

Estimated Heat Production, Blood Parameters and Mitochondrial DNA Copy Number of Nellore Bulls with High and Low Residual Feed Intake

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Abstract : With increased production costs there is a need for animals that are more efficient in terms of meat production. In this context, the role of mitochondrial DNA (mtDNA) on physiological processes in liver, muscle and adipose tissues may account for inter-animal variation in energy expenditures and heat production. The purpose this study was to investigate if the amounts of mtDNA in liver, muscle and adipose tissue (subcutaneous and visceral depots) of Nellore bulls are associated with residual feed intake (RFI) and estimated heat production (EHP). Eighteen animals were individually fed in a feedlot for 90 days. RFI values were obtained by regression of dry matter intake (DMI) in relation to average daily gain (ADG) and mid-test metabolic body weight (BW). The animals were classified into low (more efficient) and high (less efficient) RFI groups. The bulls were then randomly distributed in individual pens where they were given excess feed twice daily to result in 5 to 10% orts for 90 d with diet containing 15% crude protein and 2.7 Mcal ME/kg DM. The heart rate (HR) of bulls was monitored for 4 consecutive days and used for calculation of EHP. Electrodes were fitted to bulls with stretch belts (POLAR RS400; Kempele, Finland). To calculate oxygen pulse (O2P), oxygen consumption was obtained using a facemask connected to the gas analyzer (EXHALYZER, ECOMedics, Zurich, Switzerland) and HR were simultaneously measured for 15 minutes period. Daily oxygen (O2) consumption was calculated by multiplying the volume of O2 per beat by total daily beats. EHP was calculated multiplying O2P by the average HR obtained during the 4 days, assuming 4.89 kcal/L of O2 to measure daily EHP that was expressed in kilocalories/day/kilogram metabolic BW (kcal/day/kg BW^{0.75}). Blood samples were collected between days 45 and 90th after the beginning of the trial period in order to measure the concentration of hemoglobin and hematocrit. The bulls were slaughtered in an experimental slaughter house in accordance with current guidelines. Immediately after slaughter, a section of liver, a portion of longissimus thoracis (LT) muscle, plus a portion of subcutaneous fat (surrounding LT muscle) and portions of visceral fat (kidney, pelvis and inguinal fat) were collected. Samples of liver, muscle and adipose tissues were used to quantify mtDNA copy number per cell. The number of mtDNA copies was determined by normalization of mtDNA amount against a single copy nuclear gene (B2M). Mean of EHP, hemoglobin and hematocrit of high and low RFI bulls were compared using two-sample t-tests. Additionally, the one-way ANOVA was used to compare mtDNA quantification considering the mains effects of RFI groups. We found lower EHP (83.047 vs. 97.590 kcal/day/kgBW^{0.75}; $P < 0.10$), hemoglobin concentration (13.533 vs. 15.108 g/dL; $P < 0.10$) and hematocrit percentage (39.3 vs. 43.6 %; $P < 0.05$) in low compared to high RFI bulls, respectively, which may be useful traits to identify efficient animals. However, no differences were observed between the mtDNA content in liver, muscle and adipose tissue of Nellore bulls with high and low RFI.

Keywords : bioenergetics, *Bos indicus*, feed efficiency, mitochondria

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