

Fine mapping of quantitative trait loci for meat color on Sus scrofa chromosome 6: Analysis of the swine NUDT7 gene

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Abstract :

In the livestock industry, meat color has become important because consumer acceptance is subject to the appearance of the product in the marketplace. Our previous analyses of a whole genome QTL scan for various meat qualities using 2 F2 families from Japanese wild boar (known as a red meat) x Large White and from Duroc x Chinese Jinhua suggested that a meat color (heme content) QTL is located on SSC6. The objective of this study was to fine-map this SSC6 meat color QTL and subsequently investigate positional candidate genes for polymorphisms that may cause changes in meat color. Therefore, we conducted interval mapping on SSC6 using an additional 9 gene markers through combined analyses of the 2 F2 families of Japanese wild boar x Large White (353 progeny) and Duroc x Chinese Jinhua (204 progeny). Comparative analysis with humans, mice, and cattle suggested that there were 10 functional genes in the region. Among these genes, we suggested that a novel pig gene encoding a nudix (nucleoside diphosphate linked moiety X)-type motif 7 (NUDT7, a member of the nudix hydrolases) is a strong candidate for the QTL because the mouse Nudt7 is reported to hydrolyze succinyl-CoA, a substrate of the reaction limiting the rate of heme biosynthesis. We therefore determined the pig NUDT7 gene sequence including the 5' promoter region and explored genetic polymorphisms between Japanese wild boar and Large White. We identified 116 polymorphisms within the NUDT7 CDS or in the 5' region. None of the AA substitutions were associated with the meat color QTL; however, 3 polymorphisms were found in putative transcription factor recognition sites. We then investigated the differential expression of NUDT7 in Japanese wild boar and Large White by allele-specific quantitative real-time PCR. The expression level of the Large White type allele was greater than that of the Japanese wild-boar-type allele. Consequently, we speculated that the difference in meat color between Japanese wild boar and Large White is caused partly by differential expression of this candidate gene. Upregulation of NUDT7 expression in muscle may reduce succinyl-CoA content and thus reduce the level of heme biosynthesis.

Key Word :

gene expression, meat color, meat quality, quantitative trait loci, swine

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