

## Three novel SNPs of the bovine *Tf* gene in Chinese native cattle and their associations with milk production traits

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**ABSTRACT.** Transferrin (Tf) is a  $\beta$ -globulin protein that transports iron ions in mammalian cells. It contributes to innate immunity to microbial pathogens, primarily by limiting microbial access to iron. Thus, polymorphisms present in bovine Tf could potentially underlie inherited differences in mastitis resistance and milk production traits. We detected three novel single-nucleotide polymorphisms of the *Tf* gene in Chinese native cattle by screening for genetic variation of *Tf* in 751 individuals of three Chinese cattle breeds, namely China Holstein, Luxi Yellow and Bohai Black, using PCR-RFLP and DNA sequencing techniques. The three new SNPs, g.-1748G>A ss250608649, g.13942T>C ss250608650, and g.14037A>G ss250608651, had allele frequencies of 85.9, 86.3 and 92.5%, 64.5, 73.3 and 65.0%, and 67.6, 73.7 and 60.0%, respectively. SNP g.-1748G>A was located in the 5' flanking region of *Tf*. SNP g.14037A>G was located in intron 8 of *Tf*. SNP g.13942T>C, located in exon 8 of *Tf*, was a synonymous mutation (TTA > CTA), encoding a leucine (326 aa) in the Tf protein. Associations of the *Tf* SNPs with milk traits were also analyzed. Significant ( $P < 0.05$ ) relationships among the *Tf* polymorphisms, somatic cell scores (SCS), and milk productive traits were observed. Cows with genotypes *TT* (g.13942T>C),

*GG* (g.-1748G>A) and *AG* (g.14037A>G) had a lower SCS and higher protein levels and 305-day milk yield. Nineteen combinations of different haplotypes from the three SNPs were identified in Chinese Holstein cattle. The haplotype combination ATA/GCA, GCA/GCA and GCG/GTA was dominant in cows with a lower SCS, a higher protein level and a higher 305-day milk yield, respectively. Moreover, the gene expression level of Tf was higher in mastitis-affected mammary tissues than in normal mammary tissues. These results suggest that the *Tf* gene affects milk production, as well as mastitis-resistance traits, in Chinese Holsteins.

**Key words:** Chinese native cattle; Transferrin; SNPs; Milk production traits; Somatic cell score