# Lactate – Software for Calculating Blood Lactate Endurance markers

Dr. John Newell, October 2005.

The Lactate-E software has been written as an Excel template. A paper detailing the algorithms used to calculate the markers has been submitted to the Journal of Computers in Biology and Medicine under the title "Software for Calculating Blood Lactate Endurance Markers" (J. Newell, D. Higgins, N. Madden, J. Cruikshank, J. Einbeck). It is expected that use of this software will be acknowledged by a suitable reference.

To activate the software open Excel and open the Lactate-E file. A security warning may appear indicating that the template contains macros.
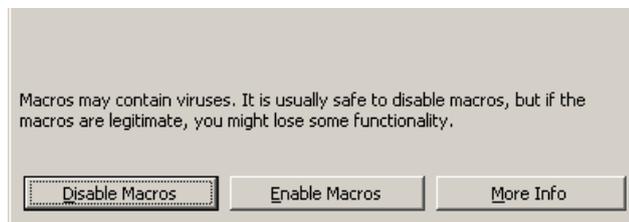
> ➤ Press Enable Macros.

A welcome screen will appear confirming that the software loaded correctly and a drop down menu called Lactate Analysis will appear on the toolbar with the following options:
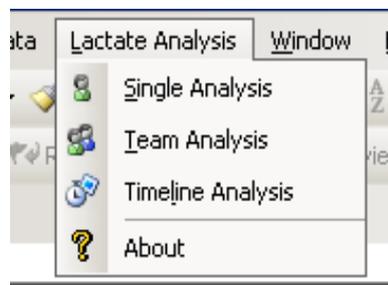

The menu offers the user a Single, Team or Timeline analysis. Examples of these routines are given below.

Single Analysis Example.

Download the sample data file *Sample Runner.xls* and open it in Excel. The data are lactate and heart rate measurements collected from a long distance runner. The first column contains the treadmill speed (workload) with the remaining columns containing blood lactate and heart rate readings for each workload.

To calculate Lactate Markers for a single athlete:

- ➤ select the drop down menu **Lactate Analysis** and choose **Single Analysis**
- ➤ Press the **Workload** dialog box and then select the data in cells A2:A14 and *be careful not to include cell A1.*
- ➤ Press the **Lactate** dialog box and then select the data in cells B2:B14. Note that the title cell B1 can not be included in this selection.
- ➤ Select **km/h** as the units here are km/h.
- ➤ If a resting value for lactate is available type it in the **Resting Value Lactate** dialog box. As an example type in the number 1 here.
- ➤ Press the **Heart Rate Values** dialog box and then select the data in cells C2:C14. Note that the title cell C2 can not be included in this selection.
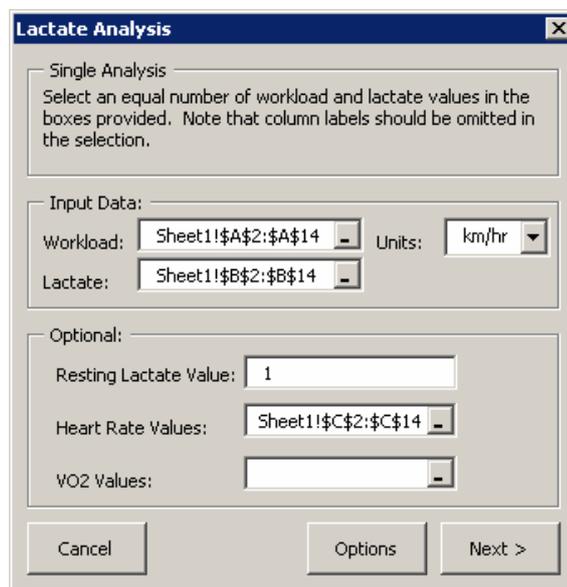

- ➤ Press on **Options** and confirm the settings as required.
- ➤ Press **Next** and a plot of the estimated Lactate Curve and a table of Endurance Markers and corresponding heart rates will be calculated for the athlete in question as demonstrated below.

Sample Lactate-E Output for Single Analysis

	Marker Workload	Equivalent Heartrate
FBLA (lactate=4mmol/l)	15.48	176.75
FBLA (lactate=3.5mmol/l)	15.26	174.64
Initial Rise of 1mmol/l at	14.36	165.78
TEM of 1mmol/l at	14.19	164.07
Dmax	13.78	159.80
Lactate Threshold	14.80	170.19
Log-log LT	11.19	131.14

Sample Lactate-E Plot for Single Analysis
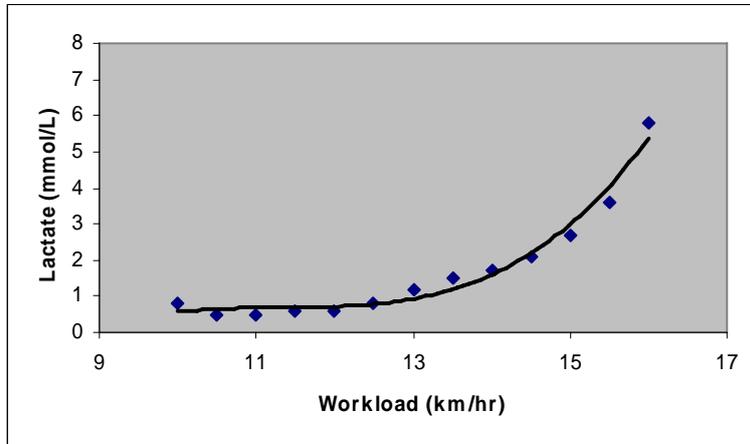
Timeline Analysis

To calculate Lactate Markers for an Athlete across Time:

- ➤ Open the sample Excel sheet called **Runner Timeline Data.xls** which contains lactate data from a long distance runner measured 3 times across a season.
- ➤ Select the drop down menu **Lactate Analysis** and choose **Timeline Analysis**
- ➤ Press the **Workload** dialog box and then select the data in cells A2:A13 and be careful not to include cell A1.
- ➤ Press the **Lactate** dialog box and then select the data in cells B1:D13. Note that the *title cells can be included* in this selection.
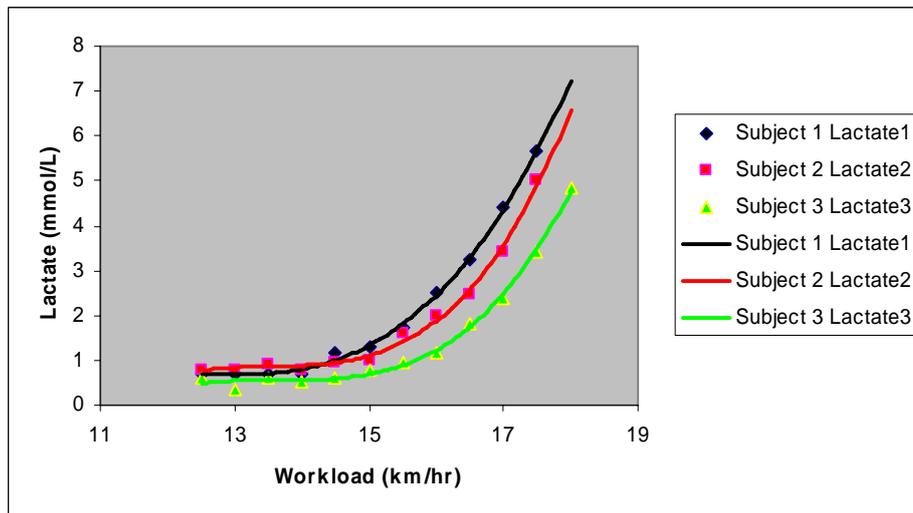- ➤ Select **km/h** as the units here are km/h.

- ➢ As this option relates to Lactate markers only leave the **Optional** dialog box blank.
- ➢ Press **Next** and a plot of the estimated Lactate Curves for each time point and corresponding endurance markers will be calculated for the athlete at each time point as illustrated below.

Sample Lactate-E Output and Plot for Timeline Analysis

	Subject 1 Lactate	Subject 2 Lactate	Subject 3 Lactate
FBLA (lactate=4mmol/l)	16.84	17.18	17.72
FBLA (lactate=3.5mmol/l)	16.61	16.97	17.51
Initial Rise of 1mmol/l at	15.40	15.93	16.38
TEM of 1mmol/l at	15.40	15.93	16.38
Dmax	15.32	15.61	15.89
Lactate Threshold	15.35	16.25	16.25
Log-log LT	13.94	14.79	14.69

Team Analysis

To calculate Lactate Markers for a Squad:

- ➢ Open the sample Excel sheet called **Team Lactate Data.xls** which contains lactate data from a squad of football players.
- ➢ Select the drop down menu **Lactate Analysis** and choose **Team Analysis**
- ➢ Press the **Workload** dialog box and then select the data in cells A2:A17 and be careful not to include cell A1.
- ➢ Press the **Lactate** dialog box and then select the data in cells B1:N14. Note that the title cells can be included in this selection.
- ➢ Select **km/h** as the units here are km/h.

- ➢ As this routine relates to Lactate markers only leave the **Optional** dialog box blank.
- ➢ Press **Next** and a series of plots of the estimated Lactate Curve and endurance markers will be calculated for each player including a summary sheet listing the markers for the squad collectively.

Sample Lactate-E Output for Single Analysis

Summary

	Player 1	Player 2	Player 3	Player 4
FBLA (lactate=4mmol/l)	14.74	13.59	14.58	14.19
FBLA (lactate=3.5mmol/l)	14.51	13.27	14.38	13.84
Initial Rise of 1mmol/l at	13.99	13.13	13.47	13.38
TEM of 1mmol/l at	13.99	13.13	13.47	13.38
Dmax	13.34	12.13	13.37	16.88
Lactate Threshold	13.30	12.20	13.75	12.30
Log-log LT	13.09	11.84	13.54	12.09

Note a single plot of the lactate curves of all members of a squad on the same graph is possible by using the **Timeline** option. For example:

- ➢ Open the sample Excel sheet called **Team Lactate Data.xls** which contains lactate data from a squad of football players.
- ➢ Select the drop down menu **Lactate Analysis** and choose **Timeline Analysis**
- ➢ Press the **Workload** dialog box and then select the data in cells A2:A17 and be careful not to include cell A1.
- ➢ Press the **Lactate** dialog box and then select the data in cells B1:N17. Note that the title cells can be included in this selection.
- ➢ Select **km/h** as the units here are km/h.
- ➢ Press **Next.**

Sample Lactate-E Plot for Timeline Analysis when using a squad