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Stearoyl CoA desaturase gene polymorphism in Italian cattle breeds

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ABSTRACT

Stearoyl CoA desaturase (SCD) is a rate-limiting enzyme in the biosynthesis of monounsaturated fatty acids. In cattle, a number of studies support the hypothesis that SCD gene regulation and polymorphism may affect fatty acid composition and fat quality in meat and milk. In ruminant-derived food products, SCD activity has been correlated to the content of conjugated linoleic acid (CLA), a mixture of geometrical and positional isomers of linoleic acid C_{18:2} having several positive effects on human health (i.e. anticarcinogenic, antiatherogenic and immunomodulating effects).

Aim of this study was to assess the polymorphism of 3 previously reported Single Nucleotide Polymorphisms (SNPs) in exon 5 of SCD gene in 12 cattle breeds raised in Italy, to evaluate the genetic variability and the genetic differences due to breed and/or selection purpose. Breeds sampled cover the whole geographic area of Italian peninsula and represent different selective purposes: 6 meat-purpose or meat-prevalence breeds (Piedmontese [n=27], Chianina [n=26], Romagnola [n=28], Marchigiana [n=30], Italian Limousine [n=22], Podolica [n=28]), 5 dairy-purpose or dairy-prevalence breeds (Italian Holstein [n=28], Italian Brown [n=26], Alpine Grey [n=18], Rendena [n=24], Cabannina [n=21]) and 1 dual-purpose breed (Italian Red Pied [n=25]).

Genotyping, carried out using a competitive allele specific PCR system (KASPar) by an out-sourcing service (Kbiosciences, UK), confirmed the 3 SNPs being polymorphic in all breeds analysed. In particular, allele frequencies of the non-synonymous SNP T/C at position 10329 of the genomic sequence (GenBank accession no. AY241932), range from 0.34 in Italian Red Pied to 0.89 in Grey Alpine, showing a high variability of this polymorphism across Italian cattle. It is worth mentioning that the C allelic variant of this SNP has been associated to higher SCD activity and MUFA concentration in milk in Italian Holstein, and to higher level of MUFA percentage and lower melting point in intra-muscular fat in the Japanese Black meat breed. In the 12 breeds analysed 5 haplotypes has been reconstructed. The most frequent, ATC and GCT, are present in all the breeds studied. Interestingly, the GTC haplotype is present only in the Italian beef breed Chianina, Marchigiana, Romagnola, Podolica e Piedmontese, the ACT haplotype only in two dairy breeds Rendena and Italian Brown, and the ACC haplotype only in the Podolica breed with a low frequency. The correspondence analysis based on the genotypes at the 3 SNPs shows a clear separation between Italian beef cattle breeds and the other breeds considered. This may reflect a differential selective pressure on SCD polymorphisms or a different evolutionary history of this group of breeds.