

## Effects of High Altitude Exposure on Pulmonary Function in College Students

Phillip Phan, Victoria Zatorski, Devon A. Dobrosielski.

Towson University, Towson, MD

Ascent to higher altitude may alter lung function, which can negatively impact exercise capacity and predispose lowland natives to altitude illness. In contrast, individuals born and raised at high altitudes often exhibit large lung volumes, increased exercise capacity and resistance to altitude illness.

**PURPOSE:** To (1) examine the change in lung function of lowland natives sojourning to high altitude, and (2) compare lung function of these individuals to native highlanders. **METHODS:** Undergraduate students traveled to Peru as part of a study abroad program. Prior to traveling, all students completed a symptom-limited graded exercise test on a treadmill with breath-by-breath analysis to determine aerobic capacity ( $VO_{2max}$ ). Upon arriving in Peru, lung function was assessed at sea level (Lima) using a hand-held spirometer. Spirometry was repeated at 3550 meters following a 1-day hike on the Inca trail. The students were accompanied by high altitude natives who also underwent spirometry assessment at 3550 meters. **RESULTS:** Thirteen students ( $20.8 \pm 1.9$  years; W:10, M:3) and six male high altitude natives ( $20 \pm 1.5$  years) completed the protocol. Among the college students, higher  $VO_{2max}$  was associated with greater lung capacity (FVC) ( $r=0.61$ ,  $P=0.03$ ). At sea level the FVC and FEV1 of the college men was  $4.82 \pm 0.92$  liters and  $4.22 \pm 0.66$  liters, respectively, compared to  $3.70 \pm 0.60$  liters and  $3.19 \pm 0.42$  liters among the women (both  $p$ 's  $<0.05$ ). Upon ascent to 3550 m, the FEV1/FVC of the group increased at altitude from  $0.87 \pm 0.06$  to  $0.90 \pm 0.06$  ( $P<0.01$ ). The FVC and FEV1 among the native highlanders was  $5.04 \pm 0.42$  liters and  $4.27 \pm 0.31$  liters, respectively, but no difference was observed compared to college men. The FEV1/FVC of the college men at altitude was  $0.93 \pm 0.03$  compared to  $0.85 \pm 0.06$  for the native highlanders ( $P=0.03$ ). **CONCLUSION:** We found a strong association between  $VO_{2max}$  and FVC in college students, indicating that pulmonary function influences aerobic capacity. The FEV1/FVC of the college students increased upon ascent to 3550 meters, suggesting that altitude induces a restrictive ventilatory process. Compared to the students, the FEV1/FVC in native highlanders was lower, implying that no such restrictive process occurs in those who have adapted to altitude.