Molecular determinants of milk lactoferrin as a bioactive compound in early neurodevelopment and cognition

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Background/Aims: To test the hypothesis that milk Lf may induce gene expression profiling and function to improve neurodevelopment and cognition in postnatal piglets, an animal model for human infants.

Methods: 3-day-old male piglets were randomly allocated to 2 groups. Group 1 were fed milk replacer supplemented with bovine milk Lf at a dose level of 0.6g/L (n= 17) and Group 2, 0.06 g/L (n= 16; control). Global gene expression profile and the selected target gene expression were determined using a Porcine Affymetrix GeneChips representing 20,201genes from S. scrofa and real-time PCR to validate the microarray findings. The selected protein expression was analysed using western blot and immunohistochemistry techniques.

Results: A total of 1,187 genes were differentially expressed between the control and Lf groups, based on our filter criteria (fold change: 1.15 and $p < 0.05$). A positive global effect of milk Lf on neurodevelopment and cognition was observed, as evidenced by the modulation of a wide range of neuronal processes. Milk LF up-regulated transcriptional and translational levels of the brain-derived neurotrophin factor (BDNF) and increased phosphorylation of the cAMP responsive element–binding protein (CREB), a downstream target of the BDNF signaling pathway, and a protein of crucial importance in neurodevelopment and cognition. Milk Lf enhanced the piglet learning speed and long-term memory.

Conclusions: Milk Lf can improve neural development and cognition in postnatal piglets, an animal model of human infant.

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