RESEARCH REGARDING MILK PRODUCTION TRAITS ON A HOLSTEIN-FRIESIAN BREED POPULATION FROM MOLDOVIAN REGION

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Abstract

The aim of this study was estimation of genetic parameters for five quantitative traits for milk production. In this research were analyzed 191 cows from 24 bulls from Holstein-Friesian breed from a farm in the Moldovian region. The used information in this study were obtained from primary data processing according to the ICAR guidelines. Estimation of genetic parameters was performed through S.A.V.C. software. The estimated heritabilities, after data processing, were 0.27 for the milk yield, 0.31 for fat yield, 0.28 for protein yield, 0.76 for the percentage of fat and 0.65 for the percentage of protein. The repeatability coefficients for the analyzed traits were 0.30 for milk yield, 0.35 for fat yield, 0.31 for protein yield, 0.86 for fat percentage and 0.68 for protein percentage. The correlations between the traits showed that genetic correlation ranged from -0.13 to 0.98, phenotypic correlation ranged from -0.16 to 0.99 and environmental correlation from -0.23 to 0.99. In conclusion, the results were between the values found in the specialty literature.

Key words: genetic parameters, heritability, repeatability, genetic correlations

INTRODUCTION

Milk is a white liquid nutrient-rich food that has an important role in human alimentation due to its complex chemical composition, high degree of digestibility and essential nutrients including proteins, lipids, carbohydrates and mineral salts. The major issue in animal breeding programs represents increasing the milk production from dairy farms.

An important step in the development animal breeding programs represents establishment of characteristics for the studied population, more exactly, the knowledge of the productive and reproductive performance of animals, their heritability coefficients, repeatability coefficients and genotypic, phenotypic and environmental correlations between the studied traits [4], [11].

This research is part of a larger study aimed to estimate an index for milk production of dairy cattle in the Moldovian region of Romania.

The purpose of this paper was estimation of heritability and repeatability coefficients for traits like: milk, fat, and protein yields, for percentages of fat and protein. Also, in this paper will be estimated the genetic, phenotypic and environmental correlations between the analyzed traits for cows of Holstein-Friesian breed from a dairy farm.

MATERIALS AND METHODS

The biological material studied consisted from 191 cows that had age at first calving ranged between 581 and 1452 days. From the total number of registrations were excluded cows affected by various diseases (mastitis or problems with the udder), those lacking the dry date or the calving date, those who had under 7 completed controls and those who have had missing more than two successive controls. The data used in this paper was taken from the Holstein Ro association.

The studied traits were the milk, fat and protein yields, measured in the kilogram unit, and the percentages of fat and protein. The samples were taken monthly from each daughter, starting on the 5th day after calving and continuing until dry. The amounts of milk, fat and protein for normal and standard

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lactations were calculated according with the results obtained from the analysis of milk samples using Combifoss apparat and, also, the calculation methods presented in the ICAR guidelines, applying the appropriate coefficients [22].

Estimates of genetic parameters for the standard lactation for the five quantitative traits were performed using the S.A.V.C. software (2003) by prof. dr. V. Maciuc.

The obtained results will be used in the construction of a selection index for milk production traits in a population of Holstein-Friesian breed from Moldova.

RESULTS AND DISCUSSION

Estimated heritabilities and repeatabilites coefficients for five quantitative traits have medium to large values, that ranged from 0.27 to 0.86 (Table 1).

Table 1 Heritability and repeatability coefficients for milk traits

Trait	h^2	R
Milk yield	0.27	0.30
Fat yield	0.31	0.35
Protein yield	0.28	0.31
Fat percentage	0.76	0.86
Protein percentage	0.65	0.68

The obtained result for milk yield was 0.27, which is higher compared to the results presented in [17], [18] and [21] papers, with the values of 0.15, 0.24 and 0.22, respectively. But it were smaller compared to those obtained by Atil (2006) [1] and Missanjo et al. [13], of 0.47 and 0.30, respectively. Therefore, the obtained values are between the limits presented in the literature.

The values of fat yield was 0.31 and of protein yield was 0.28 which are appropriate for the medium heritable traits. The results are within the limits found in other specialized papers, ranging from 0.15 to 0.39 for the fat yield [10], [19], [20], [21] and between 0.13 and 0.40 for the protein yield [2], [5], [16].

Fat percentage had the value of 0.76 and protein percentage had the value of 0.65 wich corresponds to a highly heritable traits.

For milk production traits that refer to the its quantity the coefficient of repeatability were: 0.30 for the milk yield, 0.35 for the fat yiled and 0.31 for the protein yield.

Qualitative milk production is expressed through the percentage of fat and percentage of protein, which were highly repeatable traits: 0.86 for the fat percentage and 0.68 for the protein percentage.

Compared to the results presented in Missanjo et al. (2013) [13] and Montaldo et al. (2017) [15] papers the values for the repeatability coefficient are lower.

After processing data, the phenotypic, genetic and environmental correlations were obtained between the main quantitative traits for the studied population (Table 2 and 3).

Table 2 Phenotypic correlations (above diagonal) and genetic correlations (below diagonal) for milk production of studied traits

		Phenotypic correlations				
		Milk kg	Fat %	Fat kg	Protein %	Protein kg
Genetic correlations	Milk kg	-	-0.23	0.98	-0.24	0.99
	Fat %	-0.25	-	-0.27	0.24	-0.25
	Fat kg	0.98	-0.18	-	0.22	0.99
	Protein %	-0.19	0.17	0.15	-	0.27
	Protein kg	0.95	-0.21	0.89	0.29	-

The obtained results regarding genetic correlation between yields of milk and fat (0.98), milk and protein yields (0.95), and between fat and protein yields (0.89) indicate a strong and positive correlation between the traits. The estimated genetic correlations between milk yield and other traits of milk production have been published by many authors. Costa et al. (2000) [3] in their research for genetic analysis on the Holstein-Friesian cattle population in USA and Brasil obtained values for the genetic correlation

between the milk and the fat yields of 0.79 in Brasil and 0.62 for USA. Gaydarska et al. (2001) [6] estimated phenotypic and genetic correlations in a population of 3254 cows. The obtained results were 0.935 for the genetic correlation between the milk and fat yields. There was a negative and low correlation between the milk yield and the percentage of fat, respectively -0.155.

Between the milk yield and percentage of fat (-0.21), the milk yield and percentage of protein (-0.19), the percentage of fat and fat yield (-0.18), and the percentage of fat and the protein yield (-0.21) the genetic correlations were small to medium and negative. In first two cases the values are smaller than in the presented research by [8].

A similar situation to the genetic correlation between the five quantitative traits was also observed after estimating the phenotypic correlations. Therefore, between the milk and fat yields the obtained value was 0.98, between the milk and protein yields and between fat and protein yields the obtained values were 0.99, in both situations. Values are higher than those found in other researches. For the correlation between the milk and fat yields was found the values: 0.70 Wongpom et al. (2017) [21], 0.76 Lee et al. (2004) [10], 0.77 Koonawootrittriron et al (2009) [9], 0.56 Miglior et al. (2007) [12]; between the milk and protein yields: 0.98 Missanjo et al. (2013) [13], 0.91 Mokhtari et al. (2015) [14] and the fat and protein yields: 0.93 Missanjo et al. (2013) [13], 0.72 Mokhtari et al. (2015) [14].

The correlation between the percentage of protein and the protein yield in this study showed medium and positive correlation (0.27). The value is approximately equal to the result obtained by Montaldo et al. (2017) [15] of 0.26.

The phenotypic correlation between the milk yield and the fat percentage was -0.23, which is lower compared to the result obtained by Ivancia et al. (2011) [7] of -0.44. Regarding correlation between the milk yield and the protein percentage, was obtained the medium and negative value (-0.24). The result were higher than the value obtained by Ivancia et al. (2011) [7] which was -0.12. The percentages of protein and fat are medium and positive correlated with a value of 0.24, which is lower than the result obtained in other papers Ivancia et al. (2011) [7] and Missanjo et al. (2013) [13].

Table 3 Environmental correlations for studied milk production traits

	Environmental correlations				
	M kg	F %	F kg	P %	P kg
M kg		-0.24	0.99	-0.25	0.99
F %			-0.35	0.27	-0.30
Fkg				0.29	0.99
P %					0.32

M=milk; F=fat; P=protein

The environmental correlations obtained between the milk and fat yields, between the milk and protein yields and between fat and protein yields were strong and positive ones with the value of 0.99.

A medium and negative correlation was recorded between: the milk yield and the fat percentage (-0.24), the milk yield and the protein percentage (-0.25), the fat and the protein percentages (-0.35) and the percentage of fat and protein yield (-0.30).

CONCLUSIONS

It is known that in order to obtain genetic gain in a dairy cattle population, either by selection or by breeding, it is important to estimate genetic parameters.

In this research, the obtained heritabilities was medium for the traits referring to milk production, and high for those referring to the milk quality.

A similar situation was also observed for the repeatability coefficient for the five studied traits.

For all three types of predicted correlations (phenotypic, genotypic and environmental) situation was similar. Thus, for the correlation between milk and fat yields, milk and protein yields and fat and protein yields, the results were positive showing a strong correlation between the traits.

Correlations between the milk yield and the fat or protein percentages, as well as those between the fat percentage and fat or protein yields were negative and medium.

For correlations between of protein and the percentage of fat or the percentage of

protein and the protein yield were obtained positive medium and high values.

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