

INBREEDING OF THE HUNGARIAN HOLSTEIN-FRIESIAN POPULATION

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SUMMARY

The inbreeding of the Hungarian Holstein Friesian population was analysed between the birth years of 1997 and 2003. The total number of animals was 4664874 in the pedigree. There were 1015936 inbred animals in the population. The highest inbreeding coefficient (F) was 37.5 %. The 95.4 percent of inbred animals had less than 5% inbreeding coefficient. The inbreeding coefficient increased by 0.1% annually during the observed time period. The relationship between the inbreeding coefficient and the open days, the lactation length and the 305d milk yield were analysed, respectively. The parity, the herd and the birth year were fixed effects in the model, the inbreeding coefficient was covariate. Lactation yield decreased by 10.4 kg, open days and the lactation length increased by 0.8 and 0.6 days respectively by 1% increase of the F.

ÖSSZEFOGLALÁS

Márkus Sz. – Posta J. – Bognár L. – Komlósi I.: A HAZAI HOLSTEIN-FRÍZ POPULÁCIÓ BELTENYÉSZTETTSÉGÉNEK ÉRTÉKELÉSE

Szerzők a hazai holstein-fríz populáció beltenyészetttségét vizsgálták az 1997 és 2003 között született egyedeknél. A pedigrében 4664874 egyed adatai szerepeltek. Az állományban 1015936 egyed volt beltenyészett. A legmagasabb beltenyészetttségű egyed együtthatója 37,5% volt. A beltenyészett egyedek 95,4%-ának a beltenyészettési együtthatója kisebb volt, mint 5%. A vizsgált időszakban a beltenyészetttség évenként 0,1%-kal növekedett. A beltenyészetttség hatását vizsgálva a nyitott napok számára, a tejelő napok számára és a 305 napos standard laktációs tejtermelésre, a modellben fix hatású tényezőként szerepeltek a laktáció sorszáma, a tenyésztet, a születési év, kovariáló hatásként pedig az egyed beltenyészetttségi együtthatója. Egy százaléknyi együttható növekedés 0,8 nappal növeli a nyitott napok számát, 0,6 nappal növeli a tejelő napok számát és 10,4 kg-mal csökkenti a standard laktációs tejtermelést.

INTRODUCTION

Because of the biotechnical and biotechnological improvements and their increasing utilization, the analysis of the inbreeding level is getting important in the animal breeding. Breeders use as much as possible progenies of animals with high genetic merit to make the production more profitable. This may result in the increased inbreeding level of the population which lead to inbreeding depression in the production as well as fitness traits.

The inbreeding level of different Holstein-Friesian populations is widely analysed. *Miglior and Burnside* (1995), *Young and Seykora* (1996), *Kearney et al.* (2004) and *Atashi et al.* (2011) reported in their studies the inbreeding of Holstein-Friesian population of Canada, the United States, Great Britain, Iran, respectively. *Mc Parland et al.* (2007) investigated the population structure of Irish Holstein-Friesian besides five meat cattle breeds. *Miglior et al.* (1995) and *Thompson et al.* (2000) analysed the effect of inbreeding on production traits for the Holstein-Friesian population of the United States. *Weigel and Lin* (2000) analysed the possibilities of keeping inbreeding between limits.

The lifetime production of top cows of different dairy breeds was evaluated by *Horvai-Szabó et al.* (2000), whereas the effect of lameness on the production performance was studied by *Gudaj et al.* (2012).

The aims of this study were the analysis of the inbreeding of the Hungarian Holstein-Friesian population and discover the relationships between inbreeding and some dairy production traits. *Vigh et al.* (2008) showed some measurement of pedigree analysis and its application in their study.

MATERIALS AND METHODS

The dataset used in the analysis was collected and was given by the Hungarian Central Agricultural Office. Dairy production traits of 338489 cows, born after 1997, were known. Their pedigree data was 11 generations back and contained 4664874 animals.

The pedigree data was analysed with PEDIG (*Boichard, 2002*) software package. The inbreeding coefficients were calculated using the algorithm of *Meuwissen and Luo* (1992). The annual changing of the inbreeding was evaluated with SAS PROC REG (*SAS Institute Inc., 2002*).

The relationships between service period, number of open days, lactation yield and inbreeding coefficient were analysed with the following model:

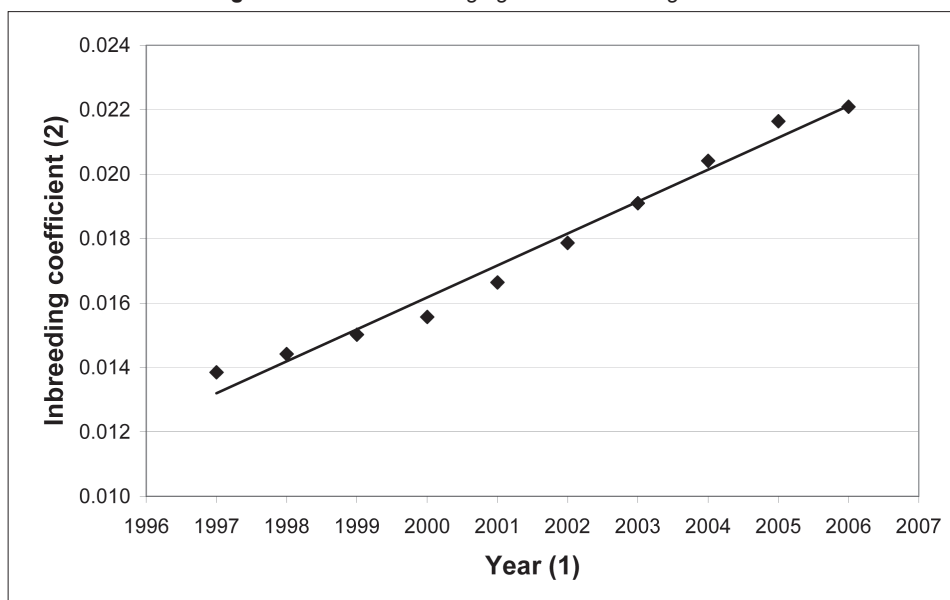
$$y_{ijk} = \text{Lactation}_i + \text{Herd}_j + \text{BirthYear}_k + F_x + e_{ijk},$$

where y_{ijk} is the dependent variable – service period, number of milking days, standard lactation yield –, Lactation_i the lactation number of the cow, Herd_j the herd of the cow, BirthYear_k the birth year of the cow. F_x is the inbreeding coefficient, what was taken into account as covariable trait, e_{ijk} is the residual. These effects were tested prior the analysis using SAS PROC GLM (*SAS Institute Inc., 2002*).

RESULTS AND DISCUSSION

There were 1,015,936 inbred animals in the analyzed population. The inbreeding coefficient of 969,470 cows (95.4% of the inbred animals) was lower than 5%, whereas the inbreeding coefficient of 5,062 animals was higher than 20%. *Thompson et al* (2000) reported similar results based on their research on the Holstein –Friesian population of the United States.

Figure 1. The annual changing of the inbreeding coefficient



$$y = 0.001x - 1.97 \quad R^2 = 0.98 \quad R = 0.99 \quad Df = 9$$

1. ábra Az átlagos beltenyésztési együttható változása születési évenként év (1); beltenyésztési együttható (2)

The highest inbreeding coefficient was 37.5%. The average inbreeding of the population was 0.41%, the inbreeding of the inbred animals was 1.88%, respectively. The values obtained are similar to the estimations of *Miglior and Burnside* (1995) for Canadian Holstein-Friesians.

The analysis of the inbreeding coefficient of animals born after 1997 (Fig. 1.) showed 0.1% annual increase in the average inbreeding coefficient ($y = 0.001x - 1.97$, $R^2 = 0.98$, $R = 0.99$, $Df = 9$). The estimated parameters were significant at $p < 0.01$ level. Our estimations are also in agreement with *Mc Parland et al.* (2007) results based on the Irish Holstein-Friesian population. *Kearney et al.* (2004) found almost twice annual increase in the average inbreeding (0.17%) for the Holstein-Friesian population of the United Kingdom.

The effect of the inbreeding coefficient was estimated for the open days, lactation length and the 305d lactation yield. Based on our research, 1% increase in the

inbreeding caused 0.8 increase in open days, 0.65 increase in the lactation length and 10.4 kg decrease in 305d lactation yield, respectively. These results for the 305d lactation yield were much lower than the value reported by *Thompson et al.* (2000) (35 kg and 55 kg decrease for cows with inbreeding coefficient lower than 7% and higher than 10%, respectively) and *Atashi et al.* (2011) (19 kg decrease).

CONCLUSIONS

Based on our results, it can be concluded, that the inbreeding of the Hungarian Holstein-Friesian population is similar to and in some cases better than the international tendencies. The continuous increase of the inbreeding level and the fact that inbreeding decreases the lactation yield and increases number of open days, mating plans needs to account the inbreeding coefficient of the future progeny.

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EFSA HÍREK

Az EFSA végső állásfoglalást tett közzé (EFSA Journal, 2012.10.11.) A Séralini és mtsai által 2012-ben publikált eredményekkel kapcsolatban. A nevezett szerzők egy kétéves kísérletben az NK603 GMO kukorica és egyes glyphozfát tartalmú növényvédő szerek etetésének hatásait vizsgálták patkányokban. A EFSA szakértők véleménye szerint nem volt megfelelő a kísérletek ter-

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