Characterization of Specific Immune Cell Parameters in Calves Produced by IVF, Microinjection of DNA, and Delivered by Elective Cesearean Section

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Introduction

In vitro fertilization (IVF) and micro-injection of DNA are reproductive technologies available to enhance the genome of production animals. Immune cell function is poorly understood in calves produced by these reproductive methods. Based on economic value and potential use, characterizing immune cell function would aid in better understanding of both management and medicine of calves produced by enhanced reproductive technologies. The objective of this study was to evaluate specific immune cell parameters in these calves.

Materials and Methods

The control (CON) group consisted of 12 Holstein calves produced by artificial insemination (AI) and delivered vaginally. The treatment (TRT) group consisted of 30 Holstein or Holstein-cross calves produced by IVF and micro-injection of DNA. TRT calves, born to first-calf heifers, were delivered by elective C-section 4-5 days prior to the projected due date to decrease dystocia, stress, and mortality. Dams received 25 mg of dexamethasone 24 hours prior to elective C-section to enhance fetal lung development. Calves in both groups were hand-fed 2 L of colostrum at 1, 6, 12 and 24 hrs post-delivery. Each calf ingested 6 L of colostrum by 12 hrs and 8 L by 24 hrs of age. Blood samples were obtained via jugular venipuncture from each calf at 0 (pre-feeding) and 24 hrs post-delivery for serum IgG quantification, complete blood counts, lymphocyte CD4/CD8 subsets and monocyte MHC class II molecules expression, and neutrophil phagocytic activity.

Results and Conclusions

TRT calves ingested and absorbed more IgG ($P<0.001$) by 24 hrs of age as compared to CON calves. Lymphocyte numbers were greater in CON calves at 2.85 x $10^3\mu l$ versus TRT calves at 1.70 x $10^3\mu l$, but TRT calves exhibited a higher percentage of CD4+ and CD8+ subsets. The CD4+/CD8+ ratio was similar for both groups at 0 hrs (0.70). At 24 hrs, the ratio was reversed in CON calves (1.29), but not in TRT calves (0.88).

An inverse relationship between neutrophil number and phagocytic activity was observed between CON and TRT calves. Moreover, differences between groups for monocyte number and cell expression of MHC class II molecules were observed.

Immune cells of calves derived from IVF and C-section appear to differ in maturity and functionality, compared to calves delivered vaginally and conceived by AI. This may influence immunocompetence during the neonatal period. Immunocompetence in calves derived by IVF and micro-injection may be influenced by genomic manipulation, hormonal stress, colostral quality and environmental management. Based on data from this pilot study, additional research needs to be conducted to further classify immune cell function in IVF calves.