

Department of  
**Orthopaedic Surgery**

# Are You Exercising at the Right Intensity?



# Cardiorespiratory Fitness

Cardiorespiratory fitness plays an important role in our overall health in preventing cardiovascular diseases (e.g. heart attack), metabolic syndromes (e.g. diabetes) and it is also associated with our bone mineral density. To improve our cardiorespiratory fitness, exercising at the right intensity is important. Hence, an analysis of your current fitness level is important in designing the right exercise plan for you.

What you can get from the test:  
(depending on the type of tests performed)

1. Fitness level
2. Aerobic\* and anaerobic\* training thresholds
3. Most effective intensity to burn fat
4. Pacing strategy during an endurance event
5. Refuelling strategy during long endurance events
6. Individualised training program

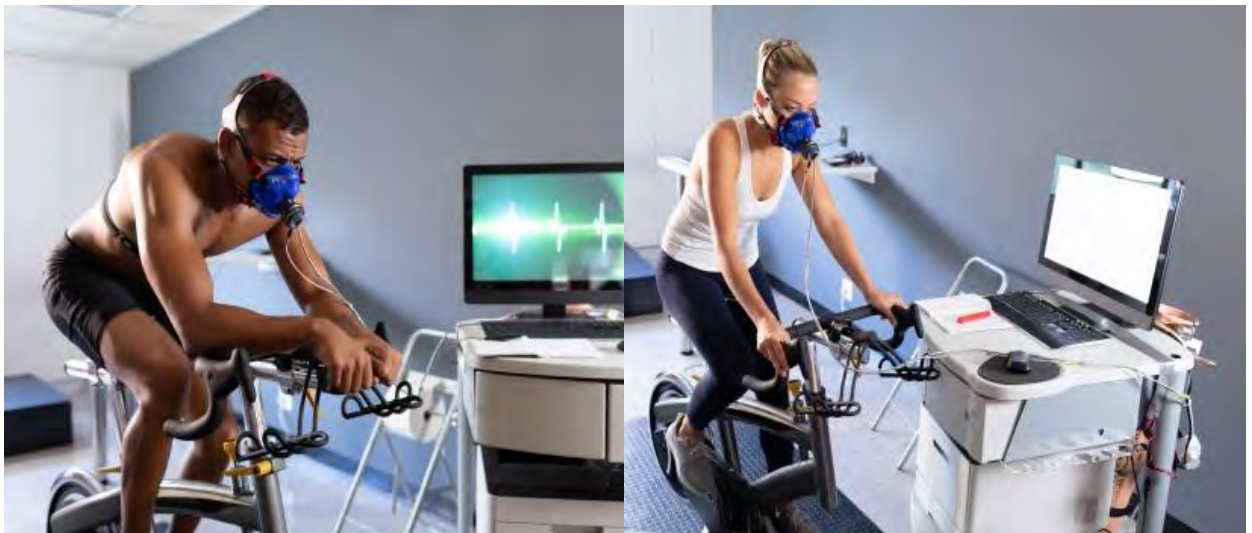


Aerobic\* = exercise that are lower in intensity and sustained over a period of time;  
Anaerobic\* = exercise is more intense, but shorter in duration

# Cardiopulmonary Exercise Testing (CPET)

The cardiopulmonary exercise test or VO<sub>2</sub> test is an exercise test conducted to measure your cardiovascular fitness. This test should NOT be confused with an ECG\* exercise stress test performed to measure how well your heart responds to exercise stress for medical screening or clearance.

Instead, the VO<sub>2</sub> test measures the efficiency of your heart, lungs, and muscles working together (i.e. cardiorespiratory endurance or aerobic fitness) during sustained physical activity. The results allow us to plan an effective and safe training program based on your goal.



# Cardiopulmonary Exercise Testing (CPET)

## Exercise Plan

Exercise frequency	5 days
Mode	Walking, jogging, swimming, cycling
Intensity	Easy - average heart rate 101 - 119
	Moderate - average heart rate 120-130
	Mod-high - average heart rate 131-149
	High - Average hear rate above 150
Duration	60% moderate, 15% Mod-high, 5% High E.g. 10 mins High, 20-30 mins Mod-High, 30-45 mins Mod, >60

### Training plan

	One	Two	Three	Four	Five
Week 1	Jog 4-5 km (6.5-7 km/h speed)	Jog 4-5 km (6.5-7 km/h speed)	Anaerobic (EMOM) Deadlift 10 reps + Chest press 10 reps, 5 sets, total 10 mins	Run interval 4:1 mins Run (8-9 km/h) 4 mins, Rest 1 min, 4 sets , total 20 mins	Jog and walk 60-120 mins easy Foam roll Stretch
Week 2	Jog 5-6 km (6.5-7 km/h speed)	Jog 5-6 km (6.5-7 km/h speed)	Anaerobic (EMOM) Bike Threshold protocol, total 13 mins	Run long interval 1 km at 8-9 km/h Rest 1 min, 4 sets , total 27 mins	Jog and walk 80-120 mins easy Foam roll Stretch
Week 3	Jog 5-6 km (6.5-7 km/h speed)	Jog 5-6 km (6.5-7 km/h speed)	Anaerobic (EMOM) 100m sprint, Rest 2.5mins, 6 sets 18 mins	Run unstructured interval Hilly fartlek, total 30 mins	Jog and walk 100-150 mins easy Foam roll Stretch
Week 4 Recovery Week	Recovery Swimming/Bike 30-45 mins	Jog easy 30 mins Yoga 45 mins	Anaerobic Gym Weight 8 exercise 60% 1RM	Jog and walk 120-150 mins easy	Run easy 60-90 mins Foam roll Stretch

This is an example of a part of the five day-16 weeks personalised periodised training program.

A three or four day-16 weeks program can also be created based on individual needs.

# Cardiopulmonary Exercise Testing (CPET)

## Assessment to Maximum Exercise

### Performance Assessment

( $\dot{V}O_2/kg$ )peak 43 ml/min/kg



### Relation to Normal Values

VT1 1.78 L/min



WRmax 163 W



( $\dot{V}O_2/HR$ )max 13 ml



BFmax 49 /min



### Maximum Exercise Criteria

RERmax 1.04



HRmax 163 /min



### Additional Information

BMI 22



Above is a sample report on the cardiorespiratory results with indicators of your current fitness.

# Cardiopulmonary Exercise Testing (CPET)

## Fat utilisation during exercise

Duration of exercise required to deplete 0.5kg of body fat

Activity	Intensity	Estimated Heart Rate	Duration
Sitting		74	58 hours 15 minutes
Standing		75	56 hours 9 minutes
Walking	3km/h speed	96	42 hours 14 minutes
	4km/h speed	105	34 hours 2 minutes
	5km/h speed	121	22 hours 18 minutes
Jogging	6km/h speed	131	20 hours 51 minutes
	7km/h speed	146	46 hours 54 minutes

Above is an example of the optimal fat burning intensity and the exercise volume needed to deplete half a kilo of fat in our body.

## Carbohydrate utilisation during exercise

Duration of exercise sustainable

Activity	Intensity ( $\pm 0.5$ )	Estimated Heart Rate	Threshold	Duration
Running	8.5 km/h speed	110-120	50%	4 Hours 4 minutes
	9.5 km/h speed	>120-130	50%	2 hours 7 minutes
	10.5 km/h speed	>130-140	50%	1 hours 47 minutes
	11.5 km/h speed	>140-150	50%	1 hours 20 minutes
	12.5 km/h speed	>151 - 160	50%	1 hours 11 minutes
	13.5 km/h speed	>160 - 170	50%	1 hours 6 minutes

Glycogen (storage form of glucose and carbohydrates in our body) use is compulsory during exercise. When about 50% of glycogen is used up, muscle functions will be reduced. Above is an example of the duration of sustainable exercise based on an immediate storage of about 500g of glycogen in our body.

# Types of Tests

## VO2max Test

- A maximal exercise test (very high intensity and a medical clearance for vigorous exercise is needed)
- A test to determine current fitness level
- Training programme included to improve performance

## Exercise Fat Utilisation Test

- A submaximal exercise test (moderate intensity)
- A test to determine the best exercise intensity to lose weight
- Training programme included to improve fat utilisation during exercise

## Exercise Economy Test

- A submaximal test (high-moderate intensity)
- A test to determine fuel utilisation at each submaximal exercise intensity
- For pacing strategy during endurance events (e.g. marathons) to avoid sudden loss of energy (i.e hit the wall)
- For refuelling strategy during a long race
- Training programme included to improve exercise economy

Price starting from S\$160

Clinic B1A  
TTSH Medical Centre, Level B1  
Contact:  
6357 7000 (Central Hotline)



Scan the QR Code with your smart phone to  
access the information online or visit  
<http://bit.ly/TTSHHealth-Library>

Was this information helpful?  
Please feel free to email us if you have  
any feedback regarding what you have  
just read at  
[patienteducation@ttsh.com.sg](mailto:patienteducation@ttsh.com.sg)



© Tan Tock Seng Hospital, Singapore 2021. All rights reserved. All information correct as of June 2021. No part of this document may be reproduced, copied, reverse compiled, adapted, distributed, commercially exploited, displayed or stored in a database, retrieval system or transmitted in any form without prior permission of Tan Tock Seng Hospital. All information and material found in this document are for purposes of information only and are not meant to substitute any advice provided by your own physician or other medical professionals.