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[Am J Clin Nutr. 1986 Aug;44\(2\):181-7.](#)

### Functional anemia of complicated protein-energy malnutrition at high altitude.

Beard JL, Gomez LH, Haas JD.

#### Abstract

The effect of severe protein-energy malnutrition (PEM) on erythropoiesis in children living in the highlands of Bolivia, altitude 3700 m, was studied. Forty percent reduced hemoglobin concentrations, significantly lower arterial oxygen tensions, and a right-shifted, oxygen-dissociation curve were observed compared to high-altitude controls. Serum and erythrocyte folate concentrations were 44% and 82%, respectively, of control values. Low initial transferrin saturation decreased significantly during the 10-wk refeeding period. Thus, iron and folate deficiency contributed significantly to the poor red cell response. Results suggest that the anemia associated with severe PEM has a more significant impact on oxygen transport at high altitude than at sea level and requires an adaptive response in the oxygen-dissociation curve to satisfy tissue-oxygen demands. Furthermore, marginal iron and folate status and an inflammatory block of iron supply may limit the reestablishment of a normal tissue mass during refeeding.

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