THE GENETICS OF POLYSACCHARIDE STORAGE MYOPATHY IN HORSES

Universitat Autònoma de Barcelona

CLÀUDIA PÉREZ ALBALÁ

FINAL DEGREE PROJECT - JUNE 2023

FACULTAT DE VETERINÀRIA

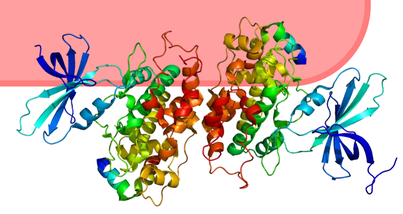
OBJECTIVES

- Define the genetics of PSSM.
- Study the origin and the specific mutation (genes involved, molecular alterations…).
- Know more about de mechanism(s) responsible for the disease.
- To explain the pathophysiological basis and which body functions are affected.

INTRODUCTION

PSSM, identified in 1992, is a type of exertional rhabdomyolysis characterized by an accumulation of amylase-resistant and less-branched polysaccharide in skeletal muscle fibers with 1.7-4 times normal muscle glycogen.

There are 2 types: PSSM1 associated with a mutation that produces an overexpression of Glycogen synthase (GYS1) and PSSM2 with unknown etiology.



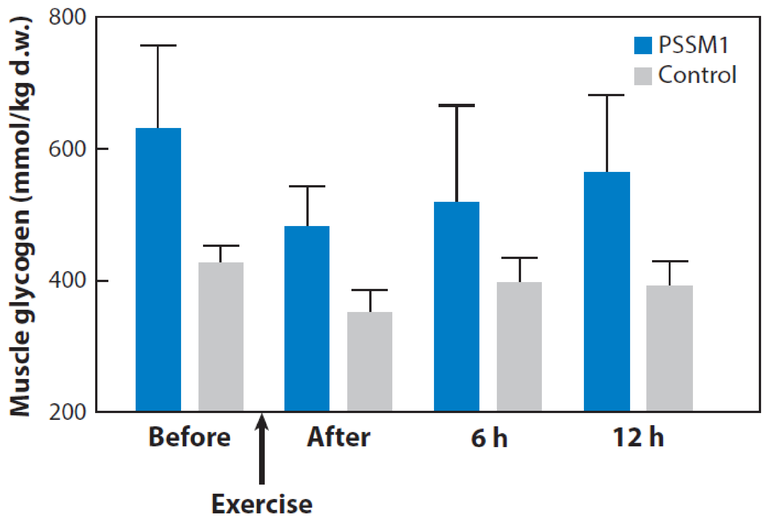
PSSM1 vs. PSSM2

PSSM1	PSSM2
• GYS1 mutation	• Unknown etiology, no mutation
• Possible inheritance	• No inheritance is possible

COMMON CLINICAL SIGNS

Poor performance, refusal to move forward, sweating, muscle fasciculations, short steps, gait abnormalities…

Same histopathological image.



Comparison muscle glycogen concentrations between PSSM and control *(Mickelson & Valberg, 2015)*

DIETARY CONTROL

↓↓starch (carbohydrates) and sugar

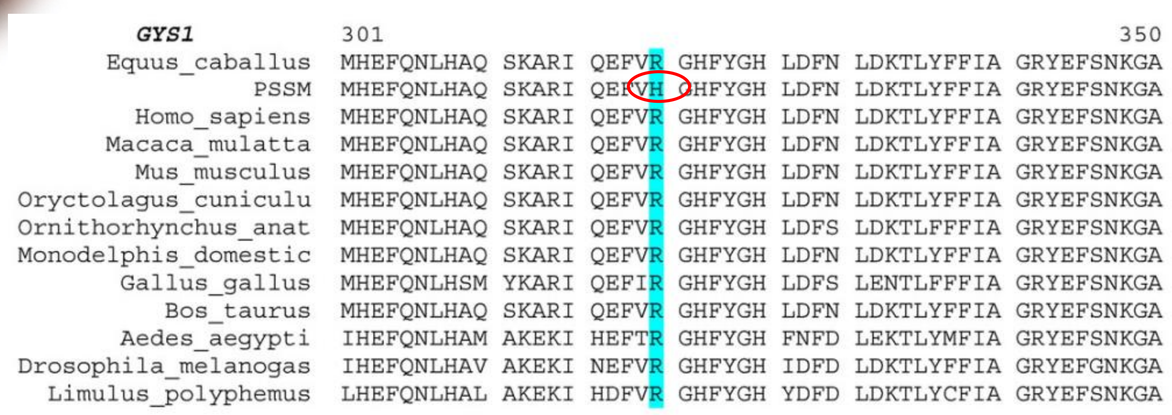
+

↑↑ fat

+

Regular exercise

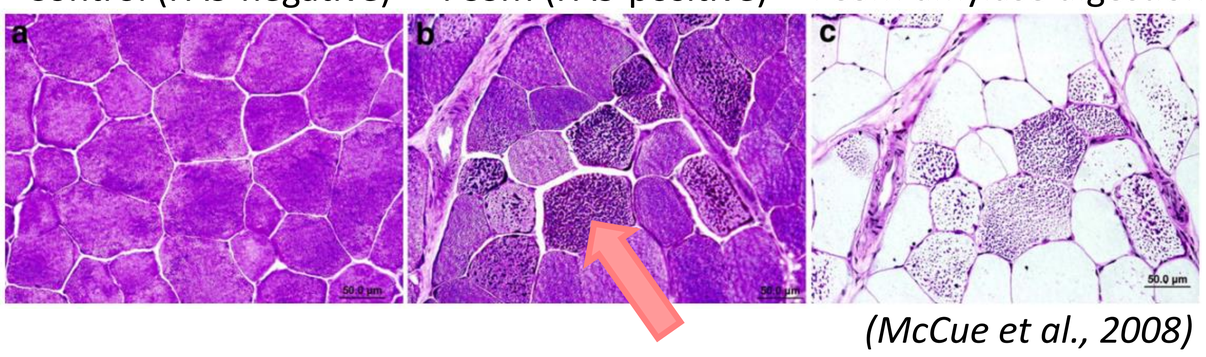
R309H



GYS1 mutation in PSSM produces a change of normal arginine (R) residue at codon 309 to a histidine (H) → R309H *(McCue et al., 2008)*

DIAGNOSIS: MUSCLE BYOPSY

Control (PAS-negative) PSSM (PAS-positive) PSSM amylase digestion



(McCue et al., 2008)

CONCLUSION

- PSSM is a poorly studied disease that only affect horses and not human, so studies available to date are not enough to know all about it, there are lots of aspects that are still unknown.
- As much suspected horses as possible should be genotyped to eliminate them from breeding and avoid transmitting PSSM.
- For the affected horses the owners should try dietary control and light and regular exercise.

REFERENCES

- McCue, M. E., Valberg, S. J., Miller, M. B., Wade, C., DiMauro, S., Akman, H. O., & Mickelson, J. R. (2008b). Glycogen synthase (GYS1) mutation causes a novel skeletal muscle glycogenosis. Genomics, 91(5): 458-466. https://doi.org/10.1016/j.ygeno.2008.01.011
- Mickelson, J. R., & Valberg, S. J. (2015). The genetics of skeletal muscle disorders in horses. Annual Review of Animal Biosciences, 3(1): 197-217. https://doi.org/10.1146/annurev-animal-022114-110653
- Naylor, R. J. (2015). Polysaccharide storage myopathy - the story so far. Equine Veterinary Education, 27(8), 414–419. https://doi.org/10.1111/eve.12329
- Williams, Z. J., Bertels, M., & Valberg, S. J. (2018). Muscle glycogen concentrations and response to diet and exercise regimes in Warmblood horses with type 2 Polysaccharide Storage Myopathy. 13(9): e0203467. https://doi.org/10.1371/journal.pone.0203467