



Adaptive evolution of the mitochondrial *ND6* gene in the domestic horse

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ABSTRACT. Mitochondria play a crucial role in energy metabolism through oxidative phosphorylation. Organisms living at high altitudes are potentially influenced by oxygen deficits and cold temperatures. The severe environmental conditions can impact on metabolism and direct selection of mitochondrial DNA. As a wide-ranging animal, the domestic horse (*Equus caballus*) has developed various morphological and physiological characteristics for adapting to different altitudes. Thus, this is a good species for studying adaption to high altitudes at a molecular level. We sequenced the complete NADH dehydrogenase 6 gene (*ND6*) of 509 horses from 24 sampling locations. By comparative analysis of three horse populations living at different altitudes (>2200 m, 1200-1700 m, and <900 m), we found that the high-altitude population had the lowest genetic diversity and significant negative Tajima's *D*; both values declined with increasing elevation. Moreover, non-directional selection was identified for the *ND6* gene by a tree-based relative ratio test ($P = 0.007$); the highest proportion of high-altitude horses was found distributed on the selected branches. We conclude that the high-altitude environment has directed adaptive evolution of the mitochondrial *ND6* gene in the plateau horse.

Key words: Domestic horse; *ND6*; Adaptive evolution