ABEL-Sport Test

For Assessing Overtraining Syndrome And Detecting Infection

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INTRODUCTION

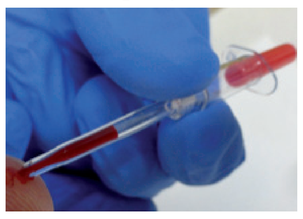
THERE are many tests available to the sports science team to manage training loads and measure the effects of physical, psychological, environmental and physiological interventions.

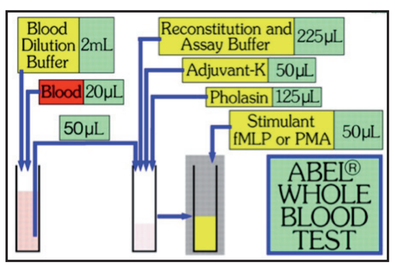
However, those that aim to predict an infection and / or identify overtraining generally remain wanting.

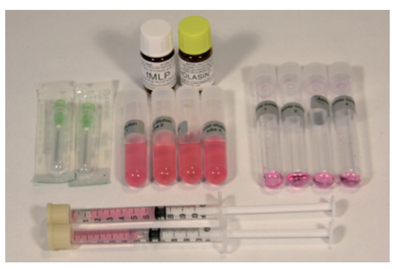
And to complicate matters further, there is often a lack of consensus as to what constitutes over-reaching (OR) overtraining (OT), and the overtraining syndrome (OTS).

The ABEL-Sport Test is a quantifiable test that uses only a small drop of capillary blood, collected in EDTA-coated capillary tubes, that can be performed close to the athlete on a portable luminometer (the ABEL-Meter 1) or in a laboratory.

20µl EDTA capillary blood is dispensed into 2ml blood dilution buffer. After mixing, 50µl diluted blood is added to a tube containing 225µl buffer & 50µl Adjuvant-K to which 125µl freshly reconstituted Pholasin® is added. After warming for 6 minutes at 37^{0}C the tube, attached to the black tube loader, is inserted in ABEL-meter. Reconstituted fMLP is loaded into the injection pipette positioned for the start of the assay.







Heater (above) with (Rt) ABEL-Meter, tube loader and injection pipette

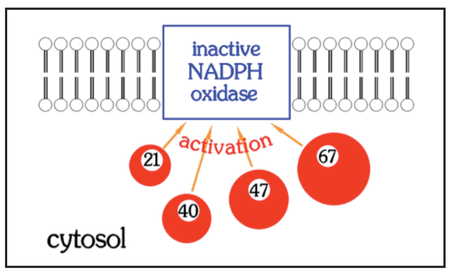
Tube and pipette loaded into Meter

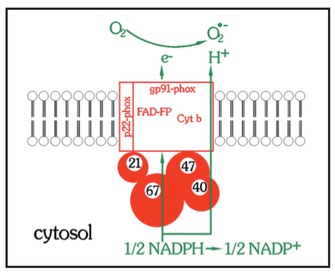
HOW DOES IT WORK?

The test incorporates the bioluminescent protein Pholasin® which emits light with reactive oxygen species (ROS) such as the free radical superoxide.

In the test, the NADPH oxidase system of the leucocytes is artificially activated to produce ROS. Light response graphs quantify changes in the rate of production and magnitude of the ROS generated.

The interpretation of the graphs is used to identify various responses during training, indicating if the athlete is heading towards OTS, and identifying infections, often superimposed on training curves.





The NADPH oxidase is usually inactive in circulating white blood cells but the cells are primed by their experience in the blood – and when activated artificially in our test, the secret knowledge they have is disclosed in the light response curves generated.

RESULTS

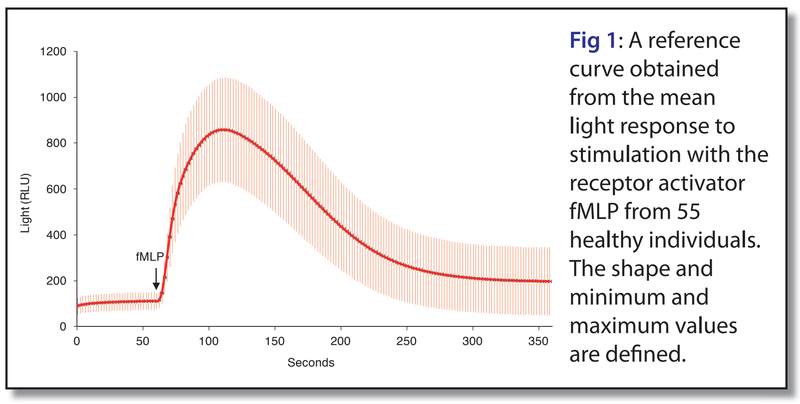


Fig 1: A reference curve obtained from the mean light response to stimulation with the receptor activator fMLP from 55 healthy individuals. The shape and minimum and maximum values are defined.

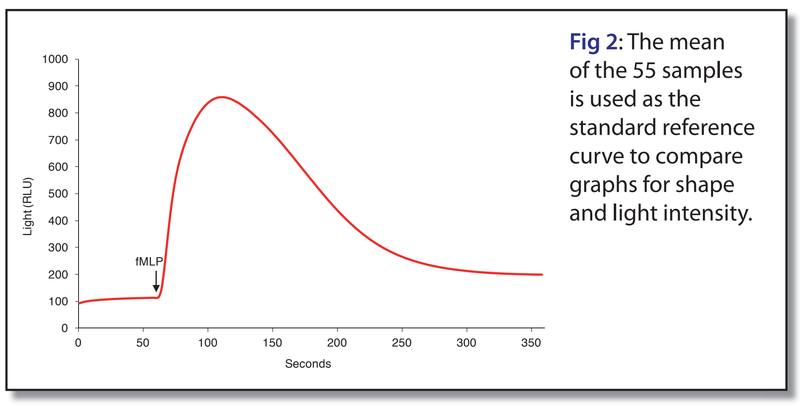


Fig 2: The mean of the 55 samples is used as the standard reference curve to compare graphs for shape and light intensity.

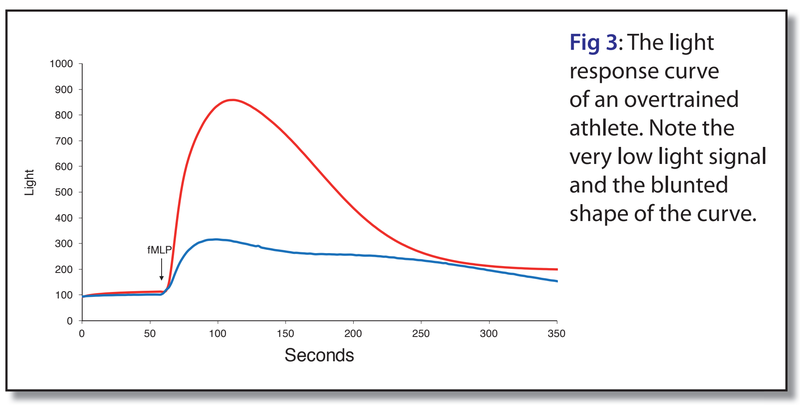


Fig 3: The light response curve of an overtrained athlete. Note the very low light signal and the blunted shape of the curve.

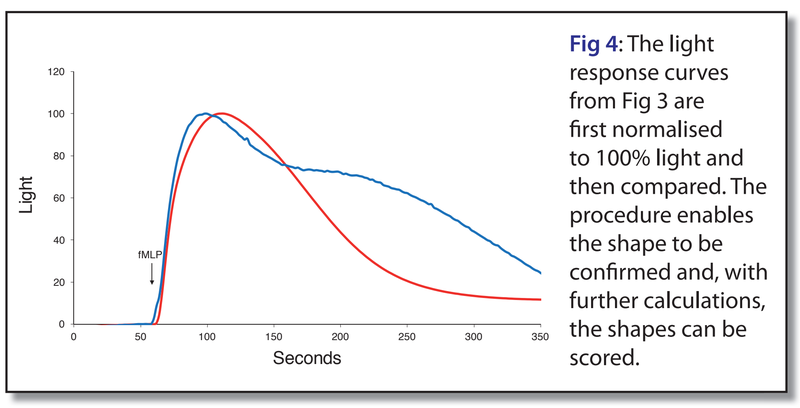


Fig 4: The light response curves from Fig 3 are first normalised to 100% light and then compared. The procedure enables the shape to be confirmed and, with further calculations, the shapes can be scored.

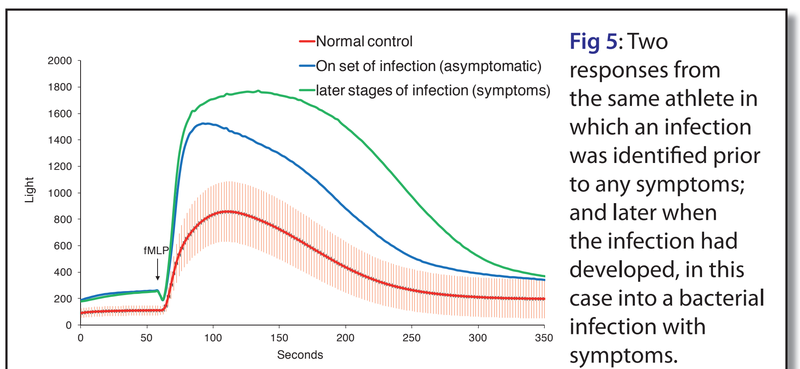


Fig 5: Two responses from the same athlete in which an infection was identified prior to any symptoms; and later when the infection had developed, in this case into a bacterial infection with symptoms.

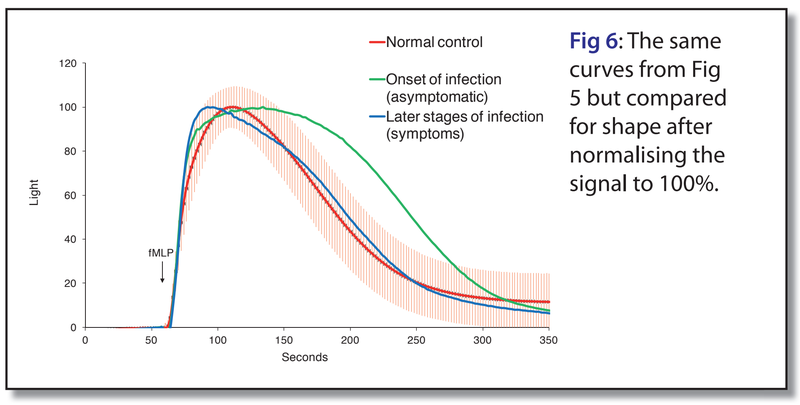


Fig 6: The same curves from Fig 5 but compared for shape after normalising the signal to 100%.

Figs 1-6 illustrate just a few of the responses that can be identified in the ABEL-sport test. Using this approach, it is possible to monitor an athlete through all stages of training and attain the right balance between overload and recovery.

DISCUSSION

The ABEL-sport test does not measure a single biomarker of OTS but instead utilises hidden information acquired by circulating leucocytes as they patrol the body spotting pathogens, responding to markers of inflammation (cytokines and chemokines) and other changes in the blood that occur after strenuous exercise.

In the test, the white blood cells are stimulated with the peptide fMLP (formyl-methyl-phenyalanine) which is derived from the cell wall of bacteria.

The granulocytic leucocytes, mainly neutrophils in the blood, have receptors to fMLP and when stimulated in the test the NADPH oxidase is activated with the production of extracellular superoxide which reacts with Pholasin to produce light.

It is the kinetics of this response (and later degranulation) that provides the tool to monitor the athlete during training.

And because of the ultra-sensitivity of Pholasin to superoxide, it is possible to identify an infection, often before the athlete has any signs or symptoms.

The ABEL-sport™ test is designed to elicit this hidden information from the cells.

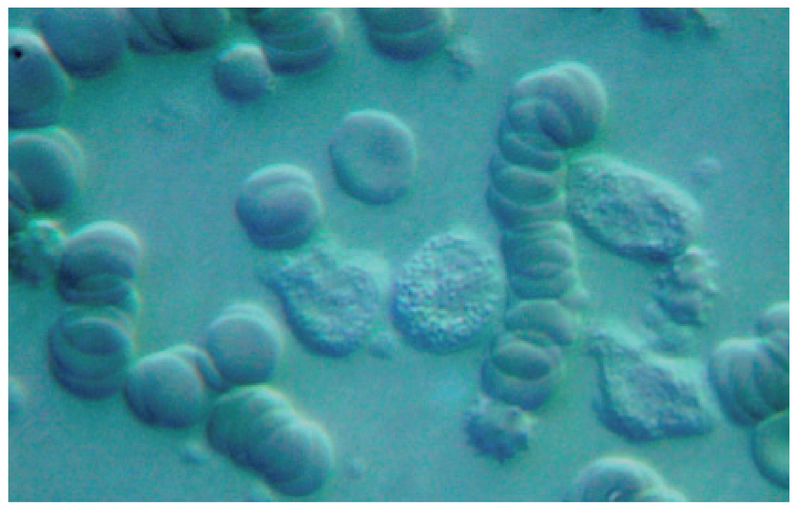
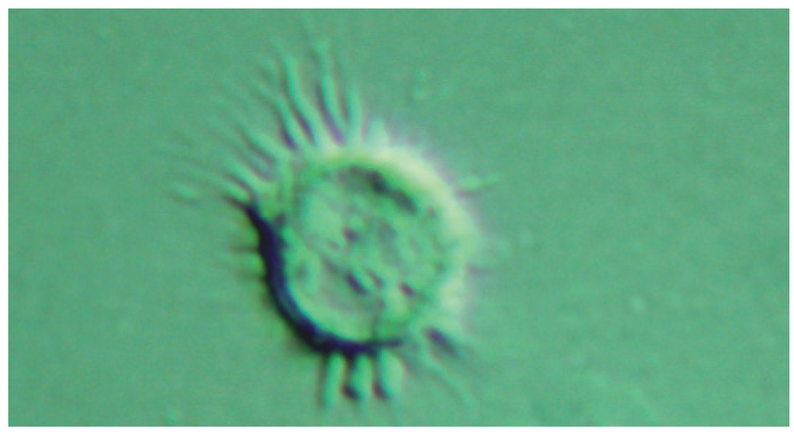


Fig 7: A sample of diluted blood (above) in which there is, on average, one white blood cell to 1,000 red cells.
Fig 8: A single neutrophil (below) becoming active and producing ROS and releasing granule enzymes.



The Holy Grail of Sports Science is being able to identify and manage the early signs of overtraining.

ABEL-Sport provides objective assessments of an athlete which can support management decisions.

The test has been validated for many years with elite and amateur athletes in many different fields and was successfully used by Skandia Team GB for two years prior to and in the run-up to the Beijing Olympics in 2008 when Britain's squad topped the medal table in the sailing competition.

Poster presented at the International Sports Science + Sports Medicine Conference 2013