

Can maternal nutrition alter imprinted genes in oocytes?

M.Vinsky¹, W. Dixon¹, G. Foxcroft¹

¹ Swine Research & Technology Centre, Swine Reproduction-Development Program, Dept. AFNS, Univ Alberta, Edmonton, AB T6G2P5; *Email*: george.foxcroft@ualberta.ca

Limited feed intake in first parity sows during the last week of lactation results in developmentally challenged oocytes and increased embryonic mortality. At this time it is not clear whether metabolic factors, genetic factors, or a combination of both, cause this decrease in embryonic survival. However, feed restriction occurs in a critical period of oocyte development, when the final stages of a process called "gene imprinting" occurs. Work in other species shows that abnormal methylation of imprinted genes leads to abnormal embryonic development and poor survival; furthermore, fetuses which survive to term have a higher incidence of birth defects, growth abnormalities, and permanent mutations in their germline. The large male offspring syndrome in cattle is one example of abnormal gene imprinting affecting fetal development.

Defective embryos resulting from previous nutritional restriction may show a change in overall DNA methylation, and changes in methylation state in specific regions of imprinted genes, such as the IGF2 receptor gene that controls normal embryonic development. A decrease in nutrients in maternal plasma, which are essential for DNA methylation, such as folic acid and vitamin B12, may also be anticipated during a period of feed restriction. We are presently measuring such changes in an established experimental model in which nutritional restriction in late lactation results in a significant increase in embryonic mortality by day 30 of gestation.

Implications:

Errors in imprinted genes in the pig may decrease litter size, cause prenatal and postnatal growth abnormalities, and reduce piglet health. Understanding if poor nutritional state affects sow fertility and the development of offspring through effects on imprinted genes will help us to develop long-term strategies to improve breeding herd performance.