Research Week 2020

Placental Glucose Uptake in a Nonhuman Primate Model of Western-Style Diet and Chronic Hyperandrogenemia

Aaron Streblow, B.S., Victoria HJ Roberts, Jessica E Gaffney, Ov D Slayden, Antonio E Frias

OHSU

Keywords

Placenta Glucose Diet Hyperandrogenemia

Abstract

Introduction

During pregnancy, glucose is predominantly transported to fetus by the placenta via facilitated diffusion through glucose transporter (GLUT) proteins. Our group has previously demonstrated altered placental perfusion and levels of GLUT proteins in a nonhuman primate model of Western-style diet (WSD) with and without hyperandrogenemia. Therefore, we hypothesized that there would be dysregulation of placental glucose uptake in this model.

Methods

Female rhesus macaques were randomly assigned at puberty to one of four treatment groups: controls receiving subcutaneous cholesterol implants + standard chow diet (C); testosterone implants + standard chow diet (T); cholesterol implants + WSD (WSD); and testosterone implants + WSD (T+WSD). After ~6 years of treatment, animals were bred and the pregnancies were delivered by Cesarean section at G135 (term is G168). Placental villous explants were harvested for radiolabeled glucose assay, and glucose uptake was measured over 120 seconds. Villous tissue was also harvested for western blot and immunohistochemistry analysis of GLUT proteins.

Results

Linear glucose uptake was observed between 0 and 30 seconds. At 20 seconds, glucose uptake did not differ across the four treatment groups. Glucose uptake values (mean ± SD) at 20 seconds were as follows: C: 25.5 ± 6.33 pmol/mg (n=6), T: 22.9 ± 0.404 pmol/mg (n=3), WSD: 27.0 ± 3.24 pmol/mg (n=5), T+WSD: 33.0 ± 3.12 pmol/mg (n=3). Western blot analysis showed no difference in GLUT profiles. Immunohistochemistry showed that GLUT1 primarily localizes on the basal membranes and fetal capillaries. GLUT4 localizes to the syncytiotrophoblasts.

Conclusion

We anticipated that decreased placental perfusion would impact glucose transport. However, no change in uptake nor transporter expression was observed between groups. This suggests that the primate placenta has sufficient capacity to compensate for these effects to maintain normal nutrient transport and optimize fetal growth.