EVIDENCE OF INTERACTION BETWEEN THE DEGREE OF DAILY FLUCTUATION IN DRY MATTER INTAKE AND PRODUCTION TRAITS IN NELLORE CATTLE

Julian A. Muñoz[1*], Marcelo S. Borges[1], Letícia P. Silva[1], Marina O. Silva[1], Leticia F. L. Pompolim[1], Roberta C. Canesin[1], Joslaine N.S.G. Cyrillo[1], Maria Eugênia Z. Mercadante[1], Sarah F.M. Bonilha[1].

[1] Institute of Animal Science, Rodovia Carlos Tonani km 94, 14.174-000 Sertãozinho, Brazil

*Corresponding author email: julianmunoz@alumni.usp.br

I. INTRODUCTION

The degree of daily fluctuation in dry matter intake (DMI) in Nellore cattle was significantly related to the blood gas profile and rumenitis scores, indicating that high-DMI fluctuation had adverse effects on growth performance potentially associated with an increased incidence of metabolic disorders [1]. The present study seeks to determine whether daily fluctuation in DMI can influence the performance and carcass traits of Nellore cattle from the genetic improvement program for Nellore breeds at the Institute of Animal Science, Sertãozinho/SP, Brazil (a program designed to increase animals' post-weaning weight and whose selection is carried out based on individual performance).

II. MATERIALS AND METHODS

For this study, 107 non-castrated 15-month-old Nellore males (358 ± 5.56 kg of live weight) were housed in experimental pens, fed high-concentrate diets for a minimum of 92 days, following the distribution of a completely randomized design, in 2 x 3 factorial arrangement: two groups of DMI fluctuation (GF of DMI: high and low fluctuation) and three genetic groups (GG: control Nellore-NeC, selection Nellore-NeS and traditional Nellore-NeT). The fluctuation was calculated by the difference between DMI of the previous and the current day [%F-DMI = $((DMI_{Previous} - DMI_{Current})*100)/DMI_{Previous}$], expressed as percentage. Then, animals were classified as high (H: 2.01%) or low (L: 0.90%) DMI fluctuation (P=0.001). Genetic groups of Nelore cattle were established based on selection for higher yearling body weight (NeS and NeT), or selection for mean yearling body weight (NeC). NeS and NeC were closed since the beggining of the program, while NeT eventually received bulls from other herds [2]. The criteria for slaughter was when animals had reached the minimum of 4 mm of subcutaneous fat thickness over the 12th rib measured by ultrasound. The performance and carcass traits were analyzed by PROC MIXED of SAS, considering the fixed effects (GF and GG), the covariate (age at slaughter), and the random effect (year). The differences between means were compared using the Tukey test (P<0.05), and trends were verified when P<0.10.

III. RESULTS AND DISCUSSION

The degree of DMI fluctuation did not influence ADG, DMI, FER, RFI, pH, CY, luminosity (L*) and yellow content (b*) means (P>0.05). However, it was observed that animals from high-DMI fluctuation had lower FBW compared to the ones from low-DMI fluctuation group (P=0.001). Likewise, there was a tendency towards greater HCW, CCW, BFT, and REA to cattle from low-DMI fluctuation group when compared to cattle from the high-DMI fluctuation one.

For GG results, selection for growth was highly effective in increasing body and carcass weights, what can be seen comparing NeT and NeS groups with NeC. Selected animals had greater live body weights, hot and chilled carcass weights (P<0.05) than control animals. However, these differences in body size did not influence FER, RFI, or meat quality traits (P>0.05).

Significative interactions between GF and GG were detected for DMI fluctuation, DMI and a*. The GF results show that within each GG, there were cattle with high and low DMI fluctuations. For DMI, there was greater feed intake from low-fluctuation NeS animals compared to high-fluctuation NeS cattle. In the results of a*, NeC animals from the low DMI fluctuation group showed higher intensities of red color in the meat than NeT animals.

Table 1. Average productive traits and carcass traits of male Nellore cattle

[3]Parameter	[2]GF		[2]GG			[1]P Value		
	Low	**High**	**NeC**	**NeS**	**NeT**	**GF**	**GG**	**GFxGG**
DMI fluctuation, %	0.90	2.01	1.52	1.52	1.31	0.001	0.421	0.025
IBW, kg	345	337	316b	351a	356a	0.338	0.014	0.205
FBW, kg	487a	466b	432b	501a	497a	0.072	0.001	0.528
DMI, kg/d	9.50	9.44	8.92	10.04	9.46	0.083	0.063	0.039
ADG, kg/d	1.49	1.47	1.32b	1.60a	1.52ab	0.643	0.019	0.162
FER, kg/kg	0.16	0.16	0.16	0.17	0.17	0.369	0.161	0.119
RFI, kg/d	0.040	0.039	0.308	-0.109	-0.079	0.793	0.308	0.545
BFT, mm	4.82a	4.21b	4.35	4.52	4.67	0.085	0.906	0.393
REA, cm^2	77.15a	73.50b	72.01	74.72	79.26	0.093	0.165	0.317
HCW, kg	285a	272b	250b	292a	295a	0.074	0.002	0.677
CCW, kg	281a	268b	246b	287a	290a	0.054	0.002	0.592
L*	30.53	30.84	29.35	31.70	31.01	0.615	0.215	0.090
a*	18.55	16.55	19.38	17.21	16.05	0.012	0.110	0.028
b*	8.41a	7.03b	8.36	7.79	7.01	0.089	0.598	0.118
pH	5.50	5.55	5.55	5.45	5.58	0.989	0.791	0.161
CY, %	58.34	58.15	57.79	57.93	59.00	0.615	0.262	0.733

[4]Significant interactions

GG	Flutuação CMS, %		P Value	CMS, kg/d		P Value	a*		P Value
	GF			GF			GF		
	Low	**High**		**Low**	**High**		**Low**	**High**	
NeC	0.98Ab	2.07Aa		9.00Aa	8.83Aa		20.89Aa	17.86Aa	0.028
NeS	0.82Ab	2.23Aa	0.025	10.21Aa	9.86Ab	0.039	18.89ABa	15.53Aa	
NeT	0.89Ab	1.72Aa		9.30Aa	9.62Aa		15.86Ba	16.23Aa	

[1]Means followed by the same capital letters do not differ in the columns, and same lowercase letters do not differ in the rows by Tukey test (P<0.05 or trend P<0.10); [2]GF: DMI fluctuation groups; GG: genetic groups (NeC: control Nellore; NeS: selection Nellore; NeT: traditional Nellore); [3]Dry matter intake, DMI; Average daily gain, ADG; Initial body weight, IBW; Final body weight, FBW; Feed efficiency ratio, FER; Residual feed intake, RFI; Rib eye area, REA; Backfat thickness, BFT; Hot carcass weight, HCW; chilled carcass weight, CCW; color (CIELAB system: L, a*, and b*);pH; Carcass yield, CY.[4]Significant interaction between factors (GF and GG)

IV. CONCLUSION

The fluctuation of DMI can interact mainly with live body weight and carcass traits of Nellore cattle, as well as influencing color attributes of the meat.

It is desirable to optimize monitoring and control processes of the production system to reduce variability in animal DMI, avoiding metabolic disorders related to performance in Nellore cattle.

ACKNOWLEDGEMENTS

This study was supported by São Paulo Research Foundation - FAPESP (grants: 2017/50339-5 and 2022/12347-4).

REFERENCES

1. Pereira, I.C; Costa, C.F; Martins, C.L; Pereira, M.C.S; Squizatti, M.M; Owens, F.N; Cruz, G.D; Millen, D.D.; Arrigoni, M.D.B. (2021). Voluntary daily fluctuation in dry matter intake is associated with feedlot performance, feeding behavior and rumen morphometrics in beef cattle, Livestock Science, 250:104565.
2. Mercadante, M.E.Z., Packer, I. U.; Razook, A. G.; Cyrillo, J. N. S. G.; Figueiredo, L. A. 2003. Direct and correlated responses to selection for yearling weight on reproductive performance of Nellore cows. Journal of Animal Science 81: 376–384.