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# Genetic study of longevity of Hungarian pigs

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**_ABSTRACT_**

*Authors jointly analyzed dataset measuring the reproductive performance of Hungarian Large White (LW, n=37806), Hungarian Landrace (LR, n=13620) and their cross (F1, n=40652). Number of records was 283528 collected for 92082 dams born between 1999–2004. Using the Weibull model (survival analysis) lifetime performances of the different genotypes were evaluated. The herd effects were significant for both lifetime performance traits (age at culling, total number of piglets born alive). The effect of age was only significant for total number of piglets born alive although the differences were small. Inbreeding on the other hand unfavourably affected lifetime performance for both traits.*
(Keywords: lifetime performance, inbreeding, swine, survival analysis)

## INTRODUCTION

Survival analysis is a well known and widely used statistical procedure correlating time to event data. An event might be death, developing a certain disease, or any other condition if its occurrence can be clearly detected on time scale. Survival analysis is mainly used in health sciences where the efficiency of various alternative treatments against some pre-defined illnesses can be compared with each other. Yet the method is widely used by sociologists, criminologists and also by animal scientists. The invaluable advantage of this procedure is that the so called censored data are not wasted but also used in the analysis. Censoring means that the event has not occurred till the experiment is terminated and thus the exact survival time of the participant is unknown. These phenomena either cannot be handled at all by other types of statistical analyses (like analysis of variance) or the data is reduced to being dichotomous (logistic regression) and hence considerable information is lost. Is application in the Hungarian pig breeding was practically absent until the beginning of the last decade (*Nagy et al.,* 2002) but more recently several studies were published (*Balogh et al.,* 2007a, 2007b; *Balogh et al.,* 2008). However, the effects of inbreeding were not yet been tested for any Hungarian pig population with the help of survival analysis. This was the objective of this study.

## MATERIALS AND METHODS

The analyses were conducted using the Hungarian Pig breeding dataset. Farrowing data containing 283528 records of 92082 dams born between 1999–2004 were evaluated. The dataset contained the reproductive performance of three genotypes: Hungarian Large White (LW, n=37806), Hungarian Landrace (LR, n=13620) and Hungarian Large White×Hungarian Landrace (F1, n=40652). The dams were originated from 193 herds and their lifetime parity number varied between 1 and 15. Lifetime performance was measured as either age (AGE) (until culling) or total number of pigs born alive (TNB) pooling the litter sizes of the successive parturitions. Basic statistics of the lifetime performance of the analyzed genotypes is provided in *Table 1*.

**Table 1**

**Mean and standard deviation of age and total number of born piglets in the analyzed genotypes**

| **Genotype** | **LW** | | **LR** | | **F1** | |
|---|---|---|---|---|---|---|
| Trait | AGE | TNB | AGE | TNB | AGE | TNB |
| Mean | 784 | 31.9 | 738 | 31.4 | 760 | 30.8 |
| Std. | 385 | 24.5 | 359 | 22.7 | 370 | 23.2 |

Lifetime performance was evaluated the WEIBULL model (*Weibull,* 1951) using the SURVIVAL KIT software (*Ducrocq and Sölkner,* 1998). Four different models were applied. In the first two models the factors taken into the model were: genotype (3), herd (193) while the dependent variables were AGE and TNB, respectively. In the third and fourth models only the purebreds were analyzed but as an additional factor the inbreeding coefficient of the dams was also taken into the analysis. The calculations were done with the PEDIG software (*Boichard,* 2002) using the algorithm of Van Raden. The inbreeding coefficients (%) were classified into 7 levels (1: 0; 2: 0–3.125; 3: 3.125–6.25; 4: 6.25–12.5; 5: 12.5–18.25; 6: 18.25–25; 7: 25–)

## RESULTS AND DISCUSSION

The results are presented in *Tables 2–5*. The results for the herd effects could not be presented in tables due to the high number of levels (193). Nevertheless significant differences were found across the herds for both traits. The effect of genotype on age was not significant while significant differences were found for the total number of born piglets, although the differences among the genotypes were small (*Tables 1–3*). Contrary to our results analyzing more than 10.000 records 6 different pig genotypes *Balogh et al.* (2006) observed significant differences among the genotypes' survival time (AGE) using the survival functions of *Kaplan and Meier* (1958).

After taking into account the inbreeding coefficients of the dams the genotype effects were not significant for either trait therefore were not presented (*Tables 4–5*). The herd effect remained highly significant while higher risk ratios could be observed (although only partly significant) for the inbred dams for both traits, thus inbreeding unfavourably affects lifetime performance (*Tables 4–5*). In a similar study made for several cattle breeds (*Sewalem et al.,* 2006) a trend toward increased risk of culling among more inbred animals was observed for all breeds.

**Table 2**

**Risk ratio of the dams depending on the genotype for AGE***

| **Factor (Genotype)** | **Risk Ratio** | **Significance** |
|---|---|---|
| 1. Hungarian Large White | 1.006 | 0.695 |
| 2. Hungarian Landrace | 0.943 | 0.211 |
| 3. Hungarian Large White×Hungarian Landrace | 1.000 | * |

*AGE: age at culling

**Table 3**

**Risk ratio of the dams depending on the genotype for TNB***

| Factor (Genotype) | Risk Ratio | Significance |
|---|---|---|
| 1. Hungarian Large White | 1.034 | 0.027 |
| 2. Hungarian Landrace | 1.021 | 0.665 |
| 3. Hungarian Large White×Hungarian Landrace | 1.000 | * |

*TNB: Total number of piglets born alive (pooled)

**Table 4**

**Risk ratio of the dams depending on the inbreeding coefficient for AGE***

| Factor (Inbreeding coefficient) | Risk Ratio | Significance |
|---|---|---|
| 1. 0 | 1.000 | * |
| 2. 0–3.125 | 1.262 | 0.0000 |
| 3. 3.125–6.25 | 1.237 | 0.0000 |
| 4. 6.25–12.5 | 1.159 | 0.0141 |
| 5. 12.5–18.25 | 1.186 | 0.4128 |
| 6. 18.25–25 | 1.583 | 0.2008 |
| 7. 25– | 1.146 | 0.0677 |

*Age at culling

**Table 5**

**Risk ratio of the dams depending on the inbreeding coefficient for TNB***

| Factor (Inbreeding coefficient) | Risk Ratio | Significance |
|---|---|---|
| 1. 0 | 1.000 | 0.0000 |
| 2. 0–3.125 | 1.168 | 0.0000 |
| 3. 3.125–6.25 | 1.198 | 0.0095 |
| 4. 6.25–12.5 | 1.169 | 0.6807 |
| 5. 12.5–18.25 | 1.090 | 0.4447 |
| 6. 18.25–25 | 1.309 | 0.0862 |
| 7. 25– | 1.137 | 0.0000 |

*TNB: Total number of piglets born alive (pooled)

## CONCLUSIONS

Based on the results it can be concluded that survival analysis can be successfully applied not only for evaluating lifetime performances but also for evaluating inbreeding effects for lifetime performing traits.

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