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## Genetic Variants of Candidate Genes Influencing Milk Yield, Composition and Somatic Cell Score in German Holstein Cows

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### Abstract

The aims of this study were to estimate the genotype and allele frequencies and genotype effects located in the Acyl-CoA: diacylglycerol acyltransferase 1 (DGAT1), Leptin (Lep/ob), Growth hormone receptor (GHR), Prolactin receptor (PRLR), and Kappa casein (CSN3) genes on milk yield, composition and somatic cell score (SCS) in German Holstein cows. The association analyses were based on data from 1380 German Holstein cows. The allele frequencies of the DGAT1 K232A were 44.2 % and 55.8 % for the Lysine and Alanine variant, respectively. The allele substitution effect for the Lysine variant was significantly increased the fat (0.30 %,  $p < 0.0001$ ), protein (0.08 %,  $p < 0.0001$ ) and casein contents (0.06 %,  $p < 0.0001$ ) and fat yield (9.13 kg,  $p < 0.0001$ ). In contrast, the effect was negative on milk yield (-372.77 kg,  $p < 0.0001$ ), protein yield (-6.32 kg,  $p < 0.0001$ ), and lactose yield (-0.05 kg,  $p < 0.0001$ ). With respect to the Mbo1-RFLP in the Lep gene, the allele A was the major allele with a frequency of 90.3 %. The substitution effect of the minor allele B had a significant influence on fat yield (6.3 kg,  $p < 0.05$ ). The frequency of the Phenylalanine allele of the GHR F279Y polymorphism was 83 %. The allele substitution effect of the minor Tyrosine variant was 320 kg ( $p < 0.0001$ ), 0.02 kg ( $p < 0.05$ ), 0.07 kg ( $p < 0.0001$ ), and 0.03 % ( $p < 0.05$ ) for milk, casein, and lactose yields, and lactose content, respectively. Negative effects were evident for fat (-0.12 %,  $p < 0.0001$ ), protein (-0.09 %,  $p < 0.0001$ ) and casein (-0.07 %,  $p < 0.0001$ ) contents. The Tyrosine variant of GHR F279Y was associated with lower SCS ( $p < 0.05$ ). For the PRLR S18N polymorphism, Serine was the major allele (76.7 %). The Asparagine variant had a significant ( $p < 0.05$ ) effect on the casein content (0.02 %). For the CSN3 gene locus, the allele encoding the protein variant A was higher frequent (85.1 %) and the minor Allele B was associated with protein (0.03 %,  $p < 0.05$ ) and casein contents (0.03 %,  $p < 0.05$ ). This study demonstrated that power of candidate gene analyses. The gene effects are considered in genome wide genomic selection programs.

**Keywords:** Candidate genes, dairy cow, milk composition, milk yield, somatic cell score