Comparative responses of arterial oxygen saturation and heart rate during postnatal development in rats living at high and low altitude.

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We used pulse oximetry to measure arterial oxygen saturation (SpO2) and heart rate (HR) in 4 and 14 day-old rats raised at HA (La Paz, Bolivia, 3,600 m / 12,000ft) or at sea level (SL, Québec, Canada). SpO2 and HR were measured at 5 different levels of inspired PO2 (PiO2: 160 - 60 mmHg – 10 min each), in awake rats maintained in a chamber flushed with room air or the desired gas mixtures. When exposed to a PiO2 of 160 mmHg, P4 HA rats had a similar SpO2 than P4 SL, but a lower HR. At lower PiO2, HA rats maintained a much higher SpO2 than SL rats. HR increased in HA rats (but not in SL rats) at low PiO2. Contrastingly, P14 HA rats exposed to a PiO2 of 160 mmHg had a lower SpO2 than SL (93.7±1.1% vs. 98.8±0.1%, $p<0.0001$), and similar SpO2 at lower PiO2. HR was higher in P14 HA rats vs. SL rats at all PiO2 levels. A group of SL rats was raised in hypoxia (13.5% O2 – similar to HA PiO2) between P4 and P14. This reduces SpO2 values measured at PiO2 below 160 mmHg, and enhances HR. Male and female rats had similar responses. We conclude that: a) 4-day old rats raised at HA had efficient responses that help maintaining a high SpO2 under a wide range of PiO2 - b) these responses are no longer apparent in P14. Since rats are not found under natural conditions at HA, success to develop adequate responses to hypoxia during early postnatal development might be critical for genetic adaptation to altitude.

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