

METABOLOMIC FINGERPRINTING OF NELLORE CALVES WITH VARIATION IN BIRTH WEIGHT

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INTRODUCTION

Variation in the birth weight of beef cattle is generally explained by genetic and non-genetic fetal and maternal factors [1]. In this context, interactions between genes and environmental factors generate specific metabolic rates and/or metabolisms that may represent the phenotype of interest [2]. Metabolomics is an analytical tool used to evaluate metabolites, which in turn provides a better understanding of the metabolism that generates the phenotype [3]. Considering the differences in birth weight, it is believed that variations in the metabolism of these animals may exist. Therefore, the aim of this study was to evaluate whether differences in birth weight lead to changes in the calves metabolism.

MATERIALS AND METHODS

The experimental procedures were conducted in accordance with the Institutional Animal Care of the College of Animal Science and Food Engineering at the University of São Paulo (9249180123). A total of 100 male calves were separated into two treatments based on the average weight: high birth weight (HW, ≤ 35 kg) and low birth weight (LW, ≥ 43 kg). Blood samples and weight measurements were taken on day two after birth. Blood samples were taken through the jugular vein using a vacutainer tube of 10 mL, samples were centrifuged for 15 min at $2000 \times g$ at 4°C . Serum was collected, and macromolecules were removed using 3 kDa filters (Amicon® Ultra - 0.5, Merck Millipore Ltd, Ireland) [4]. The spectra were obtained by nuclear magnetic resonance spectrometry (^1H -NMR), exported to the online tool NMRProcFlow - version 1.4.24 (<https://nmrprocflow.org/>), processed, and divided into buckets of 0.05 ppm width, resulting in 111 buckets. Statistical analyses were performed using the web tool MetaboAnalyst 6.0 (<http://www.metaboanalyst.ca/>), employing principal component analysis (PCA) and Volcano plot.

RESULTS AND DISCUSSION

The PCA analysis showed similarity between the groups (Figure 1A). However, in the Volcano analysis (Figure 1B), calves born with higher weight had higher concentrations of lactate and histidine, and lower concentrations of 3-hydroxybutyrate and glucose compared to calves in the LW group. Amino acids and lactate are important precursors of glucose in newborn calves [5]; therefore, calves in the HW group had greater availability of substrates to synthesize energy reserves. The increase in 3-hydroxybutyrate and glucose in the blood plasma of the LW group may come from lipolysis caused by stress from negative energy balance [6].

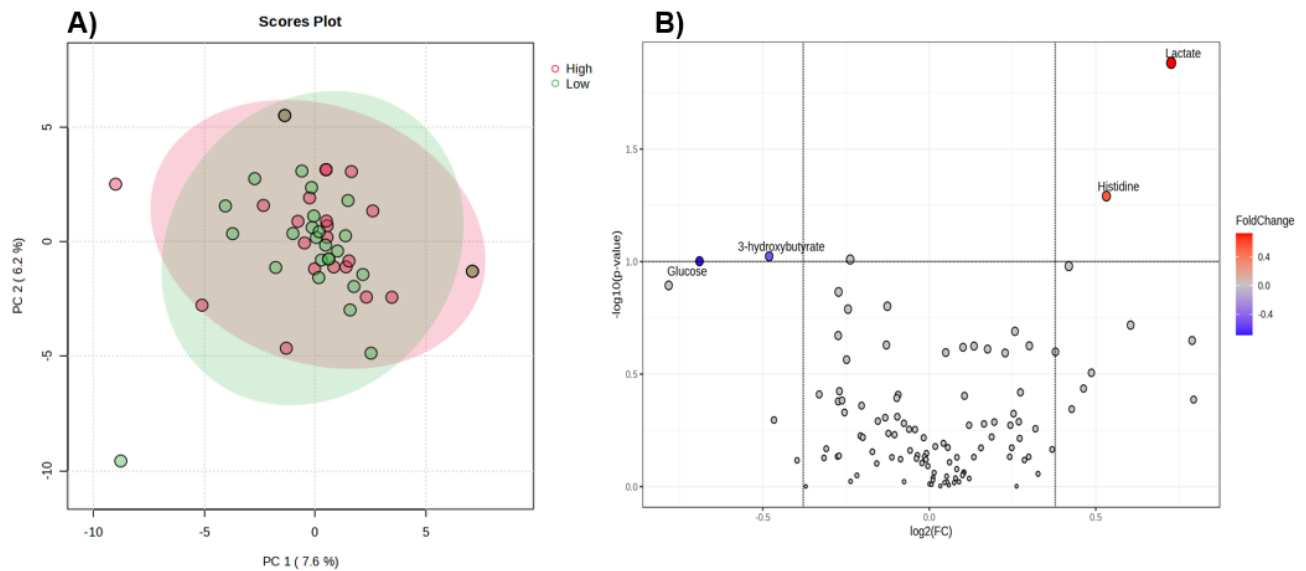


Figure 1. A) Principal component of analysis from calves with high and low birth weight; B) Volcano plot of metabolites from calves with high and low birth weight

CONCLUSION

Nellore calves with greater birth weight may presented a neoglycogenic metabolism by lactate and aminoacids, and the metabolism of lower birth weight calves appears to be correlated with lipolytic metabolic pathways to generate energy.

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