

# Adaptive functional evolution of leptin in cold-adaptive pika family

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Researchers at the Northwest Institute of Plateau Biology, Chinese Academy of Sciences have put forward the viewpoint for the first time that adaptive functional evolution may occur in the leptin protein of the pika (*Ochotona*) family, a typical cold-adaptive mammal. They speculated that the cold, rather than hypoxia, may be the primary environmental factor that drives the adaptive evolution of pika leptin. This study is published in the January 23 issue of PLoS ONE.

Pikas are small non-hibernating lagomorphs living only in cold regions at either high altitudes or high latitudes and have a maximum distribution of species diversification confined to the Qinghai-Tibet Plateau (average altitude >3000 m), which is called the “roof of the world” and “third polar of the world”.

The low temperature and hypoxia are the two most remarkable climatic characteristics of the Plateau. During evolution, pikas have become highly hypoxic- and low temperature-tolerant mammals with markedly high resting metabolic rates, non-shivering thermogenesis, and a high ratio of oxygen utilization to cope with the cold and hypoxic plateau environment.

Compared to other lineages of representative mammals, pika leptin shows unique sequence characteristics: positive selection (PS) acts on pika leptin, and there are 20 sites under positive selection, while nine PS sites located within the functionally significant segment 85-119 of leptin and one unique motif appeared only in pika lineages, the ATP synthase  $\alpha$

and a subunit signature site. These data indicate the functional variation of pika leptin.

“Due to their similar cold survival environment and their common Asiatic origin, this adaptive evolution of leptin may be a common characteristic of the entire pika family throughout the world,” said Dr Zhao.

“Because of the key role of leptin in the energy metabolism, thermogenesis, glucose and lipid metabolism, our current study not only explains the important ecology issues: the adaptive mechanism of small mammals to extremely stressful environment and the significance of adaptively functional evolution of pika leptin on the pikas’ acclimation to the harsh plateau environment,” said Dr Zhao. “But the study of adaptively functional evolution of pika leptin from a typical cold-adaptive species may enlighten us to understand and to identify it as one of potential new candidate of therapeutic strategies for human’s diseases associated with metabolic disorders, such as obesity, diabetes, osteoporosis, etc”.

“Now our research team is carrying out the functional experiments of pika leptin to further confirm this viewpoint,” said Dr Zhao.

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