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Animal selection by expected progeny difference influences beef tenderness in *bos indicus* cattle (#559)

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Introduction

Brazil is the largest commercial cattle producer in the world. However, domestic beef cattle are characterized by low productivity and great variation in beef quality (Siqueira et al., 2012). This second aspect can be justified by the great *Bos indicus* fraction found in the genetic base of our cattle. In generally, *Bos indicus* present less tender beef and less intramuscular fat when compared to *Bos taurus* (Pereira et al., 2015; Lage et al., 2012), making the appreciation of this beef difficult towards the international markets (USDA Quality Grade, 2016).

The phenotypic differences related to beef traits can be find within the same breed for different pedigree (Smith et al., 2007). That happens as a result of the great genetic heterogeneity of the Brazilian herd (Fernandes et al., 2016), mainly affecting beef tenderness. Thus, the selection of earlier pedigrees, presenting superior beef quality can be a profitable investment. For this reason, one of the tools used to identify the genetic value of animals is the Expected Progeny Difference (EPD).

The goal of this study was to evaluate the mechanisms involved in beef tenderness of Nelore cattle progenies from bulls selected by contrasting traits for precocity, growth and muscularity, through the EPD as a study tool.

Methods

One hundred and five Nelore bulls (initial weight of 350kg±15kg), 20 months of age were confined for 100 days and fed with same diet consisted of corn silage, corn grain, ground sorghum, soybean meal, citrus pulp, urea, and mineral core. Were selected 32 animals to create the contrasting groups (16 animals assigned as a low EPD group – LEPD, and 16 animals assigned as a high EPD group – HEPD). These animals were selected based on their parents EPD, which are divided into two contrasting groups for precocity, growth and muscularity (LEPD and HEPD). *Longissimus* muscle were collected at harvest for analysis of gene expression and frozen in liquid nitrogen and stored at −80°C. After, a 24h, chilling period a 2.54 cm thick steaks were cut from *Longissimus* muscle between 12th-13th ribs for Warner-Bratzler Shear Force (WBSF) analysis, total collagen content and heat solubility. Samples were vacuum packaged and frozen at −18°C until analysis.

The samples were cooked according to AMSA (2015) and the WBSF was performed according Wheeler et al. (2001) using a texture analyzer equipment TMS – PRO® (Food Technology Corporation, VA, USA).

Collagen and its heat soluble fraction were estimated from the hydroxyproline (OH-Prol) determination (Woessner, 1961). The quantities of OH-Prol in soluble and insoluble fractions were multiplied by 7.52 and 7.25, respectively, to calculate the collagen content in each (Cross et al., 1973).

RNA was extracted using TRIzol reagent® according to the manufacturer's recommendations. The qPCR reactions were analyzed in Real-Time PCR QuantStudio 6. To calculate relative expression, the target genes were normalized to the geometric mean of the *GAPDH* and β-*actin*, and the relative levels were represented as $2^{-\Delta Ct}$.

The statistical analyses were performed by the proc MIXED SAS® (version 9.4). The experimental design was completely randomized and were used a linear model, including EPD's groups as fixed effect, and bulls as random effect.

Results

The progenies of bulls with contrasting EPD for the precocity, growth and muscularity affected beef tenderness (P=0.049; Figure 1). The HEPD group presented decreased shear force values when comparing to LEPD (72.45±2.54 N and 80.77±3.11 N, respectively).

However, there was no difference in total collagen content (P=0.131) and collagen solubility (P=0.098; Figure 2).

Moreover, the groups did not influence the transcript levels of *CAST* (P=0.143), *CAPN1* (P=0.432), *CAPN2* (P=0.206; Figure 3).

Therefore, to date, there is a lack on the validation of genes in beef of high and low EPD progenies. Thus, it is necessary to keep studying these traits in *Bosindicus* cattle under tropical conditions, in order to elucidate the genetic architecture of carcass and meat quality of this animals.

Conclusion

Animal selection by EPD influences beef tenderness in *Bos indicus* cattle. The beef produce by HEPD group is more tender than LEPD. The results of this study suggest that the groups of different EPD have different physiolog

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ical and molecular mechanisms that contribute to the observed phenotype in their progenies. However, this phenotype is not due to the differences in expression of the *CAPN1*, *CAPN2* and *CAST* genes, and by the collagen solubility. Nevertheless, other proteolytic systems, besides calpain-calpastatin, may be involved in meat tenderization (Ouali et al., 2006), such as caspase systems (CASP) and heat shock proteins (HSP) (Ouali et al., 2013; Saccá et al., 2018) among others.

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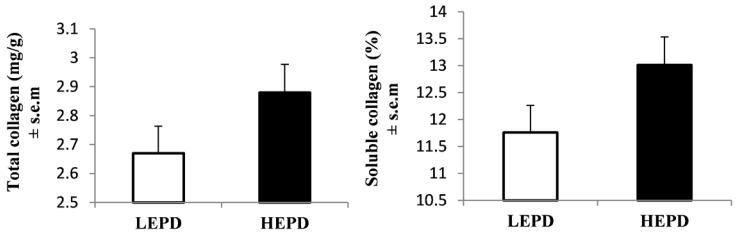

Figure 2. Total collagen (mg/g) and Soluble collagen (%) of beef from LEPD and HEPD groups; ± s.e.m = standard error of the mean. LEPD = low EPD and HEPD = high EPD (simultaneous contrasts for precocity, growth and muscularity).

Figure 2.

Notes

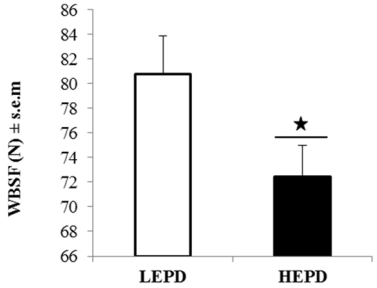

Figure 1. WBSF of *Longissimus* from LEPD and HEPD groups, in Newtons (N). ± s.e.m = standard error of the mean. LEPD = low EPD and HEPD = high EPD (simultaneous contrasts for precocity, growth and muscularity). ★ = significant difference (P<0.05).

Figure

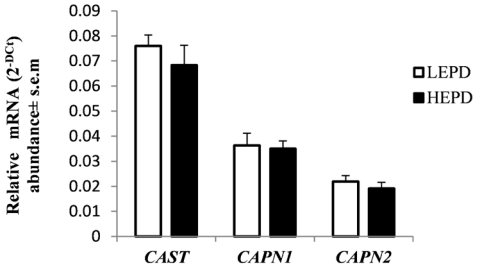

Figure 3. Gene expression of *CAST* (calpastatin), *CAPN1* (μ-Calpaín 1) and *CAPN2* (m-Calpaín 2); ± s.e.m = standard error of the mean. LEPD = low EPD and HEPD = high EPD (simultaneous contrasts for precocity, growth and muscularity).

Figure 3.

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