

Correlation between PTA for milk and beef traits of Guzerá animals from dual-purpose herds in Brazil

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ABSTRACT: PTA for milk and beef traits were used with the objective to assess the genetic correlations between these traits. PTA for milk traits were estimated from 7,636 lactation records and for beef traits from 172,764 records, using an animal model. Pearson's correlation coefficients were obtained using the SAS® procedures. Overall correlations between PTA for milk and beef traits were positive and ranged from zero to lightly moderate magnitude, varying with the dataset used. Results raised up three hypotheses: first, there is a non-evident antagonism between milk and beef traits; second, there is no expressive genetic correlation between milk and beef traits in the Guzerá breed; and third, joint selection for dairy and beef purposes can be inducing a favorably relationship between those traits. In conclusion, if the two first hypotheses are confirmed, selection for dual-purpose can result in genetic progress for both traits.

Keywords: Zebu cattle; Genetic correlation; Selection goal

Introduction

Specialized and intensive production systems have been increasingly criticized for offering environmental risks, high costs, and do not comply with the animal welfare as well (McMichael et al.(2007)). Moreover, in the developing countries, to increase the profit from the sale of milk, the sale of calves and the decreasing of feed costs become fundamental in revenue (Vercesi Filho et al. (2000), Madalena (2001)). Thus, breeds whose males are viable to beef purposes have been taking advantage over those exclusively dairy (Jarvis, 1990).

The Guzerá breed is adapted to the several environmental conditions of Brazil, mainly the harsh ones. Their potential for dual purpose was revealed in this country where has been selected for milk and beef traits since 1994. Two independent breeding programs have been conducted for these traits in this breed that despite being independent are genetically connected (Peixoto et al. (2010)). Therefore this breed represents an important genetic resource to those pure or crossbred herds which focus selection on dual purpose objectives.

Definition of breeding goals is important for an economical and sustainable genetic progress (Olesen et al. (2000)). For that, the knowledge about the heritability and genetic correlations between traits of interest that expresses

the degree of genetic variance and the extent to which two traits are associated is crucial (Falconer and Mackay, 1996). Important also is to assess the genetic progress in each trait under selection as well as in other important traits to evaluate whether the proposed goals are being reached and to maximize the genetic response in each trait (Rauw et al. (1990), Hansen (2000), Peixoto et al. (2006)).

Genetic progress for milk and beef traits in Guzerá breed in Brazil were reported (Peixoto et al. (2006), Vieira et al. (2004)). These authors found positive genetic gains for both traits, indicating the effectiveness of dual-purpose selection. The objective of this study was to estimate the association between milk and beef traits PTA as an initial approach to assess the genetic progress and genetic correlations for these traits and evaluate the status and perspectives of dual purpose selection in the Guzerá breed.

Materials and Methods

PTA estimates. Data on PTA were obtained from the genetic evaluations of each breeding program. PTA for milk, fat, and protein productions were estimated from the databank of the National Improvement Program of Guzerá Breed for Milk Purposes carried out in Brazil by the Embrapa Dairy Cattle – CBMG² partnership. Data on 7636 lactation records from 4924 cows were analyzed through the algorithms available in the MTDReML using an animal model. Model included the fixed effect of herd-year, season, genetic composition group (pure to crossbred animals), and the linear and quadratic effect of age. Genetic evaluations for fat and protein productions were conducted using a bivariate analysis with milk yield as second trait. PTA for weaning weight (210 days), yearling weight (450 days), and post-weaning gain were estimated from the databank of the Improvement Program for the Zebu Cattle – ABCZ. Data consisting of 272,260 records of growth traits for both sexes were processed according the methodological procedures of BIF. PTA was also estimated by the MTDReML using an animal model. Model included the sex, contemporary group (herd, year, and season), and age of the dam as fixed effects, the progeny's age as a covariate, and the direct and maternal genetic and permanent as random effects. Both databank were genetically connected. It must be emphasized that no joint analyzes of data on milk production and weight performance and gain were performed. These are initial analyzes to evaluate the dual purpose goals.

Statistical analyses. For this study, only estimates obtained with minimum reliability of 50% and both PTA for milk and beef production traits from independent genetic evaluations were included in these analyzes. Nine datasets were defined based on the inclusion of the cows and sires estimates and positive and negative estimates of PTA for the traits under study with the objective of allowing a better understanding about the associations between traits and the efficiency of dual purpose selection as well. The dataset were the following:

- a) All cows and sires with negative or positive PTA;
- b) Only sires, but sires with negative or positive PTA;
- c) Only cows, but cows with negative or positive PTA;
- d) All cows and sires, but only with positive PTA for milk traits regardless PTA sign's for beef traits;
- e) Only sires, but only sires with positive PTA for milk traits regardless PTA sign's for beef traits;
- f) Only cows, but only cows with positive PTA for milk traits regardless PTA sign's for beef traits;
- g) All cows and sires, but only animals with positive PTA for both traits;
- h) Only sires, but only sires with positive PTA for both traits;
- i) Only cows, but only cows with positive PTA for both traits.

Pearson's correlations between these traits were calculated using the CORR procedure available in SAS®. The frequency of sires with positive PTA for milk production, and annual averages of PTA for milk and post-yearling weight was also obtained as an e.g. to a further evaluation of the dual-purpose selection.

Results and Discussion

Correlation estimates. Table 1 shows the correlations between beef and milk traits. Correlation values ranged from zero to .26 and from negative to positive side. The small differences between correlations obtained with any of milk traits and the beef traits can be explained by the high genetic correlations between milk, fat and protein production (Costa et al. (2005)). The lowest correlation value was found between milk production traits and daily weight gain. On the other hand, high correlation was observed between milk production and post-yearling weight. These results indicated the existence of low association between PTA for beef and milk production traits, except for correlations involving daily weight gain for which no evidence of genetic association was found. Despite low it can be considered a favorable result under the perspective of selection, reflecting the genetic independence between beef and milk traits and the possibility of joint selection. Otherwise it can be showing that the dual-purpose selection objective practiced during the last twenty years, for about three selection generations (Peixoto et al. (2010)), is not working well. Therefore we raised up three hypothesis: first, despite the low association there is an antagonism between milk and beef traits minimizing the expected genetic response in each trait; second, there is no expressive genetic correlation between milk and beef traits in the Guzerá breed, so there is

no or few genes influencing both traits; and third, joint selection for dairy and beef purposes can be inducing a favorably relationship between those traits without necessarily expressing a cause and effect association. Another aspect is related to the fact that the Guzerá breed was initially and for a long time selected almost exclusively for beef purposes in Brazil (Peixoto et al. (2010)). So, as selection for dairy purposes is recent and selection pressure for milk production traits is low, the unfavorable effects of the joint selection due to possible genetic correlations among these traits may have not yet been observed in these herds. Correlation values were lower with the dataset containing only sires and using all PTA estimates than that with cows' exclusive dataset, indicating a higher association between beef and milk traits in cows than in sires. Considering that selection pressure is lower for cows, the correlations obtained for this gender can be expressing more precisely the real association between these traits. This result can also be attributed to the reproductive criteria for the first service adopted in these herds which is based on the heifer body score, which could be inducing a stronger association between these traits in cows than that supposed to exist. However, when the dataset containing only positive PTA for both traits was used, correlations for sires were higher than for cows, becoming evident the lightly moderate association between milk and beef traits, except for daily weight gain correlations. It demonstrated the possibility of obtaining dual-purpose proven sires and that selection for dual-purpose has been more intense for sires. Furthermore if this association is due to the genetic correlation between these traits, selection for the weaning or for post-yearling weights can result somehow in more productive dairy cows.

Table 1. Correlations between PTA for milk and beef traits of Guzerá animals using different datasets.

Beef traits	Milk traits		
	Milk	Fat	Protein
	Dataset (a)		
Weaning weight	0.17	0.16	0.16
Post-yearling weight	0.26	0.25	0.25
Daily weight gain	0.04	0.04	0.04
	Dataset (b)		
Weaning weight	0.09	0.08	0.07
Post-yearling weight	0.11	0.10	0.10
Daily weight gain	-0.03	-0.04	-0.03
	Dataset (c)		
Weaning weight	0.14	0.13	0.13
Post-yearling weight	0.23	0.22	0.22
Daily weight gain	0.01	0.01	0.01
	Dataset (d)		
Weaning weight	0.13	0.12	0.12
Post-yearling weight	0.21	0.20	0.21
Daily weight gain	0.00	0.00	0.00
	Dataset (e)		
Weaning weight	0.20	0.19	0.19
Post-yearling weight	0.22	0.21	0.22
Daily weight gain	0.01	0.01	0.01
	Dataset (f)		

Weaning weight	0.07	0.05	0.05
Post-yearling weight	0.14	0.13	0.14
Daily weight gain	-0.06	-0.05	-0.05
Dataset (g)			
Weaning weight	0.05	0.04	0.04
Post-yearling weight	0.17	0.16	0.16
Daily weight gain	-0.03	-0.02	-0.02
Dataset (h)			
Weaning weight	0.23	0.21	0.21
Post-yearling weight	0.23	0.21	0.23
Daily weight gain	0.02	0.00	0.01
Dataset (i)			
Weaning weight	0.02	0.01	0.01
Post-yearling weight	0.12	0.11	0.12
Daily weight gain	-0.08	-0.06	-0.06

Average PTA of sires positive for milk production and their PTA for post-yearling weight. The average PTA for proven and positive dairy sires with their respective PTA for post-yearling weight is presented in the table 2. In the Guzerá dual-purpose herds, the more or less intense use of proven sires for milk or beef traits oscillate yearly with the market trends for the maximization of the profits. The results for average PTA shows that none of proven and positive sires for milk production had negative genetic merit for post-yearling weight, indicating the viability of dual-purpose objectives.

Table 2. Average PTA for milk production and post-yearling weight for sires proven as positives for milk and their respective descendents, according to their birth year.

Birth Year	Number of proven dairy sires	Percent of descendents*	Means	
			Milk PTA	Post-yearling PTA
2000	2	6.42	197,0	5,0
2001	9	16.36	131,2	3,2
2002	16	26.88	144,7	1,3
2003	11	20.9	143,2	1,2
2004	18	33,55	124,8	1,2
2005	18	28,21	123,7	0,1
2006	21	24,85	142,6	0,8
2007	15	14,51	191,6	1,4
2008	13	22,77	246,2	0,9

*Percent of proven dairy sires' progenies in relation to the total yearly born progenies.

Conclusion

Correlations between PTA for milk, fat, and protein and weaning and post-weaning weight were positive but low. Results suggest that there is a low genetic correlation between these traits indicating the viability of the selection for dual-purpose objectives in the Guzerá cattle. Correlations involving post-weaning daily gain were considered null. So, there is no evidence of genetic correlation between this trait and milk traits. To our knowledge similar studies have not previously been reported. Although results of the present study are favorable, further studies must be carried out to accurately estimate the genetic correlations and to establish the real potential of joint selection for dairy and beef purposes.

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