PSSM in the Gypsy Vanner Breed

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Polysaccharide Storage Myopathy, referred to as PSSM, is a fact of the Gypsy Vanner breed. It is feared, it is dismissed and it is passionately discussed but until now, PSSM has never been given 'a face'. Meet North Fork Orion, who is n/P1, which means that he carries one copy of the gene. Orion, whose sire and dam were imported from England, was born in 2009, and has since built an impressive resume:

2011
- Orion's debut showcasing the Gypsy Vanner breed at the 100th Calgary Stampede

2012
- Orion spent a good part of the year in training, and acted as demo horse with Stunthorse.com, doing public trick demonstrations

2013
- Orion qualified for Team Gypsy Vanner, where he competed in Precision Driving at Spruce Meadows.

2014
- This year was spent working with the Regina Therapeutic Riding Association in their horse program.

2015
- Orion received the first ever 5-Star Conformation-Movement score awarded to a gelding by the GVHS
- Orion also earned his Versatility Medallion, and contributed to seeing his sire, Tumbleweed, awarded the first ever GVHS Hall of Fame Stallion achievement
- Orion also returned to Team Gypsy Vanner where he competed in trail at the Sask Equine Expo.

2016
- Orion competed in Western Dressage on Team Gypsy Vanner, and the team won 2nd place overall at the Saskatchewan Equine Expo Battle of the Breeds
- Orion won High Point Gelding at the Saskatchewan Gypsy Vanner Horse Association's 2nd Annual Breed Show, and was awarded GVHS top 20 Performance placement in the High Point Gypsy Vanner Awards.

2017
- Orion performed with the RCMP Tattoo Royale and continues his training in all disciplines.

Orion is trained and has shown hunters and jumpers up to 2'9" with the talent to free jump 4', he drives singles, pairs and hitches, has competed Western Dressage, Reining, Trail, Western Pleasure, is used as a general pleasure mount, and is always on standby to step in wherever needed.

To date, PSSM has not held Orion back, nor has it affected his ability to perform at competitive levels. Although Orion carries the PSSM gene, he, like most Gypsy Vanners, is non-symptomatic. We highlight Orion and his achievements not to brag, but to emphasize the fact that this is what to expect of most PSSM positive horses throughout their lifetimes.

The classic symptoms of PSSM are tying-up (Rhabdomyolysis), and muscle tremors. Briefly explained, tying-up is a temporary state whereby the horse experiences major muscle cramps, generally after exercise, similar to an athletic cramp which affects large muscles in the hind end and back. Muscle tremors can either be localized to a specific large muscle, or can occur across the horse's entire body, and may look like the horse is involuntarily shaking, as if it were cold. Muscle tremors are NOT the controlled muscle flutter that horses use to rid themselves of flies or other irritants. In affected horses episodes of tie-up or muscle tremors are most often seen after the horse has experienced a stressful situation, or has been briskly exercised. Muscle tremors and tie-up are commonly linked to PSSM (although a horse that is negative for PSSM can also tie-up).

PSSM is the medical term which identifies a particular

occurrence of how some horses metabolize sugar and starch, then subsequently store glycogen in the muscles, for later use as energy. In non-positive horses, glycogen is used as one of the primary energy sources for performance. Horses with PSSM are not able to effectively use glycogen for energy; rather they need to derive their energy from fat. For this reason, PSSM positive Gypsy Vanners can be fairly easily managed with diet and exercise. Think of a PSSM negative horse as being a gas engine where the fuel is called glycogen, and a PSSM positive horse as being a diesel engine where the fuel is called fat.

The diet of a PSSM positive Gypsy Vanner is, at it simplest form, low sugar and low starch. These hardy horses don't need sugar or starch at the best of times, and most Gypsy Vanners are already on the "PSSM Diet" due to their naturally plump waistlines. Horses on the "PSSM Diet" receive no oats, grains, or corn, no molasses, no sugary treats, sweetened supplements or goodies, and have restricted access to spring and fall grass when sugar/starch content is at its highest. In place of sugar and starch, PSSM horses should be fed fat for extra calories or to boost energy levels and fill their fuel tanks. Pellets with a high fat percentage and oils such as coconut and basic vegetable oils have shown to be effective in the dietary management of PSSM, as well as the addition of Vitamin E, electrolytes and salt as a benefit to horses who are working. Limiting exposure to sugar and starch is one of the easiest and most beneficial ways to control PSSM and prevent excessive levels of glycogen from being stored in your horse.

Exercise is the second component to managing PSSM. If glycogen builds in the muscle for energy, the easiest way to keep it at a manageable level is to keep burning it out of the muscle. This can be as simple as giving your Gypsy Vanner the largest pasture space possible - which allows glycogen to burn out of the muscle naturally through the horses tendency to move around for forage and play. Those with limited grazing can encourage natural movement by placing food, water and shelter as far from each other as possible, which creates an environment where the horse must move from one to the other naturally. For Gypsy Vanners that are being ridden or driven, a period of conditioning after a length of time off work allows a gradual reduction of glycogen from the muscles. In areas that experience seasonal riding, gradual conditioning occurs naturally every spring when rides increase in duration and intensity as weather and daylight hours allow. Where riding occurs year round, giving your Gypsy Vanner a couple of days of low impact shorter duration rides before returning to regular exercise, reduces the glycogen in the muscles when the horse has had more than a week off. Whether at peak condition, or returning to work, proper warm up, a brief duration of long trotting after exercise, and then a proper cool down is the best way

to manage glycogen levels in ALL horses, and knowing that your horse is positive for PSSM will make you more conscious of this basic element of equine management which is often bypassed.

At this point it should be noted that research has shown PSSM is in more than 20 breeds of horse and studies show that horses of light build are more likely to experience classic symptoms of PSSM than those of heavy, draft build, such as Percherons (of which up to 65% of the breed sample tested positive for PSSM). PSSM is also genetically inherited, which means that it is passed from parent to offspring. A horse is either n/n and does not carry PSSM, is n/P1, which means that it carries one copy of PSSM, or is P1/P1, which means that it carries 2 copies of PSSM. Whether the horse is n/P1, or P1/P1, the likelihood of them experiencing classic symptoms is neither increased by being P1/P1, nor decreased by being n/P1 - they will ether experience symptoms, or they won't. The challenge presented to breeders today is whether or not to breed a Gypsy Vanner that is guaranteed, or possibly liable to pass PSSM to their offspring. If either the sire, or dam is P1/P1 they are guaranteed to create a foal that is n/P1, even if bred to a horse that is n/n. If the sire or dam is n/P1, then they have a 50% chance of passing along PSSM to their offspring, even when bred to a n/n horse.

Although PSSM is a new challenge to Gypsy Vanner breeders, it is NOT new to the Gypsy Vanner breed, or the equine industry overall. Leading PSSM researcher Dr. Stephanie Valberg, D.V.M., Ph.D., of the Michigan State University College of Veterinary Medicine states, "(PSSM) is estimated to have emerged as far back as 1,600 years ago, when the great horse was being developed from European draft and light horse breeds to carry knights with heavy armour into battle". PSSM, only recently discovered via genetic testing, came to the Gypsy Vanner breed through foundation sires and dams, and was likely introduced into the breed during its very development and inception. Although breeders of Gypsy Vanners are actively working to reduce occurrences of PSSM in the breed, great care must be taken so as not to 'throw out the baby with the bath water'. At the time of this article there is no medical documentation made public regarding adverse health, well being or usefulness of Gypsy Vanners which are either n/P1 or P1/P1. PSSM is also not something that breeders can instantly remove from their genetic pools. Even if zero known PSSM horses were bred today, it would take ~30 years from the point that the last positive foal was born to remove PSSM entirely. That would come at great genetic compromise to type and quality of desired traits and characteristics, when it is known that the condition was introduced into the breed directly from the very limited foundation sires and dams. The accepted position of many responsible Gypsy Vanner breeders today is to breed with thoughtful consideration of eliminating PSSM, but not at the cost of losing conformation, temperament, or foundation-quality characteristics and bloodlines.

One such breeder who is addressing the PSSM challenge head on are Dale and Cheryl Nygaard of North Fork Gypsy Cobs. As they approach their 10th year in the industry Dale and Cheryl have realized that there are many extremely important Gypsy Vanner stallions, and mares, both now and in the past, who have and continue to contribute to enhancing the quality of the Gypsy Vanner gene pool. Only one of their past stallions has carried the PSSM gene; none other than "Billy Boy" AKA the Christie Horse, sired by The Lob. Billy Boy, one of the great foundation stallions, possessed a single PSSM gene (n/P1). Billy Boy is in the back breeding of a large portion of Gypsy Vanners and has sired some of the finest examples of Gypsy Vanners alive today. Like all breeders, North Fork would like to see instances of PSSM eliminated through selective breeding over time, but foundation stallion "Billy Boy" is proof that a spectacular producing stallion or mare with a single copy of the gene should not be replaced until offspring as good or better showing as PSSM n/n has been produced. By no means do they think a horse carrying a copy of the gene is any less valuable than one who doesn't, rather they promote that very careful consideration should be given before making the decision to breed a positive stallion to a positive mare, in order to remain committed to the responsible elimination of PSSM in Gypsy Vanners.

PSSM is on the minds of Gypsy Vanner breeders, owners and buyers, and continuous education and research are keys to understanding, and comfortably managing it. Horses are built to travel 30 miles a day for water, eating nothing but grass, minerals and salt - a lifestyle which naturally managed metabolic considerations like PSSM, founder, etc. Over time, mankind has altered the horse's lifestyle from that of nomadic, to that of a machine, where they were used for work and transport all day long, 5 - 7 days a week, a lifestyle that was also naturally suited to metabolic management. The entire development of the Gypsy Vanner breed was created to work hard and travel long distances with very basic forage. Again, this is a lifestyle naturally suited to managing metabolism. The role of the original workhorse changed to that of being a pet and a luxury, and now our horses are members of our families who spend an hour or two being ridden, and the rest of the time being pampered. This does not manage their metabolisms in a way that is naturally healthy for them. The fundamental needs of any horse are proper diet and adequate exercise and, as North Fork Orion shows, Gypsy Vanners which test positive for PSSM are also a star athletes and valuable contributing members of equine society. For more information on how to genetically test your horse for PSSM, visit https://www.vdl.umn.edu/services-fees/equine-neuromuscular.

Frequency of PSSM1 Mutation in GVHS Accessions

In order to obtain an estimate of the frequency of the PSSM1 mutant allele in horses registered with the Gypsy Vanner Horse Society, 100 hair samples were selected at random from the GVHS database, spanning the years 2003-2015. Samples were tested using the TaqMan assay system for the G>A SNP in exon 6 of the GYS1 gene.

Of the 100 samples, 76 had a normal genotype of N/N and 24 tested as heterozygous N/PSSM1. This translates into 176 normal alleles and 24 mutant alleles, giving an allele frequency of 88% normal and 12% mutant. No samples were homozygous for the mutant allele.

Using these observed values of allele frequency, the Hardy-Weinberg calculation of the EXPECTED genotype frequencies in the total population are as follows:

- Expected genotype frequency for N/N: 77.44%
- Expected genotype frequency for N/PSSM1: 21.12%
- Expected genotype frequency for PSSM1/PSSM1: 1.44%

Therefore approximately 1 in 5 horses can be expected to be heterozygous for the mutation, and 1-2 horses per 100 horses can be expected to be homozygous for the mutation.

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