

Maternal subnutrition increases antioxidant defences during peri-implantation period in beef cattle

B. Serrano-Pérez¹, A. Carbonell¹, A. Noya², I. Casasús², A. Sanz², I. López-Helguera¹, J. Álvarez-Rodríguez¹, E. Molina¹ and D. Villalba¹

¹University of Lleida, Avda. Rovira roure 191, Lleida, Spain, ²CITA-IA2, Avda. Montañana 930, Zaragoza, Spain; beatriz.serrano@udl.cat

Successful implantation requires a physiological balance between reactive oxygen species (ROS) and antioxidant activity. However, nutritional deficiencies could impair pregnancy recognition mechanisms and ROS homeostasis in cattle. This study sought to determine whether maternal subnutrition during early pregnancy affects antioxidant enzyme gene expression in peripheral blood mononuclear cells during the peri-implantation period in two beef cattle breeds. Parda de Montaña (n=32, PA) and Pirenaica (n=16, PI) multiparous cows were synchronized to oestrus and artificially inseminated (AI). Dams were randomly allocated to a control (CONTROL, n=19) or subnutrition (SUBNUT, n=29) group, and were fed at 100 or 65% of their estimated energy requirements during the first 82 days of pregnancy. Dams were weighed fortnightly. The average daily gain (ADG) was calculated by linear regression. Dam BCS was registered monthly. Pregnancy diagnosis was performed by ultrasonography on Day 37 post-AI. Blood samples were drawn on Day 21 post-AI. Gene expression of CAT, SOD1 and SOD2 was analysed by qPCR. A general linear model including fixed effects (nutrition, pregnancy status, and breed) and their interactions was used to compare relative CAT, SOD1 and SOD2 gene expression with JMPPro software. When significant differences were detected, the TUKEY test was used to examine all possible pairwise comparisons. Pregnancy was confirmed in 31 dams. No significant effects were observed for reduced nutrient intake on pregnancy status. Treatment affected significantly cow ADG (P<0.001) and BCS change (P<0.05) from AI to Day 82 post-AI. No effect of pregnancy status on CAT, SOD1 and SOD2 mRNA was observed on Day 21 post-AI. SOD1 mRNA was higher in SUBNUT (P<0.01) than in CONTROL group, suggesting an oxidative damage response to dietary deficiency in these two cattle breeds during the early pregnancy. A trend to higher SOD2 mRNA was observed in PA cows respect PI cows (P=0.09). To sum up, maternal nutrient restriction during early pregnancy increased antioxidant defences during peri-implantation period in suckler beef cattle.

***In utero* undernutrition affects heifer growth, follicle and metabolic traits but not age at puberty**

A. Sanz, I. Casasús, J. Ferrer, L. López De Armentia and A. Noya

CITA de Aragón (CITA-IA2), Avda Montañana 930, 50059 Zaragoza, Spain; asanz@aragon.es

Undernutrition in early stages of pregnancy can have detrimental effects on the developing foetus. We studied the effects of peri-implantation subnutrition of beef cows on the performance of their female offspring. Fifty-three Parda and 32 Pirenaica multiparous cows were artificially inseminated (AI) and distributed into two nutritional treatments during 82 days post-AI: CONTROL (100% energy requirements) vs SUBNUT (65%); thereafter they were fed 100%. Newborns were fed on maternal milk and were weaned at 120 days. During rearing, heifer weights were recorded and blood samples were taken to study their metabolic status. On days 1 and 10 every 28-day period blood samples were collected to assess the age at puberty. Ovarian follicular dynamic was recorded at 10, 13 and 16 months of age by ultrasonography. Heifers born from SUBNUT cows were lighter at weaning (4 months old) than heifers born from CONTROL cows (133 vs 152 kg, P<0.05), but this difference disappeared at AI (16 months old, 400 vs 415 kg, P>0.05). Consequently, SUBNUT heifers had increased the requirements for growth in the rearing period, compromising their metabolic status around the onset of puberty (higher concentrations of NEFA, urea and cholesterol). Maternal undernutrition impaired their ovarian development, with lower counts of large follicles (>10 mm) at 13 months (0.4 vs 0.9, P<0.05) and small follicles (<5 mm) at 16 months (11 vs 16, P<0.05). However, the age (12 months), weight (339 kg) and percentage of mature live weight (59%) at the onset of puberty were similar in all heifers. Regarding the breed, Parda heifers had higher gains during rearing than Pirenaica ones (0.82 vs 0.71 kg, P<0.01), higher weight at AI (420 vs 395 kg, P<0.05), more large follicles at 10 months (0.8 vs 0.4, P<0.05) and larger dominant follicles at 16 months (12.4 vs 9.5 mm diameter, P<0.05). In conclusion, undernutrition of beef cows in early gestation had long-term effects on postnatal growth, follicular and metabolic parameters of their female offspring, but no effect on the age or weight at puberty. Further research is needed to determine the possible consequences of intrauterine energy restriction on heifer adult weight and reproductive lifespan.