

vVO2max and tlimvVO2max

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Billat (1999)[1], a professor of Sport Sciences at the University of Lille, has shown that in four weeks it is possible to improve an athlete's [lactate threshold](#), [VO2 max](#) and running [economy](#). To understand Billat's work, we need to be aware of two new variables - vVO2 max and tlimvVO2 max.

VO2 max on its own is a poor predictor of performance but using the velocity (vVO2 max) and duration (tlimvVO2 max) that an athlete can operate at their VO2 max will provide a better indication of performance.

Billat (1999)[1] conduct a four-week trial with a group of athletes. The athletes had six training sessions a week - 4 easy sessions, one vVO2 max session and one [lactate threshold](#) workout.

At the end of the trial vVO2 max increased by 3% and [running economy](#) increased by 6%.

Why the improvements?

Running at vVO2 max increases leg muscle strength and power, and enhanced strength tends to improve the [economy](#) (muscle cells are stronger, fewer needed to run at a particular pace, thus the energy expenditure is lower). vVO2 max-effort boosts neuromuscular responsiveness and coordination, which reduces [energy expenditure](#).

What are "vVO2 max" and "tlimvVO2 max"?

vVO2 max

vVO2 max is the minimal running velocity which produces [VO2 max](#), i.e. causes your [muscular system](#) to utilise oxygen at its highest possible rate.

tlimvVO2 max

tlimvVO2 max is the maximal amount of time a runner can keep going at vVO2 max. During the research, Billat was able to show that tlimvVO2 max, on average, was 6 minutes.

Billat found the best predictor of tlimvVO2 max is lactate threshold speed, i.e. the higher your lactate threshold speed, the longer your tlimvVO2 max. See the [lactic page](#) to find out how to improve your lactate threshold.

How do you determine your vVO2 max?

Take yourself down to the track, run as hard as you can for six minutes (360 seconds) and record the distance covered. Calculate your velocity in metres/second to determine your vVO2 max.

Let us assume you manage 1800 metres then vVO2 max is $1800 \div 360 = 5$ metres/second. It is recommended that you repeat the test 48 hours later and use the highest velocity in your training sessions.

Remember to repeat the six-minute test every 4 to 6 weeks to determine your new vVO2 max.

What types of training sessions are there?

There are three training sessions that you could use:

- 30-30 session
- 60-60 session
- 3-3 session

The 30-30 session

This session comprises of:

- 30 seconds at 100% of vVO₂ max
- 30 seconds recover at 50% of vVO₂ max

This cycle is repeated for as long as the 30 seconds at 100% vVO₂ max can be sustained.

Based on achieving 1800m in the 6-minute run then in 30 seconds, we can cover 150 metres. The 30-30 session would comprise of 150 metres in 30 seconds followed by 75 metres in 30 seconds. This is repeated until you are unable to maintain the 150 metres in 30 seconds.

The 30 seconds at 100% vVO₂ max is important, as this is the element from which the gains in fitness will be achieved. The recoveries need to be run slowly and reasonably close to 50% vVO₂ max.

The 60-60 session

This session comprises of:

- 60 seconds at 100% of vVO₂ max
- 60 seconds recover at 50% of vVO₂ max

This cycle is repeated for as long as the 60 seconds at 100% vVO₂ max can be sustained.

Based on achieving 1800m in the 6-minute run then in 60 seconds, we can cover 300 metres. The 60-60 session would comprise of 300 metres in 60 seconds followed by 150 metres in 60 seconds. This is repeated until you are unable to maintain the 300 metres in 60 seconds.

The 3-3 session

This session comprises of:

- 3 minutes at 100% of vVO₂ max
- 3 minutes of recovery

This cycle is repeated for as long as the 3 minutes at 100% vVO₂ max can be sustained or five repetitions have been completed.

Based on achieving 1800m in the 6-minute run then in 3 minutes, we can cover 900 metres. The 3-3 session would comprise of 900 metres in 3 minutes, followed by 3 minutes recovery. This is repeated until you are unable to maintain the 900 metres in 3 minutes or five repetitions have been completed.

Which of these sessions should you do?

Ballet recommends using the 30-30 session early in the season as an excellent, easily tolerated way to kick-start improvements in VO₂ max, vVO₂ max, lactate threshold and running economy. In the 4 to 6 weeks before a major competition, conduct one session a week of the 3-3 session.

vVO₂ max Calculator

The following calculator will calculate your vVO₂max based on the distance you covered in the six-minute test and suggest a 30-30 work out, a 60-60 workout and a vVO₂ max session for you. Enter the distance covered and then select the 'Calculate' button.

Free Calculator

- [vVO₂ max Calculator](#) - a free Microsoft Excel spreadsheet which you can download and use on your computer.

References

1. BILLAT, V. (1999) Interval training at VO₂max: Effects on Aerobic Performance and overtraining markers. *Medicine and Science in Sports and Exercise*, 31 (1), pp. 156-163

Related References

The following references provide additional information on this topic:

- BARNES, K. R. and KILDING, A. E. (2014) Strategies to Improve Running Economy. Sports Medicine, p. 1-20
- RIBOLI, A. et al. (2014) Comparison between continuous incremental ramp test and discontinuous square-wave test for vVO2max assessment in long distance runners and soccer players. SPORT SCIENCES FOR HEALTH, 10(1, suppl.), p. S57-S57.
- MCLAUGHLIN, J. E. et al. (2010) Test of the classic model for predicting endurance running performance. Medicine and science in sports and exercise, 42 (5), p. 991-997

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