Collection, analysis and presentation of real-life physiological data for use in teaching and engagement activities

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Acknowledgements: Dr Michele Sweeney, Dr Beth Lawry, Dr Alison Howard, Dr Dean Allerton, Sarah Stanfield, Dr Owen Jeffries, and all of the volunteers.

Introduction

Recent student attendance and engagement with seminars in stage 1 Biomedical Sciences modules was low. It was decided that using more experimental data could better engage the students. The project choice came through a moment of serendipity as one of the associated academics Dr Lawry was going on a trek to Everest Base camp. This sparked the idea to collect physiological data to assess the affect of hypoxia (low oxygen in the air), from her and her friends that could then be incorporated into teaching, engagement and outreach material.

The aims of my project were to analyse and interpret the data collected and present this data in an appropriate manner, suitable for inclusion in teaching materials.

Methods

Data was collected daily from up to n=14 trekkers and n=4 Sherpas. Heart rate data was measured using a portable ECG (electrocardiogram—shows heart rhythm) device (figure 1). O_2 saturation (how much oxygen there is in your blood) was measured using a finger pulse oximeter (figure 2).

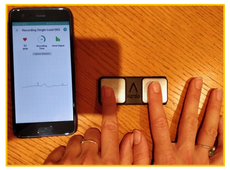

Figure 1— *portable ECG device (Kardia) with mobile app for measuring heart rate.*

Figure 2—*Finger pulse oximeter*

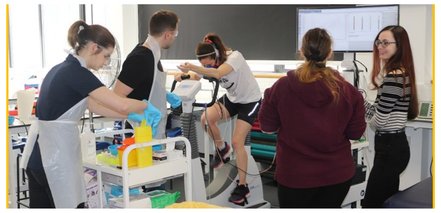

Figure 3— *Volunteer performing VO_2 max testing.*

To determine if the trekkers gained cardiovascular fitness over the course of their preparatory training and after the trek to Everest Base camp VO_2 max testing (the body's ability to consume O_2 during maximal exercise) was carried out on 2 volunteer trekkers.

VO_2 max = maximum millilitres of oxygen consumed in 1 minute / body weight in kilos.

This test involved the volunteers exercising on a stationary bike, cycling at a consistent speed while the resistance on the front wheel (power) was increased incrementally, continuing until exhaustion (figure 3). During the test VO_2 was measured in 15 second increments.

Data was analysed using GraphPad Prism comparisons of heart rate and O_2 saturation were made between trekkers and Sherpas. VO_2 max was compared between pre training, post training, 1 month post trek and 4 months post trek.

Results and Discussion

Figure 4 shows the change in O_2 saturation along with altitude over the course of the trip in trekkers and Sherpas.

As altitude increased up to day 8, O_2 saturation dropped. This drop was more severe in trekkers (red) than Sherpas (blue), suggesting that the Sherpas were more able to withstand the physiological effects of hypoxia.

In UK hospitals if O_2 saturation drops below 89% (shown by green dotted line) the patient would be given supplemental oxygen.

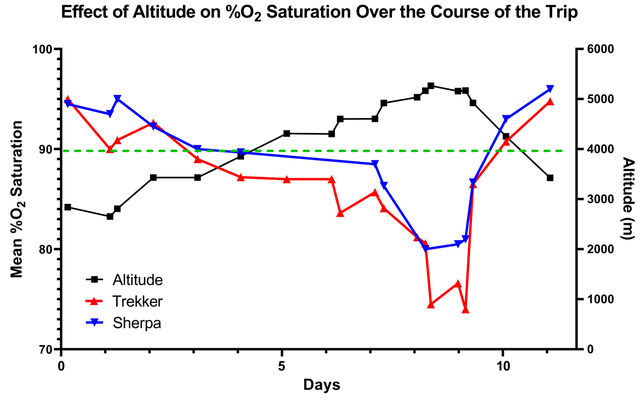

Figure 4—*The effect of altitude (black) on % O_2 saturation in both trekkers and sherpas throughout the trip*

Figure 5 shows the change in heart rate along with altitude over the course of the trip in trekkers and Sherpas.

There was an overall trend of increasing in heart rate within increasing altitude in both trekkers and Sherpas although variability is seen. This could be due to a number of factors, e.g. time measurements were taken (morning/ evening/ after exercise), variation in level of fitness.

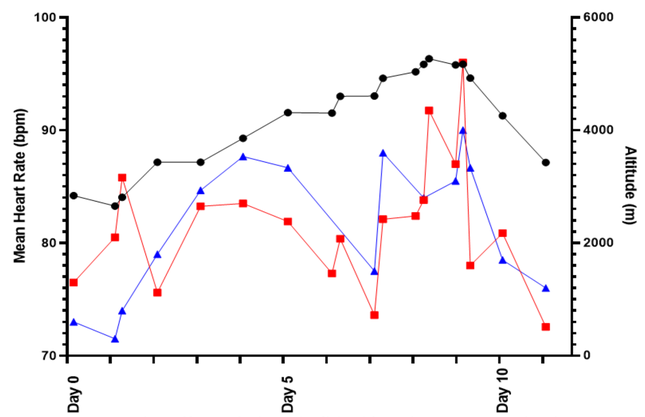

Figure 5—*The effect of altitude (black) on heart rate in both trekkers and Sherpas throughout the trip.*

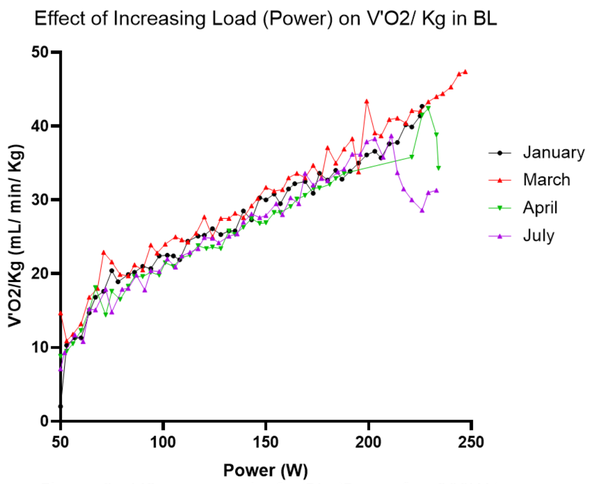

Figure 6—*VO_2 max results for BL. (Data after 200W in April and July subject unreliable due to technical difficulty.)*

Figure 6 shows VO_2 max results for 1 volunteer (BL). VO_2 max improved during the training period (January –March), but decreased post trek (April). At 4 months post trek (July) it began to recover towards training level.

Conclusion

The data collected provided results that were as expected and consistent with published literature[1]. Therefore this data will be a useful resource for physiological teaching and outreach material.

1. Lu Hui et al, 2016.