# GENETICS OF RACING PERFORMANCE IN THE AMERICAN QUARTER HORSE: ADJUSTMENTS FOR JOCKEY WEIGHT

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## SUMMARY

A reduced animal model has been developed to genetically evaluated racing performance in the American Quarter Horse. The model includes repeated records on horses to improve prediction accuracy. Breeding values are determined for racing finish time and expressed in ± seconds for each horse evaluated. Finish times are currently adjusted for horse sex and age, but not for other effects. An analysis was undertaken to re-examine whether finish times should also be adjusted for jockey weight, where jockey weight includes the rider, tack and any assigned handicap. The analysis included racing starts for three distances: 274.2, 365.5 and 402.2 m. Racing starts were classified according to type of race: allowance, stakes, handicap and others. Results found finish time to be significantly affected by jockey weight for all types of races, with the exception of races classified as handicap races. For the 274.2 m race, linear regressions on the jockey weight covariate were highly significant. For the 365.5 and 402.2 m races, both linear and quadratic regressions on the covariate were highly significant.

## INTRODUCTION

The power of mixed model methodology, developed by Henderson (1973) to evaluate livestock for various genetic traits of economic importance, has been well documented. Beef and dairy industries in the United States of America (USA) have used this technology for several years to provide sire evaluation summaries to breeders. More recently, USA swine and sheep industries have developed national programs of genetic improvement based on mixed model methods of prediction. The USA horse industry has not yet embraced this technology as an aid to horse breeders. Wilson et al. (1988) described a reduced animal model that was developed to genetically evaluate American Quarter Horses for racing performance. This model used repeated racing records on individual horses to improve prediction accuray. A genetic evaluation for racing performance using this model was conducted for the American Quarter Horse Association (AQHA) (Wilson and Willham, 1988).

Subsequent research on the genetic evaluation model was conducted to examine fixed effect adjustment factors. Initial research on the AQHA data base, reported by Buttram et al. (1988), indicated that adjustments for jockey weight, defined as weight of the jockey plus tack and assigned handicap, were not warranted because of the small covariate regressions that were determined. Additional research was conducted on jockey weight to determine whether finish times should, in fact, be adjusted for jockey weight. The purpose of this paper is summarize these research findings.

## MATERIALS AND METHODS

*Data*. Racing records used in the analysis were obtained from the AQHA and included official racing starts from 1971 to 1988 for distances of 274.2, 365.6 and 402.2 m. These records are summarized in Table 1. Data included 169,801,

435,299 and 109,211 starts for each of the three distances, respectively, after edits. Finish times faster than the official world records and slower than six standard deviations from the average time for each race distance were deleted from the analysis. In addition, starts from horses older than 10 years were also deleted. All racing starts included definitions of track, date, race number, horse sex, horse pedigree, finish time, type of race and jockey weight.

*Type of Race.* The data were classified according to race type: stakes race, handicap race, allowance race and others. The stakes race was originally a sweepstakes in which owners put up stakes such as nominating fees, entry fees and starting fees, all of which went to the winner. Today, the racetrack puts up money, in addition to the fees put up by the owners, called added money which can range from a few thousand dollars to $100,000. In handicap races, the racing secretary (in the role of a handicapper) assigns the weight to be carried by each horse according to an evaluation of the horse's potential. In theory, these weight assignments put all contestants on an equal basis which should result in a deadheat for the entire field. In the allowance race, the respective weights to be carried are based on amounts of money or the number of races a horse has won over a specified period. Although a base weight is established, horses with poorer performance records are given allowances (reductions in weight) in order to bring the field together.

*Analysis.* A general linear model was used to examine the need to adjust finish times for jockey weight along with other adjustments for sex and age of the horse. The model fit finish time as a dependent variable of contemporary group effects and horse sex and age. Contemporary groups were defined as race location, date and race number. The model fit horse sex and age as classificatory variables and jockey weight minus 55 kg as linear and quadratic covariate effects, where 55 kg was the average jockey weight.

## RESULTS AND DISCUSSION

Results of the regression analysis for the covariate, jockey weight minus 55 kg, on horse finish time are presented in Table 2. Four main observations can be made from the analysis: (1) The analysis model accounts for an increasing amount of the variation in finish time as distance increase, (2) linear and quadratic regressions for the covariate are nonsignificant in handicap races, with the exception of 274.2 handicap races where the linear regression is significant, (3) linear regressions for the covariate at the 274.2 m distance are of the opposite sign to those in the 365.6 and 402.2 m distances, and (4) covariate regressions are large enough to warrant adjustments in genetic evaluations for racing performance.

Race Distance and Model $R^2$. The 274.2 m race is typically run by young horses, 2 year-olds, and it is speculated that their general performance is more erratic than for older and more seasoned track veterans. Of the horses that run the 274.2 m race, 71.6 percent are 2 year-olds in stake races and 64.8 percent in all handicap races. In the 365.6 m races, the majority of the horses are 3 year-olds; for the 402.2 m races, the majority are 3 and 4 year-olds.

*Handicap Races.* The major goal of the handicap race is to even out the field, giving each horse an equal opportunity to win. Results of the analysis indicate that handicappers are accomplishing their objective. Not only were the

Table 1. Racing starts used in jockey weight adjustment analysis.

| Type of Race | Record No. | Ave. Finish Time, s | Ave. Jockey Weight, kg |
|---|---|---|---|
| Distance: 274.2 m | | | |
| Allowance | 71,351 | 16.53±.54 | 54.87±1.40 |
| Handicap | 10,977 | 16.58±.53 | 54.87±1.29 |
| Stakes | 4,482 | 16.19±.44 | 55.04±1.44 |
| Other | 82,991 | 16.65±.58 | 55.06±1.28 |
| Distance: 365.6 m | | | |
| Allowance | 128,074 | 20.99±.57 | 54.79±1.26 |
| Handicap | 7,919 | 21.05±.62 | 54.94±1.48 |
| Stakes | 19,684 | 20.60±.48 | 54.87±1.09 |
| Other | 279,622 | 21.08±.57 | 54.79±1.26 |
| Distance: 402.2 m | | | |
| Allowance | 30,210 | 23.00±.65 | 54.95±1.44 |
| Handicap | 2,199 | 22.91±.66 | 55.42±1.93 |
| Stakes | 7,857 | 22.41±.53 | 54.95±1.12 |
| Other | 68,945 | 22.97±.63 | 54.84±1.04 |

Table 2. Regression analysis for jockey weight adjustment factors.

| | Covariate Regression Coefficients | | | | |
|---|---|---|---|---|---|
| Type of Race | Linear | P | Quadratic | P | $R^2$ |
| Distance: 274.2 m | | | | | |
| Allowance | .01869 | *** | .00017 | NS | .56 |
| Handicap (H) | .02194 | *** | .00072 | NS | .47 |
| Stakes | .01179 | * | -.00031 | NS | .64 |
| Other | .01689 | *** | .00143 | *** | .53 |
| Overall less H | .01938 | *** | | | .55 |
| Distance: 365.6 m | | | | | |
| Allowance | -.01010 | *** | .00414 | *** | .66 |
| Handicap (H) | .00410 | NS | .00118 | NS | .68 |
| Stakes | -.01745 | *** | .00520 | *** | .71 |
| Other | -.00160 | NS | .00400 | *** | .65 |
| Overall less H | -.00616 | *** | .00400 | *** | .67 |
| Distance: 402.2 m | | | | | |
| Allowance | -.00970 | *** | .00360 | *** | .70 |
| Handicap (H) | .13494 | NS | -.00005 | NS | .71 |
| Stakes | -.01840 | *** | .00499 | *** | .74 |
| Other | -.01098 | *** | .00565 | *** | .70 |
| Overall less H | -.01163 | *** | .00430 | *** | .72 |

***P<.001, **P<.01, *P<.10, NS=nonsignificant.

indicate that handicappers are accomplishing their objective. Not only were the linear and quadratic regressions for the covariate nonsignificant, horse age effects were nonsignificant across the three race distances. It is interesting to note though that sex was still a significant effect at all three distances. The results indicate that handicap races should not used in determining jockey weight adjustment factors.

*Covariate Linear Regression Slope.* General differences between the covariate regressions for the 274.2 m race and the longer two race distances are shown in Figure 1. Buttram et al. (1988) reported that American Quarter Horses tend to be at their best when the jockey weight is 54-55 kg. Research reported in this paper would substantiate Buttram's finding for the 365.6 and 402.2 m races, but not for the 274.2 m race distance.

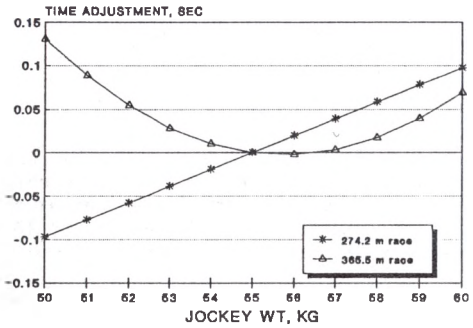


Figure 1. Jockey weight adjustment factors for 274.2 and 365.5 m races.

*Adjustments for Jockey Weight.* Regressions for both linear and quadratic effects of the covariate are sufficiently large enough to warrant adjustments in finish times. Although standard deviations on jockey weight are not large, finish times that separate the horses are not large either, being measured in hundredths of seconds. Results suggest that a linear adjustment for the 274.2 m distance is appropriate; both linear and quadratic covariate adjustments for the 365 and 402.2 m distances are appropriate. It is recommended that the overall regressions presented in Table 2 be used to adjust finish times by race distance.

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