THE EFFECT OF SELECTED FACTORS ON LENGTH OF SHOW-JUMPING CAREER OF HORSES IN HUNGARY. PILOT STUDY

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SUMMARY

The main aim of this study was the evaluation of the risk factors of 'age at first competition result' and 'maximum difficulty' of ever completed track based on sport competition results of Hungarian show-jumping horses. Competition results of 2605 geldings recorded between 1996 and 2009 in show-jumping competitions were used in the analysis. The dataset contained 30% right-censored records. The discrete measurement of time, the number of years spent in competition, was chosen as dependent variable. The evaluation model contained the fixed effects of birth year, age at first competition result and the maximum difficulty of ever completed track. Both fixed effects were highly significant ($p<0.01$). The mathematical evaluation was carried out using Kaplan-Meier procedure and Cox Regression in SPSS 13.0. The culling risk was 5.5 times higher for horses competing only in the easiest category then horses which ever competed in the heaviest category. The younger the horse started competition, the longer it stayed in competition. The cumulated survival functions also strengthened these results. Overall, it can be concluded that horses with talent to perform at the most difficult categories spent more time in sport competitions. Furthermore, the start of the show-jumping career in earlier age showed smaller risk ratios of leaving competition fields than for horses starting their career in later age.

ÖSSZEFOGLALÁS

Posta, J. – Balogh, P. – Mihók, S.: NÉHÁNY TÉNYEZŐ HATÁSA MAGYAR SPORTLOVAK DÍJUGRATÁSI SPORTKARRIERÉRE. KÍSÉRLETI TANULMÁNY

A tanulmány célja magyarországi sportlovak díjugratási sporteredményeit alapul véve az első induláskori életkor, és a nehézségi szint, mint kockázati tényezők, értékelése. Az elemzésben összesen 2605 herélt ló 1996 és 2009 közötti díjugratási sporteredményeit dolgozták fel. A felhasznált adatbázis 30%-nyi jobbról cenzorált adatot tartalmazott. Függő változónak a sportban töltött évek számát választották. A modellben a születési évet, az első induláskori életkort és a maximális nehézségi szintet vették figyelembe fix hatásként. Minden fix hatást szignifikánsnak ($p<0,01$) találtak. A matematikai értékeléshez Kaplan-Meier és Cox regressziót alkalmaztak, SPSS 13.0 szoftver használatával. A kiesési kockázat 5,5-szer magasabb volt a kizárólag a legkönnyebb kategóriában versenyző lovakra, mint a legnehezebb kategóriában is indulók esetében. A sportba korábban bekerülő lovak hosszabb ideig teljesítettek a díjugratásban. Az összesített túlélési függvények megerősítették a fenti eredményeket. Összességében kijelenthető, hogy a maximális nehézségi szinten teljesíteni képes lovak több időt töltöttek a díjugratásban. Továbbá, a díjugratási karrierjüket korábbi életkorban kezdő lovak kisebb kockázati értékkel hagyták el a sportpályákat, mint a sportpályafutásukat később kezdő egyedek.

INTRODUCTION AND LITERATURE REVIEW

The long-lasting performance might be a more important trait in horse breeding than in other farm animals. Horses have longer productive life than other species, and long-lasting performance requires significant time and money. Riding horses usually take their maximum sport performance as 10-15 years old, which certainly shows the importance of a long productive life, that's why the evaluation of some risk factors could be interesting.

There are some previous studies in this field. *Ducro et al.* (2007) and *Thorén Hellsten et al.* (2006) studied the genetic relations between early measurable traits and later sport performance on show-jumping and dressage. *Ricard and Fournet-Hanocq* (1997) found low heritability of longevity for French jumping horses using survival analysis. *Wallin et al.* (2001) concluded that the birth year and sex have an effect on longevity. *Árnason* (2006) reported 5% genetic proportion of total phenotypic variance based on performance results of Swedish Trotters. *Braam et al.* (2011) found a positive correlation between the number of years in competition and sport performance. They took into account birth year and age at first competition. *Ricard and Blouin* (2011) concluded that horses, which started their careers earlier, had longer sport competition performance. *Árnason and Björnsdóttir* (2003) estimated the heritability of the effect of radiographic signs and age-at-onset of bone spavin of Icelandic horses using survival analysis.

The length of racing careers of Thoroughbreds was also studied. *Sobczynska* (2007) reported that age at first start influenced the later length of racing life. The author found that horses began their career at earlier age had a higher probability of a long racing life. *Burns et al.* (2006) found that the high ratio of censored data biased the estimated heritability because of poor-performing animals.

Parameters with effect on the longevity of farm animal species were studied in Hungary in different ways. *Dákay et al.* (2006) and *Zsuppán et al.* (2009) analysed the effect of reproduction traits on longevity of beef cattle, *Gulyás et al.* (2012) studied using proteomic methods the longevity of dairy cows whereas *Nagy et al.* (2010) published some results from the genetic background of longevity of Hungarian pigs.

The main aim of this study was the evaluation of the risk factors of 'age at first competition result' and 'maximum difficulty' of ever completed track based on sport competition results of Hungarian show-jumping horses.

MATERIALS AND METHODS

Competition results recorded between 1996 and 2009 in show-jumping competitions were used to estimate the effect of age at first competition result and the maximum difficulty of ever completed track on the career longevity. The results were collected by the Show-jumping Group of the Hungarian Horse Breeder's Society and contained both national and international results of 8953 horses. To avoid the possible bias due to early culling of mares or stallions due to entering breeding, only the results of geldings born during 1992 or later were included in the analysis. The filtered database contained the information of 2605 horses with 116 018 start in show-jumping competitions. Horses with competition

results from the last evaluation year had no information about the finishing time of their sport career. The data of such animals were handled during the analyses as right-censored records, due to the lack of information about the exact finishing time of their sport career. The filtered dataset contained 30% right-censored records.

The discrete measurement of time, the number of years spent in competition, was chosen as dependent variable. The number of years in competition was computed as the difference between the last and first competition year. The evaluation model contained the fixed effects of birth year, age at first competition result and the maximum difficulty of ever completed track. The maximum difficulty of ever completed track was scored from 1 to 5 given 1 for the easiest and 5 for the most difficult competition following the categorization of difficulty levels reported by *Rudiné et al.* (2013).

The mathematical evaluation was carried out using Kaplan-Meier procedure (*Kaplan and Meier*, 1958) and Cox Regression (*Cox*, 1972) in SPSS 13.0. The Kaplan-Meier procedure is a method of estimating time-to-event models in the presence of censored cases. The Kaplan-Meier model is based on estimating conditional probabilities at each time point when an event occurs and taking the product limit of those probabilities to estimate the survival rate at each point in time. Cox Regression allows including predictor variables (covariates) in a model and it will provide estimated coefficients for each of the covariates, allowing assessing the impact of multiple covariates in the same model. Cox Regression can be used to examine the effect of continuous covariates (*Kleinbaum and Klein*, 2012). The risk ratios were shown for the selected factors compared to a reference class. The reference class was chosen as the group with the smallest risk ratio for each factor.

RESULTS AND DISCUSSION

The effect of maximum difficulty of ever completed competition event and age at first competition on number of years in competition were both significant (*Table 1.*).

Table 1.

Significance values of the analysed factors

	Maximum difficulty (1)			Age at first competition results (2)		
	Chi-square (3)	DF (4)	Sig. (5)	Chi-square (3)	DF (4)	Sig. (5)
Log rank (Mantel-Cox)	687.950	4	P<0.001	155.431	5	P<0.001
Breslow (Generalized Wilcoxon)	708.441	4	P<0.001	161.896	5	P<0.001
Tarone-Ware	730.532	4	P<0.001	163.732	5	P<0.001

1. táblázat. A maximális nehézségi szint kockázati hányadosai. A nyíl a referencia osztályt jelöli. maximális nehézség (1); az első induláskori életkor (években) (2); Chi-négyzet érték (3); szabadságfok (4); szignifikancia szint (5)

The estimates of risk ratio and number of animals for maximum difficulty of ever completed track are shown in *Figure 1.*, whereas beta coefficients of the model and Wald statistics are shown in *Table 2.*, respectively. The largest culling risk was estimated for horses competing only in the easiest category. It was 5.5 times higher than for horses ever competing in the most difficult category. The risk ratios for leaving the competition were almost the same for category 3 and category 4. As the maximum difficulty increased, the risk ratio continuously decreased. The tendency of number of animals across categories of maximum difficulty was similar to those described for risk ratios.

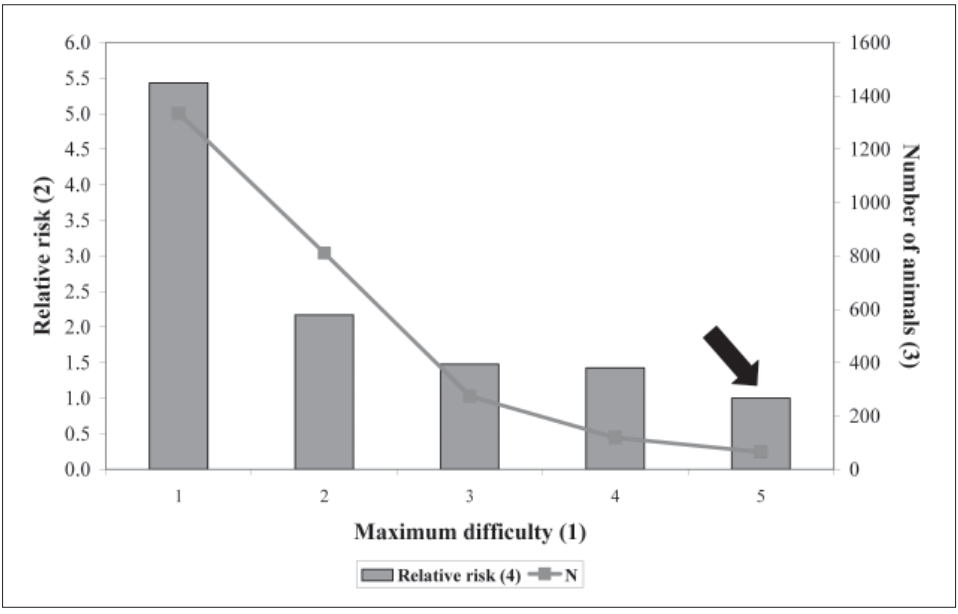
Table 2.

Risk statistics for maximum difficulty

Group (1)	Beta (2)	S.E. of beta (3)	Wald statistics (4)	DF (5)
1			465.783	4
2	1.692	0.188	81.402	1
3	0.775	0.189	16.818	1
4	0.389	0.200	3.788	1
5	0.353	0.216	2.663	1

2. táblázat. A maximális nehézségi szint kockázati statisztikái
Csoport (1); a túlélési modell együtthatói (2), az együttható standard hibája (3); Wald statisztika (4); szabadságfok (5)

Figure 1. *Estimates of risk ratio for maximum difficulty. The arrow indicates the reference class*



1. ábra. A maximális nehézségi szint kockázati hányadosai. A nyíl a referencia osztályt jelöli.
maximális nehézség (1); relatív kockázat (2); egyedszám (3); relatív kockázat (4)

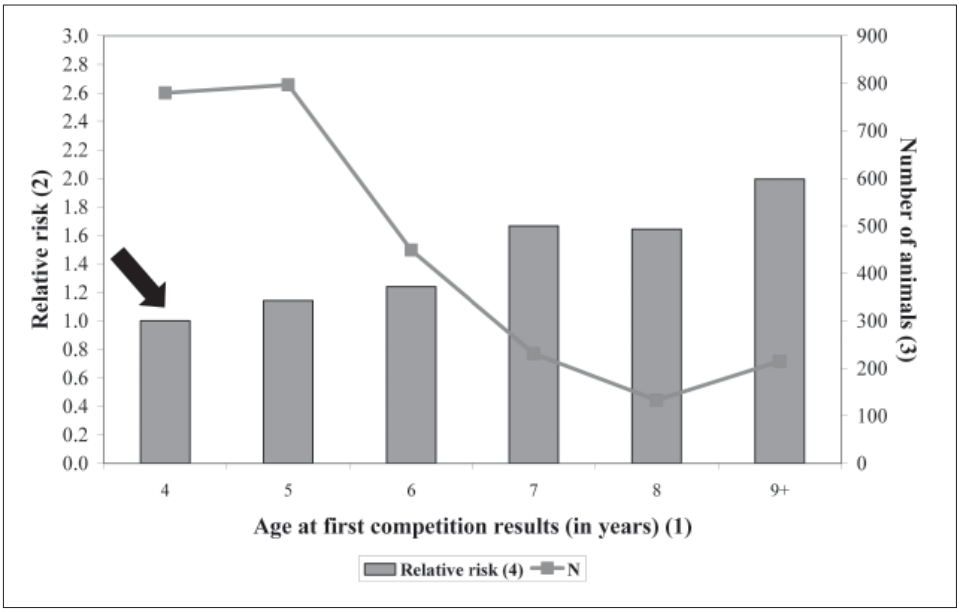
Table 3.

Risk statistics for age at first competition results

Age groups (1)	Beta (2)	S.E. of beta (3)	Wald statistics (4)	DF (5)
4			78.701	5
5	0.133	0.061	4.734	1
6	0.215	0.072	8.839	1
7	0.510	0.090	32.085	1
8	0.496	0.111	20.071	1
9+	0.690	0.094	53.868	1

3. táblázat. Az első induláskori életkor kockázati statisztikái
Korcsoportok (1); a túlélési modell együtthatói (2); az együttható standard hibája (3); Wald statisztika (4); szabadságfok (5)

Figure 2. *Estimates of risk ratio for age at first competition results. The arrow indicates the reference class*

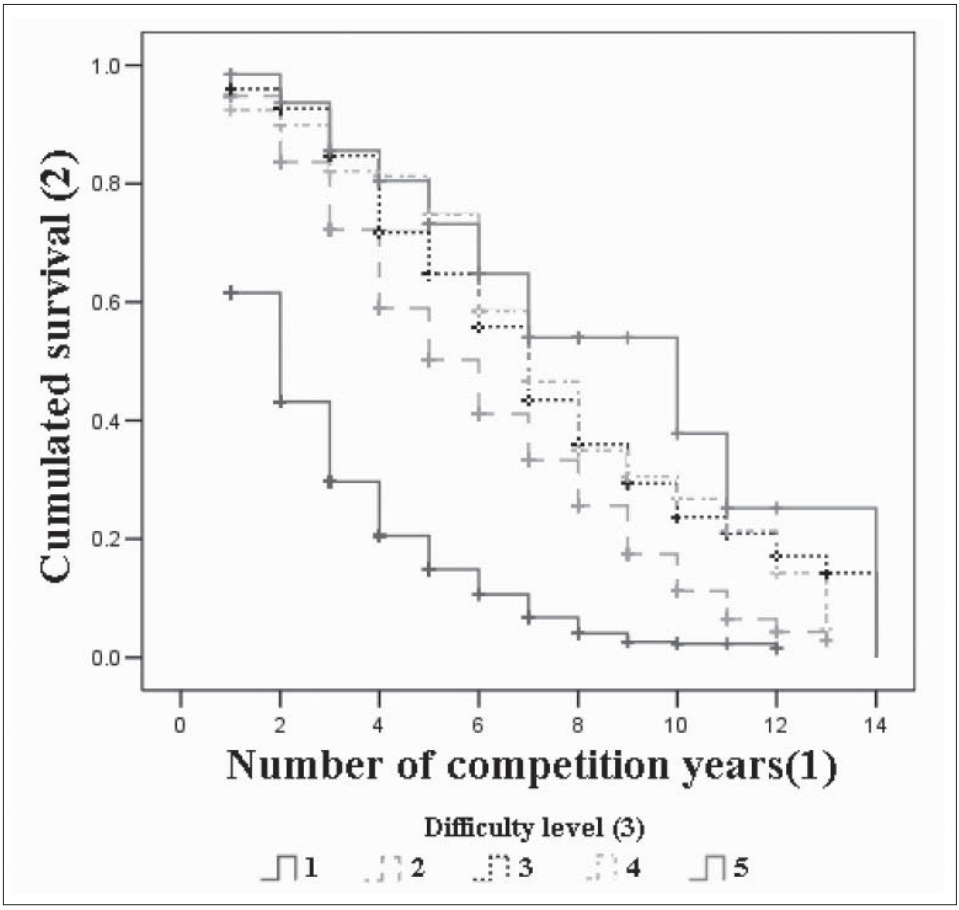


2. ábra. Az első induláskori életkor kockázati hányadosai. A nyíl a referencia osztályt jelöli.
az első induláskori életkor (években) (1); relatív kockázat (2); egyedszám (3); relatív kockázat (4)

The estimates of risk ratio and number of animals for age at first competition results are shown in *Figure 2.*, whereas beta coefficients of the model and Wald statistics are shown in *Table 3.*, respectively. The younger the horse started competition, the longer it stayed in competition, which is against common belief. The chance for leaving the competition field was quite similar for horses starting competition at the age of 7 and 8. As it was expected, the largest risk ration was estimated for older horses. Most of the animals started their sport career at the age of 4 or 5 years old. The smallest number of animals was found at the age of 8.

Figure 3. shows the survival functions of the different maximum difficulty groups. The survival rate decreased higher between the first and second year spent in competition for horses only competing in the easiest category. The rate for these horses was quite far from those of other categories and suggests that half of the horses with lack of talent will leave the competition after one or two years. Horses ever competing in the most difficult category spent the longest time in sport competitions, as it was expected. Rate of horses competing ever in category 4 was near the rate of horses in category 5 up to six years. For the remaining sport career it was near to the rate of category 3.

Figure 3. *Survival of longevity in jumping competition for different groups of maximum difficulty*

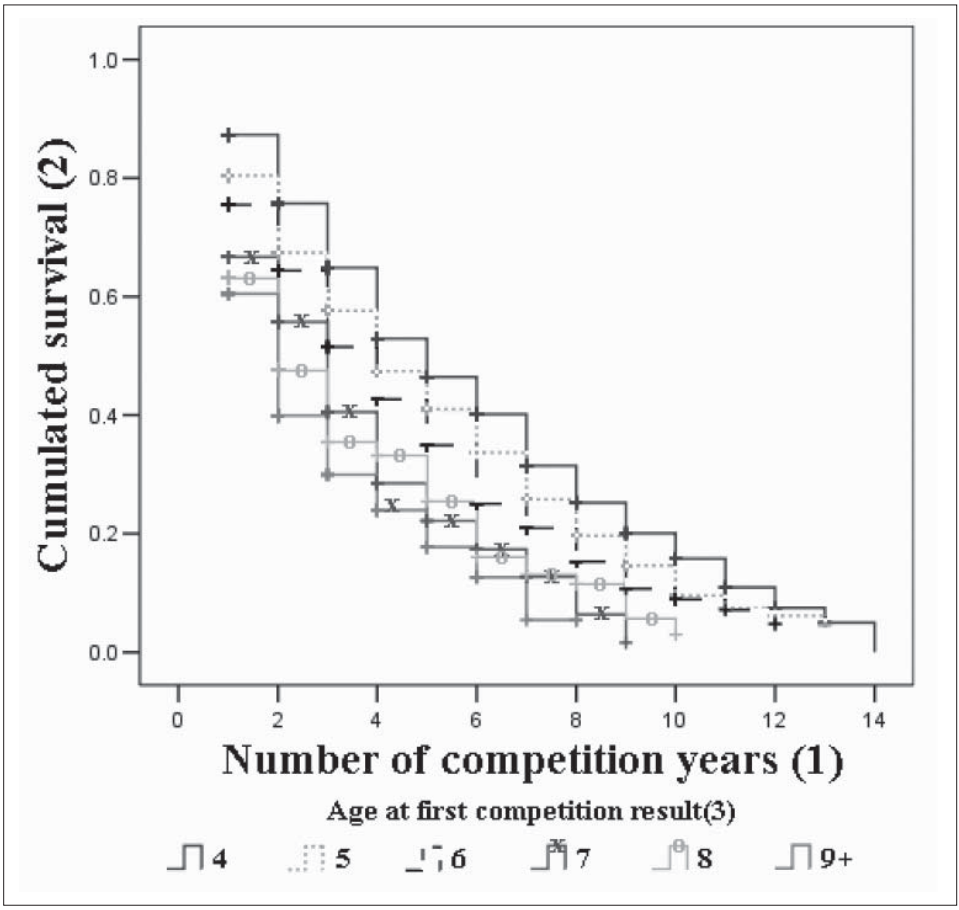


3. ábra. Az ugrósportban töltött hasznos élettartam a maximális nehézség különböző csoportjaira

a sportban töltött évek száma (1); összesített túlélés (2); nehézségi szint (3)

Figure 4. shows the survival functions of the different groups of age at first competition results. The survival rate decreased higher between the first and second year in competition for at least 8-years-old horses. For the other age categories, decreasing of the survival rate between the first and second year was quite similar to the ones between the second and the third year. Horses, which started for the first time between 4- and 6-years-old, were longer in the competition field. The tendency for horses starting their jumping career as 4-years-old was similar to the results of *Ricard and Blouin* (2011). Our results were also similar to those of published by *Ricard and Fournet-Hanocq* (1997) for 4-, 6- and 8-years-old horses, respectively. These results were in agreement with the results for Thoroughbreds in *Sobczynska* (2007) study.

Figure 4*. Survival of longevity in jumping competition for different age groups at first competition results*



4. ábra. Az ugrósportban töltött hasznos élettartam az első induláskori életkor különböző csoportjaira

a sportban töltött évek száma (1); összesített túlélés (2); az első induláskori életkor (4)

CONCLUSIONS

Horses with talent to perform at the most difficult categories spent more time in sport competitions. The start of the show-jumping career in earlier age showed smaller risk ratios of leaving competition fields than for horses starting their career in later age.

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IN MEMORIAM HAJBA NÁNDOR /1927-2013/

A Budapesten született, érettségit tett fiatalember előbb lóápoló, majd csődörös, 1956-tól az FM Lótenyésztési Igazgatóságán törzskönyvezési előadó. E feladatkörében kedvtelésből végzett fotózása egyre jobban szakmai szükségszerűséggé is vált. Az 1960-as évektől a mezőgazdasági kiállításokon már mindegyik állatfajt nagy hozzáértéssel fényképezte. Szakmai ismeretei gyarapítására elvégezte az agrártudományi egyetemet.

Az 1970-es évek elején az FM főállású fotósává léptették elő. Több mint 60 éven át fotózta a hazai állattenyésztés reprezentánsait, amelyek egy része az utóbbi évtizedek mindegyik állattenyésztési tankönyvében is megtalálhatók. Ezzel az oktatást, a szakemberképzést páratlan módon segítette és Hazánk egyik legismertebb állatfotósa lett.

Az újjászerveződő tenyésztő-szervezetek szinte naponta használják képeit, s általa válnak ismerté az utókor számára a nagy genetikai értékű tenyészállataink.

Hajba Nándor állattenyésztésünk történetét örökítette meg képi formában. Hiteles állatképei nemzetközileg is fontossá váltak, mert sokszor csak ezek adhattak hírt állattenyésztésünkről, és ezek alapján válhattak ismerté a hazai tenyészállataink.

Agrártörténeti emlékként felfogható hatalmas archívumát a Mezőgazdasági Múzeumnak ajánlotta fel.