Following Lactation is an extremely energy demanding event, impacting naïve dams to a greater extent as they are still physiologically immature. The objective of the current study was to determine if a unique plasma metabolome exists at early and late lactation from first parity gilts having similar body measurements and litter sizes post-farrow (PF) with divergent body condition measurements at weaning. Farrowing data, body composition traits (bodyweight, backfat thickness, and loin eye area), and a plasma sample were collected PF (2.7 ± 1.45 d) and 1 d prior to weaning (WN) from composite Landrace-Duroc-Yorkshire gilts bred with Yorkshire semen. Twenty-seven gilts were identified from 68 first parity farrowings with similar farrowing ages (P = 0.9442), PF body weight (P = 0.6789), PF backfat thickness (P = 0.8549), and litter size (P ≥ 0.2263). Dams were fed to appetite from d3 PF through WN. Of the 27 dams, 10 with the greatest (Hi) and 10 with the least (Lo) body weight loss (P < 0.0001; 26.1 ± 1.90 kg and 8.6 ± 1.48 kg, respectively) and backfat thickness loss (P = 0.0094; 4.7 ± 0.86 mm and 1.3 ± 0.67 mm, respectively) had plasma samples submitted for non-targeted profiling by UPLC-MS and GC-MS techniques. Raw spectral data was processed using XCMS package in R to generate feature detection and alignment followed by grouping of features into compounds. Samples were blocked by time of collection (PF and WN) and body condition loss (Hi and Lo) and ANOVA was performed on each compound in R with a Benjamini-Hochberg false discovery rate adjustment. Several compound changes (P ≤ 0.05) in the metabolome occurred from PF to WN under both detection techniques (UPLC-MS, 112; GC-MS, 59). While changes (P ≤ 0.05) in compounds between Hi loss and Lo loss also occurred, the prevalence was much less (UPLC-MS, 21; GC-MS, 11). Interestingly, the interaction of time by body condition loss yielded unique compound profiles for both detection techniques (UPLC-MS, 16; GC-MS, 20). Of the 36 compounds significant for interactions, 11 compound signatures may prove to be relevant as predictors for animals that will or won’t lose excessive weight and backfat thickness during the course of lactation. Further investigations into the specific identities and validation of all significant compounds will provide potential nutraceuticals to offset intensive depletion of energy stores in young dams during lactation. USDA is an equal opportunity provider and employer.

**Key Words:** gilts, lactation, metabolome