Increased Oxidative Stress at Altitude

To the Editor:

We read with interest the study in CHEST (February 2013) by Bailey et al1 in which they describe increased oxidative-nitrosative stress in people who live in a high altitude. In their article, they stated that “there are no studies, to our knowledge, that have examined this response during lifelong exposure to high altitude in healthy, well-adapted and maladapted highlanders.”2 Hypoxia has been associated with oxidative stress in in vitro experiments,2 in animal models exposed to hypobaric hypoxia,3 in humans acutely exposed to high altitude,4 and in simulated altitude.5

We would like to highlight our prior study. We investigated oxidative stress in both acute exposure to high altitude (48 h in volunteers at sea level; n = 28) and chronic exposure to high altitude in the Andes (healthy residents at high altitude [n = 25] and residents at high altitude [n = 27] with abnormal adaptation to high-altitude living, a condition known as chronic mountain sickness).6 Assessment of oxidative stress was performed by measuring oxidation products in plasma (thiobarbituric acid reactive substances) and urine (F2-isoprostanes [8-isoprostaglandin F2α]). As an assessment of antioxidant status, we measured total plasma glutathione.

Our study confirmed that both acute (48 h) and chronic exposure to high altitude are associated with increased levels of lipid peroxidation, and these levels correlate with increased plasma levels of total glutathione. Patients chronically living at high altitude have elevated levels of plasma total glutathione and lipid peroxidation products, and the subgroup with chronic mountain sickness, or Monge disease, has significantly greater levels of lipid peroxidation compared to control subjects at sea level and control subjects at high altitude. Indeed, in our study, the subjects with the highest degree of oxidative stress also had elevated blood cobalt levels, likely related to contamination from the local mines.7 Currently, we are conducting a clinical trial to see if we can both chelate the cobalt and reduce the oxidative stress with N-acetylcysteine.

REFERENCES

Response

To the Editor:

We thank Dr Jefferson and colleagues for their interest in our publication in CHEST® describing the vascular implications of altered free radical metabolism during the course of human acclimatization to terrestrial high altitude. Our study revealed that, compared with lowlander control subjects, systemic free radical formation was moderately elevated in healthy well-adapted Andean highlanders, with more exaggerated increases observed in those...