UNIVERSITY OF LIFE SCIENCES"KING MIHAI I" FROM Timisoara

Multidisciplinary Conference on Sustainable Development

15 – 16 May 2025

The genetic parameters for average daily gain and Kleiber ratio in Aberdeen Angus breed

Mircea Cătălin Rotar, Rodica Ștefania Pelmuș, Mihail Alexandru Gras, Cristina Van
National Research-Development Institute for Animal Biology and Nutrition, no. 1, Calea Bucuresti, 077015, Balotesti, Romania

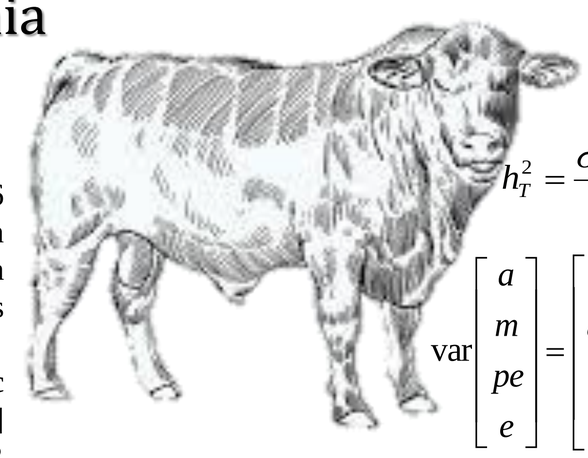
Abstract:

The objective of this study was to approximate the genetic parameters for average daily gain from birth to 200 days and Kleiber ratio in Aberdeen Angus breed with maternal animal model. The data were represented by 1206 records from Aberdeen Angus cattle breed. The pedigree was formed from 2563 cattle: 154 sire, 1203 dams and 1206 cattle with performances. The data were obtained from Aberdeen Angus Association. The direct breeding value of cattle ranged between -0.401 and 0.772 for average daily gain and maternal breeding value between -0.191 and 0.243. The direct breeding value of cattle for Kleiber ratio ranged between -0.370 and 0.347 and maternal breeding value between -0.164 and 0.123. The direct heritability for average daily gain from birth to 200 days was 0.218, the maternal heritability 0.082 and the total heritability 0.200. The direct heritability for Kleiber ratio was 0.219, the maternal heritability 0.081 and total heritability 0.200.

Introduction

The profitability of beef production depends the feed efficiency. Aberdeen Angus breed has a good conversion of the forage. The objective of the breeding program of the Aberdeen Angus was the improvement the growth traits for increase meat production, to increase quality of beef production, to develop a genetically valuable nucleus and recognized worldwide. Development of the program breeding is carried out so that the Aberdeen Angus breed evolves in the direction of the coming requirements from farmers. The Aberdeen Angus breed is the most widespread and appreciated beef cattle breed in the world. It is adapted to the pedoclimatic conditions from our country. The aim of this study was the estimation the genetic parameters for average daily gain from birth to 200 days and Kleiber ratio in Aberdeen Angus breed with maternal animal model for selection.

Material and method



The data were represented by records of 1206 cattle. The pedigree consisted in 1206 cattle with records, 1203 dams and 154 sire from Aberdeen Angus breed. The data were from Aberdeen Angus Association for beef cattle.

The estimation of variance components and genetic parameters was performed based on script [1] using maternal animal model with the software R [2].

The maternal animal model was (Mrode and Thompson, 2005) :y = Xb+Za+Wm+Spe+e

$$h_T^2 = \frac{\sigma_a^2 + 0.5\sigma_m^2 + 1.5\sigma_{am}}{\sigma_p^2}$$

$$\text{var}\begin{bmatrix} a \\ m \\ pe \\ e \end{bmatrix} = \begin{bmatrix} \sigma_a^2 A & \sigma_{am} A & 0 & 0 \\ \sigma_{am} A & \sigma_m^2 A & 0 & 0 \\ 0 & 0 & I\sigma_{pe}^2 & 0 \\ 0 & 0 & 0 & I\sigma_e^2 \end{bmatrix}$$

Results and discussions

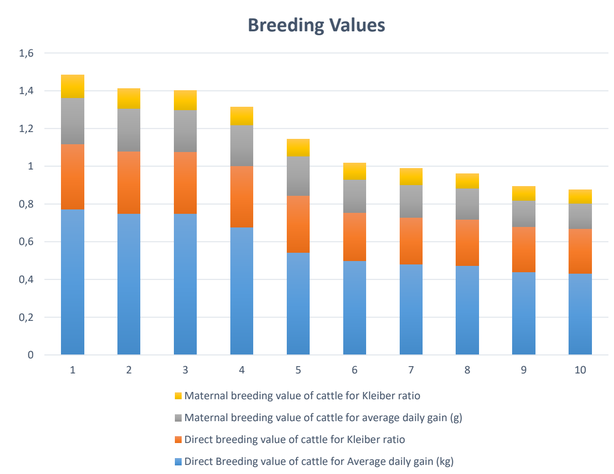
The average performances for growth traits, average daily gain and Kleiber ratio for females and males

No.	Birth weight	Weight at 200 days	Average daily gain (kg)	Metabolic body weight	Kleiber ratio
Mean ±standard error for females	29.780±0.176	213.079±1.630	0.916±0.008	55.569±0.315	1.628±0.089
Standard deviation	4.634	42.862	0.218	8.278	0.145
Coefficient of variability (%)	15.562	20.115	23.862	14.897	8.905
Mean ±standard error for males	30.188±0.235	226.961±1.970	0.983±0.009	58.261±0.380	1.668±0.006
Standard deviation	5.344	44.709	0.224	8.624	0.146
Coefficient of variability (%)	17.704	19.699	22.838	14.803	8.75

The growth traits depend by the breed, individual, nutrition. The average daily gain of calves from birth to weaning depends the milk production of cows. Mădescu et al. (2022) reported a mean of 184.3 kg at 7 months and average daily gain 799g/day in Aberdeen Angus population. Bissembayev et al. (2023) reported the value for birth weight in Aberdeen Angus 28.25 kg for males and 27.18 kg for heifers and for weaning weight 212.31 kg for bulls and 198.04 for heifers and for average daily gain from birth to 210 days 879.56 g for bulls and 847 g for heifers from Aberdeen Angus breed lower that the values obtained in our study. Forster et al. reported higher mean for birth weight than in our study 34.58 kg, 33.69 kg for female and 34.66 kg for males.

Estimates of (co)variance components and genetic parameters for average daily gain and Kleiber ratio for Aberdeen Angus cattle breed

Item	Average daily gain	Kleiber ratio
σ^2_a	0.0129	0.054
σ^2_m	0.0048	0.002
σ_{am}	-0.002	-0.0009
σ^2_{pe}	0.034	0.0145
σ_e^2	0.004	0.0019
σ_p^2	0.059	0.024
c^2	0.576	0.604
σ_{am}/σ_p^2	-0.033	-0.037
h_a^2	0.218	0.219
h_m^2	0.082	0.081
r_{am}	-0.293	-0.294
h_T^2	0.200	0.200



The direct breeding value of cattle from our study ranged between -0.401 and 0.772 for average daily gain and maternal breeding value ranged between -0.191 and 0.243.

The direct breeding value of cattle for Kleiber ratio ranged between -0.370 and 0.347 and maternal breeding value ranged between -0.164 and 0.123. The direct breeding value and maternal breeding value of the best cows for average daily gain and Kleiber ratio was presented in the graph above.

The genetic parameters for average daily gain from birth to 200 days and Kleiber ratio were shown in table 5. Schenkel et al. (2004) reported the heritability for average daily gain 0.35. Crowley et al. (2010) reported the heritability for average daily gain from 10 months to 12 months 0.27 and for Kleiber ratio 0.24 and maternal heritability 0.03 for average daily gain and 0.06 for Kleiber ratio. Khobondo et al. (2022) reported direct heritability for average daily gain at 205 days 0.27 and for Kleiber index at 205 days 0.13 in beef cattle. Matos et al. (2019) obtained a value of direct heritability for the average daily gain from birth to 205 days 0.21 and maternal heritability 0.05 in Brahman cattle breed and for Kleiber ratio direct heritability 0.19 and maternal heritability 0.04. Mehrban et al. (2021) obtained the heritability for Kleiber ratio 0.28. Koster et al. (1994) reported heritability for Kleiber ratio from birth to 205 days 0.218 in Hereford herd. El-Saied et al. (2006) reported the direct heritability for pre-weaning daily weight gain was 0.22 and maternal heritability 0.18 in Charolais breed.

Conclusions

Aberdeen Angus breed had high average daily gain and Kleiber ratio from birth to 200 days. The direct heritability for average daily gain and Kleiber ratio was moderate. The genetic correlation between direct breeding values of cattle and maternal breeding values for average daily gain and Kleiber ratio was very high.

For improvement feed efficiency and meat production in Aberdeen Angus breed must to select the cattle with the best breeding values for average daily gain and Kleiber ratio.

Acknowledgement:

This work was supported by funds from the National Research Projects 8.1.2 and 8.1.3 granted by the Romanian Ministry of Agriculture and Rural Development and from Aberdeen Angus Association.

Mrode, R.A., Thompson, R., Maternal Trait Models: Animal and Reduced Animals Models. In: Linear models for the Prediction of Animal Breeding Values. Cabi Publishing UK., 2005, pp. 121-134.