POSSIBLE RISKS OF HIGH ALTITUDE EXPOSURE ON PROSTATE DISEASES

Diana E. Alcantara-Zapata[1], Gustavo F. Gonzales[2]

[1] School of Public Health. Faculty of Medicine. University of Chile. diana.alcantara@ug.uchile.cl
[2] Laboratory of Endocrinology and Reproduction. Universidad Peruana Cayetano Heredia. gustavo.gonzales@upch.pe

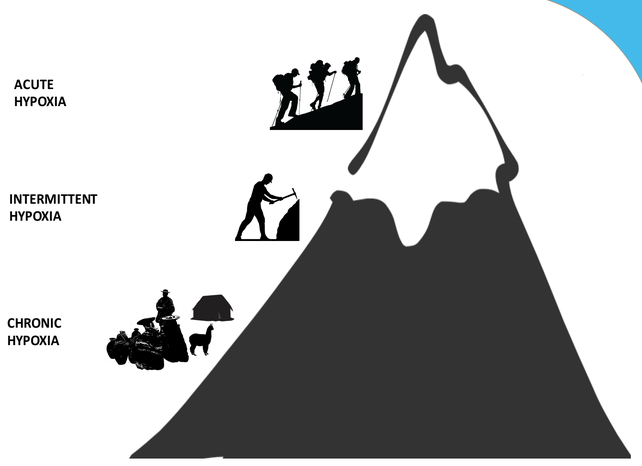
ID: 2997102

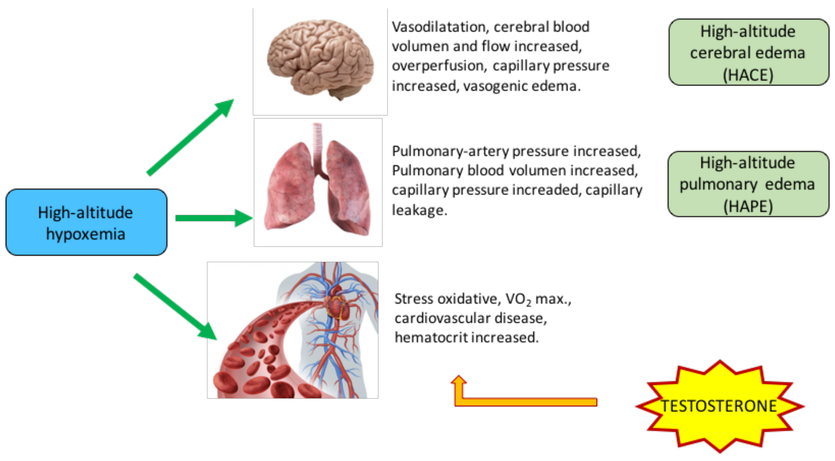
BACKGROUND

More of 200 million people worldwide live permanently over 2000 meter above sea level.

This population is exposed to **acute, intermittent, or chronic hypoxia** due to residence, work, sports and tourism (1).

Hypoxia is produced by the scarcity of oxygen in tissue or cells and this process activates several adapting mechanisms to high altitude exposure to compensate this effect (2,3).

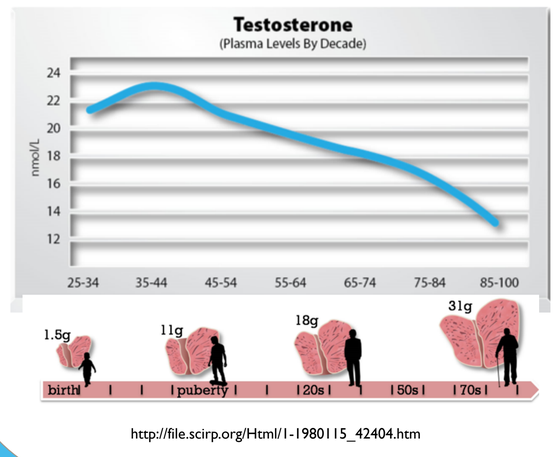




One mechanism in high altitude exposure is the increment of hemoglobin. This process is regulated by the main androgen: testosterone, which is involved in the erythropoyesis mechanism. The lack of adaptation to this geographical condition for long period of time causes excessive erythrocytosis (EE) and chronic mountain sickness (CMS) (4).

From 5-20% of the population living at high altitude is diagnosed of EE (Hb>21 g/dl in men) and CMS, an d this event is associated to elevated serum testosterone levels.

In Andean populations, this high production of erythrocytes has been associated with activation of gene SENP1, which in time is related to increased androgenic activity (5).



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Testosterone declines meanwhile the 5 alfa-reductase enzyme in prostate, increases with age or disease. Interestingly, prostate disease at sea level and EE at High Altitude share similar molecular and physiological mechanisms such increase of hypoxic induced factor (HIF), activation SENP1, IL-6, among others (6).

AIM

This study aimed to identify the possible risk factors related to high altitude illness and prostate diseases based on literature.

FINDINGS

Table 1: Hypoxia effects on male reproductive parameters.

HIGH ALTITUDE EFFECTS ON MALE REPRODUCTIVE PARAMETERS
• Testicle & seminiferous tubules.
• Spermatogenesis, sperm count & semen quality.
• Erectile dysfunction.
• Sexual hormone: testosterone.
• Lower urinary tract symptoms (LUTS).
• Varicocele.
• Prostatitis ?, benign prostatic hyperplasia ? and prostate cancer.
• Prostate-specific antigen (PSA) ?

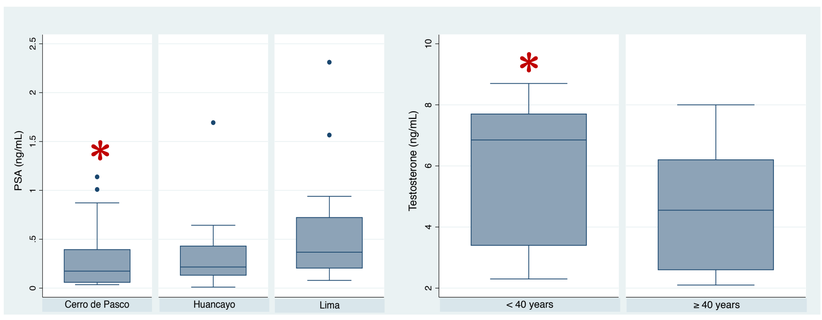
Common mechanisms are involved in prostate diseases and Mountain Sickness. Reduction of diameter of seminiferous tubules and sperm count. However, there are lack of information about benign prostate illness such prostatitis and benign prostatic hyperplasia. Besides, information about prostatic biomarkers levels at high altitude, such PSA, are poor (7).

Table 2: Common factors of high altitude and prostatic diseases.

BIOMARKERS	HIGH ALTITUDE DISEASES	PROSTATiC DISEASES
HIF-1	✓	✓
SENP1	✓	✓
IL-6	✓	✓
CRP	✓	✓
T	✓	✓
PSA	✓	✓

HIF-1: Hipoxia inducible factor1, SENP1: SUMO Sentrin-specific protease 1, Hct: Hematocrit, IL-6: Interleukine-6, CRP: C-reactive protein, T: testosterone, PSA: prostate-specific antigen.

Higher expression of SENP1 is associated with higher androgen activity in Andean highlanders with excessive erythrocytosis (EE) and this expression promotes the development or progression of prostate cancer (5).



Levels of Prostatic Specific Antigen (PSA) in two high altitude cities compared to sea level (Lima= 150 m): Cerro de Pasco (4340 m) and Huancayo (3200 m). Levels of Testosterone (T) in two groups of age in three cities of Peru. * statistical significance ($p<0.05$).

A recent work from our laboratory showed that PSA levels were lower in high altitude (HA) compared with sea level ($p<0.05$), and testosterone decrease in men over 40 years living at HA. According to these data is suggested that prostate cancer could be a risk for population with EE sharing elevated testosterone levels at HA. There is no evidence about the effect of EE of high altitude in Prostatic specific antigen levels. Therefore, is important to perform a research to identify the existence of these factors in males with EE living at HA with the purpose of prevent and treat opportunely prostate diseases (8).

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FUTURE DIRECTIONS

Occupational exposure to high altitude has been little studied. Some male workers, speciality miners (aged 18-65 years old), are exposed to high altitude inttermitently and the effects of this condition in prostate illness are unknown. We are going to evaluate the intermittent exposure to HA in PSA levels in miners.

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