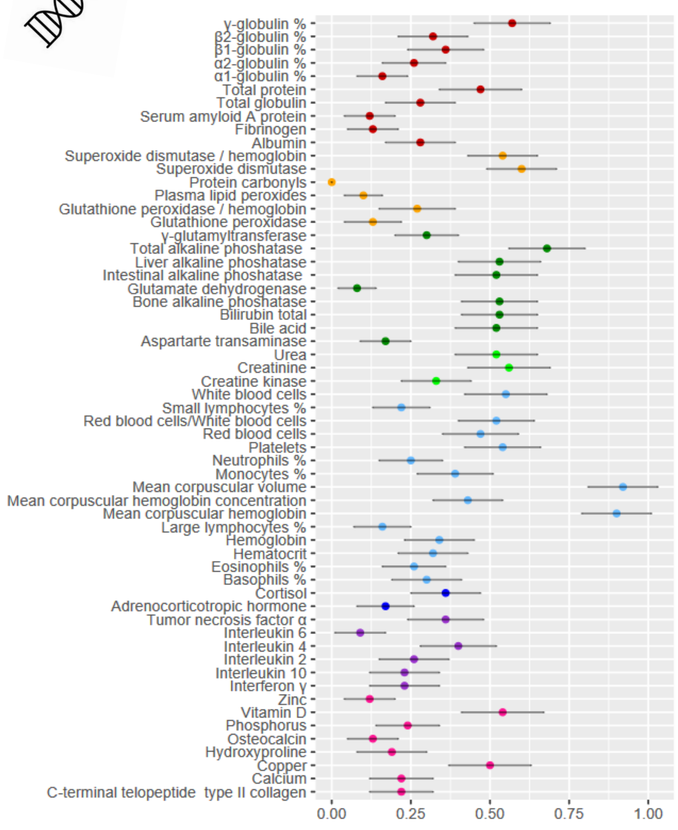
3. Partial Least Square logistic regression to predict the sire group (U or F).

$$g(\theta)_i = \sum_{h=1}^{H}\left(c_h \sum_{j=1}^{p} w_{jh} y_{ij}^*\right)$$

g is the logit link-function
i is the horse, p is the number of variable
H is the number of components, w_{jh} is the coefficient of the predictor j for the component h
c_h is the coefficient of each component h

RESULTS AND DISCUSSION

HERITABILITY ESTIMATES



- **Effects of age, sex, visit and weight on several variables :** relevance of their inclusion in the final model.
- **Phenotypic correlations** were found within functions - some high - but not between functions.
- High **heritability estimates :** 30% greater than 0.5 but **possible surestimation** due to the nature of the sample : progeny of extreme stallions for longevity EBV.
- **Significant results for the logistic regression**
- **No pre-existing studies** on this question.

FUNCTIONAL LONGEVITY

Group	Variable	Effect	Estimated regression coefficient	P-value
Kidney function	Creatine kinase	Negative	-0.06	< 0.05
Protein	α1-globulin %	Positive	0.10	< 0.05
	α2-globulin %	Positive	0.17	< 0.001
	β1-globulin %	Negative	-0.12	< 0.01
	Total protein	Positive	0.03	< 0.05
Liver function	Liver alkaline phosphatase %	Negative	-0.05	< 0.01
	Intestinal alkaline phosphatase %	Positive	0.11	< 0.01
	Bone alkaline phosphatase %	Positive	0.03	< 0.01
	Total alkaline phosphatase	Negative	-0.05	< 0.01
Hematology	Hemoglobin	Negative	-0.07	< 0.05
	Hematocrit	Negative	-0.06	< 0.05
	RBC/WBC	Positive	0.13	< 0.05
	Mean corpuscular hemoglobin	Negative	-0.19	< 0.001
	Mean corpuscular volume	Negative	-0.16	< 0.001
	White blood cells	Negative	-0.09	< 0.01
	Monocytes %	Negative	-0.11	< 0.05

CONCLUSION

Potentially, 16 heritable blood parameters taken at rest on young horses have a genetic correlation with the functional longevity in jumping competition. Four groups of parameters are concerned : hematology, protein, kidney function and liver function. However, there is little information on these subjects in the literature to compare our results.

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14th INTERNATIONAL HAVEMEYER FOUNDATION HORSE GENOME WORKSHOP

May 12-15, 2024