Selection of Quarter Horses affected with hyperkalemic periodic paralysis by show judges

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Summary: Thirty offspring of a Quarter Horse sire, affected by hyperkalemic periodic paralysis (HPP), were examined electromyographically. On the basis of the detection of or lack of spontaneous activity with high frequency myotonic or pseudomyotonic discharges, the horses were diagnosed as being affected (14 horses) or unaffected (16 horses) with HPP. The show performance of these horses was evaluated for the first 3 to 9 years of their life by use of American Quarter Horse Association records. Horses affected with HPP performed significantly (P < 0.01) better in halter classes than did unaffected horses; mean halter points for the 2 groups were 11.9 and 4.4, respectively. The mean total performance points were not significantly different. None of the offspring had a successful racing record.

Hyperkalemic periodic paralysis (HPP) was first described in horses by 2 independent groups of veterinary clinicians.1,2 Overt signs of the condition are characterized by intermittent episodes of muscle fasciculation and spasm, which usually are accompanied by a high serum potassium concentration. Recumbency and ataxia during these episodes can cause longer-term sequelae, such as abrasions and muscle damage.3 Hyperkalemic periodic paralysis is attributable to a point mutation in the skeletal muscle sodium-channel gene4,5 and is transmitted as an autosomal dominant genetic condition in horses6,7 and people.8,9 Hyperkalemic periodic paralysis primarily affects Quarter Horses, and one study10 has shown that all known cases of HPP were descendants of a common sire. The affected bloodline of Quarter Horses accounted for approximately 2% of all registered Quarter Horses at the end of 1988,10 and affected horses likely account for at least 0.4% of the breed.3 There has been concern that this high prevalence might reflect selection for a phenotype influenced by the presence of the HPP gene. Affected horses may or may not have clinical signs; however, electromyographic examinations are consistently abnormal between attacks11 and are indicative of increased muscular contraction. This increased activity could lead to muscle hypertrophy, which in turn could result in HPP-affected horses being more successful in the show ring because a well-muscled appearance is desired by show judges, especially in halter classes.

The purpose of the study reported here was to compare the show records of HPP-affected and HPP-unaffected offspring to determine if HPP-affected horses have a more successful show career. The number of HPP-affected horses is increasing; determining the reason why would benefit the Quarter Horse breed, the registry, and Quarter Horse producers and enthusiasts.

Materials and Methods

Horses—The show records of 30 offspring produced by a sire affected by HPP2 (sire B) were compared. Sire B had a successful show career as a halter horse, and was a son of sire A (Impressive) that heads an affected family of horses.10,11 Sire B was bred to 11 mares on 1 farm between 1984 and 1989, and the performance of the offspring was followed until July 1993. All horses were diagnosed as HPP-affected (n = 14) or HPP-unaffected (n = 16) on the basis of electromyographic testing. Testing was performed before knowledge of the horses’ show performance was gained, usually when the horses were weanlings or yearlings. Horses were diagnosed as being HPP-affected if they had spontaneous activity with high-frequency myotonic or bizarre high-frequency discharges.3,11 Several experiments have shown that these changes are highly repeatable5 and are sensitive and specific indicators of the presence of HPP in descendants of sire A.3,11 In 1 horse, electromyographic testing on 2 separate occasions gave conflicting results, and HPP status was determined on the basis of DNA gene probe

Magotiaux H, Communications Officer, Office of Public Relations, University of Saskatchewan, Saskatoon, Saskatchewan; University News Release, May 27, 1992.
testing for the point mutation responsible for HPP.\textsuperscript{5}

Records analysis—The American Quarter Horse Association provided "Produce of Dam" records documenting all previous winnings of the dams and their offspring. The complete show records of horses with known HPP status were then obtained. The show points were tabulated in the following divisions: open halter, open performance, amateur halter, amateur performance, youth halter, and youth performance. Horses are allowed to enter halter classes as weanlings, and separate classes exist for each sex (mare, stallion, and gelding) and each year of age until horses reach 4 years of age. Horses ≥ 4 years are shown as one age group. Performance divisions include reining, team penning, working cow horse, cutting, roping, barrel racing, western pleasure, hunt seat classes, trail, jumping, and driving classes. Performance classes require a horse broke for riding, and these classes are usually divided into junior classes for horses ≤ 4 years and senior classes for older horses. Points awarded are dependent on the number of horses competing in the class.\textsuperscript{12} There are 8 placings for classes with 8 to 29 horses competing, 9 placings for 30 to 34 horses, 10 placings for 35 to 39 horses, 11 placings for 40 to 44 horses, and 12 placings for classes with ≥ 45 horses.

Statistical analysis—Comparisons were made in 2 stages. Initially, all HPP-affected horses were compared with all HPP-unaffected horses. The second comparison minimized sex differences by excluding the 2 sexually intact stallions from analysis. Age inequalities were removed by grouping horses according to year of birth and randomly matching an HPP-affected horse with an unaffected horse from the nearest possible year of birth. If the 2 horses in the match differed in age, then show points were only used up to the age of the younger horse in the pair.

Group variances (HPP-affected vs HPP-unaffected) were compared by use of Bartlett’s test. If the variance was homogenous, then a t-test was performed. All show point data have nonhomogenous variances and were analyzed by the Kruskal-Wallis test. Sex distributions were compared by use of the \( \chi^2 \) test. Calculations were performed by use of a computer-based software program.\textsuperscript{6}

Results

Of the parents (F\(_0\)), the stallion and 2 mares had shown successfully in both halter and performance classes, and 1 mare had shown successfully in halter classes. One mare had raced but had not placed first, second, or third in any race.

There were 14 HPP-affected and 16 HPP-unaffected offspring (F\(_1\)). Ages ranged from 3 to 7 years old for the affected group and 4 to 9 years old for the unaffected group. The mean ages were not significantly different and were 6.0 ± 2.0 (SD) and 5.1 ± 1.4 years old for HPP-affected and HPP-unaffected offspring, respectively. Of the 30 horses, 18 were mares, 10 were geldings, and 2 were stallions. The HPP-affected group consisted of 6 geldings and 8 mares, whereas the HPP-unaffected group consisted of 4 geldings, 2 stallions, and 10 mares. The sex distributions were not significantly different.

With the exception of barrel racing, none of the offspring had records of placing first, second, or third in races. The mean total halter points were significantly (\( P < 0.01 \)) higher in the HPP-affected group than in the unaffected group (11.9 ± 24.7 vs 0.4 ± 1.1, respectively). Horses in the HPP-affected group significantly outperformed unaffected horses in open (\( P = 0.02 \)) and amateur halter (\( P = 0.04 \)) classes but not in youth halter classes. Of the 11 mares whose offspring’s halter records were studied, there was not a single case where an HPP-unaffected offspring was more successful in the halter division than any of its HPP-affected siblings. The mean total performance points were not significantly different (7.3 ± 18.5 vs 1.0 ± 2.2 for the HPP-affected and HPP-unaffected groups, respectively). There were no significant differences between affected and unaffected horses in open, amateur, or youth performance classes.

In the matched group, the age up to which records were used was 5.2 ± 1.3 years for both groups of horses. The HPP-affected group consisted of 6 geldings and 8 mares; the HPP-unaffected group consisted of 4 geldings and 10 mares. The sex distributions were not significantly different. Horses in the HPP-affected group had significantly more total halter points (\( P = 0.02 \)), open halter points (\( P = 0.03 \)), and amateur halter points (\( P = 0.05 \)), compared with those of unaffected horses.

Discussion

The superior performance of HPP-affected horses in halter classes, which are judged partly on the basis of a well-muscled appearance, supports the hypothesis that the constant muscle activity of HPP-affected horses leads to muscle hypertrophy\textsuperscript{6} and a more desired appearance. This preference was most intense in the open divisions and would explain the preponderance of HPP-affected horses in the breeding stock on certain farms,\textsuperscript{6} because horses that do well on the show circuit are more likely to be kept for breeding purposes.

Although HPP-affected horses had more performance points than did their unaffected counterparts, this difference was not significantly different. The difference in means was largely attributable to 1 HPP-affected horse that accumulated a large number of performance points. The lack of statistical difference presumably is because performance classes are more dependent on physical ability, partic-

ularly agility, and stamina. Interestingly, none of the offspring had a productive race record. This was probably because none of the parents had placed in a race. Affected and unaffected horses failed to race, thus, this study could not evaluate the effects of HPP on speed and endurance. Some halter enthusiasts may believe that selection for HPP-affected horses would be of some benefit; however, clinical attacks tend to occur sporadically as well as in stressful situations, such as a horse show, and could be fatal to the horse and dangerous to those around it. With the testing procedures available now, it would be more beneficial to the industry to try to eliminate this condition rather than allowing it to spread further.

References


Books Received

Receipt of these books is acknowledged. Listing should be regarded as a return of courtesy to the sender. Books that appear to be of particular interest will be reviewed as space permits.


