



From genes to sperm: The consequences of genomic inbreeding increase on stallion spermatozoa shape

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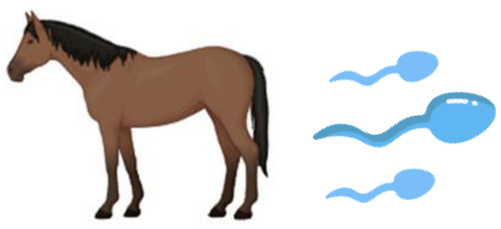
INTRODUCTION

Breeding programs for equine breeds such as the **Pura Raza Español (PRE), Polo Argentino (CPO)** and **Pura Raza Árabe (PRA)** aim to preserve and enhance the distinctive and advantageous characteristics of each breed. However, these programs produce increased **regions of homozygosity (ROH)** and promote the development of **inbreeding depression**, which is associated with **loss of fertility**.

OBJECTIVE

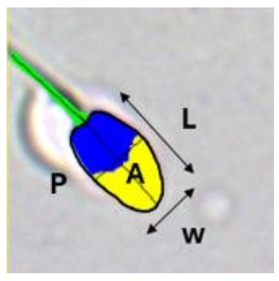
The main objective of this study was to evaluate the influence of inbreeding levels (F_{ROH}) in different genome regions on sperm morphometry in stallions of these equine breeds.

MATERIALS AND METHODS



Semen samples from 90 stallions

49 PRE + 33 CPO + 8 PRA



L=Length
W=Width
A=Area
P=Perimeter
Elongation
p^2a

100 spermatozoa per individual

Diff Quick™ + SCA™ CASMA system

GGP Equine Array

56,471 autosomal markers

PLINK 1.9 beta

RESULTS

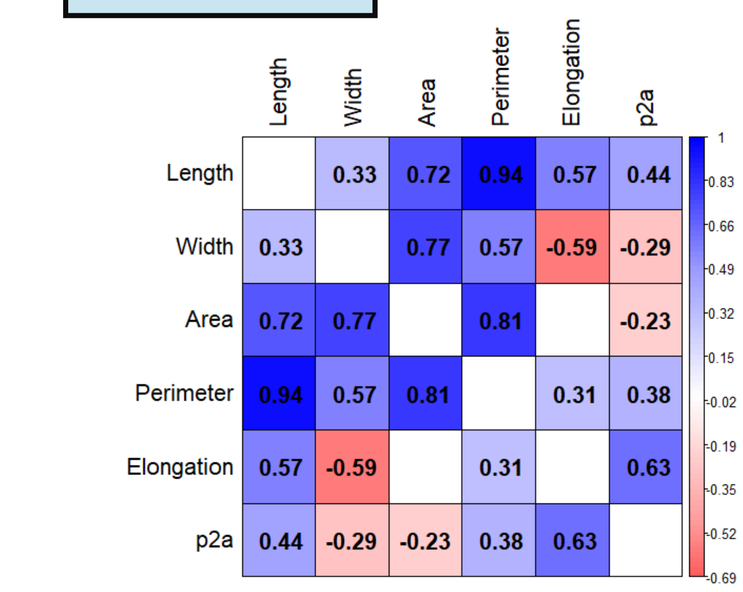


Figure 1. Correlation analysis between morphometric parameters of sperm (p-value < 0.05).

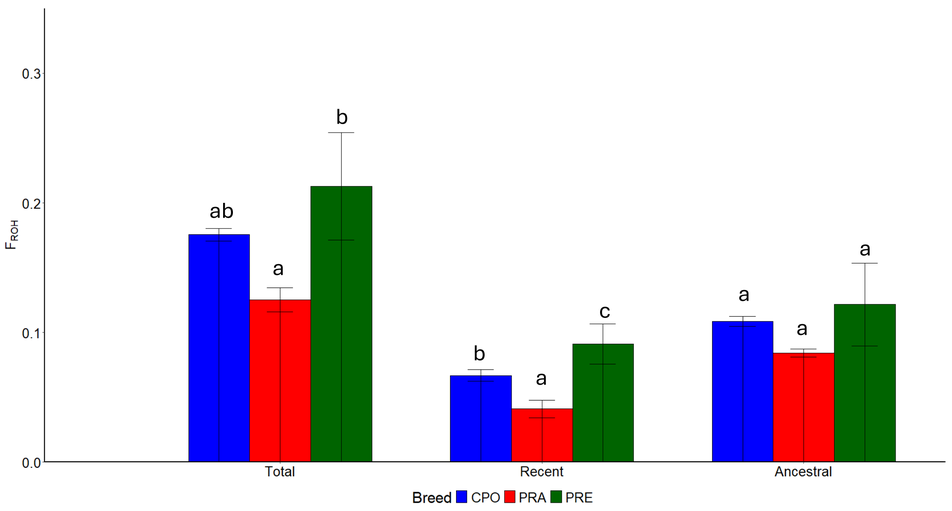


Figure 2. Total, recent (<9G) and ancestral (>9G) F_{ROH} analysis by breed (p-value < 0.05).

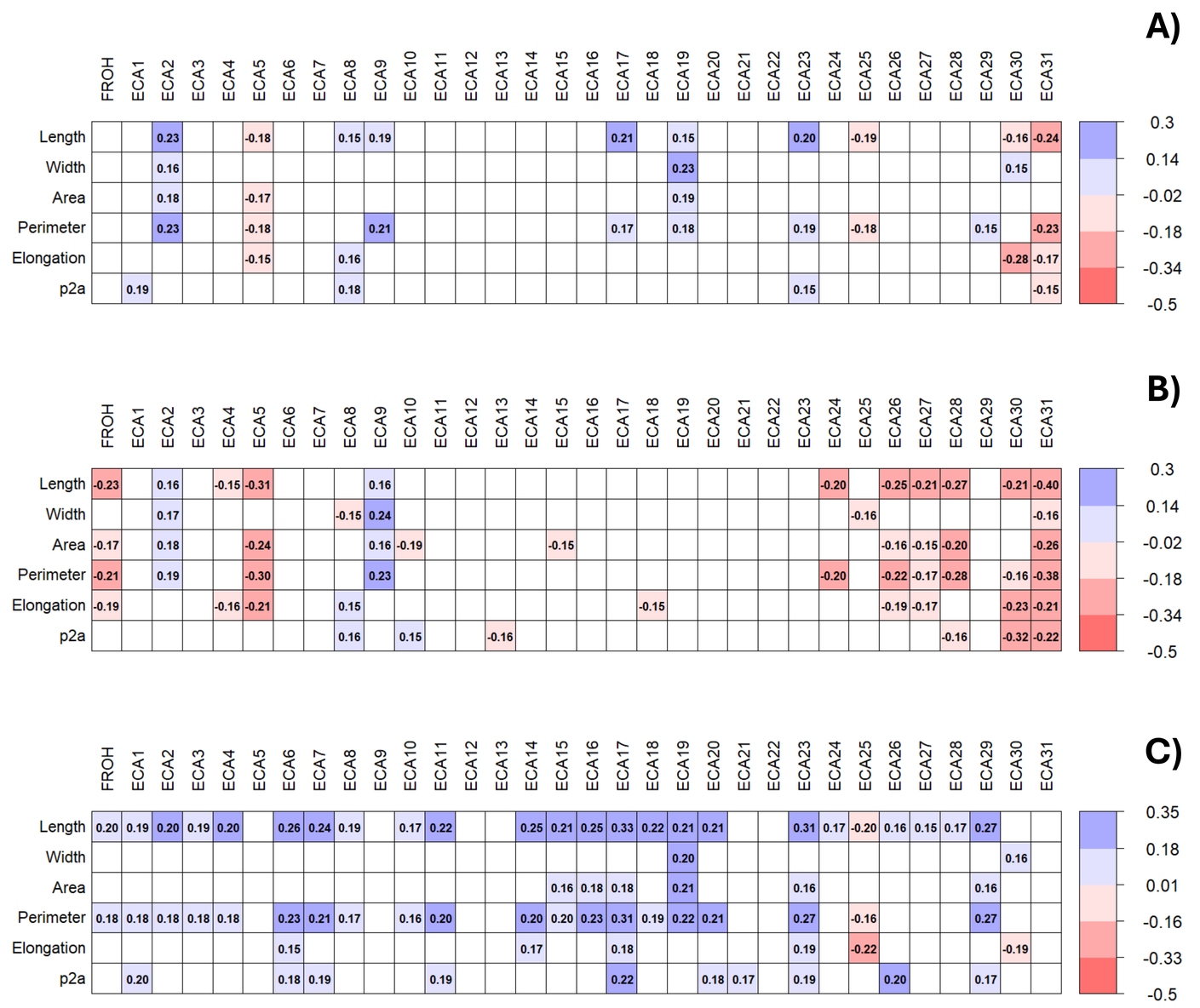


Figure 3. Correlation analysis between morphometric parameters of sperm and total (A), recent (B) and ancestral (C) F_{ROH} values (p-value < 0.05).

CONCLUSION

Our results reveal the effects of inbreeding on sperm morphometry and the existence of large differences between chromosomes and recent and ancestral inbreeding loads. Ancestral F_{ROH} was the most prevalent and tended to increase sperm head size and p^2a, a hydrodynamic proxy previously associated with higher fertility in livestock. In contrast, recent F_{ROH} tended to reduce sperm head size and alter its shape. Notably, some chromosomes showed significant effects while others did not, and the same chromosome could display opposite effects depending on the origin of F_{ROH}. These findings highlight the need for precise management and detailed analysis of inbreeding to better understand its impact on sperm quality.

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