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A Mountain or a Plateau? Hematological Traits Vary Nonlinearly with Altitude in a Highland Lizard

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Abstract

High-altitude organisms exhibit hematological adaptations to augment blood transport of oxygen. One common mechanism is through increased values of blood traits such as erythrocyte count, hematocrit, and hemoglobin concentration. However, a positive relationship between altitude and blood traits is not observed in all high-altitude systems. To understand how organisms adapt to high altitudes, it is important to document physiological patterns related to hypoxia gradients from a greater variety of species. Here, we present an extensive hematological description for three



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populations of *Sceloporus grammicus* living at 2,500, 3,400, and 4,300 m. We did not find a linear increase with altitude for any of the blood traits we measured. Instead, we found nonlinear relationships between altitude and the blood traits erythrocyte number, erythrocyte size, hematocrit, and hemoglobin concentration. Erythrocyte number and hematocrit leveled off as altitude increased, whereas hemoglobin concentration and erythrocyte size were highest at intermediate altitude. Additionally, lizards from our three study populations are similar in blood pH, serum electrolytes, glucose, and lactate. Given that the highest-altitude population did not show the highest levels of the variables we measured, we suggest these lizards may be using different adaptations to cope with hypoxia than lizards at low or intermediate altitudes. We discuss future directions that research could take to investigate such potential adaptations.

Keywords: high altitude, hypoxia, hematology, lizard, physiological constraints.

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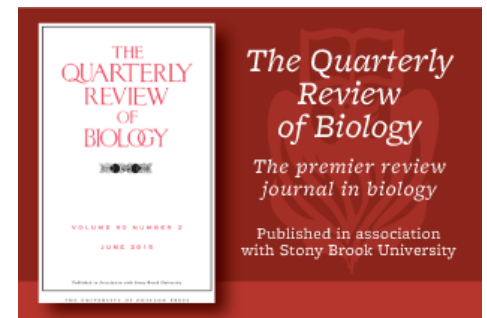
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