Genome wide association studies of growth traits in grazing Rasa Aragonesa ewes

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Rasa Aragonesa sheep is an autochthonous meat breed from the northeast of Spain, mainly reared in extensive or semi-extensive farming systems and characterized by a marked seasonality of breeding activity from March to June, being the longest seasonal anoestrous in ewes with low body condition (BC) and body weight (BW). This study aimed to perform a genome-wide association study (GWAS) to identify SNPs and genomic regions associated with BC, BW and growth rate (GR) in 215 Rasa Aragonesa ewes raised on pasture, of which 110 were genotyped using the 50k and 115 with 680k *Illumina Ovine Beadchips.* BC and BW were collected every three weeks during 2 years from January to August and were estimated and adjusted by BLUPF90 software, and GR was estimated by a linear regression in R. The pseudo-phenotypes obtained were utilized as input for the GWAS. The Beagle 4.0 program was used to impute missing SNPs from the 50k chip to 680k. GWAS was performed using the GCTA program running a mixed linear model association (MLMA) and the leaving-one-chromosome-out approach (LOCO). Only one SNP associated to GR in chromosome 9 overcame the genome-wise significance level (FDR 10%). This SNP was located approximately at 83 kb from the *CYP7B1* gene, which is involved in the metabolism of endogenous oxysterols, which are key mediators of cholesterol and lipid homeostasis. We also identified 1, 3 and 9 SNPs for BC, BW and GR, respectively, reaching the chromosome-wise level of significance (FDR 10%). *NPC2* gene located in chromosome 7 is close to a chromosome-wise significant SNP for GR, and it is involved in the intracellular trafficking of cholesterol and other lipids. No candidate genes were found for BC. However, several genes were annotated near the significant SNPs for the BW trait, namely, *MARK1* located in chromosome 12 and related to gastrointestinal parasite resistance traits in Djallonké sheep, and *ZEB1* gene in chromosome 13 associated with obesity in human and adipogenesis in mice. Future studies characterizing these candidate genes, may uncover the genetic architecture underlying the bodyweight and growth rate traits in Rasa Aragonesa.