Published April 25, 2019

2018 Reciprocal Meat Conference – Environment, Production Systems

Meat and Muscle Biology™

Effects of Replacing Supplemental Sucrose with Beef on Maternal Health and Fetal Growth and Development Using a Sow Biomedical Model

M. A. Nelson*, A. K. Ward, K. C. Swanson, K. A. Vonnahme, and E. P. Berg

Animal Science, North Dakota State University, Fargo, ND, 58105, USA
*Corresponding author. Email: megan.nelson.6@ndsu.edu (M. A. Nelson)

Keywords: beef, biomedical model, sucrose, swine
Meat and Muscle Biology 2(2):22 **doi:10.221751/rmc2018.019**

Objectives

A diet high in sucrose is reflective of a Western diet that the average American consumes. When consuming a Western diet, individuals consume roughly 20 teaspoons of sucrose per day. The Western diet has been previously linked to metabolic disorders such as diabetes and obesity, which may be prevented by replacing dietary sucrose with a healthy protein alternative like beef. The objectives of this study were to investigate the impact of substituting dietary sucrose with beef supplementation on maternal health and fetal development utilizing the sow as a biomedical model.

Materials and Methods

Multiparous pregnant sows (Landrace × Yorkshire; BW = 222 kg; n = 21) were fed a complete sow gestation diet (corn-soybean meal-based, CSM; NRC 2017) at 1 percent of BW on sow d 30 of gestation at 700 h daily from d 30 to 39 of gestation. Sows were then fed CSM at 1 percent of BW on d 39 of gestation at 700 h daily from d 40 to 110 (± 0.58) of gestation. Sows were randomly assigned to 1 of 4 isocaloric dietary supplements consisting of 126 g CSM (CON, n = 5); 110 g cooked ground beef (CGB; BEEF, n = 6); 54.8 g CGB and 42.7 g sucrose (B+S, n = 5); or 85.5 g sucrose (SUCROSE, n = 5). Dietary supplements were fed 3 times daily from d 40 to 110 (± 0.58) of gestation. Sows were housed in gestation crates from d 30 to 111 (± 0.58) of gestation and euthanized on d 111 (± 0.58) of gestation. Blood was collected via jugular venipuncture from sows on d 29 and 111 (± 0.58) of gestation. Blood chemistry was immediately analyzed using iSTAT point-of-care device. Bodyweights were measured on d 30, 39, 54, 68, 82, 96, and 111 (± 0.58) of gestation. Tenth rib and last rib fat depth were measured on d 35, 70, and 110 (± 0.58) of gestation utilizing an ALOKA SSD-500V ultrasound. Fetal growth measurements were recorded for all fetuses. Two median weight male and female fetuses were selected from each sow for tissue collections which included pancreas, kidney, liver, heart, heart fat, lung, empty body weight, semimembranosus, and semitendinosus weights. A repeated measures design, using sow as the repeated measure, was modeled using the MIXED procedure of SAS (SAS Inst. Inc., Car, NC) using compound symmetry variance covariance matrix. Alpha level was 0.05.

Results

Dietary treatment did not influence blood metabolites of sows on d 29 or 111 of gestation (P = 0.09 and P = 0.20, respectively). Sow weight throughout gestation was not influenced by dietary treatment (P = 0.74). Dietary treatment did not influence tenth rib or last rib fat depth on d 35, 70, or 110 of gestation (P = 0.27). Compared to CON and SUCROSE, fetuses from sows supplemented with BEEF had greater nose to crown lengths (6.03 ± 0.29, 6.02 ± 0.28, and 7.33 ± 0.36 cm, respectively; P = 0.04). Compared to CON, fetuses from sows supplemented with sucrose had respectively greater BW (1296 ± 73.6 vs. 1556 ± 68.8 g; P = 0.02); heart girths (22.90 ± 0.39 vs. 24.13 ± 0.39 cm; P = 0.03), and liver weights (36.48 ± 2.19 vs. 43.44 ± 2.05 g; P = 0.04). Dietary treatment did not influence other fetal characteristics or organ weights ($P \geq 0.05$).

Conclusion

Beef supplementation during mid to late pregnancy had minimal effects on maternal blood metabolites, bodyweight, or backfat depth or fetal growth. The increase in fetal weight due to sucrose supplementation should be further explored.

