

# Take It to the Max

What does the amount of oxygen you take in during exercise got to do with your heart health?  
We ask the experts.

By Long Li Yann

Sure, you've got your heart rate monitor on when you're exercising. But is that really the best way to track how optimally your cardiovascular system is performing? Enter VO2 max testing. During exercise, your heart sends oxygen-rich blood to the muscles. The oxygen is then used to convert food into energy. This means that the more oxygen you take in, the better your performance. If you are fit and your heart is functioning well, you should be able to pump more oxygen-rich blood into your muscles at a faster rate.

The VO2 max test measures just that: the amount of oxygen you use at your maximum exercise intensity. It involves running on a treadmill at an increasing speed until you have to stop. During this time, an air mask strapped over your nose and mouth will measure the amount of oxygen that you have breathed in. It is measured by the volume of oxygen inhaled per kilogram of body weight in every minute (millilitres/kg/minute).

## What a VO2 max test can do for you

Besides giving an indication to how well your heart is functioning, people go to the Singapore Sports Medicine Centre (SSMC) for a VO2 max test to know more about their fitness levels. According to Agnes Lee, a sports trainer at SSMC, about seven to eight people take the VO2 max test each week. Most of them are recreational athletes who participate and train for triathlons, although there are others who simply want to assess their fitness to get a better idea of their overall health.

Theoretically, people with strong hearts should have high VO2 max readings. "However, there could be underlying abnormalities that are triggered off by high-intensity exercise in unpredictable ways. The VO2 max test alone cannot detect such problems," says Dr Jason Chia, associate consultant sports physician at SSMC. He advises against making conclusions about the condition of your heart based solely on the results of the VO2 max test. If your aim is to uncover these abnormalities, you should undergo other tests such as an electrocardiogram (ECG), he says.

To better understand how it works, we put our writer and two *Shape* readers to the VO2 max test — and get their verdicts on the expert's advice.

## ***Some terms you need to know***

### Maximum heart rate (MHR)

This is the fastest speed that your heart can beat in a minute. VO2 max can only be calculated when you have been pushed to the point where you cannot increase your workload. This usually coincides with the point where you are almost reaching your MHR.

It can be calculated by subtracting your age from 220.

## Training heart rate (THR)

These are heart rate zones that help you achieve your goals more efficiently. For example, if your aim is to lose weight and burn fat, your THR should be from 60 to 70 per cent of your MHR. To improve your cardiovascular fitness, you would be pushing yourself harder at between 70 and 80 per cent of your MHR. To find out if you are exercising within your THR, measure your pulse immediately after exercise either manually (fingers on your neck), or wear a heart rate monitor.

## Anaerobic threshold

This happens at a time when your muscles require more oxygen than the heart and lungs can supply. At the same time, lactic acid builds up, causing fatigue in the legs. At this point, you'll feel tired, breathless and can no longer continue the activity. A higher threshold means you take a longer time to get to that stage. A person with a high VO<sub>2</sub> max reading but a low anaerobic threshold will find it hard to maintain a fast pace for a long period of time.

## *“I would like to start exercising regularly to keep fit.”*

Joyce Lim, 24,

music teacher

Does not exercise regularly. Last worked out a year ago.

Height: 1.52m | Weight: 44.9kg

Absolute VO<sub>2</sub>: 1.48l/min

Relative VO<sub>2</sub>: 33ml/kg/min

Max heart rate: 197 beats/min

Anaerobic threshold: 81%

| **Dr Chia's diagnosis:** Joyce pushed herself hard and hit her maximum heart rate (MHR) during the test (220 – 24 = 196; she clocked 197 beats/min). This indicates that the test is valid, as VO<sub>2</sub> max is only accurate when you have been pushed to the point where your heart cannot take on more workload.

At 33ml/kg/min, Joyce's results are mid-range. This is based on the Korean population (the only Asian country which has compiled its results), which indicates that the middle range is 30 to 33ml/kg/min for women aged 25 to 29 years old.

If Joyce needs another reason to get active, it's her anaerobic threshold. At 81 per cent, she can exercise at a higher intensity without feeling fatigued too quickly.

| **Workout recommendations:** Joyce should exercise at least four times a week, for at least 30 to 60 minutes during each session. She can start by running 30 minutes on Mondays, swimming 60 minutes on Wednesdays, and running for another 30 minutes on Fridays. Based on her fitness goal, her THR should be between 149 to 169 beats per minute.

However, she should not push herself too hard, too soon, says Dr Chia. “Going beyond the recommended THR could lead to over training and injuries.

| **Joyce says:** It's a relief that my results are okay despite not exercising! As my father has heart problems, it worries me that it may run in the family. The test results are reassuring but I want to do an ECG to find out more details about my heart health. My priorities now are to reassess my lifestyle, and start exercising and eating right.

## *“I want to put in my best performance at the marathon in May.”*

Rue Chamberlain, 30, group fitness manager

18 hours of exercise a week. 7-8 hours of running, 3-4 hours of indoor cycling, 3 hours of flexibility training

Height: 1.56m | Weight: 58.1kg

Absolute VO<sub>2</sub>: 2.72l/min

Relative VO<sub>2</sub>: 46.8ml/kg/min

Maximum heart rate: 183 beats/min

Anaerobic threshold: 78%

| **Dr Chia's diagnosis:** Rue's anaerobic threshold (78 per cent) is lower than Joyce's (81 per cent), even though Rue is very fit, as seen in her high VO<sub>2</sub> reading. Being fitter doesn't necessarily mean a higher threshold, says Dr Chia. "Age, gender and genetics play a part in determining anaerobic threshold." For now, Rue can improve on her threshold by working her cardiovascular system at a higher intensity. "She can focus on interval training to improve on it," recommends Dr Chia.

### | **Workout recommendations:**

As Rue is training for the marathon, she should start by clocking weekly mileage. At the initial stage, her training zone should be about 70 to 80 per cent of her MHR to build intensive endurance. About three months before the race day, she should increase her mileage and extend the distance of her longest run. At this point, she should improve on her speed by introducing interval training to her regime, and keep her THR to 80 to 90 per cent of her MHR. She can alternate interval training with hill running to build up the strength of her legs.

| **Rue says:** The results are very useful for me. Even though I exercise a lot, I do not fully understand where I stand in terms of my fitness level. I now know how to structure my training to reach my goals for the marathon.

## *“I want to improve my endurance.”*

Long Li Yann,

27, writer

One hour of cardio, strength building and flexibility exercises each per week.

Height: 1.57m | Weight: 38.2kg

Absolute VO<sub>2</sub>: 1.52l/min

Relative VO<sub>2</sub>: 37.8ml/kg/min

Maximum heart rate: 184 beats/min

Anaerobic threshold: 62%

| **Dr Chia's diagnosis:** Due to a cold, Li Yann did not manage to reach her MHR ( $220 - 27 = 193$ ; she reached 184 beats/min). But the test is still valid as she was only a little away from her MHR (she reached about 95 per cent of her MHR). On top of that, she has a very low BMI, which can also influence her results.

"Those who are obese tend to have lower VO<sub>2</sub> max readings due to their body composition and because they tend to be less fit," says Dr Chia. Conversely, those with a low BMI would have higher VO<sub>2</sub> readings as they tend to be more active physically.

Li Yann's relative VO<sub>2</sub> reading, as compared to Joyce's, reflects her higher fitness level. Although her anaerobic threshold is good at 62 per cent, Joyce can probably maintain a higher workload than Li Yann for a longer period of time.

| **Workout recommendations:**

To improve her cardiovascular fitness, Li Yann should run twice a week for 60 minutes at 70 to 80 per cent of her MHR (THR of 131 to 149 beats per minute). But if she wants to improve on her race timings, she should think about doing more speed training at higher intensities.

| **Li Yann's take:** I exercise to keep my heart healthy and strong. It's good to know that I'm still in good shape even though my family has a history of heart problems. I would like to better my 10km race timing and my results show that I still have room for improvement.