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THE USE OF TD-NMR SPECTROSCOPY TO PREDICT THE MEAT QUALITY FROM ANIMALS WITH DIVERGENTE GENETIC POTENTIAL FOR GROWTH

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Abstract – The aim of this study was to evaluate meat quality from animal with different Expected progeny difference for growth (EPDg) and the prediction power of cooking loss (CL) and Warner-Bratzler shear force (WBSF) using time-domain nuclear magnetic resonance (TD-NMR) relaxometry data and multivariate models. Samples from 74 Nellore bulls were separated into two groups according the EPDg. Longissimus samples were analyzed by reference methods such as CL and WBSF. The raw beef samples of the same animals were analyzed by TD-NMR relaxometry using Carr-Purcell-Meiboom-Gill (CPMG) and Continuous Wave-Free Precession (CWFP) pulse sequences. The CL and WBSF, measured in aged beef samples, by reference methods and NMR relaxometry and analyzed by principal component analysis (PCA) did not show any difference between the two EPDg groups. The multivariate regression PLS model results did not show any correlation between the CL and WBSF measured by traditional methods and the TD-NMR data acquired with CPMG and CWFP pulse sequences.
Key Words – expected progeny difference, Nellore bulls, TD-NMR

INTRODUCTION

Genetic selection has been largely applied in herds in order to increase performance and meat production. However, because the increase concerning about meat quality parameters, studies to evaluate the selection for growth can affect the meat quality standards has become necessary. Meat quality traits has been largely use in beef industry, it can be assessed by physicochemical parameters and by sensory attributes. However, the physicochemical methods or sensory panel are destructive, laborious, time consuming and show an inherent subjectivity in the results. In this sense, technology such as Nuclear Magnetic Resonance (NMR) has been used to evaluate meat quality traits in a non-invasive way and without destroying the sample [1, 2]. Therefore, the aim of this study was to evaluate meat quality from animals with different Expected progeny difference for growth (EPDg) and the prediction power of CL and WBSF using time-domain nuclear magnetic resonance (TD-NMR) relaxometry data and multivariate models.

MATERIALS AND METHODS

Longissimus samples from 74 Nellore bulls feedlot finished were collected 24 hours post mortem according the EPDg (high, from 4.4 to 13.8 kg with 18 months age; low, from -9.92 kg to 4.0 kg with 18 months age), vacuum packed and aged for 7 days to measure the cooking loss (CL), and Warner-Bratzler shear force (WBSF) according methodology described in AMSA [3]. In addition, meat quality were also evaluated by time-domain nuclear magnetic resonance (TD-NMR) using Carr-Purcell-Meiboom-Gill (CPMG) and Continuous Wave-Free Precession (CWFP) pulse sequences. The CL and WBSF measured by reference methods were analyzed using SAS version 9.1.2 for Windows (SAS Inst. Inc., Cary, NC). The TD-NMR analyses were performed in a SLK-IF-1399 (0.23 T or 9 MHz for ^{1}H resonance frequency) spectrometer, Spinlock (Córdoba, Argentine), using a 10 cm probe, at 23 °C. The principal component of analyses (PCA) of CL and WBSFand and TD-NMR data were analyzed using MatLab software. Multivariate regression PLS model between the CL and WBSF measured by traditional methods and the TD-NMR data acquired with CPMG and CWFP pulse sequences were calculated with the SIMPLS algorithm. The PLS was preprocessing using the mean center and smoothing (order: 2, window: 71 pt); in addition, the cross validation, leave one out, was included at the model.

RESULTS AND DISCUSSION

There was no effect (P>0.05) of EPD for CL (22.9 vs 22.2% for high and low EPD for growth) and WBSF (38.35 vs 40.39 N for high and low EPD for growth) measured by reference methods, indicating similarity of animals. As consequence, the score plots of PCA analysis of physicochemical and TD-NMR data present in Figure 1 and 2, respectively, show an overlap between these data indicating no difference between high and low EPDg samples. The green symbol in both figures represents high EPDg animals and red low EPDg animals. This was not initially expected because the different growth patterns according EPDg that could interfere in meat quality by difference in muscle fiber type and/or by enzymatic proteolytic system. In addition, the multivariate regression PLS models indicate no correlation between physicochemical analyses and TD-NMR, with the determination coefficient of cross-validation (CV R^2) for 0.008 and 0.01 for CL and WBSF respectively. Probably this is the consequence of high similarity between the seven days aged beef samples of the two EPDg treatments. Contrary to the present study, Pereira *et al.* [1], founded a high correlation coefficient (r) between the classical analysis results for sensorial parameters and physicochemical parameters of non-aged beef samples and those predicted by PLS multivariate model with TD-NMR signals.

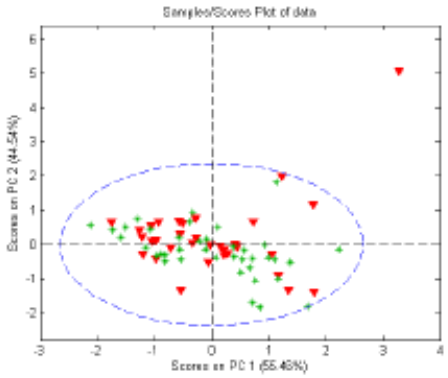

Figure 1. CL and WBSF distributions measured by physicochemical methods.

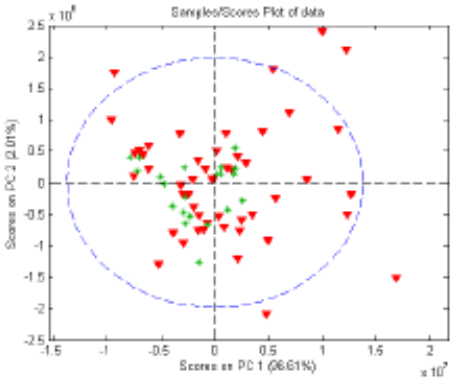

Figure 2. TD-NMR data distribution.

CONCLUSIONS

The CL and WBSF of seven days aged beef were not affect by EPD for growth. As a consequence no correlation between the CL and WBSF measured by traditional methods with the TD-NMR data from acquired with two different sequences, CPMG and CWFP was observed when the data were modeled with PLS.

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