Responses of Appetite and Appetite Regulating Hormones to Acute Altitude Exposure

Morgan Busboom, Robert Shute, Rebecca Cuthbert, Christina Angeli, Brooks Coleman, Caleb Ross, Roksana Zak, and Dustin Slivka

University of Nebraska at Omaha, School of Health, Physical Education, and Recreation, Omaha, NE

Exercise Physiology Lab

ABSTRACT

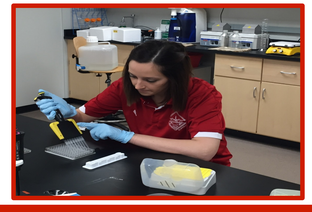
PURPOSE: To determine the acute response of appetite and appetite regulating hormones after exposure to simulated altitude in resting conditions. **METHODS**: Seven male and six female recreationally active subjects (height 178 ± 8.1cm, weight: 77.3 ± 24.8kg, body fat: 18.4 ± 5.7%) participated in two, three-hour trials in an environmental chamber with one trial simulating 5000 m altitude (hypoxic) and the other simulating 350 m altitude (control). Blood samples from the antecubital vein were collected prior to entering the environmental chamber and immediately following the three hours of seated rest. Blood samples were analyzed for serum leptin, adiponectin, and ghrelin concentrations via enzyme-linked immunosorbent assay kits. Subjective feelings of acute mountain sickness and perceived appetite were also assessed. Heart rate, blood oxygenation, tissue oxygenation, respiration rate, and whole body gases were also analyzed throughout the trials. **RESULTS:** Satiety decreased over time in both trials ($p < 0.001$) but was not different between trials ($p = 0.347$). Symptoms of acute mountain sickness were higher in hypoxia compared to control ($p = 0.023$) but did not reach clinical levels. Blood and tissue oxygenation was higher in control compared to hypoxia ($p < 0.05$). HR was higher in hypoxia compared to control ($p = 0.01$). Hypoxia did not effect oxygen utilization ($p = 0.494$). Analysis of appetite related hormones is currently being conducted but not yet complete. **CONCLUSION:** Subjective appetite does not appear to be affected with acute hypoxic exposure despite alterations in oxygen transport. However, acute hormonal response may not be immediately apparent from subjective measures of appetite, and thus analysis of these hormones remains paramount to this project.

INTRODUCTION

- Weight loss is observed in hypoxic environments and may be related to loss of appetite.
- However, it is unknown whether the loss of appetite occurs with hypoxia alone or if other conditions (exercise, temperature, food availability, etc.) inherent to field environments are the major factors.
- Leptin, adiponectin, and ghrelin work to regulate appetite and maintain energy homeostasis through receptors in the hypothalamus and pituitary gland.
- Conflicting research currently exists on the effects altitude has on leptin, adiponectin, and ghrelin.
- The purpose of this study is to determine the acute response of appetite and appetite regulating hormones after exposure to simulated altitude in well controlled resting conditions.

METHODS

- Seven male and six female recreationally active subjects completed an initial visit and two experimental trials.
- Subjects rested in a seated position for 3 h during two experimental trials, one in a hypoxic condition (5,000 m) and the other in an ambient control condition (350 m).
- The trials were conducted in an environmental chamber (Darwin, St. Louis, MO) that controlled for environmental oxygen concentration simulating altitude, temperature (22 °C) and humidity (40%).
- Experimental trials were conducted in a randomized and counter-balanced order separated by no more than 5 days.
- Subjects arrived having fasted for 12 h and were provided with a small standardized breakfast before the experimental trials.
- Blood samples (4 mL from the antecubital vein) were collected prior to entering the chamber and immediately following the 3 h experimental condition.
- Plasma concentrations of leptin, adiponectin, and ghrelin will be determined in triplicate using enzyme-linked immunosorbent assay (ELISA) kits.
- Perceived appetite and Acute Mountain Sickness were assessed via subjective questionnaires.
- Heart rate, blood oxygenation, tissue oxygenation, respiration rate, and whole body gas exchange were analyzed throughout the trials.
- A repeated measures 2 x 2 (time x trial) ANOVA was used to determine statistical significance.
- Additionally, the relationship between questionnaire and blood data will be analyzed using multiple regression.



RESULTS

Table 1. Participant descriptive data

Age (y)	Height (cm)	Weight (kg)	Body Fat (%)	BMI (kg/m^2)
24.6 ± 2.3	178.9 ± 8.1	77.3 ± 24.8	18.4 ± 5.7	24.8 ± 2.3

Data are mean ± SD

RESULTS

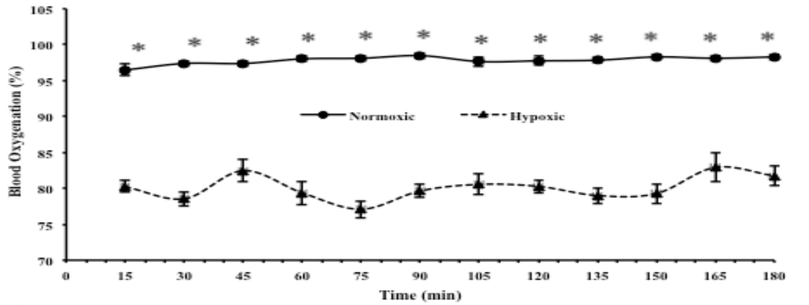


Figure 1. Blood oxygenation during 3 hour experimental trials. *p < 0.05 from hypoxic.

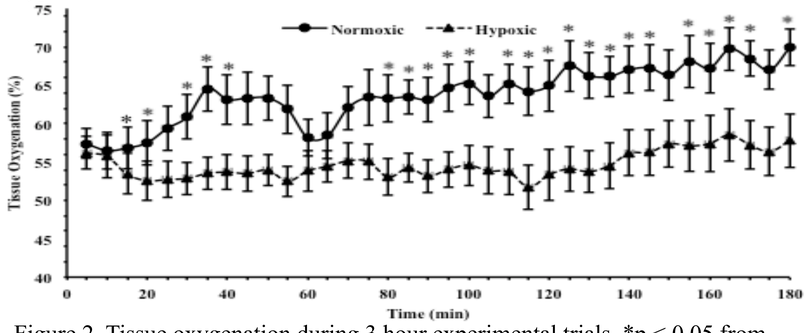
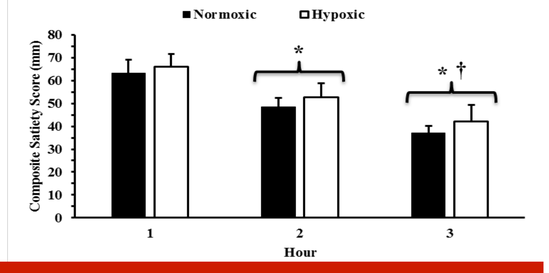


Figure 2. Tissue oxygenation during 3 hour experimental trials. *p < 0.05 from hypoxic.

Figure 3. Composite Satiety Score for hypoxia and normoxia during 3 hour experimental trials. *p < 0.05 from hour 1. †p < 0.05 from hour 2.



CONCLUSION

- Subjective appetite does not appear to be affected with acute exposure despite alterations in oxygen transport.
- However, acute hormonal response may not be immediately apparent from subjective measures of appetite.
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