Title: Increase in Mid-pregnancy Placental kPL in Guinea Pigs Fed a Lifelong Western Diet

Trainee Name: Mary-Ellen Empey

Supervisor(s): Dr. Charles McKenzie

Structured Abstract:

Introduction: The rising incidence of obesity in Canadians, including reproductive-age women, is partially attributed to the consumption of a Western Diet (WD) high in saturated fat and sugar. Fetal exposure to a maternal WD has demonstrated alterations in metabolic programming that predisposes the offspring to developing adverse health outcomes in later life. Maternal WD consumption impacts near-term placental oxidative capacity, potentially resulting in increased anaerobic metabolism and lactate production, but how placental metabolic processes develop over gestation is currently ill defined. This study aims to quantify changes in the rate constant for pyruvate to lactate conversion (kPL) and we hypothesize that lifelong consumption of a WD, in conjunction with pregnancy, will result in an increased mid-pregnancy placental kPL.

Methods: Data was obtained from 7 fetoplacental units from 2 WD-fed sows and 5 fetoplacental units from 1 CD-fed sow. Sows underwent metabolic magnetic resonance imaging at 33 days gestation (term ~ 69 days) under isoflurane anaesthesia. Each placenta was segmented as a whole volume and an area under the curve (AUC) was calculated from the mean signal intensities of pyruvate and lactate in each placental volume. The lactate-to-pyruvate ratio (LPR= AUCLACTATE/AUCPYRUVATE) is proportional to kPL.

Results: The LPR is 0.042 +/- 0.009 (mean +/- standard deviation) for the WD group and 0.033 +/- 0.006 for the CD group. The difference in LPR between these groups is significant (p=0.048).

Discussion: The increased LPR, and therefore kPL, in the WD GPs at mid-pregnancy, indicates a shift from aerobic to anaerobic placental metabolism. This may be the result of a hypoxic environment caused by lifelong WD consumption. Identification of this placental dysfunction might serve as an early pregnancy, non-invasive biomarker of fetal health that can provide previously unavailable information about a developing WD-exposure pregnancy.