Introduction

John O'Hara (Senior Lecturer in Sport & Exercise Science and British Association of Sport and Exercise Sciences Accredited Sport Science Support Physiologist) on behalf of the Carnegie Research Institute, Leeds Metropolitan University is heading up the provision of Sport Science Support to help the British Army and Territorial Army in their preparations for their ascent of the West Ridge of Everest in 2006.

Leeds Met is putting the Everest West Ridge 2006 Main and Development Team through a series of physiological assessments. These assessments are occurring on four occasions over a 12 month period. The information collected and analysed by the Leeds Met team will enable Paul Rafferty the Physical Performance Coach with the Everest team to prescribe relevant training in preparation for the expedition. The effects of these interventions will be monitored and evaluated through the use of the follow up tests. This program of testing and prescription will ensure that all the team members are in the best physiological condition they can be prior to the expedition.

The data collected from the initial set of physiological assessments was used as baseline information and used to initiate individualised training interventions. The three follow up assessments will be used to assess the effectiveness of the interventions and to ensure that each individual is at an optimal level of fitness prior to the expedition.

Tests Performed

The physiological assessments we are utilising include:

- The assessment of Body Composition
  - Body Mass (kg), Stature (cm), Sum of 8 site skinfolds (mm), estimation of body fat percentage (%)

- The assessment of Haemoglobin ($mg.l^{-1}$) and Haematocrit (%) levels.

- The measurement of Heart Rate ($beats.min^{-1}$) and Blood Lactate ($mmol.l^{-1}$)responses to incremental exercise

- The measurement of Maximal Oxygen Uptake ($ml.kg^{-1}.min^{-1}$)

- The assessment of Lung Function

Feedback

The feedback mechanisms employed included an individual report for each team member, as well as a team report for the Expedition Leader (Dave Bunting) and the Physical Performance Coach. Feedback meetings are held with the physical performance coach after each set of tests to discuss the finer detail. Individual team members are able to call John O'Hara directly to clarify any points of information.

Recommendations
Within each report recommendations are made on where improvements are required, that are specific to each individual. This has enabled more specific training programs to be produced by the Physical Performance Coach, based on the test results. Specific examples of data interpretation and subsequent recommendations can be seen below:

Body Composition
Depending upon the sum of skinfolds and the estimated body fat percentage, recommendations were made to maintain or decrease fat mass during this period of preparation. Recommendations on target body fat percentages will vary as we move through the various phases of training for the expedition.

For those subjects who needed to decrease their fat mass it was recommend that this could be achieved through dietary and/or an increase in training intensity/volume. It was advised that any changes should be made gradually as a major energy deficit may affect their ability to train properly. This should also be supported with a long term change in eating habits so any reduction in fat mass can be maintained. Further advice and support is being provided to achieve these recommendations.

Haemoglobin and Haematocrit Levels
For those subjects with a low haemoglobin level it was recommended that they may benefit from some dietary manipulation, to try and increase haemoglobin levels. A normal range observed for females is 120 – 160 $mg.l^{-1}$ and a lower level reflects a reduced oxygen carrying capacity of the blood, which may limit endurance performance, especially at altitude. Those with low levels were also monitored over time to establish any change.

For those subjects with low haematocrit levels it was recommended that we monitor this over time to establish any change. A typical value is 45% and a low values indicates a decreased oxygen carrying capacity of the blood, which may pose a problem at altitude.

Blood Lactate & Heart Rate Response to Incremental Exercise
Once the production and appearance of lactate exceeds the maximum rate of removal from the blood the blood lactate concentration will continue to rise without an increase in exercise intensity, eventually causing fatigue. The blood lactate and heart rate responses to incremental exercise where collected and plotted on a graph (Figure 1 below). This information was used to help prescribe individualised training sessions to improve the running speed at this point. The follow up assessments were used to assess the effectiveness of the interventions, which can be identified by a shift to the right in the blood lactate curve. If an improvement is not shown, then the intervention program will be reassessed and the individual's responses monitored and evaluated through the further tests.

Maximal Oxygen Uptake

$\dot{V}O_{2max}$ is the maximum rate at which an individual can take up and utilise oxygen whilst breathing air at sea level, which is effectively a measure of cardiovascular function and a measure of performance capability. This is reduced at altitude, which means that exercise performance is severely compromised, even in well trained individuals. Therefore, if individual $\dot{V}O_{2max}$ scores were relatively low, then recommendations were made to try and increase $\dot{V}O_{2max}$ through the employment of specific training sessions.

Those individuals with a relatively high $\dot{V}O_{2max}$ were recommended to try and make further improvements, through the employment of specific training sessions as well. However, it was not deemed to be a major limiting factor in their performance.

Typical Data

Table 1 shows physiological data collected from the initial set of tests for a female member of the development team. Figure 1 shows her heart rate and blood lactate responses to incremental exercise.

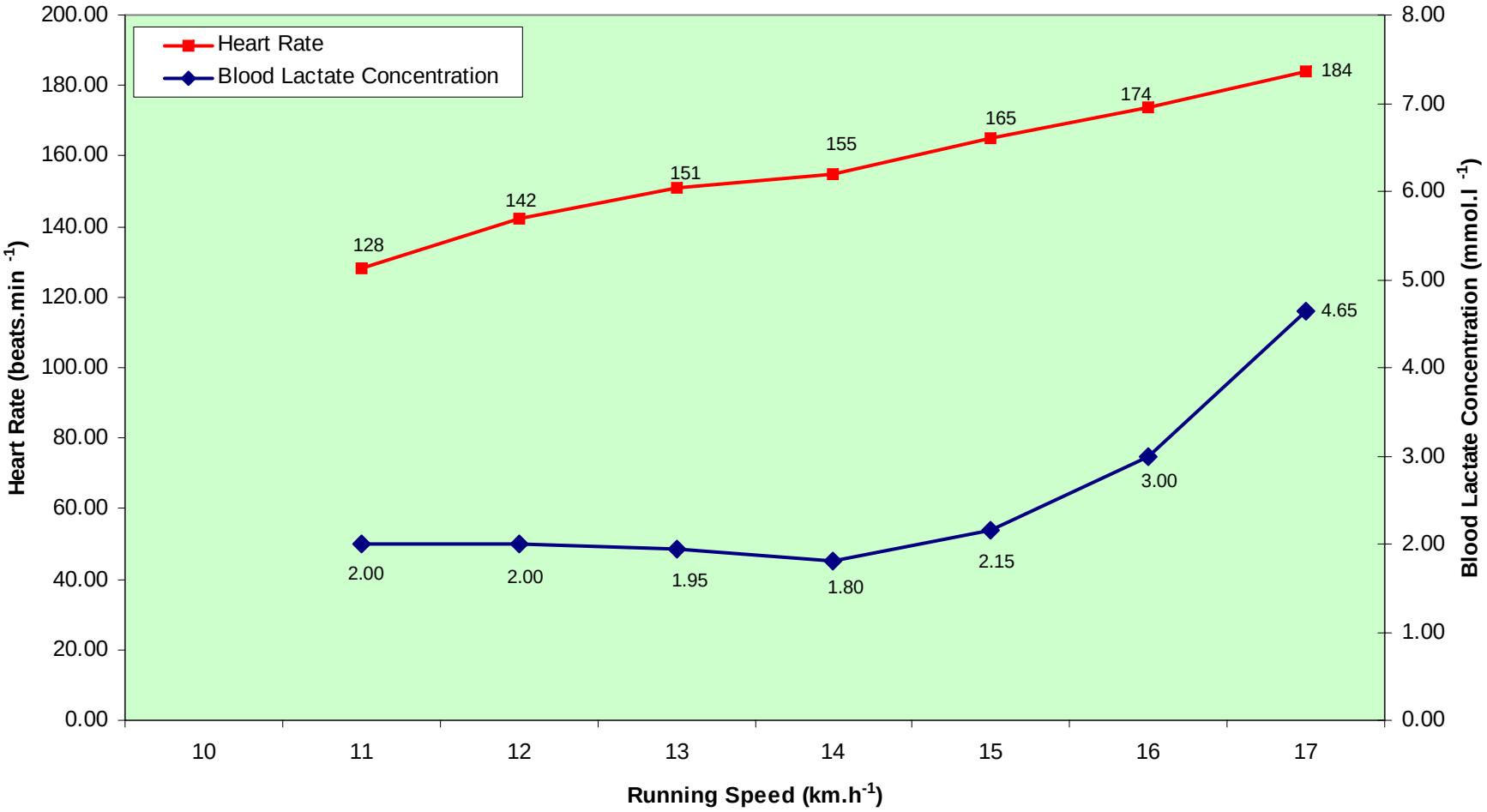
TABLE 1: Typical Physiological data.

Body Mass (kg)	Stature (cm)	Sum o f 8 Skinfolds (mm)	Body Fat (%)	Haemoglobin ($mg.l^{-1}$)	Haematocrit (%)	Maximal Oxygen Uptake ($ml.kg^{-1}.min^{-1}$)
58.15	166.5	70.4	20.80	153.0	40.0	58.64

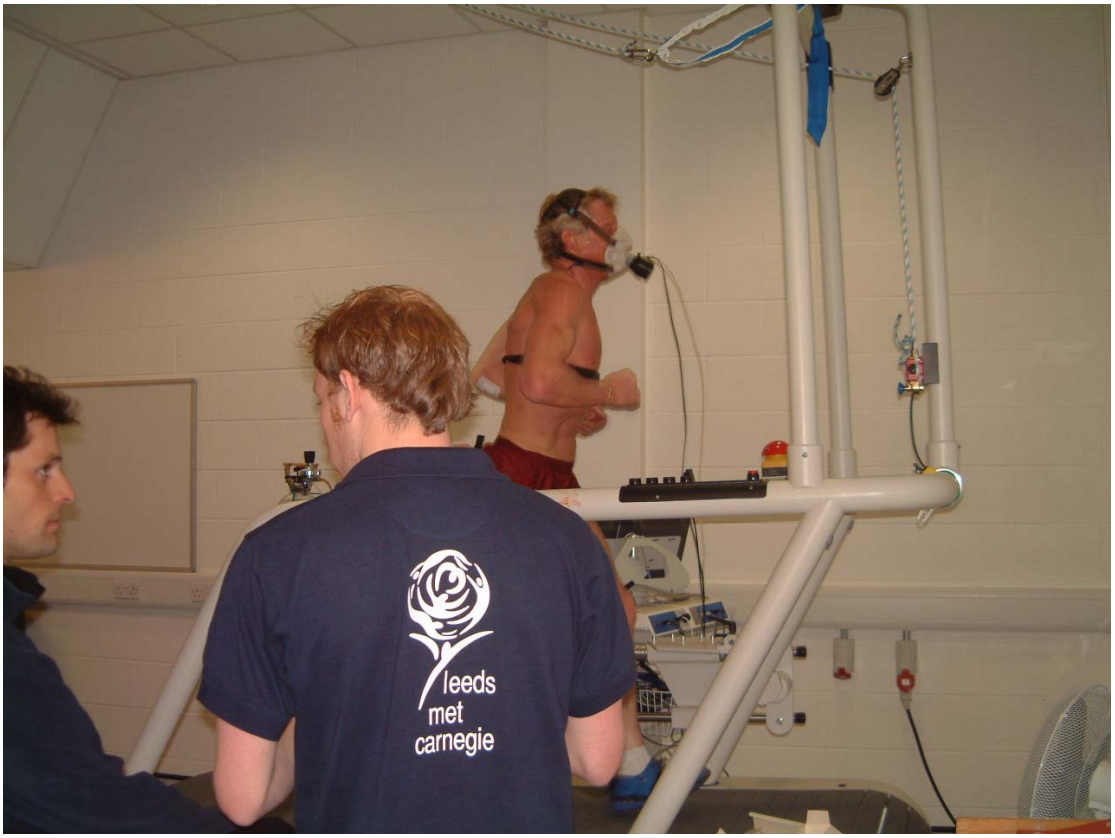
Figure 1 shows a linear increase in heart rate with increased running speed. This response is typical of the well establish relationship between heart rate and incremental exercise. The blood lactate responses demonstrate a stable baseline, showing little change at low running speeds, which is followed by an exponential rise above speeds of 14 kmh^{-1}. This is also typical of blood lactate responses to increasing exercise intensity.

Improvements with training would show a decrease in heart rate response at a given running speed, together with a right shift in the exponential rise in blood lactate concentration. For example the exponential rise being initiated at higher running speeds.

FIGURE 1. Heart Rate and Blood Lactate Responses to Incremental Exercise – Baseline Data



Photo’s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