

GENETIC PARAMETERS OF INCIDENCE OF DYSTOCIA AND NUMBER OF STILLBIRTHS IN POPULATION OF HOLSTEIN-FRIESIAN COWS IN VOJVODINA

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Abstract: For today's trends in contemporary production of milk and meat, selection only for production traits is completely unacceptable, since it can contribute to numerous metabolic disorders and shortening of the production life of the animal. Contemporary breeding goals and programs are directed towards, first of all, reaching and maintaining of the optimal balance between production and functional traits without compromising the health and ethological characteristics of animals. Regardless of the breeding objective, i.e. defined program, fertility traits and fitness properties, that is the properties relating to resistance to diseases, must be included. In many countries, problems with calving difficulties and increase of mortality rate of calves in Black and White breeds occurred with the increase of share of Holstein genes in the population of Friesian cattle. Objective of this study is to present the data on number of difficult parities (calving) and number of still born calves (still births) in population of Holstein-Friesian cows in Vojvodina, and to calculate and present genetic parameters for mentioned traits. In this study, data was used on the incidence of difficult calving and number of still born calves (still births) obtained from the calving register for all producers included in the animal control program, carried out by the Faculty of Agriculture from Novi Sad, Animal Science Department, as Main breeding organization for Holstein-Friesian cattle population in Vojvodina. Data refer to years 2008 and 2009, with total of 35000 calvings. Based on calculated parameters, factors were defined which influence the expression of mentioned traits, with major impact on the economical efficiency of the milk production. It is expected that, in spite of low heritability level of 0.149 for dystocia and 0.160 for number of stillbirths, by applying the accurate methods

of their genetic assessment, studied traits can be included in the breeding goals of Holstein-Friesian cattle breed in Vojvodina.

Key words: difficult calvings, number of still born calves (still births), genetic parameters, Holstein-Friesian breed

Introduction

Contemporary and profitable livestock production, including production of milk, cannot be realized without reliable identification of individual animals and keeping of accurate and valid records on all relevant production and reproduction parameters of animals. Obtained data is stored in data bases which, among other things, are used for gaining of the most accurate assessments of the breeding values of animals which are included in the breeding through selection. For execution of this activity computers of certain characteristics are necessary, as well as adequate software. Improvement of fertility traits, either through adequate management or selection, depends on the availability and accuracy of data collected in the field (for instance, insemination date, calving date, etc.), as well as adequate statistical model used for evaluation of the variance components and breeding value of the animal (*Kadarmideen and Coffey, 2001*). Among properties which influence the functional status of the animal, on the production of milk and cost of milk production, fertility has major role, considering that fertility problems are one of the main reasons for culling of cows from the herd (*Price et al., 1998*). With that in mind, good functional status of the animal has become one of the breeding goals for breeders' world wide (*Biffani, 2005; Bogdanović et al., 2005*). Previous studies have shown that number of difficult calvings and number of still born calves (still births) can be reduced, primarily through adequate rearing management (*Darwash et al., 2001*) and adequate nutrition of cows (*Philippson, 1979*) before and after gravidity, but part of the variability of fertility traits certainly is of genetic origin (*Jansen, 1985*), which in practice means that selection for these traits can be carried out (*Philippson, 1981*). The argument to this claim is also in the fact that the use of hormones in sense of correction of fertility disorders will no longer be available, because of the animal welfare and human health aspects (*Kadarmideen et al., 2003*). So, adequate selection and optimal breeding programs will continue to be of great importance. Fertility traits belong to the group of low heritability traits, because of the great impact of non-genetic factors on the variability of fertility traits the heritability is low, therefore linear mixed models are recommended (AM), in order to maximize the accuracy of the assessment based on available data (*Hagger et al., 1990; Groen et al., 1997; Kardamideen, 2003; Đedović, 2004*). Values of calculated heritability can vary depending on the rearing conditions, model and method of its assessment, size of the population, rearing method, as well

as the structure of data used for assessment. In the literature, it is stated that more precise evaluations of heritability traits are obtained by use of threshold method (Weller *et al.*, 1989). Such analyses of fertility traits should be done in Serbia as well, especially if it is taken into consideration that not many researches and studies dealing with this topic have been done in Serbia so far.

Material and Methods

In this study, data was used on the incidence of difficult calving and number of still born calves (still births) obtained from the calving register for all producers included in the animal control program, carried out by the Faculty of Agriculture from Novi Sad, Animal Science Department, as Main breeding organization for Holstein-Friesian cattle population in Vojvodina. Calving flow was evaluated according to Main breeding goal for Holstein-Friesian cattle breed (2010):

- 5- Easy calving no assistance
- 4- Easy calving with assistance
- 3- Difficult calving (assistance of 2 or more assistants or use of mechanical devices)
- 2- Caesarean birth
- 1- Fetotomy (removal/dissection of dead foetus/calf in uterus)

Data was collected on the territory of AP Vojvodina, and refer to years 2008 and 2009 (period from October 1st 2007 to September 30th 2009), with total of 35.000 calvings of cows of all breeds, i.e. 22.099 calvings of Holstein-Friesian cows. In addition to studied traits, the data base also included data about the farm where calves were born (87 farms), calf sex, sire of the calf (173 sires) and body mass at birth.

The effect of the sire, farm, calf sex and calving season and year as fixed factors on the dystocia and number of stillbirth calves was established by application of ANOVA analysis (single dimensional classification) in the software Statistika 10. Factors demonstrating significant effect on observed traits were included in the model for evaluation of genetic parameters. In addition to fixed factors, also body mass of calves at birth was included in the model as linear regression effect. Genetic parameters were calculated using the method of intraclass correlation by applying the software LSMLMW and MIXMDL (Harvey, 1990), and the following model:

$$Y_{ijklmno} = \mu + O_i + F_j + Gt_k + S_l + P_m + b_1(x_1 - x_l) + e_{ijklmnop}$$

where:

Y – phenotypic value of observed traits

μ - general mean value

- O_i – random sire effect
 F_j – fixed effect of the farm
 Gt_k – fixed effect of the calving year
 S_l – fixed effect of the calving season
 P_m – fixed effect of the calf sex
 $b_1(x_l - x_l)$ – linear regression effect of the body mass of calves
 e – other uncontrollable effects (random error)

Results and Discussion

For the purpose of calculation of genetic parameters for incidence of difficult calvings and number of still born calves (still births), first the phenotypic variability of studied traits was established. The percentage of live and still born calves (still births), as well as distribution of the frequency of calving type are presented in Table 1.

Table 1. Percentages of calving type, live and still born calves (still births)

Trait	N	%
ECNA	20.309	91.90
ECWA	1.374	6.22
DC	187	0.85
CR	68	0.31
F	160	0.72
LBC	20.929	94.71
SBC	1169	5.29

ECNA-easy calving, no assistance; ECWA- easy calving with assistance; DC- difficult calving; CR-caesarean birth; F-fetotomy; LBC-number of live born calves; SBC-number of still born calves (still births)

The percentage of difficult calvings in the studied population is in concordance with results obtained in studies by *Philippson (1979, 1981)*, *Jansen, (1985)*, *Darwash et al. (2001)* and *Dedović (2004)*. However, compared to data obtained in those studies, the percentage of easy calvings without assistance in the tested population was significantly higher, which can be explained by lower milk yield in studied population compared to the average for Holstein-Friesian breed, so there is room for improvement of reproduction parameters. The percentage of still born calves (still births) was similar to the percentage obtained in studies by *Philippson (1979, 1981)*, *Jansen, (1985)*, *Darwash et al. (2001)* but somewhat higher compared to values established in the research by *Dedović (2004)*.

The next step in the study was to identify the genetic and environment factors which influenced the variability of the studied traits, which is presented in the Table 2.

Table 2. The effect of genetic and environment factors on dystocia (D) and number of stillbirths calves (SBC)

Effect	DF	D			SBC		
		SS	MS	F-value	SS	MS	F-value
Sire	56	201065	3590	13.005**	345037	61615	13.961**
Farm	85	308307	3627.14	77.7039**	3780436	44475.7	276.858**
Sex	1	211	211.05	3.466 ^{nz}	467	467.0	1.387 ^{nz}
Season	2	752	375.98	6.177**	128	64.1	0.190 ^{nz}
Year	2	8062	4031.15	66.6068**	209164	104581.8	319.992**

DF-degree of freedom; SS- sum of squares; MS-mean of squares; F-values

**-P<0.01-statistically highly significant effect; ns-P>0,05-no significant effect

Data presented in Table 2 shows highly significant effect of the sire, farm, calving season and year on type of calving, which is in concordance with the results obtained by *Hagger et al. (1990)* and *Groen et al. (1997)*, whereas in the study by *Dedović (2004)*, highly significant effect of the sire and farm on calving flow was established, but calving season had no significant effect on this parameter. Contrary to cited authors, in this research the calf sex had no significant effect on calving flow, which can be explained by moderate differences in body mass between male and female calves.

Highly significant effect on number of still born calves (still births) was established for sire, farm and calving year, whereas the sex and calving season showed no statistical significance.

By including all factors which had statistically significant effect on studied traits, genetic parameters, presented in Table 3, were calculated.

Table 3. Heritability and heritability standard errors for calving flow (CF) and number of still born calves (still births) (SBC) on diagonal, genetic correlations and correlations and standard errors of genetic correlations below and phenotypic correlations above the diagonal

Traits	CF	SBC
CF	0.149±0.029	0.194
SBC	0.285±0.133	0.160±0.031

Heritability for calving type was 0.149, and for number of still born calves (still births) 0.160, which means that, environment factors display significantly greater influence on these traits than genetic factors. Therefore, in order to improve these traits, it is necessary first of all to optimize the environment factors. However, obtained heritability values indicate also the possibility that it is possible to influence their improvement through selection, primarily through selection of bulls with the best breeding value scores for these traits. Obtained results are in concordance with the research of *Hagger et al. (1990)* and *Groen et al. (1997)*,

whereas in the research by *Dedović (2004)*, significantly lower heritability value for number of still born calves (still births) was reported. These differences can be explained by the fact that these studies were carried out in population under selection measures, where the genetic variability was significantly lower as the results of it.

Conclusion

In the studied population of Holstein-Friesian cows the percentage of difficult calvings was 0,85%, and percentage of still born calves (still births) was 5,29%, which indicates absence of major reproduction problems in this population. However, in order to achieve better economical results, it is necessary to work on further optimization of the environment factors, as well as on genetic improvement, primarily of bull-sires in the population. Based on the study of the effect of sire, farm, sex, calving season and year on studied traits, in which it was established that only sex had no significant effect on both traits, and calving season on number of still born calves (still births), it can be concluded that the improvement can be achieved. Also, heritability values of 0.149 for calving flow and 0.160 for number of still born calves (still births) indicate that there is a possibility for improvement of these traits, primarily by improving the environment factors, and through implementation of sophisticated mathematical-statistical methods and genetic improvement of the population.

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Genetski parametri za pojavu teških teljenja i broj mrtvorodene teladi u populaciji krava holštajn frizijske rase vojvodine

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Rezime

Za današnje trendove u savremenoj proizvodnji mleka i mesa potpuno je neprihvatljiva jednostrana selekcija samo na proizvodne osobine, jer to umnogome može doprineti brojnim metaboličkim poremećajima i skraćivanju produktivnog života. Savremeni odgajivački ciljevi i programi usmereni su pre svega na

dostizanje i održavanje optimalnog balansa između proizvodnih i funkcionalnih osobina bez narušavanja zdravlja i etoloških karakteristika životinja. Bilo koji odgajivački cilj, odnosno program da smo definisali, u isti moraju biti uključene osobine plodnosti i fitness svojstva, odnosno svojstva otpornosti na bolesti. U mnogim zemljama su se problemi sa teškoćama pri teljenju i mortalitetom teladi povećali kod crno-belih rasa, kada se proporcija gena holštajn rase povećavala u populaciji frizijske rase goveda. Cilj ovog rada jeste da prikaže broj teških teljenja i broj mrtvorodne teladi u populaciji krava holštajn frizijske rase u Vojvodini, te da izračuna i prikaže genetske parametre za navedene osobine. U istraživanju su se koristili podaci o pojavi teških teljenja i broju mrtvorodne teladi, koji su dobijeni iz registra teljenja od svih proizvođača koji su pod kontrolom, Poljoprivrednog fakulteta iz Novog Sada, Departmana za stočarstvo, kao glavne odgajivačke organizacije za holštajn frizijsku rasu u Vojvodini. Podaci se odnose na 2008. i 2009. godinu, sa ukupno 35000 teljenja. Na osnovu izračunatih parametara definisani su faktori koji utiču na ispoljavanje ovih osobina, koje imaju značajnog uticaja na ekonomičnost proizvodnje mleka. Očekuje se, da se i pored niskog stepena heritabilnosti od 0,149 za tok teljenja i 0,160 za broj mrtvorodne teladi, primenom tačnih metoda njihove genetske procene, ispitivane osobine mogu uključiti u oplemeljivljičke ciljeve holštajn frizijske rase u Vojvodini.

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