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Impacts of early life nutrition on fat tissue morphology and gene expression in adult sheep

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We assessed the long-term impacts of pre- and early postnatal malnutrition on fat tissue in sheep. The fat tissue samples were obtained from 2½ years old males (M) and females (F) sheep, born to twin-pregnant dams fed with NORM (100% of energy (E) and protein (CP) requirements), HIGH (150% E and 10% CP) or LOW (50% of NORM) diets during the last trimester. Postnatally the twins were fed moderate (CONV) or high-fat-high-carbohydrate (HCHF) diet until 6 months of age. Thereafter, they were fed with a moderate diet for 2 years and then slaughtered. Adipocyte (AP) morphology and mRNA expression for a range of genes were assessed in subcutaneous, perirenal, mesenteric and epicardial fat and linear mixed model was used for data analyses. Even after 2 years of dietary correction, there was a clear shift towards larger AP and altered gene expression patterns for adipogenic and lipid metabolism genes in HCHF compared to epicardial fat from CONV sheep. HCHF sheep appeared to be tolerant towards impacts of early postnatal obesogenic diet, since HIGH-HCHF sheep attained similar expression for many genes to those of NORM-CONV. M had overall higher expression levels for a wide range of genes compared to F. Long-term implications of prenatal programming were observed more frequently and pronounced in M than F. In subcutaneous fat, LOW sheep of both sexes had distinct changes in AP shape and size compared to NORM and HIGH; LOW and HIGH sheep had reduced expression levels for a range of genes compared to NORM sheep. Perirenal fat was the most sensitive among all tissues to early life malnutrition, and prenatal implications were observed most in LOW sheep irrespective of the postnatal diet. In conclusion, even 2 years of dietary correction could not reverse impacts of early obesity on adipocyte morphology. Long-term differential implications of prenatal malnutrition on fat tissues development may depend on timing of the nutritional insults. Changes in AP morphology could not readily be associated to expression of genes involved in a wide range of functional traits.

Effect of early shearing on the productive performance of offspring in their first 18 months of age

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Nutritional and environmental stress at critical moments of foetal development can alter the physiology and metabolism of the organs and tissues of the offspring and influence its growth after weaning. The effect of shearing at 50 days of gestation on body condition (BCS) and body weight (BW) of male offspring in the first 18 months of life were evaluated. Seventy-nine male lambs (Polwarth) born in spring, whose mothers were assigned to two treatments factors: shearing time (prepartum (PS) and postpartum (U)) and litter size (single (S) and twin (T)) resulting in four treatments: SPS (n=23) single lambs born to PS ewes; SU (n=21) single lambs born to U ewes; TPS (n=18) twin lambs born to PS ewes and TU (n=17) twin lambs born to U ewes were used. From weaning (104±0.6 d) male lambs were handled on improved pastures, and BCS (scale of 1-5) and BW were recorded every 14 days. Data were analysed using a repeated-measure analysis with PROC MIXED procedure of SAS (SAS 9.3). Means were compared by Tukey-Kramer test (P<0.05). The weight of the lambs at birth (P=0.0002, 4.8±0.3 vs 4.4±0.2 kg) and at weaning (P=0.01, 21.5±0.9 vs 19.2±0.9 kg) was greater in PS lambs than U. BCS was not different (P=0.10, 1.9±0.05 vs 1.9±0.06 units PS and U) among treatments. BW of PS was higher than U male lambs (P=0.02, 34.6±0.7 vs 32.2±0.7 kg) but was not accompanied by a higher (P=0.42) daily gain of BW (0.73±0.04 vs 0.78±0.04 kg). BW of S and T male lambs was not different (P=0.10, 34.3±0.8 vs 32.5±0.8 kg, PS and U). The maximum difference (P=0.007) in BW among treatments was reached at 285 days old (33.9±0.9 vs 30.3±0.9 kg, PS and U) but the difference was lost after the age of 12 months. U male lambs could not compensate after weaning the lower BW they had at birth and at weaning. The high BW reached by PS lambs up to 12 months of age is of great importance for sheep meat producers, since it is the period where the products have the greatest commercial value.